



**10** YEARS  
OF UNIVERSITY  
RECOGNITION  
**20** YEARS OF  
ACADEMIC  
EXCELLENCE



**REVA**  
UNIVERSITY  
Bengaluru, India

**School of Computing and Information  
Technology**

**B.Tech. ISE**

**2021-25 Batch**

**HANDBOOK**

SCHOOL OF COMPUTING AND INFORMATION TECHNOLOGY

HANDBOOK

B. Tech in Information Science and Engineering

2021-25

Rukmini Knowledge Park,  
Kattigenahalli, Yelahanka, Bangalore - 560 064  
Phone No: +91-080-46966966

## Chancellor's Message

*"Education is the most powerful weapon which you can use to change the world."*

- Nelson Mandela.

There was a time when survival depended on just the realization of physiological needs. We are indeed privileged to exist in a time when 'intellectual gratification' has become indispensable. Information is easily attainable for the soul that is curious enough to go look for it. Technological boons enable information availability anywhere anytime. The difference, however, lies between those who look for information and those who look for knowledge.



It is deemed virtuous to serve seekers of knowledge. As educators, it is in the ethos at REVA University to empower every learner who chooses to enter our portals. Driven by our founding philosophy of 'Knowledge is Power', we believe in building a community of perpetual learners by enabling them to look beyond their abilities and achieve what they assumed impossible.

India has always been beheld as a brewing pot of unbelievable talent, acute intellect and immense potential. All it takes to turn those qualities into power is a spark of opportunity. Being at a University is an exciting and rewarding experience with opportunities to nurture abilities, challenge cognizance and gain competence.

For any University, the structure of excellence lies in the transitional abilities of its faculty and its facility. I'm always in awe of the efforts that our academic board puts in to develop the team of subject matter experts at REVA. My faculty colleagues understand our core vision of empowering our future generation to be ethically, morally and intellectually elite. They practice the art of teaching with a student-centered and transformational approach. The excellent infrastructure at the University, both educational and extra-curricular, magnificently demonstrates the importance of ambience in facilitating focused learning for our students.

A famous British politician and author from the 19th century - Benjamin Disraeli, once said 'A University should be a place of light, of liberty and of learning'. Centuries later this dictum still inspires me and I believe, it takes team-work to build successful institutions. I welcome you to REVA University to join hands in laying the foundation of your future with values, wisdom and knowledge.

**Dr. P. Shyama Raju**

The Founder and Honorable Chancellor, REVA University

## Vice-Chancellor Message

The last two decades have seen a remarkable growth in higher education in India and across the globe. The move towards inter-disciplinary studies and interactive learning have opened up several options as well as created multiple challenges. India is at a juncture where a huge population of young crowd is opting for higher education. With the tremendous growth of privatization of education in India, the major focus is on creating a platform for quality in knowledge enhancement and bridging the gap between academia and industry.



A strong believer and practitioner of the dictum “Knowledge is Power”, REVA University has been on the path of delivering quality education by developing the young human resources on the foundation of ethical and moral values, while boosting their leadership qualities, research culture and innovative skills. Built on a sprawling 45 acres of green campus, this ‘temple of learning’ has excellent and state-of-the-art infrastructure facilities conducive to higher teaching-learning environment and research. The main objective of the University is to provide higher education of global standards and hence, all the programs are designed to meet international standards. Highly experienced and qualified faculty members, continuously engaged in the maintenance and enhancement of student-centric learning environment through innovative pedagogy, form the backbone of the University.

All the programs offered by REVA University follow the Choice Based Credit System (CBCS) with Outcome Based Approach. The flexibility in the curriculum has been designed with industry-specific goals in mind and the educator enjoys complete freedom to appropriate the syllabus by incorporating the latest knowledge and stimulating the creative minds of the students. Bench marked with the course of studies of various institutions of repute, our curriculum is extremely contemporary and is a culmination of efforts of great think-tanks - a large number of faculty members, experts from industries and research level organizations. The evaluation mechanism employs continuous assessment with grade point averages. We believe sincerely that it will meet the aspirations of all stakeholders – students, parents and the employers of the graduates and postgraduates of REVA University.

At REVA University, research, consultancy and innovation are regarded as our pillars of success. Most of the faculty members of the University are involved in research by attracting funded projects from various research level organizations like DST, VGST, DBT, DRDO, AICTE and industries. The outcome of the research is passed on to students through live projects from industries. **The entrepreneurial zeal of the students is encouraged and nurtured through EDPs and EACs.**

REVA University has entered into collaboration with many prominent industries to bridge the gap between industry and University. Regular visits to industries and mandatory internship with industries have helped our students. REVA University has entered into collaboration with many prominent industries to bridge the gap between industry and University. Regular visits to industries and mandatory internship with industries have helped our students become skilled with relevant to industry requirements. Structured training programs on soft-skills and preparatory training for competitive exams are offered here to make students more employable. 100% placement of eligible students speaks the effectiveness of these programs. The entrepreneurship development activities and establishment of “Technology Incubation Centers” in the University extend full support to the budding entrepreneurs to nurture their ideas and establish an enterprise.

With firm faith in the saying, “Intelligence plus character –that is the goal of education” (Martin Luther King, Jr.), I strongly believe REVA University is marching ahead in the right direction, providing a holistic education to the future generation and playing a positive role in nation building. We reiterate our endeavour to provide premium quality education accessible to all and an environment for the growth of over-all personality development leading to generating “GLOBAL PROFESSIONALS”.

Welcome to the portals of REVA University!

**Dr.M.Dhanamjaya**

Vice-Chancellor, REVA University

## Director Message

I congratulate and welcome all the students to the esteemed school of Computing and Information Technology (CS& IT)). You are in the right campus to become a computer technocrat. The rising needs of automation in Industry 4.0 and improvising living standards have enabled rapid development of computer software and hardware technologies. Thus, providing scope and opportunity to generate more human resources in the areas of computers and IT. The B. Tech, M. Tech and Ph.D. programs offered in the school are designed to cater the requirements of industry and society. The curriculum is designed meticulously in association with persons from industries (TCS, CISCO, AMD, MPHASIS, etc.), academia and research organizations (IISc, IIIT, Florida University, Missouri S & T University, etc.).

This handbook presents the B. Tech in Information Science and Engineering program curriculum. The program is of 4 years duration and split into 8 semesters. The courses are classified into foundation core, hard core, and soft-core courses. Hard core courses represent fundamentals study requirements of **B. Tech ISE** program. Soft courses provide flexibility to students to choose the options among several courses as per the specialization, such as, Artificial Intelligence, Fuzzy Logic and Systems, Cognitive science and predictive analytics etc. Theoretical foundations of engineering, science, and Information Science are taught in first two and half years. Later, advanced courses and recent technologies are introduced in subsequent semesters for pursuing specialization. The Curriculum caters to local, national, regional and global developmental needs. Maximum number of courses are integrated with cross cutting issues relevant to professional ethics, global needs, human values, environment and sustainability. The curriculum also focusses on skill development, innovation and entrepreneurship.

The important features of the **B. Tech ISE** are as follows:

1) Choice based course selection and teacher selection, 2) Studies in emerging areas like Machine Learning, Artificial Intelligence, Data Analytics, Cloud Computing, Python/R Programming, NLP, IoT and Cloud security, 3) Short and long duration Internships 4) Opportunity to pursue MOOC course as per the interest in foundation and soft core courses, 5) Attain global and skill certification as per the area of specialization, 6) Self-learning components, 7) Experiential, practice, practical, hackathons, and project based learning, 8) Mini projects and major projects with research orientation and publication, 9) Soft skills training and 10) Platform for exhibiting skills in cultural, sports and technical activities through clubs and societies.

The school has well qualified faculty members in the various areas of computing and IT including cloud computing, security, IOT, AI, ML and DL, software engineering, computer networks, information technology, cognitive computing, block chain technology etc. State of art laboratories are available for the purpose of academics and research.

**Dr. Mallikarjun Kodabagi**  
**Director, School of Computing and Information Technology**

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## **RUKMINI EDUCATIONAL CHARITABLE TRUST**

It was the dream of late Smt. Rukmini Shyama Raju to impart education to millions of underprivileged children as she knew the importance of education in the contemporary society. The dream of Smt. Rukmini Shyama Raju came true with the establishment of **Rukmini Educational Charitable Trust (RECT)**, in the year 2002. Rukmini Educational Charitable Trust (RECT) is a Public Charitable Trust, set up in 2002 with the objective of promoting, establishing and conducting academic activities in the fields of Arts, Architecture, Commerce, Education, Engineering, Environmental Science, Legal Studies, Management and Science & Technology, among others. In furtherance of these objectives, the Trust has set up the REVA Group of Educational Institutions comprising of REVA Institute of Technology & Management (RITM), REVA Institute of Science and Management (RISM), REVA Institute of Management Studies (RIMS), REVA Institute of Education (RIE), REVA First Grade College (RFGC), REVA Independent PU College at Kattigenahalli, Ganganagar and Sanjay Nagar and now REVA University. Through these institutions, the Trust seeks to fulfil its vision of providing world class education and create abundant opportunities for the youth of this nation to excel in the areas of Arts, Architecture, Commerce, Education, Engineering, Environmental Science, Legal Studies, Management and Science & Technology.

Every great human enterprise is powered by the vision of one or more extraordinary individuals and is sustained by the people who derive their motivation from the founders. The Chairman of the Trust is Dr. P. Shyama Raju, a developer and builder of repute, a captain of the industry in his own right and the Chairman and Managing Director of the DivyaSree Group of companies. The idea of creating these top notched educational institutions was born of the philanthropic instincts of Dr. P. Shyama Raju to do public good, quite in keeping with his support to other socially relevant charities such as maintaining the Richmond Road Park, building and donating a police station, gifting assets to organizations providing accident and trauma care, to name a few.

The Rukmini Educational Charitable Trust drives with the main aim to help students who are in pursuit of quality education for life. REVA is today a family of ten institutions providing education from PU to Post Graduation and Research leading to PhD degrees. REVA has well qualified experienced teaching faculty of whom majority are doctorates. The faculty is supported by committed administrative and technical staff. Over 15,000+ students study various courses across REVA's three campuses equipped with exemplary state-of-the-art infrastructure and conducive environment for the knowledge driven community.



## ABOUT REVA UNIVERSITY

REVA University has been established under the REVA University Act, 2012 of Government of Karnataka and notified in Karnataka State Gazette dated 7<sup>th</sup>February, 2013. The University is recognised by UGC under Sec 2 (f) and empowered under Sec.22 of the UGC Act, 1956 to award degrees in any branch of knowledge. The Programs of the University are approved by All India Council for Technical Education (AICTE), University Grants Commission (UGC), Bar Council of India (BCI), and Council of Architecture (COA). The University is a Member of Association of Indian Universities, New Delhi. The main objective of the University is to prepare students with knowledge, wisdom and patriotism to face the global challenges and become the top leaders of the country and the globe in different fields.

REVA University located in between Kempe Gowda International Airport and Bangalore city, has a sprawling green campus spread over 45 acres of land and equipped with state-of-the-art infrastructure that provide conducive environment for higher learning and research. The REVA campus has well equipped laboratories, auditoriums, seminar halls, custom-built teaching facilities, fully air-conditioned library and central computer centre, well-planned sports facility with cricket ground, running track & variety of indoor and outdoor sports activities, facilities for cultural programs. The unique feature of REVA campus is the largest residential facility for students, faculty members and supportive staff.

The University is presently offering 26 Post Graduate Degree programs, 35 Undergraduate programs in various branches of studies and has 15000+ students studying in various branches of knowledge at graduate and post graduate level and 494 Scholars pursuing research leading to PhD in 19 disciplines. It has 900+ well qualified, experienced and committed faculty members of whom majority are doctorates in their respective areas and most of them are guiding students pursuing research leading to PhD.

The programs being offered by the REVA University are well planned and designed after detailed study with **emphasis on knowledge assimilation, applications, global job market and their social relevance.** Highly qualified, experienced faculty and scholars from reputed universities / institutions, experts from industries and business sectors have contributed in preparing the scheme of instruction and detailed curricula for this program. **Greater emphasis on practice in respective areas and skill development to suit to respective job environment has been given importance while designing the curricula.** The Choice Based Credit System and Continuous Assessment Graded Pattern (CBCS – CAGP) of education has been introduced in all programs to facilitate students to opt for **subjects of their choice in addition to the core subjects of the study and prepare them with needed skills.** The system also allows students to move forward under the fast track for those who have the capabilities to surpass others. These programs are taught by well experienced qualified faculty supported by the experts from

industries, business sectors and such other organizations. REVA University has also initiated many supportive measures such as bridge courses, special coaching, remedial classes, etc., for slow learners so as to give them the needed input and build in them confidence and courage to move forward and accomplish success in their career. The University has also entered into MOUs with many industries, business firms and other institutions seeking their help in imparting quality education through practice, internship and also assisting students' placements.

REVA University recognizing the fact that research, development and innovation are the important functions of any university has established an independent Research and Innovation division headed by a senior professor as Dean of Research and Innovation. This division facilitates all faculty members and research scholars to undertake innovative research projects in engineering, science & technology and other areas of study. The interdisciplinary-multidisciplinary research is given the top most priority. The division continuously liaisons between various funding agencies, R&D Institutions, Industries and faculty members of REVA University to facilitate undertaking innovative projects. It encourages student research projects by forming different research groups under the guidance of senior faculty members. Some of the core areas of research wherein our young faculty members are working include Data Mining, Cloud Computing, Image Processing, Network Security, Big data analytics, Information Retrieval, VLSI and Embedded Systems, Wireless Sensor Networks, Artificial Intelligence, Computer Networks, IOT, MEMS, Nano- Electronics, Wireless Communications, Bio-fuels, Nano-technology for coatings, Composites, Vibration Energies, Electric Vehicles, Multilevel Inverter Application, Battery Management System, , LED Lighting, Renewable Energy Sources and Active Filter, Innovative Concrete Reinforcement, Electro Chemical Synthesis, Energy Conversion Devices, Nano-structural Materials, Photo-electrochemical Hydrogen generation, Pesticide Residue Analysis, Nano materials, Photonics, Nano Tribology, Fuel Mechanics, Operation Research, Graph theory, Strategic Leadership and Innovative Entrepreneurship, Functional Development Management, Resource Management and Sustainable Development, Cyber Security, General Studies, Feminism, Computer Assisted Language Teaching, Culture Studies etc.

The REVA University has also given utmost importance to develop much required skills through variety of training programs, industrial practice, case studies and such other activities that induce the said skills among all students. A full-fledged Career Development and Placement (CDC) department with world class infrastructure, headed by a dynamic experienced Professor and Dean, and supported by well experienced Trainers, Counsellors and Placement Officers. The University also has University-Industry Interaction (UIIC) and Skill Development Centre headed by a Senior Professor and Director facilitating skill related training to REVA students and other unemployed students. The University has been recognized as a Centre of Skill Development and Training by

NSDC (National Skill Development Corporation) under Pradhan Mantri Kaushal Vikas Yojana. The Centre conducts several add-on courses in challenging areas of development. It is always active in facilitating student's variety of Skill Development Training programs, Entrepreneurship activities, and IPR workshops. UIIC has established REVA NEST, an incubation centre for promoting start up industries.

The University has collaborations with Industries, universities abroad, research institutions, corporate training organizations, and Government agencies such as Florida International University, Oklahoma State University, Western Connecticut University, University of Alabama, University of California Berkeley, Arkansas State University, Columbia University, Huntsville, Oracle India Ltd, Texas Instruments, Nokia University Relations, EMC<sup>2</sup>, VMware, SAP, Apollo etc., to facilitate student exchange and teacher-scholar exchange programs and conduct training programs. These collaborations with foreign universities also facilitate students to study some of the programs partly in REVA University and partly in foreign university, viz, M.S in Computer Science one year in REVA University and the next year in the University of Alabama, Huntsville, USA.

The University has also given greater importance to quality in education, research, administration and all activities of the university. Therefore, it has established an independent Internal Quality division headed by a senior professor as Dean of Internal Quality. The division works on planning, designing and developing different quality tools, implementing them and monitoring the implementation of these quality tools. It concentrates on training entire faculty to adopt the new tools and implement their use. The division further works on introducing various examination and administrative reforms.

To motivate the youth and transform them to become innovative entrepreneurs, successful leaders of tomorrow and committed citizens of the country, REVA organizes interaction between students and successful industrialists, entrepreneurs, scientists and such others from time to time. As a part of this exercise great personalities such as Bharat Ratna Prof. C. N. R. Rao, a renowned Scientist, Dr. N R Narayana Murthy, Founder and Chairman and Mentor of Infosys, Dr. K Kasturirangan, Former Chairman ISRO, Member of Planning Commission, Government of India, Dr. Balaram, Former Director I.I.Sc., and noted Scientist, Dr. V S Ramamurthy, Former Secretary, DST, Government of India, Dr. V K Aatre, noted Scientist and former head of the DRDO and Scientific Advisor to the Ministry of Defence Dr. Sathish Reddy, Scientific Advisor, Ministry of Defence, New Delhi and many others have accepted our invitation and blessed our students and faculty members by their inspiring addresses and interaction.

As a part of our effort in motivating and inspiring youth of today, REVA University also has instituted awards and prizes to recognize the services of teachers, researchers, scientists, entrepreneurs, social workers and such

others who have contributed richly for the development of the society and progress of the country. One of such awards instituted by REVA University is '**Life Time Achievement Award**' to be awarded to successful personalities who have made mark in their field of work. This award is presented on occasion of the "**Founders' Day Celebration**" of REVA University on 6<sup>th</sup> January of every year in presence of dignitaries, faculty members and students gathering. The first "**REVA Life Time Achievement Award**" for the year 2015 has been awarded to Shri. Kiran Kumar, Chairman ISRO, followed by Shri. Shekhar Gupta, renowned Journalist for the year 2016, Dr K J Yesudas, renowned play back singer for the year 2017. REVA also introduced "**REVA Award of Excellence**" in the year 2017 and the first Awardee of this prestigious award is Shri Ramesh Aravind, Actor, Producer, Director, Screen Writer and Speaker.

REVA organizes various cultural programs to promote culture, tradition, ethical and moral values to our students. During such cultural events the students are given opportunities to unfold their hidden talents and motivate them to contribute innovative ideas for the progress of the society. One of such cultural events is REVOTHASAVA conducted every year. The event not only gives opportunities to students of REVA but also students of other Universities and Colleges. During three days of this mega event students participate in debates, Quizzes, Group discussion, Seminars, exhibitions and variety of cultural events. Another important event is ShubhaVidaaya, - Graduation Day for the final year students of all the programs, wherein, the outgoing students are felicitated and are addressed by eminent personalities to take their future career in a right spirit, to be the good citizens and dedicate themselves to serve the society and make a mark in their respective spheres of activities. During this occasion, the students who have achieved top ranks and won medals and prizes in academic, cultural and sports activities are also recognized by distributing awards and prizes. The founders have also instituted medals and prizes for sports achievers every year. The physical education department conducts regular yoga classes every day to students, faculty members, administrative staff and their family members and organizes yoga camps for villagers around.

Within short span of time, REVA University has been recognised as a fast-growing university imparting quality higher education to the youth of the country and received many awards, ranks, and accolades from various agencies, institutions at national and international level. These include: Asia's Greatest Brand and Leaders, by Asia One, National Award of Leadership Excellence, by ASSOCHAM India, Most promising University, by EPSI, Promising Upcoming Private University in the Country, by The Economic Times, Best University of India (South), by Dialogue India, Gold Brand by QS University Ranking, placed under 151-200 band by NIRF, 6<sup>TH</sup> Rank in the Super Excellence category by GHRDC, 6<sup>TH</sup> Rank in All India Law School Survey, ranked among Top 30 Best B Schools by Business World, India's Best Law Institution by Careers 360, to mention a few.

## **REVA UNIVERSITY**

### **Vision**

“REVA University aspires to become an innovative university by developing excellent human resources with leadership qualities, ethical and moral values, research culture and innovative skills through higher education of global standards”.

### **Mission**

- To create excellent infrastructure facilities and state-of-the-art laboratories and incubation centers
- To provide student-centric learning environment through innovative pedagogy and education reforms
- To encourage research and entrepreneurship through collaborations and extension activities
- To promote industry-institute partnerships and share knowledge for innovation and development
- To organize society development programs for knowledge enhancement in thrust areas
- To enhance leadership qualities among the youth and enrich personality traits, promote patriotism and moral values.

### **Objectives**

- Creation, preservation and dissemination of knowledge and attainment of excellence in different disciplines
- Smooth transition from teacher - centric focus to learner - centric processes and activities
- Performing all the functions of interest to its major constituents like faculty, staff, students and the society to reach leadership position
- Developing a sense of ethics in the University and Community, making it conscious of its obligations to the society and the nation
- Accepting the challenges of globalization to offer high quality education and other services in a competitive manner.

## **ABOUT THE SCHOOL OF COMPUTING AND INFORMATION TECHNOLOGY**

The school has a rich blend of experienced and committed faculty who are well-qualified in various aspects of computing and information technology apart from the numerous state-of-the-art digital classrooms and laboratories having modern computing equipment. The school offers four full-time undergraduate programs, B. Tech in Computer Science and Engineering (Artificial Intelligence and Machine Learning), B. Tech in Computer Science and Information Technology, B. Tech in Computer Science and Systems Engineering, B. Tech in Information Science and Engineering and the following two postgraduate programs: M. Tech in Artificial Intelligence and M. Tech in Cyber security. In addition, the school has a research centre in which students can conduct cutting edge research leading to a Ph.D. degree.

Curriculum of both undergraduate and postgraduate programs have been designed through a collaboration of academic and industry experts in order to bridge the growing gap between industry and academia. This makes the program highly practical-oriented, and thus industry-resilient. The B. Tech programs aims to create quality human resources to play leading roles in the contemporary, competitive industrial and corporate world. The masters' degrees focus on quality research and design in the core and application areas of Artificial Intelligence and Information Technology to foster a sustainable world and to enhance the global quality of life by adopting enhanced design techniques and applications. This thought is reflected in the various courses offered in the masters' programs.

### **School Vision**

To produce excellent quality technologists and researchers of global standards in computing and Information technology who have potential to contribute to the development of the nation and the society with their expertise, skills, innovative problem-solving abilities, strong moral and ethical values.

### **School Mission**

- To create state of the art computing labs infrastructure and research facilities in information technology.
- To provide student-centric learning environment in Computing and Information technology through innovative pedagogy and education reforms.
- To encourage research, innovation and entrepreneurship in computing and information technology through industry/academia collaborations and extension activities
- Organize programs through club activities for knowledge enhancement in thrust areas of information technology.
- To enhance leadership qualities among the youth and enrich personality traits, promote patriotism, moral and ethical values.

### **Quality Policy**

The School of computing and Information Technology is committed to excellence through following policies.

1. Impart quality education by providing state of art curriculum, experimental learning, and state of the art labs.
2. Enhance skill set of faculty members through faculty development programs and interaction with academia and industries.
3. Inculcate the competency in software/hardware design and programming through co-curricular activities like Hackathon, Project exhibition, Internship and Entrepreneurship Program.
4. Provide soft skill and skill development training for personality development and better placement.
5. Promote innovation and research culture among students and support faculty members for better research and development activity.

### MEMBERS OF BOARD OF STUDIES

Sl. No.	Name		Correspondence Address
1.	<b>Dr. Mallikarjun M Kodabagi</b> Professor and Director School of Computing and Information Technology REVA University	Chairperson	Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Bengaluru, Karnataka 560064
2.	<b>Dr. Vishwanath R Hulipalled</b> Professor School of C&IT	Member	Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Bengaluru, Karnataka 560064
3.	<b>Dr. Udaya Rani V</b> Professor School of C&IT	Member	Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Bengaluru, Karnataka 560064
4.	<b>Dr. Parthasarathy G</b> Associate Professor, School of C&IT	Member	Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Bengaluru, Karnataka 560064
5.	<b>Dr. M.Thurai Pandian</b> Associate Professor, School of Computing and Information Technology	Member	Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Bengaluru, Karnataka 560064
6.	<b>SreenivasaRamanujamKanduri</b> Academic Relationship Manager, TCS	Member (Industry Expert)	Academic Relationship Manager, Tata Consultancy Services, Bangalore.
7.	<b>Dr. Sundar K S</b> Associate Vice-President & Head, IMS Academy at Infosys	Member (Industry Expert)	Associate Vice-President & Head, IMS Academy at Infosys, Mysore
8.	<b>Dr. RamabrahmamGunturi</b> Consultant, TCS	Industry Expert	Tata Consultancy Services, Hyderabad.
9.	<b>Dr. S. A. Angadi</b> Professor, School of CSE,VTU	Academic Expert	Professor, School of CSE Visvesvaraya, Belagavi
10.	<b>Dr. Bharati Arakeri</b> Professor, School of CSE BMSIT, Bangalore.	Academic Expert	Professor, School of CSE BMSIT, Bangalore
11.	<b>Abhishek Revanna Swamy</b> Associate Project Manager, Robert Bosch	Alumni-Member	Associate Project Manager, Robert Bosch, Bangalore
12.	<b>Prasad Chitta</b> Solution Architect, TCS Bangalore	Member (Industry Expert)	Solution Architect, TCS Bangalore



## B. Tech Information Science and Engineering

### Program Overview

**Information Science and Engineering** encompasses a variety of topics that relates to computation and applications of computing like, development of algorithms, analysis of algorithms, programming languages, software design, computer hardware, e-commerce, business information technology, Data Analytics, Machine Learning, Block Chain Technology, Augmented Virtual Reality, Mobile Application Development, IoT, Wireless Sensor network, Web Technology. Information Science and Engineering has roots in Electrical Engineering, Mathematics, and Linguistics. In the past Computer Science and information science were taught as part of mathematics or engineering departments and in the last 3 decades they are emerged as separate engineering fields. In the present information era (Knowledge era), the Information Science and Engineering program will see an exponential growth as the future machines work on artificial intelligence.

The oldest known complex computing device, called the Antikythera mechanism, dates back to 87 B.C., to calculate astronomical positions and help Greeks navigate through the seas. Computing took another leap in 1843, when English mathematician Ada Lovelace wrote the first computer algorithm, in collaboration with Charles Babbage, who devised a theory of the first programmable computer. But the modern computing-machine era began with Alan Turing's conception of the Turing Machine and three Bell Labs scientists' invention of the transistor, which made modern-style computing possible, and landed them the 1956 Nobel Prize in Physics. For decades, Computing Technology was exclusive to the government and the military; later, academic institutions came online, and Steve Wozniak built the circuit board for Apple-1, making home computing practicable. On the connectivity side, Tim Berners-Lee created the World Wide Web, and Marc Andreessen built a browser, and that's how we came to live in a world where our glasses can tell us what we're looking at. With wearable computers, embeddable chips, smart appliances, and other advances in progress and on the horizon, the journey towards building smarter, faster and more capable computers is clearly just beginning.

Computers have become ubiquitous part of modern life, and new applications are introduced every day. The use of computer technologies is also commonplace in all types of organizations, in academia, research, industry, government, private and business organizations. As computers become even more pervasive, the potential for computer-related careers will continue to grow and the career paths in computer-related fields will become more diverse. Since 2001, global information and communication technologies (ICTs) have become more powerful, more accessible, and more widespread. They are now pivotal in enhancing competitiveness, enabling development, and bringing progress to all levels of society.

The career opportunities for Information Science and Engineering graduates are plenty and growing. Programming and software development, Data Scientists, Data Analysts, information systems operation and management, telecommunications and networking, computer science research, web and Internet, graphics and multimedia, training and support, and computer industry specialists are some of the opportunities the graduates find. The School of Computing and

Information Technology at REVA UNIVERSITY offers B. Tech., Information Science and Engineering, an undergraduate program to create motivated, innovative, creative and thinking graduates to fill ICT positions across sectors who can conceptualize, design, analyze, and develop ICT applications to meet the modern-day requirements.

The B. Tech. in Information Science and Engineering curriculum developed by the faculty at the School of Computing and Information Technology is outcome based and it comprises required theoretical concepts and practical skills in the domain. By undergoing this program, students develop critical, innovative, creative thinking and problem-solving abilities for a smooth transition from academic to real-life work environment. In addition, students are trained in interdisciplinary topics and attitudinal skills to enhance their scope. The above-mentioned features of the program, advanced teaching and learning resources and experience of the faculty members with their strong connections with ICT sector makes this program unique.

### **Program Educational Objectives (PEO's)**

After few years of graduation, the graduates of B. Tech (Information Science and Engineering) will:

- **PEO-1:** Communicate as a member in team and provide solutions in the area of expertise in software Industry.
- **PEO-2:** Start enterprise to improve the economy of the country for provide support to the customers with an attitude of lifelong learning.
- **PEO-3:** Pursue higher education in the field of Information Science and Engineering in allied areas.

### **Programme Outcomes (PO's)**

On successful completion of the program, the graduates of B. Tech (Information Science and Engineering) program will be able to:

- **PO-1: Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals for the solution of complex problems in Computer Science and Engineering.
- **PO-2: Problem analysis:** Identify, formulate, research literature, and analyze engineering problems to arrive at substantiated conclusions using first principles of mathematics, natural, and engineering sciences.
- **PO-3: Design/development of solutions:** Design solutions for complex engineering problems and design system components, processes to meet the specifications with consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- **PO-4: Conduct investigations of complex problems:** Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

- **PO-5: Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- **PO-6: The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- **PO-7: Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- **PO-8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
- **PO-9: Individual and team work:** Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.
- **PO-10: Communication:** Communicate effectively with the engineering community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations, and give and receive clear instructions.
- **PO-11: Project management and finance:** Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments.
- **PO-12: Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### **Program Specific Outcomes (PSO's)**

On successful completion of the program, the graduates of B. Tech (Information Science and Engineering) program will be able to:

- **PSO-1:** Develop and write algorithms in Information Science and Engineering
- **PSO-2:** Analyze and Solve problems in the field of Information Science and Engineering and address the real-life situations in the industry.
- **PSO-3:** Use different tools and techniques in Information Science and Engineering and allied areas.

# REVA University Academic Regulations

## B. Tech Degree Programmes

(Framed as per the provisions under Section 35 (ii), Section 7 (x) and Section 8 (xvi) & (xxi) of the REVA University Act, 2012)

### **Title and Commencement:**

These Regulations shall be called “REVA University Academic Regulations – B. Tech, Degree Program 2020-21 Batch subject to amendments from time to time by the Academic Council on recommendation of respective Board of Studies and approval of Board of Management

These Regulations shall come into force from the date of assent of the Chancellor.

### **The Programmes:**

These regulations cover the following B. Tech, Degree programs of REVA University offered during 2020-21

### **B. Tech in:**

Bioelectronics Engineering  
Civil Engineering  
Computer Science and Engineering  
Computer Science and Information Technology  
Computer Science and Systems Engineering  
Computer Science and Engineering (AI and ML)  
Electrical and Electronics Engineering  
Electrical and Computer Engineering  
Electronics and Communication Engineering  
Electronics and Computer Engineering  
Information Science and Engineering  
Mechanical Engineering  
Mechatronics Engineering

### **Duration and Medium of Instructions:**

Duration: The duration of the B. Tech degree program shall be FOUR years comprising of EIGHT Semesters. A candidate can avail a maximum of 16 semesters - 8 years as per double duration norm, in one stretch to complete B. Tech degree, including blank semesters, if any. Whenever a candidate opts for blank semester, he/she has to study the prevailing courses offered by the School when he/she resumes his/her studies.

The medium of instruction shall be English.

### **Definitions:**

Course: "Course" means a subject, either theory or practical or both, listed under a program; Example: "Fluid Mechanics" in B.Tech Civil Engineering program, Engineering Thermodynamics in B.Tech, Mechanical program are examples of courses to be studied under respective programs.

Every course offered will have three components associated with the teaching-learning process of the course, namely:

L	Lecture
T	Tutorial
P	Practice

Where:

L stands for Lecture session consisting of classroom instruction.

T stands for Tutorial session consisting participatory discussion / self-study/ desk work/ brief seminar presentations by students and such other novel methods that make a student to absorb and assimilate more effectively the contents delivered in the Lecture classes.

P stands for Practice session and it consists of Hands-on Experience / Laboratory Experiments / Field Studies / Case Studies / Project Based Learning or Course end Project/Self Study/ Online courses from listed portals that equip students to acquire the much-required skill component.

## 4.2 Classification of Courses

Courses offered are classified as: Core Courses, Open Elective Courses, Project work/Dissertation

**Core Course:** A course which should compulsorily be studied by a candidate choosing a particular program of study.

**Foundation Course (FC):** The foundation Course is a mandatory course which should be completed successfully as a part of graduate degree program irrespective of the program of study.

**Hard Core Course (HC) simply core course:** The Hard-Core Course is a Core Course in the main branch of study and related branch (es) of study, if any, that the candidates have to complete compulsorily.

**Soft Core Course (SC)** (also known as Professional Elective Course)

A Core course may be a Soft Core if there is a choice or an option for the candidate to choose a course from a pool of courses from the main branch of study or from a sister/related branch of study which supports the main branch of study.

**Open Elective Course (OE):**

An elective course chosen generally from other discipline / subject, with an intention to seek exposure to the basics of subjects other than the main discipline the student is studying is called an Open Elective Course.

**Project Work / Dissertation:**

Project work / Dissertation work is a special course involving application of knowledge in solving / analysing /exploring a real-life situation / difficult problem to solve a multivariable or complex engineering problems. The project will be conducted in two phases, Phase-I (7th Semester), consists of literature survey, problem identification, formulation and methodology. In Phase-II (8th Semester) student should complete the project work by designing or creating an innovative process or development of product as an outcome. A project work carrying TWO, FOUR or SIX credits is called Minor Project work / Dissertation. A project work of SIX, EIGHT, or TEN, credits is called Major Project work / Dissertation. A Minor Project work may be a hard core or a Soft Core as decided by the BOS / concerned. But the Major Project shall be Hard Core.

“Program” means the academic program leading to a Degree, Post Graduate Degree, Post Graduate Diploma Degree or such other degrees instituted and introduced in REVA University.

**Eligibility for Admission:**

5.1. The eligibility criteria for admission to B. Tech Program of 4 years (8 Semesters) is given below:

Sl. No.	Program	Duration	Eligibility
1	Bachelor of Technology (B. Tech)	4 Years (8 Semesters)	Passed 10+2 examination with Physics and Mathematics as compulsory subjects, along with any one of the following subjects, namely, Chemistry, Bio-Technology, Computer Science, Biology, Electronics and Technical Vocational subject Obtained at least 45% marks (40% in case of candidate belonging to SC/ST category) in the above subjects taken together.
2	Bachelor of Technology (B. Tech)	Lateral entry to second year	(A) Passed Diploma examination from an AICTE approved Institution with at least 45% marks (40% in case of candidates belonging to SC/ST category) in appropriate branch of Engineering / Technology.  (B) Passed B. Sc Degree from a recognized University as defined by UGC, with at least 45% marks (40% in case of candidates belonging to SC/ST category) and passed XII standard with mathematics as a subject.  (C) Provided that in case of students belonging to B. Sc. Stream, shall clear the subjects of Engineering Graphics / Engineering Drawing and Engineering Mechanics of the first year Engineering program along with the second year subjects.

			<p>(D) Provided further that, the students belonging to B. Sc. Stream shall be considered only after filling the seats in this category with students belonging to the Diploma stream.</p> <p>(E) Provided further that student, who have passed Diploma in Engineering &amp; Technology from an AICTE approved Institution or B. Sc., Degree from a recognized University as defined by UGC, shall also be eligible for admission to the first year Engineering Degree courses subject to vacancies in the first year class in case the vacancies at lateral entry are exhausted. However the admissions shall be based strictly on the eligibility criteria as mentioned in A, B, D, and E above.</p>
3	Bachelor of Technology (B. Tech)	Lateral entry to fourth year (final year)	(F) Any candidate with genuine reason from any University / Institution in the country upon credit transfer could be considered for lateral admission to the respective semester in the concerned branch of study, provided he/she fulfils the University requirements.
5	B. Tech. in Bioelectronics		Pass in PUC /10+2 examination with Physics, Biology/Biotechnology as compulsory along with at least one of the Chemistry/Mathematics / Computer Science / Electronics obtained minimum 45% marks (40% in case of candidates belonging to SC / ST category) in the above subjects taken together of any board recognized by the respective State Government / Central Government / Union Territories or any other qualification recognized as equivalent there to.

Provided further that the eligibility criteria are subject to revision by the Government Statutory Bodies, such as AICTE, UGC from time to time.

### **Courses of Study and Credits**

Each course of study is assigned with certain credit value

Each semester is for a total duration of 20 weeks out of which 16 weeks dedicated for teaching and learning and the remaining 4 weeks for final examination, evaluation and announcement of results

The credit hours defined as below

In terms of credits, every one hour session of L amounts to 1 credit per Semester and a minimum of two hour session of T or P amounts to 1 credit per Semester or a three hour session of T / P amounts to 2 credits over a period of one Semester of 16 weeks for teaching-learning process.

Credit = 13 credit hours spread over 16 weeks or spread over the semester

The total duration of a semester is 20 weeks inclusive of semester-end examination.

The following table describes credit pattern

Lectures (L)	Tutorials (T)	Practice (P)	Credits (L:T:P)	Total Credits	Total Contact Hours
4	2	0	4:1:0	5	6
3	2	0	3:1:0	4	5
3	0	2	3:0:1	4	5
2	2	2	2:1:1	4	6
0	0	6	0:0:3	3	6
4	0	0	4:0:0	4	4

The concerned BoS will choose the convenient Credit Pattern for every course based on size and nature of the course

Different Courses of Study:

Different Courses of Study are labeled as follows:

Core Course (CC)

Foundation Course (FC)

Hard Core Course (HC)

Soft Core Course (SC)

Open Elective Course (OE)

Project Work / Dissertation:

A project work carrying TWO, FOUR or SIX credits is called Minor Project work / Dissertation. A project work of EIGHT, TEN, TWELVE or SIXTEEN credits is called Major Project work / Dissertation. A Project work may be a hard core or a Soft Core as decided by the BoS / concerned.

These are defined under Section 4 of these regulations.

Credits and Credit Distribution

A candidate has to earn 160 credits for successful completion of B. Tech degree with the distribution of credits for different courses as given in table below:

Course Type	Credits (Range)
	For B. Tech Degree (8 Semesters)
Foundation Core Course	A minimum of 06 but not exceeding 12
Hard Core Course	A minimum of 118 but not exceeding 121
Soft Core Course	A minimum of 15 but not exceeding 21
Open Elective	A minimum of 04 but not exceeding 12

8.2. The concerned BOS based on the credits distribution pattern given above shall prescribe the credits to various types of courses and shall assign title to every course including project work, practical work, field



work, self-study elective, as Foundation Course (FC), Hard Core (HC) or Soft Core (SC), Open Elective (OE).

- 8.3. Every course including project work, practical work, field work, self-study elective should be entitled as Foundation Course (FC), Hard Core (HC) or Soft Core (SC) or Open Elective (OE) or Core Course (CC) by the BoS concerned. However, following shall be the Foundation Courses with credits mentioned against them, common to all branches of study.

Sl. No.	Course Title	Number of Credits
<b>Foundation Courses</b>		
1	English for Technical Communication / Communication Skills	2
2	Environmental Studies / Environmental Science	2
3	Indian Constitution and Professional Ethics	2
4	MOOC / Internship /Soft Skill Training	6-15

- 8.4. The concerned BOS shall specify the desired Program Educational Objectives, Program Outcomes, Program Specific Outcomes and Course Outcomes while preparing the curriculum of a particular program.
- 8.5. A candidate can enrol for a maximum of 28 credits and a minimum of 19 credits per Semester. However, he / she may not successfully earn a maximum of 28 credits per semester. This maximum of 28 credits does not include the credits of courses carried forward by a candidate.

Only such full-time candidates who register for a minimum prescribed number of credits in each semester from I semester to VIII semester and complete successfully 160 credits in 8 successive semesters shall be considered for declaration of Ranks, Medals, Prizes and are eligible to apply for Student Fellowship, Scholarship, Free ships, and such other rewards / advantages which could be applicable for all full-time students and for hostel facilities.

#### **Add- on Proficiency Certification:**

To acquire Add on Proficiency Certification a candidate can opt to complete a minimum of 4 extra credits either in the same discipline /subject or in different discipline / subject in excess to 160 credits for the B. Tech Degree program.

Add on Proficiency Diploma / Minor degree/ Honours Degree:

To acquire Add on Proficiency Diploma/ Minor degree/ Honour Degree: a candidate can opt to complete a minimum of 18 extra credits either in the same discipline /subject or in different discipline / subject in excess to 160 credits for the B. Tech Degree program.

The Add on Proficiency Certification / Diploma/ Minor degree/ Honour Degree: so, issued to the candidate contains the courses studied and grades earned.

#### **Assessment and Evaluation**

The Scheme of Assessment will have two parts, namely;

Internal Assessment (IA); and

Semester End Examination (SEE)

Assessment and Evaluation of each Course shall be for 100 marks. The Internal Assessment (IA) and Semester End Examination (SEE) of UG Engineering programs shall carry 50:50 marks respectively (i.e., 50 marks internal assessment; 50 marks semester end examination).

The 50 marks of internal assessment shall comprise of:

Internal Test	30 marks
Assignments / Seminars / Model Making / Integrated Lab / Project Based Learning / Quizzes etc.	20 marks

There shall be two Internal Tests conducted as per the schedule announced below. The students shall attend both the Tests compulsorily.

1st test is conducted for 15 marks during 6th week of the semester;

2nd test is conducted for 15 marks during 12th week of the of the semester;

The coverage of syllabus for the said tests shall be as under:

Question paper of the 1st test should be based on first 40 %of the total syllabus;

Question paper of the 2nd test should be based on second 40 %of the total syllabus;

An assignment must be designed to cover the last 20% of the syllabus.

There shall be one Assignment / Project Based Learning / Field Visit / Quiz test carrying 20 marks covering the last 20% of the syllabus.

The Semester End Examination for 50 marks shall be held in the 18th and 19th week of the beginning of the semester and the syllabus for the semester end examination shall be entire syllabus.

A test paper is set for a maximum of 30 marks to be answered in 1 hour duration. A test paper can have 4 main questions. Each main question is set for 10 marks. The main question can have 2-3 sub questions all totalling 10 marks. Students are required to answer any three main questions. Each question is set using Bloom's verbs. The questions must be set to assess the students' outcomes described in the course document.

The question papers for internal test shall be set by the internal teachers who have taught the course. If the course is taught by more than one teacher all the teachers together shall devise a common question paper(s). However, these question papers shall be scrutinized by the Question Paper Scrutiny Committee to bring in the uniformity in the question paper pattern and as well to maintain the necessary standards.

The evaluation of the answer scripts shall be done by the internal teachers who have taught the course and set the test paper.

Assignment/seminar/Project based learning/simulation-based problem solving/field work should be set in such a way, students be able to apply the concepts learnt to a real-life situation and students should be able to do some amount self-study and creative thinking. While setting assignment care should be taken such that the students will not be able to plagiarise the answer from web or any other resources. An assignment / Quiz can be set for a maximum of 20. Course instructor at his/her discretion can design the questions as a small group exercise or individual exercise. This should encourage collaborative learning and team learning and also self-study.

Internal assessment marks must be decided well before the commencement of Semester End examinations.

Semester End Examination: The Semester End Examination is for 50 marks shall be held in the 18th and 19th week of the semester and the entire course syllabus must be covered while setting the question paper.

Semester End Examination paper is set for a maximum of 100 marks to be answered in 3 hours duration. Each main question be set for a maximum of 25 marks, main questions can have a 3-4 sub questions. A total of 8 questions are set so that students will have a choice. Each question is set using Bloom's verbs. The questions must be set to assess the students' outcomes described in the course document. (Please note question papers have to be set to test the course outcomes)

There shall be three sets of question papers for the semester end examination of which one set along with scheme of examination shall be set by the external examiners and two sets along with scheme of examination shall be set by the internal examiners. All the three sets shall be scrutinized by the Board of Examiners. It shall be responsibility of the Board of Examiners particularly Chairman of the BOE to maintain the quality and standard of the question papers and as well the coverage of the entire syllabus of the course.

There shall be single evaluation by the internal teachers who have taught the subject. However, there shall be moderation by the external examiner. In such cases where sufficient number of external examiners are not available to serve as moderators internal senior faculty member shall be appointed as moderators.

Board of Examiners, question paper setters and any member of the staff connected with the examination are required to maintain integrity of the examination system and the quality of the question papers.

There shall also be an Program Assessment Committee (PAC) comprising at-least 3 faculty members having subject expertise who shall after completion of examination process and declaration of results review the results sheets, assess the performance level of the students, measure the attainment of course outcomes, program outcomes and assess whether the program educational objectives are achieved and report to the Director of the School. The Examination Review Committee shall also review the question papers of both Internal Tests as well Semester End Examinations and submit reports to the Director of the respective School about the scope of the curriculum covered and quality of the questions.

The report provided by the Examination Review Committee shall be the input to the Board of Studies to review and revise the scheme of instruction and curriculum of respective program

During unforeseen situation like the Covid-19, the tests and examination schedules, pattern of question papers and weightage distribution may be designed as per the convenience and suggestions of the board of examiners in consultation with COE and VC

University may decide to use available modern technologies for writing the tests and SEE by the students instead of traditional pen and paper

Any deviations required to the above guidelines can be made with the written consent of the Vice Chancellor

Online courses may be offered as per UGC norms.

For online course assessment guidelines would be as follows:

If the assessment is done by the course provider, then the school can accept the marks awarded by the course provider and assign the grade as per REVA University norms.

If the assessment is not done by the course provider, then the assessment is organized by the concerned school and the procedure explained in the regulation will apply

In case a student fails in an online course, s/he may be allowed to repeat the course and earn the required credits

IAs for online courses could be avoided and will remain the discretion of the school.

The online platforms identified could be SWAYAM, NPTEL, Coursera, Edx.org, Udemy, Udacity and any other internationally recognized platforms like MIT online, Harvard online etc.

Utilization of one or two credit online courses would be:

4-week online course – 1 credit

8-week online course / MOOC – 2 credits

12-week online course / MOOC – 3 credits

Summary of Internal Assessment, Semester End Examination and Evaluation Schedule is provided in the table given below.

Summary of Internal Assessment and Evaluation Schedule

Sl. No.	Type of Assessment	when	Syllabus Covered	Max Marks	Reduced to	Date by which the process must be completed
1	Test-1	During 6th week	First 40%	30	15	7th week
2	Test -2	During 12th Week	Second 40%	30	15	13th Week
3	Assignment / Quiz	15th Week	Last 20%	20	20	16th Week
4	SEE	18/19th Week	100%	100	50	20th Week

Assessment of Students Performance in Practical Courses

The performance in the practice tasks / experiments shall be assessed on the basis of:

- a) Knowledge of relevant processes;
- b) Skills and operations involved;
- c) Results / products including calculation and reporting.

The 50 marks meant for Internal Assessment (IA) of the performance in carrying out practical shall further be allocated as under:

i	Conduction of regular practical / experiments throughout the semester	20 marks
ii	Maintenance of lab records	10 marks
iii	Performance of mid-term test (to be conducted while conducting second test for theory courses); the performance assessments of the mid-term test includes performance in the conduction of experiment and write up about the experiment.	20 marks
<b>Total</b>		<b>50 marks</b>

10.2 The 50 marks meant for Semester End Examination (SEE), shall be allocated as under:

i	Conducting of semester end practical examination	30 marks
ii	Write up about the experiment / practical conducted	10 marks
iii	Viva Voce	10 marks
<b>Total</b>		<b>50 marks</b>

10.3 The duration for semester-end practical examination shall be decided by the concerned School Board.

For MOOC and Online Courses assessment shall be decided by the BOS of the School.

For > 3 credit courses

i	IA-I	25 marks
ii	IA-2	25 marks
iii	Semester end examination by the concern school board (demo, test, viva voice etc.)	50 marks
<b>Total</b>		<b>100 marks</b>

For 1 & 2 credit courses

i	IA-I	15 marks
ii	IA-2	15 marks

iii	Semester end examination by the concern school board (demo, test, viva voice etc.)	20 marks
<b>Total</b>		<b>50 marks</b>

11. Evaluation of Minor Project / Major Project / Dissertation:

Right from the initial stage of defining the problem, the candidate has to submit the progress reports periodically and also present his/her progress in the form of seminars in addition to the regular discussion with the supervisor. At the end of the semester, the candidate has to submit final report of the project / dissertation, as the case may be, for final evaluation. The components of evaluation are as follows:

Component – I	Periodic Progress and Progress Reports (25%)
Component – II	Demonstration and Presentation of work (25%)
Component – III	Evaluation of Report (50%)

Requirements to Pass a Course:

A candidate's performance from IA and SEE will be in terms of scores, and the sum of IA and SEE scores will be for a maximum of 100 marks (IA = 50, SEE = 50) and have to secure a minimum of 40% to declare pass in the course. However, a candidate has to secure a minimum of 25% (13 marks) in Semester End Examination (SEE) which is compulsory.

The Grade and the Grade Point: The Grade and the Grade Point earned by the candidate in the subject will be as given below:

Marks, P	Grade, G	Grade Point (GP=V x G)	Letter Grade
90-100	10	v*10	O
80-89	9	v*9	A+
70-79	8	v*8	A
60-69	7	v*7	B+
55-59	6	v*6	B
50-54	5.5	v*5.5	C+
40-49	5	v*5	C
0-39	0	v*0	F
ABSENT			AB

O - Outstanding; A+-Excellent; A-Very Good; B+-Good; B-Above Average; C+-Average; C-Satisfactory; F – Unsatisfactory.

Here, P is the percentage of marks ( $P=[IA + SEE]$ ) secured by a candidate in a course which is rounded to nearest integer. V is the credit value of course. G is the grade and GP is the grade point.

Computation of SGPA and CGPA

The Following procedure to compute the Semester Grade Point Average (SGPA).

The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student in a given semester, i.e :  $SGPA (S_i) = \frac{\sum(C_i \times G_i)}{\sum C_i}$  where  $C_i$  is the number of credits of the  $i$ th course and  $G_i$  is the grade point scored by the student in the  $i$ th course.

Illustration for Computation of SGPA and CGPA

Illustration No. 1

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade)
Course 1	3	A+	9	3X9=27
Course 2	3	A	8	3X8=24
Course 3	3	B+	7	3X7=21
Course 4	4	O	10	4X10=40
Course 5	1	C	5	1X5=5
Course 6	2	B	6	2X6=12
Course 7	3	O	10	3X10=30
	<b>19</b>			<b>159</b>

Thus,  $SGPA = 159 \div 19 = 8.37$

Illustration No. 2

Course	Credit	Grade letter	Grade Point	Credit Point (Credit x Grade point)
Course 1	4	A	8	4X8=32
Course 2	4	B+	7	4X7=28
Course 3	3	A+	9	3X9=27
Course 4	3	B+	7	3X7=21
Course 5	3	B	6	3X6=18
Course 6	3	C	5	3X5=15
Course 7	2	B+	7	2X7=14
Course 8	2	O	10	2X10=20
	<b>24</b>			<b>175</b>

Thus,  $SGPA = 175 \div 24 = 7.29$

Illustration No.3

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade point)
Course 1	4	O	10	4 x 10 = 40
Course 2	4	A+	9	4 x 9 = 36
Course 3	3	B+	7	3 x 7 = 21
Course 4	3	B	6	3 x 6 = 18
Course 5	3	A+	9	3 x 9 = 27
Course 6	3	B+	7	3 x 7 = 21
Course 7	2	A+	9	2 x 9 = 18
Course 8	2	A+	9	2 x 9 = 18
	<b>24</b>			<b>199</b>

Thus, SGPA =  $199 \div 24 = 8.29$

Cumulative Grade Point Average (CGPA):

Overall Cumulative Grade Point Average (CGPA) of a candidate after successful completion of the required number of credits (160) for B. Tech degree in Engineering & Technology is calculated taking into account all the courses undergone by a student over all the semesters of a program, i. e :  $CGPA = \frac{\sum(C_i \times S_i)}{\sum C_i}$

Where  $S_i$  is the SGPA of the  $i$ th semester and  $C_i$  is the total number of credits in that semester.

Illustration:

CGPA after Final Semester

Semester (ith)	No. of Credits ( $C_i$ )	SGPA ( $S_i$ )	Credits x SGPA ( $C_i \times S_i$ )
1	19	6.83	19 x 6.83 = 129.77
2	21	7.29	21 x 7.29 = 153.09
3	22	8.11	22 x 8.11 = 178.42
4	22	7.40	22 x 7.40 = 162.80
5	22	8.29	22 x 8.29 = 182.38
6	22	8.58	22 x 8.58 = 188.76
7	22	9.12	22 x 9.12 = 200.64
8	10	9.25	10 x 9.25 = 92.50
<b>Cumulative</b>	<b>160</b>		<b>1288.36</b>

Thus,  $CGPA = \frac{19 \times 6.83 + 21 \times 7.29 + 22 \times 8.11 + 22 \times 7.40 + 22 \times 8.29 + 22 \times 8.58 + 22 \times 9.12 + 10 \times 9.25}{160} = 8.05$

**Conversion of grades into percentage:**

Conversion formula for the conversion of CGPA into Percentage is:

Percentage of marks scored = CGPA Earned x 10

Illustration: CGPA Earned 8.05 x 10 = 80.5



The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

#### Classification of Results

The final grade point (FGP) to be awarded to the student is based on CGPA secured by the candidate and is given as follows.

CGPA	Grade (Numerical Index)	Letter Grade	Performance	FGP
	G			Qualitative Index
9 >= CGPA 10	10	O	Outstanding	Distinction
8 >= CGPA < 9	9	A+	Excellent	
7 >= CGPA < 8	8	A	Very Good	First Class
6 >= CGPA < 7	7	B+	Good	
5.5 >= CGPA < 6	6	B	Above average	Second Class
>5 CGPA < 5.5	5.5	C+	Average	
>4 CGPA < 5	5	C	Satisfactory	Pass
< 4 CGPA	0	F	Unsatisfactory	Unsuccessful

Overall percentage=10\*CGPA

**Provisional Grade Card:** The tentative / provisional grade card will be issued by the Controller of Examinations at the end of every semester indicating the courses completed successfully. The provisional grade card provides Semester Grade Point Average (SGPA).

**Final Grade Card:** Upon successful completion of B. Tech Degree a Final Grade card consisting of grades of all courses successfully completed by the candidate will be issued by the Controller of Examinations.

#### 14. Attendance Requirement:

14.1 All students must attend every lecture, tutorial and practical classes.

14.2 In case a student is on approved leave of absence (e g:- representing the University in sports, games or athletics, placement activities, NCC, NSS activities and such others) and / or any other such contingencies like medical emergencies, the attendance requirement shall be minimum of 75% of the classes taught.

14.3 Any student with less than 75% of attendance in aggregate of all the courses including practical courses / field visits etc, during a semester shall not be permitted to appear to the end semester examination and such student shall seek re-admission

#### 15. Re-Registration and Re-Admission:

15.1 In case a candidate's class attendance in aggregate of all courses in a semester is less than 75% or as stipulated by the University, such a candidate is considered as dropped the semester and is not allowed to appear for semester end examination and he / she shall have to seek re-admission to that semester during subsequent semester / year within a stipulated period.

15.2 In such case where in a candidate drops all the courses in a semester due to personal reasons, it is considered that the candidate has dropped the semester and he / she shall seek re-admission to such dropped semester.

**Absence during Internal Test:**

In case a student has been absent from an internal tests due to the illness or other contingencies he / she may give a request along with necessary supporting documents and certification from the concerned class teacher / authorized personnel to the concerned Director of the School, for conducting a separate internal test. The Director of the School may consider such request depending on the merit of the case and after consultation with course instructor and class teacher, and arrange to conduct a special internal test for such candidate(s) well in advance before the Semester End Examination of that respective semester. Under no circumstances internal tests shall be held / assignments are accepted after Semester End Examination.

17. Provision for Appeal

17.1. If a candidate is not satisfied with the evaluation of Internal Assessment components (Internal Tests and Assignments), he/she can approach the Grievance Cell with the written submission together with all facts, the assignments, and test papers, which were evaluated. He/she can do so before the commencement of respective semester-end examination. The Grievance Cell is empowered to revise the marks if the case is genuine and is also empowered to levy penalty as prescribed by the University on the candidate if his/her submission is found to be baseless and unduly motivated. This Cell may recommend for taking disciplinary/corrective action on an evaluator if he/she is found guilty. The decision taken by the Grievance committee is final.

18. **Grievance Committee:**

For every program there will be one grievance committee. The composition of the grievance committee is as follows:-

The Controller of Examinations - Ex-officio Chairman / Convener

One Senior Faculty Member (other than those concerned with the evaluation of the course concerned) drawn from the school / department/discipline and/or from the sister schools / departments/sister disciplines – Member.

One Senior Faculty Members / Subject Experts drawn from outside the University school / department – Member.

**Eligibility to Appear for Semester End Examination (SEE)**

Only those students who fulfil a minimum of 75% attendance in aggregate of all the courses including practical courses / field visits etc., as part of the program shall be eligible to appear for Semester End Examination

**Provision for Supplementary Examination**

In case a candidate fails to secure a minimum of 25% (13 marks) in Semester End Examination (SEE) and a minimum of 40% marks together with IA and SEE to declare pass in the course, such candidate shall seek supplementary examination of only such course(s) wherein his / her performance is declared unsuccessful. The supplementary examinations are conducted after the announcement of even semester examination results. The

candidate who is unsuccessful in a given course(s) shall appear for supplementary examination of odd and even semester course(s) to seek for improvement of the performance.

**Provision to Carry Forward the Failed Subjects / Courses:**

The student who has failed in a maximum of 4 courses in odd and even semesters together shall move to next semester of succeeding year(s) of study till 8th semester. And he / she shall appear for Semester End examination of failed courses of previous semesters concurrently with odd semester end examinations and / or even semester end examinations of current year of study.

**Examples:-**

Student "A" has failed in 1 Course in First Semester and 3 Courses in Second Semester. He / she is eligible to seek admission for Third Semester and appear for Semester End Examination of 1 failed Course of First Semester concurrently with Third Semester end examination. Likewise, he / she is eligible to appear for Semester End Examination of 3 failed Courses of Second Semester concurrently with Fourth Semester end examination.

Student "B" has failed in 2 Courses of First Semester and 2 Courses in Fourth Semester and has passed in all Courses of First and Second Semesters. He / she is eligible to seek admission to Fifth Semester and appear for Semester End Examination of 2 failed Courses of First Semester concurrently with Fifth Semester end examination. Likewise, he / she is eligible to appear for Semester End Examination of 2 failed Courses of Fourth Semester concurrently with Sixth Semester end examination.

Student "C" has failed in one course in Second Semester one course in third semester and two courses in fifth semester and has cleared all other courses from first semester to Sixth Semester. He / She has also passed all the courses of First to Sixth Semesters. Student "C" is eligible to seek admission for Seventh Semester and appear for Semester End Examination of one failed Course of Second Semester, one course of third semester and two courses in fifth semester concurrently with Seventh Semester end examination. However, he / she has to pass all the failed courses of Second Semester, Third Semester and Fifth Semester along with Seventh and Eighth Semesters courses to earn B. Tech Degree.

Student "D" failed in three courses in first semester and one course in second semester, but has passed in all the courses of second to sixth semester. Student "D" is also eligible to seek admission for 7th Semester and appear for Semester End Examination of 3 failed courses of 1st Semester and one course of second semester concurrently with 7th Semester and 8th semester end examinations. However, he / she has to pass three failed courses of first semester and one failed course of second semester along with Seventh and Eighth Semester courses to earn B. Tech Degree.

The student failed in any course(s) in any of the first to eight semester has to pass all the failed courses of all Semesters within the double duration to earn B. Tech Degree failing which he / she has to seek re-admission to the program afresh.

**Challenge Valuation:**

- a) A student who desires to apply for challenge valuation shall obtain a photo copy of the answer script(s) of semester end examination by paying the prescribed fee within 10 days after the announcement of the results. He / She can challenge the grade awarded to him/her by surrendering the grade card and by submitting an application along with the prescribed fee to the Controller of Examinations within 10

days after the announcement of the results. This challenge valuation is only for semester end examination.

- b) The answer scripts (in whatever form) for which challenge valuation is sought for shall be evaluated by the external examiner who has not involved in the first evaluation. The higher of two marks from first valuation and challenge valuation shall be the final.

With regard to any specific case of ambiguity and unsolved problem, the decision of the Vice-Chancellor shall be final.

All assessments must be done by the respective Schools as per the guidelines issued by the Controller of Examinations. However, the responsibility of announcing final examination results and issuing official transcripts to the students lies with the office of the Controller of Examinations.

**School of Computing and Information Technology**  
**Scheme of Instructions (2021 – 2025 Batch)**  
**B. Tech ISE**

**I SEMESTER**

Sl. No	Course Code	Title of the Course	HC/FC/SC/ OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Credits	
1	B20AS0105	Multivariable Calculus and Linear Algebra	HC	3	0	0	3	3
2	B20EE0101	Basics of Electrical and Electronics Engineering	HC	3	0	1	4	5
3	B20CI0101	Introduction to Python Programming	FC	2	0	1	3	4
4	B20AS0104	Engineering Chemistry	HC	3	0	0	3	3
<b>TOTAL</b>				<b>11</b>	<b>0</b>	<b>2</b>	<b>13</b>	<b>15</b>
<b>Practical /Term Work / Practice Sessions /MOOCs</b>								
5	B20ME0102	Design Thinking	FC	1	0	1	2	3
6	B20AS0109	Biology for Engineers	FC	1	0	0	1	1
7	B20ME0101	Computer Aided Engineering Drawing	HC	2	0	1	3	4
<b>TOTAL</b>				<b>4</b>	<b>0</b>	<b>2</b>	<b>6</b>	<b>8</b>
<b>TOTAL SEMESTER CREDITS</b>								<b>19</b>
<b>TOTAL CUMULATIVE CREDITS</b>								<b>19</b>
<b>TOTAL CONTACT HOURS</b>								<b>23</b>

**II SEMESTER**

Sl. No	Course Code	Title of the Course	HC/FC/SC/ OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Credits	
1	B20AS0204	Probability and Statistics	HC	4	0	0	4	4
2	B20AS0106	Physics for Computer Science	HC	3	0	0	3	3
3	B20CS0101	Introduction to Data Science	FC	2	0	1	3	4
4	B20CE0201	Basics of Civil and mechanical Engineering	HC	3	0	1	4	5
5	B20CS0102	Programming for Problem Solving	HC	3	0	1	4	5
<b>TOTAL</b>				<b>15</b>	<b>0</b>	<b>3</b>	<b>18</b>	<b>21</b>
<b>Practical /Term Work / Practice Sessions /MOOCs</b>								
6	B20EC0101	IoT and Applications	FC	1	0	1	2	3
7	B20ME0104	Entrepreneurship	FC	1	0	0	1	1
<b>TOTAL</b>				<b>2</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>4</b>
<b>TOTAL SEMESTER CREDITS</b>								<b>21</b>
<b>TOTAL CUMULATIVE CREDITS</b>								<b>40</b>
<b>TOTAL CONTACT HOURS</b>								<b>25</b>

### III SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC/SC/ OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Credits	
1	B20CI0301	Analog and Digital Electronics	HC	3	0	0	3	3
2	B20CI0302	Programming with JAVA	HC	3	0	0	3	3
3	B20CI0303	Data Structures	HC	3	0	0	3	3
4	B20AS0302	Discrete Mathematics and Graph Theory	HC	3	0	0	3	3
5	B20CI0304	Agile Software Development and DevOps	HC	3	0	0	3	3
6	B20CI0305	Analog and Digital Electronics Lab	HC	0	0	1	1	2
7	B20CI0306	Programming with JAVA Lab	HC	0	0	1	1	2
8	B20CI0307	Data Structures Lab	HC	0	0	1	1	2
<b>TOTAL</b>				<b>15</b>	<b>0</b>	<b>3</b>	<b>18</b>	<b>21</b>
<b>Practical /Term Work / Practice Sessions /MOOCs</b>								
9	B20MGM301	Management Science	FC	2	0	0	2	2
10	B20AS0301	Environmental Science	FC	2	0	0	2	2
11	B20AHM301 OR B20AHM302	Advanced Kannada OR Basics of Kannada	MC	0	0	0	0	0
<b>TOTAL</b>				<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>4</b>
<b>TOTAL SEMESTER CREDITS</b>							<b>22</b>	
<b>TOTAL CUMULATIVE CREDITS</b>							<b>62</b>	
<b>TOTAL CONTACT HOURS</b>							<b>25</b>	

### IV SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC/SC/ OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Credits	
1	B20CI0401	Design and Analysis of Algorithms	HC	3	0	0	3	3
2	B20CI0402	Operating System	HC	3	0	0	3	3
3	B20CI0403	Database Management System	HC	3	0	0	3	3
4	B20EJ0401	Computer Organization and Architecture	HC	3	0	0	3	3
5	B20AS0401	Numerical Methods and Optimization Techniques	HC	3	0	0	3	3
6	B20EJ0402	Theory of Computation	HC	3	0	0	3	3
7	B20CI0404	Design and Analysis of Algorithms Lab	HC	0	0	1	1	2
8	B20CI0405	Operating System Lab	HC	0	0	1	1	2
9	B20CI0406	Database Management System Lab	HC	0	0	1	1	2
<b>TOTAL</b>				<b>18</b>	<b>0</b>	<b>3</b>	<b>21</b>	<b>24</b>
<b>Practical /Term Work / Practice Sessions /MOOCs</b>								

10	B20AH0301	Communication Skills	FC	2	0	0	2	2
11	B20LS0301	Indian Constitution and Professional Ethics	FC	2	0	0	2	2
12	B20AHM401	Universal human values	MC	0	0	0	0	0
<b>TOTAL</b>				<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>4</b>
<b>TOTAL SEMESTER CREDITS</b>							<b>25</b>	
<b>TOTAL CUMULATIVE CREDITS</b>							<b>87</b>	
<b>TOTAL CONTACT HOURS</b>							<b>28</b>	

### V SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC/SC/ OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Credits	
1	B20EJ0501	Web Technologies and Applications	HC	3	0	0	3	3
2	B20CI0501	Computer Networks	HC	3	0	0	3	3
3	B20CI0502	Machine Learning	HC	3	0	0	3	3
4	B20EQ0501	Information Theory & Coding	HC	3	0	0	3	3
5	B20EXS5(01-05)	Professional Elective-I	SC	3	0	0	3	3
6	B20XXO5XX	Open Elective-I	OE	3	0	0	3	3
7	B20EJ0504	Web Technologies and Applications Lab	HC	0	0	1	1	2
8	B20CI0505	Machine Learning Lab	HC	0	0	1	1	2
9	B20CI0506	Computer Networks Lab	HC	0	0	1	1	2
<b>TOTAL</b>				<b>18</b>	<b>0</b>	<b>3</b>	<b>21</b>	<b>24</b>
<b>Practical /Term Work / Sessions</b>								
10	B20CI0503	Technical Documentation	FC	1	0	0	1	1
11	B20EJ0503	Software Testing	HC	1	0	1	2	3
<b>TOTAL</b>				<b>2</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>4</b>
<b>TOTAL SEMESTER CREDITS</b>							<b>24</b>	
<b>TOTAL CUMULATIVE CREDITS</b>							<b>111</b>	
<b>TOTAL CONTACT HOURS</b>							<b>28</b>	

### VI SEMESTER

Sl. No	Course Code	Title of the Course	HC/F C/SC/ OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Credits	
1	B20EJ0601	Information and Network Security	HC	3	0	0	3	3
2	B20EQ0601	Information Retrieval System	HC	3	0	0	3	3
3	B20EXS6(01-06)	Professional Elective-II	SC	3	0	0	3	3
4	B20EXS6(07-09)	Professional Elective-III	SC	3	0	0	3	3
5	B20EXS6(10-12)	Professional Elective-IV	SC	3	0	0	3	3
6	B20XXO6XX	Open Elective-II	OE	3	0	0	3	3
7	B20EJ0603	Information and Network Security Lab	HC	0	0	1	1	2
8	B20EQ0602	Information Retrieval System Lab	HC	0	0	1	1	2

<b>TOTAL</b>				<b>18</b>	<b>0</b>	<b>2</b>	<b>20</b>	<b>22</b>
<b>Practical /Term Work / Sessions</b>								
9	B20CI0601	Research Based Mini Project	HC	0	0	2	2	4
10	B20PA0501	Indian Tradition and Culture	FC	1	0	0	1	1
11	B20EQ0603	Modern Database	HC	1	0	1	2	3
<b>TOTAL</b>				<b>2</b>	<b>0</b>	<b>3</b>	<b>5</b>	<b>8</b>
<b>TOTAL SEMESTER CREDITS</b>							<b>25</b>	
<b>TOTAL CUMULATIVE CREDITS</b>							<b>136</b>	
<b>TOTAL CONTACT HOURS</b>							<b>30</b>	

## VII SEMESTER

Sl. No	Course Code	Title of the Course	HC/F C/SC/ OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Credits	
1	B20EXS7 (01-03)	Professional Elective-V	SC	3	0	0	3	3
2	B20XXO7XX	Open Elective-III	OE	3	0	0	3	3
<b>TOTAL</b>				<b>6</b>	<b>0</b>	<b>0</b>	<b>6</b>	<b>6</b>
<b>Practical /Term Work / Sessions</b>								
3	B20CI0701	Summer Internship/Global Certification	HC	0	0	3	3	6
4	B20CI0702	Project Phase-I	HC	0	0	4	4	8
<b>TOTAL</b>				<b>0</b>	<b>0</b>	<b>7</b>	<b>7</b>	<b>14</b>
<b>TOTAL SEMESTER CREDITS</b>							<b>13</b>	
<b>TOTAL CUMULATIVE CREDITS</b>							<b>149</b>	
<b>TOTAL CONTACT HOURS</b>							<b>20</b>	
<p><b>Note:</b> (1) Internship must be for atleast 2 months to be considered for 6 credits. Internships abroad will also be considered for the credits. (2) Global certification program students must obtain a certificate to attain 85 to 100% marks based on relative performance. If not eligible for certificate, they will have to undergo examination at school level for 80% marks, and marks will be awarded based on examination performance; such a program will be considered as Skill Development Program. (3) Phase-I Project: It may be covered as a crash course before the commencement of 8th semester to pave the way for internship and project work.</p>								

## VIII SEMESTER

Sl. No	Course Code	Title of the Course	HC/F C/SC/ OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Credits	
1	B20CI0801	Capstone-Project Phase-II	HC	0	0	8	8	16
<b>TOTAL</b>				<b>0</b>	<b>0</b>	<b>8</b>	<b>8</b>	<b>16</b>
<b>Practical /Term Work / Practice Sessions /MOOCs</b>								



2	B20XXO8XX	Open Elective-IV	OE	3	0	0	3	3
<b>TOTAL</b>				<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>3</b>
<b>TOTAL SEMESTER CREDITS</b>							<b>11</b>	
<b>TOTAL CUMULATIVE CREDITS</b>							<b>160</b>	
<b>TOTAL CONTACT HOURS</b>							<b>19</b>	

## Professional Electives

Professional Electives with specialization in ISE Stream						
	Code	Course	Code	Course	Code	Course
<b>PE-I/ V sem</b>	B20EQS501	Digital Communications	B20EJS502	System Software	B20EJS503	Mobile Application Development
	B20EJS504	Human Computer Interaction	B20EQS505	Data Mining		
<b>PE-II/ VI sem</b>	B20EQS601	Virtualization and Cloud Computing	B20EQS602	Advanced DBMS	B20EQS603	Big Data Analytics
	B20EJS604	Block Chain Technology	B20EQ0605	Multi Agent Systems	B20EJS606	Neural Networks and Deep learning
<b>PE-III/ VI sem</b>	B20EQS607	Image processing and Computer Vision	B20EQS608	Data Centre Technology	B20EJS609	Compiler Design
<b>PE-IV/ VI sem</b>	B20EQS611	Storage Area Networks	B20EJS610	Natural Language Processing in AI	B20EQS612	Full Stack Development
<b>PE-V/ VII sem</b>	B20EJS701	Multimedia Systems	B20EJS0702	Augmented and Virtual Reality	B20EJS703	Soft Computing systems

Open Electives Offered to Other schools											
5TH SEM /OE-I			6th SEM /OE-II			7th SEM /OE-III			8th SEM /OE-IV		
Course code	Course Name	Teaching School	Course code	Course Name	Teaching School	Course code	Course Name	Teaching School	Course code	Course Name	Teaching School
B20CIO501	Introduction to AI	CIT	B20CIO601/602	Data Mining/ Machine Learning	CIT	B20CIO701	Python for data science	CIT	B20CIO801	IoT Programming	CIT
B20CIO502/503	OOPS with C++/ Web technology	CIT	B20CIO603	Neural Networks	CIT	B20CIO702	Deep Learning	CIT	B20CIO802	Reinforcement Learning	CIT

## Detailed Syllabus Semester1

Course Title	Multivariable Calculus and Linear Algebra				Course Type		Theory	
Course Code	B20AS0105	Credits	3		Class		I Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	IA	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	-	<b>50%</b>	<b>50%</b>

### COURSE OVERVIEW:

The course Differential Calculus deals with the basic aspect's differential calculus. The students of Computer Science are equally benefited with this course as stepping stone to the broad areas of calculus. This course familiarizes students with important concepts coming under differential calculus and to develop strong foundations on these concepts. In Computer Science, Calculus is used for machine learning, data mining, scientific computing, image processing, and creating the graphics and 3D visuals for simulations. Calculus is also used in a wide array software program that require it. Linear algebra provides concepts that are crucial to many areas of computer science, including graphics, image processing, cryptography, machine learning, optimization, graph algorithms, information retrieval and web search.

### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the scalar product and vector product of two or more vectors.
2. Illustrate how to find angle between polar curves with a suitable example.
3. Demonstrate the use of radius of curvature of the curves can be best suited for machine learning techniques with big data analytics.
4. Describe the concepts of Linear algebra and calculus theory.

**COURSE OUTCOMES (COs)**

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply Taylor's and Maclaurin's series for finding series expansions of functions and approximating values. expansions of functions and approximating values.	1-6	1,2
CO2	Identify and evaluate the radius of curvature of the given curve. Also evaluate the given indeterminate form using L' Hospital rule.	1-6	1,2
CO3	Make use of Gauss elimination and Gauss Jordan method for solving the system of equations, if the given system of equations is consistent.	1-6	1,2
CO4	Determine the Eigen values, the corresponding Eigen vectors and diagonalizable the given square matrix.	1-6	1,2
CO5	Learn new tools and technologies in the linear algebra and apply for suitable application development.	12	1,2
CO6	Develop solutions in the linear algebra to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5, 9, 10	2, 3

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply(L3)	Analyse(L4)	Evaluate(L5)	Create(L6)
CO1			✓			
CO2			✓		✓	
CO3			✓			
CO4			✓			
CO5			✓			
CO6			✓	✓		

## COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	3	3	2	2	3	1							3	3	
CO2	3	3	3	3	3	1							3	3	
CO3	3	3	2	2	3	1							2	2	
CO4	2	3	2	3	3	1							1	1	
CO5												2	2	2	
CO6					2				2	2				2	3

Note:1-Low,2-Medium,3-High

## COURSE CONTENT THEORY

Contents
<b>UNIT – 1</b>
<p><b>Introduction to Vector Differentiation:</b> Introduction, Scalar and vector point functions, velocity, acceleration, Gradient, Divergence, Curl, Laplacian, Solenoidal and Irrotational vectors, Vector identities.</p> <p><b>Differential Calculus-1:</b> Successive differentiation- nth derivatives of standard functions (no proof) simple problems, Leibnitz Theorem (without proof) and problems, Taylor's series and McLaurin's series expansion for function of one variable(only problems), Polar curves- Angle between the radius vector and the tangent, angle between two curves, Pedal equation for polar curves. Applications in computer science.</p>
<b>UNIT-2</b>
<p><b>Differential Calculus-2:</b> Derivative of arc length – concept and formulae (without proof), Radius of curvature- Cartesian, parametric, polar and pedal forms (with proof) problems. Indeterminate forms and solution using L'Hospital's rule. Analysis of Randomized algorithms using Differential Calculus. Applications in computer science.</p>
<b>UNIT-3</b>
<p><b>Linear Algebra-1:</b> Basic concepts, Echelon form, normal form of a matrix, Rank of Matrix, Gauss-Jordon method to find inverse of a matrix, consistency of linear system of equations, Gauss elimination and Gauss-Jordon method to solve system of equations. Linear Algebra for statistics. Applications in computer science.</p>
<b>UNIT-4</b>
<p><b>Linear Algebra-2:</b> Linear Transformations, orthogonal transformation, Eigen values and Eigen Vectors. Complex matrices, Similarity of Matrices, Diagonalization. Rayleigh power method to determine largest Eigen value and the corresponding Eigen vector. Analysis of Randomized algorithms using Linear Algebra. Applications in computer science.</p>

**TEXTBOOKS:**

1. Theodore Shifrin, "Multi-Variable Calculus and Linear Algebra with Applications", Wiley, 1st Edition, Volume 2, 2018.
2. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43<sup>rd</sup> edition, 2015.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Publications, 9<sup>th</sup> edition, 2013.
4. Ron Larson, "Multivariable Calculus, Cengage Learning", 10th Edition, 2013.

**REFERENCE BOOKS:**

1. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publications, 19th Reprint edition, 2013.
2. R.K.Jain and S.R.K.Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House, 4th edition, 2016.
3. Stanley I. Grossman, "Multivariable Calculus, Linear Algebra, and Differential Equations", 2nd Edition, Academic Press 1986.

**JOURNALS/MAGAZINES**

<https://www.sciencedirect.com/journal/linear-algebra-and-its-applications>

**SWAYAM/NPTEL/MOOCs:**

1. <https://youtu.be/XzaeYnZdK5o>
2. <https://youtu.be/KSntcGOFdUc>
3. <https://youtu.be/LJ-LoJhbBA4>

**SELF-LEARNING EXERCISES:**

1. Vectors in Space, Generalized Leibniz Rules, Mean Value of Derivatives, Powers of a matrix,
2. Testing of Linear Dependence and Independence and multivariate calculus. Introduction to differential equations.

Course Title	Basic Electrical and Electronics Engineering				Course Type		Integrated	
Course Code	B20EE0101	Credits	4		Class		I Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	1	2	2	Theory Hours	Practical Hours	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>4</b>	<b>5</b>	<b>5</b>	<b>39</b>	<b>26</b>	<b>50%</b>	<b>50%</b>

### COURSE OVERVIEW

Basic Electrical & Electronics Engineering covers basic concepts of electrical engineering and electromagnetism. This course introduces the student to the working AC and DC Machines. It also helps the student to understand the basics in digital electronics by applying the knowledge of logic gates and learning the applications of diodes in rectifiers, filter circuits. Further, it has a self-learning component on BJT's.

### COURSE OBJECTIVE (S):

1. Explain the basics of electrical and electronics engineering terminologies.
2. Distinguish the single and three phase systems.
3. Illustrate the different building blocks in digital electronics using logic gates and explain simple logic functions using basic universal gates.
4. Discuss the applications of diode in rectifiers, filter circuits and wave shaping.
5. To build a broad concept for hands on experience in various types of electrical apparatus, tools and instrumentation with electrical safety norms.
6. To analyze the schematics for making electrical connection and to interpret experimental data for various electrical appliances.

**COURSE OUTCOMES (COs)**

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Summarize the basics of electrical engineering terminology and the usage.	1-6	1
CO2	Analyze the concepts and applications of DC & AC Machines.	1-5	1
CO3	Apply the concept of domestic wiring, importance of safety and sensing devices	1-5,10	1
CO4	Analyze the different building blocks in digital electronics using logic gates and applications of diode in rectifiers, filter circuits and wave shaping.	1-5	1
CO5	Interpret, Identify and use appropriate electrical tools for electrical connections and to repair electrical equipment's.	1-7, 9,10	1,2
CO6	Compare experimental results with theoretical analysis and the ability to critically evaluate the performance of electrical appliances.	1-7, 9,10	1,2

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2				√		
CO3			√			
CO4				√		
CO5			√			
CO6				√		



## COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	3	1	2	1							1		
CO2	1	3	2	2	1								1		
CO3	2	2	2	2	1					2			1		
CO4	3	3	3	1	1								1		
CO5	2	2	1	3	1	3	1		3	1			3	3	
CO6	2	2	1	3	1	3	1		3	1			3	3	

Note:1-Low,2-Medium,3-High

### COURSE CONTENT:

#### THEORY:

CONTENTS
<p align="center"><b>UNIT-1</b></p> <p>Electrical Circuits: Basic definitions, Types of elements, Ohm's Law, Kirchhoff's Laws, Resistive, Inductive, capacitive networks, Series, Parallel circuits and Star-delta and delta-star transformations, Network Theorems (Superposition, Thevenin's &amp; Norton's) Generation of an alternating Emf—average and rms values of alternating quantity—representation of alternating quantities by phasors—single phase series and parallel circuits (simple problems), three phase systems and power calculations</p>
<p align="center"><b>UNIT-2</b></p> <p>DC-Machines: Construction and Principle of operation of DC Machines—Emf &amp; Speed equations—types—applications. AC-Machines: Principle of operation of single phase transformers—Emf equation—losses— efficiency and regulation—Construction and working principle of induction motors—Slip—torque characteristics—applications—Construction and Principle of operation of alternators applications.</p>
<p align="center"><b>UNIT-3</b></p> <p>Instruments: Basic Principle of indicating instruments—PMMC&amp;MI instruments. Tariff, Protective Devices and Sensors: Tariff schemes, basic concepts of domestic wiring and types, Earthing, protective fuses, MCB, sensors: pressure sensors, strain gage, proximity sensors, displacement sensors, Rotatory encoder and ultrasonic sensors and civil engineering applications.</p>
<p align="center"><b>UNIT-4</b></p> <p>Diodes: Introduction, Physical operation of p-n junction diodes, Characteristics of p-n junction diodes, Zener diode, Rectifier circuits (half-wave, full-wave, bridge and peak rectifiers), Light emitting diodes. Digital Electronic Principles: Introduction, Binary digits, Logic levels and Digital waveforms, Introduction to basic logic operation, Number system, Decimal numbers, Binary numbers, Decimal-to-Binary conversion, Simple binary arithmetic.</p>

**PRACTICE:**

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
1.	Electrical Safety Training. a) To Study the importance of Earthing during accidental shorting of line wire and the body of equipment.	Trainer kit Ohms Law Fall of resistance	Importance & applications of Earthing, Fuse & MCB
	b) To conduct experiment and to know the Importance and mechanism of FUSE		
	c) To study the Importance and mechanism of MCB.		
2.	Home Electrical Wiring Demonstration. a) To study & verify the connection procedure for fluorescent lamp wiring.	Fluorescent Lamp wiring Panel Fan with switch and regulator Kit	Connection & Troubleshooting of fluorescent lamp wiring & Fan with switch and regulator
	b) To study the connection of Fan with switch and regulator.		
3.	Two-way switch/ staircase wiring. To study & verify the connection procedure for two-way switch or staircase wiring	Two-way switch or staircase wiring Kit	Connection, Working & application of Two-way switch
4.	Behaviour of current and voltage in series and parallel circuits. a) To study and verify the behaviour of current and voltage in series circuit.	Series and parallel circuits Kit	Connection & behaviour of current & voltage in series, parallel circuit
	b) To study and verify the behaviour of current and voltage in parallel circuit.		
5	Polarity test on single phase transformer. a) To determine the additive polarity of a single-phase transformer.	Transformer Kit	Polarities of single phase transformer
	b) To determine the subtractive polarity of a single-phase transformer.		
6	Determination of VI characteristics of Zener Diode	VI characteristics of Zener Diode kit	VI characteristics of Zener Diode
7	Determination of VI characteristics of Silicon Diode	VI characteristics of Silicon Diode kit	VI characteristics of Silicon Diode
8	Analyze the Half Wave and Full Wave rectifiers using Diode with and without filter	Rectifier kit	Determine the efficiency, Voltage regulation, ripple
9	Determine the Characteristics of BJT in Common Emitter Configuration	Characteristics of BJT in Common Emitter	Input & Output Characteristics of BJT
10	Determine the Characteristics of JFET in Common Source Configuration	Characteristics of JFET in Common	Input & Output Characteristics of JFET
11	Realization of Universal gates using basic logic gates.	Trainer kit	Universal gates will be realized using basic gates

**TEXTBOOKS:**

1. Nagrath I.J. and D. P. Kothari, "Basic Electrical Engineering", Third Edition Tata McGraw Hill, 2009.
2. Hayt and Kimberly, "Engineering Circuit Analysis", 8<sup>th</sup> Edition, Tata McGraw Hill, 2013.
3. Kulshreshtha D.C., "Basic Electrical Engineering", Tata McGraw Hill, 2009.
4. Rajendra Prasad, "Fundamentals of Electrical Engineering", Prentice Hall, India, 2009.
5. Hughes, E., "Electrical Technology", Pearson, 2005.
6. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5<sup>th</sup> Edition, 2008.
7. D.P. Kothari, I. J. Nagrath, "Basic Electronics", McGraw Hill Education (India) Private Limited, 2014.

**REFERENCEBOOKS:**

1. Theodore Wildi, "Electrical Machines, Drives, and Power, 5<sup>th</sup>Systems", Pearson Edition, 2007.
2. Hughes, "Electrical Technology", International Students 9<sup>th</sup> Edition, Pearson, 2005.

**JOURNALS/MAGAZINES**

1. International Journal of Electrical Power and Energy Systems (<https://www.journals.elsevier.com/international-journal-of-electrical-power-and-energy-systems>)
2. Journal of Electrical Engineering (<https://link.springer.com/journal/202>)

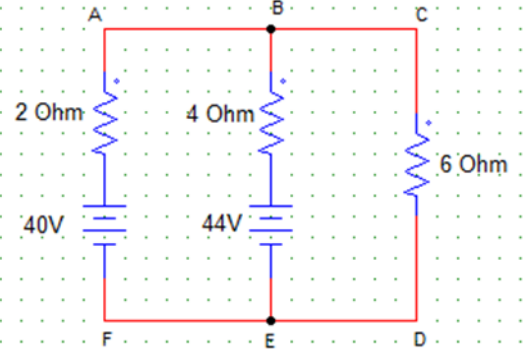
**SWAYAM/NPTEL/MOOCs:**

1. <https://nptel.ac.in/courses/108/108/108108076/>

**SELF-LEARNINGEXERCISES:**

1. Build an electrical circuit using BJT as a switch
2. Identifying the practical application of Electromagnetic Induction

**PROBLEMBASEDLEARNING**

No	Problems
1	A current of 20A flows through two ammeter A and B in series. Potential difference across A is 0.2V and across B is 0.8 V. Find how the same current will divide between A and B when they are joined in parallel.
2	For the given circuit calculate the current supplied by each battery and current in 6 ohm resistor. 
3	Two 12V batteries with internal resistances 0.2 ohm and 0.25 ohm respectively are joined in parallel and a resistance of 1 ohm is placed across the terminals. Find the current supplied by each battery.

4	A 6 pole induction motor is connected to a 50 Hz supply. It is running at a speed of 970 R.P.M. Find the synchronous speed and the slip
5	If $A = (1011)_2$ and $B = (1110)_2$ , perform the following arithmetic operations. i) Addition ii) subtraction ii) Multiplication
6	Simplify the given Boolean expression and implement using logic gates. i) $Y = AB + ABC + AB(D + E)$ ii) $Y = ABCD + ABD$ iii) $Y = AB + A(B + C) + B(B + C)$
7	Simplify the given Boolean Expression: i) $Y = XY + XYZ + XY\bar{Z} + \bar{X}Y\bar{Z}$ ii) $Y = \bar{A}\bar{B}C + \bar{A}B\bar{C} + \bar{A}BC$ iii) $Y = AC + C(A + \bar{A}B)$
8	a) Perform the following operations: (i) Convert $(01110111)_2$ to decimal (ii) Convert $(21)_{10}$ to binary (iii) Add: $(1010)_2$ and $(0011)_2$ (iv) Subtract: $(111.111)_2$ from $(1010.01)_2$ (v) Divide: $(101101)_2$ by $(110)_2$

### PROJECTBASEDLEARNING

To enhance the skill set in the integrated course, the students are advised to execute course-based Design projects. Some sample projects are given below:

	Suggested Projects
1.	Design & Development of a rectifier circuit
2.	Identify the types of wiring
3.	Electricity bill calculation
4.	Identify the types of motors used in domestic & industrial application with nameplate details.
5.	Identification of different transformer based on their rating used for various applications.

Course Title	Introduction to Python Programming				Course Type		Integrated	
Course Code	B20CI0101	Credits	3		Class		I Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	2	2	2				
	Practice	1	2	2	Theory	Practical	IA	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>4</b>	<b>4</b>	<b>26</b>	<b>26</b>	<b>50</b>	<b>50</b>

#### COURSE OVERVIEW:

Python is a Programming Language that can be treated in a procedural way, an object-orientated way or a functional way. It can be used on a server to create web applications, create workflows, connect to database systems, read and modify files, handle big data and perform complex mathematics. It can implement object oriented features and exception handling, It can parse the strings using regular expressions. It can be used for implementing the machine learning algorithms to develop solutions for interdisciplinary problems apart from any general problems leading to automation.

#### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the fundamentals of python programming language constructs and their applications.
2. Inculcate knowledge of parsing of regular expressions and their usage in various application domains.
3. Gain expertise in Object oriented programming and NumPy package.
4. Discuss the files, Pandas and Data Virtualization concepts.

#### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of language constructs to solve real world problems using python programming.	1- 4, 8, 9, 12	1
CO2	Develop programs for text processing and other application domains by making use of regular expressions.	1-3, 5,9,12	2
CO3	Apply features of object oriented and NumPy package to develop computationally intensive programming to analyze and interpret the data.	1- 5, 9, 12	3
CO4	Create data science solutions with the help of files, Pandas and Data Visualization.	1,4,5,9,12	1-3
CO5	Learn new tools and technologies in the python and apply for suitable application development.	12	1,2
CO6	Develop solutions in the python 1to the complex problems, either individually or as a part of the team and report the results with proper	5, 9, 10	2,3

### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√	√		
CO4			√	√	√	√
CO5			√			
CO6			√	√		

### COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2				1	1			1	3		
CO2	3	2	3		2				1			1		3	
CO3	3	1	2	1	2				1			1			
CO4	3			2	2				1			1	3	3	3
CO5												1	2	2	
CO6					2				1	1				2	2

Note:1-Low,2-Medium,3-High

### COURSE CONTENT THEORY

Contents
<p align="center"><b>UNIT-1</b></p> <p><b>Introduction to Computer Fundamentals:</b> Computer Components, accessories, specifications of computers and external devices. Flowchart symbols and guidelines, types and advantages, Algorithm design.</p> <p><b>Python Fundamentals:</b> Introduction to Python: History, Applications, Your First Python Program, Constants, Variables, Naming conventions, simple data types, Type casting, Assignment statements, expressions, Boolean data type, Trigonometry functions, operators, precedence of operators, libraries, keywords, Python Collections, I/O statements, conditional statements, loops, functions, user defined functions. Introduction to GitHub and applications.</p>
<p align="center"><b>UNIT-2</b></p> <p>Strings: Unicode, Formatting Strings, Format Specifiers, other Common String Methods, Slicing a String. Regular Expressions: Case Study: Street Addresses, Case Study: Roman Numerals, Checking for Thousands, Checking for Hundreds, Using the {n,m} Syntax, Checking for Tens and Ones.</p>
<p align="center"><b>UNIT-3</b></p> <p>Object Oriented Programming: Defining Classes, The init() Method, Instantiating Classes, OOP features: Abstraction. Encapsulation, Single Inheritance, Polymorphism. Files: Reading from Text Files, Writing to text files, Reading and Writing the Binary Files.</p>
<p align="center"><b>UNIT-4</b></p> <p>NumPy: Introduction to NumPy, Creating arrays, Indexing Arrays, Array Transposition, Universal Array Function,</p>

Array Processing, Array Input and Output.

Pandas and Data Visualization: Introduction, Series and Data Frames in pandas and Data Visualization.

**PRACTICE:**

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
Part-A			
1.	a). "LIST1" is a list that contains "N" different SRN of students read using a user defined function with the help of input () function. It is required to add SRN of "M" more students that are to be appended or inserted into "LIST1" at the appropriate place. The program must return the index of the SRN entered by user.	Windows/Linux OS, IDE, Jupyter	Create and perform operations on list.
	b)"TUPLE1" and "TUPLE2" are two tuples that contain "N" values of different data types read using the user defined function "READ" with the help of input() function. Elements of "TUPLE1" and "TUPLE2" are to be read one at a time and the "larger" value among them should be placed into "TUPLE3". Display all tuples.	Windows/Linux OS, IDE, Jupyter	Create and perform operations on Tuples.
2.	a)SET1 and SET2 are two sets that contain unique integers. SET3 is to be created by taking the union or intersection of SET1 and SET2 using the user defined function Operation (). Perform either union or intersection by reading choice from user. Do not use built in functions union () and intersection () and also the operators " " and "&".	Windows/Linux OS, IDE, Jupyter	Create and perform Union and Intersection, Operations on Sets.
	b)The Dictionary "DICT1" contains N Elements and each element in dictionary has the operator as the KEY and operand's as VALUES. Perform the operations on operands using operators stored as keys. Display the results of all operations.		Create dictionary and perform operation using user defined function.
3.	a)A substring "Substr" between index1 and index2 is to be extracted from the given input string "Str1", which is read using input(). Display the substring "Substr" using a user defined function if available in string "Str1", otherwise display NULL.	Windows/Linux OS, IDE, Jupyter	String operations.
	b) A string containing multiple words is to be read from the user one at a time, after reading perform following operations. Convert all the strings to uppercase and display Split the words of a string using space as the separation character and display.		
4.	a)Consider the text file, "Std.txt", with the details of students like SRN, NAME, SEMESTER, SECTION AND AVG_MARKS. Read the file, "Std.txt" and display the details of all the students of 4 <sup>th</sup> Semester "A" Section who have scored more than 75%.	Windows/Linux OS, IDE, Jupyter	File Handling.

	<p>b) Consider the text file "Emp.txt", with the details of Employees like EMP_CODE, EMP_NAME, BASIC_SALARY, DA, GROSS_SALARY, NET_SALARY, LIC, PF and TOTAL-DEDUCTIONS. Read EMP_CODE, EMP_NAME, BASIC_SALARY, DA, LIC and PF from the user using input() and compute the following:  TOTAL_DEDUCTIONS= (LIC+PF)  GROSS_SALARY= BASIC_SALARY+ DA  NET_SALARY= GROSS_SALARY – TOTAL_DEDUCTIONS.  Write the above data to file for each employee. Read the content of "Emp.txt" and display the details of each employee</p>		File Handling.
5.	<p>a). A "CAR" has the attributes COMPANY_NAME, MODEL, COLOR, MANUFACTURING_YEAR and PRICE. A Class is required to be created for "CAR" to store the above attributes and perform the following operations:  Get the details of "CAR" object from user and store into Array of objects  Display the details of "CAR" object based on "COMPANY", "MODEL" and "PRICE".</p> <p>b). Airline Reservation System contains the attributes of passengers such as NAME, PAN_NO, MOBILE_NO, EMAIL_ID, SOURCE, DESTINATION, SEAT-NO, AIR-FARE and TRAVEL_DATE. A Class is required to be created for "Airline" with the above attributes and perform the following operations:  Get the details of "Airline" object from user and store into Array of objects  List details of all the passengers who travelled From "Bengaluru to London".  List details of all the passengers who travelled From "Chicago to Beijing" on 10<sup>th</sup> of Feb, 2020.</p>	Windows/Linux OS, IDE, Jupyter	Classes and objects usage.
6.	<p>a). "Arr_1" is an integer array of size M x N. Size and content of the array is to be read using input() by using the user defined function READ_DATA(). It is required to display the Diagonal elements of "Arr_1"  Elements of m<sup>th</sup> row (row no should be entered by user)  Elements of n<sup>th</sup> column (column no should be entered by user)</p> <p>b) The dictionary "DICT1" contains the pass percentage of each semester of B. Tech in CSE, where, "Semester" acts as the key and "Pass Percentage" acts as the value. A Python Pandas dataframe is required to be created using the dictionary "DICT1" and display it using a user defined function.</p>	Windows/Linux OS, IDE, Jupyter	NumPy arrays usability.  Pandas Series usability.
<b>Part-B (Mini Project: Library Management System)</b>			
1.	<p>Develop a program to create the class "USER" with the attributes USER_NAME, USER_ID, SCHOOL_NAME, ADDRESS, PHONE_NO, EMAIL_ID, DOB and AGE. The functions add user (), delete user (), edit user (), search user () should be part of the class. Instantiate "User" class with 10 objects. Read the attributes of each "User" object using input () and store them in the file "User_File.txt".</p>	Windows/Linux OS, IDE, Jupyter	Create a class user to read the attributes of user and store them in a file.



2	Develop a program to get the name of the "User" object whose details are to be deleted. Read the "User_File.txt" and delete the "User" object if found. Display the contents of "User_File.txt" after	Windows/Linux OS, IDE, Jupyter	Create a class user to read the attributes and
3	Develop a program to get the name of the "User" object whose details are to be edited (modified). Edit the details of the user object in the file "User_File.txt" and display the contents after	Windows/Linux OS, IDE, Jupyter	To create a class and edit the file.
4	Develop a program to create the class "BOOK" with the attributes TITLE, AUTHOR, PUBLISHER, YEAR, PRICE, SCHOOL_NAME and the functions add book(), delete book(), edit book() and search book(). Instantiate "Book" class with 10 objects. Read the attributes of each "BOOK" object using input () and store them in the file	Windows/Linux OS, IDE, Jupyter	Create a class book to read the attributes of user and store them in a file.
5	Develop a program to get the name of the "BOOK" object whose details are to be deleted. Read the "Book_File.txt" and delete the "BOOK" object whose details match with the data entered. Display the contents of "Book_File.txt" after deletion.	Windows/Linux OS, IDE, Jupyter	Create a class book to read the attributes and delete the object.
6	Develop a program to get the name of the "BOOK" object whose details are to be edited (modified). Edit the details of the "Book" object in the file "Book_File.txt" and display the contents after modification.	Windows/Linux OS, IDE, Jupyter	To create a class and edit the file.
7	Develop a program to create the class "TRANSACTION" with the attributes USER_ID, USER_NAME, AUTHOR, TITLE, EDITION, ISSUE_DATE, DUE_DATE and RETURN_DATE and the functions issue book(), return book() and search book(). Instantiate "Transaction" class with 10 objects. Read the attributes of each "Transaction" object using input () and store them in the file "TransactionFile.txt". Develop a program to issue the book as requested by the user. Update the attributes in "Transaction_File"	Windows/Linux OS, IDE, Jupyter	Create class and perform string operations.
8	Develop a program to return the book. Edit the details of the user like USER_ID, USER_NAME, AUTHOR, TITLE, EDITION, ISSUE_DATE, DUE_DATE and RETURN_DATE in "TransactionFile.txt" and display the contents after modification. Compute the fine amount to be paid if return date is not same as due date. If both return date and due date are same and put zero in fine amount.	Windows/Linux OS, IDE, Jupyter	Create class and perform string operation.
9	Develop a program to search for a book using its "author". Display the message "available" if search is successful otherwise display the message "not available".	Windows/Linux OS, IDE, Jupyter	Create class and object, perform file operations and regular expressions.
10	Develop a program to get a list of users by referring to "User_File.txt" and "Transaction_File.txt".	Windows/Linux OS, IDE, Jupyter	Create class and object, perform file operations and regular expressions.
11	Develop a program to get List of Books in stock by referring to "Book_File.txt" and "Transaction_File.txt".	Windows/Linux OS, IDE, Jupyter	Create class and object, perform file operations and regular expressions.
12	Develop a program to get List of Books Issued by referring to "User File", "Book File" and "Transaction File".	Windows/Linux OS, IDE, Jupyter	Create class and object, perform file operations and
13	Develop a project by integrating User, Books, Transaction and Reports Modules.	Windows/Linux OS, IDE, Jupyter	Module integration and project

**TEXTBOOKS:**

1. Mark Pilgrim, "Dive into Python 3", A press special edition, second edition, 2015.
2. Travis E. Oliphant, "Guide to NumPy", Trelgol publishers, 2006.

**REFERENCEBOOKS:**

1. A B Choudhary, "Flowchart and Algorithms Basics" Mercury Learning and Information, 2020
2. Mark Lutz, "Learning Python", O'Reilly. 2003.
3. John M. Zelle, "PYTHON Programming: An Introduction to Computer Science", Franklin, Beedle & Associates, 2004.
4. Michael Dawson, "Python Programming for the Absolute Beginners", 3<sup>rd</sup> Edition, CENAGE Learning.
5. Wesley J. Chun, "Core Python Programming", 2<sup>nd</sup> Edition, Prentice Hall.
6. Steve Holden and David Beazley, "Python Web Programming", New Riders, 2002. Springer, Kent D. Lee, "Python Programming Fundamentals", 2<sup>nd</sup> Edition.
7. John V. Guttag, "Introduction to Computation and Programming using Python", MIT Press, 2016.
8. [https://www.tutorialspoint.com/computer\\_fundamentals/computer\\_fundamentals\\_tutorial.pdf](https://www.tutorialspoint.com/computer_fundamentals/computer_fundamentals_tutorial.pdf)

**JOURNALS/MAGAZINES**

1. <https://www.codemag.com/Magazine/ByCategory/Python>
2. [http://ijaerd.com/papers/special\\_papers/IT032.pdf](http://ijaerd.com/papers/special_papers/IT032.pdf)
3. <https://iopscience.iop.org/article/10.1088/1742-6596/423/1/012027>
4. <https://ieeexplore.ieee.org/document/4160250>

**SWAYAM/NPTEL/MOOCs:**

1. Coursera – Python for everybody, University of Michigan
2. Coursera – Python Basics, University of Michigan
3. <https://nptel.ac.in/courses/106/106/106106182/>
4. <https://www.edx.org/learn/python>

**SELF-LEARNING EXERCISES:**

1. Explore PYTHON library for IOT programming
2. More exploration on GitHub
3. Data Visualization packages
4. C modules interface

Course Title	Engineering Chemistry				Course Type	Theory		
Course Code	B20AS0104	Credits	3		Class		I semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	0	0	0	Theory	Practical	IA	SEE
	Tutorial	0	0	0				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>0</b>	<b>50%</b>	<b>50%</b>

#### **COURSE OVERVIEW:**

Engineering chemistry covers very relevant topics compatible with ECE, EEE and C&IT students and make them aware of importance of various aspects of basic science in engineering. The subject of Engineering chemistry covers area of light and matter interaction, clean energy storage and conversion devices, corrosion phenomenon and control which is widely an interdisciplinary subject of discussion. Further the course focus on the chemistry of engineering materials, and various applications. This area of science is very much interdisciplinary in its nature and gives a platform for students to strengthen their engineering knowledge to enlighten on the energy conversion and storage devices, which have become very attractive field of research in engineering stream. The subject deals with various engineering materials, their properties and applications in the field of engineering.

#### **COURSE OBJECTIVE**

The Engineering chemistry course is designed to fulfil the following objective;

1. Engineering chemistry covers the very basic knowledge required for engineering students to understand its importance of science in technology.
2. It provides the basic knowledge on Interaction of light and matter to know the electronic transitions in materials and storage and conversion devices.
3. Corrosion and metal finishing, explains the phenomenon of corrosion and its Prevention. It also covers the importance of metal finishing in various industries and fabrication of PCB
4. Polymers are all about the properties of various polymeric materials and their Commercial significance. The chapter reveals about technical and commercial Importance of composite materials.

**COURSE OUTCOMES (COs)**

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand the phenomenon of light and matter interaction to study the materials	1,2,4,7,11	2
CO2	Demonstrate the electrode processes in Batteries and conversion devices.	6,11	2
CO3	Describe Corrosion phenomenon and precautions to be taken in the selection of materials in controlling corrosion, Fabrication of PCB and industrial applications.	2,4,7,11	2
CO4	Illustrate the properties of polymers, nano materials, composite materials and their applications in various fields.	1,2,11,12	2
CO5	Learn new tools and technologies in the engineering chemistry and apply for suitable application development.	12	1,2
CO6	Develop solutions in the engineering chemistry to the complex problems, either individually or as a part of the team and report the results with proper analysis	5, 9, 10	2,3

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyse (L4)	Evaluate (L5)	Create (L6)
CO1	√					
CO2		√		√		
CO3		√	√			
CO4	√	√		√		
CO5			√			
CO6			√	√		

## COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3		1			2				1			2	
CO2						2					2	3		2	
CO3	2	2		2		1	2							2	
CO4		2		2			2				3			2	
CO5												2	2	2	
CO6					2				2	2				2	2

Note:1-Low,2-Medium,3-High

## COURSE CONTENT THEORY

Contents
<p style="text-align: center;"><b>UNIT-1</b></p> <p><b>Light and matter interaction:</b> Electro-magnetic spectrum-Applications in Engineering, Interaction of EM radiation with matter, work function of matter, Electrons in matter. Bonding theories: MOT, Band structure of matters HOMO-LUMO. Photochemical and thermal reactions: Laws of photochemistry, quantum yield, high and low quantum yield reactions. Jablonski diagram - photophysical and photochemical processes, photo-sensitization, photo- polymerization and commercial application of photochemistry.</p>
<p style="text-align: center;"><b>UNIT-2</b></p> <p><b>CLEAN ENERGY STORAGE AND CONVERSION DEVICES:</b> Introduction to electrochemistry, basic concepts of Batteries and characteristics. Classification: Primary (Dry cell, Li-MnO<sub>2</sub>) and Secondary (Pb-acid, Li-ion) batteries. Super capacitors: classification, construction and applications in hybrid vehicles. Fuel cells: Alkaline fuel cells, Solid oxide fuel cells and phosphoric acid fuel cell. Photo-conversion devices: Photovoltaic cell, antireflective coating, panels and arrays. Production of single crystal semiconductor by Crystal pulling technique (Czochralski pulling technique), zone refining process (of Si). Problems: Calculation of energy and power density, capacity of a Battery and capacitance of super capacitors for electric vehicle applications.</p>
<p style="text-align: center;"><b>UNIT-3</b></p> <p><b>Corrosion:</b> Electrochemical theory of corrosion, types of Corrosion- differential metal corrosion, differential aeration corrosion, boiler corrosion, and grain boundary corrosion, Corrosion studies on Al, Fe with pourbiax diagram, Factors affecting rate of corrosion-Primary, secondary. Corrosion control: Galvanizing &amp; tinning, cathodic protection &amp; Anodic Protection.</p> <p><b>Metal Finishing:</b> Theory of electroplating, Factors required to study electroplating Effect of plating variables in electroplating process, Electroplating of gold (acid, neutral and alkaline cyanide bath). Electro less plating of copper and PCB manufacture by Electro less plating of copper. (Applications/case studies).</p>

#### UNIT-4

CHEMISTRY OF ENGINEERING MATERIALS: Polymer composites: Carbon fiber, Kevlar synthesis and applications, Conducting polymers: synthesis, electron transport mechanism and applications in polyacetylene and polyaniline. Liquid crystals: Introduction classification and applications in electronic display devices. Nanomaterials: Introduction, classification based on dimensionality, quantum confinement. Size dependent properties- surface area, magnetic properties (GMR phenomenon), and thermal properties. Synthesis, Properties and applications of Fullerenes, CNT and Graphene. Sensors: Physical and chemical sensors, Biosensors for bioelectronic applications.

#### TEXTBOOKS:

1. R.V.Gadag&Nithyanandashetty, "Engineering Chemistry", Ik International Publishing house.
2. S.S. Dara, "Text Book of Engineering Chemistry", S. Chand & Co.
3. S.S.Chawla, "Text Book of Engineering Chemistry", Dhanpat Rai Pub. Co.

#### REFERENCE BOOKS:

1. P.W. Atkins, "Physical Chemistry", 5<sup>th</sup> edition Oxford.
2. Callister W.D., "Materials Science and Engineering", John Wiley & Sons.
3. R.Gopalan, D. Venkappaya, S.Nagarajan, "Engineering Chemistry", Vikas Publication.

#### JOURNALS/MAGAZINES:

1. <https://www.sciencedirect.com/journal/water-science-and-technology>
2. <https://iwaponline.com/wst>
3. <https://www.scitechnol.com/nanomaterials-molecular-nanotechnology.php>
4. <https://www.journals.elsevier.com/journal-of-energy-storage>

#### SWAYAM/NPTEL/MOOCs

1. <https://nptel.ac.in/courses/105/105/105105201/>
2. <https://nptel.ac.in/courses/112/108/112108150/>

#### PROBLEM BASED LEARNING

No	Problems
1	Calculation of wavelength and frequencies of the radiations
2	Calculation of band structure by HOMO and LUMO
3	Determination of cell potentials
4	Calculation of energy density and power density of a battery.
5	Determination of capacitance of a super capacitor
6	Crystal field stabilization energy

#### PROJECT BASED LEARNING

To enhance the skill set in the integrated course, the students are advised to execute course-based

**Design projects.** Some sample projects are given below

<b>No.</b>	<b>Suggested Projects</b>
1.	Collection of literature for the materials for the semi conducting applications
2.	Synthesis of a semiconductor materials for the electronic applications
3.	Construction of a PCB for the electronic device
4.	Synthesis of conducting polymers
5.	Synthesis of Energy storage materials
6.	Fabrication of efficient aqueous battery or super capacitor

Course Title	Design Thinking		Course Type				Integrated	
Course Code	B20ME0102	Credits	2		Class		I Semester	
Course structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	1	1	1				
	Tutorial	0	0	0	Theory	Practical	IA	SEE
	Practice	1	2	2				
	<b>Total</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>13</b>	<b>26</b>	<b>50%</b>	<b>50%</b>

#### COURSE OVERVIEW:

Today, innovation is everyone's business. At every level, in every kind of organization, design thinking provides the tools that one needs to become an innovative thinker and uncover creative opportunities. For example, companies like Procter, Gamble and GE have incorporated Design Thinking into their strategy and marketing. The course draws on methods from engineering and design, and combines them with ideas from the arts, tools from the social sciences, and insights from the business world. In this course, students start in the field, where they discover the needs of the target audience. They then iterate ideas on teams to develop a range of promising possible solutions, create rough prototypes to take back out into the field, and learn to test with real people in the target audience.

#### COURSE OBJECTIVE:

1. To impart knowledge on design thinking process for understanding designs.
2. To provide design skills to analyze design thinking issues and apply the tools and techniques of design.
3. To inculcate attitude to solve societal problems using design thinking tools.

#### COURSE OUTCOMES (CO's):

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the problems that fall under the purview of human centered design process for creative problem solving.	1,2, 9,10,12	1,2
CO2	Create empathy maps to visualize user attitudes and develop innovative products or services for a customer base using ideation techniques	1,2,9,10,12	2
CO3	Build simple prototypes for problems using gathered user requirements.	1,3, 9,10,12	1,2
CO4	Improve prototype by testing it with a specific set of users for making it sustainable by following ethics.	1,4,8,9,10,12	1,2
CO5	Learn new tools, technologies and apply for suitable application development.	12	1, 2
CO6	Develop solutions to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5, 9, 10	2, 3



**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓					
CO2			✓			
CO3			✓			
CO4				✓		
CO5			✓			
CO6			✓	✓		

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2							2	2		2	3	2	
CO2	1	3							2	3		2		2	
CO3	2		3						3	3		2	2	3	
CO4	2			2				1	3	2		2	2	3	
CO5												2	2	2	
CO6					2				2					2	2

Note:1-Low,2-Medium,3-High

**Course Content Theory**

Contents
<b>UNIT-1</b>
<p><b>Design Thinking Process:</b> Types of the thinking process, Design thinking: Definition, Origin of design thinking, Importance of design thinking, Design vs Design thinking. Problem Exploration, Case Studies from Embrace-Stanford Innovation Challenge, IDEO, GE Healthcare, The Good Kitchen- Denmark Program etc, identifying the target users for the problem selected, Survey on existing solutions for the problem identified.</p> <p><b>Empathizing:</b> Powerful Visualizing tool – a method to connect to the user, Creating Empathy maps – Case studies.</p>
<b>UNIT-2</b>
<p><b>Defining the problems:</b> POV statements from User perspective. Idea generation: Methods to spark the innovative ideas – Brainstorming, Mind map, Story board, Provocation etc.</p> <p><b>What is a prototype?</b> - Prototyping as a mindset, prototype examples, prototyping for products; Why we prototype? Fidelity for prototypes, Process of prototyping- Minimum Viable prototype</p> <p><b>Prototyping for digital products:</b> What's unique for digital, Preparation; Prototyping for physical products: What's unique for physical products, Preparation; Testing prototypes with users.</p>

**PRACTICE:**

Sl.No	Name of the Practice Session	Tools and Techniques	Expected Skill /Ability
1	Identifying the problem that can be solved using Design Thinking approach	Observation and survey	Develop identifying human centered problems
2	Build the empathy maps for simple problems like single user	Visualization	Develop ability to understand other's emotions
3	Build the detailed empathy maps for problem identified in the teams formed	Visualization	Develop ability to understand other's emotions
4	Presentation by student teams	PPT	Develop ability to express their views
5	Obtain the insights into user's problems and make PoV statement	Understanding	Develop making problem statements from user perception
6	Presentation by student teams	PPT	Develop ability to express their views
7	Carry out Brain storming between the groups and generate as many as ideas possible	Ideation tools	Develop innovative mind set
8	Prototype for best 3 ideas selected	Sketching, simple model making etc	Develop prototyping techniques
9	Presentation by student teams	PPT	Develop ability to express their plan
10	Test the developed prototype with set of identified users	Google forms, cold calls, social media etc.	Develop understanding of various testing methods
11	Pitching final solution	PPT	Develop ability to express their views

**TEXT BOOKS:**

1. Gavin Ambrose, "Paul Harris, Basics Design-Design Thinking", AVA Publishing, 2010
2. Kathryn McElroy, "Prototyping for Designers: Developing the best Digital and Physical Products", O'Reilly, 2017.

**REFERENCE BOOKS:**

1. Michael G. Luchs, Scott Swan, Abbie Griffin, "Design Thinking – New Product Essentials from PDMA", Wiley, 2015.
2. Vijay Kumar, "101 Design Methods: A Structured Approach for Driving Innovation in Your Organization", 2012.

**JOURNALS/MAGAZINES/ADDITIONAL SOURCES**

1. Leonard, D., and Ray port, J. F. 1997. Spark Innovation through Empathic Design. In Harvard Business Review, November-December 1997, 102-113.
2. <https://www.ideo.com>
3. <https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process>
4. <https://www.ibm.com/design/thinking/page/toolkit>
5. <https://www.interaction-design.org/literature/article/define-and-frame-your-design-challenge-by-creating-your-point-of-view-and-ask-how-might-we>
6. <https://www.culturepartnership.eu/en/article/ten-tools-for-design-thinking>
7. <https://youtu.be/M66ZU2PClM>
8. [https://thisisdesignthinking.net/2017/07/innogy\\_energy\\_ecarsharing/](https://thisisdesignthinking.net/2017/07/innogy_energy_ecarsharing/)

**SWAYAM/NPTEL/MOOCs:**

1. <https://nptel.ac.in/courses/109/104/109104109/>
2. <https://nptel.ac.in/courses/110106124/>

Course Title	Biology For Engineers				Course Type	Theory		
Course Code	B20AS0109	Credits	1		Class		I semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	1	1	1	Theory	Practical	CIE	SEE
	Practice	-	-	-				
	Tutorial	-	-	-				
	<b>Total</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>13</b>	<b>0</b>	<b>50%</b>	<b>50%</b>

#### COURSE OVERVIEW:

Understanding biological systems, principles and concepts in order to create usable, tangible, economically viable product or process has become need of the hour. Hence irrespective of the parent engineering discipline, knowledge and expertise from pure and applied sciences is necessary to create product or process related to healthcare, agriculture, environmental issues and many more. Any engineer will have a high probability of using biology related skills and concepts to create products and processes beneficial to the mankind and as well for the sustainable environmental friendly approach. For example, the knowledge can be used to create medical devices, diagnostic equipment's, bioreactor designing, agriculture related equipment/instruments or anything related to surface science, fluid mechanism and polymer science. This course is designed to lay foundation in the field of Cell biology, Molecular biology and Genetics, so that anyone who is interested can design better product/process to enhance the overall quality of life.

#### COURSE OBJECTIVES:

1. To inculcate the basic concepts of biology from engineering perspective among students
2. To understand the interplay between biology and engineering disciplines
3. To conceptualize the engineering design/process/product for life science challenges

#### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand and explain the biology concepts from engineering perspective.	1	1
CO2	Apply the principles of Biology either for the process/product development from the engineering perspective.	1,2	1,2

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2	√	√	√			

**COURSE ARTICULATION MATRIX**

CO# / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2												2	
CO2	2	2											2	1

**Note:** 1-Low, 2-Medium, 3-High

**COURSE CONTENT****THEORY:**

CONTENTS
Introduction to Biology, Evolution and Origin of Life, Bio molecules-Lipids, Bio molecules: Carbohydrates, Water, Bio molecules: Amino acids, Proteins, Bio molecules: Enzymes, Bio molecules: Nucleotides, Cell structure and function – Prokaryotes, Cell structure and function – Eukaryotes, Cell cycle-Mitosis and Meiosis, Mendelian genetics: Mendelian inheritance, Genetic diseases and Mendelian inheritance, Central Dogma – Replication, Transcription and Translation.

**TEXTBOOKS:**

1. G.K. Suraishkumar, "Biology for Engineers", Oxford University Press, 2019.
2. "Biology for Engineers: As per AICTE curriculum", Wiley publication.
3. Dr. Sohini Singh, Dr. Tanu Allen, "Biology for Engineers", Vayu Education of India.

**REFERENCE BOOKS:**

1. P.S. Verma and V.K. Agarwal, "Cell Biology, Genetics, Molecular Biology", Evolution and Ecology, 2018.
2. Sambamurthy, "Handbook of Genetics", Friends Publisher, 2010.

**JOURNALS/MAGAZINES**

1. Current Sciences

**SWAYAM/NPTEL/MOOCs:**

1. [https://onlinecourses.nptel.ac.in/noc19\\_ge31/preview](https://onlinecourses.nptel.ac.in/noc19_ge31/preview)
2. Coursera: Biology everywhere

**SELF-LEARNINGEXERCISES:**

1. Case study: Computational biology in agriculture and Health Care
2. Artificial Intelligence in health care
3. Image processing for medical applications

**PROBLEMBASEDLEARNING**

No.	Case Study
1	Case study: Computational biology in agriculture and Health Care
2	Case study: Artificial Intelligence in health care

Course Title	Computer Aided Engineering Drawing				Course Type		Integrated	
Course Code	B20ME0101	Credits	3		Class		I Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	2	2	2				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	0	-	-				
	<b>Total</b>	<b>3</b>	<b>4</b>	<b>4</b>	<b>26</b>	<b>26</b>	<b>50</b>	<b>50</b>

#### COURSE OVERVIEW:

Engineering Graphics or drawing is known as language of engineers. All phases of engineering process require the conversion of new ideas and design concepts into the basic line language of graphics. There are many areas such as civil, mechanical, electrical, architectural, computer, electronics and industrial applications where knowledge and skills of the drawing play major roles in the design and development of new products or construction. This course emphasizes on projection of point, line, surfaces and solids. It also provides knowledge about representing the object in terms of 3d view and also development of the object.

#### COURSE OBJECTIVE (S):

1. To introduce the students to various concepts like dimensioning, conventions and standards of engineering drawings in order to become professionally efficient
2. To enable students to learn about the software tool to prepare engineering drawings
3. To teach the students about the concepts and principles of orthographic projections, development of lateral surfaces and isometric projection of simple solids
4. To communicate the concept/idea with others through the language of technical drawing and sketching.

#### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Construct the simple 2D drawings manually and also by using CAD software	1,5,10,12	1
CO2	Draw orthographic projection of point, line, plane surfaces and simple solids	1,3,5,10,12	1
CO3	Draw sectional views of a prisms, pyramids, cone and cylinder	1,3,5,10,12	1
CO4	Develop the lateral surfaces of the solids	1-3,5,10,12	1,2,3
CO5	Create isometric view of the solids	1,3,5,10,12	1
CO6	Develop solutions in the CAD to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5, 9, 10	2, 3

### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4				√		
CO5				√		
CO6			√	√		

### COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3				3					3		2	3		
CO2	3		2		3					3		2	3		
CO3	3		2		3					3		2	3		
CO4	3	2	2		3					3		3	3	3	2
CO5	3		2		3					3		3	3	2	1
CO6					2				2	2				2	2

Note:1-Low,2-Medium,3-High

### COURSE CONTENT

#### THEORY:

CONTENTS
<p align="center"><b>UNIT – 1</b></p> <p>Introduction – Geometrical constructions, engineering drawing standards, Introduction to CAD Software. Orthographic projection of points in first and third Quadrant only. Orthographic projection of straight lines inclined to both horizontal and vertical planes. Orthographic projection of regular plane surfaces when the surface is inclined to both HP and VP.</p>
<p align="center"><b>UNIT-2</b></p> <p>Orthographic projection of regular solids like prisms, pyramids cone and cylinder when the axis is inclined to both HP and VP.</p>

**UNIT-3**

Sections of solids – Drawing sectional views and true shape of section, Development of surfaces- Parallel line method for prisms and cylinders, Radial line method for pyramids and cones.

**UNIT-4**

Isometric projections of simple and combined solids.

**PRACTICE:**

No	Practice	Tools and Techniques	Expected Skill /Ability
1.	Use of solid edge software and familiarization of tools	Solid Edge Software	Use of commands to draw the drawings
2.	Draw the projection of point locating in first and third quadrant	Solid Edge Software	Analyzing and software skill
3.	Draw the projection of lines locating in first quadrant	Solid Edge Software	Draw the views of the line and software skill
4.	Draw the projection of rectangular and pentagonal lamina inclined to both HP and VP	Solid Edge Software	analyzing and software skill
5.	Draw the projection of hexagonal and circular lamina inclined to both HP and VP	Solid Edge Software	analyzing and software skill
6.	Draw the projection of prisms inclined to both HP and VP	Solid Edge Software	interpretation and software skill
7.	Draw the projection of pyramids inclined to both HP and VP	Solid Edge Software	interpretation and software skill
8.	Draw the projection of cone and cylinder inclined to both HP and VP	Solid Edge Software	interpretation and software skill
9	Draw the projection of section of solids in simple position	Solid Edge Software	analyzing and software skill
10	Develop the lateral surface of prisms and cylinder	Solid Edge Software	Creative and software skill
11	Develop the lateral surface of pyramids and cone	Solid Edge Software	Creative and software skill
12	Draw the isometric projection of simple plane surface and simple solids	Solid Edge Software	Analyzing and software skill
13	Draw the isometric projection of two co-axial solids	Solid Edge Software	Analyzing and software skill

**TEXT BOOKS:**

1. K. R. Gopala krishna, "Engineering Graphics", Subhas Publications, 2012.
2. Bhatt N.D., Panchal V.M. & Ingle P.R., "Engineering Drawing", Charotar Publishing House, 2014.

**REFERENCE BOOKS:**

1. Luzadder and Duff, "Fundamental of Engineering Drawing", Prentice hall of India Pvt Ltd. 11<sup>th</sup> Edition, 2001.



2. Shah, M.B. & Rana B.C., “Engineering Drawing and Computer Graphics”, Pearson Education, 2008.

**SWAYAM/NPTEL/MOOCs:**

1. <https://nptel.ac.in/courses/112/103/112103019/>
2. <https://www.udemy.com/course/ed/>

**PROBLEM BASED LEARNING**

Sl. No	Problems
1	A point 30 mm above XY line is the front view of two points A and B. The top view of A is 40 mm behind VP and the top view of B is 45 mm in front of VP. Draw the projections of the points and state the Quadrants in which the points are situated.
2	A point 'A' is 30 mm in front of VP & 40 mm above HP. Another point B is 20 mm behind VP & 35 mm below HP. The horizontal distance between the points measured parallel to XY line is 60 mm. Draw the three projections of the points. Join their front and top views.
3	A point P is on HP and 35 mm in front of VP. Another point Q is on VP and below HP. The line joining their front views makes an angle of 30° to XY line, while the line joining their top views makes an angle of 45° with XY line. Find the distance of the point Q from HP.
4	A point is 35 mm below HP, 20 mm behind VP and 25 mm behind / in front / from RPP. Draw its projections and name the side view.
5	A line AB 80 mm long is inclined to HP at 30 degree and inclined to VP at 45 degree. Draw front and top views of line and determine their lengths. Also, measure the perpendicular distance of end B from both HP & VP.
6	A line AB has its end A 20 mm above the HP and 30 mm in front of VP. The other end B is 60 mm above HP and 45 mm in front of VP. The distance between end projectors is 70 mm. draw its true length and apparent inclinations.
7	The top view pq of a straight line is 70 mm and makes an angle of 60 degree with XY line. The end Q is 10 mm in front of VP and 30 mm above HP. The difference between the distances of P and Q above HP is 45 mm. draw the projections. Determine its true length and true inclinations with HP and VP.
8	The top view of a line 75 mm long measures 50 mm. The end P is 30 mm in front of VP and 15 mm above HP. The end Q is 15 mm in front of VP and above HP. Draw the projections of the line and find its true inclinations with HP and VP.
9	The distance between the end projectors through the end points of a line AB is 60 mm. the end A is 10 mm above HP and 15 mm in front of VP. The end B is 35 mm in front of VP. The line AB appears 70 mm long in the front view. Complete the projections. Find the true length of the line and its inclinations with HP and VP.
10	The point B of a line AB is on the horizontal plane, the top view of the line makes an angle of 30 degree with XY line, being 80mm. the point A is on the vertical plane and 50 mm above the horizontal plane. Draw the top and front views of the line and obtain the true length of the line. Also find the inclinations of the line with two planes.
11	The end A of a line AB is in HP and 25 mm in front of VP. The end B is 10 mm in front of VP and 50 mm above HP. The distance between the end projectors when measured parallel to the line of intersection of HP and VP is 80 mm, Draw the projection of the line AB and determine its true length and true inclination with HP and VP.
12	Find the true length and true inclination of a line AB with HP having one of its ends 20 mm in front of VP and 30 mm above the HP. The line is inclined at 40 degree to VP and left side view of the line is 60 mm long and inclined at 60 degree to the x1y1 line. Draw all the three views of the line.
13	An equilateral triangular lamina of 25mm side lies with one of its edges on HP such that the surface of the lamina is inclined to HP at 60 degree. The edge on which it rests is inclined to VP at 60 degree. Draw its projections.

Sl. No	Problems
14	A 30 degree-60degree setsquare of 60mm longest side is kept such that the longest side is in HP, making an angle of 30 degree with VP. The set square itself is inclined at 45 to HP. Draw the projections of the setsquare.
15	A square lamina ABCD of 40mm side rests on corner C such that the diagonal AC appears to be at 45 degree to VP. The two sides BC and CD containing the corner C make equal inclinations with HP. The surface of the lamina makes 30 degree with HP. Draw its top and front views.
16	A mirror 30 mm x 40 mm is inclined to the wall such that its front view is a square of 30 mm side. The Longer sides of the mirror appear perpendicular to both HP and VP. Find the inclination of the mirror with the wall.
17	A pentagonal lamina of sides 25 mm is resting on one of its edges on HP with the corner opposite to that edge touching VP. This edge is parallel to VP and the corner, which touches VP, is at a height of 15 mm above HP. Draw the projections of the lamina and determines the inclinations of the lamina with HP and VP and the distance at which the parallel edge lies from VP.
18	A pentagonal lamina of sides 25 mm is having a side both on HP and VP. The corner opposite to the side on which it rests is 15 mm above HP. Draw the top and front views of the lamina.
19	Draw the top and front views of a hexagonal lamina of 30mm sides having two of its edges parallel to both vertical and horizontal planes and one of its edges is 10 mm from each of the planes of projection. The surface of the lamina is inclined at an angle of 60° to the HP.
20	A hexagonal lamina of sides 30 mm has one of its comers in VP and its surface inclined at an angle of 30° with VP. The diagonal passing through that corner which is in VP appears to be inclined at 45° to HP. Draw the projections of the lamina.
21	A hexagonal lamina of sides 25 mm rests on one of its corners on HP. The corner opposite to the corner on which it rests is 35mm above HP and the diagonal passing through the corner on which it rests is inclined at 30° to VP. Draw its projections. Find the inclination of the surface with HP.
22	Draw the projections of a circular plate of negligible thickness of 50 mm diameter resting on HP on a point A on the circumference, with its plane inclined at 45° to HP and the top view of the diameter passing through the resting point makes 60° with VP.
23	A circular lamina inclined VP appears in the front view as an ellipse of major axis 30 mm and minor axis 15 mm. The Major- axis is parallel to both HP and VP. One end of the minor axis is in both the HP and VP. Draw the projections of the lamina and determine the inclination of the lamina with the VP.
24	A square prism 35mm side of base & 60mm axis length rests on HP on one of its edges of the base which is inclined to VP at 30°. Draw the projections of the prism when the axis is inclined to HP at 45°
25	A pentagonal prism 25mm sides of base & 60mm axis length rests on HP on one of its edges of the base. Draw the projections of the prism when the axis is inclined to HP at 40° & VP at 30°
26	A Hexagonal prism 25mm sides of base and 50mm axis length rests on HP on one of its edges. Draw the projections of the prism when the axis is inclined to HP at 45° & appears to be inclined to VP 40°.
27	A cone 40 mm diameter and 50 mm axis is resting on one generator on HP which makes 30° inclination with VP. Draw its projections.
28	A pentagonal pyramid 25mm sides of base and 50mm axis length rests on HP on one of its edges of the base which is inclined to VP at 30°. Draw the projections of the pyramid when the axis is inclined to HP at 45°
29	A hexagonal pyramid 30mm sides of base and axis 70mm long is resting on its base on HP with one of the edges of the base parallel to VP. It is cut by sectional plane, perpendicular to VP, inclined at 30° to HP and bisects the axis. Draw the front view, sectional top view & true shape of the section.

Sl. No	Problems
30	A vertical cylinder of base diameter 50 mm and axis 65 mm long rests on HP. It is cut by a section plane perpendicular to VP, inclined at 45 degree to HP and at a height of 30mm from the base. Draw its sectional top view and true shape of the section.
31	A hexagonal pyramid 30mm sides of base and axis 70mm long is resting on its base on HP with one of the edges of the base parallel to VP. It is cut by sectional plane, perpendicular to VP, inclined at 30° to HP and bisects the axis. Draw the front view, sectional top view & true shape of the section.
32	A square pyramid base 40mm side and axis 65mm long has its base on HP and all the edges of the base are equally inclined to VP. It is cut to with an inclined plane so as the truncated surface at 45 degree to axis, bisecting it. Draw the development of the truncated pyramid.
33	A Hexagonal prism of base side 30mm and axis length 60mm resting on HP in such a way that two of its edges are parallel to VP. The prism is cut by a section plane which is perpendicular to the VP and inclined at 30° to the HP at a height of 35mm from the base. Draw the development of the lateral surface of the prism.
34	A pentagonal prism, 30 mm base side & 50 mm axis is standing on HP on its base whose one side is perpendicular to VP. It is cut by a section plane 45 degree inclined to HP, through mid-point of axis. Draw FV, sectional top view & sec. Side view. Also draw true shape of section and Development of surface of remaining solid.
35	A hexagonal pyramid 25mm side of base and axis 65mm long is resting on its base on HP with one of the edged of the base parallel to VP. It is cut by a section plane inclined at 60° to HP and perpendicular to VP and intersecting the axis at 30mm above the base. Draw the development of the remaining portion of the pyramid.
36	A cone of base diameter 40 mm and height 50 mm is placed centrally on the top of a square slab side 60 mm and height 25 mm. Draw the isometric projection of the combination.
37	A sphere of diameter 45mm rests centrally over a frustum of cone of base diameter 60mm, top diameter 40mm and height 50mm. Draw its isometric projections.
38	A cube of 35 mm placed centrally on a square slab of 50 mm and thickness 30 mm. Draw the isometric projection of the combination.
39	Draw the isometric projection of the combination. Draw isometric projection of a hexagonal prism of side of base 40mm and height 60mm with a right circular cone of base 40mm as diameter and altitude 50mm, resting on its top such that the axes of both the solids are collinear.
40	A rectangular pyramid of base 40mmx25mm and height 50mm is placed centrally on a rectangular slab side 100mmx60mm and thickness 20mm. Draw the isometric projection of the combination.

### PROJECT BASED LEARNING

To enhance the skill-set in the integrated course, the students are advised to execute course-based design projects.

No.	Suggested Projects
1.	Model making of different solids by using Hardbound sheet.
2.	Using Hardbound sheet, prepare the different solids models by development and section methods.
3.	Prepare a demo model to show the principle of orthographic projection.
4.	Prepare the models for showing the method of Isometric projection.
5.	Problem based on Practical approach in view of orthographic projection of lines and planes.
6.	Collection or Interpretation of Engineering Drawing sheets Related to Manufacturing, Civil construction, Layouts, Plans and other Applications.
7.	Study on Comparison of 3D views and isometric Views.
8.	Drawing the Plan of students Home or building (2D)

## Detailed Syllabus Semester 2

Course Title	Probability and Statistics				Course Type		Theory	
Course Code	B20AS0204	Credits	4		Class		II semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	4	4	4				
	Practice	-	-	-	Theory	Practical	IA	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>52</b>	<b>-</b>	<b>50%</b>

### COURSE OVERVIEW:

The course Probability and Statistics for Computer Science treats the most common discrete and continuous distributions, showing how they find use in decision and estimation problems, and constructs computer algorithms for generating observations from the various distributions. Probability in the design and analysis of randomized algorithms. Common randomized algorithms are things like Quick sort and Quick select. Probabilistic method can also useful to prove various important results. Probabilistic methods used to prove some partition theorems that were then used to create efficient data structure.

### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Describe Curve fitting and regression in various problems in Computer Science & engineering fields
2. Illustrate the applications of Probability and statistics in various computer sciences engineering Fields like data mining, classification problems etc.
3. Discuss Sampling theory concepts to solve various engineering problems like structured and unstructured Data models
4. Demonstrate Stochastic problem as Markov model as a problem solving methods for systematic model buildings.
5. Learn new algorithms and methods in probability and statistics and apply for suitable problem solving methods.
6. Create solutions for problem solving methods using algorithms to the complex problems, either individually Or as a part of the team and report the results with proper analysis.

### COURSEOUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Solve the problems of Curve fitting and regression in various problems in Computer Science & Engineering fields.	1-6	1,2
CO2	Apply the concepts of Probability and statistics in various computer science engineering fields like data mining, classification problems etc.	1-6	1,2
CO3	Develop a stochastic problem as Markov model as a problem solving methods for systematic model buildings.	1-6	1,2
CO4	Make use of sampling theory concepts to solve various engineering problems like structured and unstructured data models.	1-6	1,2
CO5	Learn new algorithms and methods in probability and statistics and apply for suitable problem solving methods.	1-6	1,2
CO6	Create solutions for problem solving methods using algorithms to the complex problems, either individually or as a part of the team and report the results with proper analysis.	1-5,9	1

### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply(L3)	Analyze(L4)	Evaluate(L5)	Create(L6)
CO1			✓			
CO2			✓		✓	
CO3			✓			
CO4			✓	✓		
CO5		✓				
CO6			✓			

### COURSE ARTICULATION MATRIX

CO# / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	3	1							3	3
CO2	3	3	3	3	3	1							3	3
CO3	3	3	2	2	2	1							2	2
CO4	2	3	2	2	3	1							1	1
CO5	3	3	2	2	1	1							2	1
CO6	2	3	3	3	1	1							2	1

Note:1-Low,2-Medium,3-High

## COURSE CONTENT THEORY

Contents
<b>UNIT – 1</b> Curve Fitting: Curve fitting by the method of least squares and fitting of the curves of the form, $y = ax + b$ , $y = ax^2 + bx + c$ , $y = aebx$ and $y = axb$ Statistical Methods: Measures of central tendency and dispersion. Correlation-Karl Pearson's coefficient of correlation-problems. Regression analysis- lines of regression, problems. Rank correlation. Applications in computer science
<b>UNIT – 2</b> Probability distributions: Recap of probability theory (definition, addition rule, multiplication rule, conditional probability). Random variables, Discrete and continuous probability distributions. Binomial, Poisson, exponential and normal distributions (derivation of mean and variance for all distributions). Applications in computer science.
<b>UNIT – 3</b> Joint Probability distribution: Joint Probability distribution for two discrete random variables (both discrete and continuous cases), expectation, covariance, correlation coefficient. Stochastic processes- Stochastic processes, probability vector, stochastic matrices, fixed points, regular
<b>UNIT – 4</b> Sampling theory:-Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student's t-distribution, Chi-square distribution as a test of goodness of fit. Applications in Computer Science.

### TEXTBOOKS:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43<sup>rd</sup> edition, 2015.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Publications, 9<sup>th</sup> edition, 2013.
3. Seymour Lipschutz, John J. Schiller., "Schaum's Outline of Introduction to Probability and Statistics" McGraw Hill Professional, 1998, pp. 256.

### REFERENCE BOOKS:

1. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publications, 19<sup>th</sup> print edition, 2013.
2. R.K.Jain and S.R.K.Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House, 4<sup>th</sup> edition, 2016.
3. V.Sundarapandian, "Probability, Statistics and Queuing theory", PHI Learning, 2009
4. Dr. B. Krishna Gandhi, Dr. T.K.V. Iyengar, Dr. M.V.S.S.N. Prasad & S. Ranganatham. "Probability and Statistics", S. Chand Publishing, 2015.
5. J. K. Sharma "Operations Research theory and applications", Macmillan publishers, fifth

### JOURNALS/MAGAZINES

1. <https://www.hindawi.com/journals/jps/>
2. <https://www.journals.elsevier.com/statistics-and-probability-letters>
3. <http://www.isoss.net/japs/>

### SWAYAM/NPTEL/MOOCs:

1. <https://www.coursera.org/browse/data-science/probability-and-statistics>
2. <https://nptel.ac.in/courses/111/105/111105041/>

### SELF-LEARNING EXERCISES:

1. Curve fitting for application problems, Regression analysis for a bivariate data.
2. Probability distribution- Geometric, gamma- distributions, Joint probability distributions of continuous random variables.

Course Title	Physics for Computer Science				Course Type		Theory	
Course Code	B20AS0106	Credits	3		Class		II Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	0	0	0	Theory	Practical	IA	SEE
	-	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>-</b>	<b>50</b>	<b>50</b>

### COURSE OVERVIEW

This course introduces the basic concepts of Physics and its applications to Computer Science Engineering courses by emphasizing the concepts underlying four UNITS: Wave Mechanics, Lasers and optical fibers, EM wave and spectrum, Display Technology and Quantum computation. The subject has basic laws, expressions and theories which help to increase the scientific knowledge to analyze upcoming technologies.

### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Impart the knowledge about wave mechanics, electromagnetic waves, and its applications
2. Demonstrate the different applications of lasers, and optical fibers
3. Discuss different types of display technologies, touch screen techniques and its applications
4. Explain the importance of quantum computation as an emerging technology.
5. Learn new tools and technologies Physics and its applications to Computer Science Engineering and Apply for suitable technologies.
6. Increase the scientific knowledge to analyze upcoming technologies.

### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply knowledge of wave mechanics, its importance, and applications	1-4	1
CO2	Classify EM waves based on the frequency range, optical fibers and derive expression for NA, number of Modes and attenuation.	1-4	1
CO3	Summarize capacitive and resistive Display Technologies.	1-4	2
CO4	Analyze the working and application of quantum computation	1-3	1
CO5	Learn new tools and technologies Physics and its applications to Computer Science Engineering and apply for suitable technologies.	1-4	2
CO6	Increase the scientific knowledge to analyze upcoming technologies.	1-3	1

### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply(L3)	Analyze(L4)	Evaluate(L5)	Create(L6)
CO1			√			
CO2		√				
CO3		√				
CO4			√			
CO5		√	√			
CO6				√		

### COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1									3		
CO2	3	3	2	1									3		
CO3	3	3	2	1										3	
CO4	3	2	1										3		
CO5	3	2	2										3		
CO6	3	2	2										3		

Note: 1-Low, 2-Medium, 3-High

### COURSE CONTENT THEORY

Contents
<p style="text-align: center;"><b>UNIT-1</b></p> <p>Wave mechanics: Introduction to Wave mechanics, De-Broglie hypothesis. Expression for de-Broglie wavelength of an electron in terms of accelerating potential. Phase velocity and group velocity, Relation between phase velocity and group velocity.</p> <p>Quantum Physics: Wave function, properties of wave function and physical significance. Probability density and Normalization of wave function, Schrodinger time- dependent and independent wave equation, Eigen values and Eigen functions. Applications of Schrödinger wave equation – energy Eigen values of a free particle, Particle in one dimensional infinite potential well with numerical examples. Application-Quantum computation.</p>



#### UNIT-2

Lasers: Lasers Interaction between radiation and matter (induced absorption, spontaneous and stimulated emission). Expression for energy density at thermal equilibrium in terms of Einstein's coefficients. Characteristics of laser light, Conditions for laser operation (population inversion and Meta stable state). Requisites of laser system, semiconductor laser and its applications.

Electromagnetic Waves: Basic idea of displacement current, Electromagnetic waves, their characteristics, Electromagnetic spectrum (7 types of EM waves) including elementary facts. Uses of EM waves in communications.

#### UNIT-3

Optical fibers: Construction and light propagation mechanism in optical fibers (total internal reflection and its importance), Acceptance angle, Numerical Aperture (NA), Expression for numerical aperture in terms of core and cladding refractive indices, Condition for wave propagation in optical fiber, V-number and Modes of propagation, Types of optical fibers, Attenuation and reasons for attenuation, Applications: Explanation of optical fiber communication using block diagram, Optical source (LED) and detector (Photodiode) and their applications. Advantages and limitations of optical communications.

#### UNIT-4

Display technology: Touch screen technologies: Resistive and capacitive touch screen and Displays: CRT, Field emission display, Plasma display, LED display, OLED display, LCD display.

Quantum Computation: Quantum wires (one dimensional), Quantum dots (zero dimensional); the idea of "qubit" and examples of single qubit logic gates- Classical bits, Qubit as a two-level system.

#### TEXT BOOKS:

1. William T. Silfvast, "Laser Fundamentals", Cambridge University press, New York, 2004
2. D. Halliday, R. Resnick and J. Walker, "Fundamentals of Physics", John Wiley and Sons, New York, 10<sup>th</sup> edition 2013
3. R. K. Gaur and S.L. Gupta, "Engineering Physics", DhanpatRai Publications (P) Ltd, New Delhi. 53<sup>rd</sup> edition, 2014.
4. M.N. Avadhanulu and P.G. Kshirsagar, "A textbook of Engineering Physics", S. Chand and Company, New Delhi, 2014.
5. EM Waves and Fields: P. Lorrain and O. Corson.

#### REFERENCE BOOKS:

1. Charls Kittel, "Introduction to Solid State Physics", Wiley, Delhi, 8th Edition, 2004
2. Arthur Beiser, "Concepts of modern Physics", Tata McGraw Hill publications, New Delhi, 8th Edition, 2011.
3. S. O. Pillai, "Solid State Physics", New Age International publishers, New Delhi, 2010
4. Chen, Wayne Cranton, Mark Fihn, "Handbook of Visual Display Technology", Springer Publication, Second edition 2012.

#### JOURNALS/MAGAZINE

1. <https://www.codemag.com/Magazine/ByCategory/Python>
2. [http://ijaerd.com/papers/special\\_papers/IT032.pdf](http://ijaerd.com/papers/special_papers/IT032.pdf)
3. <https://iopscience.iop.org/article/10.1088/1742-6596/423/1/012027>
4. <https://ieeexplore.ieee.org/document/4160250>
5. Python for scientific computing

#### SWAYAM/NPTEL/MOOCs:

1. <https://www.mooc.org/>
2. <https://www.coursera.org/>

Course Title	Introduction to Data Science				Course Type		Integrated	
Course Code	B20CS0101	Credits	3		Class		II semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	2	2	2				
	Practice	1	2	2	Theory	Practical	IA	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>4</b>	<b>4</b>	<b>26</b>	<b>26</b>	<b>50%</b>	<b>50%</b>

#### COURSE OVERVIEW:

Data Science is an interdisciplinary, problem-solving oriented subject that is used to apply scientific techniques to practical problems. The course orients on preparation of datasets and programming of data analysis tasks. This course covers the topics: Set Theory, Probability theory, Tools for data science, ML algorithms and demonstration of experiments by using MS-Excel.

#### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the fundamental concepts of Excel.
2. Illustrate the use of basic concepts of Data Science in the real world applications.
3. Demonstrate the use of SQL commands in real world applications.
4. Discuss the functional components of Data Science for real world applications

#### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of the concepts of Data Science in developing the real world applications.	1-4,11	1,2
CO2	Apply the SQL commands in developing the real-world applications.	1,2	2, 3
CO3	Build the data analytics solutions for real world problems, perform analysis, interpretation and reporting of data.	1-4	1, 2, 3
CO4	Create the real world AI based solutions using different machine learning algorithms	1-4	1, 2
CO5	Learn new tools and technologies in Data Science and apply for suitable application development.	1-5	1,2
CO6	Develop solutions in the Data Science to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation	1-3	1,2

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply(L3)	Analyze(L4)	Evaluate(L5)	Create(L6)
CO1			✓			
CO2			✓			
CO3			✓	✓		
CO4			✓	✓	✓	✓
CO5		✓	✓			
CO6			✓	✓		

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2							3	3	3	3	
CO2	2	2									2	2		3	3
CO3	3	3	3	3							3	3	3	3	2
CO4	3	3	3	3							3	3	3	3	
CO5	3	3	3	3									3	3	
CO6	3	3	3	1									3	3	2

**Note:** 1-Low, 2-Medium, 3-High

**COURSE CONTENT  
THEORY**

<b>Contents</b>
<p style="text-align: center;"><b>UNIT-1</b></p> <p>Introduction to Microsoft Excel Creating Excel tables, understand how to Add, Subtract, Multiply, Divide in Excel. Excel Data Validation, Filters, Grouping. Introduction to formulas and functions in Excel. Logical functions (operators) and conditions. Visualizing data using charts in Excel. Import XML Data into Excel How to Import CSV Data (Text) into Excel, How to Import MS Access Data into Excel, Working with Multiple Worksheets.</p>
<p style="text-align: center;"><b>UNIT-2</b></p> <p><b>Introduction to Data Science</b> What is Data Science? Probability theory, Bayes theorem, Bayes probability; Cartesian plane, equations of lines, graphs; exponents.</p> <p><b>Introduction to SQL</b> SQL: creation, insertion, deletion, retrieval of Tables by experimental demonstrations. Import SQL Database Data</p>
<p style="text-align: center;"><b>UNIT-3</b></p> <p><b>Data science components</b> Tools for data science, definition of AI, types of machine learning (ML), list of ML algorithms for classification, clustering, and feature selection. Description of linear regression and Logistic Regression. Introducing the Gaussian, Introduction to Standardization, Standard Normal Probability Distribution in Excel, Calculating Probabilities from Z-scores, Central Limit Theorem, Algebra with Gaussians, Markowitz Portfolio Optimization, Standardizing x and y Coordinates for Linear Regression, Standardization Simplifies Linear Regression, Modeling Error in Linear Regression, Information Gain from Linear Regression.</p>
<p style="text-align: center;"><b>UNIT-4</b></p> <p><b>Data visualization using scatter plots, charts, graphs, histograms and maps</b> Statistical Analysis: Descriptive statistics- Mean, Standard Deviation for Continuous Data, Frequency, Percentage for Categorical Data</p> <p><b>Applications of Data Science</b> Data science life cycle, Applications of data science with demonstration of experiments either by using Microsoft Excel.</p>

**PRACTICE:**

No	Title of the Experiment	Tools and Techniques	Expected Skill/Ability																																												
1	<p>The height (in cm) of a group of fathers and sons are given below, Find the lines of regression and estimate the height of son when the height of father is 164 cm.</p> <p>Plot the graph.</p> <table border="1"> <tr> <td>Hgt of Fathers</td> <td>15</td> <td>16</td> <td>16</td> <td>16</td> <td>16</td> <td>17</td> <td>16</td> <td>17</td> <td>17</td> <td>18</td> </tr> <tr> <td>Hgt of Sons</td> <td>8</td> <td>6</td> <td>3</td> <td>5</td> <td>7</td> <td>0</td> <td>7</td> <td>2</td> <td>7</td> <td>1</td> </tr> </table> <p>Hgt of Fathers</p> <table border="1"> <tr> <td>Hgt of Sons</td> <td>16</td> <td>15</td> <td>16</td> <td>17</td> <td>16</td> <td>18</td> <td>17</td> <td>17</td> <td>17</td> <td>17</td> </tr> <tr> <td>Sons</td> <td>3</td> <td>8</td> <td>7</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>5</td> <td>2</td> <td>5</td> </tr> </table>	Hgt of Fathers	15	16	16	16	16	17	16	17	17	18	Hgt of Sons	8	6	3	5	7	0	7	2	7	1	Hgt of Sons	16	15	16	17	16	18	17	17	17	17	Sons	3	8	7	0	0	0	0	5	2	5	MS Excel	Create and perform operations on Excel data set by applying Linear regression
Hgt of Fathers	15	16	16	16	16	17	16	17	17	18																																					
Hgt of Sons	8	6	3	5	7	0	7	2	7	1																																					
Hgt of Sons	16	15	16	17	16	18	17	17	17	17																																					
Sons	3	8	7	0	0	0	0	5	2	5																																					
2	<p>Using the data file DISPOSABLE INCOME AND VEHICLE SALES, perform the following:            Plot a scatter diagram.            Determine the regression equation.            Plot the regression line (hint: use MS Excel's Add Trend line feature).            Compute the predicted vehicle sales for disposable income of \$16,500 and of \$17,900.            Compute the coefficient of determination and the coefficient of correlation</p>	MS Excel	Perform prediction and visualization of data																																												
3	<p>Managers model costs in order to make predictions. The cost data in the data file INDIRECT COSTS AND MACHINE HOURS show the indirect manufacturing costs of an ice-skate manufacturer. Indirect manufacturing costs include maintenance costs and setup costs. Indirect manufacturing costs depend on the number of hours the machines are used, called machine hours. Based on the data for January to December, perform the following operations.            Plot a scatter diagram.            Determine the regression equation.            Plot the regression line (hint: use MS Excel's Add Trend line feature).            Compute the predicted indirect manufacturing costs for 300 machine hours and for 430 machine hours.            Compute the coefficient of determination and the coefficient of correlation</p>	MS Excel	Perform prediction and visualization of data																																												
4	<p>Apply multiple linear regression to predict the stock index price which is</p> <table border="1"> <tr> <td>year</td> <td>month</td> <td>interest rate</td> <td>unemployment rate</td> <td>stock index price</td> </tr> <tr> <td>2020</td> <td>10</td> <td>2.75</td> <td>5.3</td> <td>1464</td> </tr> </table>	year	month	interest rate	unemployment rate	stock index price	2020	10	2.75	5.3	1464	MS Excel	Perform prediction and visualization of data																																		
year	month	interest rate	unemployment rate	stock index price																																											
2020	10	2.75	5.3	1464																																											
5.	<p>Calculate the total interest paid on a car loan which has been availed from HDFC bank. For example, Rs.10, 00,000 has been borrowed from a bank with annual interest rate of 5.2% and the customer needs to pay every month as shown in table below. Calculate the total interest rate paid for a loan availed of Rs.10, 00,000 during 3 years.</p> <table border="1"> <tr> <td>SI No.</td> <td>A</td> <td>B</td> </tr> <tr> <td>1</td> <td>Principal</td> <td>Rs.10,00,000</td> </tr> <tr> <td>2</td> <td>Annual interest rate</td> <td>5.20%</td> </tr> <tr> <td>3</td> <td>Year of the loan</td> <td>3</td> </tr> <tr> <td>4</td> <td>Starting payment number</td> <td>1</td> </tr> <tr> <td>5</td> <td>Ending payment number</td> <td>36</td> </tr> <tr> <td>6</td> <td>total interest paid during period</td> <td>?</td> </tr> </table>	SI No.	A	B	1	Principal	Rs.10,00,000	2	Annual interest rate	5.20%	3	Year of the loan	3	4	Starting payment number	1	5	Ending payment number	36	6	total interest paid during period	?	MS Excel	Create Excel data and perform EMI estimator																							
SI No.	A	B																																													
1	Principal	Rs.10,00,000																																													
2	Annual interest rate	5.20%																																													
3	Year of the loan	3																																													
4	Starting payment number	1																																													
5	Ending payment number	36																																													
6	total interest paid during period	?																																													

6	Create a supplier database of 10 records with SUPPLIER_ID as primary key, SUPPLIER_NAME, PRODUCTS, QUANTITY, ADDRESS, CITY, PHONE_NO and PINCODE, Where SUPPLIER_NAME, PRODUCTS, QUANTITY and PHONE_NO, should not be NULL.	SQL	Creating Tables			
7	Create the customer database of a big Market with CUSTOMER_ID as primary key, CUSTOMER_NAME, PHONE_NO, EMAIL_ID, ADDRESS, CITY and PIN_CODE. Store at least twenty customer's details where CUSTOMER_NAME and PHONE_NO are mandatory and display the customer data in alphabetical order.	SQL	Creating and retrieving Tables			
8	Apply linear regression to find the weather (temperature) of a city with the amount of rain in centimeters. Create your own database with following details.  <table style="margin-left: 40px; border: none;"> <tr> <td style="padding-right: 40px;">CITY</td> <td style="padding-right: 40px;">Temperature in Centigrade</td> <td>Rain in Centimeters</td> </tr> </table>	CITY	Temperature in Centigrade	Rain in Centimeters	MS Excel	Apply Linear regression
CITY	Temperature in Centigrade	Rain in Centimeters				
9	Use the linear regression technique to compare the age of humans with the amount of sleep in hours.  <table style="margin-left: 40px; border: none;"> <tr> <td style="padding-right: 40px;">Name</td> <td style="padding-right: 40px;">Age in Years</td> <td>Sleep in hours</td> </tr> </table> Create your own database with above details.	Name	Age in Years	Sleep in hours	MS Excel	Apply Linear regression
Name	Age in Years	Sleep in hours				
10	Apply the linear regression, compare the average salaries of batsman depending on the run rate scored/ recorded in the matches. Assume your own database.	MS Excel	Apply Linear regression			
11	Design the ER diagram and create schema of the REVA library management system.	Entity Relationship	Entity Relationship			
12	Design the ER diagram and create schema for Hospital Management system.	Entity Relationship	Schema design			

#### TEXT BOOKS:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43rd edition, 2015.
2. Ramakrishnan and Gehrke, "Database Management systems", Third Edition, McGraw Hill Publications, 2003.
3. Mastering Data Analysis in Excel - <https://www.coursera.org/learn/analytics-excel>.
4. Kenneth N. Berk, Carey, "Data Analysis with Microsoft Excel", S. Chand & Company, 2004.

#### REFERENCE BOOKS:

1. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publications, 19th edition, 2013.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Publications, 9th edition, 2013.
3. Seymour Lipschutz, John J. Schiller, "Schaum's Outline of Introduction to Probability and Statistics", McGraw Hill Professional, 1998.

#### JOURNALS/MAGAZINES

1. <https://www.journals.elsevier.com/computational-statistics-and-data-analysis>
2. <https://www.springer.com/journal/41060>- International Journal on Data Science and Analytics
3. <https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=8254253>-IEEE Magazine on Big data & Analytics

#### SWAYAM/NPTEL/MOOCs:

1. Excel Skills for Business: Essentials, Macquarie University (<https://www.coursera.org/learn/excel-essentials>)
2. SQL for Data Science, University of California, Davis (<https://www.coursera.org/learn/sql-for-data-science>)
3. Data Science Math Skills, Duke University (<https://www.coursera.org/learn/datasciencemathskills>)
4. <https://www.edx.org/course/subject/data-science>
5. [https://onlinecourses.nptel.ac.in/noc19\\_cs60/preview](https://onlinecourses.nptel.ac.in/noc19_cs60/preview)

#### SELF-LEARNING EXERCISES:

1. Relational database management system.
2. Advanced MS-Excel

Course Title	Basics of Civil and Mechanical Engineering				Course Type		Integrated	
Course Code	B20CE0201	Credits	4		Class		II Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	1	2	2	Theory	Practical	IA	SEE
	-	-	-	-				
	<b>Total</b>	<b>4</b>	<b>5</b>	<b>5</b>	<b>39</b>	<b>26</b>	<b>50</b>	<b>50</b>

### COURSE OVERVIEW

This course introduces the Mechanical and Civil Engineering concepts, underlying the fact that this knowledge is essential for all Engineers. The students are made to understand the concept of internal combustion engines and power transmission systems. The students are also exposed to the knowledge of mechanical machine tools with its operations on lathe, drilling, and CNC machines. The students are introduced to the domain of fabrication processes like Soldering, Welding and 3D printing technology. Along with this student are made to expose to scope of Civil engineering, role of civil engineers in different infrastructure & economic development of the country. Students will learn about basic concept of forces, friction, centroid and moment of inertia.

### COURSE OBJECTIVE

This course enables graduating students

1. To develop the basic knowledge of IC engines, refrigeration-air conditioning and power
2. Transmission systems.
3. To incorporate the concepts of manufacturing processes using different machine tools, welding
4. Techniques, CNC and 3D printing technology.
5. To understand a broad concept of engineering mechanics.
6. To develop the basics of composition of coplanar forces and fluid mechanics
7. Learn concept of internal combustion engines and power transmission systems
8. Introduction to the domain of fabrication processes like Soldering, Welding and 3D printing technology.

### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Describe the fundamentals of IC engines, refrigeration-air conditioning and power transmission systems.	1,2	3
CO2	Explain the manufacturing processes using lathe, drilling, welding, CNC machines and 3D printing technology	1,2	3
CO3	Describe the moment of force and couples and equivalent force-couple system.	1,2	3
CO4	Solve numerical problems on composition of coplanar concurrent and non-concurrent force system and basics of fluid mechanics	1,2	3
CO5	Learn concept of internal combustion engines and power transmission systems	1,2	1
CO6	Introduction to the domain of fabrication processes like Soldering, Welding and 3D printing technology.	1,5	1

### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		✓				
CO2		✓				
CO3	✓	✓	✓	✓	✓	
CO4	✓	✓	✓			
CO5		✓				
CO6		✓				

### COURSE ARTICULATION MATRIX:

CO# / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2													1
CO2	3	2													1
CO3	3	2													1
CO4	3	2													1
CO5	3	2													1
CO6	3	2													1

**Note:** 1-Low, 2-Medium, 3-High

### COURSE CONTENT

#### THEORY

Contents
<p align="center"><b>UNIT-1</b></p> <p>Introduction to Mechanical Engineering: Overview of Mechanical Engineering, Importance and applications of Mechanical Engineering in different fields.</p> <p>Thermal Energy Systems: Introduction to IC Engines, Classification, parts of IC Engine, working of 4-stroke Petrol engine with PV-diagram. Simple numerical on calculation of IP, BP and Mechanical efficiency, Introduction to refrigeration system, working of vapour compression refrigeration and window split air conditioning system. Applications of refrigeration systems</p>



### **UNIT-2**

Power Transmission System: Introduction to drives, classification, belt drives (open and crossed-No derivations) and gear drives and types of gear, Numerical on gear drives.

Mechanical Machine Tools: Introduction- lathe, classification, major parts of engine lathe, operations, Drilling machine, classification working bench drilling machine and operations, CNC Machines-Block diagram and applications. Introduction to 3D Printing technology

Joining processes-Welding: Working of electric arc welding and soldering, Differences between welding and

### **UNIT-3**

Introduction to Civil Engineering: Scope of Civil Engineering, Types of Infrastructure, Effect of Infrastructure facilities, Role of Civil Engineers in the Infrastructure and Economic Development of Country.

Introduction to Engineering Mechanics: Basic concepts, Newton laws of Motion Elements of force, system of forces, principles of physical Independence, superposition and Transmissibility of forces. Moment of force –Couple, Moment of couple and its characteristics, Equivalent Force – Couple system. Resolution and composition of forces.

Coplanar Concurrent Force System: Parallelogram Law of forces, principle of resolved parts, composition of

### **UNIT-4**

Coplanar Non – concurrent forces: Varignon's principle of Moments, Resultant of Non – Concurrent force systems, Equilibrium of Coplanar Concurrent Force System: Type's forces acting on the body, free body diagrams, Equations of Equilibrium, Lami's theorem, Equilibrium of Non – concurrent forces equilibrium equations

Friction: Frictional forces, Law of friction, Angle of friction, Angle of Repose and Cone of Friction (Theory only)

Centroid: Center of Gravity, Center of Gravity of Flat Plate, Centroid, difference between Center of gravity and Centroid, Uses of Axis Symmetry, simple problems

Moment of Inertia: Moment of Inertia of Plane Figure, Polar Moment of Inertia and Moment of Inertia of Standard sections (Derivations not included). Simple problems.

Fluid Mechanics: Introduction, methods of describing fluid motion, definitions of types of fluid flow, streamline, path line, stream tube. General Continuity equation (problems).

**PRACTICE:**

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
1.	Dismantling and Assembly of 2-Wheeler (2–stroke) Engine	2-Stroke Engine (TVS Bike)	Hands on Experience
2	Study of Fitting tools and preparation of fitting model (1 Model)	Fitting tools	Hands on experience
3.	Study of sheet metal tools and development of Cylinder (1 Model)	Sheet metal tools and soldering tools	Hands on experience
4.	Study of sheet metal tools and development of Pen stand and funnel (2-Models)	Sheet metal tools and soldering tools	Creative Thinking
5.	Hands on training on basic welding joint (Butt Joint-1 Model)	Welding tools	Hands on experience
6.	To study the carpentry tools with one model (Half joint-Model)	Carpentry Tools (Marking, Sawing, Planning and Chiseling)	Comprehend the different handling carpentry tools
7.	To study the carpentry tools with one model (Dovetail-Model)	Carpentry Tools (Marking, Sawing, Planning and Chiseling)	Comprehend the different handling carpentry tools
8.	To study the carpentry tools with one model ( T-Joint - Model)	Carpentry Tools (Marking, Sawing, Planning and Chiseling)	Comprehend the different handling carpentry tools
9.	To Study the plumbing tools and to make threads on pipe and pipe fittings using plumbing tools	Plumbing Tools	Comprehend the different handling plumbing tools
10.	To Study the plumbing tools used for valves and sanitary fitting	Plumbing Tools	Comprehend the different handling plumbing tools

**TEXTBOOKS:**

1. K.R. Gopalkrishna ,“Elements of Mechanical Engineering”, 12th Edition, Subhash Publishers, Bengaluru, 2012.
2. Roy & Choudhury, "Elements of Mechanical Engineering", Media Promoters & Publishers Pvt. Ltd, Mumbai, 2000.
3. Mikell P Groover : Automation, Production Systems, and Computer Integrated Manufacturing , Pearson India, 2007, 4<sup>th</sup> Edition

**REFERENCE BOOKS:**

1. SKH Chowdhary, AKH Chowdhary, Nirjhar Roy,“The Elements of Workshop Technology Vol I & II, 11<sup>th</sup> edition, Media Promoters and publisher, Mumbai, 2001.
2. AvikshitSaras, “3D Printing-Made Simple”, BPB Publications-New Delhi.

**JOURNALS/MAGAZINES**

1. International Journal of Machine Tools and Manufacture
2. International Journal of Refrigeration.

**SWAYAM/NPTEL/MOOCs:**

1. <https://nptel.ac.in/courses/112/103/112103262/#>
2. <https://www.my-mooc.com/en/mooc/fundamentals-manufacturing-processes-mitx-2008x/>
3. <https://www.coursera.org/learn/3d-printing-applications>

Course Title	Programming for Problem Solving				Course Type	Integrated		
Course Code	B20CS0102	Credits	4		Class	II Semester		
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	1	2	2	Theory	Practical	IA	SEE
	-	-	-	-				
	<b>Total</b>	<b>4</b>	<b>5</b>	<b>5</b>	<b>39</b>	<b>26</b>	<b>50%</b>	<b>50%</b>

#### COURSE OVERVIEW:

Algorithms and flowcharts are the fundamental tools for problem solving which can be used by the computers. The computer programs can be developed using algorithms and flowcharts to provide solutions to problems. C Language is a general-purpose, structured and procedure oriented programming language. It is one of the most popular computer languages today because of its structure and higher-level abstraction C. This course introduces algorithms, flowcharts and various C Programming language constructs for the development of real world applications.

#### COURSE OBJECTIVE (S):

1. Explain algorithms, flowcharts and different programming constructs of C to be used for Development of applications.
2. Illustrate the use of iterative statements and conditional Statements for solving the real world problems.
3. Demonstrate the use of functions with parameter passing mechanisms for solving the real world problems.
4. Discuss the use of structures, unions, pointers and file operations for solving the real world Problems.
5. Learn new algorithms and technologies in C Programming and apply for suitable application development.
6. Develop solutions by using C Programming to the complex problems, either individually or as a part of team and report the results.

#### COURSE OUTCOMES (COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the programming constructs of C language to solve a given problem.	1-6	1
CO2	Apply the concepts of matrices to develop data processing and analysis solutions in various application domains.	1-5	1
CO3	Develop text processing based applications using string operations.	1-5	2,3
CO4	Create solutions for real world problems using Pointers, Union, Structures and file operations.	1-5	2,3
CO5	Learn new algorithms and technologies in C Programming and apply for suitable application development	1-5	2,3
CO6	Develop solutions by using C Programming to the complex problems, either individually or as a part of the team and report the results	1-5,9	2,3

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1				✓		
CO2			✓			
CO3			✓			
CO4						✓
CO5		✓	✓			
CO6						✓

**COURSE ARTICULATION MATRIX**

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	3	1	2	1							3		
CO2	1	3	2	2	1								3		
CO3	2	2	2	2	1									3	3
CO4	3	3	3	1	1									3	3
CO5	3	3	3	2	2	1									
CO6	3	3	3	2	2	2							3	3	2

**Note:**1-Low,2-Medium,3-High

**COURSE CONTENT  
THEORY**

<b>Contents</b>
<b>UNIT-1</b>
Algorithm: Definition, Purpose of writing an algorithm, Rules for writing an algorithm, Advantage of writing algorithm and examples. Flowchart: Definition, Notations used to write a flow chart, Advantage and disadvantages of writing the flowchart and examples. Introduction to “C”: Introduction to GitHub, Structure of C program with example, C language & its features, C tokens, data types in C, variables, constants, input and output functions
<b>UNIT-2</b>
Operators and Expressions: Unary operator, assignment operator, arithmetic operator, relational operators, logical operators & bitwise operator, conditional operator, increment and decrement operator, special operator. Conditional Statements: if statement, if-else statement, nested if, switch statement. Unconditional Statements: break and continue statement, goto statement, return statement Iterative Statements (loops): while loop, do-while, for loop, differences between while, do-while and for loop.
<b>UNIT-3</b>
Arrays: one dimensional array, two dimensional array, Linear and binary search and bubble sorting. Functions: Structure of a function, types of functions, parameter passing mechanisms, Command line arguments. Strings: string operations with and without using inbuilt string functions.
<b>UNIT-4</b>
Structures & Union: Derived types- structures- declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, union, typedef. Pointers: Introduction to pointers. File Operations: Formatted Input & Output, Character Input and Output Functions, Direct Input and Output Functions, File Positioning Functions, Error Functions

**PRACTICE:**

<b>PART A:</b>			
<b>No</b>	<b>Title of the Experiment</b>	<b>Tools and Techniques</b>	<b>Expected Skill /Ability</b>
1	Consider Loan applications in a bank consisting of various customer details such as Name, Organization, salary and loan amount applied. Segregate the loan applications based on income (low: <=5 lpa, medium: >5lpa <10lpa and high:>10lpa)	Condition checking	Apply if-else and switch
	Two files DATA1 and DATA2 contain sorted lists of integers. Write a C program to merge the contents of two files into a third file DATA i.e., the contents of the first file followed by those of the second are placed in the third file. Display the contents of DATA.	Files operations	Apply File concepts
	Statistical measures are used for data analysis and interpretation. Develop program to determine the mean and stand deviation of data stored in an array.	Statistical Computing	Use Array and loops
2	Consider the details of Airline passengers such as Name, PAN-No., Mobile-no, Email-id, Source, Destination, Seat-No and Air-Fare. Develop a program to read the details of airline passengers, store them in the structure “Airline” and List details of all the passengers who travelled From “Bengaluru to London”.	Search technique	Apply Structures

3	Assume that Mr. Peterson shopped N items at Big Market and his Cart comprises of name of the item, cost of the item per UNIT and quantity. Read the details of shopping and store them in the structure "Shop". Compute the total amount spent on shopping at Big Market and also find out the item with minimum and maximum cost.	Statistical measure	Apply Structure and if then else
	b. Write a C program to define a structure named Student with name and DOB, where DOB in turn is a structure with day, month and year. Read the details of student and store them in the structure "Student". Display name and date of birth of students using the concept of nested structures.	Nested Structures	Apply Nested Structures
4	Consider a set of N students with SRN, name, and marks scored in 8 subjects. Read the details of students and store them in the structure "Student_Marks". Compute total marks and average marks of each student and display them with suitable headings.	Average computation and visualization	Apply Structure, Array and Loops
	b. Create the structure "Book" with book_id, title, author_name and price. Write a C program to pass a structure as a function argument and print the book details.	Functions	Passing structures to function
5	Assume that Ms. Jassica shopped N items at Amazon and the Cart comprises of name of the item, cost of the item per UNIT and quantity. Arrange the items in the increasing order of cost of the item per UNIT.	Sorting	Apply sorting the contents of structure.
	Write a C program to compute the monthly pay of "N" employees using each employee's name, Basic_Pay, DA and HRA. The DA and HRA are 80% and 30% of the Basic_Pay respectively. Gross-salary is computed by adding DA and HRA to Basic_Pay. Store all the details in an array of structures and print the name and gross salary of each employee.	Reading and storing data	Use structures for reading and storing data
6	a. Consider the details of "N" Faculty members consisting of Name, EMP-ID, name of the school, address and salary. Create a file to store the above details. Retrieve the contents of the file to perform following operations: (i) Display the details of the faculty based on salary range entered. (ii) Display the details of the faculty based on the EMP-ID entered.	File operations	Create file, store data and display details.
	b. Write a C program to determine whether the character entered is a capital letter, a small case letter, a digit or a special symbol using if else and switch case.	String operations	Apply string functions

<b>PART B:</b>			
	Project 1: Address Contact List with the following modules: User Add User(Name, Address, Primary contact number, secondary contact number, E-mail ID) Delete User Search for User Edit Find and replace the user name Edit the contact (Phone Number) details. Edit the Address of the user Report List of users based on the starting letter of their names. List of users based on first 2 digits of their mobile number. List of users based on the domain name of their E-mail ID.		
1	Develop a program in C to create the structure "Contact" with the fields, user_name, address, mobile, phone1 and email_id. Read the data into the structure "Contact" and store them in the file "Contact.txt".	Structures and Files	Develop the program using Structures and Files
2	Develop a program in C to open contact list from the file "Contact.txt" in read mode and delete contact details of the person based on name of the person by searching his/her details. Display the updated list.	String, File and Linear Search	Develop the program using String and File
3	Develop a program in C to input the string,"Str1"( which can be either a mobile no. or name of the user) and search for it in the file , "Contact.txt" and display the details if it is found else display an error.	String, File and Linear Search	Develop the program using String and File
4	Develop a program in C to input the name of the user into the string, "Str1" , search for it in the file "Contact.txt" and replace the content of "Str1" with the new data if found.	String, File and Linear Search	Develop the program using String, File and apply linear search
5	Develop a program in C to input the phone number of user into the string, "Str1", search for it in the file "Contact.txt" and edit it with new data if found and save the same.	String, File and Linear Search	Develop the program using String, File and apply linear search
6	Develop a program in C to input the address of the user and search for the same in the file, "Contact.txt" and edit the address with new address and save the same.	String, File and Linear Search	Develop the program using String, File and apply linear search
7	Develop a program in C to input a letter into "Letter", compare it with the details stored in "Contact.txt" and then display the list of the users whose name begin with "Letter".	File operations	Develop the program using file
8	Develop a program in C to input first two digits of a mobile number into "Mobile", search for the same in "Contact.txt" and display the details of all the users whose mobile number begin with "Mobile".	File operations	Develop the program using file
9	Develop a program in C to input a domain name of email-id and search for the same in the file, "contact.txt" and list the details of the users whose email-id matches with the given domain name.	File operations	Develop the program using file

### TEXT BOOKS:

1. B.W. Kernighan & D.M. Ritchie, "C Programming Language", 2<sup>nd</sup> Edition, PRENTICE HALL
2. SOFTWARE SERIES, 2005.
3. Herbert Schildt, "C: The Complete Reference", 4<sup>th</sup> edition, TATA McGraw Hill, 2000.
4. B.S. Anami, S.A. Angadi and S. S. Manvi, "Computer Concepts and C Programming: A
5. Holistic Approach", second edition, PHI,2008.

### REFERENCE BOOKS:

1. Balaguruswamy," Programming in ANSI C", 4<sup>th</sup> edition, TATA MCGRAW Hill, 2008.
2. Donald Hearn, Pauline Baker," Computer Graphics C Version", second edition, Pearson Education, 2004.

### JOURNALS/MAGAZINES:

1. <https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6294> (IEEE Journal/Magazine on IT Professional)
2. <https://ieeexplore.ieee.org/document/1267572> (IEEE Computing in Science and Engineering)

### SWAYAM/NPTEL/MOOCs:

1. [https://online.courses.nptel.ac.in/noc20\\_cs06/preview](https://online.courses.nptel.ac.in/noc20_cs06/preview) (Problem Solving through Programming in C)
2. <https://www.edx.org/course/c-programming-getting-started> (C Programming Getting started)
3. <https://www.coursera.org/specializations/c-programming> (Introduction to C programming)

### SELF-LEARNING EXERCISES

1. **Fundamentals of computer graphics:** output primitives–Line, Circle and Ellipse drawing algorithms- Attributes of output primitives.
2. **Inline Assembly Language Program:** Simple inline assembly, Extended Assembly Syntax Microsoft C Compiler.



Course Title	IoT and Applications				Course Type		Integrated	
Course Code	B20EC0101	Credits	2		Class		II Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	1	1	1				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>13</b>	<b>26</b>	<b>30%</b>	<b>30%</b>

### COURSE OVERVIEW

The Internet of Things (*IoT*) expands access to the world-wide web from computers, smart phones, and other typical devices to create a vast network of appliances, toys, apparel, and other goods that are capable of connecting to the Internet. This introductory course focuses on IoT architecture, its domains and communication protocols. The course is supported with hands on sessions that incorporates different types sensors interfaced with IoT board to build IoT projects to solve real time problems. The case study of deployment of IoT in various applications are provided.

### COURSE OBJECTIVE(S):

The objectives of this course are to:

1. Explain the architecture of Internet of Things.
2. Inculcate knowledge of IoT devices, Sensors and Communication Protocols in various application domains.
3. Gain expertise in interface of various sensors to IoT Boards.
4. Discuss the various applications of IoT.
5. Learn new technologies in the IoT and apply for suitable application development.
6. Develop simple IoT projects and modules.

### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Describe the architecture of IoT eco-system	1	1,2
CO2	Identify IoT devices, architecture, sensors and Communication protocols	1	1,2
CO3	Demonstrate the interface of sensors to IoT board	1,5, 12	1,2
CO4	Realize various Applications of IoT through case studies	1,5, 12	1,2
CO5	Learn new technologies in the IoT and apply for suitable application development.	1,5,9, 12	1,2
CO6	Develop simple IoT projects and modules	1,5,6,9, 12	1,2

### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2		√				
CO3			√			
CO4				√	√	
CO5			√			√
CO6						√

### COURSE ARTICULATION MATRIX

CO# / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												3	3	
CO2	3												3	3	
CO3	3				3							3	2	2	
CO4	3				3							3	1	1	
CO5	3		2		3				2				1	1	1
CO6	3				3				2			3	3	3	

Note: 1-Low, 2-Medium, 3-High

### COURSE CONTENT THEORY

Contents
<p align="center"><b>UNIT-I</b></p> <p><b>IoT Basics:</b> Introduction to IoT, How does Internet of Things Works, Features of IoT, Advantages and Disadvantages of IoT, Embedded Devices in IoT, IoT eco-system</p> <p><b>IoT Architecture and IoT Devices:</b> Components of IoT architecture, Stages of IoT solution architecture, Smart Objects, IoT Devices.</p>
<p align="center"><b>UNIT-II</b></p> <p><b>IoT boards in Market:</b> Arduino, Arduino UNO, ESP8266, Raspberry Pi</p> <p><b>IoT Platform:</b> Amazon Web Services (AWS) IoT platform, Microsoft Azure IoT platform, Google Cloud Platform IoT, IBM Watson IoT platform, Thing Work IoT platform</p> <p><b>Technologies Used in IoT:</b> Bluetooth, Wi-Fi, Li-Fi, RFID, Cellular, Z-Wave</p>

**PRACTICE:**

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
1.	Introduction to IoT Board	Hardware	Identifications of various parts of Arduino and Node MCU boards Study of Ethernet shield and connection to the board
	Arduino UNO		
	Arduino Nano		
	Node MCU		
	Ethernet Shield		
2.	Working with Arduino IDE (Integrated Development Environment)	Open source Arduino IDE	Download specified software Modify code as per the application
3.	a) Demonstration of Multi meter usage	Multi meter Breadboard Resistor packs	Measurement of voltage at various points in IoT boards Choose the value of Resistor for an application
	b) Demonstration of Breadboard connection for Voltage, Ground, series and parallel connections		
	c) Exercise to read the value of resistor using Color code chart		
4	Reading photo resistor sensor value connected to Arduino Board	Arduino UNO Arduino IDE LDR, Multi meter, Resistor	Interface of photo sensor to IoT board for light measurement applications
5	Reading temperature sensor value connected to Arduino Board	Arduino UNO, Arduino IDE, Temperature sensor, Multi meter	Interface of Temperature sensor to IoT board for temperature measurement application
6.	Reading motion detector sensor value connected to IoT board	Arduino UNO, ArduinoIDE, pyro-dielectric sensor,	Interface of Motion detector sensor to IoT board for motion detection applications
7	Reading distance measurement using Ultrasonic sensor Connected to IoT board	Arduino UNO, Arduino IDE, Ultrasonic sensor, Multi meter	Interface of Motion detector sensor to IoT board for motion detection
8	Interface relay to IoT board	Arduino UNO, Arduino IDE, relay Multi meter	Interface relay to IoT board for Switching applications
9	Connect Wifi-ESP8266 to Arduino UNO board , Send and receive data through smart phone.	Arduino UNO ESP8266, Arduino IDE Smart phone	Connect IoT board to Wifi network
9	Mini Projects Arduino Controlled Light intensity Thermometer Motion activated light lamp Touchless motion sensor trash can		

**TEXTBOOK:**

1. Vijay Madiseti, ArshdeepBahga, " Internet of Things: A Hands-On- Approach", ISBN: 978 0996025515,2014.

**REFERENCEBOOKS:**

1. Raj Kamal, " Internet of Things: Architecture & design Principle", McGraw Hill Education,2017.

**SWAYAM/NPTEL/MOOCs:**

- <https://www.coursera.org/learn/iot>
- <https://www.coursera.org/learn/interface-with-arduino>

**SELF-LEARNINGEXERCISES:**

- Create Arduino project hub

Course Title	ENTREPRENEURSHIP				Course Type		Theory	
Course Code	B20ME0104	Credits	1		Class		II semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	1	1	1				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>13</b>	<b>0</b>	<b>50%</b>	<b>50%</b>

#### COURSE OVERVIEW:

Course Description: This is an *introductory course* is designed to provide the foundational concepts of *entrepreneurship*, including the definition of *entrepreneurship*, the profile of the *entrepreneur*, and the role of venture creation in society. The course also provides a bird's eye view on the steps to start a venture, financing, marketing as well as support by various institutions towards entrepreneurship.

#### COURSE OBJECTIVE

1. To understand the basic terms, concepts in Entrepreneurship Development
2. To apply for the supporting schemes towards entrepreneurship

#### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand and explain the key terms, definitions, and concepts used in Entrepreneurship Development	1	1
CO2	Plan a startup and understand sources available for finance and the supporting schemes offered by state and central governments and other entrepreneurial development organizations	1,2	1,2

#### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2	√	√	√			

#### COURSE ARTICULATION MATRIX

CO#/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2												2		
CO2	2	2											2	1	

Note: 1-Low, 2-Medium, 3-High

## COURSE CONTENT

### THEORY

Contents
<p style="text-align: center;"><b>UNIT-1</b></p> <p><b>INTRODUCTION TO ENTREPRENEURSHIP</b></p> <p>Evolution of term 'Entrepreneurship', Factors influencing entrepreneurship', Psychological factors, Social factors, Economic factors, Environmental factors. Characteristics of an entrepreneur, Difference between Entrepreneur and Entrepreneurship, Types of entrepreneurs. New generations of entrepreneurship viz. social entrepreneurship, Edupreneurship, Health entrepreneurship, Tourism entrepreneurship, Women entrepreneurship etc., Barriers to entrepreneurship, Creativity and entrepreneurship, Innovation and inventions, Skills of an entrepreneur, Decision making and Problem Solving</p>
<p style="text-align: center;"><b>UNIT-2</b></p> <p><b>INSTITUTIONAL SUPPORT FOR ENTREPRENEURSHIP</b></p> <p>Organization Assistance to an entrepreneur, New Ventures, Industrial Park (Meaning, features, &amp; examples), Special Economic Zone (Meaning, features &amp; examples), Financial assistance by different agencies, MSME Act Small Scale Industries, Carry on Business (COB) licence, Environmental Clearance, National Small Industries Corporation (NSIC), e-tender process, Excise exemptions and concession, Exemption from income tax, The Small Industries Development Bank of India(SIDBI), Incentives for entrepreneurs</p>

### TEXTBOOKS:

1. K. Ramachandran, "Entrepreneurship Development", Tata Mc. Graw Hill, 2008.
2. Sangeeta Sharma, "Entrepreneurship Development", PHI Publications, 2016.

### REFERENCE BOOKS:

1. Baringer and Ireland, "Entrepreneurship", 11th Edition, Pearson, 2020.
2. P. Narayana Reddy, "Entrepreneurship – Text and Cases", Cengage Learning India, 10th Edition, 2010
3. Paul Burns, "Corporate Entrepreneurship: Building The Entrepreneurial Organization", Palgrave Macmillan.
4. Drucker F Peter, "Innovation and Entrepreneurship", 1985. Heinemann, London.
5. Doanld F Kuratko & Richard M, "Entrepreneurship in the New Millennium", India Edition.

### JOURNALS/MAGAZINES

1. International Small Business Journal: <https://journals.sagepub.com/home/isb>
2. Journal of Development Entrepreneurship: <https://www.worldscientific.com/worldscinet/jde>

### SWAYAM/NPTEL/MOOCs:

1. Entrepreneurship: <https://nptel.ac.in/courses/110/106/110106141/>

### SELF-LEARNING EXERCISES:

1. Introverts participate. If you have a few vocal students asking questions and little participation from others, anonymous questions lower student anxiety, which makes it easier for everyone to participate.
2. You learn what students are thinking about. Anonymity provides cover for students to ask questions they may be too afraid to ask but are curious about.
3. Discussions start. Anonymity means you can invite students to pose "challenging" questions. If you encourage your students to question what they're learning, why it's important, or why they should have to do the work you're assigning, you spark discussions about how entrepreneurship is relevant, which can often be the key to increasing engagement.

## PROBLEMBASEDLEARNING

No.	
1	How to write a Business Plan
2	Creating Marketing, Financial and Organizational Plans.
3	How to apply for financial assistance via various schemes
4	How to file taxes as a Small Business and understand the importance of GST

## Detailed Syllabus Semester -3

Course Title	Analog and Digital Electronics				Course Type		Integrated	
Course Code	B20CI0301	Credits	3		Class		III Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3	Theory	Practical	CIE	SEE
	Practice	-	-	-				
	-							
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>-</b>	<b>50</b>	<b>50</b>

### COURSE OVERVIEW

This course covers basic concepts of Electrical Engineering. The course introduces the working of analog components and helps in understanding basics in digital electronics by applying the knowledge of logic gates and learning the applications of diodes and op amps. The course provides foundation on designing and implementation of logic circuits. Analog circuits are simulated using ORCAD tool and digital circuits using XILINX tool which helps in gaining experience in creating and testing of circuits.

### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Discuss the applications of diode in rectifiers, filter circuits and wave shaping.
2. Describe the foundation on designing, building and testing of common combinational and sequential Digital logic circuits.
3. Explain the procedure required for simulation of digital logic circuits.
4. Analyze the working principle and designing of analog circuits using ORCAD tool
5. Analyze the working principle and designing of digital circuits using XILINX tool
6. Demonstrate the use of general electronic instruments in design and testing of digital logic circuits.

### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Analyze the use of diodes in rectifiers, filter circuits and wave shaping	1 to 4	1
CO2	Apply the basic knowledge used in solid state electronics including diodes, and operational amplifiers for specific engineering applications.	1 to 3, 5	1
CO3	Identify the different families of digital integrated circuits build, and troubleshoot combinatorial circuits using digital integrated circuits	1 to 5	2
CO4	Analyze the working principle and designing of analog circuits using ORCAD tool	1 to 4	1
CO5	Analyze the working principle and designing of digital circuits using XILINX tool	1 to 4	1
CO6	Develop the ability to analyze and design analog electronic circuits using discrete components	1,4,5	3

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1				√		
CO2			√			
CO3			√			
CO4				√		
CO5				√		
CO6			√			

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2									3		
CO2	3	2	3		2								3		
CO3	3	1	2	1	2									3	
CO4	3	1	1	2									3		
CO5	3	1	1	2									3		
CO6	3			2	2										3

Note:1-Low,2-Medium,3-High

**COURSE CONTENT**

**THEORY:**

<b>UNIT – 1</b>
<b>Limiters and Oscillators:</b> Clipping and clamping circuits using diodes, Oscillator operation, Phase shift Oscillator, Wien bridge Oscillator, Tuned Oscillator circuits, Crystal Oscillator. (BJT Version Only) Simple design methods of Oscillators.
<b>UNIT- 2</b>
<b>Operational Amplifiers:</b> Ideal Opamp versus Practical Opamp, Performance Parameters, Some Applications: Peak Detector Circuit, Absolute Value Circuit, Comparator, Active Filters-First order LPF and HPF, Phase Shifters, Instrumentation Amplifier, Non-Linear Amplifier-Log and antilog amplifier.
<b>UNIT – 3</b>
<b>Principle and Minimization Techniques of combinational Circuits:</b> Introduction to combinational logic, Minimization Techniques: Min term, Max term, Sum of Products (SOP), Product of Sums (POS), 3 and 4 Variable Karnaugh map.
<b>UNIT – 4</b>
<b>Analysis of Combinational and sequential Circuits:</b> Half adder, full Adder, Half Subtractor, full Subtractor, multiplexers and De multiplexers. Introduction to Sequential circuits: flip-flops: SR, JK, D, T Characteristic tables and equations; Application of Shift register (Ring Counter and Johnson counter) .



**TEXT BOOKS:**

1. Anil K Maini, Varsha Agarwal, "Electronic Devices and Circuits", Wiley, 2009.
2. Jacob Millman, Christos Halkias, Chetan D Parikh, "Millman's Integrated Electronics – Analog and Digital Circuits and Systems", 2nd Edition, Tata McGraw Hill, 2010.
3. Donald P Leach, Albert Paul Malvino & Goutam Saha, "Digital Principles and Applications", 7th Edition, Tata McGraw Hill, 2010.

**REFERENCE BOOKS:**

1. Stephen Brown, Zvonko Vranesic, "Fundamentals of Digital Logic Design with VHDL", 2nd Edition, Tata McGraw Hill, 2005.
2. R D Sudhaker Samuel, "Illustrative Approach to Logic Design", Sanguine-Pearson, 2010.
3. Charles H. Roth, "Fundamentals of Logic Design", Jr., 5th Edition, Cengage Learning, 2004.
4. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss, "Digital Systems Principles and Applications", 10th Edition, Pearson Education, 2007.
5. M Morris Mano, "Digital Logic and Computer Design", 10th Edition, Pearson Education, 2008.
6. Jacob Millman, Christos Halkias, "Analog and Digital Circuits and Systems", 2nd Edition, Tata McGraw Hill, 2010
7. R. D. Sudhaker Samuel, "Electronic Circuits", Sanguine-Pearson, 2010

**JOURNALS/MAGAZINES**

1. <https://ieeexplore.ieee.org/document/1085417>
2. [https://www.academia.edu/Documents/in/Digital\\_Electronics](https://www.academia.edu/Documents/in/Digital_Electronics)
3. [https://www.mdpi.com/journal/electronics/special\\_issues/circuit\\_machine\\_learning](https://www.mdpi.com/journal/electronics/special_issues/circuit_machine_learning)

**SWAYAM/NPTEL/MOOCs:**

1. <https://technobyte.org/digital-electronics-logic-design-course-engineering/>
2. <https://www.udemy.com/course/digital-electronics-logic-design/>

Course Title	Programming with JAVA				Course Type	Integrated		
Course Code	B20CI0302	Credits	3		Class		III Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	-	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>-</b>	<b>50</b>	<b>50</b>

### COURSE OVERVIEW

Java's unique architecture enables programmer's to develop a single application that can run across multiple platforms seamlessly and reliably. In this course, students gain extensive experience with Java, object-oriented features and advance Java programming skills. Students learn to create robust object-oriented applications with Java.

### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the basic data types and control structures of the Java language.
2. Illustrate the creation of classes and objects in Java.
3. Demonstrate the extending a class (inheritance) and use proper program anomaly handling structures.
4. Discuss the use of Java generics and collections.
5. Discuss object-oriented features and advance Java programming skills
6. Explain to create robust object-oriented applications with Java.

### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of array concepts in java to solve real world problems.	1 to 5	1
CO2	Apply the features of OOPS in java to solve the real-world problems.	1 to 5	1
CO3	Develop program for stack implementation using Exception Handling in java.	1 to 5	2, 3
CO4	Identify suitable data structures to solve real world applications.	1 to 5, 12	2
CO5	Discuss object-oriented features and advance Java programming skills	1 to 5	1
CO6	Explain to create robust object-oriented applications with Java.	1 to 5, 12	2,3

### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√	√		
CO4			√			
CO5		√				
CO6		√				

### COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	1								3		
CO2	3	3	2	2	1								3		
CO3	3	3	1	1	1									3	3
CO4	3	3	3	1	2							1		3	
CO5	3	3	3	1	2								3		
CO6	3	3	2	2	2									3	3

Note:1-Low,2-Medium,3-High

### COURSE CONTENT

#### THEORY:

<p><b>UNIT – 1</b></p> <p><b>Fundamental Programming Structures:</b> Dissecting the “Hello, World” Program; Compiling and Running a Java Program; Primitive Types; Variables; Arithmetic Operations; Strings; Input and Output; Control Flow; Arrays; Functional Decomposition.</p>
<p><b>UNIT – 2</b></p> <p><b>Object-Oriented Programming:</b> Working with Objects; Implementing Classes; Object Construction; Static Variables and Methods, Packages; Nested Classes; Documentation Comments; Interfaces; Static, Default and Private Methods in interface; Lambda Expressions; Method and Constructor References; Local and Anonymous Classes.</p>

### UNIT – 3

**Inheritance and Exceptions:** Extending a Class; Object: The Cosmic Super class; Enumerations; Runtime Type Information and Resources; Exception Handling: Throwing Exceptions; The Exception Hierarchy; Declaring Checked Exceptions; Catching Exceptions; the Try-with-Resources Statement; The finally Clause; Re throwing and Chaining Exceptions; Uncaught Exceptions and the Stack Trace.

### UNIT – 4

**Generic Programming and Collections:** Generic Classes; Generic Methods; Type Bounds; Type Variance and Wildcards; Restrictions on Generics; an Overview of the Collections Framework; Iterators; Sets; Maps.

#### TEXT BOOKS:

1. Cay S. Horstmann, "Core Java® SE 9 for the Impatient", Addison Wesley, Second Edition, 2018.
2. Herbert Schildt, "Java™: The Complete Reference", McGraw-Hill, Tenth Edition, 2018.
3. David Gallardo, Ed Burnette, Robert McGovern, "Eclipse in Action a guide for java developers", Manning Publications, 2003.
4. Ed Burnette, "Eclipse IDE Pocket Guide: Using the Full-Featured IDE", O'Reilly Media, Inc, USA, 2005.

#### REFERENCE BOOKS:

1. Cay S. Horstmann, "Core Java™ Volume I—Fundamentals", Prentice Hall, Tenth Edition, 2015
2. Joshua Bloch, "Effective Java", Addison-Wesley Professional, Third Edition, 2017
3. Ken Kousen, "Modern Java Recipes", O'Reilly Media, Inc., 2017
4. Oracle Java Documentation. (<https://docs.oracle.com/javase/tutorial/>)

#### JOURNALS/MAGAZINES

1. <https://ieeexplore.ieee.org/document/5464387>
2. <https://files.eric.ed.gov/fulltext/EJ1075126.pdf>
3. <https://www.sciencedirect.com/science/article/pii/S0167642304000590>
4. <https://www.informingscience.org/Publications/4322?Source=%2FJournals%2FJITEIP%2FArticles%3FVolume%3D0-0>
5. <https://www.javadevjournal.com/>
6. <https://blogs.oracle.com/javamagazine/>

#### SWAYAM/NPTEL/MOOCs:

1. [https://onlinecourses.nptel.ac.in/noc19\\_cs84/preview](https://onlinecourses.nptel.ac.in/noc19_cs84/preview)
2. <https://www.classcentral.com/course/swayam-programming-in-java-12930>
3. <https://swayam.gov.in/explorer?searchText=java>

#### Self-Learning Exercises:

1. The Eclipse-IDE
2. Streams
3. Concurrent Programming
4. Swing and JavaFX
5. Networking- JDBC, Database Access

Course Title	Data Structures				Course Type		Integrated	
Course Code	B20CI0303	Credits	3		Class		III Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	-	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>-</b>	<b>50</b>	<b>50</b>

### COURSE OVERVIEW

The course focuses on basic and essential topics in data structures, including array-based lists, linked lists, recursion, stack, queues, and binary trees, heaps, sorting and searching algorithms. It also covers analysis and design of fundamental data structures and engages learners to use data structures as tools to algorithmically design efficient computer programs that will cope with the complexity of actual applications.

### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Discuss the concept of Abstract Data Types (ADT)
2. Provide the knowledge of stacks and queues.
3. Understand the importance of Linked lists
4. Illustrate the operations of trees
5. Demonstrate the use of appropriate of data structures for a given problem.
6. Design a data structure application for real time problems.

### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Explain the Abstract Data Types, Structures.	1,3, 5,10,11	1
CO2	Formulate the solution for any computational problem using stacks and queues.	3,8	1,2
CO3	Analyze the importance of linked lists.	5,7,9	1,2
CO4	Solve real time problems using trees data structure.	1,2,7,8,9,10	1,2
CO5	Apply appropriate data structures to solve a given problem.	1, 5,7,8,9,12	1
CO6	Compare the performance of various data structures.	2,7,8,9,12	1,2

### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2	√	√				
CO3				√		
CO4			√			
CO5			√			
CO6					√	

### COURSE ARTICULATION MATRIX

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		1		2					1	2				
CO2			1					1							
CO3					2		2		2						
CO4	3	3					2	1	2	1					
CO5	1				1		2	2	2			2			
CO6		1					2	2	2			2			

Note:1-Low,2-Medium,3-High

### COURSE CONTENT

#### THEORY:

<b>UNIT – 1</b>
Introduction to Data structures and Algorithms: Data, Data Types, Abstract Data Types and Examples, Algorithms, Arrays: One Dimensional and Two Dimensional, Structures: Introduction to structures and nested structures.
<b>UNIT – 2</b>
Data Structures-1: Stacks, Evaluation of expressions: Infix, Prefix, postfix; Queues: Simple, circular and priority Queues.
<b>UNIT – 3</b>
<b>Data Structures-2:</b> Pointers; Dynamic memory allocation; Linked List: singly linked list, doubly linked list, stack using linked list, queue using linked list.
<b>UNIT – 4</b>
<b>Data Structures-3:</b> Trees: Binary Tree, Binary Tree Traversals, Binary search Tree

**TEXTBOOKS:**

1. Horowitz, Sahni, Anderson-Freed, Fundamentals of Data Structures in C, 2nd Edition, Universities Press, 2007.
2. Joshi, Data Structures and Algorithms In C, Tata McGraw-Hill Education, 2010.

**REFERENCEBOOKS:**

1. The design and analysis of computer algorithms, 4th Edition Addison-Wesley
2. Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft, Data Structures and Algorithms, Addison-Wesley, 1987.
3. Richard Gilberg, Behrouz Forouzan, Data Structures: A Pseudo code Approach with C, Cengage Learning, 2004.
4. ACM Transactions on Data structures
5. ACM Journal of Algorithms and Computational Technology..

**JOURNALS/MAGAZINES**

1. <https://www.imedpub.com/scholarly/data-structure-journals-articles-ppts-list.php>
2. [https://www.mdpi.com/journal/algorithms/special\\_issues/Efficient\\_Data\\_Structures](https://www.mdpi.com/journal/algorithms/special_issues/Efficient_Data_Structures)
3. <https://ieeexplore.ieee.org/document/4055607>
4. <https://ieeexplore.ieee.org/abstract/document/6312216>
5. <https://www.sciencedirect.com/science/article/pii/S0022000083900065>
6. <https://www.sciencedirect.com/journal/journal-of-algorithms>

**SWAYAM/NPTEL/MOOCs:**

1. Coursera – Data Structures and Algorithms Specialization
2. Coursera – Data Structures, University of California San Diego
3. Data Structures and Algorithms, National Research University Higher School of Economics
4. <https://nptel.ac.in/courses/106/102/106102064/>
5. <https://nptel.ac.in/courses/106/106/106106127/>
6. <https://nptel.ac.in/courses/106/103/106103069/>

**Self-Learning Exercises:**

1. Storing game entities in a array
2. Pseudo-random number generators
3. Reversing an array using a stack
4. Matching parentheses and HTML tags
5. Double ended queue
6. Application of tree traversals

Course Title	Discrete Mathematics and Graph Theory				Course Type		Theory	
Course Code	B20AS0302	Credits	3		Class		III Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3	Theory	Practical	CIE	SEE
	Practice	-	-	-				
	-	-	-	-				
<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>-</b>	<b>50</b>	<b>50</b>	

### COURSE OVERVIEW

Discrete Mathematics is the study of discrete objects. Discrete Mathematics is used to develop our ability to understand and create mathematical arguments and also used to provide the mathematical foundation for advanced mathematics and computer science courses. Graphs (abstract networks) are among the simplest mathematical structures, which are used in most of the areas of Computer Science to solve the complex problems.

### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain mathematical arguments using logical connectives and quantifiers.
2. Illustrate the operation on discrete structures such as sets, relations and functions.
3. Describe the theory and application of graphs, fundamental theorems and their proofs.
4. Demonstrate the use of graphs to model many types of relations and processes in physical, biological. Social and information system.
5. Explain to provide the mathematical foundation for advanced mathematics
6. Illustrate to use discrete mathematics to solve the complex problems in most of the areas of Computer Science

### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Construct mathematical arguments using logical connectives and quantifiers	1 to 4	2
CO2	Apply the operations like union and intersection on discrete structures such as sets, relations and functions	1 to 3, 5,6	2
CO3	Make use of graph and fundamental theorems in real world applications	1 to 6	2
CO4	Develop a model using advanced concepts of graph for real world applications	1,2,4,5,6	2
CO5	Apply the mathematical foundation for advanced mathematics	1 to 3, 5,6	2
CO6	Solve the complex problems in most of the areas of Computer Science	1,2,3,4	3



## BLOOM'S LEVEL OF THE COURSE OUTCOMES

	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4			√			
CO5			√			
CO6					√	

## COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2										3	
CO2	3	2	3		2	1								3	
CO3	3	1	2	1	2	3								3	
CO4	3	2		2	2	2								3	
CO5	3	2	3		2	1								3	
CO6	3	2	3	3											3

Note:1-Low,2-Medium,3-High

## COURSE CONTENT

### THEORY:

#### UNIT – 1

**Set Theory and Logic:** Fundamentals of Sets, Sub sets, Venn diagram, Operations on sets, Laws of set theory, Countable and Uncountable sets, Addition Principle, Extended Addition Principle, Propositions, Logical Connectives and truth tables (Illustrative Examples), Logical equivalence, Laws of logic, Duality, NAND and NOR connectives (Circuits), Converse, Inverse and Contra positive, Rules of Inference, Open statements, Quantifier, Logical implication involving quantifiers, Statement with more than one variable. Methods of Proofs and Disproof.

#### UNIT – 2

**Relations and Functions :** Cartesian product of sets (Illustrative Examples), Matrices and Digraph of the relations, Properties of relations, Equivalence relations, Partial ordered relations, Posets, Hasse diagrams, Extremal elements in posets, Types of Functions, properties of Functions, The pigeon hole principle, composite functions, invertible functions, Floor and ceiling functions, Sterling number of second kind.

### UNIT – 3

**Introduction to graph theory:** Königsberg's bridge problems, Utilities problem, Seating Problem, Graphs, Representation of Graphs. Directed graphs, Incidence, Adjacency, Degree, In degree, Out degree, Regular graphs, Complete graphs, Null Graph, Bipartite Graphs, Isomorphism, Directed Graphs, Sub graphs, Walk, Trail, Path, Circuit, Cycle, Connected and disconnected graphs, Components, Weakly connected and Strongly connected Components, Complement of graphs, Partition and Decompositions.

### UNIT – 4

**Euler and Hamiltonian graphs and Graph colouring:** Operation on graphs, Definition of Euler Trail, Euler Graphs, Hamiltonian path, Hamiltonian Cycle, Hamiltonian Graphs, Standard Theorems on Euler and Hamiltonian graphs, planar graph, detection of Planarity, Dual of planar graphs, Euler formula for planar graph, Graph colouring, Chromatic polynomial, Map coloring, Four Color Theorem, Five Color Theorem, Matching, Network flow, and its applications, Cut set, Cut vertex, Chord, Properties of Cut Sets, Max Flow Min Cut Theorem.

#### TEXT BOOKS:

1. Ralph P Grimaldi, "Discrete and Combinatorial Mathematics", Pearson Education, 5<sup>th</sup> Edition, 2014.
2. Nasingh Deo, "Graph Theory with Applications to Engineering Computer Science", Prentice-Hall, 2014.

#### REFERENCE BOOKS:

1. Kenneth H Rosen, "Discrete Mathematics and its applications", 5<sup>th</sup> Edition,, Tata McGraw Hill, 2014.
2. C L Liu, "Elements of Discrete Mathematics", 4<sup>th</sup> edition, Tata MacGraw Hill 2014.
3. Thomas Khoshy, "Discrete Mathematics with applications", Elsevier, 2012.
4. Ralph P Grimaldi, "Discrete and Combinatorial Mathematics", Pearson Education, Asia, 2015.
5. Frank Harary, "Graph Theory", Norosa, 2013.
6. J. A. Bondy and V. S. R. Murthy, "Graph Theory with Applications", Macmillan, London, 2013.

#### JOURNALS/MAGAZINES

1. <https://www.journals.elsevier.com/discrete-mathematics>
2. <http://www.math.iit.edu/~kaul/Journals.html>
3. <https://www.siam.org/publications/journals/siam-journal-on-discrete-mathematics-sidma>
4. <https://onlinelibrary.wiley.com/journal/10970118>
5. <https://iopscience.iop.org/article/10.1088/1742-6596/1175/1/012069/meta>
6. <https://iopscience.iop.org/article/10.1088/1742-6596/1188/1/012065/meta>
7. <https://www.worldscientific.com/worldscinet/jml>
8. <https://www.scimagojr.com/journalsearch.php?q=12000154480&tip=sid>

#### SWAYAM/NPTEL/MOOCs:

1. <https://nptel.ac.in/courses/111/107/111107058/>
2. <https://nptel.ac.in/courses/106/103/106103205/>
3. [https://onlinecourses.swayam2.ac.in/cec20\\_ma02/preview](https://onlinecourses.swayam2.ac.in/cec20_ma02/preview)
4. [https://onlinecourses.nptel.ac.in/noc20\\_ma05/preview](https://onlinecourses.nptel.ac.in/noc20_ma05/preview)
5. [https://onlinecourses.swayam2.ac.in/cec20\\_ma03/preview](https://onlinecourses.swayam2.ac.in/cec20_ma03/preview)
6. <https://www.coursera.org/learn/graphs>

Course Title	Agile Software Development and DevOps				Course Type		Theory	
Course Code	B20CI0304	Credits	3		Class		III Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	0	0	0	Theory	Practical	CIE	SEE
	-	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>0</b>	<b>50</b>	<b>50</b>

### COURSE OVERVIEW

The course provides students with knowledge on the basic principles of software development life cycle, activities involved in software requirements engineering, software development, testing, evolution and maintenance. It introduces concepts such as software processes and agile methods, and essential software development activities.

### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Discuss the importance of the software development process.
2. Demonstrate the workflow of Automating process.
3. Explain the development of a software using Agile method
4. Illustrate with case study, the importance of DevOps.
5. Discuss about importance of software testing process.
6. Explain essential software development activities.

### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	Pos	PSOs
CO1	Apply software development process to solve complex problems of engineering	1	2
CO2	Make use of Agile principle for rapid software development	1,3	3
CO3	Distinguish between the traditional SDLC and agile ALM model for efficient and effective product delivery.	1,3,4	1
CO4	Develop the real-world applications using DevOps tools.	1,3	2,3
CO5	Discuss about importance of software testing process.	4	3
CO6	Explain software development activities.	4,6	3

**BLOOM’S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom’s Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3				√		
CO4			√			
CO5				√		
CO6				√		√

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	3									3	
CO2	1	1	3	3	3										3
CO3	1	3	2	3	1								3		
CO4	1	1	3	2	2									3	3
CO5				2											3
CO6				2		3									3

**Note:**1-Low,2-Medium,3-High

**COURSE CONTENT**

**THEORY:**

**UNIT – 1**

**Introduction Defining the Software Development Process:** Goals of Defining the Software Development Process , Why Is Defining the Software Development Process Important? , Where Do I Start?, Explaining the Software Development Lifecycle , Systems versus Software Development Life cycle Defining Requirements, Managing Complexity and Change, Validity of Requirements, Testing Requirements ,Functional Requirements, Non functional Requirements, Epics and Stories, Planning for Changing Requirements , Workflow for Defining Requirements ,Test- Driven Development , Designing Systems ,Software Development ,Testing , Testing the Application ,Testing the Process Itself , Continuous Integration , Continuous Delivery and Deployment , Defining Phases of the Lifecycle ,Documentation Required , DevOps , Communicating with All Stakeholders, Production Support ,Maintenance and Bugfixes, Lifecycle in the Beginning ,Maintenance of the Lifecycle ,Creating the Knowledge Base.

## UNIT – 2

**Agile Application Life cycle Management:** Goals of Agile Application Life cycle Management, Why Is Agile ALM Important? Where Do I Start? Understanding the Paradigm Shift, Rapid Iterative Development, Remember RAD?, Focus on 12 Agile Principles, Agile Manifesto, Fixed Time box Sprints, Customer Collaboration, Requirements and Documentation.

## UNIT – 3

**Automating the Agile ALM:** Goals of Automating the Agile ALM, Why Automating the ALMs Important, Where Do I Start? Tools, Do Tools Matter? Process over Tools, Understanding Tools in the Scope of ALM, Staying Tools Agnostic, Commercial versus Open Source, What Do I Do Today?, Automating the Workflow, Process Modelling Automation, Managing the Lifecycle with ALM, Broad Scope of ALM Tools ,Achieving Seamless Integration ,Managing Requirements of the ALM, Creating Epics and Stories, Systems and Driven Development, Environment Management, Gold Copies, Supporting the CMDB, Driving DevOps ,Supporting Operations ,Help Desk ,Service Desk ,Incident Management , Problem Escalation ,Project Management, Planning the PMO ,Planning for Implementation, Evaluating and Selecting the Right Tools, Defining the Use Case, Training Is Essential, Vendor Relationships, Keeping Tools Current.

## UNIT – 4

**DevOps:** Goals of DevOps, Why Is DevOps Important? Where Do I Start? How Do I Implement DevOps? Developers and Operations Conflicts, Developers and Operations Collaboration, Need for Rapid Change, Knowledge Management, the Cross-Functional Team, Is DevOps Agile? The DevOps Ecosystem, Moving the Process Upstream, Left-Shift, Right-Shift, DevOps in Dev, DevOps as Development, Deployment Pipeline, Dependency Control, Configuration Control, Configuration Audits, QA and DevOps, Information Security, Infrastructure as Code, Taming Complexity, Automate Everything, Disaster Recovery and Business Continuity, Continuous Process Improvement.

### TEXTBOOKS:

1. Bob Aiello and Leslie Sachs, "Agile Application Life cycle Management Using DevOps to Drive Process Improvement", Addison Wesley, First printing, 2016.

### REFERENCEBOOKS:

1. Roger S, "Software Engineering-A Practitioner's Approach", seventh edition, Pressman, 2010.
2. Roger Pressman, Ian Sommerville, "Software Engineering", Pearson, 9<sup>th</sup> edition, 2010.
3. Hans Van Vliet, "Software Engineering: Principles and Practices", Wiley, 2008.
4. Richard Fairley, "Software Engineering Concepts", McGraw-Hill, 2008
5. ACM Transactions on Software Engineering and Methodology (TOSEM).
6. IEEE Transactions on Software Engineering.

### JOURNALS/MAGAZINES

1. Journal of Software Engineering Research and Development
2. International Journal of Agile and Extreme Software Development
3. A decade of agile methodologies: Towards explaining agile software development
4. Journal of Systems and Software

**SWAYAM/NPTEL/MOOCs:**

1. <https://www.udemy.com/course/devops-core-fundamentals>
2. <https://www.scaledagile.com/certification/courses/safe-devops/>
3. <https://www.coursera.org/learn/devops-culture-and-mindset>
4. <https://www.coursera.org/learn/uva-darden-continous-delivery-devops>

**Self-Learning Exercises:**

1. Case study on Critical system
2. Case study on ATM using agile method

Course Title	Analog and Digital Electronics Lab				Course Type		Theory	
Course Code	B20CI0305	Credits	1		Class		III semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	1	2	2				

### COURSE OVERVIEW

This course covers basic concepts of Electrical Engineering. The course introduces the working of analog components and helps in understanding basics in digital electronics by applying the knowledge of logic gates and learning the applications of diodes and opamps. The course provides foundation on designing and implementation of logic circuits. Analog circuits are simulated using ORCAD tool and digital circuits using XILINX tool which helps in gaining experience in creating and testing of circuits.

### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Discuss the applications of diode in rectifiers, filter circuits and wave shaping.
2. Describe the foundation on designing, building and testing of common combinational and sequential Digital logic circuits.
3. Explain the procedure required for simulation of digital logic circuits.
4. Analyze the working principle and designing of analog circuits using ORCAD tool
5. Analyze the working principle and designing of digital circuits using XILINIX tool
6. Demonstrate the use of general electronic instruments in design and testing of digital logic circuits.

### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Analyze the use of diodes in rectifiers, filter circuits and wave shaping	1 to 4	1
CO2	Apply the basic knowledge used in solid state electronics including diodes, and operational amplifiers for specific engineering applications.	1 to 3, 5	1
CO3	Identify the different families of digital integrated circuits build, and troubleshoot combinatorial circuits using digital integrated circuits	1 to 5	2
CO4	Analyze the working principle and designing of analog circuits using ORCAD tool	1 to 4	1
CO5	Analyze the working principle and designing of digital circuits using XILINIX tool	1 to 4	1
CO6	Develop the ability to analyse and design analog electronic circuits using discrete components	1,4,5	3

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1				√		
CO2			√			
CO3			√			
CO4				√		
CO5				√		
CO6			√			

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2									3		
CO2	3	2	3		2								3		
CO3	3	1	2	1	2									3	
CO4	3	1	1	2									3		
CO5	3	1	1	2									3		
CO6	3			2	2										3

**Note:** 1-Low, 2-Medium, 3-High



**PRACTICE:**

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
<b>Part-A</b>			
1	To simulate a positive clipper, double ended clipper & positive clamper circuits using diodes	Orcad	Simulation of clipper and clamper electronic
2	To simulate a rectangular wave form generator (Op-amp relaxation oscillator) and compare the frequency and duty cycle with the design specifications	Orcad	Simulation of rectangular waveform generator
3.	To simulate a Schmitt trigger using Op-amp and compare the UTP andLTP values with the given specification	Orcad	Simulation of Schmitt trigger
4.	To simulate a Wien bridge Oscillator	Orcad	Simulation of wein bridge oscillator
5.	To determine the working of a power supply and observe the waveforms	Orcad	Simulationof power supply
6.	To build and simulate CE amplifier (RC coupled amplifier) for itsfrequency response and measure the bandwidth.	Orcad	Simulation of RC coupled amplifier and determining the frequency response
7.	Realization of Half/Full adder and Half/Full Subtractors using logic gates	ICs, Trainer kit and patch cords Create and perform the adder and subtractor circuits	ICs, Trainer kit and patch cords Create and perform the adder and subtractor circuits
8.	Design and develop VHDL code to realize Full adder and Full Subtractors	Xilinx	Simulation knowledge of the mentioned adders an
9.	.Given a 4-variable logic expression, simplify it using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer IC	ICs, Trainer kit and patch cords	Realization of a multiplexer
10.	Design and develop the VHDL code for an 8:1 multiplexer. Simulate and verify it's working	Xilinx	Simulation knowledge of combinational logic circuit
11.	Design and implement a ring counter using 4-bit shift register and demonstrate its working	ICs, Trainer kit and patch cords	Realization of shift register and ring counter
12.	Design and develop the Verilog / VHDL code for switched tail counter.	Xilinx	Simulation of ring counter

Course Title	Programming with JAVA Lab				Course Type		Theory	
Course Code	<b>B20CI0306</b>	Credits	1		Class		III semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	1	2	2	0	26	50%	50%

### COURSE OVERVIEW

Java's unique architecture enables programmers to develop a single application that can run across multiple platforms seamlessly and reliably. In this course, students gain extensive experience with Java, object-oriented features and advance Java programming skills. Students learn to create robust object-oriented applications with Java.

### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the basic data types and control structures of the Java language.
2. Illustrate the creation of classes and objects in Java.
3. Demonstrate the extending a class (inheritance) and use proper program anomaly handling structures.
4. Discuss the use of Java generics and collections.
5. Discuss object-oriented features and advance Java programming skills
6. Explain to create robust object-oriented applications with Java.

### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of array concepts in java to solve real world problems.	1 to 5	1
CO2	Apply the features of OOPS in java to solve the real-world problems.	1 to 5	1
CO3	Develop program for stack implementation using Exception Handling in java.	1 to 5	2, 3
CO4	Identify suitable data structures to solve real world applications.	1 to 5, 12	2
CO5	Discuss object-oriented features and advance Java programming skills	1 to 5	1
CO6	Explain to create robust object-oriented applications with Java.	1 to 5, 12	2,3

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√	√		
CO4			√			
CO5		√				
CO6		√				

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	1								3		
CO2	3	3	2	2	1								3		
CO3	3	3	1	1	1									3	3
CO4	3	3	3	1	2							1		3	
CO5	3	3	3	1	2								3		
CO6	3	3	2	2	2									3	3

**Note:** 1-Low, 2-Medium, 3-High

**PRACTICE:**

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
<b>Part-A</b>			
1.	The sieve of Eratosthenes is one of the most efficient ways to find all primes smaller than n when n is smaller than 10 million. Given a number n, use JAVA to print all primes	Windows/Linux OS, IDE	Understanding conditional operators and statements
2.	The Gauss-Jordan method is also known as Gauss-Jordan elimination method is very useful in solving a linear system of equations. It is a technique in which a system of linear equations is resolved by the means of matrices. Develop a	Windows/Linux OS, IDE	Creating an array and performing some operations on array.
3.	To compute a square root of any positive number a, start with an initial guess $x=x_1$ for $\sqrt{a}$ ; then calculate successive approximations $x_2, x_3, \dots, \sqrt{a}$ using the formula:  $x_i = \frac{x_{i-1} + (a/x_{i-1})}{2}, i = 2, 3, \dots$	Windows/Linux OS, IDE	Understanding conditional statements (if, if..else, etc)
4.	Model a lamp as a Java object. Make a Lamp class. This will contain atleast one instance variable which will be of type Boolean and will hold the state of the lamp: i.e., whether it is on or off. In addition, add methods to do the following things: switch the light on and off, and check its current state, i.e., whether it is on or off. Maintain proper encapsulation mechanism.  Next, write a launcher class with a main() method to carry out the following tasks:	Windows/Linux OS, IDE	Object and class creation and its usage
5.	Given the following functional interface: <pre>interface MathOperation {     int operation(int a, int b); }</pre> Develop an application that would implement the above interface using lambda expressions as to perform the	Windows/Linux OS, IDE	Creation of interfaces and its usage.

6.	The String class in JAVA has a static method compare To Ignore Case, which compares two strings and the Arrays class has a static sort method. Build a JAVA program that creates an array of strings, use the sort function from Arrays class to sort the strings by passing the compare To Ignore	Windows/Linux OS, IDE	Creation of string class and its usage
7	XYZ technologies is firm that has 5 employees with 1 manager, and 4 technicians. XYZ wants to digitize its payroll system, the following requirements: Dearness Allowance is 70% of basic for all employees. House Rent Allowance is 30% of basic for all employees. Income Tax is 40% of gross salary for all employees. The annual increments to the employees are to be given of the following criteria: -Manager 10% of the basic salary, and Technicians 15% of basic. Develop the pay roll for XYZ. Implement a class hierarchy using	Windows/Linux OS, IDE	Creation multiple inheritance and its usage
8	Define a new Exception class named Odd Exception. Create a new class named Even Odd. Write a method called halfOf(), which takes an int as parameter and throws an Odd Exception if the int is odd or zero, otherwise returns (int / 2). Write a main method that calls halfOf() three times (once each with an even int, an odd int, and zero), with three	Windows/Linux OS, IDE	Creation of exception class and its usage
9	Implement a class named Fraction that represents fractions with numerator and denominator always stored reduced to lowest terms. If fraction is negative, the numerator will always be negative, and all operations leave results stored in lowest terms. Implement the addition, subtraction, multiplication and division operation for the Fraction class	Windows/Linux OS, IDE	Creation of exception class and its usage
10	Create a class Student that has instance variables as Name, Age, Address and access transmutation methods to access the instance variables along with display method to print the details of student. Next write a main() function that will create a collection of 10 students and reverse the list. Print	Windows/Linux OS, IDE	Object and class creation and its usage
11	Use generics to build a class Sort. Implement the bubble sort algorithm to sort an array of any type.	Windows/Linux OS, IDE	Creation of generics class and its usage
12	Write a generic method to count the number of elements in a collection that have a specific property (for example, odd integers, prime numbers, palindromes).	Windows/Linux OS, IDE	Creation of generics class and its usage

Sl. No.	Part B Mini Project
1	<p>Develop a project for Airline reservation system List with the following modules:</p> <ol style="list-style-type: none"> <li>1. PASSENGER               <ol style="list-style-type: none"> <li>a) Add member</li> <li>b) Delete member</li> <li>c) Search for member</li> <li>d) Edit member</li> </ol> </li> <li>2. FLIGHT               <ol style="list-style-type: none"> <li>a. Add Flight</li> <li>b. Delete Flight</li> <li>c. Search Flight</li> <li>d. Display Flights</li> </ol> </li> <li>3. RESERVATION               <ol style="list-style-type: none"> <li>a. Book</li> <li>b. Cancel</li> </ol> </li> </ol> <p>Title: Airline Reservation system            Problem Definition:  <i>Airline Reservation System</i>” main aim is to provide the online ticket &amp; seat reservation of National and International Flights and give the information about flight departures.            Solution:            Develop a project to implement an Airline reservation system with the following modules:</p> <ol style="list-style-type: none"> <li>1. PASSENGER               <ol style="list-style-type: none"> <li>a. Add member</li> <li>b. Delete member</li> <li>c. Search for member</li> <li>d. Edit member</li> </ol> </li> <li>2. FLIGHT               <ol style="list-style-type: none"> <li>a. Add Flight</li> <li>b. Delete Flight</li> <li>c. Search Flight</li> <li>d. Display Flights</li> </ol> </li> <li>3. RESERVATION               <ol style="list-style-type: none"> <li>a. Book</li> <li>b. Cancel</li> </ol> </li> </ol>

**List of Experiments:**

Sl.No	Name of the Experiment
1	<p>Create a passenger class with the attributes Adhar_number, Passenger_name, Email_id, Phone, Address, DOB and the methods to facilitate Addition, Deletion, Search and Modify the passenger data. Store the details of the 10 passenger objects in “Passenger.txt” and Display.</p> <ol style="list-style-type: none"> <li>a. void Add_passenger()</li> <li>b. Display_details()</li> <li>c. void Delete_Passenger(Adhar_number)</li> <li>d. void Search_Passenger(Adhar_number)</li> <li>e. void Modify_Passenger(Adhar_number)</li> </ol>
2	<p>It is required to delete an existing passenger data based on the request from the passenger. Read adhar card number of the passenger to be deleted and delete the record from “passenger.txt” if found. Otherwise display an error message saying that “record does not exist”. Develop a program to implement the above task.</p>
3	<p>It is required to modify an existing passenger data based on the request from the passenger. Read adhar card number of the passenger to be modified and modify the record from “passenger .txt” if found. Otherwise display an error message saying that “Record does not exist”. Develop a program to implement the above task.</p>

4	It is required to Search an existing passenger data based on the request from the passenger. Read Adhaar card number of the passenger to be searched for, search the record from “passenger .txt” and display the details of passenger if found. Otherwise display the error message “Record does not exist”. Develop a program to implement the above task.
5	Create a Flight class with attributes Flight_number, Flight_name, Source, Destination, Departure_Timing and the methods Add_Flight(), Delete_Flight(), Search_Flight() and Display_Flight(). Store the details of any 5 Flights in a file called “Flights.txt” and display the same. Develop a program to achieve the above task.
6	It is required to delete the details a flight stored in “Flights.txt”. Read the Flight_no and search for the same in “Flights.txt”. If found, it should be deleted from “Flights.txt”. Otherwise display the error message “Flight Does Not Exist”. Develop a program to achieve the above task.
7	It is required to delete the search for a flight stored in “Flights.txt”. Read the Flight_no and search for the same in “Flights.txt”. If found, Display the details of Flight, otherwise display the error message “Flight Does Not Exist”. Develop a program to achieve the above task.
8	It is required to display the details of all the flights running from Source1 to Destination1. Read the name of source1 and destination1 and fetch from “Flights.txt” the details of all the flights running between Source1 and destination1 and display the same. Develop a program to achieve the above task.
9	Create a reservation class that facilitates booking and cancellation of domestic and international flights using the following methods and parameters. Develop a program to store the details of 10 bookings in “Reservations.txt” and display the same. <ul style="list-style-type: none"> <li>a. Book_Ticket(Flight_Number, Flight_Name, Ticket_Number, Source, Destination, Adhar_number, Passport_number, Date, Departure_time, Class, Type_of_Travel(Domestic , International), Fare, Status)</li> <li>b. Cancel_Ticket(Ticket_Number)</li> </ul>
10	A passenger would like to cancel the ticket due to a genuine reason. Read the ticket_no and search for the record in “Reservation.txt”. Cancel the Ticket based on the request from passenger and update the status.

Course Title	Data Structures Lab				Course Type		Theory	
Course Code	<b>B20CI0307</b>	Credits	1		Class		III semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	1	2	2				

### COURSE OVERVIEW

The course focuses on basic and essential topics in data structures, including array-based lists, linked lists, recursion, stack, queues, and binary trees, heaps, sorting and searching algorithms. It also covers analysis and design of fundamental data structures and engages learners to use data structures as tools to algorithmically design efficient computer programs that will cope with the complexity of actual applications.

### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Discuss the concept of Abstract Data Types (ADT)
2. Provide the knowledge of stacks and queues.
3. Understand the importance of Linked lists
4. Illustrate the operations of trees
5. Demonstrate the use of appropriate of data structures for a given problem.
6. Design a data structure application for real time problems.

### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Explain the Abstract Data Types, Structures	1 to 5	1
CO2	Formulate the solution for any computational problem using stacks and queues.	1 to 5	1,2
CO3	Analyze the importance of linked lists.	1 to 5	1,2
CO4	Solve real time problems using trees data structure.	1 to 5	1,2
CO5	Apply appropriate data structures to solve a given problem.	1 to 5	1
CO6	Compare the performance of various data structures.	1 to 5	1,2



### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4			√			
CO5		√				
CO6			√			√

### COURSE ARTICULATION MATRIX

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		1		2					1	2		3		
CO2			1					1					3	3	
CO3					2		2		2				3	3	
CO4	3	3					2	1	2	1			3	3	
CO5	1				1		2	2	2			2	3		
CO6		1					2	2	2			2	3	3	

Note: 1-Low, 2-Medium, 3-High

### PRACTICE:

1	<p>Design, Develop and Implement a menu driven Program in C for the following Array operations</p> <ol style="list-style-type: none"> <li>Creating an Array of N Integer Elements</li> <li>Display of Array Elements with Suitable Headings</li> <li>Inserting an Element (ELEM) at a given valid Position (POS)</li> <li>Deleting an Element at a given valid Position(POS)</li> <li>Exit.</li> </ol> <p>Support the program with functions for each of the above operations.</p>
2	<p>Design, Develop and Implement a Program in C for the following operations on Strings</p> <ol style="list-style-type: none"> <li>Read a main String (STR), a Pattern String (PAT) and a Replace String (REP)</li> <li>Perform Pattern Matching Operation:</li> <li>Find and Replace all occurrences of PAT in STR with REP if PAT exists in STR.</li> <li>Report suitable messages in case PAT does not exist in STR Support the program with functions for each of the above operations.</li> </ol> <p>Note: Don't use Built-in functions</p>
3	<p>Design, Develop and Implement a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX)</p> <ol style="list-style-type: none"> <li>Push an Element on to Stack</li> <li>Pop an Element from Stack</li> <li>Demonstrate how Stack can be used to check Palindrome</li> </ol>

	<p>d. Demonstrate Overflow and Underflow situations on Stack  e. Display the status of Stack  f. Exit  Support the program with appropriate functions for each of the above operations</p>
4	<p>Design, Develop and Implement a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, %( Remainder), ^ (Power) and alphanumeric operands.</p>
5	<p>Design, Develop and Implement a Program in C for the following Stack Applications  a. Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^  b. Solving Tower of Hanoi problem with n disks</p>
6	<p>Design, Develop and Implement a menu driven Program in C for the following operations on Circular QUEUE of Characters (Array Implementation of Queue with maximum size MAX)  a. Insert an Element on to Circular QUEUE  b. Delete an Element from Circular QUEUE  c. Demonstrate Overflow and Underflow situations on Circular QUEUE  d. Display the status of Circular QUEUE  e. Exit  Support the program with appropriate functions for each of the above operations</p>
7	<p>Design, Develop and Implement a menu driven Program in C for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, Branch, Sem, PhNo  a. Create a SLL of N Students Data by using front insertion.  b. Display the status of SLL and count the number of nodes in it  c. Perform Insertion and Deletion at End of SLL  d. Perform Insertion and Deletion at Front of SLL  e. Demonstrate how this SLL can be used as STACK and QUEUE  f. Exit</p>
8	<p>Design, Develop and Implement a menu driven Program in C for the following operations on Doubly Linked List (DLL) of Employee Data with the fields: SSN, Name, Dept, Designation, Sal, PhNo  a. Create a DLL of N Employees Data by using end insertion.  b. Display the status of DLL and count the number of nodes in it  c. Perform Insertion and Deletion at End of DLL  d. Perform Insertion and Deletion at Front of DLL  e. Demonstrate how this DLL can be used as Double Ended Queue  f. Exit</p>
9	<p>Design, Develop and Implement a Program in C for the following operations on Singly Circular Linked List (SCLL) with header nodes  a. Represent and Evaluate a Polynomial <math>P(x,y,z) = 6x^2y^2z - 4yz^5 + 3x^3yz + 2xy^5z - 2xyz^3</math>  b. Find the sum of two polynomials POLY1(x,y,z) and POLY2(x,y,z) and store the result in POLYSUM(x,y,z)  Support the program with appropriate functions for each of the above operations</p>
10	<p>Design, Develop and Implement a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers  a. Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2  b. Traverse the BST in Inorder, Preorder and Post Order  c. Search the BST for a given element (KEY) and report the appropriate message  d. Delete an element(ELEM) from BST  e. Exit</p>

Course Title	Management Science				Course Type		Theory	
Course Code	B20MGM301	Credits	2		Class		III Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	2	2	2				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	-	-	-	-				
	<b>Total</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>50</b>	<b>50</b>

### COURSE OVERVIEW

The course intends to familiarise students to understand the management principles and applications, which lays a strong foundation for managers and leaders in critical thinking and decisions making process. The course emphasises on giving an overview of the functional area of management

### COURSE OBJECTIVE (S):

The objectives of this course are to:

### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	To Plan organizational structure for a given context in the organisation carries out production operations through Work-study.	1-5	2
CO2	To carry out production operations through Work-study.	1-5	3
CO3	To Understand the markets, customers and competition better and price the given products Appropriately.	1-5	2
CO4	To Plan and control the HR function better.	1-5	2,3
CO5	To create foundation of decision making process and critical thinking	1-6	3
CO6	To emphasises on giving an overview of the functional area of management	2,4	2

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√	√	√	√	
CO2	√	√	√	√	√	
CO3	√	√	√	√	√	
CO4	√	√	√	√	√	
CO5	√	√	√	√	√	√
CO6		√		√		

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	3									3	
CO2	1	1	3	3	3										3
CO3	1	3	2	3	1									3	
CO4	1	1	3	2	5									3	3
CO5	1	1	2	3	2	2									3
CO6		1		2										3	

**Note:** 1-Low, 2-Medium, 3-High

**COURSE CONTENT**

**THEORY:**

**UNIT – 1**

**Introduction to Management and Organisation:** Concepts of Management and organization- nature, importance and Functions of Management. Systems Approach to Management – Taylor’s Scientific Management Theory- Taylor’s Principles of Management, Maslow’s theory of Hierarchy of Human Needs- Douglas McGregor’s Theory X and Theory– Hertzberg Two Factor Theory of Motivation – Leadership Styles, Social responsibilities of Management. Designing Organisational Structures: Basic concepts related to Organisation Departmentation and Decentralisation.

### UNIT – 2

. **Operations and Marketing Management:** Principles and Types of Plant Layout-Methods of Production( Job, batch and Mass Production), Work Study –Basic procedure involved in Method Study and Work Measurement – Business Process Reengineering(BPR) Statistical

Quality Control: control charts for Variables and Attributes (simple Problems) and Acceptance Sampling, TQM, Six Sigma, Deming's contribution to quality. Objectives of Inventory control, EOQ, ABC Analysis. Purchase Procedure, Stores Management and Store Records – JIT System, Supply Chain Management, Functions of Marketing, Marketing Mix. And Marketing Strategies based on Product Life Cycle. Channels of distribution.

### UNIT – 3

**Human Resources Management (HRM):** Concepts of HRM. HRD and Personnel Management and Industrial Relations (PMIR), HRM vs PMIR.. Basic functions of HR Manager: Manpower planning, Recruitment, Selection, Training and Development. Placement, Wage and Salary Administration, Promotion. Transfer, Separation, Performance Appraisal, Grievance Handling and Welfare Administration, Job Evaluation and Merit Rating -Capability Maturity Model (CMM) Levels – Performance Management System.

### UNIT – 4

**Strategic Management and Contemporary strategic Issues:** Mission, Goals, Objectives, Policy, Strategy. Programmes, Elements of Corporate Planning Process, Environmental Scanning. Value Chain Analysis, SWOT Analysis. Steps in Strategy Formulation and implementation, Generic. Strategy alternatives. Bench Marking and Balanced Score and as Contemporary Business Strategies.

#### TEXTBOOKS:

1. Kotler Philip and Keller Kevin Lane, Marketing Management, Pearson, New York, 15<sup>th</sup> Edition, 2012.
2. Koontz and Wehrich: Essentials of management, McGraw Hill, New Delhi, 11<sup>th</sup> Edition, 2012.

#### REFERENCEBOOKS:

1. Thomas N. Duening and John M. Ivancevich, Management – Principles and Guidelines, Dreamtech Press; 1<sup>st</sup> Edition, 2012.
2. Samuel C. Certo, Modern Management, Prentice Hall, New York, 9<sup>th</sup> Edition, 2012.
3. Schermerhorn, Capling, Poole and Wiesner, Management, Wiley, New York, 6<sup>th</sup> Edition, 2012.
4. John A. Parnell, Strategic Management – Theory and Practice, Cengage Publications, 2018.
5. Lawrence R Jauch, R. Gupta and William F. Gluckek: Business Policy and Strategic Management Science, McGraw Hill, New York, 5<sup>th</sup> Edition, 2012.

Course Title	Environmental Science				Course Type		Theory	
Course Code	B20AS0301	Credits	2		Class		III Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	2	2	2				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	-	-	-	-				
	<b>Total</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>26</b>	<b>-</b>	<b>50</b>

### COURSE OVERVIEW

This course intends to understand, analyze and execute the environmental conditions and the control measures on various types of pollutions can be recognized. This course also talks about the environmental degradation on global warming, acid rain formation, and waste management and how the energy and natural resources can be used effectively in ecosystem.

### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Graduates will be familiar with current and emerging environmental engineering and global issues, and have an understanding of ethical and societal responsibilities.
2. Graduates will have the ability to obtain the knowledge, and will recognize the need for engaging in life-long learning.
3. Will find the need of various types of energy (conventional & non-conventional) resources and natural resources.
4. Acquire knowledge with respect to biodiversity, threats, conservation and appreciate the concept of ecosystem.
5. Acquire knowledge about sources, effects and control measures of environmental pollution, degradation and waste management.
6. Explore the ways for protecting the environment

### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	Pos	PSOs
CO1	Understand, analyse and execute favourable environmental conditions and the role of individual, government and NGO in environmental protection.	1-5	2
CO2	List the causes, effects & remedial measures and find ways to overcome them by suggesting the pollution-controlled products.	1-5	3
CO3	Classify different wastes, sources of waste and their effect on population	1-5	2,3
CO4	Get motivation to find new renewable energy resources with high efficiency through active research and innovation and critically analyse the ecological imbalances and provide recommendations to protect the environment.	1-5	2,3
CO5	To learn about increase in population growth and its impact on environment	2,3,4	3
CO6	To Gain knowledge about environment and ecosystem	1-5	3

### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3				√		
CO4			√			
CO5		√	√	√		
CO6	√	√	√	√	√	

### COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	3									3	
CO2	1	1	3	3	3										3
CO3	1	3	2	3	1									3	3
CO4	1	1	3	2	5									3	3
CO5		2	2	2											3
CO6	1	2	2	2	2										3

Note:1-Low,2-Medium,3-High

### COURSE CONTENT

#### THEORY:

#### UNIT – 1

##### ENVIRONMENT & ENVIRONMENTAL PROTECTION:

**Basics of environment:** Introduction & definition to Environment, objectives and guiding principles of environmental education, Components of environment, Structure of atmosphere, Sustainable environment/Development, Impact of technology on the environment in terms of modern agricultural practices and industrialization, Environmental Impact Assessment.

**Environmental protection:** Role of Government - Assignments of MOEF, Functions of central and state boards, Institutions in Environment and People in Environment, Environmental Legislations, Initiative and Role of Non-government organizations in India and world.

## UNIT – 2

### **Environmental pollution, degradation & Waste management:**

**Environmental Pollution:** Definition, sources and types, Pollutant-Definition & classification, Concepts of air pollution, water pollution, Soil pollution, Automobile Pollution-Causes, Effects & control measures.

**Environmental degradation:** Introduction, Global warming and greenhouse effect, Acid rain-formation & effects, Ozone depletion in stratosphere and its effect.

**Waste management:** Municipal solid waste, Bio medical waste and Electronic waste (E-Waste).

## UNIT – 3

### **Energy & Natural resources:**

**Energy:** Definition, classification of energy resources, electromagnetic radiation-features and applications, Conventional/Non-renewable sources – Fossil fuels based (Coal, petroleum & natural gas), nuclear energy, Non-conventional/renewable sources – Solar, wind, hydro, biogas, biomass, geothermal, ocean thermal energy, Hydrogen as an alternative as a future source of energy.

### **Natural resources:**

Water resource - Global water resource distribution, Water conservation methods, Water quality parameters, Uses of water and its importance.

Mineral resources - Types of minerals, Methods of mining & impacts of mining activities. Forest wealth - Importance, Deforestation-Causes, effects and controlling measures

## UNIT – 4

### **Ecology, ecosystem & field work:**

**Ecology-**Definition, branches, objectives and classification, Concept of an ecosystem – Structure and functions, Characteristics of an Ecosystem - Ecosystem Resilience, Ecological succession and productivity, Balanced ecosystem, Components of ecosystem-a biotic and biotic, biological diversity.

Biogeochemical cycles and its environmental significance – Carbon and nitrogen cycle, Energy flow in ecosystem, food chains –types, food web & Ecological Pyramids.

### **TEXTBOOKS:**

1. R. J. Ranjit Daniels and Jagadish Krishnaswamy, "Environmental Studies", Wiley India Private Ltd., New Delhi, Co-authored & Customised by Dr. MS Reddy & Chandrashekar, REVA University, 1<sup>st</sup> Edition, 2017. . R.J.
2. Ranjit Daniels and Jagadish Krishnaswamy, "Environmental Studies", Wiley India Private Ltd., New Delhi, 2<sup>nd</sup> Edition, 2014
3. Benny Joseph, "Environmental Studies", Tata McGraw – Hill Publishing Company Limited, New Delhi, 2<sup>nd</sup> Edition, 2008
4. Dr.S.M.Prakash, "Environmental Studies", Elite Publishers, Mangalore, 2<sup>nd</sup> Edition, 2009

### **REFERENCEBOOKS:**

1. Rajagopalan R, "Environmental Studies – from Crisis to cure", Oxford University Press, New Delhi, 3<sup>rd</sup> Edition, 2016
2. Anil Kumar Dey and Arnab Kumar Dey, "Environmental Studies", New age international private limited publishers, New Delhi, 2<sup>nd</sup> Edition, 2007
3. Michael Allaby, "Basics of environmental Science", Routledge-Taylor & Francis e-library, New York, 2<sup>nd</sup> Edition, 2002
4. Dr.Y.K Singh, "Environmental Science", New age international private limited publishers, New Delhi, 1<sup>st</sup> Edition, 2006.

**Self-Learning Exercises:** Need for public awareness on the environment, Gaia Hypothesis



Course Title	ADVANCED KANNADA (or) Basics of Kannada				Course Type		Theory	
Course Code	B20AHM301 & B20AHM302	Credits	0		Class		III Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	-	-	-	-	-	-	-



ರುಕ್ಕಿಣಿ ಜ್ಞಾನವನ, ಕಟ್ಟಿಗೆನಹಳ್ಳಿ, ಯಲಹಂಕ, ಬೆಂಗಳೂರು - 560064

ಕನ್ನಡಿಗರಿಗೆ ಇಂಜಿನಿಯರಿಂಗ್ ಪ್ರಥಮ ಪದವಿ ಪಠ್ಯ

**ಪರಿವಿಡಿ**

**ಘಟಕ - 1 : ಕವಿತೆಗಳು**

1. ಬೆಳಗು - ದ ರಾ ಬೇಂದ್ರೆ
2. ಕಲ್ಪಿ - ಕುವೆಂಪು

**ಘಟಕ - 2 : ಕಥೆಗಳು**

3. ಗಾಂಧಿ - ಬೆಸಗರಹಳ್ಳಿ ರಾಮಣ್ಣ
4. ಸೆರೆ - ಯಶವಂತ ಚಿತ್ತಾಲ

**ಘಟಕ - 3 : ವಿಜ್ಞಾನ ಲೇಖನಗಳು**

5. ಆನೆಹಳ್ಳದಲ್ಲಿ ಹುಡುಗಿಯರು - ಬಿ ಜಿ ಎಲ್ ಸ್ವಾಮಿ
6. ವೃತ್ತಿಶಿಕ್ಷಣದಲ್ಲಿ ಕನ್ನಡ ಮಾಧ್ಯಮ - ಎಸ್ ಸುಂದರ್

**ಘಟಕ - 4 : ಪರಿಸರ ಲೇಖನಗಳು**

7. ಚೀಂಕ್ರ ಮೇಸ್ತಿ ಮತ್ತು ಅರಿಸ್ಪಾಟಲ್ - ಕೆ ಪಿ ಪೂರ್ಣಚಂದ್ರ ತೇಜಸ್ವಿ
8. ಗುಬ್ಬಚ್ಚಿಯ ಗೂಡು - ಪಿ ಲಂಕೇಶ್

- ❖ ಬಿ ಎಂ ಎಸ್ ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ, ಬೆಂಗಳೂರು ಕನ್ನಡಿಗರಿಗೆ 'ಕನ್ನಡ ಕಲಿ' ಪಠ್ಯ ಪುಸ್ತಕ
- ❖ ಕರ್ನಾಟಕ ತಾಂತ್ರಿಕ ಶಿಕ್ಷಣ ವಿಭಾಗ ಕನ್ನಡಿಗರಿಗೆ 'ಸಾಹಿತ್ಯ ಸಿಂಚನ' ಪಠ್ಯ ಪುಸ್ತಕ
- ❖ ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ ಕನ್ನಡಿಗರಿಗೆ 'ಬಳಕೆ ಕನ್ನಡ' ಪಠ್ಯ ಪುಸ್ತಕ

ಹಲವಾರು ಪಠ್ಯಪುಸ್ತಕಗಳು ಇಂಜಿನಿಯರಿಂಗ್ ವಿಭಾಗದಲ್ಲಿ ಕನ್ನಡ ಬೋಧನೆಗೆ ಬಳಕೆಯಲ್ಲಿದ್ದು ಜೊತೆಗೆ ಬಿಎಡ್ ಕನ್ನಡ ಕಲಿಕೆಯ ಪಠ್ಯಪುಸ್ತಕಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ರೇವಾ ವಿಶ್ವವಿದ್ಯಾಲಯದ ತಾಂತ್ರಿಕ ವಿಭಾಗದ ಕನ್ನಡಿಗರು ಮತ್ತು ಕನ್ನಡೇತರ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಇಷ್ಟವಾಗುವ ಮತ್ತು ಪ್ರಯೋಜನಕಾರಿಯಾಗುವ ಪಠ್ಯ ಪುಸ್ತಕವನ್ನು ತರಗತಿಗಳು ಪ್ರಾರಂಭವಾಗುವುದರ ಒಳಗೆ ಸಿದ್ಧಪಡಿಸಲಾಗುವುದು.

ರುಕ್ಕಿಣಿ ಜ್ಞಾನವನ, ಕಟ್ಟಿಗೆನಹಳ್ಳಿ, ಯಲಹಂಕ, ಬೆಂಗಳೂರು – 560064

ಕನ್ನಡೇತರರಿಗೆ ಇಂಜಿನಿಯರಿಂಗ್ ಪ್ರಥಮ ಪದವಿ ಪಠ್ಯ  
ಭಾಷಾ ಕೌಶಲ್ಯಗಳು

ಘಟಕ – 1

**1. ಆಲಿಸುವುದು**

- ಆಲಿಸುವ ಕೌಶಲ್ಯ
- ಆಲಿಸುವಿಕೆಯಲ್ಲಿನ ದೋಷಗಳು
- ಉತ್ತಮ ಆಲಿಸುವಿಕೆ

ಘಟಕ – 2

**2. ಮಾತನಾಡುವುದು**

- ಸಂಭಾಷಣೆ
- ವ್ಯವಹಾರಿಕ ಸಂಭಾಷಣೆ
- ದೋಷಗಳು ಮತ್ತು ಪರಿಹಾರಗಳು

ಘಟಕ – 3

**3. ಓದುವುದು**

- ಓದು ಕಲಿಸುವಾಗ ಗಮನಿಸಬೇಕಾದ ಅಂಶಗಳು
- ಧ್ವನ್ಯಾಂಗಗಳ ಪರಿಚಯ
- ಓದಿನ ವಿಧಗಳು

ಘಟಕ – 4

**4. ಬರೆಯುವುದು**

- ವರ್ಣಮಾಲೆಯ ಸ್ವರೂಪ
- ಕಾಗುಣಿತ ಸ್ವರೂಪ
- ಕನ್ನಡ ಸಂಖ್ಯೆಗಳು

- ❖ ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ ಕನ್ನಡೇತರರಿಗೆ 'ಬಳಕೆ ಕನ್ನಡ' ಪಠ್ಯ ಪುಸ್ತಕ
- ❖ ಬಿ ಎಂ ಎಸ್ ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ, ಬೆಂಗಳೂರು ಕನ್ನಡೇತರರಿಗೆ 'ಕನ್ನಡ ಮನಸ್ಸು' ಪಠ್ಯ ಪುಸ್ತಕ
- ❖ ಕರ್ನಾಟಕ ತಾಂತ್ರಿಕ ಶಿಕ್ಷಣ ವಿಭಾಗ ಇವರು 'ಬಳಕೆ ಕನ್ನಡ' ಪಠ್ಯ ಪುಸ್ತಕ ತಂದಿದ್ದಾರೆ.

ಹಲವಾರು ಪಠ್ಯಪುಸ್ತಕಗಳು ಇಂಜಿನಿಯರಿಂಗ್ ವಿಭಾಗದಲ್ಲಿ ಕನ್ನಡ ಬೋಧನೆಗೆ ಬಳಕೆಯಲ್ಲಿದ್ದು ಜೊತೆಗೆ ಬಿಎಡ್ ಕನ್ನಡ ಕಲಿಕೆಯ ಪಠ್ಯಪುಸ್ತಕಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ರೇವಾ ವಿಶ್ವವಿದ್ಯಾಲಯದ ತಾಂತ್ರಿಕ ವಿಭಾಗದ ಕನ್ನಡಿಗರು ಮತ್ತು ಕನ್ನಡೇತರ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಇಷ್ಟವಾಗುವ ಮತ್ತು ಪ್ರಯೋಜನಕಾರಿಯಾಗುವ ಪಠ್ಯ ಪುಸ್ತಕವನ್ನು ತರಗತಿಗಳು ಪ್ರಾರಂಭವಾಗುವುದರ ಒಳಗೆ ಸಿದ್ಧಪಡಿಸಲಾಗುವುದು.

## Detailed Syllabus

### Semester-4

Course Title	Design and Analysis of Algorithm				Course Type		Theory	
Course Code	B20CI0401	Credits	3		Class		IV Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	-	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>-</b>	<b>50</b>

#### COURSE OVERVIEW

In this course the study of fundamental algorithms to solve a variety of problems, including sorting, searching and graph algorithms are discussed. Techniques for analyzing time and space complexity of algorithms are discussed and hence evaluation of tradeoffs between different algorithms is done.

#### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the mathematical foundation for the analysis of algorithms.
2. Illustrate the algorithms using brute force and divide and conquer design technique.
3. Make use of greedy and dynamic algorithmic design techniques for a given problem.
4. Discuss the problems based on backtracking and branch and bound techniques.

#### COURSE OUTCOMES (COs):

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply the knowledge of mathematical foundation for the analysis of algorithms.	1 to 5, 12	1,2
CO2	Develop a program to solve the given real world problems using brute force and divide and conquer design paradigm.	1 to 5,12	1,2
CO3	Make use of greedy and dynamic programming techniques for solving the given real world problem.	1 to 5,12	1,2,3
CO4	Utilize backtracking and branch and bound techniques to solve real world problems.	1,to 5,12	1,2,3
CO5	Learn new tools and technologies in the Designing of algorithms and apply for suitable application development.	12	1
CO6	Develop solution to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5,6,12	1,2

**BLOOM'S LEVEL OF THE COURSE OUTCOMES:**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4			√			
CO5			√			
CO6			√	√		

**COURSE ARTICULATION MATRIX**

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	2	2	1	3	1							1	3	3	
CO2	2	2	1	2	2							2	3	3	
CO3	2	2	1	3	2							2	3	3	3
CO4	2	1	1	3	2							1	3	3	3
CO5												3	3		
CO6					3				3	2			3	3	

**Note:**1-Low,2-Medium,3-High

**COURSE CONTENT**

**THEORY:**

**UNIT – 1**

**Introduction**-Notion of an Algorithm; Fundamentals of Algorithmic Problem Solving; Fundamentals of the Analysis of Algorithm Efficiency- The Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive Algorithms, Mathematical Analysis of Recursive Algorithms.

**UNIT – 2**

**Brute Force:** Bubble Sort, Selection Sort, Sequential Search and Brute-Force String Matching, Exhaustive Search, Depth-First Search and Breadth-First Search, Divide-and-Conquer: Merge sort, Quick sort, Multiplication of Large Integers, Decrease-and-Conquer- Insertion Sort, Topological Sorting.

### UNIT – 3

**Greedy Technique**-Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm Dynamic Programming- Fibonacci numbers, Binomial coefficient, The Knapsack Problem and Memory Functions, Warshall's and Floyd's Algorithms

### UNIT – 4

**Space and Time Trade-Offs**- Sorting by Counting, Input Enhancement in String Matching,, Coping with the Limitations of Algorithm Power- Backtracking-n-Queens Problem, Subset-Sum Problem, Branch-and-Bound, Assignment Problem, Travelling Salesman Problem

#### TEXTBOOKS:

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson, 3rd Edition, 2012.
2. Ellis Horowitz, SatrajSahni and Rajasekaran, "Computer Algorithms/C++", Universities Press, 2nd Edition, 2014.
3. Kleinberg, "Algorithm Design", Pearson Education, 1st Edition, 2013.
4. Michael Goodrich, Roberto Tamassia, "Algorithm Design and Applications", Wiley Publishers, 1st Edition, 2014.

#### REFERENCEBOOKS:

1. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, "Introduction to Algorithms", PHI, 3rd Edition,
2. ACM Transactions on Algorithms.
3. ACM Journal of Algorithms and Computational Technology.

#### JOURNALS/MAGAZINES

1. <https://www.mdpi.com/journal/algorithms>
2. <https://ieeexplore.ieee.org>
3. <https://www.springer.com/journal/453>
4. <https://ieeexplore.ieee.org/document/7990553>

#### SWAYAM/NPTEL/MOOCs:

1. [https://onlinecourses.swayam2.ac.in/cec20\\_cs03/preview](https://onlinecourses.swayam2.ac.in/cec20_cs03/preview)
2. <https://iiiiier.org/NPTEL-Local-Chapter>
3. <https://www.edx.org/course/algorithm-design-and-analysis>

#### Self-Learning Exercises:

1. More exploration on GitHub

Course Title	Operating Systems				Course Type	Integrated			
Course Code	B20CI0402	Credits	3		Class		I Semester		
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage		
	Theory	3	3	3					
	Practice				Theory	Practical	IA	SEE	
	-	-	-	-					
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>-</b>	<b>50%</b>	<b>50%</b>

#### COURSE OVERVIEW:

This course starts with a brief historical perspective of the evolution of operating system and then covers the major components of most of the operating systems. The operating system provides a well-known, convenient, and efficient interface between user programs and the bare hardware of the computer on which they run. The operating system is responsible for allowing resources (e.g., disks, networks, and processors) to be shared, providing common services needed by many different programs (e.g., file service, the ability to start or stop processes, and access to the printer) and protecting individual programs from one another.

#### COURSE OBJECTIVE(S):

- 1: Explain the major components and different services of Operating system
- 2: Implement process management and scheduling schemes.
- 3: Discuss synchronization and deadlock techniques in real time applications.
- 4: Demonstrate memory management techniques for a given machine architecture

#### COURSE OUTCOMES (COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the major components and different services of Operating system	1-3	1
CO2	Evaluate the Performance of different CPU Scheduling algorithm for the given real world applications	1-5	1
CO3	Build applications to overcome synchronization problems and to avoid deadlocks	1-3,5	2,3
CO4	Compare the physical and virtual memory management techniques and interpret the file systems concepts	1-5	2,3
CO5	Understand fundamental operating system abstractions such as processes, threads, files, semaphores, IPC abstractions, shared memory regions, etc.,	1-5	2,3
CO6	Explain the performance trade-offs inherent in OS implementation	1-5,9	2,3

#### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom'sLevel					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		✓				
CO2					✓	
CO3			✓			
CO4				✓		
CO5		✓	✓			
CO6			✓			

#### COURSE ARTICULATIONMATRIX

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2		1							1	3		
CO2	3	2	3	1	1								3		
CO3	3	2	3	1	1				1			1		3	
CO4	2	2	2	2	2				2			2	3		
CO5	3	3	3	2	2	1									
CO6	3	3	3	2	2	2			3				3	3	2

Note:1-Low,2-Medium,3-High



**COURSE CONTENT  
THEORY**

<b>Contents</b>
<b>UNIT-1</b> <b>Operating System Principles:</b> what Operating Systems do, Computer System organization, computer system architecture, Operating System structure, Computing environments, Operating System Services, User - Operating System interface, System calls and system programs, Operating System structure.
<b>UNIT-2</b> <b>Process Management:</b> Process concept, process scheduling, Operations on processes, Inter process communication. Threads: Overview, Multicore programming, Multithreading models, Thread Libraries, threading issues. <b>Process Synchronization:</b> Background, The Critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization: The Bounded-Buffer Problem, The Readers-Writers Problem, The Dining-Philosophers Problem.
<b>UNIT-3</b> <b>CPU Scheduling:</b> Basic concepts, scheduling criteria, Scheduling algorithms, Multiple Processor scheduling, thread scheduling. <b>Deadlock:</b> Definition, Deadlock characteristics, methods of handling deadlocks, Deadlock Prevention, Deadlock Avoidance: banker's algorithm, Deadlock detection and Recovery.
<b>UNIT-4</b> <b>Memory Management:</b> Background, Swapping, contiguous memory allocation, Paging, structure of page table, Segmentation. Virtual Memory Management: Background, Demand paging, copy-on-write, Page replacement, Allocation of frames, Thrashing. <b>File System Interface:</b> File concept; Access methods; Directory and disk structure; File system mounting; File sharing; Protection.

**TEXT BOOKS:**

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 9th edition, Wiley-India, 2012.

**REFERENCE BOOKS:**

1. D.M Dhamdhere, Operating Systems: A Concept Based Approach 3rd Ed, McGraw- Hill, 2013.
2. Andrew Tanenbaum & Albert Woodhull, Operating Systems: Design and Implementation. Prentice-Hall, Third edition, 2014.
3. William Stallings Operating Systems: Internals and Design Principles, 6th Edition, Pearson.
4. P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition, PHI(EEE),2014.

**JOURNALS/MAGAZINES:**

1. S. Pamplona, N. Medinilla and P. Flores, "A Systematic Map for Improving Teaching and Learning in Undergraduate Operating Systems Courses," in *IEEE Access*, vol. 6, pp. 60974-60992, 2018, doi: 10.1109/ACCESS.2018.2871768.

2. Y. Liu, Z. Yu, B. Guo, Q. Han, J. Su and J. Liao, "CrowdOS: A Ubiquitous Operating System for Crowdsourcing and Mobile Crowd Sensing," in *IEEE Transactions on Mobile Computing*, vol. 21, no. 3, pp. 878-894, 1 March 2022, doi: 10.1109/TMC.2020.3015750.
3. P. Li, Binoy Ravindran, S. Suhaib and S. Feizabadi, "A formally verified application-level framework for real-time scheduling on POSIX real-time operating systems," in *IEEE Transactions on Software Engineering*, vol. 30, no. 9, pp. 613-629, Sept. 2004, doi: 10.1109/TSE.2004.45.
4. F. Ugalde Pereira, P. Medeiros de Assis Brasil, M. A. de Souza Leite Cuadros, A. R. Cukla, P. Drews Junior and D. F. Tello Gamarra, "Analysis of Local Trajectory Planners for Mobile Robot with Robot Operating System," in *IEEE Latin America Transactions*, vol. 20, no. 1, pp. 92-99, Jan. 2022, doi: 10.1109/TLA.2022.9662177.

**SWAYAM/NPTEL/MOOCs:**

1. <https://archive.nptel.ac.in/courses/106/105/106105214/> (Operating System fundamentals)
2. <https://www.coursera.org/courses?query=operating%20system> (Introduction to operating system)
3. <https://www.udacity.com/course/introduction-to-operating-systems--ud923> (Introduction to Operating System)

**SELF-LEARNING EXERCISES**

Virtual machines and Introduction to Linux Operating System, Introduction to Distributed computing, Parallel computing, grid computing, cloud computing.

Course Title	Database Management System				Course Type		Integrated	
Course Code	B20CI0403	Credits	3		Class		IV Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	-	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>-</b>	<b>50</b>	<b>50</b>

#### COURSE OVERVIEW:

This course introduces topics such as conceptual data modelling, relational data model, relational query languages, and relational database design. It helps the students to gain fundamental concepts, techniques and applications in database.

#### COURSE OBJECTIVE(S):

The objectives of this course are to:

1. Explain the basics of Database Management System.
2. Demonstrate the use of Relational model and Relational algebra.
3. Illustrate the use of different SQL statements.
4. Discuss the topics such as Database Design and Normalization.

#### COURSE OUTCOMES (COs):

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Design conceptual entity relationship diagrams for the real world applications.	1 to 5, 10,12	1,2
CO2	Make use of the concepts of relational algebra to solve queries over database.	1 to 5,12	1,2
CO3	Construct the database for given real world application and solve queries over it using SQL commands.	1 to 5,12	1,2,3
CO4	Develop an optimized database using design guidelines and normalization technique.	1,to 5,12	1,2
CO5	Learn new tools and technologies in DBMS and apply for suitable application development.	12	1
CO6	Develop solutions and create better database, either individually or as a part of the team and report the results with proper analysis and interpretation.	5,6,10	1,2

#### BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4			√			
CO5			√			
CO6			√	√		

**COURSE ARTICULATION MATRIX:**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2					1		1	3	3	
CO2	3	3	2	3	1							1	3	3	
CO3	3	3	2	3	3							1	3	3	3
CO4	3	3	2	3	1							1	3	3	
CO5												3	2		
CO6					2				3	2			3	3	

**Note:** 1-Low,2-Medium,3-High

**COURSE CONTENT**

**THEORY:**

<b>UNIT – 1</b>
<b>Introduction to databases and Conceptual Modelling:</b> Introduction to database, characteristics of the database approach, data models, schemas, instances, database languages and interfaces, Using high-level conceptual data models for database design, a sample database application, entity types, attributes, keys, relationship types, weak entity types, ER diagrams, naming conventions, design issues. Introduction to various database tools and framework (commercial and open source)
<b>UNIT – 2</b>
<b>Relational Data Model and Relational algebra:</b> Relational model concepts, relational model constraints and relational database schemas, update operations, transactions, dealing with constraint violations, unary relational operations, select and project, relational algebra operations from set theory, binary relational operations, join and division, additional relational operations, examples of queries in relational algebra.
<b>UNIT – 3</b>
<b>SQL:</b> SQL data definition and data types, specifying constraints in SQL, basic retrieval queries in SQL, insert, delete, update statements in SQL, additional features of SQL, schema change statements in SQL, Retrieving data using the SQL Select Statement, Restricting and sorting data, Using Single row functions, Joins, More complex SQL retrieval queries, views in SQL.
<b>UNIT – 4</b>
<b>Database Design Theory and Normalization:</b> Informal design guidelines for relation schemas, Functional dependencies, and Normal forms based on primary keys, General definitions of second and third normal forms, Other Normal forms.

**TEXTBOOKS:**

1. Elmasri and Navathe, "Fundamentals of Database Systems", Pearson Education, 5th Edition, 2007.
2. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", McGraw-Hill, 3rd Edition, 2003.
3. Phill Pratt, "Concepts of Database Management, Cengage Learning", 8<sup>th</sup> Edition, 2014
4. Jeffrey A Hoffer, "Modern Database Management, Pearson", 12<sup>th</sup> Edition, 2015

**REFERENCE BOOKS:**

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan: "Database System Concepts", 6th Edition, McGraw Hill, 2010.
2. C J Date, "Database Design and Relational Theory: Normal Forms and All that Jazz", O 'Reilly, April 2012.
3. James Martin, "Principles of Database Management Systems", 1985, Prentice Hall of India, New Delhi
4. IEEE Transactions on Knowledge and Data Engineering
5. Elsevier Data and Knowledge Engineering

**JOURNALS/MAGAZINES**

1. <http://www.iistr.org/final-print/june2019/Database-Management-System.pdf>
2. <https://www.dbjournal.ro/>

**SWAYAM/NPTEL/MOOCs:**

1. <https://www.coursera.org/courses?query=database%20management>
2. [https://onlinecourses.swayam2.ac.in/cec19\\_cs05/preview](https://onlinecourses.swayam2.ac.in/cec19_cs05/preview)
3. <https://www.edx.org/learn/databases>
4. <https://www.classcentral.com/course/swayam-data-base-management-system-9914>

**Self-Learning Exercises:**

1. MONGODB
2. Transaction and concurrency control
3. UML

<b>Course Title</b>	<b>Computer Organization and Architecture</b>				<b>Course Type</b>		<b>Integrated</b>	
<b>Course Code</b>	<b>B20EJ0401</b>	<b>Credits</b>	<b>3</b>		<b>Class</b>		<b>IV Semester</b>	
<b>Course Structure</b>	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	0	0	0	Theory	Practical	CIE	SEE
	-	-	-	-				
	<b>Total</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>39</b>	<b>0</b>	<b>50</b>

### COURSE OVERVIEW

Computer organization and architecture is the science and art of selecting and interconnecting hardware components to create a computer that meets functional, performance, and cost goals. Computer organization defines the constituent parts of the system, how they are interconnected, and how they interoperate in order to implement the architectural specification. In this course, student will learn the basics of hardware components from basic arithmetic units to memory and I/O devices, instruction set architectures and assembly language, and designs to improve performance.

### COURSE OBJECTIVE(S):

The objectives of this course are to:

1. Explain architecture of ARM processor and write simple assembly programs.
2. Demonstrate the translation of assembly instructions into their binary representation.
3. Describe and understand the processor memory hierarchy.
4. Discuss basic understanding of interrupts, I/O devices, and I/O protocols

### COURSE OUTCOMES (COs):

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of ARM processor instruction set for developing simple assembly programs.	1,2,7,12	1
CO2	Interpret the functional architecture of computing systems.	1,2,4,10	1
CO3	Identify the issue related to instruction set architecture, memory unit and control unit and I/O functions.	1,11	1
CO4	Develop a real world application using parallel processing concepts.	1,2,4,10,11	1,2
CO5	Learn new tools and technologies and apply for suitable application development.	12	1
CO6	Develop solutions in the Computer Architecture and Organization to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5, 6, 10	1, 2

## BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2		√				
CO3			√			
CO4			√			
CO5			√			
CO6			√			

## COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	2	3					3					1	3		
CO2	3	3		2						2			3		
CO3	3										2		3		
CO4	3	3		2						2	2		3	3	
CO5												1			
CO6					1				1	1			1	1	

Note: 1-Low, 2-Medium, 3-High

## COURSE CONTENT

### THEORY:

#### UNIT – 1

**Introduction to ARM processor:** Introduction to the architecture of Microprocessor, Microcontroller, Microcomputer and Internet of Things (IoT). ARM characteristics, Register structure, Addressing modes, Instructions, Assembly language, Operating Modes and Exceptions, Conditional execution of Instructions.

#### UNIT – 2

**Arithmetic unit:** Addition and Subtraction of Signed Numbers, Multiplication of unsigned numbers, Multiplication of signed numbers, Fast multiplication, Integer division, Floating point numbers and operations, Arithmetic operations on floating point numbers.

#### UNIT – 3

**Memory System:** Basic concepts, Synchronous RAM memories, Read-only memories, Direct Memory Access, Memory Hierarchy, Cache memories, Virtual memory.

## UNIT – 4

**Input/output Organization:** Bus structure, Bus operation, Arbitration, Interface circuits, Intercommunication standards.

**Parallel processing:** Hardware multithreading, Vector (SIMD) processing and Shared Memory multiprocessors.

### TEXTBOOKS:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Mcgrahill.

### REFERENCEBOOKS:

1. Linda Null, Julia Labor, "The Essentials of Computer Organization and Architecture", Viva Publishers, 4th Edition, 2015.
2. William Stallings. "Computer organization and architecture: designing for performance". Pearson Education India, 2000.
3. David A. Patterson, John L. Hennessy. "Computer organization and design: the Hardware/software interface". Elsevier, 2011.
4. Peter Knaggs, "ARM Assembly Language Programming", April 2016.

### JOURNALS/MAGAZINES

1. <https://engineering.lehigh.edu/cse/academics/course-index/cse-202-computer-organization-and-architecture-3>
2. <https://www.computer.org/csdl/magazine/co/1977/12/01646340/13rRUwlnvNA>
3. <https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=10208>

### SWAYAM/NPTEL/MOOCs:

1. <https://www.classcentral.com/course/swayam-computer-organization-and-architecture-a-pedagogical-aspect-9824>
2. [https://onlinecourses.nptel.ac.in/noc20\\_cs25/preview](https://onlinecourses.nptel.ac.in/noc20_cs25/preview)
3. <https://www.edx.org/course/computation-structures-2-computer-architecture-2>

### Self-Learning Exercises:

1. Intel IA-32 architecture, Instruction Set Architecture of IA-32, Basic Input/Output, Basic processing unit and Pipelining.



Course Title	Numerical Methods and Optimization Techniques				Course Type	Theory		
Course Code	B2OAS0401	Credits	3		Class	IV Semester		
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	-	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>50%</b>	<b>50%</b>

#### COURSE OVERVIEW:

Numerical Methods and Optimization Techniques emphasizes on the development of numerical algorithms to provide solutions to common problems formulated in science and engineering. The primary objective of the course is to develop the basic understanding of the construction of numerical algorithms, and perhaps more importantly, the applicability and limits of their appropriate use. The emphasis of the course will be the thorough study of numerical algorithms to understand the guaranteed accuracy that various methods provide, the efficiency and scalability for large scale systems, and issues of stability. Optimization Techniques provide ability to solve real-world problems by finding the optimal solutions to the models subject to constraints.

#### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain numerical methods to obtain approximate solutions to mathematical problems.
2. Examine numerical methods for various mathematical operations and tasks, such as interpolation and integration.
3. Illustrate the notation of vector spaces, sub spaces, linear independence, coordinate and change of coordinate.
4. Solve linear programming problems considering Transportation and Assignment Problems.

#### COURSE OUTCOMES (COs):

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply numerical methods to obtain approximate solutions for mathematical problems.	1 to 3, 12	1
CO2	Determine suitable interpolation formula and quadrature formulae to find the solution for the given data.	1 to 4, 12	2
CO3	Solve the matrix associated with liner transformation with respect to the given base and understand the relationship between the operation and linear transformations and their corresponding matrices.	1 to 5,	3
CO4	Develop mathematical equations with simplex method and Transportation-Assignment problem for linear programming	1 to 5, 12	1, 2, 3
CO5	Learn new tools and technologies in the Numerical Methods and apply for suitable application development.	12	2, 3
CO6	Develop solutions in the Numerical Methods to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5, 6, 10	2, 3

## BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2					√	
CO3			√			
CO4			√			
CO5			√			
CO6			√		√	

## COURSE ARTICULATION MATRIX

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3									1	3		
CO2	3	3	3	3								1		3	
CO3	3	3	3	3	3							1			3
CO4	3	3	3	3	3							1	3	3	3
CO5												2			
CO6					2	3				3					

Note: 1-Low, 2-Medium, 3-High

## COURSE CONTENT

### THEORY:

#### UNIT – 1

**Numerical Methods:** Errors in Numerical Calculations Types of Errors-Significant Digits-Programming Errors-Numerical Solution of Non-Linear Equations-Bisection Method-Regula Falsi Method-Newton Raphson Method – Fixed Point Method of Iteration – Rates of Convergence of These Methods. Solutions of Algebraic Equations, Relaxation Method and Gauss Seidel Iteration Method.

#### UNIT – 2

**Numerical Analysis:** Finite Differences-Operators ( $\Delta$ ,  $\nabla$  and  $E$ ), Interpolation, Newton-Gregory Forward Interpolation Formula, Central Difference, Stirling And Bessel's Interpolation Formulae, Lagrange's Interpolation Formula, Inverse Interpolation Formula, Divided Difference Formula, and Newton's Divided Differences Formula. Numerical integration: Newton-Cotes quadrature formulae: Trapezoidal, Simpson's rules and Weddle's rule.

#### UNIT – 3

**Vector Spaces and Linear transformations:** Bases, Echelon forms, Rank, and determinants. Gauss elimination and its complexity, Inner products, Gram-Schmidt orthogonalization. Linear transformations.

## UNIT – 4

**Linear Programming:** Introduction, Canonical and Standard Form of LPP-Simplex Method-Big M Method- Two Phase Method-Principle of duality-Dual Simplex Method. Transportation Problem and Assignment problem.

### TEXTBOOKS:

1. Sastry S.S., "Numerical Analysis", Prentice-Hall India (module I), 4th edition
2. K. Hoffman and R. Kunze, "Linear Algebra", Prentice-Hall India, 1971.
3. R Panneerselvam, "Operations research", 2nd edition, PHI

### REFERENCES

1. KanthiSwarup, P.K. Gupta, Man Mohan, "Operations research", Sultan Chand & Sons. (module II), 5<sup>th</sup> edition.
2. Froberg, "Introduction to Numerical Analysis", Second Edition, Addition Wesley
3. Gerald and Wheatley, "Applied Numerical Analysis", Pearson Education Asia, Sixth Edition
4. S.S Rao, "Optimization Theory and Applications", Wiley Eastern
5. Grawin W. W, "Introduction of Linear Programming", McGraw Hill.

### JOURNALS/MAGAZINES

1. <https://onlinelibrary.wiley.com/journal/10970207>
2. <https://www.springer.com/journal/245>
3. <https://ijnao.um.ac.ir/>
4. <https://www.scimagojr.com/journalrank.php?category=2612>

### SWAYAM/NPTEL/MOOCs:

1. <https://nptel.ac.in/courses/106/108/106108056/>
2. <https://www.coursera.org/learn/intro-to-numerical-analysis>
3. <https://nptel.ac.in/courses/122/102/122102009/>
4. <https://nptel.ac.in/courses/122/106/122106033/>
5. <https://www.edx.org/course/convex-optimization>

### Self-Learning Exercises:

1. Optimization Methods for Business Analytics
2. Numerical Methods and Optimization in Finance

Course Title	Theory of Computation				Course Type		Theory	
Course Code	B20EJ0402	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>-</b>	<b>50%</b>	<b>50%</b>

#### COURSE OVERVIEW:

The course introduces some fundamental concepts in automata theory and formal languages including finite automaton, regular expression, formal language, grammar, pushdown automaton, and Turing machine. These form basic models of computation; they are also the foundation of many branches of computer science, e.g. compilers, software engineering, concurrent systems, etc.

#### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the concepts of Deterministic and Non-Deterministic Finite Automata.
2. Demonstrate the use of regular expressions for constructing DFA and NFA.
3. Illustrate the construction of context free grammar for a given language.
4. Describe computing Machine including PDA and Turing Machine

#### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Construct the Finite State Machine by applying the concepts of DFA and NFA.	1 to5,11,12	1
CO2	Make use of regular expressions for constructing DFA and NFA.	1to5,11,12	2
CO3	Identify ambiguity in grammar and Construct CFG for the given language in Normal Forms.	1 to5,11,12	3
CO4	Apply the concepts of Push down Automata and Turing machine for a given Language.	1to5,11,12	2
CO5	Understand the complexity or difficulty level of problems when solved using these machines.	1to5,11,12	2
CO6	Explore the formal languages and grammars: regular grammar and regular languages, context-free languages and context-free grammar; and introduction to context-sensitive language and context-free grammar, and unrestricted grammar and languages.	1 to5,11,12	3

### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply(L3)	Analyze(L4)	Evaluate(L5)	Create(L6)
CO1		√	√			
CO2		√	√			
CO3			√			
CO4			√			
CO5		√				
CO6					√	

### COURSE ARTICULATION MATRIX:

CO#/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	1						1	1	3		
CO2	2	2	1	1	1						1	1		3	
CO3	2	2	1	1	1						1	1			3
CO4	2	2	1	1	1						1	1		3	
CO5	2	2	1	1	1						1	1		3	
CO6	2	2	1	1	1						1	1			3

Note:1-Low,2-Medium,3-High

### COURSE CONTENT THEORY

Contents
<b>UNIT-1</b>
<b>Introduction to finite automata:</b> Alphabets; Languages; strings; Deterministic and non-deterministic finite automata (with and without epsilon transitions) and their applications; Equivalence of finite automata; Minimization of Finite Automata
<b>UNIT-2</b>
<b>Regular Expressions,</b> regular languages, and their properties: Regular Expressions; Finite Automata and Regular Expressions; Equivalence of finite automata and regular expressions; Pumping lemma for regular languages;

### UNIT-3

**Context free Grammars and Normal forms:** Context Free Grammars; Parse Trees; Ambiguity in Grammars and languages; Normal forms-CNF and GNF.

### UNIT-4

**Push Down Automata and Turing Machine:** Push down automata (PDA); Languages of a PDA; Deterministic PDA; Turing Machine.

#### TEXT BOOKS:

1. John E Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Introduction to Automata Theory, Languages and Computation, 3rd Edition, Pearson Education, 2009.
2. Peter Linz, An Introduction to formal Languages and Automata, 4/ E, Jones and Bartlett Publishers, 2006.

#### REFERENCE BOOKS:

1. Kamala Krithivasan, Rama R, Introduction to Formal Languages, Automata Theory and Computation, Pearson, 2009.
2. B N Srinivasa Murthy, Formal Languages and Automata Theory, Sanguine Publishers, 2006.

#### JOURNALS/MAGAZINES

1. <https://theoryofcomputing.org/>
2. <https://www.journals.elsevier.com/theoretical-computer-science>
3. <https://www.springer.com/journal/224>

#### SWAYAM/NPTEL/MOOCs:

1. <https://www.edx.org/course/automata-theory>
2. <https://nptel.ac.in/courses/106/104/106104028/>
3. <https://ocw.mit.edu/courses/mathematics/18-404j-theory-of-computation-fall-2006/syllabus/>

#### Self-Learning Exercises:

1. Applications of Finite Automata and Applications of Regular Expressions.

Course Title	Design and Analysis of Algorithms Lab				Course Type		Theory	
Course Code	B20EJ0402	Credits	1		Class		IV semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	1	2	2	0	26	50%	50%

### COURSE OVERVIEW

In this course the study of fundamental algorithms to solve a variety of problems, including sorting, searching and graph algorithms are discussed. Techniques for analyzing time and space complexity of algorithms are discussed and hence evaluation of tradeoffs between different algorithms is done.

### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the mathematical foundation for the analysis of algorithms.
2. Illustrate the algorithms using brute force and divide and conquer design technique.
3. Make use of greedy and dynamic algorithmic design techniques for a given problem.
4. Discuss the problems based on backtracking and branch and bound techniques.

### COURSE OUTCOMES (COs):

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply the knowledge of mathematical foundation for the analysis of algorithms.	1 to 5, 12	1,2
CO2	Develop a program to solve the given real world problems using brute force and divide and conquer design paradigm.	1 to 5,12	1,2
CO3	Make use of greedy and dynamic programming techniques for solving the given real world problem.	1 to 5,12	1,2,3
CO4	Utilize backtracking and branch and bound techniques to solve real world problems.	1,to 5,12	1,2,3
CO5	Learn new tools and technologies in the Designing of algorithms and apply for suitable application development.	12	1
CO6	Develop solution to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5,6,12	1,2

**BLOOM'S LEVEL OF THE COURSE OUTCOMES:**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4			√			
CO5			√			
CO6			√	√		

**COURSE ARTICULATION MATRIX**

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	2	2	1	3	1							1	3	3	
CO2	2	2	1	2	2							2	3	3	
CO3	2	2	1	3	2							2	3	3	3
CO4	2	1	1	3	2							1	3	3	3
CO5												3	3		
CO6					3				3	2			3	3	

**Note:**1-Low,2-Medium,3-High

Exp. No	PROBLEM STATEMENT
1	Search for a given pattern in a text string using Brute Force String Matching.
2	Sort a set of elements in ascending order using Quick Sort algorithm.
3	Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's
4	Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithms. Differentiate the methods.
5	From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm
6	Design and Implement 0/1 Knapsack problem using Dynamic Programming.
7	Implement All-Pairs Shortest Paths Problem using Floyd's algorithm
8	Obtain the DFS ordering of vertices in a given digraph.
9	Implement Horspool's algorithm for String Matching and find the number of key comparisons in successful search and unsuccessful search
10	Sort a given set of elements in ascending order which has duplicate entries. Use the sorting by counting algorithm
11	Implement N Queen's problem using Back Tracking.
12	Write a program to sort all transactions of Big Mall by quantity of sales.
13	Write a program to find network of people of same location in LinkedIn social network



Course Title	Operating Systems Lab				Course Type	HC			
Course Code	B20CI0405	Credits	1		Class		I Semester		
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage		
	Theory								
	Practice	1	2	2	Theory	Practical	IA	SEE	
	-	-	-	-					
	<b>Total</b>	1	2	2	-	28	<b>50%</b>	<b>50%</b>	

#### COURSE OVERVIEW:

Operating system provides a practical case of operating systems for the user to understand and master deeply and tangibly the theory and algorithms in operating systems. It gives deeper insights into the hierarchical structure, principles, applications, shells, development, and management of the operation system multi-dimensionally, systematically and from the elementary to the profound. It makes the user to understand about how operating system functions.

#### COURSE OBJECTIVE (S):

The objective of this lab is to:

1. Provide the knowledge and skills required to understand Basics of UNIX Operating Environment
2. Describe process concepts and scheduling techniques.
3. Illustrate the use of different memory management techniques of operating system.
4. Describe the data structures and internal representation of files in operating system.

#### COURSEOUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	CourseOutcomes	POs	PSOs
CO1	Understand the scope of UNIX operating environment	1,3	1
CO2	Implementation of scheduling algorithm using C	1,4,5	1,3
CO3	Compare and analyze the performance of different memory management techniques	1,4,5	2,3
CO4	Make use of file types, file structure and file system implementation. .	1,2,4, 5	1,3
CO5	Learn new tools and technologies in the Designing of algorithms and apply for suitable application development.	1,2,4, 5	1,3
CO6	Develop solution to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5,6,10	1,2

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		✓				
CO2			✓			
CO3				✓		
CO4				✓		
CO5		✓				✓
CO6				✓		

**COURSE ARTICULATION MATRIX**

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2		3										3		
CO2	1			2	2								3		1
CO3	2			2	1									3	3
CO4	3	3		1	1								1		3
CO5	3	3		2	2								1		3
CO6					2	2				3			3	3	

**Note:** 1-Low, 2-Medium, 3-High

**PRACTICE:**

<b>PART A:</b>			
<b>No</b>	<b>Title of the Experiment</b>	<b>Tools and Techniques</b>	<b>Expected Skill /Ability</b>
1	<p>When the parent process creates a child process, child process can perform any task assigned to it. During the execution of child process, the parent process waits and vice versa.</p> <p>Develop a program in C to create a child process to read commands from the standard input and execute them.</p>	Process creation using fork()	Programming with C
2	<p>Multithreading is a technique, where each thread is assigned with a task and they get executed simultaneously. For instance, if there are two tasks, two threads are created, one for each task. When one thread is being executed, the other thread waits and vice versa. So, if there are N tasks, N threads can be created one for each task. It works on shared memory technique, where all the threads share the common memory for storing or retrieving the data.</p> <p>Build a program in C to carry out the following tasks</p> <ul style="list-style-type: none"> <li>i) create two functions, Generate() and Print() to generate the Fibonacci series and print them respectively.</li> <li>ii) Create a separate thread to execute each function.</li> <li>ii) Ensure the synchronization while executing above functions</li> </ul>	Parallel Programming	Programming with C
3	<p>A policy is applied by a Scheduler to select a process for execution when there is more than one process ready for execution. The policy may be the process which arrives first is executed first (<b>First Come First Served-FCFS</b>) or the process which has shortest execution time (<b>Shortest Job First-SJF</b>) amongst the set of processes is executed first.</p> <p>Develop a program in C to carry out the following tasks:</p> <ul style="list-style-type: none"> <li>i) Read a set of processes along with the CPU burst time, arrival time (may be assumed as 0) for each process</li> <li>ii) Allocate the processor to the process which has arrived first (<b>apply FCFS</b>) and compute the average waiting time and average turnaround time.</li> <li>iii) Allocate the processor to the process which has shortest CPU burst time (<b>apply SJF</b>) and compute the average waiting time and average turnaround time.</li> </ul> <p>Compare the performance of both.</p>	Scheduling concept	Programming with C
4	<p>The scheduler may apply different policies to select a process for execution when there is more than one process ready for execution. The policy may be the process which has highest priority (<b>Priority based</b></p>	Scheduling concept	Programming with C

	<p><b>scheduling)</b> amongst all the processes arrived for execution.</p> <p>Develop a program for carrying out the following tasks</p> <ul style="list-style-type: none"> <li>i) read a set of processes along with the CPU burst time, arrival time ( may be assumed as 0) and the priority for each process</li> <li>ii) allocate the processor to the process which has the highest priority and</li> </ul> <p>compute the average waiting time and average turnaround time</p>		
5	<p>Given the list of processes and their CPU burst time, arrival time, the Scheduler may apply a different policy that “each process is given certain amount of execution time called time slice or quantum time” and after completion of time slice, another process in queue is taken for execution. This procedure repeats until all the processes in the list get executed for fixed amount of time. Later, the first process in the queue is selected for the execution once again. This process repeats until the completion of execution of all the processes. <b>This technique is called Round Robin Technique.</b></p> <p>Develop a program for carrying out the following tasks</p> <ul style="list-style-type: none"> <li>i) read a set of processes along with the CPU burst time, arrival time (may be assumed as 0) and the time slice or time quantum</li> <li>ii) allocate the processor to the processes in the order of their arrival based on arrival time and execute each of them for fixed amount of time ( Time quantum).</li> <li>iii) After completion of first round, if execution of processes is not completed, repeat the step ii)</li> <li>iv) compute the average waiting time and average turnaround time</li> </ul>	Scheduling concept	Programming with C
6	<p>Consider an example of multi-process synchronization problem, where producer produces the data and stores at some location which will be accessed by another process called Consumer. Since, the producer and consumer share a common, fixed size buffer, there will be a synchronization problem.</p> <p>The solution can be obtained by using semaphores to establish inter process communication with synchronization.</p> <p>Develop a program in C to implement Producer-Consumer Problem by using semaphores to establish inter process communication with synchronization. Create two separate threads, one for producer and another one for consumer. When producer is getting executed, consumer must be in waiting state and vice-versa.</p>	Process synchronization	Programming with C

7	<p>Consider a set of processes, where each process holds some resources with it and requests for some more resources to complete its execution. But, when process P1 is requesting for resource R1 which is being used by P2 and if P2 is requesting for R2 which is held by P1, dead lock occurs and execution does not continue. Banker's Algorithm is used to avoid such deadlocks.</p> <p>Develop a program in C to implement Banker's Algorithm which finds whether the state is safe or not after allocating the resources requested by the processes.</p>	Process synchronization	Programming with C
8	<p>The operating system replaces the old page of a process whenever a new page of the same process is to be loaded into memory. To select the page for replacement, OS may choose a policy that "the page which has not been used for the longest period of time is to be replaced first". It is termed as Least recently used technique.</p> <p>Develop a C program to implement LRU page replacement algorithm.</p>	Page replacement Algorithm	Programming with C
9	<p>When a process with different size arrives to main memory for loading, Find the frame which is larger than the page arrived and store the page in that frame. This strategy is termed as First fit memory allocation technique.</p> <p>Develop a program in C to implement the First fit memory allocation technique.</p>	Memory management	Programming with C
9	<p>The operating system manages storage of information by creating and storing information in the file. The memory required for a new file may be allocated using one of the methods such as Linked list, Indexed or Contiguous method.</p> <p>Develop a C program to implement any one of the file allocation techniques (Linked, Indexed or Contiguous).</p>	File Management	Programming with C

Course Title	Database Management System Lab				Course Type		Theory	
Course Code	B20CI0406	Credits	1		Class		IV semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	1	2	2				

**COURSE OVERVIEW:**

This course introduces topics such as conceptual data modelling, relational data model, relational query languages, and relational database design. It helps the students to gain fundamental concepts, techniques and applications in database.

**COURSE OBJECTIVE(S):**

The objectives of this course are to:

1. Explain the basics of Database Management System.
2. Demonstrate the use of Relational model and Relational algebra.
3. Illustrate the use of different SQL statements.
4. Discuss the topics such as Database Design and Normalization.

**COURSE OUTCOMES(COs):**

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Design conceptual entity relationship diagrams for the real world applications.	1 to 5, 10,12	1,2
CO2	Make use of the concepts of relational algebra to solve queries over database.	1 to 5,12	1,2
CO3	Construct the database for given real world application and solve queries over it using SQL commands.	1 to 5,12	1,2,3
CO4	Develop an optimized database using design guidelines and normalization technique.	1,to 5,12	1,2
CO5	Learn new tools and technologies in DBMS and apply for suitable application development.	12	1
CO6	Develop solutions and create better database, either individually or as a part of the team and report the results with proper analysis and interpretation.	5,6,10	1,2

**BLOOM'S LEVEL OF THE COURSE OUTCOMES:**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4			√			
CO5			√			

CO6			v	v		
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**COURSE ARTICULATION MATRIX:**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2					1		1	3	3	
CO2	3	3	2	3	1							1	3	3	
CO3	3	3	2	3	3							1	3	3	3
CO4	3	3	2	3	1							1	3	3	
CO5												3	2		
CO6					2				3	2			3	3	

**Note:** 1-Low,2-Medium,3-High

**PRACTICE:**

S.No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
<b>Part-A</b>			
1	<p>Consider the following schema for Order Database: SALESMAN (Salesman_id, Name, City, Commission) CUSTOMER (Customer_id, Cust_Name, City, Grade, Salesman_id)</p> <p>ORDERS (Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> <li>Count the customers with grades above Bangalore's average.</li> <li>Find the name and numbers of all salesmen who had more than one customer.</li> <li>List all salesmen and indicate those who have and don't have customers in their cities (Use UNION operation.)</li> <li>Create a view that finds the salesman who has the customer with the highest order of a day.</li> <li>Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted</li> </ol>	SQL PLUS	Solving queries using SQL

2	<p>Specify the following queries on the Flight relational database schema using SQL</p> <p>Flights(<u>fno</u>: integer, from: string, to: string, distance: integer, departs: time, arrives: time)</p> <p>Aircraft(<u>aid</u>: integer, aname: string, cruisingrange: integer)</p> <p>Certified(<u>eid</u>: integer, aid: integer)</p> <p>Employees(<u>eid</u>: integer, ename: string, salary: integer)</p> <ol style="list-style-type: none"> <li>1. Find the eids of pilots certified for some Boeing aircraft.</li> <li>2. Find the names of pilots certified for some Boeing aircraft.</li> <li>3. Find the aids of all aircraft that can be used on non-stop flights from Bonn to Madras.</li> <li>4. Identify the flights that can be piloted by every pilot whose salary is more than \$100,000.</li> <li>5. Find the names of pilots who can operate planes with a range greater than 3,000 miles but are not certified on any Boeing aircraft.</li> <li>6. Find the eids of employees who make the highest salary.</li> <li>7. Find the eids of employees who make the second highest salary.</li> </ol>	SQL PLUS	Solving queries using SQL
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<p><b>3</b></p>	<p>Solve the below queries by using SQL</p> <p>Student(snum, sname, major, level, age)</p> <p>Class(cname, meets at, room, fid)</p> <p>Enrolled(snum, cname)</p> <p>Faculty(fid, fname, deptid)</p> <p>The meaning of these relations is straightforward; for example, Enrolled has one record per student-class pair such that the student is enrolled in the class.</p> <p>Queries</p> <ol style="list-style-type: none"> <li>1. Find the names of all juniors (Level = JR) who are enrolled in a class taught by I. Teacher.</li> <li>2. Find the age of the oldest student who is either a History major or is enrolled in a course taught by I. Teacher.</li> <li>3. Find the names of all classes that either meet in room R128 or have five or more students enrolled.</li> <li>4. Find the names of all students who are enrolled in two classes that meet at the same time.</li> <li>5. Find the names of faculty members who teach in every room in which some class is taught.</li> <li>6. Find the names of faculty members for whom the combined enrollment of the courses that they teach is less than five.</li> <li>7. Print the Level and the average age of students for that Level, for each Level.</li> <li>8. Print the Level and the average age of students for that Level, for all Levels except JR.</li> <li>9. Find the names of students who are enrolled in the maximum number of classes.</li> <li>10. Find the names of students who are not enrolled in any class.</li> </ol>	<p>SQL PLUS</p>	<p>Solving queries using SQL</p>
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4	<p>Solve the below queries by using SQL</p> <p>branch (<u>branch-name</u>, branch-city, assets)  customer (<u>customer-name</u>, customer-street, customer-city)  account (<u>account-number</u>, branch-name, balance)  loan (<u>loan-number</u>, branch-name, amount)  depositor (<u>customer-name</u>, <u>account-number</u>)  borrower (<u>customer-name</u>, <u>loan-number</u>)  employee (<u>employee-name</u>, <u>branch-name</u>, salary)</p> <ol style="list-style-type: none"> <li>1. Find the names of all customers.</li> <li>2. Find the names of all branches in the loan relation, don't display duplicates.</li> <li>3. Display the entire Branch table.</li> <li>4. Find the account number for all accounts where the balance is greater than \$700.</li> <li>5. Find the account number and balance for all accounts from Brighton where the balance is greater than \$800.</li> <li>6. Display the branch name and assets from all branches in thousands of dollars and rename the assets column to 'assets in thousands'.</li> <li>7. Find the name of all branches with assets between one and four million dollars.</li> <li>8. Find the name, account number, and balance of all customers who have an account.</li> <li>9. Find the name, account number, and balance of all customers who have an account with a balance of \$400 or less.</li> </ol>	SQL PLUS	Solving queries using SQL
5	<p>Consider the following schema for a Library Database:</p> <p>BOOK (Book_id, Title, Publisher_Name, Pub_Year)  BOOK_AUTHORS (Book_id, Author_Name)  PUBLISHER (Name, Address, Phone)  BOOK_COPIES (Book_id, Branch_id, No-of_Copies)  BOOK_LENDING (Book_id, Branch_id, Card_No, Date_Out, Due_Date)  LIBRARY_BRANCH (Branch_id, Branch_Name, Address)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> <li>1. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each branch, etc.</li> <li>2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017</li> <li>3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation.</li> <li>4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query.</li> <li>5. Create a view of all books and its number of copies that are currently available in the Library.</li> </ol>	SQL PLUS	Solving queries using SQL

Course Title	Communication Skills				Course Type		Theory	
Course Code	B20AH0301	Credits	2		Class		IV Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	2	2	2				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	-	-	-	-				
	<b>Total</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>50%</b>	<b>50%</b>

#### COURSE OVERVIEW:

This course is to develop basic communication skills in English in the learners, to prioritize listening and reading skills among learners, to simplify writing skills needed for academic as well as work place context, to examine that the learners use the electronic media such as internet and supplement the learning materials used in the classroom.

#### COURSE OBJECTIVE(S):

The objectives of this course are to:

1. Develop basic communication skills in English.
2. Emphasize on the development of speaking skills amongst learners of Engineering and Technology
3. Impart the knowledge about use of electronic media such as internet and supplement the learning materials used in the classroom.
4. Inculcate the habit of reading and writing leading to effective and efficient communication.

#### COURSE OUTCOMES (Cos):

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Demonstrate speaking ability with clarity, confidence and comprehension and communicate with one or many listeners using	1 to 3, 12	1,3
CO2	Build inferences from the text.	1 to 4, 12	2
CO3	Make use of accurate writing skills using different components of academic writing.	1 to 5, 12	2
CO4	Develop the ability to write cohesively, coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic	1 to 5, 12	2,3

**BLOOM'S LEVEL OF THE COURSE OUTCOMES:**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2					√	
CO3			√			
CO4			√			

**COURSE ARTICULATION MATRIX:**

CO#/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	3	3	3									1	3		1
CO2	3	3	3	3								1		3	
CO3	3	3	3	3	3							1		2	
CO4	3	3	3	3	3							1		3	3

Note: 1-Low, 2-Medium, 3-High

**COURSE CONTENT**

**THEORY:**

<b>UNIT – 1</b> Functional English: Grammar: Prepositions; Modal Auxiliaries, Reading Comprehension, Active and passive voice, Giving Instructions.
<b>UNIT – 2</b> Interpersonal Skills: Grammar: Tenses; Wh-questions, Compound words; Phrasal verbs, Recommendations
<b>UNIT – 3</b> Multitasking Skills Grammar: Conditional Sentences, Homonyms; homophones, Subject- verb agreement.
<b>UNIT – 4</b> Communication Skills Grammar: Direct and indirect speech, Interpreting visual materials(line graphs, pie charts etc.), Single word substitutes.

**TEXT BOOKS:**

- Green, David. Contemporary English Grammar Structures and Composition, NewDelhi: MacMillan Publishers,2010,
- Thorpe, Edgar and Showick, Basic Vocabulary. Pearson Education India, 2012.
- Leech, Geoffrey and Jan Svartvik, A Communicative Grammar of English, Longman,2003.

**REFERENCES:**

- Murphy, Raymond “ Murphy’s English Grammar with CD”,CambridgeUniversityPress,2004.
- Rizvi,M .Ashraf, “Effective Technical Communication”, New Delhi, TataMcGraw-Hill,2005.
- Riordan, Daniel, “Technical Communication”, New Delhi: Cengage Publications,2011.
- Senetal, “Communication and Language Skills” CambridgeUniversityPress,2015.

<b>Course Title</b>	<b>Indian Constitution and Professional Ethics</b>				<b>Course Type</b>		<b>Theory</b>	
<b>Course Code</b>	<b>B20LS0301</b>	<b>Credits</b>	<b>2</b>		<b>Class</b>		<b>IV Semester</b>	
<b>Course Structure</b>	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	2	2	2				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	-	-	-	-				
	<b>Total</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>50</b>	<b>50</b>

### COURSE OVERVIEW

The Constitution of India lays down in defining fundamental political principles, establishes the structure, procedures, powers and duties of government institutions and sets out fundamental rights, directive principles and duties of citizen. It helps to know and understand the human rights and human values. It also helps to know the meaning of ethics and need of ethics in personal and professional life.

### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain basic knowledge required to understand Constitution of India.
2. Describe the Fundamental Rights, Duties and other Rights.
3. Discuss different types of ethics.
4. Explore ethical standards followed by different companies.

### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Analyze the Fundamental Rights, Duties and other Rights protected under Indian Constitution.	1,6,7,8,9, 12	1,3
CO2	Demonstrate the practicality of Constitution perspective and make them face the world as a bonafide citizen.	1 to 4,7,8,12	2
CO3	Illustrate the professional ethics and human values.	1 to 5, 7,8,12	2
CO4	Summarize ethical standards followed by different companies.	1 to 5,7,8,12	2,3

### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2					√	
CO3			√			
CO4			√			

### COURSE ARTICULATION MATRIX

CO#/ CO1	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3					2	2	2	2			1	3		1
CO2	3	3	3	3			3	3				1		3	
CO3	3	3	3	3	3		3	3				1		2	3
CO4	3	3	3	3	3		3	3				1		3	3

Note: 1-Low, 2-Medium, 3-High

### COURSE CONTENT

#### THEORY:

<b>UNIT – 1</b>
<b>Indian constitution:</b> Salient features, fundamental rights and duties (Directive principle and state policy), Legislature (Loka Sabha & Rajya Sabha), Executive (President & Governor) and Judiciary (Supreme court & high court), Composition and function of parliament, Council of ministers, prime minister, Speaker, Passing of bills.
<b>UNIT – 2</b>
<b>Human Rights:</b> Nature and Scope of human rights, Universal protection of human rights (UDHR), Regional protection of human rights, National level protection of human rights, Human rights and vulnerable groups (children, women & old-age).  Human values: Truth, Honesty, Loyalty, Love, Peace with examples, Difference between ethics, beliefs and morals.
<b>UNIT – 3</b>
<b>Ethics:</b> Meaning, Definition, Evolution, Need of ethics, Aristotlean Ethics, Utilitarianism, Kantianism, human values (Good conduct, respect for elders), ethical human conduct (Gender equality), Professional Ethics, Personal Ethics and Business Ethics, Ethical Standards, Duties of Employers and Employees.

## UNIT – 4

**Engineering Ethics:** Definition Scope and needs, Ethics in Consumer Protection, Due Care theory, Environmental Ethics, Ethical Code of Conduct in ethics. Best Ethical Companies in India and Abroad; Corporate Social Responsibilities, Code of Conduct and Ethical Excellence

### TEXT BOOKS:

1. Kapoor, S.K., "Human rights under International Law and Indian Law", Prentice Hall of India, New Delhi, 2002.
2. Basu, D.D., "Indian Constitution", Oxford University Press, New Delhi, 2002.
3. Chakraborty, S.K., "Values and ethics for Organizations and Theory Practice", Oxford University Press, New Delhi, 2001.

### REFERENCES BOOKS:

1. Meron Theodor, "Human Rights and International Law Legal Policy Issues", Vol. 1 and 2, Oxford University, Press, New Delhi, 2000.
2. M V Pylee, "An Introduction to Constitution of India", S Chand & Company, 5<sup>th</sup> Edition
3. Durga Das Basu, "Introduction to constitution of India", LexisNexis, 23<sup>rd</sup> Edition.

### SELF-LEARNING EXERCISES:

Abuse of Technologies: Hacking and other crimes, addiction to mobile phone usage, video games and social networking websites.

Course Title	Universal human values				Course Type		Theory	
Course Code	B20AHM401	Credits	0		Class		IV Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	-	-	-	Theory	Practical	CIE	SEE
	Practice	-	-	-				
	Tutorial	-	-	-				
	<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>50%</b>	<b>50%</b>

### COURSE OVERVIEW

Universal human values help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.

### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Development of a holistic perspective based on self- exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act

### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand the significance of value inputs in a classroom and start applying them in their life and profession	1 to 3, 12	1,3
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.	1 to 4 ,12	2
CO3	Understand the role of a human being in ensuring harmony in society and nature.	1 to 5,12	2
CO4	Demonstrate the role of human being in the abatement of pollution	1 to 5,12	2,3



## BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2					√	
CO3			√			
CO4			√			

## COURSE ARTICULATION MATRIX

CO#/ PO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3									1	3		1
CO2	3	3	3	3								1		3	
CO3	3	3	3	3	3							1		2	3
CO4	3	3	3	3	3							1		3	3

Note:1-Low,2-Medium,3-High

## COURSE CONTENT

### THEORY:

#### UNIT – 1

Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship, basic requirements for fulfilment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly, Method to fulfil human aspirations: understanding and living in harmony at various levels, Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility. Understanding the Body as an instrument of 'I' (I being the doer, seeker and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.

#### UNIT – 2

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship. Understanding the meaning of Trust; Difference between intention and competence. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family

### UNIT – 3

Understanding the harmony in the Nature. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film “Home” can be used), pollution, depletion of resources and role of technology etc.

### UNIT – 4

Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems. Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers b) At the level of society: as mutually enriching institutions and organizations

#### TEXT BOOKS:

1. R R Gaur, R Sangal, G P Bagaria, Human Values and Professional Ethics, Excel Books, New Delhi, 2010
2. A.N Tripathy, Human Values, New Age Intl. Publishers, New Delhi, 2004.
3. R.R. Gaur, R. Sangal and G.P. Bagaria, A Foundation Course in Human Values and Professional Ethics, Excel Books, New Delhi, 2010
4. Bertrand Russell, Human Society in Ethics & Politics, Routledge Publishers, London, 1992

#### REFERENCE BOOKS:

1. Corliss Lamont, Philosophy of Humanism, Humanist Press, London, 1997
2. I.C. Sharma, Ethical Philosophy of India Nagin & co Julundhar, 1970
3. Mohandas Karamchand Gandhi, The Story of My Experiments with Truth, Navajivan Mudranalaya, Ahmadabad, 1993
4. William Lilly, Introduction to Ethics, Allied Publisher, London, 1955.

## Detailed Syllabus

### Semester 5

Course Name	Web Technologies & Applications				Course Type		Theory	
Course Code	B20EJ0501	Credits	3		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>-</b>	<b>50%</b>	<b>50%</b>

#### COURSE OVERVIEW:

The basics of Web application tools such as HTML, XHTML and CSS are introduced. The course also provides knowledge about advanced research topics such as XML, Perl and PHP.

#### COURSE OBJECTIVE(S):

The objectives of this course are to:

1. Understand the various steps in designing a creative and dynamic website.
2. Describe the hierarchy of objects in HTML and XML.
3. Design dynamic and interactive web pages by embedding Java Script code in HTML.
4. Illustrate the advantages and use of different types of CSS.
5. Examine the HTML. Know how to use Dynamic HTML.
6. Familiarize server side scripting language like Perl & PHP.

#### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Describe the concepts of WWW including browser and HTTP protocol and summarize the various HTML tags and use them to develop the user- friendly web pages.	2,3,7,11	1,2
CO2	Define the CSS with its types and use them to provide the styles to the web pages at various levels.	2-5	2,3
CO3	Develop the modern web pages using the HTML and CSS features with different layouts as per need of applications.	1,4,8,9,11	2,3
CO4	Apply Java Script to develop the dynamic web pages and use server side Scripting with PHP to generate the web pages dynamically using the database connectivity.	1-4,11,12	2,3
CO5	Examine the HTML. Know how to use Dynamic HTML.	2,3,4,5	2,3
CO6	Familiarize server side scripting language like Perl & PHP.	2-5	1,2

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2		√	√	√		
CO3			√			
CO4			√	√	√	
CO5		√	√	√	√	
CO6		√	√	√	√	

**COURSE ARTICULATION MATRIX**

CO#/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2	1				1				1		2	2	
CO2		2	3	1	1									3	1
CO3	1	2	1	2				3	1		1			2	1
CO4	1	2	3	1							1	1		2	1
CO5		2	2	3	1									2	2
CO6		1	2	3	1								1	2	

Note:1-Low,2-Medium,3-High

**Course Contents**

**Theory**

Contents
<p align="center"><b>UNIT-1</b></p> <p>Web Essentials: Clients, Servers, and Communication. The Internet- Basic Internet Protocols -The World Wide Web- HTTP request message- response message-Web Clients Web Servers-Case Study. Mark up Languages: XHTML. An Introduction to HTML History-Versions-Basic XHTML Syntax and Semantics- Some Fundamental HTML Elements- Relative URLs- Lists- tables- Frames- Forms XML Creating HTML Documents. Representing Web Data: XML- Documents and Vocabularies-Versions and Declaration-Name spaces Java Script and XML</p>

## UNIT-2

Style Sheets: Lists, Tables, Forms, Frames CSS: Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The <span>and<div>tags, Conflict resolution.

Java script: Over view of Java script, Object orientation and Java script, Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructors.

## UNIT-3

Perl, CGI Programming: Origins and uses of Perl, Scalars and their operations, Assignment statements and simple input and output, Control statements, Fundamentals of arrays, Hashes, References, Functions, Pattern matching, File input and output; Examples. The Common Gateway Interface; CGI linkage; Query string format; CGI.pm module; Cookies. Data base access with Perl and MySQL

## UNIT-4

Introduction and basic syntax of PHP, decision and looping with examples, PHP and HTML, Arrays, functions, Browser control and detection, string, Form processing, Files, Advance Features: Cookies and Sessions, Object Oriented Programming with PHP. PHP and MySQL: Basic commands with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, Altering tables, queries, deleting database, deleting data and tables.

### TEXT BOOKS:

1. Robert.W.Sebesta,"Programming the World Wide Web",Fourth Edition,Pearson.
2. Education,2007 Jeffrey C .Jackson, "Web Technologies A Computer Science Perspective", Pearson Education, 2006. 2007.

### REFERENCE BOOKS:

1. Deitel, Goldberg, "Internet & World Wide Web How to Program", Third Edition, PearsonEducation,2006.
2. Marty Hall and Larry Brown, "Core Web Programming" Second Edition, Volume I and II, PearsonEducation,2001.
3. Bates,"DevelopingWebApplications",Wiley,2006.

### JOURNALS/MAGAZINES:

1. International Journal of WebTechnology-ISSN:2278-2389
2. International Journal of Web & Semantic Technology (IJWeST)
3. ELSEVIER Journals with in "Internet And Web Technology"

### SWAYAM/NPTEL/MOOCs:

1. Coursera-Web Design: Wire frames to Prototypes
2. Coursera-Web Application Technologies and Django
3. <https://nptel.ac.in/courses/106/105/106105084/>
4. <https://www.edx.org/learn/web-development>

### SELF LEARNING EXERCISES:

HTML5, JQuery, XML, Ruby, Introduction to REST and REST ful API

Course Title	Computer Networks				Course Type		Theory	
Course Code	B20CI0501	Credits	3		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>-</b>	<b>50%</b>	<b>50%</b>

#### COURSE OVERVIEW:

The main emphasis of this course is on the organization and management of local area networks(LANs).The course description include learning about computer network organization and implementation, obtaining a the or etical understanding of data communication and computer networks, and about Open Systems Interconnection(OSI) communication model with TCP/IP protocol; This course provides knowledge of error detection and recovery; local area networks; bridges, routers and gateways; network naming and addressing; and local and remote procedures. This course also emphasis on User Datagram Protocol, TCP Congestion Control; DNS Message Formatting and Remote Login. Protocols

#### COURSE OBJECTIVE(S):

The main objectives of this course are:

1. Explain the protocol stacks (OSI and TCP/IP) for data communication
2. Discuss the error detection & correction strategies for data transmission.
3. Design the connection establishment of network computing devices.
4. Illustrate the TCP, UDP protocols and explain Domain Name System.
5. Emphasis the management of local area networks
6. Learning about computer network organization and implementation

#### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of the architectural principles of computer networking and compare different approaches to organizing networks.	1to6,12	1
CO2	Identify the good network design with simplicity, scalability, performance and the end-to-end principle.	1to6,12	1
CO3	Appraise the working principles of Internet.	1to6,12	1
CO4	Develop applications using network protocols.	1to6,12	1,2,3
CO5	Emphasis the management of local area networks	1to6,12	2,3
CO6	Learning about computer network organization and implementation	1to6,12	1,2,3

#### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply(L3)	Analyze(L4)	Evaluate(L5)	Create(L6)
CO1		√		√		√
CO2					√	√
CO3	√				√	√
CO4						√
CO5	√	√	√	√		
CO6	√	√	√	√	√	

#### COURSE ARTICULATION MATRIX

CO#/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	1						1	3		
CO2	3	3	3	3	2	2						1	3		
CO3	3	3	3	3	2	1						2	3		
CO4	3	3	3	2	2	1						1	3	3	3
CO5	3	3	3	2	2	1						2		3	3
CO6	3	3	3	2	2	1						2	2	3	3

Note:1-Low,2-Medium,3-High

COURSE CONTENT  
THEORY

## Contents

### UNIT-1

**Introduction to Data Communication and Networking:** Internet history and Internet today, Data Communications, Networks, Network Topologies, Classification of Networks, Protocols & Standards, Introduction to Network Tools-(Wireshark, Packet Tracer, NS3, etc), Layered Tasks, The OSI model, Layers in OSI model, TCP/IP Protocol suite, Addressing. Introduction to switching: Circuit Switched Networks, Datagram Networks, Virtual Circuit Networks, Physical Layer – Periodic Analog signals, Digital signals, Request bit rate, Shannon capacity, performance, PCM, DM, Parallel transmission, serial transmission, ASK, FSK, PSK, QAM, AM, FM, PM.

### UNIT-2

**Coding:** Line Coding and block coding. Multiplexing: FDM, WDM, TDM, FHSS, DSSS. Transmission Media.  
**Error Detection and Correction:** Introduction, cyclic Codes: Cyclic redundancy code generation. Frames, Packets, Data Link Protocols: HDLC, Point-to-Point Protocol.  
**MAC Protocols:** classification of MAC protocols, Random access (ALOHA, CSMA/CD, CSMA/CA), Controlled Access (Reservation, Polling, Token passing), Channelization Protocols (FDMA, TDMA, CDMA)  
**Introduction to Networking Devices:** Digital Subscriber line Modems, Cable modems, Repeaters, Hubs, Bridges, Routers, and High layered switches, Gateways, Virtual LAN.

### UNIT-3

**Standards:** IEEE Standards, Standard Ethernet, Fast Ethernet, Gigabit Ethernet. IEEE 802.11: Architecture, MAC Sublayer, Addressing Mechanism. Bluetooth Architecture.  
Introduction to Wireless networks Wi-Fi, WiMAX, 4G, 5G, Satellite networks, MPLS, VPN, ATM.  
**Network Layer:** IPv4 addresses, IP Datagram format, ICMP Messages, Mobile IP, IPv6 addresses, IPv6 Packet Format, Transition from IPv4 to IPv6, Routing algorithms (Distance Vector, Link State and Path vector), Unicast Routing protocols (RIP, OSPF), Introduction to BGP, Introduction to Multicasting protocols, brief introduction to multicast protocols such as DVMRP, MOSPF, PIM, IGMP.

### UNIT-4

**Transport Layer:** Introduction to Go Back-N, Selective repeat N, Piggybacking. Services and port numbers, User Datagram Protocol (UDP): UDP Segment, Transmission Control Protocol (TCP): TCP Segment, TCP Connection Set up, Application of TCP and UDP. TCP flow control, TCP error control, TCP Congestion Control and options. Introduction to SCTP services and features.  
**Application Layer:** Client server programming using UDP and TCP, Name/Address Mapping, DNS Message Format.

#### TEXT BOOKS:

1. Behrouz A Forouzan, "Data Communications and Networking", 5th Edition, McGraw – Hill, 2016.
2. Nader F. Mir, "Computer and Communication Networks", Pearson Education, 2009.

#### REFERENCE BOOKS:

1. Alberto Leon-Garcia and Indra Idjaja, "Communication Networks – Fundamental Concepts and Key Architectures", 2nd Edition Tata McGraw – Hill, 2004.
2. Andrew S. Tanenbaum, "Computer Networks", 4th Edition, Pearson Education, 2005.
3. Larry L. Peterson and Bruce S. Davie, "Computer Networks- A system Approach", 5th Edition, Elsevier, 2012.
4. William Stallings, "Data and Computer Communications", 10th Edition, Pearson Education, 2008.
5. Douglas E. Comer, "Internetworking with TCP/IP", Vol.1, 6th Edition, Pearson, 1995.
6. IEEE Transactions on Networking.
7. Elsevier Journal of Computer Networks
8. Springer Journal of Communications and Information Networks.



**JOURNALS/MAGAZINES:**

1. [IEEE Transactions on Networking.](#)
2. [Elsevier Journal of Computer Networks](#)
3. [Springer Journal of communications and Information networks.](#)

**SWAYAM/NPTEL/MOOCs:**

1. <https://www.udemy.com/topic/computer-network/>
2. <https://www.coursera.org/courses?query=computer%20network>
3. <https://nptel.ac.in/courses/106/105/106105183/>
4. <https://www.edx.org/learn/computer-networking>

**SELF LEARNING EXERCISES:**

Remote Login. Protocols: TELNET Protocol and SSH Protocol. Electronic Mail (E-Mail), World Wide Web (WWW).

Course Title	Machine Learning				Course Type		Theory	
Course Code	B20CI0502	Credits	3		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>-</b>	<b>50%</b>	<b>50%</b>

#### COURSE OVERVIEW:

Course Description: Machine learning uses interdisciplinary techniques such as statistics, linear algebra, optimization, and computer science to create automated systems that can process through large volumes of data at high speed to make predictions or decisions without human intervention.

#### COURSE OBJECTIVES:

The objectives of this course are to:

1. Explain machine learning and problems relevant to machine learning.
2. Discuss the fundamentals of Decision trees learning and its issues
3. Illustrate neural networks, Bayes classifier and k nearest neighbour for problems appearing in machine learning.
4. Describe statistical analysis of machine learning techniques.

#### COURSE OUTCOMES (COs)

On successful completion of this course; the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Explain the basics of machine learning concepts.	1 to 5	1,2,3
CO2	Implement suitable classification technique for intelligent applications	1 to 5	1,2,3
CO3	Implement clustering algorithms for intelligent applications	1 to 5	1,2,3
CO4	Implement machine learning algorithms for intelligent applications	1 to 5	1,2,3
CO5	Learn new tools and technologies related to machine learning and apply for suitable application development.	10,12	2,3

<b>CO6</b>	Develop solutions using machine learning based algorithms for the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	11,12	2,3

#### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1						√
CO2			√			√
CO3				√		√
CO4				√	√	√
CO5		√		√		
CO6				√	√	

#### COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2	1								3	3	3
CO2	3	2	3	1	2								3	3	3
CO3	3	1	2	1	2								3	3	3
CO4	3	2	2	2	2								3	3	3
CO5	3	3	3	2	2					2		3		2	2
CO6	3	2	2	3	2						3	3		3	3

**Note:**1-Low,2-Medium,3-High

#### COURSE CONTENT:

##### THEORY

Contents
Unit-1: Introduction to Machine Learning: What is Machine Learning, challenges, Applications, methods of Machine Learning, performance metrics, Data preprocessing, Data Loading, Understanding data, Pre-Processing unit

**Unit-2:**

Classification – Decision Tree, K-nearest neighbor, logistic regression, support vector machine algorithm, naive Bayes algorithm, random forest algorithm

**Unit -3:**

Regression - linear regression, Random Forest Regression

Clustering: overview, k – means clustering, mean shift clustering, hierarchical clustering, DBSCAN clustering algorithm.

**Unit – 4**

Introduction to neural networks:

Biological Neuron, ANN Perception, Network Topology (Feed forward network, Feedback Networks), Adjustments of Weights or Learning, Activation Functions, Training Algorithm, Gradient descent algorithms -Batch Gradient Descent, Stochastic Gradient Descent, Mini Batch gradient descent.

**TEXT BOOK:**

1. Tom M. Mitchell, Machine Learning, India Edition McGraw Hill Education, 2013.

**Websites:**

1. [https://www.tutorialspoint.com/machine\\_learning\\_with\\_python/index.htm](https://www.tutorialspoint.com/machine_learning_with_python/index.htm)
2. [https://www.tutorialspoint.com/artificial\\_neural\\_network/index.htm](https://www.tutorialspoint.com/artificial_neural_network/index.htm)

**REFERENCE BOOKS:**

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, “The Elements of Statistical Learning”, 2nd edition, springer series in statistics, 2009.
2. Ethem Alpaydin, “Introduction to machine learning”, second edition, MIT press, 2009.

**JOURNALS/MAGAZINES:**

1. Springer Journal of Machine Learning.
2. International Journal of Machine Learning and Computing.

**SWAYAM/NPTEL/MOOCs:**

1. Coursera – Machine Learning
2. Coursera – Deep Learning
3. [https://onlinecourses.nptel.ac.in/noc19\\_cs53/previe](https://onlinecourses.nptel.ac.in/noc19_cs53/previe)

**SELF-LEARNING EXERCISES:**

Reinforcement Learning: Introduction, Learning Task, Q Learning.

**Website to be referred:**

1. [https://www.tutorialspoint.com/machine\\_learning\\_with\\_python/index.htm](https://www.tutorialspoint.com/machine_learning_with_python/index.htm)
2. [https://www.tutorialspoint.com/artificial\\_neural\\_network/index.htm](https://www.tutorialspoint.com/artificial_neural_network/index.htm)

Course Title	INFORMATION THEORY & CODING				Course Type		Theory	
Course Code	B20EQ0501	Credits	3		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13 weeks/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>0</b>	<b>50%</b>	<b>50%</b>

#### COURSE OVERVIEW:

Course Description: Information is the source of a communication system, whether it is analog or digital. Information theory is a mathematical approach to the study of coding of information along with the quantification, storage, and communication of information.

#### COURSE OBJECTIVE:

The objectives of this course are to:

1. Understand the concept of Entropy, Rate of information and order of the source with reference to dependent and independent source.
2. Study various source encoding algorithms.
3. Model discrete & continuous communication channels.
4. Study various error control coding algorithms.
5. Study various Channel Capacity
6. Study various types of Codes

#### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Explain concept of Dependent & Independent Source, measure of information, Entropy, Rate of Information and Order of a source	1 to 3	1
CO2	Represent the information using Shannon Encoding, Shannon Fano and Huffman codes	1 to 3, 5	2, 3
CO3	Model the continuous and discrete communication channels using input, output and joint probabilities	1 to 3	3
CO4	Determine a code word comprising of the check bits computed using Linear Block codes & convolutional codes	1 to 3, 5	1
CO5	Analyze various channel capacity of Binary Symmetric Channel, Binary Erasure Channel, Muroga's Theorem, Continuous Channels	1 to 3, 5	2
CO6	Evaluate the matrix description of Linear Block Codes	1 to 3,5,12	2,3

#### BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2		√	√		√	
CO3		√	√			
CO4			√	√		
CO5				√		
CO6					√	

**COURSE ARTICULATION MATRIX:**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2										2		
CO2	2	2	3		3									3	2
CO3	2	2	3												2
CO4	2	3	2	3	2									3	
CO5	2	3	2		2									2	
CO6	2	3	2		2							2			2

**Note:** 1-Low, 2-Medium, 3-High

**COURSE CONTENT**

**THEORY:**

Contents
<b>UNIT-1</b>
<b>Information Theory:</b> Introduction, Measure of information, Information content of message, Average Information content of symbols in Long Independent sequences, Average Information content of symbols in Long dependent sequences, Markov Statistical Model of Information Sources, Entropy and Information rate of Markoff Sources
<b>UNIT-2</b>
<b>Source Coding:</b> Source coding theorem, Prefix Codes, Kraft McMillan Inequality property – KMI Encoding of the Source Output, Shannon's Encoding Algorithm Shannon Fano Encoding Algorithm, Huffman codes.

### UNIT-3

**Information Channels:** Communication Channels, Channel Models, Channel Matrix, Joint probability Matrix, System Entropies, Mutual Information, Shannon theorem of Channel Capacity.

**Channel Capacity of:** Binary Symmetric Channel, Binary Erasure Channel, Muroga's Theorem, Continuous Channels

### UNIT-4

**Error Control Coding:** Introduction, Examples of Error control coding, methods of Controlling Errors, Types of Errors, types of Codes, Linear Block Codes: matrix description of Linear Block Codes, Error Detection and Error Correction Capabilities of Linear Block Codes, Table lookup Decoding using Standard Array.

#### TEXT BOOKS:

1. Digital and analog communication systems, K. Sam Shanmugam, John Wiley India Pvt. Ltd, 1996.
2. Digital communication, Simon Haykin, John Wiley India Pvt. Ltd, 2008.
3. Information Theory and Coding, Muralidhar Kulkarni, K.S. Shivaprakasha, Wiley India Pvt. Ltd, 2015, ISBN:978-81-265-5305-1.

#### REFERENCE BOOKS:

1. ITC and Cryptography, Ranjan Bose, TMH, II edition, 2007
2. Principles of digital communication, J. Das, S. K. Mullick, P. K. Chatterjee, Wiley, 1986 - Technology & Engineering
3. Digital Communications – Fundamentals and Applications, Bernard Sklar, Second Edition, Pearson Education, 2016,  
ISBN: 9780134724058.
4. Information Theory and Coding, K.N.Haribhat, D.Ganesh Rao, Cengage Learning, 2017.

#### JOURNALS/MAGAZINES

1. <https://ieeexplore.ieee.org/search/searchresult.jsp?newsearch=true&queryText=information%20theory>
2. <https://www.elsevier.com/catalog/computer-science/computer-science-general/coding-and-information-theory>

#### SWAYAM/NPTEL/MOOCs:

1. <https://nptel.ac.in/courses/108/102/108102117/>
2. <https://www.coursera.org/learn/information-theory#syllabus>

#### SELF-LEARNING EXERCISES:

Information theory is the mathematical treatment of the concept, parameters and rules governing the transmissions of messages through communication systems. Information theory as been most helpful in the design of more efficient telecommunication system.

Course Title	DIGITAL COMMUNICATION (PE-1)				Course Type		Theory	
Course Code	B20EQS0501	Credits	3		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13 weeks / Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>0</b>	<b>50%</b>	<b>50%</b>

#### COURSE OVERVIEW:

**Course Description:** The course focuses on digital transmission and reception, signal space representations, spectral analysis of digitally modulated waveforms, design considerations for band limited channels, introductory concepts of information theory, and error correction coding. The course is intended for graduate/senior undergraduate level students. While the course is intended to serve as introduction to digital communications, the pre-requisites/co-requisites listed are absolutely necessary.

#### COURSE OBJECTIVE

The objectives of this course is to:

1. Demonstrate the limitations of analog communications resources bandwidth and power to appreciate the effective use of such Resources.
2. Discuss the flow and processing of information from the source to various units at the transmitter side.
3. Illustrate the inverse operations at the receiver to facilitate the retrieval of transmitted information.
4. Describe various processing units of a digital communication system.
5. Solve multiplexing, multiple access, and spread spectrum concepts and techniques.
6. Analyze communications links and create system link budgets

#### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the limitations of analog communications resources bandwidth and power to appreciate the effective use of such Resources	1 to 4	1
CO2	Analyze the flow and processing of information from the source to various units at the transmitter side.	1 to 4	1
CO3	Make use of the inverse operations at the receiver to facilitate the retrieval of transmitted information.	1 to 4, 6	1
CO4	Apply the different Channel coding methods for the given real world data.	1 to 4	1, 2
CO5	Solve multiplexing, multiple access, and spread spectrum concepts and techniques	3,4	3
CO6	Analyze communications links and create system link budgets	3,4	3



**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√	√			
CO2				√	√	
CO3			√	√		√
CO4			√		√	
CO5			√	√		
CO6			√	√		

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1									3		
CO2	3	2	2	2									3		
CO3	3	3	3	2		3							3		
CO4	3	3	1	2									3	3	
CO5	1	2	3	3											3
CO6	2	1	3	3	1										3

**Note:** 1-Low, 2-Medium, 3-High

**COURSE CONTENT  
THEORY**

Contents
<b>UNIT-1</b>
<b>Information Theory:</b> Information and entropy, conditional entropy and redundancy, Shannon Fano coding, Mutual Information, Information loss due to noise, source codings - Huffman Code, variable length coding, Source coding to Increase average Information per bit, Lossy source coding.
<b>UNIT-2</b>
<b>Digital Modulation Techniques:</b> Introduction, ASK,ASK Modulator, Coherent ASK Detector, Non-Coherent ASK Detector, FSK, Bandwidth and Frequency Spectrum of FSK. Non coherent FSK Detector, Coherent FSK Detector, FSK Detection Using PLL, BPSK, Coherent PSK Detection, QPSK, Differential PSK.
<b>UNIT-3</b>
<b>Spread Spectrum Modulation Techniques:</b> Use of Spread Spectrum, Direct Sequence Spread Spectrum (DSSS), Code Division Multiple Access, and Ranging using DSSS. Frequency Hopping Spread Spectrum, PN - sequences: Generation and Characteristics. Synchronization in Spread Spectrum Systems
<b>UNIT-4</b>
<b>Channel coding:</b> Waveform Coding, Types of Error control, Structured Sequences, Matrix description of Linear Block Codes, Error detection and error Correction capabilities of linear block codes, Cyclic Codes, Algebraic structure, encoding.

**TEXTBOOKS:**

1. Bernard Sklar, "Digital Communications - Fundamentals and Applications", Pearson Education (Asia) Pvt. Ltd, 2nd Edition, 2014.
2. Herbert Taub. Donald L Schiling, Goutam Sana, "Principles of communication systems", 3rd Edition, McGraw-Hill, 2008.
3. Sam Shanmugam, "Digital and Analog Communicator Systems", John Wiley, 2005.

**REFERENCE BOOKS:**

1. John G. Proakis . Masoud Salehi, "Digital Communications", 5th Edition, McGraw-Hill, 2008.
2. Simon Haykin, "Digital Communication", John Wiley, 2005.
3. Ian A. Glover, Peter M. Grant, "Digital Communications", Edition, Pearson Edu., 2008.
4. B.P. Lathi, "Communication Systems", BS Publication, 2006.

**JOURNALS/MAGAZINES:**

1. Elsevier Journal Digital Communications and Networks.
2. IEEE Transactions on Communications.
3. Journal of Analog and Digital Communications.

**SWAYAM/NPTEL/MOOCs:**

1. <https://www.nptel.ac.in/courses/108/102/108102096>
2. <https://www.coursera.org/.../digital-communication-fgL3y>

**SELF LEARNING EXERCISES:**

Power spectra of digitally modulated signals, Performance comparison of digital modulation schemes, Signal space theory and various modulation schemes.

Course Title	System Software				Course Type		Theory	
Course Code	B20EJS0502	Credits	3		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	3	3	3				

#### COURSE OVERVIEW:

The course provides the architecture of SIC and SIC/XE machine to build the concepts of System Software, function of various system software: assemblers; loaders and linkers, and macro processors.

#### COURSE OBJECTIVE (S):

The objectives of the course are to:

1. Explain basics of system software and differentiate between system software and application software.
2. Describe assemblers design (pass1 and pass2) for the SIC and SIC/XE machine architecture.
3. Illustrate the working of the pass1 and pass2 algorithms of linkers and loaders.
4. Discuss functions and algorithms of macro-processor.

#### COURSE OUTCOMES (COs):

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of different instruction formats and addressing modes of SIC and SIC/XE architectures for implementing arithmetic operations.	1 to6,12	1
CO2	Identify the suitable data structures required to develop various system softwares.	1 to5,12	1
CO3	Develop the programs for the pass1 and pass2 algorithms of linkers and loaders.	1 to5	1,2
CO4	Apply functions and algorithms of macro-processor to process a given macro definition.	1 to5	1,2
CO5	Explain basics of system software and differentiate between system software and application software	1 to5,12	1
CO6	Describe assemblers design (pass1andpass2) for the SIC and SIC/XE machine architecture.	1 to5	1,2

#### BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√	√			
CO2				√	√	
CO3						√
CO4			√			
CO5				√	√	
CO6						√

**COURSE ARTICULATION MATRIX:**

CO#/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2	2	1						1	3		
CO2	2	2	2	2	1							1	3		
CO3	2	2	1	1	1								3	3	
CO4	2	1	1	1	1								3	3	
CO5	2	2	2	2	1							1	3		
CO6	2	2	1	1	1								3	3	

Note:1-Low,2-Medium,3-High

**COURSE CONTENT  
THEORY**

<b>Contents</b>
<b>UNIT-1</b>
<b>Architecture of SIC; SIC\XE: Introduction:</b> system software and machine architecture; Simplified Instructional Computer (SIC) – SIC; SIC/XE machine architecture; SIC and SIC/XE programming examples
<b>UNIT-2</b>
<b>Assemblers:</b> Basic assembler function; a simple SIC assembler; assembler algorithm and data structures; machine dependent assembler features - instruction formats; machine independent assembler features – literals symbol definition statements; expression; program blocks; control sections and programming linking
<b>UNIT-3</b>
<b>Loaders and Linkers:</b> Basic loader functions; design of an absolute loader; a simple bootstrap loader; machine-dependent loader features –relocation; program linking; algorithm and data structures for a linking loader; machine-independent loader features - automatic library search; loader options
<b>UNIT-4</b>
<b>Macro Processor:</b> Basic macro processor functions; macro definitions and expansion; macro processor algorithm and data structures; machine- independent macro processor features - concatenation of macro parameters; generation of unique labels; conditional macro expansion; keyword macro parameters

**TEXT BOOKS:**

- 1.Leland L Beck, “System Software”, 3rd Edition, Pearson Education, 2002.
- 2.Alfred V. Aho, “Compilers: Principles, Techniques and Tools”, Pearson, 2nd Edition, 2013.

**REFERENCES BOOKS:**

1. H. Dave, “Compilers: Principles and Practice”, Pearson, 1st Edition, 2012
2. Elsevier Journal of Systems and Software.
3. IEEE Transactions on Software Engineering

**JOURNALS/MAGAZINES;**

1. [https://www.researchgate.net/publication/328956597\\_THE\\_IMPACT\\_OF\\_ACCOUNTING\\_SOFTWARE\\_ON\\_B  
USINESS\\_PERFORMANCE](https://www.researchgate.net/publication/328956597_THE_IMPACT_OF_ACCOUNTING_SOFTWARE_ON_BUSINESS_PERFORMANCE)
2. <https://www.bioss.ac.uk/people/chris/app.pdf>
3. Elsevier Journal of Systems and Software.
4. IEEE Transactions on Software Engineering

**SWAYAM/NPTEL/MOOCs:**

1. <https://www.coursera.org/learn/cloud-sys-software>
2. <https://www.ucdenver.edu/offices/office-of-information-technology/software/how-do-i-use/coursera>

**SELF LEARNING EXERCISES:**

Design of a micro preprocessor, Peep whole optimizer and Compile and GO loader.

Course Title	Mobile Application Development (PE-1)				Course Type		Theory	
Course Code	B20EJS0503	Credits	3		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	3	3	3				

#### COURSE OVERVIEW:

This course introduces programming technologies, design and development tools related to mobile applications. Topics include accessing device capabilities, industry standards, operating systems, and programming for mobile applications using OS Software Development Kit (SDK).

#### COURSE OBJECTIVE (S):

1. Discuss mobile application models/architectures and patterns for development of a mobile software application
2. Demonstrate the installation of software and tools required for development of android applications.
3. Illustrate the use of fundamentals of android with graphics and animation APIs.
4. Describe an application with multimedia concepts of audio, video with entertainment services.

#### COURSE OUT COMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of Android features to develop real world application.	1 to6,9,10	1
CO2	Design a suitable user interface and database for the given real world application.	1 to6,9,10,12	3
CO3	Choose the intrinsic controls required for the development of real world applications.	2 to5,9,10,11	1,2
CO4	Develop Android Services for multimedia, camera and location based activities.	1 to6,9,10,11	2,3
CO5	Discuss mobile application models/ architectures and patterns for development of a mobile software application	1 to6,9,10,12	3
CO6	Demonstrate the installation of software and tools required for development of android applications	1 to6,9,10,11	2,3

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2					√	√
CO3				√		
CO4			√			√
CO5			√			
CO6		√	√			

**COURSE ARTICULATION MATRIX:**

CO#/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	1				2	2			3		
CO2	2	3	2	3	2				3	2		2			3
CO3		2	3	1					3	1			3	3	
CO4	3	3	2	2	1				2	2				3	3
CO5	2	3	2	3	2				3	2		2			3
CO6	3	3	2	2	1				2	2				3	3

Note:1-Low,2-Medium,3-High

## COURSE CONTENT THEORY

Contents
<b>UNIT-1</b> <b>Introduction to mobile communication and computing:</b> Introduction to mobile computing, Novel applications, limitations and GSM architecture, Mobile services, System architecture, Radio interface, protocols, Handover and security, Smart phone operating systems and smart phones applications.
<b>UNIT-2</b> <b>Fundamentals of Android Application Development:</b> Introduction to Android., The Android Jellybean SDK, Understanding the Android Software Stack, Installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text View Control, Using the Android Emulator.
<b>UNIT-3</b> <b>Layouts, Menus and Graphics in Android:</b> Menus: Options menu and app bar, Context menu and contextual action mode ,Popup menu, defining a Menu in XML, Creating an Options Menu, Changing menu items at runtime, Creating Contextual Menus, Creating Menu Groups, Adding Menu Items Based on an Intent, Activity, Service, Broadcast Receiver and Content Provider. Building Blocks for Android Application Design, Laying Out Controls in Containers. Graphics and Animation: Drawing graphics in Android, Creating Animation with Android's Graphics API.
<b>UNIT-4</b> <b>Creating the Activity, Working with views:</b> Exploring common views, using a list view, creating custom views, understanding layout. Using Selection Widgets and Debugging Displaying and Fetching Information Using Dialogs and Fragments. Multimedia: Playing Audio, Playing Video and Capturing Media. Advanced Android Programming: Internet, Entertainment, and Services.

### TEXT BOOKS:

1. Bill Phillips, Chris Stewart, and Kristin Marsican, "Android Programming: The Big Nerd Ranch Guide", Pearson Technology group,3rd Edition,2015.
2. Barry Burd, "Android Application Development All-in-One For Dummies", Wiley Publisher,2nd Edition, 2012.
3. ZigurdMednieks, Laird Dornin, G. Blake Meike, Masumi Nakamura,"Programming Android: Java Programming for the
4. New Generation of Mobile Devices", Oiley,2nd Edition,2012.

### REFERENCE BOOKS:

1. Greg Nudelman, "Android Design Patterns: Interaction Design Solutions for Developer", Wiley, 2013.
2. Jason Tyler, "App Inventor for Android: Build Your Own Apps No Experience Required", Wiley,2011.
3. J.F. Dimarzio, "Android programming with Android studio", wrox,4th edition ,2017
4. 4.Maurice Sharp Erica Sadun Rod Strougo, "Learning iOS Development-A Hands-on Guide to the Fundamentals of iOS
5. Programming", Addison Wesley by Pearson Education, Inc.2014. .Wei-Meng Lee, "Beginning Swift Programming", Wiley India Pvt. Ltd.,2018.

### JOURNALS/MAGAZINES:

1. [https://www.researchgate.net/publication/303370028\\_A\\_Review\\_Paper\\_on\\_Cross\\_Platform\\_Mobile\\_Application\\_Development\\_IDE](https://www.researchgate.net/publication/303370028_A_Review_Paper_on_Cross_Platform_Mobile_Application_Development_IDE)
2. [igi-global.com/journal/international-journal-mobile-computing-multimedia/1102](http://igi-global.com/journal/international-journal-mobile-computing-multimedia/1102)
3. [https://www.researchgate.net/publication/339602524\\_Framework\\_for\\_Developing\\_Secure\\_Converged\\_Web\\_and\\_Mobile\\_Applications](https://www.researchgate.net/publication/339602524_Framework_for_Developing_Secure_Converged_Web_and_Mobile_Applications)

**SELF LEARNING EXERCISES:** More Recent Applications: Multimedia;2D graphics ; networking support in Android, Introduction to IoS, App. Development



Course Title	Human Computer Interaction(PE-1)				Course Type		Theory	
Course Code	B20EJS0504	Credits	3		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	3	3	3	39	0	50%	50%

#### COURSE OVERVIEW:

This course presents the foundations of Human Computer Interaction (HCI). The contents are structured into phases comprising: Basic definitions and motivations of HCI, interaction paradigms, design principles and models, User-centred design methods comprising user studies, design approaches for interfaces and interaction, evaluation methods and techniques for data analysis, Research frontiers of HCI, including accessibility, universal design, and pervasive computing (ubiquitous, mobile and wearable computing).

#### COURSE OBJECTIVE (S):

The overall objective of the Course is as follows:

3. Explain the capabilities of both humans and computers from the viewpoint of human information processing.
4. Describe typical human-computer interaction (HCI) models and styles, as well as various HCI paradigms.
2. Demonstrate the use of an interactive design process and universal design principles in designing HCI systems.
3. Illustrate the use of different evaluation methods.

#### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the suitable positioning and pointing device to be used to work with the given application.	1 to5	1
CO2	Develop the user interface by Selecting an effective style for the given real world applications.	1 to5	2
CO3	Make use of different UI design rules to develop a user interface for a real-world application.	1 to5	3
CO4	Compare the different evaluation techniques used to measure the quality of User Interface.	1 to5	1
CO5	Demonstrate the use of an interactive design process and universal design principles in designing HCI systems	1 to5	2
CO6	Illustrate the use of different evaluation methods	1 to5	3

**BLOOM'S LEVEL OF THE COURSE OUTCOMES:**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2			√	√		√
CO3			√			
CO4				√	√	
CO5			√	√		√
CO6			√			

**COURSE ARTICULATION MATRIX:**

CO#/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	3	3	3	1	2								3		
CO2	3	2	1	1	2									3	
CO3	3	2	2	3	1								3		3
CO4	2	3	3	2	2								3		
CO5	3	2	1	1	2									3	
CO6	3	2	2	3	1								3		3

Note:1-Low,2-Medium,3-High

**COURSE CONTENT  
THEORY**

Contents
<b>UNIT-1</b> <b>Introduction to Human and the Computer:</b> Human: Input-output channels, Human memory, Thinking: reasoning and problem solving, Emotion, Individual differences, Psychology and the design of interactive systems. The computer: Positioning, pointing and drawing, Display devices, Devices for virtual reality and 3D interaction, Physical controls, sensors and special devices, Paper: printing and scanning, Memory, Processing and networks.
<b>UNIT-2</b> <b>The interaction and Paradigms:</b> Models of interaction, Frameworks and HCI, Ergonomics, Interaction styles, Elements of the WIMP interface, Interactivity, The context of the interaction. <b>Paradigms:</b> Paradigms for interaction. Interaction design basics: The process of design, User focus, Scenarios, Navigation design, Screen design and layout, Iteration and prototyping.
<b>UNIT-3</b> <b>HCI in the software process and Design rules:</b> The software life cycle, Usability engineering, Iterative design and prototyping. Principles to support usability, Standards, Guidelines, Golden rules and heuristics, HCI patterns. Universal designs.
<b>UNIT-4</b> <b>Evaluation techniques:</b> Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, choosing an evaluation method.

**TEXT BOOKS:**

1. Dix, Janet Finlay, Gregory Abowd & Russell Beale, "Human-Computer Interaction", 3rd Edition. Prentice Hall, 2004.
2. Julie A. Jacko, "Human-Computer Interaction Handbook", 3rd Edition, CRC Press, 2012.
3. Ben Shneiderman, Catherine Plaisant, "Designing the User Interface", 6th Edition, Addison Wesley, 2017.

**REFERENCE BOOKS:**

1. Jonathan Lazar, Jinjuan Heidi Feng, & Harry Hochheiser, "Research Methods in Human- Computer Interaction", Wiley, Second edition, 2010

**JOURNALS/MAGAZINES:**

1. ACM, International Journal of Human-Computer Studies, 2003.
2. IEEE, Transactions on Human-Machine Systems, 2014
3. Elsevier, International Journal of Human-Computer Studies. 2005.

**SELF LEARNING EXERCISES:**

Designing user support systems, Ubiquitous computing applications research, Hypertext, multimedia and the World Wide Web.

Course Title	DATA MINING (PE-I)				Course Type		Theory	
Course Code	B20EQS0505	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13 weeks / Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	3	3	3	39	0	50%	50%

#### COURSE OVERVIEW:

This course will cover the major techniques for mining and analyzing text data to discover interesting patterns, extract useful knowledge, and support decision making, with an emphasis on statistical approaches that can be generally applied to arbitrary text data in any natural language with no or minimum human effort. Detailed analysis of text data requires understanding of natural language text, which is known to be a difficult task for computers. This course focuses on extracting knowledge from the web by applying Machine Learning techniques for classification and clustering of hypertext documents. Basic approaches from the area of Information Retrieval and text analysis are also discussed. The students use recent Machine Learning and Data Mining software to implement practical applications for web document retrieval, classification and clustering.

#### COURSE OBJECTIVES

1. Introduce the basics of data mining, data types, similarity and dissimilarity measures
2. Explain association rules and algorithms
3. Describe the classification algorithms for data categorization
4. Illustrate the clustering algorithms for grouping datasets
5. Demonstrate the appropriate data mining techniques for decision making

#### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Explain the basics of data mining techniques, data types, identify the similarity and dissimilarity between the datasets and analyze the data sets using the association rules and algorithms	1,2,4,6,11,12	1,2
CO2	Characterize and discriminate data sets with classification methods	1-7	2
CO3	Employ the clustering methods in real life problems	1-7	2,3
CO4	Apply the knowledge for data mining applications	1-7,12	2,3
CO5	Learn new tools and technologies in the Data Mining and apply for suitable application development.	12	2,3
CO6	Develop solutions in the Data Mining to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5,9,10	2,3

## BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2		√	√	√		
CO3			√	√		
CO4			√		√	
CO5		√	√	√		
CO6			√	√	√	

## COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2		1		1					2	1	2	3	
CO2	3	3	2	2	3	2	1						3	3	
CO3	3	2	3	2	3	2	3							3	3
CO4	3	2	3	2	3	1	1					2		3	3
CO5												3			
CO6					3				3	3					

Note: 1-Low, 2-Medium, 3-High

## COURSE CONTENT THEORY

Contents
<p style="text-align: center;"><b>UNIT-1</b></p> <p><b>Introduction:</b> What is Data Mining? Motivating Challenges, The origins of data mining, Data Mining Tasks, Types of Data, Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity, Data Mining Applications, Visualization.</p>
<p style="text-align: center;"><b>UNIT-2</b></p> <p><b>Association Analysis:</b> Basic Concepts and Algorithms, Frequent Itemset Generation, Rule Generation, Compact Representation of Frequent Itemsets, Alternative methods for generating Frequent Itemsets, FP GROWTH Algorithm, Evaluation of Association Patterns .</p>
<p style="text-align: center;"><b>UNIT-3</b></p> <p><b>Classification:</b> Basics, General approach to solve classification problem, Decision Trees, Evaluating the performance of a Classifier, Rule Based Classifiers, Nearest Neighbour Classifiers, Naïve Bayes Classifier</p>
<p style="text-align: center;"><b>UNIT-4</b></p> <p><b>Clustering:</b> overview, K-means, agglomerative hierarchical clustering, DBSCAN, Cluster Evaluation, Characteristics of Data, Clusters and Clustering Algorithms, Prototype Based Clustering.</p>

**TEXT BOOKS:**

1. A Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", Pearson Education ,2007.
2. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques" Second Edition, Elsevier, Reprinted 2008.

**REFERENCE BOOKS:**

1. K.P.Soman, Shyam Diwakar and V.Ajay, "In sight in to Data mining Theory and Practice" ,Easter Economy Edition, Prentice Hall of India,2006.
2. G.K.Gupta, "Introduction to Data Mining with Case Studies" ,Easter Economy Edition, Prentice Hall of India,2006.

**JOURNALS/MAGAZINES:**

1. Data Mining and Knowledge Science – Springer.
2. Inter science, The International Journal of Data Mining, Modelling and Management-
3. IEEE, IEEE Transactions on Knowledge and Data Engineering.

**SWAYAM/NPTEL/MOOCs:**

1. <https://www.linguamatics.com/what-text-mining-text-analytics-and-natural-language-processing>
2. <https://www.coursera.org/learn/text-mining>
3. <https://www.ibm.com/cloud/learn/text-mining>

**SELF LEARNING EXERCISES:**

1. <https://www.linguamatics.com/what-text-mining-text-analytics-and-natural-language-processing>
2. <https://www.coursera.org/learn/text-mining>
3. <https://www.ibm.com/cloud/learn/text-mining>

Course Title	INTRODUCTION TO ARTIFICIAL INTELLIGENCE (OE-1)				Course Type			
Course Code	B20CIO501	Credits	3		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13 weeks / Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>0</b>	<b>50%</b>	<b>50%</b>

#### COURSE OVERVIEW:

**Course Description:** This course introduces the basics of Artificial Intelligence (AI), AI problems and search strategies. The students can explore knowledge representation issues and methods. This course provides planning methods, for problem solving and controlling the knowledge and also demonstrates various learning methods for constructing knowledge and taking decisions.

#### COURSE OBJECTIVE:

The objectives of this course are to:

1. Discuss the basics of Artificial Intelligence (AI).
2. Illustrate knowledge representation issues and methods
3. Explain planning methods/algorithms in problem solving
4. Describe the concepts of intelligent agent in a specific environment.
5. Learn new tools and technologies in the artificial intelligence development and apply for suitable solutions for application development
6. Analyse solutions using AI to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation

#### COURSE OUTCOMES (COs)

On successful completion of this course; the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Solve AI problems using AI search strategies and production system.	1 to 6	2
CO2	Represent knowledge using logic and apply reasoning methods for the given real world problem.	1 to 6	1
CO3	Make use of planning and probability to solve uncertainty problems.	1 to 6	1
CO4	Develop an intelligent agent in a specific environment to solve real world problems.	1 to 6	1,2
CO5	Learn new tools and technologies in the artificial intelligence development and apply for suitable solutions for application development	12	1
CO6	Analyse solutions using AI to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation	5,9,10	1

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√		√		√
CO2			√		√	√
CO3		√		√	√	
CO4	√	√	√	√	√	√
CO5		√				
CO6				√		

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	1	3	3								3	
CO2	3	3	3	2	3	3							3		
CO3	3	2	3	3	3	3							3		
CO4	3	2	2	2	2	3								3	3
CO5	2	2	3	2	3	2							3		
CO6	2	3	2	3	2	3							3		

**Note:** 1-Low, 2-Medium, 3-High



## COURSE CONTENT

### THEORY

Contents
<b>Unit – 1</b>
<b>Problems and search:</b> What is AI, AI Problems; AI Techniques; Problem Space and Problem Search techniques; Defining the problem as a state space search, production systems; Problem characteristics, production system characteristics, Issues in the design of search programs; Heuristic search techniques, generate-and-test; Hill climbing, BFS, DFS; Problem reduction; Constraint satisfaction
<b>Unit -2</b>
<b>Knowledge Representation:</b> Knowledge representation Issues, representations and mappings; Approaches to knowledge representation; Issues in knowledge representation; Using Predicate logic: Representing simple facts in logic; Representing Instance and ISA relationships; Computable functions and predicates; Representing Knowledge using Rules; Procedural versus declarative knowledge; Resolution Forward versus backward reasoning; Matching
<b>Unit – 3</b>
<b>Planning:</b> A simple planning agent; Representations for planning; A partial-order planning example; A partial-order planning algorithm; Planning with partially Instantiated operators; Knowledge Engineering for planning; Uncertainty: Sources of Uncertainty; Probability Theory, Issues with Probability; Advantages & Disadvantages of Bayesian Network
<b>Unit – 4</b>
<b>Intelligent Agents:</b> Introduction, How Agent should Act, Structure of Intelligent Agents, Agents and environments, Rationality, PEAS (Performance measure, Environment, Actuators, Sensors), Environment types, Agent types. Environments.

### TEXT BOOKS:

1. Russell & Norvig, "Artificial Intelligence: A Modern Approach", Third Edition, Prentice-Hall, 2010.
2. Elaine Rich, Kevin Knight, "Artificial Intelligence", 3<sup>rd</sup> edition, TataMcgraw Hill, 2009.

### REFERENCE BOOKS:

1. Nils J. Nilsson, "Principles of Artificial Intelligence", Elsevier, 1980.
2. Krishan Mehrotra, Chilkuri K. Mohan, Sanjay Ranka, "Artificial Neural Networks", Penram International Publishing, 1997.
3. B. Yegnanarayana, "Artificial Neural Networks", PHI, 2001.

### JOURNALS/MAGAZINES

1. ACM, ACM transaction on Multi-Agent System.
2. IEEE, IEEE transaction for computational Intelligence.
3. Springer, Springer transaction for security based intelligent systems.

### SWAYAM/NPTEL/MOOCs:

1. <https://medium.com/javarevisited/10-best-udemy-and-coursera-courses-to-learn-artificial-intelligence-in-2020-ec77ad13bdc1>
2. <https://medium.com/javarevisited/10-best-udemy-and-coursera-courses-to-learn-artificial-intelligence-in-2020-ec77ad13bdc1>
3. <https://javarevisited.blogspot.com/2020/08/top-10-coursera-courses-and-certification-for-artificial-intelligence-and-machine-learning.html#axzz6jQ05pXOG>

### SELF-LEARNING EXERCISES:

1. Prolog programming language for artificial intelligence.
2. Multi-Agent Systems and Agent Communication for distributed problem solving which is performed by agents working together towards a solution of a common problem.

Course Title	OOPS USING C++ (OE-1)				Course Type		Theory	
Course Code	B20CIO502	Credits	3		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>0</b>	<b>50%</b>	<b>50%</b>

#### COURSE OVERVIEW:

This course introduces the basic concepts of object oriented programming. Familiarizes with object creation and accessing members of object. OOPs concepts such as data abstraction, information hiding (Encapsulation), overloading operations, inheritance mechanisms, virtual functions, friend functions and are discussed. File/I/O operations, Templates and exception handling mechanisms are also introduce

#### COURSE OBJECTIVE

The objectives of this course are to:

1. Explain the basic concepts of objects and classes for a real world application.
2. Illustrate the use of operator overloading/function overloading for given applications.
3. Demonstrate the use of inheritance in real world applications.
4. Describe I/O streams and Templates and Exception Handling
5. Learn new tools and technologies in the concepts of object oriented programming and apply for suitable solutions for application development.
6. Develop solutions using concepts of object oriented programming to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation

#### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply the basic concepts of objects and classes for a real world application	2,3,7,11	1,2
CO2	Develop applications by implementing operator overloading and function overloading.	2,3,4,5	2,3
CO3	Make use Inheritance feature of OOPs to develop a real world application	1-4,8,9,11	2
CO4	Build the real world application using exception handling and templates	1-4,11,12	2
CO5	Learn new tools and technologies in the concepts of object oriented programming and apply for suitable solutions for application development.	5	1
CO6	Develop solutions using concepts of object oriented programming to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation	5,9,10	1

#### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2	√	√				
CO3		√	√			
CO4		√	√	√		√
CO5	√	√	√			
CO6	√	√				√

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2	1				1				1		2	2	
CO2		2	3	1	1									3	1
CO3	1	2	1	2				3	1		1			2	
CO4	1	2	3	1							1	1		2	
CO4	1												1	2	
CO4			2												1

**Note:** 1-Low, 2-Medium, 3-High

**COURSE CONTENT THEORY**

**TEXT BOOKS:**

1.

<b>Contents</b>	
<b>UNIT-1</b>	
<b>Introduction:</b> Introduction to object oriented concepts: Encapsulation, Abstraction, Inheritance, Polymorphism, Overview of OOP, Introduction to object oriented modelling, Introduction to variables in C++, I/O operators, Function overloading, Inline function, Recursive function.	
<b>Classes &amp; Objects:</b> Introduction to Classes, Member Functions and Member data, Constructors and Destructors, Static Class members.	
<b>UNIT-2</b>	
<b>Operator overloading:</b> Introduction to Objects, Array of Objects, Dynamic Objects, Pointers to objects, Friend Function, Access specifiers. The scope resolution operator, Generic functions and classes, Operator overloading using Friend function: Unary operator '+' & binary operator, Copy constructor.	
<b>UNIT-3</b>	
<b>Inheritance:</b> Base Class, Inheritance and Protected members, inheriting multiple base classes, Constructors, Destructors and Inheritance, Virtual base classes. Virtual functions and Polymorphism: Virtual functions, pure virtual functions, Early and late binding.	
<b>UNIT-4</b>	
<b>Templates and Exception handling:</b> Template Functions, Template Classes, Fundamentals of Exception handling, handling derived class exceptions.	

HerbertSchildt, "The Complete Reference C++", 4th Edition, Tata McGraw Hill, 2003.

2. SanleyB.Lippmann, JoseeLajore, "C++ Primer", 4th Edition, Pearson Education, 2005.

**REFERENCE BOOKS:**

1. Paul J Deitel, Harvey M Deitel, "C++ for Programmers", Pearson Education, 2009.
2. K R Venugopal, RajkumarBuyya, T Ravi Shankar, "Mastering C++", Tata McGraw Hill, 1999.

**JOURNALS/MAGAZINES:**

1. ACM, ACM Transactions on Programming Languages and Systems(TOPLAS).
2. ACM Journal on Object-Oriented Programming

**SWAYAM/NPTEL/MOOCs:**

1. <https://www.coursera.org/specializations/object-oriented-programming>
2. <https://www.coursera.org/lecture/writing-running-fixing-code/introduction-to-the-programming-environment-sXizU>
3. <https://www.coursera.org/learn/object-oriented-design>

**SELF LEARNING EXERCISES:**

I/O System Basics, File I/O: C++ stream classes, Formatted I/O, <fstream> and File classes.

Course Title	WEB TECHNOLOGY (OE-1)				Course Type		Theory	
Course Code	B20CIO503	Credits	3		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>0</b>	<b>50%</b>	<b>50%</b>

#### COURSE OVERVIEW:

This course covers features of HTML 5 and CSS 3, controls and web services of ASP.Net and database access with MYSQL, basics of AngularJS, basics of AJAX and JQuery AJAX library, basics of Ruby, controls and RESTful web services. These concepts are used in the development of Client-Server technology.

#### COURSE OBJECTIVE

The objectives of this course are to:

- Understand the various steps in designing a creative and dynamic website.
- Describe the hierarchy of objects in HTML and XML.
- Design dynamic and interactive web pages by embedding Java Script code in HTML.
- Illustrate the advantages and use of different types of CSS.
- Examine the HTML. Know how to use Dynamic HTML.
- Familiarize server side scripting language like Perl & PHP.

#### COURSE OUTCOMES (COs)

CO#	Course Outcomes	POs	PSOs
CO1	Describe the concepts of WWW including browser and HTTP protocol and summarize the various HTML tags and use them to develop the user friendly web pages.	2,3,7,11	1,2
CO2	Define the CSS with its types and use them to provide the styles to the web pages at various levels.	2-5	2,3
CO3	Develop the modern web pages using the HTML and CSS features with different layouts as per need of applications.	1,4,8,9,11	2
CO4	Apply JavaScript to develop the dynamic web pages and use server side scripting with PHP to generate the web pages dynamically using the database connectivity.	1-4,11,12	2,3
CO5	Learn new tools and technologies in web technology and apply for suitable solutions for application development.	5	2
CO6	Develop solutions in web technology the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5,9,10	1

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2		√	√	√		
CO3			√			
CO4			√	√	√	
CO5		√				
CO6						√

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2	1				1				1		2	2	
CO2		2	3	1	1									3	1
CO3	1	2	1	2				3	1		1			2	
CO4	1	2	3	1							1	1		2	1
CO5	1	2	3	2	3	2							1		1
CO6	1	2	3	3	2	2								1	2

**COURSE CONTENT  
THEORY**

**TEXT  
BOOKS:**

**Contents**

**UNIT-1**

Web Essentials: Clients, Servers, and Communication. The Internet-Basic Internet Protocols -The World Wide Web-HTTP request message-response message-Web Clients Web Servers-Case Study. Markup Languages: XHTML. An Introduction to HTML History-Versions-Basic XHTML Syntax and Semantics- Some Fundamental HTML Elements-Relative URLs-Lists-tables-Frames-Forms-XML Creating HTML Documents. Representing Web Data: XML-Documents and Vocabularies-Versions and Declaration - Namespaces JavaScript and XML

**UNIT-2**

Style Sheets: Lists, Tables, Forms, Frames CSS: Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The <span>and <div>tags, Conflict resolution.  
Javascript: Overview of Javascript, Object orientation and Javascript, Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructors.

**UNIT-3**

Perl, CGI Programming: Origins and uses of Perl, Scalars and their operations, Assignment statements and simple input and output, Control statements, Fundamentals of arrays, Hashes, References, Functions, Pattern matching. File input and output; Examples. The Common Gateway Interface; CGI linkage; Query string format; CGI.pm module; Cookies. Database access with Perl and MySQL

**UNIT-4**

Introduction and basic syntax of PHP, decision and looping with examples, PHP and HTML, Arrays, functions, Browser control and detection, string, Form processing, Files, Advance Features: Cookies and Sessions, Object Oriented Programming with PHP. PHP and MySQL: Basic commands with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables.

1. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education.
2. Jeffrey C.Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006. 2007.

**REFERENCE BOOKS:**

1. Deitel, Deitel, Goldberg, "Internet & World Wide Web How to Program", Third Edition, Pearson Education, 2006.
2. Marty Hall and Larry Brown, "Core Web Programming" Second Edition, Volume I and II,
3. Pearson Education, 2001.
4. Bates, "Developing Web Applications", Wiley, 2006.

**JOURNALS/MAGAZINES:**

1. International Journal of Web Technology- ISSN:2278-2389
2. International Journal of Web & Semantic Technology (IJWesT)
3. ELSEVIER Journals within "Internet and Web Technology"

**SWAYAM/NPTEL/MOOCs:**

1. [https://onlinecourses.swayam2.ac.in/nou20\\_cs05/preview](https://onlinecourses.swayam2.ac.in/nou20_cs05/preview)
2. <https://nptel.ac.in/courses/106/105/106105084/>

**SELF LEARNING EXERCISES:**

The student is expected to study more about the following topics: Rails and Angular JS.

Course Title	Web Technologies and Applications Lab				Course Type		Theory	
Course Code	B20EJ0504	Credits	1		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	1	2	2				

#### COURSE OVERVIEW:

The basics of Web application tools such as HTML, XHTML and CSS are introduced. The course also provides knowledge about advanced research topics such as XML, Perl and PHP.

#### COURSE OBJECTIVE(S):

The objectives of this course are to:

1. Understand the various steps in designing a creative and dynamic website.
2. Describe the hierarchy of objects in HTML and XML.
3. Design dynamic and interactive web pages by embedding Java Script code in HTML.
4. Illustrate the advantages and use of different types of CSS.
5. Examine the HTML. Know how to use Dynamic HTML.
6. Familiarize server side scripting language like Perl & PHP.

#### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Describe the concepts of WWW including browser and HTTP protocol and summarize the various HTML tags and use them to develop the user- friendly web pages.	2,3,7,11	1,2
CO2	Define the CSS with its types and use them to provide the styles to the web pages at various levels.	2-5	2,3
CO3	Develop the modern web pages using the HTML and CSS features with different layouts as per need of applications.	1,4,8,9,11	2,3
CO4	Apply Java Script to develop the dynamic web pages and use server side Scripting with PHP to generate the web pages dynamically using the database connectivity.	1-4,11,12	2,3
CO5	Examine the HTML. Know how to use Dynamic HTML.	2,3,4,5	2,3
CO6	Familiarize server side scripting language like Perl & PHP.	2-5	1,2



**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2		√	√	√		
CO3			√			
CO4			√	√	√	
CO5		√	√	√	√	
CO6		√	√	√	√	

**COURSE ARTICULATION MATRIX**

CO#/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2	1				1				1		2	2	
CO2		2	3	1	1									3	1
CO3	1	2	1	2				3	1		1			2	1
CO4	1	2	3	1							1	1		2	1
CO5		2	2	3	1									2	2
CO6		1	2	3	1								1	2	

Note:1-Low,2-Medium,3-High

Practice:

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
1.	<p>In today's digital world, information dissemination through printed documents consumes lot of time. To overcome this drawback, it is better to adopt digital technology for information dissemination, like e-journals, e-books, e-advertisements, etc. Information dissemination through Internet in the form of web content is essential and convenient option. Design and develop static web pages for an online Book store. The pages should resemble like www.amazon.com The website should consist of. Home page, Registration &amp; Login, User profile page, Books catalogue, Shopping cart, Payment by credit card, and order confirmation.</p>		
2.	<p>Internet or online services works on clients and server model. A client is a web browser through which users make requests, which contain input required, for service from the server to perform tasks. Server is a program running on a dedicated computer. Performance of any service or server depends on its throughput. Server throughput deteriorates when users send more and more invalid requests for service and thus results in wastage of server resources that are very precious. As a solution to this problem design a web page that takes student details such as Name, branch, Semester, University, date of admission, mobile number, email id and check for validity or correctness of the input data by writing a JavaScript to validate these fields.</p>		
3.	<p>Clients interact with servers by sending service requests that contain input required to complete the requested task or service. Input required for requested service may be collected through a web page, that acts as an interface between users and the server, in the form of text fields, text areas, radio buttons, push buttons and so on. Hence it is better to instruct or help clients to input correct data through web page by displaying appropriate error messages or alerts as and when users supply wrong input using event handlers. To demonstrate this task, design and develop a web page using JavaScript, XHTML that collects the SRN (Valid format is: Any letter followed by two digits, followed by two letters then followed by three digits). Include event handler for the form elements that collects information to validate the input. Messages must be produced in the alert windows as and when errors are detected.</p>		
4.	<p>Dynamic web content is the information that is retrieved from one or more web servers depending upon what information client have requested for, and composed in response to users' requests. Advanced web technologies play a vital role in storage, processing and retrieval of dynamic web content from web servers. Hence it is important to use advanced web technologies such as XML to improve the efficiency in data retrieval. Create and save XML document for students information and display the same using cascaded style sheet.</p>		

5.	<p>Information technology has become part and parcel of humanity to such an extent that people can shop anything online, from anywhere, at any time using an electronic device that has access to Internet. This has brought in the concept of virtual stores which provide products at less cost. To improve sales it is mandatory to organize items catalog based on item name, item price, and manufacturer so on. For such online shopping sites, look and feel is an obvious requirement which can be achieved using CSS &amp; XSLT. Design a document using CSS and XSLT to create a catalog of items for an online electronic shopping.</p>		
6.	<p>In any business organization, employees keep traveling across different geographical locations and at the same time they want to be connected to their organization's computing resources such as email server, database server, file server, etc. to retrieve information such as sales details, assigning tasks to employees, and upload inspection site details, so on. Using PHP develop a web page that accepts book information such as ISBN number, title, authors, edition and publisher and store information submitted through web page in MySQL database. Design another web page to search for a book based on book title specified by the user and displays the search results with proper headings.</p>		
7.	<p>Using computers without graphical user interfaces require the knowledge about syntax of computer commands and programming languages, also this makes users to feel that the use of computers is difficult and cumbersome. This impression of users on computers can be changed by providing good and easy-to-use graphical user interfaces which play vital role in use of computer applications or software without worrying about syntax of programming languages or computer commands. In fact computer software with good and easy-to-use graphical user interfaces will have large number of users. a) Design HTML page that takes UNIX command as input in a text field and submit it to a Perl program that executes given command and display the output on the web page b) Write a Perl program to keep track of the number of visitors to a web page and display the count of visitors with proper headings.</p>		
8.	<p>Databases are the storage systems used by most of the business and information technology enterprises as back end. When users generate data using GUI, for ex. personal information, data are sent to back end database for storage and also users can retrieve this data as and when required from the back end (database) to the front GUI. In the real world there are several databases such as Oracle, DB2, MySQL, SQL Server, MS-Access, DBMongo, etc. To illustrate the process of generating data from the front end and store it on back end database then retrieve the available data from the back end database, write a Perl program to read personal information of a person such as first name, last name, age, permanent address and pin code entered by the user into a table created in MySQL. Read the same information from the database and display on the front end.</p>		
9.	<p>Write a PHP program to store current date-time in a COOKIE and display the 'Last visited on' date-time on the web page upon reopening of the same page.</p>		

Course Title		Machine Learning Lab			Course Type		Practical	
Course Code	B20CI0505	Credits	1		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>1</b>	<b>2</b>	<b>2</b>	-	<b>26</b>	<b>50%</b>	<b>50%</b>

#### COURSE OVERVIEW:

Course Description: Machine learning uses interdisciplinary techniques such as statistics, linear algebra, optimization, and computer science to create automated systems that can process through large volumes of data at high speed to make predictions or decisions without human intervention.

#### COURSE OBJECTIVES:

The objectives of this course are to:

1. Explain machine learning and problems relevant to machine learning.
2. Discuss the fundamentals of Decision trees learning and its issues
3. Illustrate neural networks, Bayes classifier and k nearest neighbour for problems appearing in machine learning.
4. Describe statistical analysis of machine learning techniques.

#### COURSE OUTCOMES (COs)

On successful completion of this course; the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Explain the basics of machine learning concepts.	1 to 5	1,2,3
CO2	Implement suitable classification technique for intelligent applications	1 to 5	1,2,3
CO3	Implement clustering algorithms for intelligent applications	1 to 5	1,2,3
CO4	Implement machine learning algorithms for intelligent applications	1 to 5	1,2,3
CO5	Learn new tools and technologies related to machine learning and apply for suitable application development.	10,12	2,3

<b>CO6</b>	Develop solutions using machine learning based algorithms for the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	11,12	2,3
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**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1						√
CO2			√			√
CO3				√		√
CO4				√	√	√
CO5		√		√		
CO6				√	√	

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2	1								3	3	3
CO2	3	2	3	1	2								3	3	3
CO3	3	1	2	1	2								3	3	3
CO4	3	2	2	2	2								3	3	3
CO5										2		3		2	2
CO6											3	3		3	3

**Note:**1-Low,2-Medium,3-High

**COURSE CONTENT LAB:**

1	<b>Decision Tree Classifier</b> Implement and demonstrate a Decision Tree Classifier to classify the instances of dataset. Display the classification results. Also, try the same algorithm to classify the instances for any given medical diagnosis dataset.
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2	<b>Feature extraction using Principal Component Analysis (PCA)</b> Implement and demonstrate the Principal Component Analysis algorithm for dimensionality reduction for any dataset.
3	<b>K nearest neighbour (KNN)</b> Implement and demonstrate the k-Nearest Neighbour algorithm (k-NN) to classify the iris data set. Display the Confusion matrix and classification report. Also, try the same algorithm of the social networks dataset to predict a customer can purchase an item or not.
4	<b>Support Vector Machine (SVM)</b> Implement and demonstrate a Support vector machine classifier to classify the instances of any dataset. Display the classification results. Also, try the same algorithm to classify the instances for any given dataset
5	Short Title: <b>Regression</b> Implement and demonstrate linear regression and logistic regression algorithms for any given dataset(s). Visualize the results using graphs. (Salary prediction, Price Prediction)
6	<b>Random Forest (RF)</b> Implement and demonstrate a Random Forest classifier to classify the instances of dataset. Display the classification results. Also, try the same algorithm to classify the instances for any given dataset
7	<b>K-Means Clustering</b> Implement and demonstrate the k-means clustering algorithms. Visualize the results using graphs.
8	<b>Hierarchical clustering</b> Implement and demonstrate the hierarchical clustering algorithms. Visualize the results using graphs.
9	<b>DBSCAN clustering</b> Implement and demonstrate the hierarchical clustering algorithms. Visualize the results using graphs.
10	Short Title: <b>Artificial Neural Networks (ANN)</b> Implement and demonstrate the two hidden layer multilayer perceptron neural network to any given dataset for classification. Apply two different optimizers or activation functions and compare the results.

#### **TEXT BOOKS:**

1. Tom M. Mitchell, Machine Learning, India Edition McGraw Hill Education, 2013.

#### **Websites:**

1. [https://www.tutorialspoint.com/machine\\_learning\\_with\\_python/index.htm](https://www.tutorialspoint.com/machine_learning_with_python/index.htm)
2. [https://www.tutorialspoint.com/artificial\\_neural\\_network/index.htm](https://www.tutorialspoint.com/artificial_neural_network/index.htm)

#### **RECOMMENDED LEARNING RESOURCES (REFERENCE BOOKS):**

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical

- Learning”, 2nd edition, springer series in statistics.  
2. Ethem Alpaydm, “Introduction to machine learning”, second edition, MIT press.

**JOURNALS/MAGAZINES:**

1. Springer Journal of Machine Learning.
2. International Journal of Machine Learning and Computing.

**SWAYAM/NPTEL/MOOCs:**

1. Coursera – Machine Learning
2. Coursera – Deep Learning
3. [https://onlinecourses.nptel.ac.in/noc19\\_cs53/preview](https://onlinecourses.nptel.ac.in/noc19_cs53/preview)

**SELF-LEARNING EXERCISES:**

Reinforcement Learning: Introduction, Learning Task, Q Learning

Course Title	<b>COMPUTER NETWORKS Lab</b>				Course Type	Theory		
Course Code	<b>B20CI0506</b>	Credits	1		Class	VI semester		
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	1	2	2				

### COURSE OVERVIEW

The main emphasis of this course is on the organization and management of local area networks (LANs). The course description include learning about computer network organization and implementation, obtaining a theoretical understanding of data communication and computer networks, and about Open Systems Interconnection (OSI) communication model with TCP/IP protocol; This course provides knowledge of error detection and recovery; local area networks; bridges, routers and gateways; network naming and addressing; and local and remote procedures. This course also emphasis on User Datagram Protocol, TCP Congestion Control; DNS Message Formatting and Remote Login Protocols.

### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the protocol stacks (OSI and TCP/IP) for data communication.
2. Discuss the MAC protocols, error detection & correction strategies for data transmission over the networking devices.
3. Describe the standards for data communication with routing protocols.
4. Illustrate the client server communication using TCP or UDP protocols and other application level protocols

### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of the architectural principles of computer networking and compare different approaches to organizing networks.	1 to 6, 12	2
CO2	Discover the good network design with simplicity, scalability, performance and the end-to-end principle	1 to 6, 12	2
CO3	Appraise the working principles of Internet.	1 to 6, 12	3
CO4	Compile the effectiveness of existing or similar network protocols.	1 to 6, 12	3
CO5	Design a component or a product applying all the relevant standards and with realistic constraints	5,6,9,10	2



CO6	Compare various congestion control mechanisms and identify appropriate Transport layer protocol for real time applications	5,6,9,10	3
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**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√	√		
CO3			√	√	√	
CO4			√	√	√	√
CO5			√			
CO6						√

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	1						1		3	
CO2	3	3	3	3	2	2						1		3	
CO3	3	3	3	3	2	1						2			3
CO4	3	3	3	2	2	1						1			3
CO5					2	3			2	3				3	
CO6					2	3									3

Note: 1-Low, 2-Medium, 3-High

**PRACTICE:**

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
<b>Part - A</b>			
1	a) Study of different types of Network cables and practically implement the cross-wired cable and straight through cable using clamping tool.	RJ-45 connector, IO Connector, Crimping Tool, Twisted pair Cable, Cable Tester.	Cable Crimping, Standard Cabling and Cross Cabling, IO connector crimping and testing the crimped cable using a cable tester can be done successfully
	b) Install and Configure Wired and Wireless NIC and transfer files between systems in LAN and Wireless LAN.	NIC, Adapter	Installation and configuration of Wired and Wireless (remotely) NIC and transfer files between systems in LAN and Wireless LAN between two systems in a LAN can be done successfully.

	c) Install and configure Network Devices: HUB, Switch and Routers.	HUB, Switch, Router and configuration software.	Gain the knowledge on configuring the different connecting devices
	d) Connect the computers in Local Area Network.	Computer Systems with connecting media.	Interconnection and building a simple LAN
2	a) Establish Peer to Peer network connection using two systems using Switch and Router in a LAN.	Computer Systems with connecting media.	Configuration of peer to peer network communication
	b) Configure Internet connection and use IPCONFIG, PING / Tracer and Net stat utilities to debug the network issues.	Connected Computer Systems.	Configure Internet connection
	c) Transfer files between systems in LAN using FTP Configuration, install Print server in a LAN and share the printer in a network	Connected Computer Systems with printer.	File transfer between systems in LAN using FTP Configuration.
	d) Study of basic network command and Network configuration commands	Command Prompt	Network configuration
3	In information theory and coding theory with applications in computer science and telecommunication, error detection and correction or error control are techniques that enable reliable delivery of digital data over unreliable communication channels. Many communication channels are subject to channel noise, and thus errors may be introduced during transmission from the source to a receiver. Error detection techniques allow detecting such errors, while error correction enables reconstruction of the original data in many cases. Write a Program for Implementation of any one mechanism for Error Detection / Error Correction Techniques.	CRC Hamming Code	Error detection and control in data transmission.
4	A routing algorithm is a procedure that lays down the route or path to transfer data packets from source to the destination. They help in directing Internet traffic efficiently. ... Routing algorithm mathematically computes the best path, i.e. "least – cost path" that the packet can be routed through Write a Program for Implementation of any routing algorithms.	Distance vector & Link state routing	Routing in networks before the communication begins.
<b>Part B: Mini Project 1: Design of Corporate Network</b>			
1	Configuring a Switched network and Study of VLAN's and assigning a PC based on the VLAN.	Windows/Linux OS, Packet Tracer	Switch and VLAN Configuration.
2	Implementing an IP Addressing Scheme Configuring WEP on a Wireless Router. Interpreting Ping and Traceroute Output	Windows/Linux OS, Packet Tracer	Router configuration and connectivity checking.
3	Configuring Static Routing. Configuring Dynamic Routing protocols RIP, OSPF.	Windows/Linux OS, Packet Tracer	Static and Dynamic Routing over a network
4	Examining Network Address Translation (NAT). Configuring a Cisco Router as a DHCP Server	Windows/Linux OS, Packet Tracer	Configuration and working of NAT with setup of DHCP server.
<b>Part C: Mini Project 2: Performance Analysis of TCP and UDP applications over the different Topologies of network</b>			

1	Consider Six nodes and demonstrate the different ways of connecting them in topology methods. Also specify the different transmission media with specific channel specifications.	Python, NS3, Ubuntu.	Create an interface between the devices using different topologies.
2	Configure the IP address of the nodes in the specified network. Achieve the port specifications for different applications. Apply and Demonstrate the TFTP on the specified network using UDP. Observe the trace results.	Python, NS3, Ubuntu.	Analyze the performance using UDP based applications
3	Apply and Demonstrate the FTP and TELNET on the specified network using TCP. Observe the trace results.	Python, NS3, Ubuntu.	Analyze the performance using TCP based applications
4	Apply and Demonstrate the Congestion and Error Controlling mechanism in the specified networks. Observe the trace results.	Python, NS3, Ubuntu.	Analyze the congestion and error controlling in TCP based applications

Course Title	TECHNICAL DOCUMENTATION				Course Type		Theory	
Course Code	B20CI0503	Credits	1		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	1	1	1				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>13</b>	<b>0</b>	<b>50%</b>	<b>50%</b>

#### COURSE OVERVIEW:

The goal of this course is to prepare engineering students with the individual and collaborative technical writing, presentation, and research skills necessary to be effective technical communicators in academic and professional environments

#### COURSE OBJECTIVE:

The objectives of this course are:

1. To emphasize on how to prepare a technical document or a research paper for publication in a journal.
2. To teaches students a step-by-step procedure through several examples, how to plan, organize, draft, develop and prepare a document for presentation.
3. To use grammar, a precise method of preparing a document simply, clearly, and concisely
4. To organize the material in a sequential manner for writing the thesis or paper
5. To address the issues related to identifying authors and their writings through their names and affiliations, and abstracts of the work, etc.

#### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand the importance of technical writing and communicate effectively through a proper structure.	1 to 4, 8, 9, 12	1
CO2	Provide technical information and knowledge in practical documents in different styles.	1 to 3, 5,9,12	1
CO3	Practice the unique qualities of professional writing style, including sentence conciseness, readability, clarity and accuracy	1 to 5, 9, 12	2
CO4	Recognize the importance of editing and edit without bias	1,4,5,9,12	1
CO5	Learn new tools and technologies in technical document and apply for suitable solutions for application development.	12	2
CO6	Develop solutions in technical document to solve the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5,9,10	2

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√	√		
CO4						√
CO5		√				
CO6		√				√

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	2				2	2			2	2		
CO2	2	2			3				3			3	3		
CO3	1	2	1	2	3				2			2		3	
CO4	1	2	3	1	2				3			2	2		
CO5	2	3	2	2	3	3							2	3	
CO6	2	3	3	3	2	2							3	2	

**Note:** 1-Low, 2-Medium, 3-High

**COURSE CONTENT  
THEORY**

<b>Contents</b>
<b>UNIT-1</b>
Technical Writing Structure: The Importance of Information Structures: Descriptions versus Instructions; Understanding Role of Description: Structure of object and Mechanism Description, Structure of Process Description;
<b>UNIT-2</b>
Technical Writing Style: Concise Communication: Common Errors while constructing sentences; Clarity and Precision: Guidelines to clear and specific writing; American and British English; Style Manual.
<b>UNIT-3</b>
Technical documentation Editing: Meaning; Types of Editing; Technical letters writing, article writing, report writing, thesis writing, slide preparation, project proposal writing, and introduction to tools for documentation like Latex in Linux and Latex in windows.
<b>UNIT-4</b>
Technical documentation Ethics: What is Legal & Ethical? Ethical Issues in Technical documentation; copyright, Plagiarism

**TEXTBOOKS:**

1. BN Basu, Technical Writing, Prentice Hall India Learning Private Limited, 2009
2. SD Sharma, Textbook of Scientific and Technical Communication Writing for Engineers and Professionals, Ivy Publishing House, 2008

**REFERENCE BOOKS:**

1. P. Oliver, Writing Your Thesis, New Delhi: Vistaar Publications, 2004.
2. F. Mittelbach and M. Goossens, The LATEX Companion, 2nd. ed. Addison Wesley, 2004

Course Title	SOFTWARE TESTING				Course Type	Integrated		
Course Code	B20EJ0503	Credits	2		Class		V semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13 weeks / Semester		Assessment in Weightage	
	Theory	1	1	1				
	Practice	1	1	1	Theory	Practical	CIE	SEE
	Tutorial	0	0	0				
	<b>Total</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>13</b>	<b>13</b>	<b>50%</b>	<b>50%</b>

#### COURSE OVERVIEW:

**Course Description:** This course examines fundamental software testing and related program analysis techniques. In particular, the important phases of testing will be reviewed, emphasizing the significance of each phase when testing different types of software. The course will also include concepts such as test case generation, test coverage, regression testing, program analysis (e.g., program-flow and data-flow analysis), and test prioritization

#### COURSE OBJECTIVE

1. Discuss fundamental concepts in software testing.
2. Illustrate the use of different software testing methods.
3. Demonstrate the use of Selenium IDE to develop applications.
4. Discuss the use of locators in developing real world applications.
5. Apply the principles, tools, and practices of IT project management.
6. Estimate time, processes, and resources effectively by prioritizing competing demands.

#### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the fundamental concepts in software testing.	1 to 5, 9, 10	1
CO2	Analyse the performance of testing methods on the given real world applications.	1 to 5	1
CO3	Develop an application using Software Testing IDE.	1 to 5, 10, 12	2, 3
CO4	Make use of locators in developing real world applications.	1 to 5	1
CO5	Apply the principles, tools, and practices of IT project management.	1, 3 ad 7	1
CO6	Estimate time, processes, and resources effectively by prioritizing competing demands.	1, 3 ad 7	1

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2				√		√
CO3			√			√
CO4			√			
CO5			√			
CO6					√	

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	1				1	1			3		
CO2	3	3	2	2	1								3		
CO3	3	2	2	1	1					1		1		3	3
CO4	3	3	3	3	3	1							3		
CO5	3		2				3								
CO6	3		3				3								

**Note:** 1-Low, 2-Medium, 3-High



**COURSE CONTENT  
THEORY**

Contents
<b>UNIT-1</b>
<b>Introduction:</b> Software Testing Principles Need for testing, Basic definitions, Test cases, Insights from a Venn diagram, Identifying test cases, Error and fault taxonomies, Levels of testing, <b>Examples:</b> Generalized pseudocode, The triangle problem, The NextDate function, The commission problem. Introduction to Automated testing tools (open source and commercial)
<b>UNIT-2</b>
<b>Functional Testing:</b> Boundary value analysis, Robustness testing, Equivalence Class Testing, Decision table method, <b>Examples:</b> The triangle problem, <b>Structural Testing:</b> Path Testing: DD-Paths, Test Coverage Metrics, Basis path Testing; Dataflow Testing: define/Use Testing, Slice Based Testing
<b>UNIT-3</b>
<b>Getting Started with Selenium IDE:</b> Important preliminary points, What is Selenium IDE, installing Selenium IDE, Selenium IDE, Rules for automation, Recording your first test with Selenium IDE Updating a test to assert items are on the page, updating a test to verify items on the page adding Selenium IDE comments, Multiplying windows, Working with multiple windows.
<b>UNIT-4</b>
<b>Locators:</b> Locating elements by ID, Finding IDs of elements on the page with Fire bug, finding elements by ID, Moving elements on the page, finding elements by name, Adding filters to the name, finding elements by link text. Overview of Selenium Web Driver, History of Selenium Architecture, Web Driver API, Web DriverSPI.

**PRACTICE**

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
1.	Write programs in "C" language to demonstrate the working of the following: a.Constructs: i) do...while ii) while....do iii) if...else iv) switch v) for	C	Generate Test case with input, Expected output, Actual Output and remarks.
2.	A program written in "C" language for Matrix Multiplication fails or Introspect the causes for its failure and write down the possible reasons for its failure.	C	Generate Test case with input, Expected output, Actual Output and remarks.
3.	Take any system (e.g. ATM System) and study its system specifications and report the various bugs	C	Generate Test case with input, Expected output, Actual Output and remarks.
4.	Take any system (e.g. ATM System) and study its system specifications and report the various bugs.	Word	Generate Test case with input, Expected output, Actual Output and remarks.
5.	Create a test plan document for any application (eg. Library Management System)	Word	Generate Test case with input, Expected output, Actual Output and remarks.
6.	Study of any testing tool (eg., Win runner)	Win runner	Generate Test case with input, Expected output, Actual Output
7.	Study of any web testing tool(eg., Selenium)	Selenium	Generate Test case with input, Expected output, Actual Output and remarks.

8.	Study of any bug tracking tool (eg., Bugzilla, bugbit)	Bugzilla, bugbit	Generate Test case with input, Expected output, Actual Output and remarks.
9.	Study of any test management tool (eg., Test Director)	Test Director	Generate Test case with input, Expected output, Actual Output and remarks.
10.	Study of any open source-testing tool(eg., Test Link)	Test Link	Generate Test case with input, Expected output, Actual Output and remarks.

**TEXT BOOKS:**

1. P.C. Jorgensen, "Software Testing A Craftman's Approach", CRC Press, Auerbach Publications 2013.
2. David Burns, Selenium 2 Testing Tools Beginner's Guide.

**REFERENCE BOOKS:**

1. Glenford J. Myers, "The Art of Software Testing", John Wiley & Sons 1979
2. Boris Beizer, "Black-Box Testing: Techniques for Functional Testing of Software and Systems", John Wiley & Sons 1995.
3. William E. Perry, "Effective Methods for Software Testing (2nd Edition)", John Wiley & Sons 2000

**JOURNALS/MAGAZINES:**

1. Journal of Software Engineering and Research Engineering.
2. International Journal of Software Engineering, Technology and Applications

**SWAYAM/NPTEL/MOOCs:**

1. <https://www.nptel.ac.in/courses/106/101/1061011632>. [https://www.coursera.org/courses?query=software testing](https://www.coursera.org/courses?query=software%20testing)

**SELF LEARNING EXERCISES:**

Automated Testing tools: QTP tools, Lab View etc, ATLM.

## Detailed Syllabus Semester -6

Course Title	Information and Network Security				Course Type		Theory	
Course Code	B20EJ0601	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice				Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>0</b>	<b>50%</b>	<b>50%</b>

### COURSE OVERVIEW:

Course Description: The most important issue in organization operations, services and individuals is security of the exchanged data. This course introduces security policy, standards and tools used to provide security, such as shared key encryption (DES), public key encryption, and digital signature (Diffie-Hellmann, RSA, etc.). It then reviews how these tools are utilized in the internet protocols and applications and the system security issues, such as viruses, intrusion, and firewalls, will also be covered.

### COURSE OBJECTIVE

The objectives of this course are to:

1. Explain the security planning, standards and practices.
2. Describe the different cryptographic algorithms.
3. Demonstrate the use of the various authenticating functions.
4. Discuss Firewalls and Intrusion Detection system.

### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Summarize the security planning, standards and practices in Intrusion Detection Systems	1 to 5	1
CO2	Make use of the different cryptographic algorithms for encryption and decryption of given data.	1 to 5	2
CO3	Compare the various performance of protocols used for authentication.	1 to 5	2,3
CO4	Identify security in different layers of OSI for solving real world network problems	1 to 5	1
CO5	Relate different firewalls available for more security	1 to 5	2,3
CO6	Identify different auditing tools for intrusion management system.	1 to 5	1,3

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4			√			
CO5			√	√		
CO6			√	√		

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	1								3		
CO2	3	2	3	1	2									3	
CO3	3	1	2	2	3									3	3
CO4	2	2	2	1	1									3	3
CO5	2	2	3	3	1									2	3
CO6	2	2	3	3	2									2	3

**Note:** 1-Low, 2-Medium, 3-High

**COURSE CONTENT**

**Theory:**

Contents
<b>UNIT-1</b>
<b>Planning for Security:</b> Introduction; Information Security Policy, Standards, and Practices; The Information Security Blue Print; Contingency plan and a model for contingency plan.
<b>Introduction to Security Technology:</b> Physical design; Firewalls; Protecting Remote Connections.; Intrusion Detection Systems (IDS); Honey Pots, Honey Nets, and Padded cell systems; Scanning and Analysis Tools

## UNIT-2

**Computer Security Concepts:** The OSI Security Architecture, Security Attacks, Security Services , Security Mechanisms, A Model for Network Security Symmetric Ciphers, Classical Encryption Techniques, Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Steganography , Block Ciphers and the Data Encryption , The Data Encryption Standard, A DES Example, Block Cipher Design Principles, Advanced Encryption Standard . Public-Key Cryptosystems , The RSA Algorithm , Diffie-Hellman Key Exchange,

## UNIT-3

**Authentication Applications:** Kerberos, X.509 Directory Authentication Service.

**Electronic Mail Security:** Pretty Good Privacy (PGP); S/MIME.

**Transport level Security, Web Security Considerations:** Web Security Threats, Web Traffic Security Approaches, SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, Hand shake Protocol, Cryptographic Computations.

## UNIT-4

**Firewalls:** Introduction, Identification, Authentication, Authorization, Accountability, Firewall processing modes, Firewalls categorized by generation, Firewalls categorized by structure, Firewalls architectures, Selecting of right firewalls, Content Filters, Protecting remote connections, Remote Access, Virtual Private Networks.

**Intrusion Detection and Prevention Systems:** IDPS terminology, Use of an IDPS, Types of IDPS, IDPS detection methods, IDPS response, Selecting IDPS approaches and products, Strength and limitations of IDPS, Honeypots. Tools: Auditing tools, Pocket PC hacking, wireless hack walkthrough

### TEXT BOOKS:

1. William Stallings, Cryptography and Network Security, Pearson Publications, 6<sup>th</sup> edition, 2014.
2. M. E. Whitman and Herbert J. Mattored, Principles of Information Security, Information Security Professional, 4<sup>th</sup> edition, 2014.

### REFERENCE BOOKS:

1. Behrouz A. Forouzan, Cryptography and Network Security, Tata McGraw-Hill, 2007.
2. Joseph Migga Kizza, Guide to Computer Security, Springer Science & Media Inc., 3<sup>rd</sup> edition, 2015
3. Springer Journal of Cryptographic Engineering, ISSN 2190-8508
4. ACM, ACM- International Journal of Applied Cryptography, ISSN:1753-0563
5. IEEE, IEEE Transactions on Information Forensics and Security.
6. Elsevier, Journal of Information Security and Applications

### JOURNALS/MAGAZINES

1. Springer Journal of Cryptographic Engineering, <https://www.springer.com/journal/13389>
2. ACM- International Journal of Applied Cryptography, <https://dl.acm.org/citation.cfm?id=J1105>
3. IEEE Transactions on Information Forensics and Security, <https://ieeexplore.ieee.org/xpl/aboutJournal.jsp?punumber=10206>
4. Elsevier, Journal of Information Security and Applications, <https://www.journals.elsevier.com/journal-of-information-security-and-applications>

### SWAYAM/NPTEL/MOOCs:

3. <https://www.coursera.org/learn/crypto>
4. <https://nptel.ac.in/courses/106/105/106105031/>

### SELF-LEARNING EXERCISES:

Computer networks (B20IS5030).

Course Title	Information Retrieval Systems				Course Type	Theory		
Course Code	B20EQ0601	Credits	3		Class	VI semester		
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	3	3	3	39	0	50%	50%

#### COURSE OVERVIEW:

Information retrieval is the process through which a computer system can respond to a user's query for text-based information on a specific topic. IR was one of the first and remains one of the most important problems in the domain of natural language processing (NLP). Web search is the application of information retrieval techniques to the largest corpus of text anywhere -- the web -- and it is the area in which most people interact with IR systems most frequently.

#### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Describe the basic concepts of the information retrieval and its models.
2. Illustrate the use of query languages and its operations in real world applications
3. Demonstrate the use of user interfaces and visualization for search process
4. Explain the multimedia IR models, Indexing and searching the web concepts.

#### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Outline basic concepts of the information retrieval.	1 to5	2
CO2	Apply appropriate Query technique on given real world applications	1 to5	2
CO3	Develop user interfaces and visualization for search process to address research issues.	1 to5	2
CO4	Identify appropriate indexing and searching method for Feature Extraction.	1 to5	2
CO5	Demonstrate the use of user interfaces and visualization for search process	1 to5	2
CO6	Explain the multimedia IR models, Indexing and searching the web concepts	1 to5	2

**BLOOM'S LEVEL OF THE COURSE OUTCOMES:**

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply(L3)	Analyze(L4)	Evaluate(L5)	Create(L6)
CO1		√				
CO2			√			
CO3						√
CO4				√	√	
CO5		√		√		
CO6		√				

**COURSE ARTICULATION MATRIX:**

CO#/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1										3
CO2	2	3	2	1	2										3
CO3	2	2	2	2	1										3
CO4	2	2	3	1	2										3
CO5	2	3	2	1	2										3
CO6	2	2	2	2	1										3

Note:1-Low,2-Medium,3-High

**COURSE CONTENT  
THEORY**

Contents
<p style="text-align: center;"><b>UNIT-1</b></p> <p><b>INTRODUCTION TO INFORMATION RETRIEVAL AND MODELING</b> <b>Introduction:</b> Basic Concepts, The Retrieval Process. Modelling: Introduction, classic Information Retrieval, Alternative set Theoretic Models, Alternative Algebraic Models, Alternative Probabilistic Models, Structured Text Retrieval Models, Models for browsing, Trends and research Issues.</p>
<p style="text-align: center;"><b>UNIT-2</b></p> <p><b>QUERY LANGUAGES AND QUERY OPERATIONS</b> <b>Query languages:</b> Introduction, keyword querying, Pattern Matching, Structural Queries, Query Protocols, Trends, and research issues. Query Operations: Introduction, User Relevance Feedback, Automatic Local Analysis, Automatic Global Analysis, Trend and Research Issue. <b>Text Operations:</b> Document Preprocessing, Document Clustering, Text Compression, Comparing Text compression Techniques. Indexing and Searching: Inverted files, Boolean Queries, Sequential Searching, Pattern Matching, Structural Queries, Compression.</p>
<p style="text-align: center;"><b>UNIT-3</b></p> <p><b>USER INTERFACES AND VISUALIZATION</b> Human-computer Interaction, The information Access Process, Starting points, Query specification, context, using Relevance judgments, interface support for the search process, trends and research issues</p>
<p style="text-align: center;"><b>UNIT-4</b></p> <p><b>MULTIMEDIA IR</b> Data Modelling, Query languages, Trends and research issues. Indexing and searching: A generic Multimedia indexing Approach, One-dimensional Time series, Two-dimensional color images, Automatic Feature Extraction. <b>Searching the web:</b> Challenges, Characterizing the web, Search engines, Browsing, Meta searchers, Finding the needle in the Haystack, Searching using Hyperlinks.</p>

**TEXT BOOKS:**

1. Ricardo Baeza -Yates and Berthier Ribeiro - Neto, Modern Information Retrieval: The Concepts and Technology behind Search 2nd Edition, ACM Press Books 2011.
2. William B.Frakes,Ricardo Baeza-Yates "Information Retrieval: Data Structures and Algorithms" Fifth edition, Pearson,2012.

**REFERENCE BOOKS:**

1. C. Manning, P. Raghavan, and H. Schütze, Introduction to Information Retrieval, Cambridge University Press, 2008.
2. Ophir Frieder "Information Retrieval: Algorithms and Heuristics: The Information Retrieval Series ", 2nd Edition, Springer, 2004.

**JOURNALS/MAGAZINES**

1. Springer Journal on Information Retrieval (<https://link.springer.com/journal/10791>)

**SWAYAM/NPTEL/MOOCs:**

<https://www.nptel.ac.in/courses/106/101/106101007>

**SELF LEARNING EXERCISES:**

Introduction about Text and Multimedia languages and properties, Meta data, text, Markup Languages, Multimedia



<b>Course Title</b>	<b>VIRTUALIZATION &amp; CLOUD COMPUTING (PE-II)</b>				<b>Course Type</b>	<b>Theory</b>		
<b>Course Code</b>	B20EQS601	<b>Credits</b>	<b>3</b>		<b>Class</b>	<b>VI semester</b>		
<b>Course Structure</b>	TLP	Credits	Contact Hours	Work Load	13 weeks / Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>-</b>	<b>50%</b>	<b>50%</b>

#### **COURSE OVERVIEW:**

The course presents a top-down view of cloud computing, from applications and administration to programming and infrastructure. Its main focus is on parallel programming techniques for cloud computing and large scale distributed systems which form the cloud infrastructure.

#### **COURSE OBJECTIVE**

1. Introduce cloud computing and provide knowledge in different layers of cloud computing such as: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS)
2. Describe various cloud computing technologies like data center technology, virtualization technology, web technology, multitenant technology; service technology
3. Explain Virtualization technologies: Hypervisor, emulation, and application VM, Platform virtualization, storage virtualization, and network virtualization.
4. Provide knowledge about cloud security and threats
5. Gain expertise in cloud security mechanisms

#### **COURSE OUTCOMES (COs)**

After the completion of the course, the student will be able to:

<b>CO#</b>	<b>Course Outcomes</b>	<b>POs</b>	<b>PSOs</b>
<b>CO1</b>	Explain the cloud computing concepts such as Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS)	1-5	2
<b>CO2</b>	Use various cloud computing technologies like data center technology, virtualization technology, web technology, multitenant technology; service technology	1-5	3
<b>CO3</b>	Apply Virtualization technologies: Hypervisor, emulation, and application VM, Platform virtualization, storage virtualization, and network virtualization in developing cloud applications.	1-5,10	1,3
<b>CO4</b>	Analyze cloud security and threats for new problems in hand and develop and provide security services for cloud based applications	1-5, 10,11	2,3
<b>CO5</b>	Learn new tools and technologies in Virtualization and cloud computing concepts and apply for suitable solutions for application development.	12	2,3
<b>CO6</b>	Develop solutions in Virtualization and cloud computing concepts to solve the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	5,9,10	2,3

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2			√	√		
CO3			√	√		
CO4				√	√	√
CO5		√		√		
CO6			√	√		√

**COURSE ARTICULATION MATRIX**

CO#/ PO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	2	1					2				3	
CO2	2	2	2	3	2					3					3
CO3	2	3	3	3	3					2			3		3
CO4	2	2	3	3	2					2	1			3	3
CO5												2	3		
CO6	2					2			2		2			3	

**Note:** 1-Low, 2-Medium, 3-High

**COURSE CONTENT THEORY**

Contents
<b>UNIT-1</b>
<b>Introduction to Cloud Computing:</b> Origins and Influences, Basic Concepts and Terminology, Goals and Benefits, Risks and Challenges. <b>Fundamental Concepts and Models:</b> Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models.
<b>UNIT-2</b>

**Cloud Computing Technologies:** Broadband networks and internet architecture, data center technology, virtualization technology, web technology, multitenant technology, service technology Cloud Infrastructure  
**Mechanisms:** Logical Network Perimeter, Virtual Server, Cloud Storage Device, Cloud Usage Monitor, Resource Replication, Ready-made environment

**UNIT-3**

**Specialized Cloud Environment:** Automated Scaling Listener, Load Balancer, SLA Monitor, Pay-per-use monitor, Audit Monitor, Failover System, Hypervisor, Resource cluster, Multi-device Broker, State Management

**Cloud Management Mechanisms:** Remote Administration System, Resource Management System, SLA Management System, Billing Management System.

**UNIT-4**

**Virtualization:** Implementation levels of virtualization, virtualization structures/tools and mechanisms, virtualization of CPU, memory and I/O devices.

**PRACTICE**

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
1.	Evaluate the performance of MapReduce program on word count for different file size.	Ubuntu Linux 10.04 LTS (deprecated: 8.10 LTS, 8.04, 7.10, 7.04) Hadoop 1.0.3 Hadoop requires a working Java 1.5+ (aka Java 5) installation. However, using Java 1.6 (aka Java 6) is recommended for running Hadoop.	To perform the performance of MapReduce program
2.	Design a document, excel sheet, presentation and form using Google Docs, Google sheets, Google Slides and Google Forms. a) Create your resume using Google Docs and send it to your teacher and get it reviewed by your teacher. b) Create a spreadsheet containing cab requirements and collect the details from various guest teachers. c) Create a presentation containing phase1 details of your project in collaboration with your project team members.	Browser Google Account	To design a resume in different forms.
3.	Create multiple VM's on a single physical machine. Provide a communication between them using and without using Client.	To install and setup the Virtual Machine To check the connectivity between the Virtual Machines	To create multiple virtual machines
4.	Demonstrate the communication of VM's on different physical devices using ESXi.	To install and setup the Virtual Machine on same and different ESXi. To check the connectivity between the Virtual Machines	To communicate of VM's on different physical devices

5.	Illustrate the cloning of VM's.	To configure and maintain the VM's. To configure a multiple Virtual Machines on multiple ESXi's.	To create a duplicate of the virtual machine with the same configuration
6.	Illustrate the backup-restore scenario.	To figure out the different ways of backup and restore the sessions of Virtual Machine.	The VM, to which the backup is required should be in ON
7.	Add iSCSI adapter and modify the relative parameters. Create a new VMkernel using iSCSI port binding.	To provide the adapter for the already created VM's	To create a new VM kernel
8.	Performance Analysis of Virtual Machine vs Physical Machine.	To find the performance of VM's in ESXi	To Perform analysis of Virtual Machine vs Physical Machine
9.	Design a module to control an LED from Webserver using NodeMcu or Esp8266 programming with Arduino IDE.	Create IOT application using Cloud.	To control an LED from Cloud Service.
10.	Create a data center using vCenter for multiple VM's.	To install and configure the vCenter server Create a final data center for different VM's	To perform and create a data center.
11.	Install and configure the vSphere Web client	To install and configure the vSphere web Client to access the vCenter server. Create a final data center for different VM's	To perform and install and configurations
12.	Illustration of vMotion to move the VM's from one ESXi to another ESXi	To install and configure the vSphere web Client to access the vCenter server  Create a final data center for different VM's. Identify the way of moving the VM's from one ESXi to another.  Migrate the VM's from one to another ESXi.	To migrate running virtual machines from one physical server to another.

<b>Mini Project</b>		
<b>Green Cloud Computing: Demand Allocation and Pricing Policies for Cloud Service Brokerage</b>		
1	<p>Functioning as an intermediary between tenants and cloud providers, cloud service brokerages (CSBs) can bring about great benefits to the cloud market. As energy costs of cloud computing have been increasing rapidly, there is a need for cloud providers to optimize energy efficiency while maintain high service level performance to tenants, not only for their own benefit but also for social welfares. Thus, for green cloud companies, two questions have arisen: 1) under what pricing policies from the cloud providers to the CSB, a profit-driven CSB is willing to minimize the total energy cost while satisfy tenant demands and 2) how should a CSB distribute tenants demands to achieve this objective? To address question 1), we find a pricing policy for cloud providers such that maximizing CSBs profit is equivalent to minimizing cloud providers energy cost. To address question 2), we first devise a greedy solution, and then propose an approximation algorithm and a decomposition-based solution with a constant approximation ratio. Both simulation and real-world Amazon EC2 experimental results demonstrate the effectiveness of our pricing policy to incentivize CSBs to save energy and the superior performance of our algorithms in energy efficiency and resource utilization over the previous algorithms.</p> <p><b>Enhancing Performance And Energy Efficiency For Hybrid Workloads In Virtualized Cloud Environment</b></p> <p>Virtualization has accomplished standard status in big business IT industry. In spite of it's across the board appropriation, it is realized that virtualization likewise presents non-paltry overhead when executing undertakings on a virtual machine (VM). Specifically, a consolidated impact from gadget virtualization overhead and CPU booking dormancy can cause execution corruption when calculation concentrated undertakings and I/O serious errands are co-situated on a VM. Such an impedance causes additional vitality utilization, too. In this paper, we display Hylics, a novel arrangement that empowers proficient information cross ways for both I/O and calculation serious workloads. This is accomplished with the arrangement of in-memory record framework and system benefit at the hypervisor level. A few vital plan issues are pinpointed and tended to amid our model execution, including proficient moderate information sharing, organize benefit offloading, and QoS-mindful memory use administration. In view of our genuine organization on KVM, Hylics can essentially enhance calculation and I/O execution for mixture workloads. In addition, this plan likewise mitigates the current virtualization overhead and normally improves the general vitality effectiveness.</p>	<p>To multiple cloud providers to minimize the energy cost of cloud provider</p> <p style="text-align: center;"><u>Cloudsim Tools for Cloud, Edge and Fog Computing</u></p> <p>Platform virtualization, Load management, Network interfaces, VM monitors</p> <p>To enhance performance and energy efficiency</p>

**TEXT BOOKS:**

1. Thomas Erl , Ricardo Puttini , Zaigham Mahmood Cloud Computing: Concepts, Technology & Architecture PHI, 2013.
2. Kai Hwang, Geoffrey C. Fox, Jack J Dongarra, Distributed and Cloud Computing, MK, 2012.

**REFERENCE BOOKS:**

1. Dan C. Marinescu, Cloud Computing: Theory and Practice, MK
2. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing, August 2008.
3. Rajkumar Buyya, James Broberg, Andrzej Goscinski, Cloud Computing- Principles and Pradigms,Wiley.
4. Anthony T.Velte, Toby J.Velte, Robert Elsenpeter, Cloud Computing, A practical approach, TATA McGRAW HILL.
5. Gautam Shroff, Enterprise Cloud Computing- Technology, Architecture, Applications, CAMBRIDGE.
6. David Marshall, Wade A. Reynolds and Dave McCrory, Advanced Server Virtualization-VMware and Microsoft Platforms in the Virtual Data Center, AUERBACH Publications.

**JOURNALS/MAGAZINES:**

1. International Journal of Cloud Computing, INDERSCIENCE Publishers.
2. IEEE Cloud Computing
3. International Journal of Cloud Applications and Computing (IJCAC), IGI Global.

**SWAYAM/NPTEL/MOOCs:**

1. [https://onlinecourses.nptel.ac.in/noc21\\_cs15/preview](https://onlinecourses.nptel.ac.in/noc21_cs15/preview)
2. [https://onlinecourses.nptel.ac.in/noc21\\_cs14/preview](https://onlinecourses.nptel.ac.in/noc21_cs14/preview)
3. <https://www.classcentral.com/course/swayam-cloud-computing-and-distributed-systems-17544>

**SELF LEARNING EXERCISES:**

1. <https://www.cybrary.it/course/virtualization-management/>
2. <http://cds.iisc.ac.in/faculty/simmhan/SE252/>
3. <https://data-flair.training/blogs/hardware-virtualization-in-cloud-computing/>

Course Title	Advanced Database Systems(PE-II)				Course Type		Theory	
Course Code	B20EQS602	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	0	0	0	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	3	3	3				

#### COURSE OVERVIEW:

Advanced database system deals with current and emerging technologies which enables to handle complex applications, provides a comprehensive understanding of data modelling techniques, OLAP, OLTP, Data warehouse and its practical implementation.

#### COURSE OBJECTIVE (S):

1. Discuss object-oriented concepts and object relational data bases
2. Describe Parallel and distributed database.
3. Illustrate queries for distributed data storage and processing.
4. Explain enhanced data models for applications

#### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the features of Object Definition Language and Object Query Language for given real world applications	1 to6	1
CO2	Develop Complex queries in SQL and ODMG for parallel and distributed databases.	1 to6	1
CO3	Make use of different types of databases and other technologies to mine the data.	1 to6	1
CO4	Design multi dimension model for a given application in Data mining.	1 to6	1,2,3
CO5	Understand of data modelling techniques, OLAP,OLTP	1-6	1,2
CO6	Practical implementation of advanced data base system	1-6	1,2

**BLOOM'S LEVEL OF THE COURSE OUTCOMES:**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√	√		
CO4			√	√	√	√
CO5		√				√
CO6	√	√	√	√	√	√

**COURSE ARTICULATION MATRIX**

CO#/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	1	2	-	-	-	-	-	-	3	-	-
CO2	3	3	2	3	2	2	-	-	-	-	-	-	3	-	-
CO3	1	2	3	1	2	1	-	-	-	-	-	-	3	-	-
CO4	3	3	3	2	2	3	-	-	-	-	-	-	3	3	3
CO5	1	2	3	1	2	1							1	2	
CO6	3	3	3	2	2	3							2	3	

Note:1-Low,2-Medium,3-High

**COURSE CONTENT**

**Theory**

Contents
<p align="center"><b>UNIT-1</b></p> <p><b>Introduction to various tools and frameworks:</b> Introduction to OLAP, OLTP and Data warehouse system, data modelling, star schema, snowflake schema. Build Data warehouse/data mart using opensource tools like pentaho data integration tool, pentaho business analytics. OLAP versus OLTP, Introduction tovarious tools Overview of Object-Oriented Concepts, Object and Object-Relational Databases: Objects, Encapsulation, Polymorphism, Type and class hierarchies etc. Object model of ODMG, Object definition Language ODL; Object Query Language OQL; Overview of C++ language binding; Conceptual design of Object database; Overview of object relational features of SQL; Object-relational features of Oracle.</p>



#### UNIT-2

**Parallel and Distributed Databases:** Architectures for parallel databases; Parallel query evaluation; Parallelizing individual operations; Parallel query optimizations; Introduction to distributed databases; Distributed DBMS architectures; Storing data in a Distributed DBMS; Distributed catalog management; Distributed Query processing; Updating distributed data; Distributed transactions; Distributed Concurrency control and Recovery.

#### UNIT-3

**Enhanced Data Models for Some Advanced Applications:** Active database concepts and triggers; Temporal, Spatial, and Deductive Databases - Basic concepts

#### UNIT-4

**Data Warehousing and Data Mining:** Introduction to decision support, OLAP, multidimensional model, Window queries in SQL, finding answers quickly, Implementation techniques for OLAP, Data Warehousing, Introduction to Data Mining, Counting co-occurrences, Mining for rules, Tree-structured rules, Clustering, Similarity search over sequences, Incremental mining and data streams;

#### TEXTBOOKS:

1. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", 3rd Edition, McGraw- Hill, 2003.
2. Elmasri and Navathe, "Fundamentals of Database Systems", 5th Edition, Pearson Education, 2007.
3. Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining: Concepts and Techniques", Elsevier, 2011.

#### REFERENCEBOOKS:

1. Connolly and Begg, "Database Systems", 4th Edition, Pearson Education, 2002.

#### JOURNALS/MAGAZINES:

1. <https://dl.acm.org/journal/jdiq>
2. <https://dl.acm.org/journal/tkdd>
3. <https://dl.acm.org/journal/tods>
4. <https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=69>
5. <https://www.springer.com/journal/10618>

#### SWAYAM/NPTEL/MOOCs:

1. Coursera – Database Management Essentials, University of Colorado System
2. Coursera – Databases and SQL for Data Science, IBM
3. <https://www.edx.org/course/advanced-database-administration>
1. <https://www.edx.org/course/olap-and-recursion>
2. <https://www.edx.org/course/advanced-database-queries>

#### Self-Learning Exercises:

1. More Recent Applications: Mobile databases; Multimedia databases; Geographical Information Systems; Genome data management, P-P database.
2. Transaction management.

Course Title	BIG DATA ANALYTICS (PE-II)				Course Type	Theory			
Course Code	B20EQS603	Credits	3		Class		VI semester		
Course Structure	TLP	Credits	Contact Hours	Work Load	13 weeks / Semester		Assessment in Weightage		
	Theory	3	3	3					
	Practice	-	-	-	Theory	Practical	CIE	SEE	
	Tutorial	-	-	-					
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>-</b>	<b>50%</b>	<b>50%</b>	

#### COURSE OVERVIEW:

**Course Description:** This course provides practical foundation level training that enables immediate and effective participation in big data projects. The course provides grounding in basic and advanced methods to big data technology and tools, including Hadoop and Spark.

#### COURSE OBJECTIVE

The objectives of this course is to:

1. Explain the concepts of Big Data and its Business Implications.
2. Describe the framework for Scala and Spark for Big-Data Analytics.
3. Discuss the use of features of Apache Spark for Data Analytics.
4. Demonstrate solving of Business Problems with Machine Learning in Spark and Scala.
5. Learn new tools and technologies in Big Data Analytics and apply for suitable solutions for application development.
6. Develop solutions in Big Data Analytics to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.

#### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make us of the concepts of Big Data in real world application.	1 to 5, 9,12	2
CO2	Apply the theories of Hadoop in Scala for Big Data Analytics.	1 to 5, 9,12	2
CO3	Design a Data Analytics Framework using Apache Spark with Scala.	1 to 5, 9,12	1
CO4	Develop a real world application using Apache Spark with Scala.	1 to 5, 9,12	1
CO5	Learn new tools and technologies in Big Data Analytics and apply for suitable solutions for application development.	12	2
CO6	Develop solutions in Big Data Analytics to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	1 to 5,9,12	2

### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√	√			
CO2			√			
CO3						√
CO4				√	√	√
CO5			√			
CO6						√

### COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	2					1			3		3	
CO2	3	3	3	3					1			3		3	
CO3	3	3	3	3					1			3	3		
CO4	3	3	3	3					2			3	3		
CO5												3			
CO6					3				3	3	3				3

**Note:** 1-Low, 2-Medium, 3-High

### COURSE CONTENT THEORY

Contents
<b>UNIT-1</b>
<b>The Age of the Data Product:</b> What Is a Data Product?, Building Data Products at Scale with Hadoop, Leveraging Large Datasets, Hadoop for Data Products, The Data Science Pipeline and the Hadoop Ecosystem, Big Data Workflows. <b>An Operating System for Big Data:</b> Basic Concepts, Hadoop Architecture, A Hadoop

Cluster, HDFS, YARN, Working with a Distributed File System, Basic File System Operations, File Permissions in HDFS, Other HDFS Interfaces, Working with Distributed Computation,

#### UNIT-2

**MapReduce:** A Functional Programming Model, Implemented on a Cluster, Beyond a Map and Reduce: Job Chaining, Submitting a MapReduce Job to YARN. **Scala Programming:** Functional Programming Aspects, What Is Functional Programming? Scala Programming Features, Functional Programming Aspects of Scala.

#### UNIT-3

**Introduction to Apache Spark and Spark Core:** What Is Apache Spark?, Why Apache Spark?, Spark vs. Hadoop MapReduce, Apache Spark Architecture, Spark Components, Spark Shell. **Spark Core:** RDD, RDD Transformations, RDD Actions, Working with Pair RDDs, Direct Acyclic Graph in Apache Spark, Persisting RDD Shared Variables, Simple Build Tool (SBT).

#### UNIT-4

**Spark SQL, DataFrames, and Datasets:** What Is Spark SQL?, Spark Session, Creating DataFrames. **Introduction to Spark Streaming:** Data Processing, Streaming Data, Introduction to Spark Streaming, Spark Streaming Example Using TCP Socket, Stateful Streaming, Streaming Applications Considerations. **Spark Machine Learning Library:** What Is Spark MLlib?, Spark MLlib APIs, Vectors in Scala, Basic Statistics, Extracting, Transforming, and Selecting Features, ML Pipelines.

#### TEXT BOOKS:

1. Sridhar Alla, "Big Data Analytics with Hadoop 3", published by Packt Publishing Ltd, May 2018
2. Subhashini Chellappan, Dharanitharan Ganesan, "Practical Apache Spark Using the Scala API", A Press, 2018.

#### REFERENCE BOOKS:

1. Michael Minelli, Michele chambers, Ambiga Dhiraj, "Big data, big analytics", Wiley, 2013
2. P. Tan, M. Steinbach, V. Kumar, "Introduction to Data Mining", Addison-Wesley, 2005.
3. J. Han, M. Kamber, "Data Mining: Concepts and Techniques", 2nd ed. Morgan Kaufmann, 2005.

#### JOURNALS/MAGAZINES:

1. IEEE, Introduction to the IEEE Transactions on Big Data
2. Elsevier, Big data research journal Elsevier
3. Springer, Journal on Big Data Springer.
4. ACM DL, The Journal of Machine Learning Research-ACM

#### SWAYAM/NPTEL/MOOCs:

Coursera – Big Data, Coursera – Introduction to Big Data,  
<https://nptel.ac.in/courses/106/104/106104189/>  
<https://www.edx.org/learn/big-data>

**SELF-LEARNING EXERCISES:** Spark Real-Time Use Case: Data Analytics Project Architecture, Data Ingestion, Data Storage, Data Processing, Data Visualization

Course Title	Block Chain Technology(PE-II)				Course Type		Theory	
Course Code	B20EJS604	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>0</b>	<b>50%</b>	<b>50%</b>

#### COURSE OVERVIEW:

Block chain is the distributed and decentralized database technology behind this crypto currency. This course explores the fundamentals of the public, transparent, secure, immutable and distributed database called block chain. Block chains can be used to record and transfer any digital asset not just currency. This course will introduce students to the workings and applications of this potentially disruptive technology. Its potential impact on financial services, government, banking, contracting and identity management.

#### COURSE OBJECTIVE (S):

1. Describe the basic concepts of Cryptography and Block chain technology.
2. Explain the features of the block chain technology, decentralised applications and smart contract.
3. Demonstrate building of decentralised applications by deploying Smart Contracts
4. Analyse different Blockchain Platforms that can be used in real world applications.

#### COURSE OUTCOMES (COs):

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the concepts of block chain technology suitable for given real world applications	1-9	1
CO2	Compare the performance of POW and POS mining consensus algorithm with respect to given real world application.	1-11	2
CO3	Build a decentralised application by implementing smart contract using solidity programming language.	1-10	2
CO4	Apply various block chain platforms for solving real world problems.	1-12	2
CO5	Analysis new Block Chain technologies for real world problem	1-11	3
CO6	Prepare the security algorithm for securing block chains	1-12	3

**BLOOM'S LEVEL OF THE COURSE OUTCOMES:**

CO#	Bloom's Level					
	Remember (1)	Understand (2)	Apply (3)	Analyze (4)	Evaluate (5)	Create (6)
CO1	√					
CO2		√		√		
CO3		√				
CO4			√			
CO5				√	√	
CO6			√	√		√

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	3	2	3	2	0	0	0	3	0	0
CO2	3	3	2	3	2	3	2	3	2	3	3	0	0	3	0
CO3	2	3	3	2	2	3	3	3	3	2	0	0	0	3	0
CO4	2	3	3	2	2	2	2	3	2	3	3	2	0	0	3
CO5	3	3	2	3	3	3	2	3	3	2	3	0	0	0	3
CO6	3	2	3	2	3	2	3	2	3	1	3	3	0	0	3

Note: 1-Low, 2-Medium, 3-High

**COURSE CONTENT:**

**THEORY:**

Contents
<p align="center"><b>UNIT-1</b></p> <p><b>Introduction to Cryptography and Block chain:</b> Introduction to cryptography-Symmetric- key cryptography, Public-key cryptography, Digital Signatures and Elliptic Curve Cryptography.</p> <p><b>Introduction to Block chain:</b> Types of Block chain, Structure of a Block, Block Header, Block Header Hash and Block Height, Genesis Block, Linking Blocks in the Block chain, Merkle Trees, Constructing the Block Header.</p> <p><b>Mining and Consensus:</b> The Byzantine general's Problem, Consensus mechanism-proof of work &amp; proof of stake, Bit coin mining and Block chain Forks</p>
<p align="center"><b>UNIT-2</b></p> <p><b>Overview of Ethereum:</b> What Is Ethereum? Compared to Bitcoin, Ethereum: A General-Purpose Block chain, Ethereum Accounts (Externally Owned Accounts and Contracts), Ethereum and Turing Completeness, Decentralized Applications, Decentralized Autonomous Organizations, Smart Contract Introduction, Life Cycle of a Smart Contract.</p>
<p align="center"><b>UNIT-3</b></p> <p><b>Dapp development on Ethereum:</b> Programming Solidity: Structure, Basic Data Types &amp; Statements, Specific Data Types, Data Structures, Memory vs Storage, Access Modifiers, Contract Definition, Functions, Contract Constructor, The Ethereum Contract ABI, Events, Run Ethereum Dapps, Develop a simple smart contract.</p>

#### UNIT-4

**Enterprise Block chains and Applications:** Enterprise Block chains: Hyper ledger, R3 Corda, Quorum Block chain  
Applications: Identity management, Auction, Food industry supply chain and Block chain in Health care.

#### TEXT BOOKS:

1. Joseph J. Bambara Paul R. Allen, "Block chain, A Practical Guide to Developing Business, Law, and Technology Solutions", McGraw-Hill Education Professional, Second edition, 2018.
2. Melanie Swan "Block chain: Blueprint for a New Economy", O'Reilly Media, Third edition, Aug 2015.
3. Andreas M. Antonopoulos, Gavin Wood "Mastering Ethereum", O'Reilly Media, Inc., November 2018.
4. Joseph Holbrook "Architecting Enterprise Block chain Solutions", Sybex, February 2020.

#### REFERENCE BOOKS:

1. Imran Bashir, "Mastering Block chain: Distributed ledger technology, decentralization, and smart contracts "Packt , 2<sup>nd</sup> edition 2018.
2. Jimmy Cooper, "Block chain Blueprint: Guide to Everything You Need to Know About Block chain Technology and How It Is Creating a Revolution ", Create Space Independent Publishing Platform, 2017.

#### JOURNALS/MAGAZINES:

1. Deepak Puthal, Nisha Malik, Saraju P Mohanty, Elias Kougianos, Chi Yang, "The Blockchain as a Decentralized Security Framework [Future Directions]" Volume 7, Issue 2, Pages 18 – 21, 2018.
2. Valentina Gatteschi, Fabrizio Lamberti, Claudio Demartini, Chiara Pranteda, Víctor Santamaría, "To Blockchain or Not to Blockchain: That Is the Question ", Volume 20, Issue 2 Pages 62 - 74, 2018.
3. Tien Tuan Anh Dinh, Rui Liu, Meihui Zhang, Gang Chen, Beng Chin Ooi, Ji Wang "Untangling Blockchain: A Data Processing View of Blockchain Systems", Volume 30, Issue 7, Pages 1366 – 1385, 2018.
4. Mingjun Dai, Shengli Zhang, Hui Wang, Shi Jin, "A Low Storage Requirement Framework for Distributed Ledger in Blockchain", Volume 6, Pages 22970 – 22975, 2018.
5. Ruiguo Yu, Jianrong Wang, Tianyi Xu, Jie Gao Yongli An Gong Zhang, And Mei Yu "Authentication With Block-Chain Algorithm and Text Encryption Protocol in Calculation of Social Network ", Volume 5, Pages 24944 – 24951, 09 November 2017.
6. Ashiq Anjum, Manu Sporny. Alan Sill, "Blockchain Standards for Compliance and Trust", Volume 4, Issue 4, Pages 84 – 90, 2017.
7. Morgan E. Peck, Samuel K Moore, "The blossoming of the blockchain", Volume 54, Issue 10 Pages 24 – 25, 2017.
8. Inderscience Journal of Blockchain and Cryptocurrency.
9. Ledger Journal of Cryptocurrency and Blockchain Technology.

#### SWAYAM/NPTEL/MOOCs:

1. <https://nptel.ac.in/courses/106/104/106104220/>
2. <https://www.coursera.org/specializations/blockchain>

**SELF-LEARNING EXERCISES:** Distributed Ledger in Blockchain, Decentralized Applications.

Course Title	MULTI AGENT SYSTEMS(PE-II)				Course Type	Theory		
Course Code	B20EQS605	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13 weeks / Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>0</b>	<b>50%</b>	<b>50%</b>

#### COURSE OVERVIEW:

Multi-agent systems have emerged as one of the most important areas of research and development in information technology. A multi-agent system is one composed of multiple interacting software components known as agents, which are typically capable of cooperating to solve problems that are beyond the abilities of any individual member. Multi-agent systems are important primarily because they have been found to have very wide applicability, in areas as diverse as industrial process control and electronic commerce. This module will begin by introducing the student to the notion of an agent, and will lead them to an understanding of what an agent is, how they can be constructed, how agents can be made to cooperate effectively with one another to solve problems, and approaches to decision making in multiagent contexts.

#### COURSE OBJECTIVE

The objectives of this course are to:

1. Describe the notion of an agent & its application areas.
2. Discuss the abstract agent architecture & types of agents
3. Understand the key issues in designing societies of agents that can effectively cooperate in order to solve problems, including an understanding of the key types of multi-agent interactions possible in such systems
4. Understand the main application areas of agent-based solutions, and be able to develop a meaningful agent-based system using a contemporary agent development platform.
5. Use The Prisoner's Dilemma concept to solve similar real-world problem.
6. Illustrate how to solve problems on zero-sum and mixed strategy problems in real world scenario

#### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the different types of multiagent systems	1,2,3,11	1
CO2	Discover the role of the agent concept in a distributed environment.	2,5,7,8	1,2
CO3	Appraise and use an appropriate framework for agent communication and information sharing processes	2,4,5,8	2
CO4	Make use of the detailed knowledge of the different research methods for solving real world problems.	7,11	3
CO5	Use The Prisoner's Dilemma concept to solve similar real-world problem	7,11,12	3
CO6	Illustrate how to solve problems on zero-sum and mixed strategy problems in real world scenario	7,11,12	3



**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2		√	√			
CO3			√	√		
CO4	√		√	√		
CO5			√	√		
CO6			√	√		

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3								3		2		
CO2		1			2		2	2					1	3	
CO3		3		3	2			3						3	
CO4							3				3				2
CO5							1				2	1			3
CO6							1				1	1			3

**Note:** 1-Low, 2-Medium, 3-High

**COURSE CONTENT THEORY**

Contents
<b>UNIT-1</b>
<b>Introduction:</b> The Vision Thing, Some Views of the Field, Agents as a paradigm for software engineering, Agents as a tool for understanding human societies. Intelligent Agents: Intelligent Agents, Agents and objects; agents and expert systems; agents and distributed systems; typical application areas for agent systems.

<b>UNIT-2</b>
<b>Intelligent Agents:</b> Abstract architectures for agents; Deductive Reasoning Agents, Practical Reasoning Agents, Reactive and Hybrid Agents.
<b>UNIT-3</b>
<b>Multiagent Systems:</b> Ontologies: Ontology Fundamentals, Ontology building blocks, An ontology of ontologies, OWL, KIF, RDF; Constructing an Ontology, Communicating: speech acts, Agent Communication Languages KQML/KIF, the FIPA framework; cooperation: cooperative distributed problem solving (CDPS), Task Sharing and Result Sharing, Coordination: partial global planning, Applications
<b>UNIT-4</b>
<b>Multiagent Decision-Making:</b>  multi-agent interactions: solution concepts; pure and mixed strategy Nash equilibria; Pareto efficiency, zero-sum and other interactions; The Prisoner's Dilemma  <b>Making Group Decisions:</b> Social Welfare Functions and Social Choice Functions, Voting Procedures

**TEXT BOOKS:**

1. M. Wooldridge, "An Introduction to Multi Agent Systems", Second Edition, John Wiley & Sons, 2009.

**REFERENCE BOOKS:**

1. Y. Shoham and K. Leyton-Brown, "Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations", Cambridge UP, 2008.
2. G. Weiss, editor, "Multi-Agent Systems", The MIT Press, 1999.
3. M. Singh and M. Huhns, "Readings in Agents", Morgan-Kaufmann Publishers, 1997.

**JOURNALS/MAGAZINES:**

1. <https://opensky.ucar.edu/islandora/object/articles:21155>
2. [https://cs.cit.ie/contentfiles/PDFs/MScFlyers/MScAI\\_FT.pdf](https://cs.cit.ie/contentfiles/PDFs/MScFlyers/MScAI_FT.pdf)
3. <https://www.enterrasolutions.com/news/trends-predictions-2017-digital-transformation-2/>
4. <https://www.wsj.com/articles/readers-beware-ai-has-learned-to-create-fake-news-stories-11571018640>

**SWAYAM/NPTEL/MOOCs:**

1. <https://medium.com/javarevisited/10-best-udemy-and-coursera-courses-to-learn-artificial-intelligence-in-2020-ec77ad13bdc1>
2. <https://medium.com/javarevisited/10-best-udemy-and-coursera-courses-to-learn-artificial-intelligence-in-2020-ec77ad13bdc1>
3. <https://javarevisited.blogspot.com/2020/08/top-10-coursera-courses-and-certification-for-artificial-intelligence-and-machine-learning.html#axzz6jQ05pXOG>

**SELF LEARNING EXERCISES:**

1. Fixed-time/ Finite time cooperative control in Multi Agent systems and Prolog programming language for artificial intelligence.
2. Multi-Agent Systems and Agent Communication for distributed problem solving which is performed by agents working together towards a solution of a common problem.

Course Title	NEURAL NETWORKS & DEEP LEARNING (PE-II)				Course Type		Theory	
Course Code	B20EJS606	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13 weeks / Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>0</b>	<b>50%</b>	<b>50%</b>

#### **COURSE OVERVIEW:**

Neural Networks are an effective programming paradigm that enable a computer to learn from observed data. They simulate biological learning of the nervous system and have been demonstrated to increase the power of known machine learning models by stacking them as computational graphs. This is different from conventional programming where human programmers define the set of tasks to be carried out by a computer to solve a problem. Deep learning is a subset of machine learning that uses many layers of neural networks to accomplish tasks like image recognition, text procession, speech recognition, natural language processing etc. This course aims at giving the students the knowledge and the skills required to model the solutions to real world problems using neural networks and deep learning.

#### **COURSE OBJECTIVE**

The objectives of this course are to:

1. Explain the fundamentals of neural network based paradigm to problem solving.
2. Inculcate knowledge of concepts involved in training of neural networks.
3. Discuss the concepts and issues in deep neural networks.
4. Explain generalizability of deep neural networks and introduce prominent deep neural architectures.
5. Illustrate the applications of CNN for solving real world Problems.
6. Analyze the applications of CNN for solving real world Problems

#### **COURSE OUTCOMES (COs)**

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Explain the fundamental architecture of neural network and the concepts involved.	1,2,3,4,5	1,2
CO2	Apply the shallow neural network models - Perceptron, Least-Squares Regression, Logistic Regression, Support Vector machines to solve real world binary and multiclass classification problems.	1,2,3,4,5	1,2
CO3	Develop simple deep neural networks to solve problems in unsupervised learning.	1,2,3,4,5	1,3

CO4	Create deep neural models like CNN and RNN to solve problems.	1,2,3,4,5	1,3
CO5	Illustrate the applications of CNN for solving real world Problems	1,2,3, 11, 12	1,3
CO6	Analyze the applications of CNN for solving real world Problems	1,2,3, 11, 12	1,3

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√	√			
CO2			√	√		√
CO3			√	√		√
CO4			√	√	√	√
CO5			√	√		
CO6			√	√		

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	1	1	2	1								2	2	
CO2	3	2	3	1	2								2	2	
CO3	3	1	2	1	2								2		2
CO4	3	2	2	2	2								2		2
CO5	3	2	2								1	1			
CO6	3	2	3								1	1			

**Note:** 1-Low, 2-Medium, 3-High

**COURSE CONTENT  
THEORY**

<b>Contents</b>
<b>UNIT-1</b>
<p><b>Introduction to Neural Networks:</b> The basic architecture of Neural Networks – Single computational layer – The Perceptron, What Objective Function Is the Perceptron Optimizing? , Relationship with Support Vector Machines Choice of Activation and Loss Functions, Some Useful Derivatives of Activation Functions Choice and Number of Output Nodes multilayer neural network, The Multilayer Network as a Computational Graph, Training a Neural Network with Backpropagation, Practical Issues in Neural Network Training -The Problem of Overfitting, The Vanishing and Exploding Gradient Problems</p> <p><b>Common Neural Architectures</b> - Simulating Basic Machine Learning with Shallow Models, Radial Basis Function Networks, Restricted Boltzmann Machines, Recurrent Neural Networks, Convolutional Neural Networks, Two Notable Benchmarks - The MNIST Database of Handwritten Digits, The ImageNet Database</p>
<b>UNIT-2</b>
<p><b>Machine Learning with Shallow Neural Networks</b> - Neural Architectures for Binary Classification - Revisiting the Perceptron, Least-Squares Regression, Logistic Regression, Support Vector machines, Neural Architectures for Multiclass Models - Multiclass Perceptron, Weston-Watkins SVM, Multinomial Logistic Regression (Softmax Classifier), Hierarchical Softmax for Many Classes, Auto encoder: Basic Principles, Nonlinear Activations, Deep Auto encoders, Application to Outlier Detection, When the Hidden Layer Is Broader than the Input Layer, Word2vec: An Application of Simple Neural Architectures, Simple Neural Architectures for Graph Embeddings</p>
<b>UNIT-3</b>
<p><b>Deep Neural Networks</b> – Introduction, Backpropagation - Backpropagation with the Computational Graph Abstraction, Backpropagation with Post-Activation Variables, Backpropagation with Pre-activation Variables, Examples of Updates for Various Activations, Loss Functions on Multiple Output Nodes and Hidden Nodes, Setup and Initialization Issues - Tuning Hyper-parameters, Gradient-Descent Strategies- Learning Rate Decay, Momentum-Based Learning - Nesterov Momentum, Parameter-Specific Learning Rates – AdaGrad, RMSProp, Adam, Gradient Clipping, Second-Order Derivatives, Batch Normalization.</p>
<b>UNIT-4</b>
<p><b>Teaching Deep Learners to Generalize-</b> The Bias-Variance Trade-Off, Generalization Issues in Model Tuning and Evaluation, Issues with Training at Scale, Penalty-Based Regularization - L1-Regularization, L1- or L2-Regularization, Penalizing Hidden Units: Learning Sparse Representations, Ensemble Methods- Bagging and</p>

Subsampling, Parametric Model Selection and Averaging, Randomized Connection Dropping, Dropout, Data Perturbation Ensembles, Early Stopping.

**Prominent Deep Learning Models - Restricted Boltzmann Machines** – The Boltzmann Machine, How a Boltzmann Machine Generates Data, Training the RBM, **Recurrent Neural Networks** - The Architecture of Recurrent Neural Networks, Long Short-Term Memory (LSTM), **Convolutional Neural Networks** - The Basic Structure of a Convolutional Network Training a Convolutional Network, **Deep Reinforcement Learning** - The Basic Framework of Reinforcement Learning

#### **TEXT BOOKS:**

1. Charu Aggarwal, “Neural Networks and Deep Learning”, Springer, 2018.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press

#### **REFERENCE BOOKS:**

1. Francis Chollet, “Deep Learning with Python”, Manning, 2018.
2. Jacek M. Zurada, Introduction to Artificial Neural Systems, PWS Publishing Company, 1995.
3. Simon Haykin, Neural Networks: A Comprehensive Foundation, Macmillan College Publishing Company, 1994.
4. Mohamad H. Hassoun, Fundamentals of Artificial Neural Networks, The MIT Press, 1995.
5. Laurene Fausett, Fundamentals of Neural Networks: Architectures, Algorithms, and Applications, Prentice Hall International, Inc., 1994.
6. B. D. Ripley, Pattern Recognition and Neural Networks, Cambridge University Press. 1996.

#### **JOURNALS/MAGAZINES**

1. IEEE Transactions on Neural Networks and Learning Systems  
<https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=5962385>
- a. IEEE Transactions on Pattern Analysis and Machine Intelligence  
[https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=34http://ijaerd.com/papers/special\\_papers/I032.pdf](https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=34http://ijaerd.com/papers/special_papers/I032.pdf)
2. International Journal of Intelligent Systems <https://onlinelibrary.wiley.com/journal/1098111x>
3. <http://www.charuaggarwal.net/neural.htm>
4. <http://neuralnetworksanddeeplearning.com/>
5. <https://github.com/mnielsen/neural-networks-and-deep-learning>
6. [deeplearning.stanford.edu](http://deeplearning.stanford.edu)
7. <http://yann.lecun.com/exdb/mnist/>
8. University of California Irvine Machine Learning Repository - <https://archive.ics.uci.edu/ml/datasets.php>
9. <https://peterroelants.github.io/posts/rnn-implementation-part01/>
10. <https://victorzhou.com/blog/keras-rnn-tutorial/>

#### **SWAYAM/NPTEL/MOOCs:**

1. Swayam Nptel – Deep Learning – IIT Ropar [https://onlinecourses.nptel.ac.in/noc21\\_cs35/preview](https://onlinecourses.nptel.ac.in/noc21_cs35/preview)
2. Coursera – Neural Networks and Deep Learning Andrew Ng

3. Coursera - Neural Networks for Machine Learning by Geoffrey Hinton in Coursera

**Self-Learning Exercises:**

1. Experiment with problems on Kaggle.com
2. Tweak the given solutions with changes to hyper-parameters

Course Title	Image Processing and Computer Vision (PE-III)				Course Type		Theory	
Course Code	B20EQS607	Credits	3		Class		VI Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3	Theory	Practical	CIE	SEE
	Practice	-	-	-				
	-	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>-</b>	<b>50</b>	<b>50</b>

**COURSE OVERVIEW**

The course provides students with fundamental concepts and techniques for digital image processing and computer vision. It gives an overview of sampling and quantization, various techniques used for image enhancement, segmentation and compression

**COURSE OBJECTIVE (S):**

The objectives of this course are to:

1. Understand the fundamentals of digital image processing and its applications
2. Get exposed to various image enhancement segmentation and compression techniques.
3. Become familiar with image processing techniques for computer vision and three-dimensional image analysis techniques

**COURSE OUTCOMES (COs)**

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand the fundamentals of digital image processing, representation and various applications	1 to 5	1
CO2	Learn image enhancement techniques for spatial and frequency domain	1 to 5	2
CO3	Discuss and compare various image segmentation and compression techniques	1 to 5	3
CO4	Understand image processing techniques for computer vision and 3 D image analysis	1 to 5	3
CO5	Use Methods for 3D vision fir solving real world problems	1 to 5	3
CO6	Illustrate Image segmentation on a real world dataset	1 to 5	3

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√	√			
CO2		√	√			
CO3		√	√			
CO4		√				
CO5			√			



CO6			v			
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**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2								3		
CO2	3	3	2	1	3									3	
CO3	3	3	3	2	2										3
CO4	3	3	3	1	1										3
CO5	3	3	3	1	1							1			3
CO6	3	3	3	1	1						2				3

**Note:** 1-Low, 2-Medium, 3-High

**COURSE CONTENT**

**THEORY:**

**UNIT – 1**

Introduction: Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Sampling and Quantization, Representing Digital Images (Data structure), Some Basic Relationships Between Pixels, File Formats, colour images and models, Image Operations – Arithmetic, logical, statistical and spatial operations, Applications of Image Processing: Medical imaging, Robot vision, Character recognition, Remote Sensing

**UNIT – 2**

Image enhancement : Spatial domain- Gray level transformations, Histogram processing, Spatial filtering, Smoothing and sharpening, Frequency domain- Fourier Transform, Discrete Fourier Transform (DFT), properties of DFT, Discrete Cosine Transform (DCT), Image filtering in frequency domain

**UNIT – 3**

Image Segmentation: Introduction, Detection of isolated points, line detection, Edge detection, Edge linking and boundary detection. Image Compression: Introduction, coding Redundancy, Inter-pixel

redundancy, image compression model, Lossy and Lossless compression, Huffman Coding, Arithmetic Coding, LZW coding, Block transform coding

#### **UNIT – 4**

Introduction: What is Computer Vision: Image Formation, Geometric primitives and transformations, 3-D Vision and motion Introduction, 3-D Vision, Methods for 3D vision, projection schemes, shape from shading, photometric stereo, shape from texture, shape from focus, Surface representations, point-based representation, volumetric representations, Model-based reconstruction

#### **TEXT BOOKS:**

1. Rafael C G., Woods R E. and Eddins S L, Digital Image Processing, Prentice Hall, 3rd edition, 2008.
2. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer 2011.

#### **REFERENCE BOOKS:**

1. Fundamentals of Digital Image Processing- Anil K. Jain, 2nd Edition, Prentice Hall of India
2. Rafael C.Gonzalez and Richard E.Woods, "Digital Image Processing", Third Edition, Pearson Education, 2008, New Delhi.
3. S.Sridhar, "Digital Image Processing", Oxford University Press, 2011, New Delhi
4. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009
5. E. R. Davies, "Computer & Machine Vision", Fourth Edition, Academic Press, 2012

#### **JOURNALS/MAGAZINES**

1. <https://signalprocessingsociety.org/publications-resources/ieee-signal-processing-magazine>
2. <https://www.computer.org/web/tpami>
3. <http://signalprocessingsociety.org/publications-resources/ieee-transactions-image-processing>

#### **SWAYAM/NPTEL/MOOCs:**

1. Coursera – Fundamentals of Digital image and video processing by North Western University
2. Coursera – Computer Vision Basics by University of Buffalo, The State University of New York
3. <https://nptel.ac.in/courses/106/105/106105032/>

#### **Self-Learning Exercises:**

1. Sharpening Spatial Filters, Combining Spatial Enhancement Methods
2. Image Compression: DCT implementation using FFT
3. Applications: Face detection and Face recognition, 3D shape models of faces application

Course Title	Data Centre Technology (PE-III)				Course Type		Theory	
Course Code	B20EQS608	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	3	3	3	39	0	50%	50%

#### COURSE OVERVIEW

Understanding of Network Infrastructure management, Understanding of Server Management and troubleshooting, understanding of system Resource Management, Understanding of Information Security

#### COURSE OBJECTIVE (S):

- Manage Server Systems and Data Centres Infrastructure Management
- Utilize the Storage, Bandwidth, Efficiency of systems and other resources for Data centre.
- Monitoring the Networks and Resources.
- Planning for Flexible resource allocation.

#### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Introducing Data Center Technologies, Architecture, Infrastructure	1, 2	1
CO2	Data Center Design and Characteristics	1,3	1
CO3	Data Center maintenance, planning and ISP	2,3	2
CO4	Data Center serves and Planning and Network support system	2,3,4,12	1
CO5	Data Center server Analysis with Network load balancing	1,2,3,4,5,6,9,12	2
CO6	Build the data center with basic servers	1,2,3,4,5,6,11,12	3

#### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√		√		
CO2			√	√		
CO3		√				
CO4		√	√	√	√	√
CO5				√		
CO6						√

#### COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2													
CO2	3		2												
CO3		2	3												
CO4		2	2	3								3			

CO5	3	3	3	2	3	2			3			3			
CO6	3	3	3	2	3	2					2	3			

**Note:** 1-Low, 2-Medium, 3-High

**COURSE CONTENT**

**THEORY:**

**UNIT – 1**

Introduction to Data Centers - Data center Architecture, Data center Requirements, Data center prerequisites, Required Physical Area for Equipment and Unoccupied Space, Required power to run all the devices, Required cooling and HVAC Required weight, Required Network bandwidth, Budget Constraints, Selecting a Geographic Location Safety from Natural hazards Safe from Manmade disaster, Availability of local Technical talent, Abundant and Inexpensive Utilities,

**UNIT – 2**

Selecting an Existing building, Data Center design, Characteristics of an Outstanding Design Guidelines for Planning a Data Center, Data Center structures, Raised Floor Design and Deployment, Design and Plan against Vandalism, Data center design case study

**UNIT – 3**

Modular Cabling Design, Points of Distribution, ISP Network Infrastructure, ISP WAN Links, Data Center Maintenance, Network Operations Center, Network Monitoring, Datacenter physical security, Data center Logical security, Data center Consolidation, Reasons for data center Consolidation, Consolidation opportunity, Server consolidation, Storage Consolidation, Network Consolidation, Service Consolidation, Process Consolidation, Staff Consolidation, Data Consolidation phases

**UNIT – 4**

Data center servers, Sever Capacity Planning, System Management Best Practices, Server Cluster Best Practices, Data Storage Best Practices, Network Management Best Practices, Documentation Best Practices, Best Practices for System Administration, System Administration Work Automation, Device Naming, Naming Practices, NIS, DNS, LDAP, Load balancing, Terminology, Advantages, Types of load balancing, Implementing a Network with Load-Balancing Switches

**TEXT BOOKS:**

1. Administering Data Centers: Servers, Storage and Voice over IP, Kailash Jayaswal
2. Data center fundamentals, Mauricio Arregoces, Maurizio Portol

**REFERENCE BOOKS:**

1. Chang, Frank. Datacenter Connectivity Technologies: Principles and Practice. Stylus Publishing, LLC, 2019.
2. Lee, Gary. Cloud networking: Understanding cloud-based data center networks. Morgan Kaufmann, 2014.

**JOURNALS/MAGAZINES**

1. Khan, Samee U., and Albert Y. Zomaya, eds. "Handbook on data centers." (2015).
2. Cheung, Howard, Shengwei Wang, Chaoqun Zhuang, and Jiefan Gu. "A simplified power consumption model of information technology (IT) equipment in data centers for energy system real-time dynamic simulation." *Applied energy* 222 (2018): 329-342.

3. Sharma, Ratnesh K., Rocky Shih, Cullen Bash, Chandrakant Patel, Philip Varghese, Mohandas Mekanapurath, Sankaragopal Velayudhan, and Manu Kumar. "On building next generation data centers: Energy flow in the information technology stack." In *Proceedings of the 1st Bangalore annual Compute conference*, pp. 1-7. 2008.
4. Uddin, Mueen, Muhammad Talha, Azizah Abdul Rahman, Asadullah Shah, Jameel Ahmed Khader, and Jamshed Memon. "Green Information Technology (IT) framework for energy efficient data centers using virtualization." *International Journal of Physical Sciences* 7, no. 13 (2012): 2052-2065.

**SWAYAM/NPTEL/MOOCs:**

1. Coursera – Data Technologies

**Self-Learning Exercises:**

1. Data Center Technologies
2. Data Center and Green Energy

Course Title	Compiler Design(PE-III)				Course Type		Theory	
Course Code	B20EJS609	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>0</b>	<b>50%</b>	<b>50%</b>

**COURSE OVERVIEW:**

Course Description: The Course intends to make students learn the techniques needed for compiler construction and develops analytical skills. The course is conceptual.

**COURSE OBJECTIVE (S):**

1. Explain the concepts of Object-Oriented programming, Object-Relational Databases and Compilers.
2. Describe how syntax tree can be constructed to check the syntax of the given input.
3. Discuss different types of parsers and syntax directed definition and translation.
4. Demonstrate how code optimization and code generation is done for a given source code.

**COURSE OUTCOMES (COs)**

After the completion of the course, the student will be able to:

CO#	Course Outcomes	Pos	PSOs
CO1	Apply the concepts of lexical, syntactic and semantic analysis to parse the given statement.	1-5,8-10	1
CO2	Experiment with the knowledge of different parsers by constructing the top down and SLR parsers.	1-5,7,8,10-12	2
CO3	Make use of different types of parsers and syntax directed definition and translation to check the syntax of the given input.	1-5,8,9,11,12	1
CO4	Develop code optimization and code generation for a given source code.	1-5 ,11,12	2,3
CO5	Apply some algorithms for real time environment	1-12	3
CO6	Develop new algorithms for real world environment	1-12	3

#### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√	√		
CO3			√			
CO4						√
CO5			√		√	
CO6				√		√

#### COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1								2	3	0	0
CO2	2	2	2	1								2	0	3	0
CO3	2	2	2	1								2	3	0	0
CO4	2	2	2	1								2	0	3	3
CO5	3	2	3	2								3	0	0	3
CO6	2	3	2	1								3	0	0	3

**Note:**1-Low,2-Medium,3-High

## COURSE CONTENT

### THEORY:

Contents
<p align="center"><b>UNIT-1</b></p> <p><b>Overview of Object-Oriented Concepts, Object and Object-Relational Databases: Introduction to Compilers:</b> Language processors; the structure of a Compiler.</p> <p><b>Lexical analysis:</b> Tokens, Regular expressions, Finite state automata, translating regular expressions into finite state automata;</p>
<p align="center"><b>UNIT-2</b></p> <p><b>Syntax analysis 1:</b> Context-free grammars, Derivations and syntax trees, Handling ambiguous grammars, Top-down parsing, Bottom-up parsing – SLR ();</p>
<p align="center"><b>UNIT-3</b></p> <p><b>Syntax Analysis 2:</b> More powerful LR Parsers.</p> <p><b>Syntax-directed translation:</b> Syntax-directed definitions; Evaluation orders for SDDs; Applications of syntax-directed translation; Parser stack implementation of Postfix SDT;</p>
<p align="center"><b>UNIT-4</b></p> <p><b>Code optimization and generation:</b> Basic blocks and Flow graphs; Optimization of basic blocks.</p> <p><b>Intermediate code generation:</b> Variants of syntax trees; Three-address code; Control flow; back patching;</p>

### TEXT BOOKS:



1. A. V. Aho, R. Sethi and J. D. Ullman, Compilers – Principles, Techniques, and Tools, Addison-Wesley, Pearson Education, 2001.
2. Charles N. Fischer, Richard J. LeBlanc, Jr., Crafting a Compiler with C, Pearson Education, 1991.
3. Kenneth C Loudon, Compiler Construction Principles & Practice, Cengage Learning, 1997.

**REFERENCE BOOKS:**

1. A.W. Appel, Modern Compiler Implementation in Java, Cambridge University Press, 2002.

**JOURNALS/MAGAZINES**

1. <https://www.springer.com/gp/book/9783319669656>
2. <https://ieeexplore.ieee.org/document/101813>
3. IEEE, IEEE Transactions on Computers.
4. Elsevier, Computer Languages, Systems and Structures.
5. Springer, Journal of Logic, Language and Information.
6. ACM, ACM Transactions on Programming Languages and Systems (TOPLAS).

**SWAYAM/NPTEL/MOOCs:**

1. <https://nptel.ac.in/courses/106/104/106104123/>
2. <https://www.mooc-list.com/tags/compilers>

**SELF-LEARNING EXERCISES:**

More Recent Applications: translating regular expressions into finite state automata; survey of latest compilers for dealing with parallel programming.

Course Title	STORAGE AREA NETWORK (PE-IV)				Course Type		Theory	
Course Code	<b>B20EQS611</b>	Credits			Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13 weeks / Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>-</b>	<b>50</b>	<b>50</b>

**COURSE OVERVIEW**

This course provides an overview of storage network and data center networking technology. It reviews SAN concepts, Fibre Channel architecture, SAN topologies, SAN over Ethernet architectures, such as iSCSI , FCoE. Virtualization at the host, storage target and Fabric-Based Virtualization

### COURSE OBJECTIVE(S)

The objective of this course is:

1. To introduce the mathematical basics of speech modeling, and its applications.
2. To understand the various applications of speech modeling
3. To comprehend the computational concepts learned in the lecture classes through numerical simulations and programming
4. To help the students extend their understanding of signal processing algorithms for speech processing.
5. To strengthen the research skills of students in speech processing.

### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify key challenges in managing information and analyze different storage networking technologies	1,2	1, 2
CO2	Understand components and the implementation of different storage networking technologies	1, 2,	2, 3
CO3	Analyze storage area network architecture and types of archives and forms of virtualization	1, 2, 4	2, 3
CO4	Illustrate the storage virtualization concepts at different levels	1, 2, 3	3
CO5	Develop an insight into the working of the storage network algorithms used for storage virtualization	1, 2, 3, 12	3
CO6	Develop solutions to the complex problems of storage virtualization, either individually or as a part of the team and report the results with proper analysis and interpretation.	5, 9, 10	3

### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2		√				
CO3			√	√		
CO4			√	√		
CO5			√		√	
CO6				√		

### COURSE ARTICULATION MATRIX

PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO															
CO1	1	2										2	2		
CO2	2	2											2	2	
CO3	2	3		3									2	2	
CO4	3	2	3												3
CO5	3	2	3								3				3
CO6					3				3	3					3

Note: 1-Low, 2-Medium, 3-High

## COURSE CONTENT

### THEORY

Contents
<p style="text-align: center;"><b>UNIT 1</b></p> <p>Introduction to Information Storage and Intelligent Storage Systems: Evolution of Storage Architecture Data Center Infrastructure Virtualization and Cloud Computing Components of an Intelligent Storage System, Storage Provisioning, Types of Intelligent Storage Systems</p>
<p style="text-align: center;"><b>UNIT 2</b></p> <p>Fibre Channel Storage Area Networks and IP SAN: Fibre Channel, The SAN and Its Evolution, Components of FC SAN, FC Connectivity , Switched Fabric Ports, Fibre Channel Architecture , Zoning FC SAN Topologies , Virtualization in SAN iSCSI</p>
<p style="text-align: center;"><b>UNIT 3</b></p> <p>FCoE : FCIP, FCoE , General-Purpose Servers versus NAS Devices , Benefits of NAS , File Systems and Network File Sharing , Components of NAS , NAS I/O Operation , NAS Implementations, NAS File-Sharing Protocols , Factors Affecting NAS Performance</p>
<p style="text-align: center;"><b>UNIT 4</b></p> <p><b>Virtualization at the Host:</b> Logical Volume Management, Storage Metadata Servers , Server-Based Storage APIs,  <b>Virtualization at the Storage Target:</b> Array-Based Virtualization, Array-Based Data Replication, Array-Based Point-in-Time Copy (Snapshot), Distributed Modular Array Virtualization, <b>Fabric-Based Virtualization:</b> Sentient SANs, Techniques for Switch-Based Virtualization, The Fabric Application Interface Standard (FAIS)</p>

### TEXTBOOKS:

1. Information Storage and Management, Author :EMC Education Services, Publisher: Wiley ISBN: 9781118094839

2. Storage Virtualization, Author: Clark Tom, Publisher: Addison Wesley Publishing Company ISBN : 9780321262516

**REFERENCE BOOKS:**

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India, 2003.
2. Rebert Spalding: Storage Networks, The Complete Reference, Tata McGraw Hill, 2003

**JOURNALS/MAGAZINES**

1. Journal of Network and Systems Management-Springer
2. Future Generation Computer System- Science Direct.

**SWAYAM/NPTEL/MOOCs**

1. <http://www.virtualnuggets.com/emcs--storage-area-network.html>
2. <https://www.udemy.com/course/storageintro/>
3. <https://www.ibm.com/training/course/SN71G>

**SELF-LEARNING EXERCISES:**

Case study, Assignments, MOOC / Coursera/Conference

Course Title	Natural Language Processing in AI (PE-IV)				Course Type		Theory	
Course Code	B20EJS610	Credits	3		Class		VII semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>0</b>	<b>50%</b>	<b>50%</b>

**COURSE OVERVIEW**

The intent of the course is to give introduction to Natural Language Processing (NLP, a.k.a. computational linguistics), the study of computing systems that can process, understand, or communicate in human

language. The primary focus of the course will be on understanding various NLP tasks as listed in the course syllabus, algorithms for effectively solving these problems, and methods for evaluating their performance. There will be a focus on statistical algorithms to acquire the knowledge needed to perform language processing.

**COURSE OBJECTIVE (S):**

The objectives of this course are to:

1. Explain the fundamentals of natural language processing and python.
2. Discuss how to access the text corpora and Lexical Resources.
3. Demonstrate the writing the structured programs to process the raw text.
4. Describe role of Classifiers in Text processing.

**COURSE OUTCOMES (COs)**

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply the concepts of Python to implement NLTK tool to solve a given real world problem.	1 to 5	1,3
CO2	Develop an algorithm to access the text corpora and Lexical Resources to process the raw text.	1 to 5	2
CO3	Make use of Categorizing and Tagging concepts to solve the given real-world problems.	1 to 5	2,3
CO4	Analyze the performance of different classifiers in Text processing and Modelling Linguistic.	1 to 5	1
CO5	Learn new tools and technologies in the natural language processing and apply for suitable application development.	1 to 5, 12	1,2
CO6	Develop solutions in the language processing to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	1 to 5, 9, 10	2,3

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			

CO4				√		
CO5			√	√		
CO6				√		

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	3	2								3		3
CO2	2	3	2	3	3									3	
CO3	2	3	2	3	2									3	3
CO4	3	3	1	3	2								3		
CO5	2	2	2	2	2							3	3	3	
CO6	2	3	3	2	2				2	2				3	3

**Note:** 1-Low, 2-Medium, 3-High

**COURSE CONTENT**

**THEORY:**

**UNIT-1**

**Language Processing and python, Accessing Text corpora and Lexical Analysis: Computing with language-Texts and words**, a closer look at python: texts as list of words, **computing with language**: simple statistics, Automatic natural language understanding; Accessing Text Corpora, Conditional Frequency Distributions, Lexical Resources, WordNet, Introduction to NLTK Tool.

**UNIT-2**

**Processing Raw Text:** Accessing Text from the Web and from Disk, Strings: Text Processing at the Lowest Level, Text Processing with Unicode, Regular Expressions for Detecting Word Patterns, Useful Applications of Regular Expressions, Normalizing Text, Regular Expressions for Tokenizing Text, Segmentation, Formatting: From Lists to Strings.

**UNIT-3**

**Categorizing and Tagging words:** Using a Tagger, using a Tagger, Mapping Words to Properties Using Python Dictionaries, Automatic Tagging, N-Gram Tagging, Transformation-Based Tagging, How to Determine the Category of a Word.

#### **UNIT-4**

**Classifying Text:** Supervised Classification: Examples, Evaluation; Decision Trees, Naive Bayes Classifiers, Maximum Entropy Classifiers, Modelling Linguistic Patterns.

#### **TEXT BOOKS:**

1. Steven Bird, Ewan Klein and Edward Loper, "Natural Language Processing with Python", First Edition, O'Reilly Media, 2009.
2. Yuxi (Hayden) Liu, "Python Machine Learning by Example," First edition, Packt publisher, 2017.

#### **REFERENCE BOOKS:**

1. James Allen, "Natural Language Understanding", Benjamin-Cummings Publishing Co., Inc. Redwood City, CA, USA, 1995.
2. Christopher D. Manning and Hinrich Schütze, "Foundations of Statistical Natural Language Processing", The MIT Press, 1999.
3. Randolph Quirk, Sidney Greenbaum, Geoffrey Leech, Jan Svartvik, "A Comprehensive Grammar of English Language", Cambridge University Press, 1987.

#### **JOURNALS/MAGAZINES**

1. ACM Transactions on Language Processing
2. Elsevier Journal of cognitive systems research

#### **SWAYAM/NPTEL/MOOCs:**

1. <https://nptel.ac.in/courses/106/105/106105158/>
2. <https://nptel.ac.in/courses/106/106/106106211/>

#### **Self-Learning Exercises:**

Extracting information from Text, Exploring the 20 Newsgroups with Text Analysis Algorithms, Stock Price prediction with Regression Algorithms,

Best Practices:

- i) Data preparation stage
- ii) Training sets generation stage

iii) Model training, evaluation and selection stage

course Title	Full Stack Development (PE-IV)				Course Type		Theory	
Course Code	<b>B20EQS612</b>	Credits	<b>3</b>		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>0</b>	<b>50%</b>	<b>50%</b>

**COURSE OVERVIEW:**

Full stack Developer covers concepts of the method of applying both front-end and back development protocols to develop websites. This course introduces the student to develop his own project or application. It also helps the student to understand the basics in CSS, JavaScript's, NODEjs, and MongoDB.

**COURSE OBJECTIVE (S):**

1. Introduction to basic concepts of Full Stack Web Development.
2. Explain the fundamentals of HTML, CSS, Bootstrap and its applications.
3. Introduction to Javascript & ReactJS.
4. Develop a new application using the front end stack.
5. Learn new tools and technologies in full stack development and apply for suitable application development.
6. Develop solutions in full stack to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.

**COURSE OUTCOMES (COs)**

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand the platform needed for full stack web development	1,2,3,9,12	3
CO2	Understand the Markup, CSS & BootStrap	1-5,9	3
CO3	Use the JavaScript to design a Web Application.	1-5,9,11	3
CO4	Understand the ReactJS Concepts.	1-5,9,11	3
CO5	Deploy the developed web application in real time scenarios.	1-5,9,12	2
CO6	Developer of the industrial software.	1-5,9,12	2

**BLOOM'S LEVEL OF THE COURSE OUTCOMES:**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)



CO1			√			
CO2		√	√			
CO3		√				√
CO4			√	√		√
CO5		√	√			
CO6				√		√

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	2	2						3			2	3	3	2
CO2	3	3	3	2	2				3						
CO3	3	3	3	2	3				3						
CO4	2	2	3	2	2				3						
CO5	3	3	3	1	3				2			3			
CO6	2	2	3	3	3				2			3			

<b>Contents</b>
<b>UNIT-1</b>
<b>Full Stack Web Developer</b> Introduction to Full Stack Web Developer, Front End Developer, Back End Developer, HTML Syntax and Semantics, CSS & Advanced CSS, Bootstrap.
<b>UNIT-2</b>
<b>JavaScript</b> JS Syntax, JS Comments, JS Variables, JS Let, JS Const, JS Operators, JS Data Types, JS Functions, JS Objects, JS Strings, JS String Methods, JS String Search, JS Array, JS Array Methods, JS Conditional Statement and JS Looping Statement.
<b>UNIT-3</b>
<b>ReactJS</b> Introduction to ReactJS, ECMAScript 6, React Render HTML, React JSX, React Components – Class Component, React Prop, React Events, React Condition, React Forms, React Hooks.
<b>UNIT-4</b>

### Real Time Deployment Of Web Application

Deploy Web Applications on server or cloud, Configuring the Server for application, Deploying database on server and Establishing connection with database, Synchronies database with deployed Application.

#### Text Books:

1. "Learning Web Design : A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics" by Niederst Robbins
2. JavaScript: JavaScript For Beginners - Learn JavaScript Programming with ease in HALF THE TIME by Stephen Blumenthal
3. Learning React: A Hands-On Guide to Building Web Applications Using React and Redux by Kirupa Chinnathambi

#### REFERENCE BOOKS:

1. Karl Seguin, "The Little Mongo DB Book", <https://github.com/karlseguin/the-littlemongodb-book>
2. W3schools - <https://www.w3schools.com/REACT/default.asp>.
3. Gareth Dwyer, "Flask by Example", Packt Publishers, 2016.
4. <https://aws.amazon.com/education/awseducate/>
5. <http://packaging.ubuntu.com/html/packaging-new-software.html>
6. <http://www.pyinstaller.org/> 6. <https://pypi.org/project/py2exe/0.9.2.0/>

#### JOURNALS/MAGAZINES:

1. <https://vitamintalent.com/>
2. <https://www.ijert.org/the-new-era-of-full-stack-development>

#### SWAYAM/NPTEL/MOOCs:

1. <https://nptel.ac.in/>
2. <https://www.coursera.org/>

Course Title	DATA MINING(OE-II)				Course Type		Theory	
Course Code	B20CIO601	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13 weeks / Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>0</b>	<b>50%</b>	<b>50%</b>

#### COURSE OVERVIEW:

Data mining is a major area of exploration for knowledge discovery in databases. Data mining is for relatively unstructured data for which more sophisticated techniques are needed. The course

aims to cover powerful data mining techniques including clustering, classification and association rules.

**COURSE OBJECTIVE**

1. Introduce the basics of data mining, data types, similarity and dissimilarity measures
2. Explain association rules and algorithms
3. Describe the classification algorithms for data categorization
4. Illustrate the clustering algorithms for grouping data sets
5. Demonstrate the appropriate data mining techniques for decision making
6. Analyze solutions using data mining algorithms to the complex problems, either individually or as a part of the team and report the results with proper interpretation.

**COURSE OUTCOMES (COs)**

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Explain the basics of data mining techniques, data types, identify the similarity and dissimilarity between the data sets and analyze the data sets using the association rules and algorithms	1-5	1,2
CO2	Characterize and discriminate data sets with classification methods	2,3,5,7,8	2
CO3	Employ the clustering methods in real life problems	1-7	2,3
CO4	Apply the knowledge for data mining applications	1-7,11-12	2,3
CO5	Demonstrate the appropriate data mining techniques for decision making	1, 11	2
CO6	Analyze solutions using data mining algorithms to the complex problems, either individually or as a part of the team and report the results with proper interpretation.	1-5	2

**BLOOM’S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom’s Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2		√		√		
CO3			√	√		
CO4		√	√	√	√	

CO5			√			
CO6				√		

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	3	1								1	3	
CO2		1	2		1		3	1						2	
CO3	2	2	1	2	3	1	2							1	3
CO4	2	2	1	2	3	1	2				1	3		1	2
CO5	2	2									2			2	2
CO6	2	3									3			2	2

**Note:** 1-Low, 2-Medium, 3-High

**COURSE CONTENT  
THEORY**

Contents
<b>UNIT-1</b>
<b>Introduction:</b> What is Data Mining? Motivating Challenges, The origins of data mining, Data Mining Tasks, Types of Data, Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity, Data Mining Applications, Visualization.
<b>UNIT-2</b>
<b>Association Analysis:</b> Basic Concepts and Algorithms, Frequent Itemset Generation, Rule Generation, Compact Representation of Frequent Itemsets, Alternative methods for generating Frequent Itemsets, FP GROWTH Algorithm, Evaluation of Association Patterns .
<b>UNIT-3</b>
<b>Classification:</b> Basics, General approach to solve classification problem, Decision Trees, Evaluating the performance of a Classifier, Rule Based Classifiers, Nearest Neighbour Classifiers, Naïve Bayes Classifier
<b>UNIT-4</b>
<b>Clustering:</b> overview, K-means, agglomerative hierarchical clustering, DBSCAN, Cluster Evaluation, Characteristics of Data, Clusters and Clustering Algorithms, Prototype Based Clustering.

**TEXTBOOKS:**

1. A Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", Pearson

Education, 2007.

2. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques" Second Edition, Elsevier, Reprinted 2008.

**REFERENCE BOOKS:**

1. K.P. Soman, Shyam Diwakar and V. Ajay, "Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, 2006.

2. G.K. Gupta, "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006.

**JOURNALS/MAGAZINES:**

1. Data Mining and Knowledge Science – Springer.
2. Interscience, the International Journal of Data Mining, Modelling and Management-
3. IEEE, IEEE Transactions on Knowledge and Data Engineering.

**SWAYAM/NPTEL/MOOCs:**

1. <https://nptel.ac.in/courses/110/107/110107129/>
2. [https://onlinecourses.nptel.ac.in/noc19\\_mg47/preview](https://onlinecourses.nptel.ac.in/noc19_mg47/preview)
3. [https://onlinecourses.swayam2.ac.in/cec20\\_cs12/preview](https://onlinecourses.swayam2.ac.in/cec20_cs12/preview)

**SELF LEARNING EXERCISES:**

1. <https://www.linguamatics.com/what-text-mining-text-analytics-and-natural-language-processing>
2. <https://www.coursera.org/learn/text-mining>
3. <https://www.ibm.com/cloud/learn/text-mining>

Course Title	Machine Learning (OE-II)				Course Type		Theory	
Course Code	B20CIO602	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13 week / Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>0</b>	<b>50%</b>	<b>50%</b>

**COURSE OVERVIEW:**

**Course Description:** Machine learning uses interdisciplinary techniques such as statistics, linear algebra, optimization, and computer science to create automated systems that can process through large volumes of data at high speed to make predictions or decisions without human intervention.

**COURSE OBJECTIVES:**

The objectives of this course are to:

1. Explain machine learning and problems relevant to machine learning.
2. Discuss the fundamentals of Decision trees learning and its issues
3. Illustrate neural networks , Bayes classifier and k nearest neighbour for problems appearing in machine learning.
4. Describe statistical analysis of machine learning techniques.
5. Learn new techniques in Machine learning and apply for suitable application development.
6. Analyse solutions in the machine learning to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation

**COURSE OUTCOMES (COs)**

On successful completion of this course; the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Design the learning system to provide the solution for the given problem.	1 to 5	1,2,3
CO2	Apply Decision Tree technique for Classification problem	1 to 5	1,2,3
CO3	Develop Recognition or Prediction systems using Neural Network/Bayesian Model	1 to 5	1,2,3
CO4	Solve the problem by hypothesis testing using probability and statistics.	1-5	1,2,3
CO5	Learn new techniques in Machine learning and apply for suitable application development.	1-5	1,2,3
CO6	Analyse solutions and apply machine learning techniques to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation	1-5	1,2,3

**BLOOM’S LEVEL OF THE COURSE OUTCOMES**

	Bloom’s Level
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CO#	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1						√
CO2			√			√
CO3				√		√
CO4				√	√	√
CO5		√				
CO6			√	√		

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2	1								3	3	3
CO2	3	2	3	1	2								3	3	3
CO3	3	1	2	1	2								3	3	3
CO4	3	2	2	2	2								3	3	3
CO5	3	2	3	1	1								3	3	3
CO6	3	2	3	2	2				3				3	3	3

**Note:** 1-Low, 2-Medium, 3-High

**COURSE CONTENT:**

**THEORY**

Contents
<b>Unit-1:</b> <b>Introduction to Machine Learning:</b> What is Machine Learning, challenges, Applications, methods of Machine Learning, performance metrics, Data preprocessing, Data Loading, Understanding data, Pre-Processing unit

**Unit-2:**

**Classification** – Decision Tree, K-nearest neighbor, logistic regression, support vector machine algorithm, naive Bayes algorithm, random forest algorithm

**Unit -3:**

**Regression** - linear regression, **Random Forest Regression**

**Clustering: overview, k – means clustering, mean shift clustering, hierarchical clustering, DBSCAN clustering algorithm.**

**Unit – 4**

**Introduction to neural networks:** Biological Neuron, ANN Perception, Network Topology (Feed forward network, Feedback Networks), Adjustments of Weights or Learning, Activation Functions, Training Algorithm, Gradient descent algorithms -Batch Gradient Descent, Stochastic Gradient Descent, Mini Batch gradient descent.

**TEXT BOOK:**

1. Tom M. Mitchell, Machine Learning, India Edition McGraw Hill Education,2013.

**Websites:**

1. [https://www.tutorialspoint.com/machine\\_learning\\_with\\_python/index.htm](https://www.tutorialspoint.com/machine_learning_with_python/index.htm)
2. [https://www.tutorialspoint.com/artificial\\_neural\\_network/index.htm](https://www.tutorialspoint.com/artificial_neural_network/index.htm)

**REFERENCE BOOKS:**

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, “The Elements of Statistical Learning”, 2nd edition, springer series in statistics, 2009.
2. Ethem Alpaydın, “Introduction to machine learning”, second edition, MIT press, 2009.

**JOURNALS/MAGAZINES:**

1. Springer Journal of Machine Learning.
2. International Journal of Machine Learning and Computing.

**SWAYAM/NPTEL/MOOCs:**

1. Coursera – Machine Learning
2. Coursera – Deep Learning
3. [https://onlinecourses.nptel.ac.in/noc19\\_cs53/previe](https://onlinecourses.nptel.ac.in/noc19_cs53/previe)

**SELF-LEARNING EXERCISES:**

Reinforcement Learning: Introduction, Learning Task, Q Learning.

Website to be referred:

1. [https://www.tutorialspoint.com/machine\\_learning\\_with\\_python/index.htm](https://www.tutorialspoint.com/machine_learning_with_python/index.htm)
2. [https://www.tutorialspoint.com/artificial\\_neural\\_network/index.htm](https://www.tutorialspoint.com/artificial_neural_network/index.htm)



Course Title	Neural Networks (OE-II)				Course Type		Theory	
Course Code	B20CIO603	Credits	3		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13 week / Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>0</b>	<b>50%</b>	<b>50%</b>

**COURSE OVERVIEW:**

**Course Description:** This course introduces the basic learning models, learning algorithms, and some applications of neural networks. The focus is on to understand and use neural networks for solving different problems related to pattern recognition, function approximation, data visualization, etc.

**COURSE OBJECTIVES:**

The objectives of this course are to:

1. Understand mathematical basics of neural networks.
2. Choose appropriate error function and optimization algorithm
3. Enable a student to train a neural network using suitable approach
4. Design real world solutions using Neural networks.
5. understand and use neural networks for solving different problems related to pattern recognition, function approximation, data visualization.

**COURSE OUTCOMES (COs)**

On successful completion of this course; the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Outline the mathematical concepts behind working of neural networks.	1-5	1
CO2	Illustrate the error functions and optimization algorithms that can be applied to a neural network model	1-5	2
CO3	Demonstrate the training of a neural network model to solve a problem.	1-5	3
CO4	Design a neural network using Tensor Flow to solve a real world problem.	1-5	2
CO5	Understand and use neural networks for solving different problems related to pattern recognition, function approximation, data visualization.	1-5,9	3
CO6	Analyse solutions using pattern recognition to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation	1,2,5,11	3

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1						v

CO2			√			√
CO3				√		√
CO4				√	√	√
CO5		√	√			
CO6			√	√		

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2	1								3		
CO2	3	2	3	1	2									3	
CO3	3	1	2	1	2										3
CO4	3	2	2	2	2										3
CO5	3	3	3	2	2										3
CO6	3	3	3	3	3					2	2				3

**Note:** 1-Low, 2-Medium, 3-High

**COURSE CONTENT:  
THEORY**

<b>Contents</b>
<b>UNIT-1</b>
<p><b>Neural Network Basics</b> – Statistical Pattern Recognition – an example character recognition, classification and regression, pre-processing and feature extractions, polynomial curve fitting, multivariate non-linear functions, decision boundaries, minimizing risk, single layer networks – linear discriminant functions, linear separability, least squares techniques, the perceptron, multi-layer perceptron – feed forward network mappings, threshold units, sigmoidal units, error back propagation, Jacobian Matric, Hessian matrix.</p>

## UNIT-2

### **Learning and Generalization:**

Error Functions and Parameter Optimization Algorithms –Sum of squares error, Minkowski error, input dependent variance, modelling conditional distributions, estimating posterior probabilities, sum of squares for classification, cross entropy for two classes, entropy.

Error Surfaces, Local quadratic approximation, linear output units, optimization in practice, gradient descent, conjugate gradients, Newton’s Method, Bias and Variance, Regularization, Training with noise, soft weight sharing, Linear Neurons and Their Limitations, Sigmoid, Tanh, and ReLU Neurons, Softmax Output Layers, Looking Forward.

## UNIT-3

**Training Feed-Forward Neural Networks:** The Fast-Food Problem, Gradient Descent, The Delta Rule and Learning Rates, Gradient Descent with Sigmoidal Neurons, The Back-propagation Algorithm, Stochastic and Mini batch Gradient Descent, Test Sets, Validation Sets, and Over fitting, Preventing Over fitting in Deep Neural Networks. Back Propagation: The Back propagation Network, The Generalized Delta Rule, Practical Considerations, BPN Applications, The Back propagation Simulator.

## UNIT-4

**Implementing Neural Networks in Tensor Flow:** Definition of Tensor Flow, Installing Tensor Flow, Creating and Manipulating Tensor Flow Variables, Tensor Flow Operations, Placeholder Tensors ,Sessions in Tensor Flow, Navigating Variable Scopes and Sharing Variables, Managing Models over the CPU and GPU, Specifying the Logistic Regression Model in Tensor Flow, Logging and Training the Logistic Regression Model, Leveraging Tensor Board to Visualize Computation Graphs and Learning, Building a Multilayer Model for MNIST in Tensor Flow.

**TEXT BOOKS:**

1. Christopher M Bishop, "Neural Networks for Pattern Recognition", Clarendon Press, Oxford, 2005.
2. Nikhil Buduma, Nicholas Locascio, "Fundamentals of Deep Learning, designing next-generation machine intelligence algorithms", O'Reilly, 1<sup>st</sup> Edition.

**REFERENCE BOOKS:**

1. Simon Haykin, "Neural Networks- A comprehensive foundation", Pearson Education, 2003.
2. S.N.Sivanandam, S.Sumathi,S. N. Deepa "Introduction to Neural Networks using MATLAB 6.0", TATA Mc Graw Hill, 2006.
3. Neural Networks Algorithms, Applications, and Programming Techniques - James A. Freeman

**JOURNALS/MAGAZINES**

1. IEEE Transactions on Neural Networks and learning systems
2. IEEE Transactions on Evolutionary Computation
3. IEEE Transactions on Fuzzy systems
4. Journal of Applied Soft Computing –Elsevier

**SWAYAM/NPTEL/MOOCs:**

1. [www.cs.stir.ac.uk/courses/ITNP4B/lectures/kms/1-Intro.pdf](http://www.cs.stir.ac.uk/courses/ITNP4B/lectures/kms/1-Intro.pdf)
2. <https://www.nptel.ac.in/courses/106/106/106106184>

**SELF-LEARNING EXERCISES:**

Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis. Neural network applications: Process identification, control, fault diagnosis.

Course Title	Information and Network Security Lab				Course Type		Practice	
Course Code	<b>B20EJ0603</b>	Credits	1		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	1	2	2	0	26	50%	50%

**COURSE OVERVIEW:**

Course Description: The most important issue in organization operations, services and individuals is security of the exchanged data. This course introduces security policy, standards and tools used to provide security, such as shared key encryption (DES), public key encryption, and digital signature (Diffie-Hellmann, RSA, etc.). It then reviews how these tools are utilized in the internet protocols and applications and the system security issues, such as viruses, intrusion, and firewalls, will also be covered.

**COURSE OBJECTIVE**

The objectives of this course are to:

1. Explain the security planning, standards and practices.
2. Describe the different cryptographic algorithms.
3. Demonstrate the use of the various authenticating functions.
4. Discuss Firewalls and Intrusion Detection system.

**COURSE OUTCOMES (COs)**

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Summarize the security planning, standards and practices in Intrusion Detection Systems	1 to 5	1
CO2	Make use of the different cryptographic algorithms for encryption and decryption of given data.	1 to 5	2
CO3	Compare the various performance of protocols used for authentication.	1 to 5	2,3
CO4	Identify security in different layers of OSI for solving real world network problems	1 to 5	1
CO5	Relate different firewalls available for more security	1 to 5	2,3
CO6	Identify different auditing tools for intrusion management system.	1 to 5	1,3

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			

CO3			√			
CO4			√			
CO5			√	√		
CO6			√	√		

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	1								3		
CO2	3	2	3	1	2									3	
CO3	3	1	2	2	3									3	3
CO4	2	2	2	1	1									3	3
CO5	2	2	3	3	1									2	3
CO6	2	2	3	3	2									2	3

**Note:** 1-Low, 2-Medium, 3-High

**Practice:**

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
1.	Study the tool used for Network scanning ie NMAP and conduct the network analysis	NMAP	
2.	Setup a honey pot and monitor the honeypot on network (KF Sensor)	KF Sensor)	

<b>3.</b>	Implement Caesar cipher using suitable programming and show the successful decryption of Ciphertext and verify the same with “Cryptool”.	Cryptool	Network Programming /Cyber Security
<b>4.</b>	Implement DES algorithm to encrypt the data and verify the same with ‘Cyptool’.	Cryptool	
<b>5.</b>	Implement a simple RSA algorithm and demonstrate how to recover the Plaintext.	Cryptool	
<b>6.</b>	Demonstrate how to perform key exchange securely using Diffie Helman Keyexchange mechanism.	Cryptool	
<b>7.</b>	Demonstrate the data hiding using any steganography tools.	steganography tools.	
<b>8.</b>	Demonstrate intrusion detection system (ids) using any tool eg. Snort or any other s/w.	Snort or any other s/w.	
<b>9.</b>	Automated Attack and Penetration Tools Exploring N-Stalker, a Vulnerability Assessment Tool.	Vulnerability Assessment Tool.	
<b>10</b>	Install the Tinywall and configure it. Inspect the incoming and outgoing packets. Prepare the report of the Firewall traffic analysis.	Tinywall	



Course Title	Information Retrieval Systems Lab				Course Type		Practice	
Course Code	B20EQ0602	Credits	1		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13weeks/Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	1	2	2				

#### COURSE OVERVIEW:

Information retrieval is the process through which a computer system can respond to a user's query for text-based information on a specific topic. IR was one of the first and remains one of the most important problems in the domain of natural language processing (NLP). Web search is the application of information retrieval techniques to the largest corpus of text anywhere -- the web -- and it is the area in which most people interact with IR systems most frequently.

#### COURSE OBJECTIVE (S):

The objectives of this course are to:

5. Describe the basic concepts of the information retrieval and its models.
6. Illustrate the use of query languages and its operations in real world applications
7. Demonstrate the use of user interfaces and visualization for search process
8. Explain the multimedia IR models, Indexing and searching the web concepts.

#### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Outline basic concepts of the information retrieval.	1 to5	2

CO2	Apply appropriate Query technique on given real world applications	1 to5	2
CO3	Develop user interfaces and visualization for search process to address research issues.	1 to5	2
CO4	Identify appropriate indexing and searching method for Feature Extraction.	1 to5	2
CO5	Demonstrate the use of user interfaces and visualization for search process	1 to5	2
CO6	Explain the multimedia IR models, Indexing and searching the web concepts	1 to5	2

**BLOOM'S LEVEL OF THE COURSE OUTCOMES:**

CO#	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply(L3)	Analyze(L4)	Evaluate(L5)	Create(L6)
CO1		√				
CO2			√			
CO3						√
CO4				√	√	
CO5		√		√		
CO6		√				

**COURSE ARTICULATION MATRIX:**

CO#/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1										3
CO2	2	3	2	1	2										3
CO3	2	2	2	2	1										3
CO4	2	2	3	1	2										3
CO5	2	3	2	1	2										3

CO6	2	2	2	2	1											3
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Note:1-Low,2-Medium,3-High

## COURSE CONTENT

### PRACTICE

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
1.	Demonstrate simple term weights computation for the given query.	The search index must be supported by Lucene (although, there are other more research-oriented search engines). The project implementation can be in either Java (better search engine support) or <b>Python</b> (better text pre-processing support).	To quantify words in a set of documents
2.	Implement hands-on experience store, and retrieve information from www using semantic approaches.	Semantic search	To improve search accuracy by understanding the content of the search query.
3.	Implement the usage of different data/file structures in building computational search engines.	Membership Operators Linear Search Binary Search Jump Search Fibonacci Search Exponential Search Interpolation Search	To Use different data/file structures in building computational search engines
4.	Implement the Analysis and the performance of information retrieval using various classification algorithm on text	Text Classification using scikit-learn, python and NLTK.	To Analyse the performance of information retrieval using various classification algorithm on text

5.	Implement the Analysis and the performance of information retrieval using Clustering algorithm on text	Clustering text documents using k-means	To the Analysis and the performance of information retrieval using Clustering
6.	Implement Domain specific Search Engine	The Domain Specific Search Engine is specific towards "Mobile Phone Related Document Searches". It is designed into three basic parts:  Corpus collection:  Creating Inverted Index:	To design a Domain Specific Search Engine
7.	Implement how to Analyse ranked retrieval of a very large number of documents with hyperlinks between them	Hyperlink Induced Topic Search	To Analyse ranked retrieval of a very large
8.	Implement how N-grams are used for detection and correction of spelling errors.	Text Blob(offline) / Google Colab (Online)	To generate any number of n-grams for a given text dataset easily in Python and thus analyse our dataset
9.	Demonstrate Information visualization technologies like Cognition and perception in the Internet or Web search engine.	Preparing the documents  Create a Term-Document Matrix with TF-IDF weighting  Calculate the similarities between query and documents using Cosine Similarity  Retrieve the articles that have the highest similarity on it.	To build a simple search engine from scratch using Python and its supporting library

10.	Implement one of the case studies of Information Retrieval System	PyTerrier & Kaggle Dataset	To analyze the case studies of IRS and implement using Python
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**Web Resources:**

[https://www.youtube.com/watch?v=q0srNT\\_XM\\_Y&list=PL0ZVw5-GryEkGAQT7IX7oIHqyDPeUyOMQ](https://www.youtube.com/watch?v=q0srNT_XM_Y&list=PL0ZVw5-GryEkGAQT7IX7oIHqyDPeUyOMQ)

<https://towardsdatascience.com/tf-idf-for-document-ranking-from-scratch-in-python-on-real-world-dataset-796d339a4089>

<https://www.youtube.com/watch?v=yIuvahNq3wk>

[https://scikit-learn.org/stable/auto\\_examples/text/plot\\_document\\_clustering.html](https://scikit-learn.org/stable/auto_examples/text/plot_document_clustering.html)

<https://analyticsindiamag.com/guide-to-pyterrier-a-python-framework-for-information-retrieval/>

<https://towardsdatascience.com/create-a-simple-search-engine-using-python-412587619ff5>

[https://github.com/ayushjain19/Domain\\_Specific\\_Search\\_Engine](https://github.com/ayushjain19/Domain_Specific_Search_Engine)

<https://medium.com/mlearning-ai/semantic-search-with-s-bert-is-all-you-need-951bc710e160>

<https://stackabuse.com/search-algorithms-in-python/>

<https://towardsdatascience.com/machine-learning-nlp-text-classification-using-scikit-learn-python-and-nltk-c52b92a7c73a>

<https://www.analyticsvidhya.com/blog/2021/09/what-are-n-grams-and-how-to-implement-them-in-python/>

<https://stackabuse.com/spelling-correction-in-python-with-textblob/>

**Other useful references**

Managing Gigabytes, by I. Witten, A. Moffat, and T. Bell.

*Information Retrieval: Algorithms and Heuristics*, by D. Grossman and O. Frieder.

Modern Information Retrieval, by R. Baeza-Yates and B. Ribeiro-Neto.

*Search Engines: Information Retrieval in Practice*, by B. Croft, D. Metzler, and T. Strohman.

Information Retrieval: Implementing and Evaluating Search Engines, by S. Büttcher, C. Clarke, and G. Cormack.

Course Title	RESEARCH BASED MINI PROJECT				Course Type		Practice	
Course Code	B20CI0601	Credits	2		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	2	4	4	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>2</b>	<b>4</b>	<b>4</b>	<b>0</b>	<b>52</b>	<b>50%</b>	<b>50%</b>

**COURSE OVERVIEW:**

**Course Description:** This course offers "An overview of research methodology including basic concepts employed in quantitative and qualitative research methods. This course introduces problem selection, synopsis writing, ethics, research design skills, research methods, how to carry out literature survey, reading and writing technical paper, thesis writing, introduction latex and beamer and how to design the quality research proposal.

**COURSE OBJECTIVE**

The objectives of this course are to:

1. Explain the dimensions and methods of research.
2. Illustrate the design of informed choice from the large number of alternative methods and experimental designs available.
3. Describe the features of a good research proposal.
4. Discuss the skills required for undertaking a research project and preparing a technical paper.

**COURSE OUTCOMES (COs)**

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of the dimensions and methods of research for solving real world problems.	1,4,7,11,12	2,3
CO2	Identify the appropriate research problem and parameters to carry out the research work.	2,5,6,12	2,3
CO3	Apply different research skills in preparing proposal for research project and technical paper.	6,7,11	2,3
CO4	Create IPR documents using Latex Tool.	3,12	3
CO5	Learn new tools and technologies in research methodologies and apply for suitable application development.	1-5	2
CO6	Analyse solutions using Research Methodologies to the complex problems either individually or as a part of the team and report the results with proper analysis and interpretation	5,11	2

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2				√	√	
CO3			√			

CO4						√
CO5		√				
CO6			√	√		

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2			2			1				1	1	1	2	
CO2		2			1	3						2	2	2	
CO3						2	1				2		2	1	
CO4			2									2			3
CO5	2	3		2	2						2				3
CO6	2	3		2	2						2				3

**Note:** 1-Low, 2-Medium, 3-High

A Mini Project has to be carried out by the students and the same has to be completed by the end of semester. Students have to spend a minimum of 8 hours per week on the mini project. A Mini Project has to be developed and documented using Latex. The outcome of the mini project should be paper publication/ IPR

Course Title	INDIAN TRADITION & CULTURE				Course Type		Theory	
Course Code	B20PA0501	Credits	1		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	1	1	1				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>13</b>	<b>0</b>	<b>50%</b>

**COURSE OVERVIEW:**



This course offers the students with various aspects of culture and heritage of India..This course also enable the students to understand the contribution of our ancestors in the areas of science, medicine, arts, language and literature.

**COURSE OBJECTIVE:**

The objectives of this course is to:

1. To provide conceptual knowledge of Indian culture and traditions
2. To introduce students to the science and technological advancements related to Indian culture
3. To help students understand the Indian spiritual aspects of Indian culture
4. To help learners understand the factors which unite the diverse cultures of India

**COURSE OUTCOMES (COs)**

1. Gain conceptual understanding of Indian culture and traditions.
2. Describe various ancient theories in treatment of any disease, Appreciate the science and technological advancements in ancient India.
3. Comprehend the Indian spiritual aspects of Indian culture like yoga, meditation and nirvana.
4. Demonstrate the theory behind celebrating Hindu festivals and concept of making varieties of food and Understand India as a land united by cultural diversity.

**COURSE OUTCOMES (COs)**

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Gain conceptual understanding of Indian culture and traditions.	2,3,4,6,8,12	3
CO2	Describe various ancient theories in treatment of any disease, Appreciate the science and technological advancements in ancient India.	10,11	3
CO3	Comprehend the Indian spiritual aspects of Indian culture like yoga, meditation and nirvana.	11	3
CO4	Demonstrate the theory behind celebrating Hindu festivals and concept of making varieties of food and Understand India as a land united by cultural diversity	11,12	3

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2		√	√			

CO3		√				
CO4		√				

#### COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2	1	2		2		3				3			1
CO2										2	2				2
CO3											2				1
CO4											2	2			1

**Note:** 1-Low, 2-Medium, 3-High

#### COURSE CONTENT THEORY

Contents	
UNIT-1	
<b>Indian Tradition</b>	
i.	Culture – Indus Valley Civilization and early cultural practices, The Vedic culture, Influence of Buddhism and Jainism on Indian Culture, Influence of Islam and Christianity, Indian Cultural Renaissance of the 19 <sup>th</sup> Century
ii.	Religion – Pre-vedic and Vedic religion, Jainism, Buddhism, Hinduism, Religious Reform Movements, Advent of Christianity
iii.	Art – Introduction to Natyashastra, classical and contemporary art forms (dance and music), regional art forms (dance and music), Folk art, puppetry
iv.	Architecture – Engineering and Architecture in Ancient India; Evolution of Hindu Temple Structures, Sculptures, Coins and Pottery from Ancient India
v.	Literature- Vedas, Upanishads, Ramayana, Mahabharata & Bhagavat Gita.

## UNIT-2

### Contribution of ancient India to Science and Maths

- i. Development of Science in Ancient India- Astronomy, Mathematics, Medicine, Metallurgy.
- ii. Scientists of Ancient India:
  - a. Mathematics and Astronomy- Baudhayan, Aryabhata, Brahmagupta, Bhaskaracharya, Mahaviracharya
  - b. Science- Kanad, Varahamihira, Nagarjuna
  - c. Medical Sciences (Ayurveda and Yoga)- Susruta, Charaka, Yoga and Patanjali
- iii. Science and Scientists in Medieval India- Mathematics, Biology, Chemistry, Astronomy, Medicine, Agriculture.
- iv. Scientists in Modern India- Srinivas Ramanujan, Chandrasekhara V Raman, Jagadish Chandra Bose, Homi Jehangir Bhabha, Dr, Vikram Ambalal Sarabhai, ,Dr. APJ Abdul Kalam

## UNIT-3

### Indian Spiritual Aspects

- I. Hindu Spirituality based on shruti and smriti- Hinduism in General, Basic notions of Vedas, Upanishads, Ramayana, Mahabharata & Bhagavat Gita.
- ii. Hata Yoga and Pranayama- Main Features, Basics of Yoga –Different kinds of Yoga; Raja Yoga (Ashtanga yoga); Karma yoga; Bhakti Yoga – yoga of Loving Devotion; Jnana yoga – Yoga of Knowledge; Hatha Yoga (Asana/ Pranayamas); Kundalini Yoga; Nada Yoga; Sannyasa Yoga
- iii. Buddhist, Jaina Spiritualities- Main Doctrines of Buddhism: Four Noble Truths (Arya Satya), Concept of Nirvana - Ashtanga Marga

## UNIT-4

### Unity in Diversity

- i. Commensality and the Significance of Food – Eating Together as Family and as a Society, Food at Rituals; annaprasan, marriage and funeral, Kitchen as Shared Space for Women, Food and Nationalist Response of Indian Community, Visibility of Indian Cuisine in the World
- ii. Celebrating Diverse Festivals – Festival Types: Religious and Seasonal, Religious - Holi, Diwali, Ganesh Chaturthi, Janmashtami, Mahavir Jayanthi, Ramadan, Christmas, Buddha Purnima; Seasonal (harvest festivals) - Baisakhi, Pongal, Sankranti
- iii. Attire - Indus Valley Civilization, Vedic period, Modern India

### TEXT BOOKS:

1. Sundararajan K.R., Hindu Spirituality - Vedas through Vedanta, Cross Road Publications, New York, 1997.
2. Griffiths Bede, Yoga and the Jesus Prayer Tradition, Asian Trading Corporation, Bangalore, 1992

### REFERENCE BOOKS:

1. Ansh Mishra, Science in Ancient India, Indian Corporation, New Delhi, 1998
2. Sen Taylor, Collen. Feasts and Fasts: A History of Food in India. Reaktion Books, New Delhi, 2014.
3. Thapar, Romila, Readings in Early Indian History. Oxford University Press. New Delhi, 2018

### JOURNALS/MAGAZINES

1. Arts and Humanities (miscellaneous)
2. History
3. Language and Linguistics
4. History and Philosophy of Science

## 5. Literature and Literary Theory

### SWAYAM/NPTEL/MOOCs:

1. <https://nptel.ac.in/courses/109/104/109104102/>

2. <https://nptel.ac.in/courses/109/103/109103018/>

Course Title	MODERN DATABASE				Course Type		Theory	
Course Code	B20EQ0603	Credits	2		Class		VI semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13 weeks / Semester		Assessment in Weightage	
	Theory	1	1	1				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>26</b>	<b>50</b>	<b>50</b>

### COURSE OVERVIEW

This course will provide students with a general overview of databases, introducing you to database history, modern database systems, the different models used to design a database, and Structured Query Language (SQL), which is the standard language used to access and manipulate databases. Effective collection, analysis, and maintenance of data is key to achieve rapid progress in almost all disciplines of science and engineering.

### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the concepts of DBMS and SQL
2. Discuss the Object oriented concepts and object relational Databases
3. Demonstrate the use of parallel and distributed databases in real world applications
4. Illustrate the development of Enhanced Data Model for given applications
5. Utilize a wide range of features available in a DBMS package.
6. Analyse database requirements and determine the entities involved in the system and their relationship to one another.

### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of the concepts of DBMS and SQL in real world applications	1 to 4, 8, 9, 12	1

CO2	Develop programs for Make use of the Object oriented concepts and object relational databases in real world applications.	1 to 3, 5,9,12	1
CO3	Apply features of Experiment with parallel and distributed databases.	1 to 5, 9, 12	2
CO4	Create enhanced Data Model for given applications	1,4,5,9,12	1
CO5	Utilize a wide range of features available in a DBMS package.	1,4,5,9,12	1
CO6	Analyse database requirements and determine the entities involved in the system and their relationship to one another.	1,4,5,9,12	1

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			√
CO2			√			√
CO3			√	√		
CO4			√	√	√	
CO5			√			
CO6				√		

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	2									3		
CO2	2	2	3		2									3	
CO3	3	1	2	1	2										3
CO4	3			2	2								3	3	3
CO5	3			2	2								3	3	3
CO6	3			2	2								3	3	3

**Note:** 1-Low, 2-Medium, 3-High

**COURSE CONTENT  
THEORY**

<b>Contents</b>
<b>UNIT-1</b>
<b>Overview of DBMS and SQL:</b> Introduction to DBMS and SQL, SQL Data Definition and Data Types, Schema change statements in SQL, Specifying basic constraints in SQL, Basic Queries in SQL, More Complex Queries in SQL.
<b>UNIT-2</b>
<b>Modern database:</b> General Constraints as Assertions, Views in SQL, Database Programming, Embedded SQL. Introduction to Hadoop, NoSQL, New SQL, MongoDB, Amazon RDS, Oracle & other latest technologies.
<b>UNIT-3</b>
<b>Overview of Object-Oriented Concepts:</b> Objects, Encapsulation, Polymorphism, Type and class hierarchies etc. Object model of ODMG, Object definition Language ODL; Object Query Language OQL
<b>UNIT-4</b>
<b>Object and Object-Relational Databases:</b> Overview of C++ language binding; Conceptual design of Object database; Overview of object relational features of SQL; Object-relational features of Oracle.

#### **TEXT BOOKS**

1. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, 3rd Edition, McGraw- Hill, 2003.
2. Elmasri and Navathe, Fundamentals of Database Systems, 5th Edition, Pearson Education, 2007.

#### **REFERENCE BOOKS**

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan: Database System Concepts, 6th Edition, McGraw Hill, 2010.
2. C J Date, Database Design and Relational Theory: Normal Forms and All that Jazz, O 'Reilly, April 2012.
3. Jiawei Han, Micheline Kamber, Jian Pei, Data Mining: Concepts and Techniques, Elsevier, 2011.
4. Connolly and Begg, Database Systems, 4th Edition, Pearson Education, 2002.

#### **JOURNALS/MAGAZINES**

1. IEEE, IEEE Transactions on Knowledge and Data Engineering
2. Elsevier, Elsevier Data and Knowledge Engineering
3. ACM, ACM Transactions on Database Systems

#### **SWAYAM/NPTEL/MOOCs:**

1. <https://www.coursera.org/courses?query=database>
2. <https://www.edx.org/learn/databases>
3. <https://academy.oracle.com/en/solutions-curriculum.html>

#### **SELF-LEARNING EXERCISES**

1. Data warehousing, Data Marts, Getting data into the warehouse More exploration on GitHub
2. Data warehousing & KM , Data warehousing & CRM C modules interface

## Detailed Syllabus Semester -7

Course Title	MULTIMEDIA SYSTEMS (PE-V)				Course Type		Theory	
Course Code	B20EJS701	Credits	3		Class		VII semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>0</b>	<b>50%</b>	<b>50%</b>

### COURSE OVERVIEW:

The course includes fundamental concepts of multimedia, Speech, Image and video processing including international standards, Fundamentals of multimedia data compression, standards and synchronization.

### COURSE OBJECTIVE:

The objectives of this course are to:

1. Explain various multimedia components
2. Describe the different Lossy and Lossless compression techniques with respect to multimedia data
3. Discuss the different compression techniques for Image and video
4. Illustrate the use of synchronization concepts.

### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the multimedia components required for developing real world applications	1 to 4, 9, 12	1
CO2	Choose a suitable Lossy and Lossless compression techniques for compressing the given multimedia data.	1 to 3,5,9,12	2
CO3	Design the applications using different compression techniques for Image and video	1 to 3,5,9, 12	3
CO4	Analyze the working of synchronization in multimedia data.	1 to 5, 9, 12	2,3
CO5	Design applications by applying multimedia software tools	1 to 5,9,12	2,3

<b>CO6</b>	Apply synchronization techniques to solve multimedia problems	1 to 5,9,12	2,3
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**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2		√				
CO3			√			
CO4						√
CO5				√		
CO6			√			

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	2	1	2					2			2	3		
<b>CO2</b>	3	2	2		2				1			1		3	
<b>CO3</b>	3	1	1		2				1			1			3
<b>CO4</b>	3	2	2	2	2				2			2		3	3
<b>CO5</b>	3	2	2	3	1				1			2		3	3
<b>CO6</b>	3	2	2	2	2				2			2		3	3

**Note:** 1-Low, 2-Medium, 3-High

**COURSE CONTENT**

**THEORY:**

<b>Contents</b>
<b>UNIT-1</b>



**Introduction to Multimedia** - What is Multimedia? Multimedia- Past and Present, Multimedia Software Tools- A Quick Scan

**Graphics and Image Data Representations** - Graphics/Image Data Types, Popular File Formats, Colour Models in Images

#### UNIT-2

Multimedia Data Compression - Lossless Compression Algorithms, Basics of Information Theory, Run-Length Coding, Dictionary-Based Coding, Arithmetic Coding, Lossless Image Compression. Lossy Compression Algorithms - Introduction, Distortion Measures, theRate-Distortion Theory, Quantization, Transform Coding.

#### UNIT-3

**Image and Video Compressions** - The JPEG Standard, the JPEG2000 Standard, the JPEG-LS Standard, Bi-level Image Compression Standards, Introduction to Video Compression, Video Compression Based on Motion Compensation, H.261, H.263, MPEG-1.

#### UNIT-4

**Synchronization** - Defining "Synchronization", Particularities of Synchronization in Multimedia Systems, Requirements to the Presentation, Reference Elements for Synchronization, Synchronization Types, System Components Involved in Synchronization, A Reference Model for Multimedia Synchronization, Synchronization Specification, Specification Methods for Multimedia Synchronization.

#### TEXT BOOKS:

1. Li, Ze-Nian, Drew, Mark S., Liu, Jiangchuan, "Fundamentals of Multimedia", Springer, 2014.
2. Steinmetz, Ralf, Nahrstedt, Klara, "Multimedia Systems" Springer, 2004

#### REFERENCE BOOKS:

1. Fred Halshall, "Multimedia communication - Applications, Networks, Protocols and Standards", Pearson education, 2007.
2. R. Steinmetz, K. Nahrstedt, "Multimedia Computing, Communications and Applications", Pearson Education. 2008.
3. KR. Rao, Z S Bojkovic, D A Milovanovic, "Multimedia Communication Systems: Techniques, Standards, and Networks", Pearson Education 2007.
4. Introduction to Multimedia Networks, Andrew W. Davis
5. Rao, Bojkovic, Milovanovic: Introduction to Multimedia Communications, Wiley & Sons, Hoboken, NJ, 2006

#### JOURNALS/MAGAZINES

1. IEEE Transactions on Multimedia , <https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6046>
2. ACM Transactions on Multimedia Computing, Communications, and Applications, <https://dl.acm.org/journal/tomm>
3. Elsevier Journal on Multimedia Computing , <https://www.journals.elsevier.com/computer-networks/call-for-papers/recent-advances-in-ai-based-mobile-multimedia-computing>

**SWAYAM/NPTEL/MOOCs:**

1. <https://www.mooc-list.com/tags/multimedia>
2. <https://nptel.ac.in/courses/117/105/117105083/>

**SELF-LEARNING EXERCISES:**

Multimedia applications including digital libraries, system software, toolkits, conferencing paradigms, structured interaction support, and examples from video/audio/graphics conferencing. Latest Web technologies, such as XML, X3D and Semantic Web.

Course Title	Augmented and Virtual Reality (PE-IV)				Course Type		Theory	
Course Code	B20EJS702	Credits	3		Class		VII semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>0</b>	<b>50%</b>	<b>50%</b>

### COURSE OVERVIEW

This course covers basic concepts of augmented reality and virtual reality. The course also introduces the student to the working of multiple models of input and output interface in VR. The course also helps the student to understand development tools and frameworks in VR. Further, this course helps the student to work on the application of VR in digital entertainment.

### COURSE OBJECTIVE (S):

The objectives of this course are to:

- 1.Explain the principles and multidisciplinary features of Virtual Reality.
- 2.Illustrate the multimodal user interaction and perception in Virtual Reality.
- 3.Demonstrate the use of objects for managing large scale Virtual Reality environment in real time.
- 4.Discuss the various solutions using Virtual Reality system framework and development tools for industry and social relevant applications.

### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the components of Augmented and Virtual Reality	1 ,10	1
CO2	Apply multimodal user interaction and perception techniques involved in Virtual Reality.	1 to 3,5,10	3
CO3	Develop real world applications using Simulation and Interactive techniques.	1 to 3, 10	2,3
CO4	Choose the innovative Virtual Reality solutions for industrial and social relevant applications.	1,10	1

CO5	Evaluate current trends of AR and VR media delivery to propose options to potential clients, and discuss the benefits, challenges and misconceptions involved with working in AR and VR.	1,8,12	1,2
CO6	Evaluate various interaction schemes common to AR/VR experiences.	9,12	2

#### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4			√			
CO5					√	
CO6					√	

#### COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3									3			3		
CO2	3	3	3		3					3					3
CO3	3	3	3							3				3	3
CO4	3									3			3		
CO5	2							2					1	2	
CO6									2					2	

**Note:** 1-Low, 2-Medium, 3-High

#### COURSE CONTENT

##### THEORY:

#### UNIT – 1

**Introduction to Augmented Reality (AR):** Definition and Scope, A Brief History of Augmented Reality, Examples, Related Fields, System Structure of Augmented Reality, Key Technology in AR.

**Introduction to Virtual Reality (VR):** Fundamental Concept and Components of VR, Primary Features and Present Development on VR.

## UNIT – 2

**Multiple Models of Input and Output Interface in VR:** Input – Tracker, Sensor, Digital Glove, Movement Capture, Video-based Input, 3D Menus and 3D Scanner. Output – Visual, Auditory, Haptic Devices.

## UNIT – 3

**Environment Modelling in VR:** Geometric Modelling, Behaviour Simulation, Physically Based Simulation. Interactive Techniques in VR: Body Track, Hand Gesture, 3D Manus, Object Grasp.

## UNIT – 4

**Development Tools and Frameworks in VR:** Frameworks of Software Development Tools in VR, X3D Standard, Vega, MultiGen, Virtools, and Unity.

Application of VR in Digital Entertainment: VR Technology in Film and TV Production, VR Technology in Physical Exercises and Games, Demonstration of Digital Entertainment by VR.

### TEXT BOOKS:

1. Dieter Schmalzler and Tobias Hollerer, "Augmented Reality: Principles and Practice", Addison-Wesley, 2006.
2. Burdea, G. C. and P. Coffet. , "Virtual Reality Technology", Second Edition. Wiley-IEEE Press, 2003/2006.

### REFERENCE BOOKS:

1. Sherman, William R. and Alan B. Craig, "Understanding Virtual Reality – Interface, Application, and Design", Morgan Kaufmann, 2002.
2. Fei GAO, "Design and Development of Virtual Reality Application System", Tsinghua Press, March 2012.
3. Guangran LIU, "Virtual Reality Technology", Tsinghua Press, Jan. 2011.
4. International Journal of Virtual and Augmented Reality (IJVAR)
5. Springer, Virtual Reality.

### JOURNALS/MAGAZINES

1. [https://www.mdpi.com/journal/electronics/special\\_issues/VR\\_AR](https://www.mdpi.com/journal/electronics/special_issues/VR_AR)
2. <https://www.sciencedaily.com/releases/2020/04/200420145025.htm>
3. <https://www.springer.com/journal/10055>

### SWAYAM/NPTEL/MOOCs:

1. <https://nptel.ac.in/courses/106/106/106106182/>
2. <https://www.classcentral.com/course/augmented-reality-virtual-reality-mixed--10508>
3. <https://www.edx.org/learn/augmented-reality>

### Self-learning component:

Unity 3D, Manus VR

Course Title	Soft Computing Systems(PE-V)				Course Type		Theory	
Course Code	B20EJS703	Credits	3		Class		VII semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>0</b>	<b>50</b>	<b>50</b>

#### COURSE OVERVIEW:

This course covers basic concepts of soft computing concepts, neural network architectures, back propagation, fuzzy logic, fuzzy membership and rules.

#### COURSE OBJECTIVES:

Objectives of this course are to:

1. Describe soft computing techniques and their applications
2. Explain the neural network architecture with the appropriate heuristics based on human experience.
3. Demonstrate the supervised and unsupervised learning with neural network concepts
4. Discuss fuzzy logic and neuro-fuzzy logic for real world applications

#### Course Out comes (Cos):

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply soft computing techniques and their applications.	1 to 5, 7,8,10,11,12,	1
CO2	Analyze various neural network architectures.	1 to 5, 7,8,9,11,12	2
CO3	Design and develop the neural network with supervised and unsupervised learning.	1 to 5, 7,8,9,11,12	2, 3
CO4	Make use of fuzzy models for real world applications.	1 to 5, 8,9,10,11	3
CO5	Apply softy computing Techniques for real time applications	1-12	3
CO6	Develop an algorithm using soft computing to an applications	1-12	3

**BLOOM'S LEVEL**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√	√			
CO2		√	√			
CO3		√	√			
CO4		√				
CO5			√		√	
CO6						√

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2								2	3	2	2
CO2	3	3	2	1								3	3	3	1
CO3	3	3	3	2								3	3	3	3
CO4	3	3	3	1								0	2	2	3
CO5	3	2	3	3								1	1	2	3
CO6	3	2	3	3								1	2	2	3

**Note:**1-Low,2-Medium,3-High

**COURSE CONTENT:**

**THEORY**

**UNIT – I**

**Introduction and Architecture of Neural Networks:** Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various Course techniques; perception and convergence rule, Auto-associative and hetero-associative memory.

**UNIT – II**

**Back Propagation Networks Architecture:** perception model, solution, single layer artificial neural network, multi layer perception model; back propagation Course methods, effect of Course rule co- efficient; back propagation algorithm, factors affecting back propagation training, applications.

**UNIT – III**

**Introduction to Fuzzy Logic:** Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.

**UNIT – IV**

**Fuzzy Membership and Rules:** Membership functions, interference in fuzzy logic ,fuzzy if-then rules, fuzzy implications and Fuzzy algorithms, Fuzzification and Defuzzification, Fuzzy Controller, Industrial applications.

**TEXT BOOKS:**

1. S. Rajsekaran and G. A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications, 2003, Prentice Hall of India.
2. N. P. Padhy, Artificial Intelligence and Intelligent Systems, 2005, Oxford University Press.

**REFERENCE BOOKS:**

1. Timothy J. Ross, Fuzzy Logic with Engineering Applications,2010,WileyIndia.
2. Siman Haykin, Neural Networks,2009, Prentice Hall of India
3. Kumar Satish, Neural Networks,2004,TataMc.Graw.Hill

**JOURNALS/MAGAZINES**

1. <https://www.springer.com/journal/500>
2. <https://www.journals.elsevier.com/applied-soft-computing>

**SWAYAM/NPTEL/MOOCs:**



1. <https://nptel.ac.in/courses/106/105/106105173>

### SELF LEARNING

Linear Algebra, probability and Information Theory, Genetic Algorithm

Course Title	Python for Data Science (OE-III)				Course Type		Theory	
Course Code	B20CIO701	Credits	3		Class		VII semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>0</b>	<b>50</b>	<b>50</b>

### COURSE OVERVIEW

This course covers fundamentals of Python programming, data preprocessing, sampling methods, Data Visualization techniques, it involves developing a method to analyzing data effectively to extract useful information and statistical method used in statistical decision using experimental data.

### COURSE OBJECTIVE (S):

The objectives of this course are to:

- 1.Explain the fundamentals of python programming
- 2.Discuss the data science and issues of Data science.
- 3.Describe the methods and programming tips of handling large data
- 4.Summarize the fundamentals of statistics and various Data Visualization techniques.

### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply the concepts of python programming to develop simple applications.	1,2,3,4,5	1,2
CO2	Make use of the concepts of data science for solving real world problem.	1,2,3,4,5	1,2

CO3	Identify the techniques which are suitable to handle large volumes of data for distributed data storage.	1,2,3,4,5	1,2
CO4	Analyze the results obtained using various visualization techniques on given data.	1,2,3,4,5	3
CO5	Learn new tools and technologies in the data science and apply for suitable application development.	1,2,3,4,5,12	1,2
CO6	Develop solutions in the data science to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	1,2,3,4,5,9,10	2,3

### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3		√				
CO4			√	√		
CO5			√	√		
CO6				√		

### COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	2	1								3	3	
CO2	2	2	1	2	2								3	3	
CO3	2	2	2	1	2								3	3	
CO4	2	2	1	2	2										3
CO5	2	2	2	2	2							2	2	2	

CO6	2	2	3	2	2				2	2				2	2
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**Note:** 1-Low, 2-Medium, 3-High

## COURSE CONTENT

### THEORY:

#### UNIT- 1

Introduction to concepts of OOPs: Objects and Classes, Data Abstraction, Encapsulation, Polymorphism and Inheritance. Difference between OOP and POP. Python IDEs

**Your First Python Program:** Diving in; Declaring Functions; Optional and Named Arguments, Writing Readable Code, Documentation Strings, The import Search Path, Everything Is an Object, What's an Object?, Indenting Code, Exceptions, Catching Import Errors, Unbound Variables

**Native Data types:** Booleans, Numbers, Coercing integers to Floats and Vice Versa, Numbers in a Boolean Context, Lists, Tuples, Sets, and Dictionaries

**Comprehensions:** Working with Files and Dictionaries, List Comprehensions, Dictionary Comprehensions, Set Comprehensions

#### UNIT- 2

**Introduction:** Introduction to Data Science: Definition: Big Data and Data Science Hype, Why Data Science, Getting Past the Hype, Current Landscape, Who is Data Scientist?, Data Science Process Overview, Defining goals, Retrieving data, Data preparation, Data exploration, Data modeling, Presentation.

#### UNIT -3

**Handling large data** on a single computer: The problems you face when handling large data, General techniques for handling large volumes of data, General programming tips for dealing with large data sets, Case study 1: Predicting malicious URLs, Case study 2: Building a recommender system inside a database. First Steps in Big data: Distributing data storage and processing with Frameworks, Case study: Assessing risk when loaning money.

#### UNIT- 4

**Statistics:** Introduction, Types of Statistics. Data Visualization and Interpretation: Histogram, Bar Charts, Scatter Plots, Good vs. Bad Visualization.

Sampling distributions; Point estimation - estimators, minimum variance unbiased estimation, maximum likelihood estimation, method of moments, consistency; Interval estimation.

### TEXT BOOKS:

1. Mark Pilgrim, "Dive into Python 3", Apress special edition, second edition, 2015.
2. Davy Cielen, Arno D. B. Meysman, Mohamed Ali, "Introducing Data Science", Manning Publications Co., 1st edition, 2016.
3. Travis E. Oliphant, "Guide to NumPy", Trelgol publishers, 2006.
4. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Third Edition, Morgan Kaufmann, 2011.
5. William Navidi, "Statistics for Engineers and Scientists", McGraw Hill Education, India, 3rd Edition, 2013.

**REFERENCE BOOKS:**

1. Mark Lutz, "Learning Python", O'Reilly, 2003.
2. John M. Zelle, "PYTHON Programming: An Introduction to Computer Science", Franklin, Beedle & Associates, 2009.
3. Michael Dawson, "Python Programming for the Absolute Beginners", 3<sup>rd</sup> Edition, CENAGE Learning, 2011.
4. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", Person Education, 2007.
5. K.P. Soman, Shyam Diwakar and V. Ajay, "Insight into Data mining Theory and Practice", Eastern Economy Edition, Prentice Hall of India, 2016.

**JOURNALS/MAGAZINES**

1. <https://datascience.codata.org>
2. <https://www.springer.com/journal/41060>
3. <https://ieeexplore.ieee.org/document/8757088>
4. [https://www.ijcseonline.org/pub\\_paper/57-IJCSE-03229.pdf](https://www.ijcseonline.org/pub_paper/57-IJCSE-03229.pdf)

**SWAYAM/NPTEL/MOOCs:**

1. [https://onlinecourses.nptel.ac.in/noc21\\_cs33/preview](https://onlinecourses.nptel.ac.in/noc21_cs33/preview)
2. Python for Data Science, AI & Development - Coursera

**Self-Learning Exercises:**

Data Science using R, Creating own datasets, functions and packages in R and using packages in R

Course Title	Deep Learning (OE-III)				Course Type		Theory	
Course Code	B20CIO702	Credits	3		Class		VII semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>0</b>	<b>50</b>	<b>50</b>

#### COURSE OVERVIEW:

This course is an introduction to deep learning, a branch of machine learning concerned with the development and application of modern neural networks. Deep learning algorithms extract layered high-level representations of data in a way that maximizes performance on a given task. Deep learning is behind many recent advances in AI, including Siri's speech recognition, Facebook's tag suggestions and self-driving cars.

#### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the basic concepts of Deep Learning.
2. Describe supervised and unsupervised learning.
3. Demonstrate the use of a deep learning neural network in a real world application.
4. Illustrate the use of deep learning techniques in neural networks and natural language processing

#### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply the basic concepts of mathematics to solve problems based on deep learning concepts.	1,2,3,4	1,2
CO2	Make use of suitable machine learning algorithms on real world problems (classification, clustering).	1,3,4,5,8	1,2
CO3	Utilize deep learning neural network model on real time applications.	1,3,4,5,8	1,3
CO4	Develop Recommender systems applications using CNN concepts of NLP.	1,2,4,5	1
CO5	Learn new tools and technologies in deep learning and apply for suitable application development.	1,2,3,4,5,12	1,2

CO6	Develop solutions in the deep learning to the complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	1,2,3,4,5,9, 10	2,3
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**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√	√			
CO2			√			
CO3			√			
CO4						√
CO5			√	√		
CO6				√		√

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	2									3	3	
CO2	2		1	2	1			1					3	3	
CO3	1		1	2	2			1					3		3
CO4	1	1		2	1								3		
CO5	1	1	2	2	2							2	2	2	
CO6	2	2	2	2	2				2	2				2	2

Note: 1-Low, 2-Medium, 3-High

**COURSE CONTENT**

**THEORY:**

## UNIT-1

**Machine Learning Basics:** Linear Algebra-Scalars, Vectors, Matrices and Tensors, Eigen Decomposition, SVD, PCA Probability and Information Theory-Probability Distribution, Conditional Probability, Chain Rule of Conditional Probability, Bayes' Rule.

## UNIT-2

**Numerical Computation:** Overflow, Underflow, Gradient Based Optimization, Constrained Optimization, Linear Least Squares, Machine Learning Basics- Learning Algorithms, Overfitting and Underfitting, Maximum Likelihood Estimation, Supervised and Unsupervised Learning Algorithms, Building Machine Learning Algorithm, Challenges Motivating Deep Learning.

## UNIT-3

**Deep Networks:** Modern Practices-Example: Learning XOR, Gradient-Based Learning, Hidden Units, Architectural Design, Back-Propagation Algorithm.

## UNIT-4

**Convolutional Networks:** Recurrent Neural Networks, Applications- Natural Language Processing, Recommender Systems.

### TEXT BOOKS:

1. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning." First edition, An MIT Press book in preparation, 2015.

### REFERENCE BOOKS:

1. Duda, R.O., Hart, P.E., and Stork, D.G. "Pattern Classification", Wiley-Interscience. 2nd Edition. 2001.
2. Theodoridis, S. and Koutroumbas, K. ,"Pattern Recognition", Edition 4. Academic Press, 2008.
3. Russell, S. and Norvig, N. ,"Artificial Intelligence: A Modern Approach", Prentice Hall Series in Artificial Intelligence. 2003.

### JOURNALS/MAGAZINES

1. Springer Journal of Machine Learning, <https://www.springer.com/journal/10994>
2. <http://ieeexplore.ieee.org/document/8297269/>

### SWAYAM/NPTEL/MOOCs:

1. <https://nptel.ac.in/courses/106/105/106105215/>

2. <https://www.my-mooc.com/en/categorie/deep-learning>
3. Deep Learning Specialization-Coursera

**Self-Learning Exercises:**

Linear factor Models, Structured probabilistics Models, Monte-Carlo Methods, Deep generative Models

course Title	Summer Internship/Global Certification				Course Type		Practice	
Course Code	B20CI0701	Credits	3		Class		VII semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	3	6	6	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>-</b>	<b>78</b>	<b>-</b>

**COURSE OVERVIEW:**

This course covers student's knowledge with industry.

**COURSE OBJECTIVES:**

Objectives of this course are to:

1. Learn industry knowledge
2. Get certificate of emerging technologies

**Course Out comes (Cos):**

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Study emerging technologies	1 to 5, 7,8,10,11,12,	1
CO2	Analyze real time problems	1 to 5, 7,8,9,11,12	2
CO3	Design and develop the for the solution	1 to 5, 7,8,9,11,12	2, 3
CO4	Make use of emerging models for real world applications.	1 to 5, 8,9,10,11	3
CO5	Apply new Techniques for real time applications	1-12	3



CO6	Develop an algorithm using latest technology to an applications	1-12	3
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#### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√	√			
CO2		√	√			
		√	√			
CO4		√				
CO5			√		√	
CO6						√

#### COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2							2	3	0	0
CO2	3	3	2	1	3							3	0	3	0
CO3	3	3	3	2	2							3	0	3	3
CO4	3	3	3	1	1							0	0	0	3
CO5	3	2	3	3	3							3	0	0	3
CO6	3	2	3	3	2							2	0	0	3

Note:1-Low,2-Medium,3-High

#### JOURNALS/MAGAZINES

1. <https://www.springer.com/journal/500>
2. <https://www.journals.elsevier.com/>

3. <https://IEEE.org>

**SWAYAM/NPTEL/MOOCs:**

1. <https://nptel.ac.in/courses/106/105/106105173>

**SELF LEARNING**

Linear Algebra, probability and Information Theory, Genetic Algorithms.

Course Title	Project Phase-1				Course Type		Practice	
Course Code	B20CI0702	Credits	4		Class		VII semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	4	8	8	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>4</b>	<b>8</b>	<b>8</b>	<b>8</b>	-	<b>104</b>	-

**COURSE OVERVIEW:**

This course covers student's innovation in current trends.

**COURSE OBJECTIVES:**

Objectives of this course are to:

1. Learn current trends
2. Expose their knowledge with innovation methods to develop new technology

**Course Outcomes (Cos):**

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Study emerging technologies	1 to 5, 7,8,10,11,12,	1
CO2	Analyze real time problems	1 to 5, 7,8,9,11,12	2

CO3	Design and develop the for the solution	1 to 5, 7,8,9,11,12	2, 3
CO4	Make use of emerging models for real world applications.	1 to 5, 8,9,10,11	3
CO5	Apply new Techniques for real time applications	1-12	3
CO6	Develop an algorithm using latest technology to an applications	1-12	3

#### BLOOM'S LEVEL

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√	√			
CO2		√	√			
		√	√			
CO4		√				
CO5			√		√	
CO6						√

#### COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2							2	3	0	0
CO2	3	3	2	1	3							3	0	3	0
CO3	3	3	3	2	2							3	0	3	3
CO4	3	3	3	1	1							0	0	0	3
CO5	3	2	3	3	3							3	0	0	3
CO6	3	2	3	3	2							2	0	0	3

**Note:**1-Low,2-Medium,3-High

**JOURNALS/MAGAZINES**

1. <https://www.springer.com/journal/500>
2. <https://www.journals.elsevier.com/>
3. <https://IEEE.org>

**SWAYAM/NPTEL/MOOCs:**

1. <https://nptel.ac.in/courses/106/105/106105173>

**SELF LEARNING**

Linear Algebra, probability and Information Theory, Genetic Algorithms

## Detailed Syllabus Semester 8

Course Title	Capstone - Project Phase-II				Course Type		Practice	
Course Code	B20CI0801	Credits	8		Class		VIII semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	-	-	-				
	Practice	8	16	16	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>8</b>	<b>16</b>	<b>16</b>	<b>16</b>	-	<b>208</b>	-

### COURSE OVERVIEW:

This course covers student's innovation in current trends.

### COURSE OBJECTIVES:

To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

### Course Outcomes (Cos):

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Study emerging technologies	1 to 5,7,8,10,11,12,	1
CO2	Analyze real time problems	1 to 5, 7,8,9,11,12	2
CO3	Design and develop the for the solution	1 to 5, 7,8,9,11,12	2, 3
CO4	Make use of emerging models for real world applications.	1 to 5, 8,9,10,11	3
CO5	Apply new Techniques for real time applications	1-12	3
CO6	Develop an algorithm using latest technology to an applications	1-12	3

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√	√			
CO2		√	√			
CO3		√	√			
CO4		√				
CO5			√		√	
CO6						√

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2							2	3	0	0
CO2	3	3	2	1	3							3	0	3	0
CO3	3	3	3	2	2							3	0	3	3
CO4	3	3	3	1	1							0	0	0	3
CO5	3	2	3	3	3							3	0	0	3
CO6	3	2	3	3	2							2	0	0	3

**Note:**1-Low,2-Medium,3-High

**JOURNALS/MAGAZINES**

- 1 <https://www.springer.com/journal/500>
- 1 <https://www.journals.elsevier.com/>
- 2 <https://IEEE.org>

**SWAYAM/NPTEL/MOOCs:**1. <https://nptel.ac.in/courses/106/105/106105173>**Self Learning**

Linear Algebra, probability and Information Theory, Genetic Algorithms

Course Title	IoT Programming (OE-IV)				Course Type		Theory	
Course Code	B20CI0801	Credits	3		Class		VIII Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>0</b>	<b>50</b>	<b>50</b>

**COURSE OVERVIEW**

The course covers the importance of IoT in society, the current components of typical IoT devices and trends for the future. IoT design considerations, constraints and interfacing between the physical world and your device will also be covered. This course will get to know how to make design trade-offs between hardware and software. It also covers key components of networking to ensure that students understand how to connect their device to the Internet.

**COURSE OBJECTIVE (S):**

The objectives of this course are to:

1. Explain basics of Arduino programs.
2. Illustrate sample programs to interface sensors to Arduino board, store, process and analyze data.
3. Demonstrate WebApp store and stored at a from sensors, and to monitor and control IoT devices.
4. Discuss IoT programming to develop larger smart products useful for the society.

**COURSE OUTCOMES (COs)**

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Develop programs to interface sensors to Arduino board, store, process and analyze data.	1,2,3,4,5,6	3

CO2	Analyse the performance of Communication Protocols used in real time IoT Projects.	1,2,3,4,5,6	1
CO3	Make use of different IoT Patterns to develop the real world applications.	1,2,3,4,5,6	1
CO4	Identify the IoT security requirements to solve the given real world problem.	1,2,3,4,5,6	1
CO5	Learn new IoT tools and technologies and apply for suitable application development.	1,2,3,4,5,12	1,2
CO6	Develop solutions in the IoT problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	1,2,3,4,5,9,10	2,3

#### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1				√		√
CO2				√		
CO3			√			√
CO4		√	√			
CO5			√	√		
CO6				√		

#### COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	2									3
CO2	2	3	3	2	2	3							3		
CO3	3	3	2	2	3	3							3		
CO4	3	3	3	3	3	2							3		
CO5	3	3	3	2	3							2	2	2	
CO6	3	2	2	2	2				3	2				2	2

**Note:** 1-Low, 2-Medium, 3-High

#### COURSE CONTENT

##### THEORY:

##### UNIT- 1

**Building Blocks:** Arduino Basics, Hardware Requirements, Software Requirements: Toolbar, StatusWindow, Serial Monitor Window; Arduino Programming Language Reference Internet Connectivity:ArduinoUno Wired Connectivity (Ethernet), Hardware Required, Software Required Circuit, Code(Arduino), Final Product; ArduinoUno Wireless Connectivity(WiFi), Hardware Required,



Software Required, Circuit, Code (Arduino), FinalProduct

**Communication Protocols:** HTTP: Code (Arduino), Final Product; MQTT: Intrusion Detection System, Remote Lighting Control, Code (Arduino), Final Product

#### UNIT -2

**Complex Flows:** Node-RED:HardwareRequired, Software Required, Circuit, Node-REDFlow, Code (Arduino), External Libraries, Internet Connectivity (Wireless),Read Sensor Data, Data Publish, Standard Functions and the FinalProduct.

**IoT Patterns:** Real-time Clients: Hardware Required, Software Required, Circuit, Code (Arduino): External Libraries, Internet Connectivity (Wireless), Read Sensor Data, Data Publish, Standard Functions, Code (Android): Project Setup, Screen Layout, Screen Logic, MQTT Client and the Final Product.

**IoT Patterns: Remote Control:** Hardware Required, Software Required, Circuit, Code (Android): Project Setup, Screen Layout, Screen Logic; MQTTClient,Code(Arduino):External Libraries, Internet Connectivity(Wireless) ,Data Subscribe, Control Lights, Standard Functions and the Final Product.

#### UNIT- 3

**IoT Patterns:** On-Demand Clients: Hardware Required, Software Required, Circuit, Database Table(MySQL), Code(PHP): Database Connection, Receive and Store Sensor Data, Get the Parking Spot Count; Code(Arduino): External Libraries, Internet Connectivity(Wireless), Read Sensor Data;Code(iOS): Project Setup, Screen Layout, Screen Logic and the Final Product.

**IoT Patterns: Web Apps:** Hardware Required, Software Required, Circuit, Database Table (MySQL),Code(PHP): Database Connection, Receive and Store Sensor Data, Dashboard; Code (Arduino): External Libraries, Internet Connectivity (Wireless), Read Sensor Data, Data Publish, Standard Functions and the FinalProduct.

**IoT Patterns: Location Aware:** Hardware Required, Software Required, Circuit, Database Table(MySQL),Code(PHP):Database Connection, Receive and Store Sensor Data, Map; Code (Arduino):External Libraries, Get GPSCoordinates, Data Publish, Standard Functions and the Final Product.

#### UNIT-4

**IoT Patterns:** Machine to Human: Hardware Required, Software Required, Circuit, Code (Arduino): External Libraries, Internet Connectivity (Wireless), Read Sensor Data, Data Publish, Standard Functions, Effektiv Workflow: Process Creation, Process Configurations; Node-RED Flow and the Final Product.

**IoT Patterns:** Machine to Machine: Light Sensor Device, Code (Arduino): Lighting Control Device, Code (Arduino) and the Final Product

**IoT Platforms:** Hardware Required, Software Required, Circuit, Xively Setup, Zapier Setup, Xively Trigger, Code (Arduino): External Libraries, Internet Connectivity (Wireless), Read Sensor Data, Data Publish, Standard Functions and the Final Product.

Security Requirements in IoT Architecture - Security in Enabling Technologies - Security Concerns in IoT Applications. Security Architecture in the Internet of Things - Security Requirements in IoT -

Insufficient Authentication/Authorization - Insecure Access Control - Threats to Access Control, Privacy, and Availability - Attacks Specific to IoT. Vulnerabilities - Secrecy and Secret-Key Capacity - Authentication/Authorization for Smart Devices - Transport Encryption - Attack & Fault trees

#### TEXT BOOKS:

1. Adeel Javed,“Building Arduino Projects for the Internet of Things: Experiments with Real-World Applications”, Apress,2015.
2. BrianRussell, DrewVanDuren,“PracticalInternetofThingsSecurity(KindleEdition)”,2016

**REFERENCE BOOKS:**

1. Agus Kurniawan, "Smart Internet of Things Projects ", Packt Publishing,2016.

**JOURNALS/MAGAZINES**

1. [https://www.researchgate.net/publication/266854342\\_On\\_IoT\\_programming](https://www.researchgate.net/publication/266854342_On_IoT_programming)
2. <https://jisajournal.springeropen.com/about/new-content-item>
3. <https://ieeexplore.ieee.org/document/8628483/>
4. <https://ieeexplore.ieee.org/document/8845363>

**SWAYAM/NPTEL/MOOCs:**

1. [https://onlinecourses.nptel.ac.in/noc20\\_cs66/preview](https://onlinecourses.nptel.ac.in/noc20_cs66/preview)
2. An Introduction to Programming the Internet of Things (IOT) Specialization -Coursera

**Self-Learning Exercises:**

Explore any one of the boards like Raspberry Pi, Intel Galileo, Beagle Bone Black, Dragon Board, UDOO DUAL/QUAD, ARM Boards, DIY Development boards for IoT prototyping (C.H.I.P, MediatekLinkit One, Particle Photon, Tessel, Adafruit Flora, LightBlue Bean, Udo Neo, Intel Edison)

Course Title	Reinforcement Learning				Course Type		Theory	
Course Code	B20CIO802	Credits	3		Class		VIII Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>0</b>	<b>50</b>	<b>50</b>

#### COURSE OVERVIEW

This course covers fundamental principles and techniques in deep and reinforcement learning. Topics include convolutional neural networks, recurrent and recursive neural networks, backpropagation algorithms, regularization and optimization techniques for training such networks, dynamic programming, Monte Carlo, and temporal difference, and function approximation reinforcement learning algorithms, and applications of deep and reinforcement learning.

#### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Describe back propagation algorithms to train deep neural networks and apply regularization techniques.
2. Explain optimization techniques to train deep neural networks and convolutional neural networks.
3. Discuss recurrent neural networks to analyze basic deep learning algorithms for speech recognition, face recognition, object recognition and NLP.
4. Demonstrate reinforcement learning algorithms for real time applications.

#### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the concepts of Deep Feedforward Networks to train deep neural networks.	1,2,3,4,5,6	1
CO2	Utilize optimization techniques in deep neural networks and convolutional neural networks for real world application.	1,2,3,4,5,12	1
CO3	Develop recurrent neural networks algorithm for analysis of NLP applications.	1,2,3,4,5,6,9,12	1
CO4	Solve real world complex problems using reinforcement learning algorithms.	1,2, 4,5 ,6	1,2

CO5	Learn new reinforcement algorithms and apply for suitable application development.	1,2,3,4,5,12	1,2
CO6	Develop solutions in the reinforcement learning algorithms for complex problems, either individually or as a part of the team and report the results with proper analysis and interpretation.	1,2,3,4,5,9,10	2,3

#### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2			√			
CO3				√		√
CO4			√			
CO5			√	√		
CO6				√		

#### COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	2	2	2							3		
CO2	1	2	1	1	1							1	3		
CO3	3	2	1	2	2	1			1			1	3		
CO4	2	1		2	2	1							3	3	
CO5	2	1	2	2	2							2	2	2	
CO6	2	2	2	2	2				2	2				2	2

**Note:** 1-Low, 2-Medium, 3-High

#### COURSE CONTENT

#### THEORY:

#### UNIT-1

**Deep Networks: Deep Feedforward Networks:** Example: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms. **Regularization for Deep Learning:** Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multitask Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging and Other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, Tangent Prop and Manifold Tangent Classifier.

#### UNIT-2

**Optimization for Training Deep Models:** How Learning Differs from Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithms. **Convolutional Networks:** The Convolution Operation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, The Neuroscientific Basis for Convolutional Networks.

#### UNIT-3

**Sequence Modeling: Recurrent and Recursive Nets:** Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence, Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Challenge of Long-Term Dependencies, Echo State Networks, Leaky Units and Other Strategies for Multiple Time Scales, The Long Short-Term Memory and Other Gated RNNs, Optimization for Long-Term Dependencies, **Applications:** Large-Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing.

#### UNIT-4

**The Reinforcement Learning Problem:** Reinforcement Learning, Elements of Reinforcement Learning, Limitations and Scope. Multi-arm Bandits :An n-Armed Bandit Problem, Action-Value Methods, Incremental Implementation, Tracking a Nonstationary Problem, Optimistic Initial Values, Upper-Confidence-Bound Action Selection, Gradient Bandits, Associative Search, **Finite Markov Decision Processes** : The Agent-Environment Interface , Goals and Rewards, Returns, Unified Notation for Episodic and Continuing Tasks, The Markov Property, Markov Decision Processes, Value Functions, Optimal Value Function, Optimality and Approximation, Dynamic Programming: Policy Evaluation, Policy Improvement, Policy Iteration, Value Iteration, Asynchronous Dynamic Programming, Generalized Policy Iteration.

#### TEXT BOOKS:

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville Deep Learning, MIT Press, 2016.
2. Richard S. Sutton and Andrew G. Barto, "Reinforcement Learning: An Introduction" second edition, the MIT PRESS,2015.

#### REFERENCE BOOKS:

1. Abhishek Nandy, Manisha Biswas, Reinforcement Learning: With Open AI, TensorFlow and Keras Using Python, Apress,2017.
2. Eugene charniak, Introduction to Deep Learning, The MIT Press, 2018.

#### JOURNALS/MAGAZINES

1. <https://ieeexplore.ieee.org/document/6025669>
2. <https://ieeexplore.ieee.org/document/7301554>

3. <https://www.jair.org/index.php/jair/article/view/10166>
4. <http://www.ijstr.org/final-print/mar2020/A-Study-Of-Reinforcement-Learning-Applications-Its-Algorithms.pdf>

**SWAYAM/NPTEL/MOOCs:**

1. <https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-cs27/>
2. Reinforcement Learning, Practical Reinforcement Learning-Coursera

**Self-Learning Exercises:**

Implement and apply Monte Carlo reinforcement learning algorithms, implement and apply temporal-difference reinforcement learning algorithms.

**10** YEARS  
OF UNIVERSITY  
RECOGNITION  
**20** YEARS OF  
ACADEMIC  
EXCELLENCE



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UNIVERSITY  
Bengaluru, India

**School of Computing and Information  
Technology**

**M.Tech. Artificial Intelligence**

**2021-23 Batch**

**HANDBOOK**

**Rukmini Knowledge Park**

**Kattigenahalli, Yelahanka, Bengaluru – 560064**

**[www.reva.edu.in](http://www.reva.edu.in)**



**SCHOOL OF COMPUTING AND INFORMATION TECHNOLOGY**

**HANDBOOK**

**M. Tech. in Artificial Intelligence**

**2021-23**

Rukmini Knowledge Park,

Kattigenahalli, Yelahanka, Bangalore - 560 064

Phone No: +91-080-66226622, Fax: 080-28478539



## Chancellor's Message

***“Education is the most powerful weapon which you can use to change the world.”***

- Nelson Mandela.

There was a time when survival depended on just the realization of physiological needs. We are indeed privileged to exist in a time when ‘intellectual gratification’ has become indispensable. Information is easily attainable for the soul that is curious enough to go look for it. Technological boons enable information availability anywhere anytime. The difference, however, lies between those who look for information and those who look for knowledge.

It is deemed virtuous to serve seekers of knowledge and as educators it is in the ethos at REVA University to empower every learner who chooses to enter our portals. Driven by our founding philosophy of ‘Knowledge is power’, we believe in building a community of perpetual learners by enabling them to look beyond their abilities and achieve what they assumed impossible.

India has always been beheld as a brewing pot of unbelievable talent, acute intellect and immense potential. All it takes to turn those qualities into power is a spark of opportunity. Being at a University is an exciting and rewarding experience with opportunities to nurture abilities, challenge cognizance and gain competence.

For any University, the structure of excellence lies in the transitional abilities of its faculty and its facility. I’m always in awe of the efforts that our academic board puts in to develop the team of subject matter experts at REVA. My faculty colleagues understand our core vision of empowering our future generation to be ethically, morally and intellectually elite. They practice the art of teaching with a student-centered and transformational approach. The excellent infrastructure at the University, both educational and extra-curricular, magnificently demonstrates the importance of ambience in facilitating focused learning for our students.

A famous British politician and author from the 19th century - Benjamin Disraeli, once said ‘A University should be a place of light, of liberty and of learning’. Centuries later this dictum still inspires me and I believe, it takes teamwork to build successful institutions. I welcome you to REVA University to join hands in laying the foundation of your future with values, wisdom and knowledge.



**Dr. P. Shyama Raju**

The Founder and Hon'ble Chancellor, REVA University

## Vice-Chancellor Message

The last two decades have seen a remarkable growth in higher education in India and across the globe. The move towards inter-disciplinary studies and interactive learning have opened up several options as well as created multiple challenges. India is at a juncture where a huge population of young crowd is opting for higher education. With the tremendous growth of privatization of education in India, the major focus is on creating a platform for quality in knowledge enhancement and bridging the gap between academia and industry.



A strong believer and practitioner of the dictum “Knowledge is Power”, REVA University has been on the path of delivering quality education by developing the young human resources on the foundation of ethical and moral values, while boosting their leadership qualities, research culture and innovative skills. Built on a sprawling 45 acres of green campus, this ‘temple of learning’ has excellent and state-of-the-art infrastructure facilities conducive to higher teaching-learning environment and research. The main objective of the University is to provide higher education of global standards and hence, all the programs are designed to meet international standards. Highly experienced and qualified faculty members, continuously engaged in the maintenance and enhancement of student-centric learning environment through innovative pedagogy, form the backbone of the University.

All the programs offered by REVA University follow the Choice Based Credit System (CBCS) with Outcome Based Approach. The flexibility in the curriculum has been designed with industry-specific goals in mind and the educator enjoys complete freedom to appropriate the syllabus by incorporating the latest knowledge and stimulating the creative minds of the students. Bench marked with the course of studies of various institutions of repute, our curriculum is extremely contemporary and is a culmination of efforts of great think-tanks - a large number of faculty members, experts from industries and research level organizations. The evaluation mechanism employs continuous assessment with grade point averages. We believe sincerely that it will meet the aspirations of all stakeholders – students, parents and the employers of the graduates and postgraduates of REVA University.

At REVA University, research, consultancy and innovation are regarded as our pillars of success. Most of the faculty members of the University are involved in research by attracting funded projects from various research level organizations like DST, VGST, DBT, DRDO, AICTE and industries. The outcome of the research is passed on to students through live projects from industries. **The entrepreneurial zeal of the students is encouraged and nurtured through EDPs and EACs.**

REVA University has entered into collaboration with many prominent industries to bridge the gap between industry and University. Regular visits to industries and mandatory internship with industries have helped our students. REVA University has entered into collaboration with many prominent industries to bridge the gap between industry and University. Regular visits to industries and mandatory internship with industries have helped our students become skilled with relevant to industry requirements. Structured training programs on soft-skills and preparatory training for competitive exams are offered here to make students more employable. 100% placement of eligible students speaks the effectiveness of these programs. The entrepreneurship development activities and establishment of “Technology Incubation Centers” in the University extend full support to the budding entrepreneurs to nurture their ideas and establish an enterprise.

With firm faith in the saying, “Intelligence plus character –that is the goal of education” (Martin Luther King, Jr.), I strongly believe REVA University is marching ahead in the right direction, providing a holistic education to the future generation and playing a positive role in nation building. We reiterate our endeavour to provide premium quality education accessible to all and an environment for the growth of over-all personality development leading to generating “GLOBAL PROFESSIONALS”.

Welcome to the portals of REVA University!

**Dr.M.Dhanamjaya**

Vice-Chancellor, REVA University

## Director Message

I congratulate and welcome all the students to the esteemed school of Computing and Information Technology (CS&IT)). You are in the right campus to become a computer technocrat. The rising needs of automation in Industry 4.0 and improvising living standards have enabled rapid development of computer software and hardware technologies. Thus providing scope and opportunity to generate more human resources in the areas of computers and IT. The B.Tech, M.Tech and Ph.D. programs offered in the school are designed to cater the requirements of industry and society. The curriculum is designed meticulously in association with persons from industries (TCS, CISCO, AMD, MPHASIS, etc.), academia and research organizations (IISc, IIT, Florida University, Missouri S & T University, etc.). The Curriculum caters to local, national, regional and global developmental needs. Maximum number of courses are integrated with cross cutting issues relevant to professional ethics, global needs, human values, environment and sustainability. The courses also focus on skill development, innovation and entrepreneurship.

This handbook presents the B.Tech in Computer Science and Information Technology program curriculum. The program is of 4 years duration and split into 8 semesters. The courses are classified into foundation core, hard core, and soft core courses. Hard core courses represent fundamentals study requirements of B.Tech CSIT program. Soft courses provide flexibility to students to choose the options among several courses as per the specialization, such as, Artificial Intelligence, Fuzzy Logic and Systems, Cognitive science and predictive analytics etc. Theoretical foundations of engineering, science, and Information Science are taught in first two and half years. Later, advanced courses and recent technologies are introduced in subsequent semesters for pursuing specialization.

The important features of the B.Tech CSIT are as follows:

1) Choice based course selection and teacher selection, 2) Studies in emerging areas like Machine Learning, Artificial Intelligence, Data Analytics, Cloud Computing, Python/R Programming, NLP, IoT and Cloud security, 3) Short and long duration Internships 4) Opportunity to pursue MOOC course as per the interest in foundation and soft core courses, 5) Attain global and skill certification as per the area of specialization, 6) Self-learning components, 7) Experiential, practice, practical, hackathons, and project based learning, 8) Mini projects and major projects with research orientation and publication, 9) Soft skills training and 10) Platform for exhibiting skills in cultural, sports and technical activities through clubs and societies.

The school has well qualified faculty members in the various areas of computing and IT including cloud computing, security, IOT, AI, ML and DL, software engineering, computer networks, information technology, cognitive computing, block chain technology etc. State of art laboratories are available for the purpose of academics and research.

**Dr. Mallikarjun Kodabagi**

Director, School of Computing and Information Technology

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Sl. No	Course Code	Course Title	Course Type	Credit Pattern and Credit Value				No. of Hrs.
<b>THIRD SEMESTER</b>								
1	M21TFS301	Security and Resilience						
	M21TFS302	IOT Security	SC	4	0	0	4	4
	M21TFS303	Advanced topics in cyber security						
2	M21TFO3XX		MC	4	0	0	4*	4
3	M21TF0303	Project Phase-1	HC	0	0	4	4	8
4	M21TF0304	Internship/Global Certification	HC	0	0	4	4	8
<b>Total Credits for the Third Semester</b>							<b>12</b>	<b>20</b>
*(MC)This course must be completed but it will not be graded and not considered for computing CGPA/SGPA								
<b>FOURTH SEMESTER</b>								
1	M21TF0401	Project Phase -2 and Dissertation	HC	0	0	16	16	32
<b>Total Credits for the Fourth Semester</b>							<b>16</b>	<b>32</b>
<b>Total Number of Credits for all Four Semesters is 72.</b>								

Note:

**Internship** should be carried out in a reputed /Tier-1/R & D organization, preferably, internship should be with stipend. The internship should be approved by the REVA University authorities before completion of 3rd semester and the students should obtain the permission for the same by producing the necessary details of company, selection process, and the offer letter issued by the company. At the end of the Internship, detailed report must be submitted.

### Open Electives offered to other schools

1. M21CB3021 Fundamentals of cyber security
2. M21CB3022 Ethical Hacking
3. M21CB3023 Blockchain Technology

Course Title	Cyber Security And Programming				Course type	Integrated		
Course Code	M21TF0101	Credits	4		Class	VII Semester		
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3	Theory	Practical	CIE	SEE
	Practice	1	2	2				
	-	0	-	-				
	Total	4	5	5	39	26	50%	50%

#### Course Overview:

The Cyber Security and Programming course gives an awareness of software Vulnerabilities in computer systems that can be used to crack the frontier problems of the current day. The C/C++ programming concepts are covered in this course are at the forefront of commercial practice in solving real-time problems. They are applicable in Exception handling – Mitigation Strategies, stack randomization, vulnerabilities in Cybersecurity. This course is designed to understand the software security concepts in cyber security to handle real world applications.

#### Course Objective (s):

The Objectives of this course are to:

1. Understand the most frequent programming errors to software vulnerabilities.
2. Identify and analyze security problems in software and integral security issues.
3. Apply the knowledge to the common vulnerabilities associated with file I/O.
4. Apply the specific development practices for improving the overall security of the application.

#### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Discuss the software security concepts for cybersecurity	1, 2, 3, 4, 5	1
CO2	Analyze Exception Handling - Mitigation Strategies in computer systems.	1, 2, 3, 4, 5	2
CO3	Applying Stack Randomization-Mitigation Strategies to Notable Vulnerabilities in cybersecurity	1, 2, 3, 4, 5	2,3
CO4	Demonstrate Stack Randomization, Mitigation Strategies and Vulnerabilities	1, 2, 3, 4, 5	2,3

CO5	Design the Security Development Lifecycle for Cybersecurity	1, 2, 3, 4, 5	1
CO6	Analyze File I/O Interfaces, Access Control and File Identification	1, 2, 3, 4, 5	1,2

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2				√		
CO3			√			
CO4						√
CO5				√		
CO6			√			

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	1								3		
CO2	3	2	3	1	2									3	
CO3	3	1	2	2	3									3	3
CO4	2	2	2	1	1									3	3
CO5	2	2	2	1	1									3	3
CO6	2	2	2	1	1									3	3

Note: 1-Low, 2-Medium, 3-High

**Course Contents:**

**Unit-1**



SOFTWARE SECURITY CONCEPTS : Gauging the Threat - Security Concepts - C and C++ - Development Platforms - Strings - Character Strings - Common String manipulation Errors - String Vulnerabilities and Exploits - Mitigation Strategies - String handling functions - runtime protection strategies - notable vulnerabilities

**Unit-2**

POINTER SUBTERFUGE AND INTEGER SECURITY : Data Locations - Function Pointers - Object Pointers - Modifying the Instruction Pointer - Global Offset Table - The .dtors Section - Virtual Pointers - The atexit() and on\_exit() Functions - The longjmp() Function - Exception Handling - Mitigation Strategies - Integer Security - Integer Conversions - Integer Operations - Integer Vulnerabilities - Mitigation Strategies

**Unit-3**

FORMATTED OUTPUT FUNCTIONS: Variadic Functions - Exploiting Formatted Output Functions - Stack Randomization-Mitigation Strategies - Notable Vulnerabilities

**Unit-4**

File I/O: File I/O Basics - File I/O Interfaces - Access Control - File Identification - Race Conditions - Mitigation Strategies, Recommended practices: The Security Development Lifecycle - Security Training -Requirements - Design- Implementation – Verification.

**Self-learning component:**

Python, Java

**PRACTICE:**

Sl. No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
1.	Thread is an execution unit which consists of its program counter, a stack, and a set of registers. Write a c program for multi-threading and thread synchronization on a kernel such that, each thread occupied an independent memory slot.	Windows/Linux OS, IDE, C,C++	Thread operations.
2.	Demonstrate how to pass array of pointers to the thread such that, each pointer is independent to another.	Windows/Linux OS, IDE, C,C++	Pointer operations
3.	Demonstrate a program that is vulnerable to a buffer overflow.	Windows/Linux OS, IDE, C,C++	Buffer overflow vulnerability

4.	Demonstrate the concept of Signal Handler with respect to multi-threading optimization in C or C++	Windows/Linux OS, IDE, C,C++	<b>Multi-Threading</b>
5.	Demonstrate the following functions: atexit() and onexit() in C.	Windows/Linux OS, IDE, C,C++	<b>Standard functions</b>
6.	Stack may grow downward or upward depending on environment for which code is compiled. Demonstrate the growth of Stacks in C/C++.	Windows/Linux OS, IDE, C,C++	<b>Stacks</b>
7.	Integer overflow based on a real-world vulnerability in the handling of the comment field in JPEG files. Demonstrate Integer overflow vulnerability.	Windows/Linux OS, IDE, C,C++	<b>Integer overflow vulnerability</b>
8.	Write a C Programming to demonstrate mitigation strategies	Windows/Linux OS, IDE, C,C++	<b>Mitigation strategies</b>
9.	Write a C/C++ programming on File IO operation management	Windows/Linux OS, IDE, C,C++	<b>Files</b>
10.	Develop a C Program to Read content of a File and Display it	Windows/Linux OS, IDE, C,C++	<b>Files</b>

#### Text books:

1. Seacord, R. C., Secure Coding in C and C++, Addison c for Software Engineering Institute, 2nd edition, 2013.
2. Howard, M., LeBlanc, D., Writing Secure Code, 2nd Edition. Pearson Education, 2002

#### Reference books:

- 1 Daswani N., Kern C., Kesavan A., Foundations of Security, Apress, 2007.
- 2 <https://www.newhorizons.com/promotions/cybersecurity-ebooks>
- 3 <https://www.coursera.org/learn/introduction-cybersecurity-cyber-attacks#syllabus>

**JOURNALS/MAGAZINES:**

- 1 IEEE Transactions on Cybersecurity
- 2 Springer Journal of Cybersecurity.

**SWAYAM/NPTEL/MOOCs:**

1. <https://www.udemy.com/Cybersecurity/>
2. <https://www.coursera.org/learn/Cybersecurity>
3. <https://nptel.ac.in/courses/cybersecurity/>

Course Title	Mathematics for Cyber Security				Course Type		Theory	
Course Code	M21 TF 0102	Credits	4		Class		I Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	4	4	4				
	Practice	0	0	0	Theory	Practical	IA	SEE
	<b>Tutorial</b>	-	-	-				
	<b>Total</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>52</b>	-	<b>50%</b>

**COURSE OVERVIEW**

The course **Mathematics for Cyber Security** with the basic aspects of number theory like, GCD, Divisibility, Prime number etc. This course includes algebraic structure for Groups, Discrete logarithms . Probability theory is important to understand the concept of probability and conditional probability. Coding theory is important for liner code, hamming code and syndrome decoding. Pseudorandom number is used for Next bit predictor and Blum-Blum-Shub Generator. All mathematical concepts are highly important for the mathematical foundation and calculation of Cyber Security for to develop strong foundations on these concepts.

**COURSE OBJECTIVE (S):**

The objectives of this course are to:

1. Explain the basics maths used for information security.
2. Illustrate how to Design and analyse security protocols.
3. Describe the concepts of Probability and Statistics are used in many commercial, industrial as well as web Application.
4. Demonstrate the use of the coding theory concepts will help them to develop security model.

### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Effectively express the concepts and results of Number Theory. Understand basic concepts of various algebraic structures and theorems like Euler's theorem for designing security algorithm.	1-6	1,2
CO2	Apply Euclidean algorithm, Fermat's theorem to the real world application.	1-6	1,2
CO3	Describe introduction to probability concepts, random variables, probability distributions (continuous and discrete),	1-6	2
CO4	Identify and evaluate the probability based on Baye's theorem.	1-6	1,2
CO5	Make use of concept of Coding Theory in real world problem.	1-6	1,2
CO6	Apply Cryptographic Hash Functions for given data	1-6	2

### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3		√				
CO4			√			
CO5		√				
CO6			√			

### COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	3	1						3	3	
CO2	3	3	3	3	3	1						3	3	
CO3	3	3	2	2	3	1							2	
CO4	2	3	2	3	3	1						1	1	

CO5	2	3	2	3	3	1						1	1	
CO6	2	3	2	3	3	1							1	

**Note:** 1-Low, 2-Medium, 3-High

## COURSE CONTENT

### THEORY:

#### UNIT – 1

**NUMBER THEORY :** Logic, Mathematical reasoning, Sets, Basics of counting, Relations.

Introduction - Divisibility - Greatest common divisor - Prime numbers - Fundamental theorem of arithmetic - Mersenne primes - Fermat numbers - Euclidean algorithm.

**Graph Theory:** Euler graphs, Hamiltonian paths and circuits, planar graphs, trees, rooted and binary trees, distance and centres in a tree, fundamental circuits and cut sets, graph colorings and applications.

#### UNIT – 2

**Linear Algebra:** vector spaces and subspaces, linear independence, basis and dimensions, linear transformations and applications.

**Pseudorandom Number Generation:** Stream Ciphers Principles of Pseudorandom Number Generation, Principles of Pseudorandom Number Generation using a Block Cipher.

#### UNIT – 3

**Probability Theory:** introduction to probability concepts, random variables, probability distributions (continuous and discrete), Bayesian approach to distributions, mean and variance of a distribution, joint probability distributions, theory of estimation,

#### UNIT – 4

**CODING THEORY:** Introduction - Basic concepts: codes, minimum distance, equivalence of codes, Linear codes - Linear codes - Generator matrices and paritycheck matrices - Syndrome decoding – Hamming codes.

**Cryptographic Hash Functions:** Application of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security.

### TEXT BOOKS:

1. R.P.Grimaldi, "Discrete and Combinatorial Mathematics", Fifth edition, Pearson Education, 2007.
2. K. H. Rosen, "Discrete Mathematics and its applications", Seventh Edition, Tata MCGraw-Hill Publishing company limited, New Delhi, 2007.
3. H. Anton, "Elementary Linear Algebra", John Wiley & Sons, 2010.
4. N. Deo, "Graph theory with applications to Engineering and Computer Science", Prentice Hall of India, New Delhi, 1974.
5. T. M. Apostol, "Introduction to Analytic Number Theory", Springer, 1976.

## REFERENCE BOOKS:

1. Douglas C. Montgomery and George C. Runger, "Applied Statistics and Probability for Engineers", Third Edition, John Wiley & Sons Inc., 2003.
2. A. Papoulis and U. Pillai, Probability, "Random Variables and Stochastic Processes", Fourth Edition, McGraw Hill, 2002.
3. Ronald E. Walpole, Raymond H Myres, Sharon.L.Myres and Kying Ye, "Probability and Statistics for Engineers and Scientists", Seventh Edition, Pearson Education, 2002.
4. D. S. Malik, J. Mordeson, M. K. Sen, Fundamentals of abstract algebra, Tata McGraw Hill
5. P. K. Saikia, Linear algebra, Pearson Education, 2009.
6. I. Niven, H.S. Zuckerman and H. L. Montgomery, An introduction to the theory of numbers, John Wiley and Sons, 2004.
7. D P Bersekas and J N Tsitsiklis, Introduction to probability, Athena Scientific, 2008
8. Douglas Stinson, 'Cryptography – Theory and Practice', CRC Press, 2006.
9. Sheldon M Ross, "Introduction to Probability Models", Academic Press, 2003.
10. C.L. Liu, 'Elements of Discrete mathematics', McGraw Hill, 2008.
11. Behrouz A. Forouzan, " Cryptography and Network Security ", TMH Publication.

## JOURNALS/MAGAZINES

1. <https://ocw.mit.edu/courses/mathematics/>
2. <http://homes.soic.indiana.edu/yh33/Teaching/I231-2016/syllabus.html>

## SWAYAM/NPTEL/MOOCs:

1. <http://nptel.ac.in/syllabus/106105031/>
2. [http://nptel.ac.in/syllabus/syllabus\\_pdf/106105031.pdf](http://nptel.ac.in/syllabus/syllabus_pdf/106105031.pdf)
3. <http://nptel.ac.in/syllabus/106101004/>
- 4 <https://eliademy.com/catalog/physical-science/elementary-number-theory.html>

Course Title	Cyber Forensics				Course Type		Integrated	
Course Code	M21 TF 0103	Credits	4		Class		II Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	-	-	-	-				
	<b>Total</b>	<b>4</b>	<b>5</b>	<b>5</b>	<b>39</b>	<b>26</b>	<b>50</b>	<b>50</b>

## COURSE OVERVIEW

The goal of computer forensics is to examine digital media in a forensically sound manner with the aim of identifying, preserving, recovering, analyzing and presenting facts and opinions about the digital information. The course aims to give insight on Digital Forensic Evidence Collection and Processing,

Fundamentals of Host Forensics for Microsoft Windows. UNIX derivatives. It gives an overview of Forensic Database Systems and Network Forensics.

**COURSE OBJECTIVE (S):**

The objectives of this course are to:

1. Understand methodology and procedures associated with digital forensic analysis in a network environment.
2. Explain Digital Forensic Framework, Fundamentals of Host Forensics for Microsoft Windows and UNIX derivatives.
3. Illustrate Forensic Analysis of Database Systems.
4. Discuss protection of consumer web.

**COURSE OUTCOMES (COs)**

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply digital information for possible use as evidence in civil, criminal or administrative cases.	1 to 4, 8, 9, 12	1
CO2	Identify importance of digital forensic principles and procedures, legal considerations, digital evidence controls	1 to 3, 5,9,12	1
CO3	Make use of concepts of forensics for UNIX derivatives - Linux operating system and File systems	1 to 5, 9, 12	2
CO4	Illustrate Forensic analysis of Database Components,	3,4,5,9,12	2
CO5	Analyze network Forensics with case studies and tools	1,4,5,9,12	1
CO6	Classify the types of Steganography and Image file Forensics	1 to 5	2,3

**BLOOM’S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom’s Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			

CO2			√			
CO3			√	√		
CO4			√			
CO5		√	√			
CO6				√		

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2				1	1			1	3		
CO2	3	2	3		2				1			1	2	3	
CO3	3	1	2	1	2				1			1		2	
CO4	3			2	2				1			1	3		
CO5	3			2	2				1			1		3	
CO6	3			2	2				1			1		3	3

**Note:** 1-Low, 2-Medium, 3-High

**COURSE CONTENT**

**THEORY:**

**UNIT – 1**

**Digital Forensic :** Framework for Digital Forensic Evidence Collection and Processing, Fundamentals of Host Forensics for Microsoft Windows - Kernel and Device driver architecture, registry, auditing and security architecture File system handling - Reconstruction of files and directory structures on the FAT and NTFS.

**UNIT – 2**

**Linux operating system and File system:** Fundamentals of Host Forensics for UNIX derivatives - Linux operating system, Kernel and Device drives architecture, Security and audit mechanisms, file system and pseudo file systems, the reconstruction of file and directory structures using UFS and Ext2/3fs as exemplars.

**UNIT – 3**

**Forensic Database Systems:** Forensic Analysis of Database Systems, Database Tampering, Forensic analysis of Database Components, table storage, transaction log, indexes, Forensic recovery for table storage.



#### UNIT – 4

**Network Forensics:** Network Forensics, investigating logs, network traffic and web attacks, Mobile Device and Wireless Forensics, Anti-Forensics. Steganography and Image file Forensics, Email investigation, Investigating Copiers, IVR, Video Surveillance, RFID and Vehicular tracking (GPS) devices, Case studies and Tools.

No	Title of the Experiment
1.	Creating a Forensic Image using FTK Imager/Encase Imager : <ul style="list-style-type: none"><li>- Creating Forensic Image</li><li>- Check Integrity of Data</li><li>- Analyze Forensic Image</li></ul>
2.	Data Acquisition: <ul style="list-style-type: none"><li>- Perform data acquisition using:</li><li>- USB Write Blocker + FTK Imager</li></ul>
3.	Forensics Case Study : <ul style="list-style-type: none"><li>-Solve the Case study (image file) provide in lab using Encase Investigator or Autopsy</li></ul>
4.	Capturing and analyzing network packets using Wireshark (Fundamentals) : <ul style="list-style-type: none"><li>- Identification the live network</li><li>- Capture Packets</li><li>- Analyze the captured packets</li></ul>
5	Analyze the packets provided in lab and solve the questions using Wireshark : <ul style="list-style-type: none"><li>- What web server software is used by <a href="http://www.snopes.com">www.snopes.com</a>?</li><li>- About what cell phone problem is the client concerned?</li><li>- According to Zillow, what instrument will Ryan learn to play?</li><li>- How many web servers are running Apache?</li></ul>

6.	Using Sysinternals tools for Network Tracking and Process Monitoring : <ul style="list-style-type: none"> <li>- Check Sysinternals tools</li> <li>- Monitor Live Processes</li> <li>- Capture RAM</li> <li>- Capture TCP/UDP packets</li> <li>- Monitor Hard Disk</li> <li>- Monitor Virtual Memory</li> <li>- Monitor Cache Memory</li> </ul>
7	Recovering and Inspecting deleted files <ul style="list-style-type: none"> <li>- Check for Deleted Files</li> <li>- Recover the Deleted Files</li> <li>- Analyzing and Inspecting the recovered files</li> </ul>
8	Acquisition of Cell phones and Mobile devices
9	:- Email Forensics <ul style="list-style-type: none"> <li>- Mail Service Providers</li> <li>- Email protocols</li> </ul>
10	Web Browser Forensics . <ul style="list-style-type: none"> <li>-Web Browser working</li> <li>-Forensics activities on browser</li> </ul>

**Text Books/References:**

1. E. P. Dorothy, Real Digital Forensics for Handheld Devices , Auerback Publications, 2013.
2. J. Sammons, The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics, Syngress Publishing, 2012.
3. E. Casey, Handbook of Digital Forensics and Investigation, Academic Press, 2010 L T P C 3 0 0 3 Page 32 of 44
4. C. H. Malin, E. Casey and J. M. Aquilina, Malware Forensics Field Guide for Windows Systems: Digital Forensics Field Guides, Syngress, 2012 5. J. Wiles and A.Reyes,
5. J. Wiles and A.Reyes, The Best Damn Cybercrime and Digital Forensics Book Period, Syngress, 2007.

**Online Resources:**

1. <https://github.com/wtsxDev/Machine-Learning-for-Cyber-Security>
2. <https://github.com/jivoi/awesome-ml-for-cybersecurity#-books>
3. <https://github.com/RegaipKURT/CyberSecurity>

**JOURNALS/MAGAZINES**

1. <https://www.journals.elsevier.com/journal-of-information-security-and-applications>
2. <https://www.journals.elsevier.com/computers-and-security>
3. [http://scholar.google.co.in/scholar\\_url?url=https://www.profsandhu.com/cs6393\\_s19/Solms-Niekerk-3.pdf&hl=en&sa=X&ei=6QpBYLmcH5X0yATMxJGADQ&scisig=AAGBfm122ujlJW\\_s9W8QhWP-HQUU-uNQw&nossl=1&oi=scholar](http://scholar.google.co.in/scholar_url?url=https://www.profsandhu.com/cs6393_s19/Solms-Niekerk-3.pdf&hl=en&sa=X&ei=6QpBYLmcH5X0yATMxJGADQ&scisig=AAGBfm122ujlJW_s9W8QhWP-HQUU-uNQw&nossl=1&oi=scholar)

#### SWAYAM/NPTEL/MOOCs:

1. <https://www.classcentral.com/course/swayam-digital-forensic-19842>
  2. <https://nptel.ac.in/courses/106/106/106106182/>
  3. [https://onlinecourses.swayam2.ac.in/cec20\\_ge10/preview](https://onlinecourses.swayam2.ac.in/cec20_ge10/preview) **Self-Learning Exercises:**
    3. [https://onlinecourses.swayam2.ac.in/ugc19\\_hs25/preview](https://onlinecourses.swayam2.ac.in/ugc19_hs25/preview)
1. More exploration on GitHub
  2. Data Visualization packages

Course Title	Security and investigation of the block chain				Course Type	Integrated		
Course Code	M21 TF 0104	Credits	4		Class		I Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	4	4	4				
	Practice	0	0	0	Theory	Practical	CIE	SEE
	-	-	-	-				
	<b>Total</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>52</b>	<b>0</b>	<b>50</b>

#### COURSE OVERVIEW

The widespread popularity of digital cryptocurrencies has led the foundation of Blockchain, which is fundamentally a public digital ledger to share information in a trustworthy and secure way. The concept and applications of Blockchain have now spread from cryptocurrencies to various other domains, including business process management, smart contracts, IoT and so on. This course is a joint venture from academia and industry, where the target is to cover both the conceptual as well as application aspects of Blockchain. This includes the fundamental design and architectural primitives of Blockchain, the system and the security aspects, along with various use cases from different application domains.

#### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Understand the mechanism of Blockchain and Cryptocurrency.
2. Explain functionality of current implementation of blockchain technology.
3. Describe the required cryptographic background.

4. Explore the applications of Blockchain to cryptocurrencies and understanding limitations of current Blockchain and recent research.

**COURSE OUTCOMES (COs)**

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply the fundamentals of Cryptography in Cryptocurrency	1 to 4, 8, 9, 12	1
CO2	Make use of various operations associated with the life cycle of Blockchain and Cryptocurrency	1 to 3, 5,9,12	1
CO3	Explain methods for verification and validation of Bitcoin transactions	1 to 5, 9, 12	2
CO4	Explain Bitcoin as an Append only Log, Smart Property and Secure Multi Party	1 to 5	2
CO5	Analyze principles, practices and policies associated Bitcoin business and demonstrate the general ecosystem of several Cryptocurrency	1,4,5,9,12	1
CO6	Illustrate the Relationship Between Bitcoin and Altcoins	1 to 5	1

**BLOOM’S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom’s Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√	√		
CO4		√				
CO5			√			
CO6			√			

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2				1	1			1	3		
CO2	3	2	3		2				1			1	3		
CO3	3	1	2	1	2				1			1		3	
CO4	3			2	2				1			1	3		

CO5	3			2	2				1				2		
CO6	3			2	2				1				2		

**Note:** 1-Low, 2-Medium, 3-High

**COURSE CONTENT**

**THEORY:**

**UNIT – 1**

**Introduction to Cryptography and Cryptocurrencies**

Cryptographic Hash Functions, Hash Pointers and Data Structures, Digital Signatures, Public Keys as Identities, A Simple Cryptocurrency, Decentralization-Centralization vs. Decentralization-Distributed consensus, Consensus with- out identity using a blockchain, Incentives and proof of work. Simple Local Storage, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets.

**UNIT – 2**

**Mechanics of Bitcoin, Mining and Anonymity**

Bitcoin transactions, Bitcoin Scripts, Applications of Bitcoin scripts, Bitcoin blocks, The Bit- coin network, Limitations, and improvements. The task of Bitcoin miners, Mining Hardware, Energy consumption and ecology, Mining pools, Mining incentives and strategies Anonymity Basics, How to De-anonymize Bitcoin, Mixing, Decentralized Mixing, Zerocoin and Zerocash.

**UNIT – 3**

**Community, Politics, and Regulation**

Consensus in Bitcoin, Bitcoin Core Software, Stakeholders: Who’s in Charge, Roots of Bitcoin, Governments Notice on Bitcoin, Anti Money Laundering Regulation, New York’s Bit License Proposal. Bitcoin as a Platform: Bitcoin as an Append only Log, Bitcoins as Smart Property, Secure Multi Party Lotteries in Bitcoin, Bitcoin as Public Randomness, Source-Prediction Markets, and Real-World Data Feeds.

**UNIT – 4**

**Altcoins and the Cryptocurrency Ecosystem**

Altcoins: History and Motivation, A Few Altcoins in Detail, Relationship Between Bitcoin and Altcoins, Merge Mining-Atomic Cross chain Swaps-6 Bitcoin Backed Altcoins, Side Chains, Ethereum and Smart Contracts. Blockchain Use Cases – Finance, Industry

**TEXT BOOKS:**

1. Narayanan, A., Bonneau, J., Felten, E., Miller, A., and Goldfeder, S. (2016). Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press.

**REFERENCE BOOKS:**

1. Antonopoulos, A. M. (2014). Mastering Bitcoin: unlocking digital cryptocurrencies. O'Reilly Media, Inc.”.
2. Franco, P. (2014). Understanding Bitcoin: Cryptography, engineering and economics. John Wiley and Sons.

#### JOURNALS/MAGAZINES

4. <https://www.inderscience.com/jhome.php?jcode=ijbc>(Inderscience )
5. <https://www.journals.elsevier.com/blockchain-research-and-applications>(Elsevier)
6. <https://www.frontiersin.org/journals/blockchain>
7. <https://ledgerjournal.org/ojs/ledger>

#### SWAYAM/NPTEL/MOOCs:

4. Coursera – Blockchain technology
5. <https://nptel.ac.in/courses/106/104/106104220/>
6. <https://www.edx.org>

#### Self-Learning Exercises:

1. Blockchain By IBM Source: IBM Blog
2. Blockchain And Deep Learning: Future Of AI Source: Udemy
3. Bitcoin And Cryptocurrency Technologies Source: Coursera
4. Bitcoin And Cryptocurrencies Source: edX Blog
5. Introduction To Cryptocurrencies And Blockchain Source: Udemy

Course Title	Ethical Hacking and Network Defense				Course Type	HARD CORE		
Course Code	M21 TF 0105	Credits	4		Class	I Semester		
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	-	-	-	-				
	<b>Total</b>	<b>4</b>	<b>5</b>	<b>5</b>	<b>39</b>	<b>26</b>		

#### COURSE OVERVIEW

Ethical Hacking and Network Defense deals with the systematic evaluation and study of various technical aspects, approaches and paradigms of ethical hacking and networking defense properties. This course on ethical hacking has been designed to learn the fundamentals of ethical hacking. You will understand how ethical hacking plays a very important role in the present-day scenario. In this course, you will learn about the basic concepts of networking defense, ethical hacking fundamentals, various secure communication protocols and security patches.

#### COURSE OBJECTIVE (S):

The objectives of this course are to:



CO1	2	3	2	3	2									2	3
CO2	2	3	3	3	2									2	3
CO3	3	3	2	3	2									2	3
CO4	2	3	2	2	2									2	3
CO5	3	2	3	3	3									3	2
CO6	2	3	3	2	2									2	3

**Note:** 1-Low, 2-Medium, 3-High

## COURSE CONTENT

### THEORY:

#### UNIT – 1

**Introduction:** Legal Side of Hacking, Hacking Environment, Installing Virtual Box, Kali Linux server, Python and Ethical Hacking, General Syntaxes, variables, objects and Loops

#### UNIT – 2

Regular Expressions, Exceptions, Catching Errors, Classes and Databases, Sockets and Networking, Building NMAP Scanner, Dark WEB and Tor, Proxy chains, Virtual Private Networks (VPN), MAC Addresses, Security Trends

#### UNIT – 3

**Penetration Testing:** Setup of Networking Security Lab, Know Your Network, Building a Kali Web Server, Kali Linux and Python

#### UNIT – 4

SQL Mapping, Vulnerability Analysis, Information Assurance Model, Hashes and Passwords, Classic Modern Encryption, Exploiting Targets

### PRACTICE:

No	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
1.	Installation of Virtual Box, Metasploitable, Kali	Windows, VMWare	Ability to learn the process of setting up a virtual lab devices for ethical hacking



2.	Write a hashed (md5) format plain text re-representing program for capturing passwords using dictionary attack.	Windows / VmWare/ python	Tracking passwords from the regular un-texted format.
3.	Write a python script to change the MAC Address and demonstrate the following a) demonstrate spoofing attack bypassing b) demonstrate to avoid device tracking in public networks	Windows / VmWare/ python	Changing the MAC Address and validate skills of ethical hacking.
4.	Demonstrate the process of Network Scanner in Python IDE using three basic methods of ICMP Echo Request, Three-way hand shaking Method and TCP Scan	Windows / VmWare/ python	Validating the network setting skills and scanning of node information
5.	Demonstrate the process Network Scanning using scapy module	Windows / VmWare/ python	Validating the network setting skills and scanning of node information
6.	Demonstrate the process of Intrusion detection and spoofing attack in Address Resolution Protocol (ARP) in KALI LINUX	Windows / VmWare/ python	Validating ARP attacks and network defense process

#### TEXT BOOKS:

1. Sanjib Sinha, "Beginning Ethical Hacking with Python" Apress, 2018
2. Sanjib Sinha, "Beginning Ethical Hacking with Kali, Computational Techniques for resolving security issues" Apress, 2018

#### REFERENCE BOOKS:

1. Patrick Engebretson, "Basics of Hacking and Penetration Testing", Second Edition, Elsevier.

#### Self-Learning Exercises:

1. Introduction to Ethical Hacking: [https://www.tutorialspoint.com/ethical\\_hacking/index.htm](https://www.tutorialspoint.com/ethical_hacking/index.htm)

## SECOND SEMESTER

Course Title	Cloud Security				Course Type		Integrated	
Course Code	M21TF0201	Credits	4		Class		II Semester	
Course	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	2	2				
	Practice	1	2	2	Theory	Practical	CIE	SEE

Structure	-	-	-	-				
	<b>Total</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>39</b>	<b>26</b>	<b>50</b>	<b>50</b>

### COURSE OVERVIEW

Python is a Programming Language that can be treated in a procedural way, an object-orientated way or a functional way. It can be used on a server to create web applications, create workflows, connect to database systems, read and modify files, handle big data and perform complex mathematics. It can implement object oriented features and exception handling, It can parse the strings using regular expressions. It can be used for implementing the machine learning algorithms to develop solutions for interdisciplinary problems apart from any general problems leading to automation.

### COURSE OBJECTIVE (S):

The objectives of this course are to:

- 1.Understanding of the security challenges in the cloud environment.
- 2.Understanding of the issues regarding privacy and manage risks associated with it.
- 3.Knowledge of security standards and the audit processes to follow and ensure better cloud security.

### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	State the security challenges of cloud infrastructure.	1 to 4, 8, 9, 12	1
CO2	Illustrate the application security mechanisms.	1 to 3, 5,9,12	1
CO3	Make Use of concepts of standards to define a management policy.	1 to 5, 9, 12	2
CO4	Design solutions for risk management and security threats	1,4,5,9,12	1
CO5	Analyze a cloud security audit report.	1,4,5,9,12	2
CO6	Categorize record generation, reporting and management and service level agreement models	1,4,5,9,12	2

### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)

CO1			√			
CO2			√			
CO3			√	√		
CO4						√
CO5			√			
CO6				√		

### COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2				1	1			1	3		
CO2	3	2	3		2				1			1	2	3	
CO3	3	1	2	1	2				1			1		3	3
CO4	3			2	2				1			1	3		
CO5	3			2	2				1			1		2	
CO6	3			2	2				1			1		2	

**Note:** 1-Low, 2-Medium, 3-High

### COURSE CONTENT

#### THEORY:

#### UNIT – 1

##### Cloud Security Fundamentals:

Cloud computing security challenges – cloud computing security architecture–data security life-cycle-Security Patterns and architectural elements - Planning key Strategies for secure operation.

##### Cloud Application Security

Encryption techniques – homomorphic encryption - securing data Redaction - secure bitcoin – Public key infrastructure (PKI) – key management - open web application security project (OWASP) Cloud Top 10 Security Risks - Security as a service (SECaaS)

#### UNIT –2

##### Cloud Infrastructure Security

Virtualization security – securing hypervisor - securing virtual machines - designing virtual network for security - Network Security in the cloud - software-defined security - secure isolation strategy - anti- fragile cloud infrastructure - Failure as a service.

### Security Management & Privacy

Managed Security Service Provider (MSSP): Availability management – configuration management - vulnerability management - identity management. - Privacy: privacy, compliance and the cloud - privacy enhancing encryption

### UNIT-3

#### Risk Management & Security Threats

Risk management – principles - assessing the risk – strategies for managing risk – risk analysis framework – security threats – intrusion detection

#### Cloud Standards and Compliance

Cloud security alliance – cloud controls matrix - cloud security standards guidance – security compliance - NIST – PCI data security standards – SAS 70 - ISO 27001 – HIPAA – ITIL - FISMA - FIPS 140-2.

### UNIT-4

#### Audit

Cloud-Based IT Audit Process – System and Infrastructure lifecycle management for the cloud -governance, risk management and compliance (GRC) – cloud audit assurance – auditing –record generation, reporting and management- tamper-proofing audit logs service level agreement (SLA) – legal safeguards - cloud morphing.

#### PRACTICE:

1.	AWS Account Setup and Services Overview
2.	AWS Resource Discovery and Instance Setup
3.	Platform/Application Provisioning and Auto Scaling Adaptation
4.	Demonstrate Intrusion Detection System (IDS) using any tool (snort or equivalent software)
5.	Installation of rootkits and study about the variety of options
6.	Demonstrate how a sniffer attack is done using Wireshark Tool.
7.	Install Jcrypt Tool ( or any equivalent ) to demonstrate Asymmetric and Symmetric Crypto algorithm.
8.	Demonstrate how to inject JavaScript using Cross Site Scripting (XSS).

## TEXT BOOKS:

1. Tim Mather, Subra Kumaraswamy, Shahed Latif, Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, O'Reilly Media Inc, 2009.
2. Dave Shackleford, Virtualization security:Protecting virtualized environments, John Wiley & sons, 2013.
3. Vic (J.R.) Winkler, Securing the Cloud: Cloud Computer Security Techniques and Tactics, Syngress; 1st edition (April 29, 2011).
4. Raghu Yeluri, Enrique castro-leon, Building the infrastructure for cloud security:A Solutions view, Apress, 2014.
5. Krutz, R.L. (2010), Cloud Security A Comprehensive Guide to Secure Cloud Computing, Wiley
6. Ben Halpert , "Auditing Cloud Computing: A Security and Privacy Guide: ", John Wiley & Sons, 2011.
7. Shao ying zhu, Richard Hill, Guide to security assurance for cloud computing, Springer 2015.
8. John Rittinghouse, James F.Ransome, Cloud computing implementation, Management, security, CRC Press, 2010.
9. Stefan Rass, Daniel Slamanig, Cryptography for security and Privacy in cloud computing, Artech House, 2014.
10. OWASP - <https://www.owasp.org/images/4/47/Cloud-Top10-Security-Risks.pdf>
11. JOURNALS/MAGAZINES  
<https://journalofcloudcomputing.springeropen.com/>  
<https://www.journals.elsevier.com/journal-of-information-security-and-applications>  
<https://www.journals.elsevier.com/computers-and-security>  
<https://www.journals.elsevier.com/computer-fraud-and-security>

## SWAYAM/NPTEL/MOOCs:

[https://onlinecourses.nptel.ac.in/noc21\\_cs14/preview](https://onlinecourses.nptel.ac.in/noc21_cs14/preview)

<https://nptel.ac.in/courses/106/105/106105167/>

[https://onlinecourses.swayam2.ac.in/cec20\\_cs09/preview](https://onlinecourses.swayam2.ac.in/cec20_cs09/preview)

## Self-Learning Exercises:

1. Introduction to **Cloud Computing** with Amazon Web Services. ...
2. **Cloud Computing**: The Big Picture By David Chappell. ...
3. Getting Started with **Cloud Computing** — Level 1. ...
4. **Cloud Computing** Concepts by Coursera. ...
5. AWS Certified Solutions Architect — Associate.

<b>Course Title</b>	<b>Cyber security with ML and AI</b>				<b>Course Type</b>	<b>Integrated</b>		
<b>Course Code</b>	M21TF0202	<b>Credits</b>	<b>4</b>		<b>Class</b>	<b>II Semester</b>		
<b>Course Structure</b>	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	-	-	-	-				
	<b>Total</b>	<b>4</b>	<b>5</b>	<b>5</b>	<b>39</b>	<b>26</b>	<b>50</b>	<b>50</b>

## COURSE OVERVIEW

Machine learning has become a vital technology for cyber security. Machine learning preemptively stamps out cyber threats and bolsters security infrastructure through pattern detection, real-time cybercrime mapping and thorough penetration testing. The course aims to give insight on how machine learning has contributed to the success of modern spam filters, Quickly detect anomalies, including breaches, fraud, and impending system failure. It gives an overview of how to conduct malware analysis by extracting useful information from computer binaries, uncover attackers within the network by finding patterns inside datasets.

## COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the fundamentals of machine learning and their applications in cyber security.
2. Gain knowledge on anomaly detection with respect to cyber security.
3. Analyze malware using static analysis and analyze network traffic analysis.
4. Discuss protection of consumer web.

## COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Explain the fundamentals of machine learning and their applications in cyber security.	1 to 4, 8, 9, 12	1
CO2	Develop programs for anomaly detection using suitable machine learning algorithms	1 to 3, 5,9,12	1
CO3	Understand malware analysis and network traffic analysis.	1 to 5, 9, 12	2
CO4	Build a Predictive Model to Classify Network Attacks	1 to 5, 9, 12	2
CO5	Create data science solutions for consumer web	1 4,5, 9, 12	1

CO6	Demonstrate Supervised Learning for Abuse Problems and Labeling Data	1 4,5, 9, 12	2
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**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√	√		
CO4						√
CO5						√
CO6					√	

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2				1	1			1	3		
CO2	3	2	3		2				1			1	2		
CO3	3	1	2	1	2				1			1		3	
CO4	3			2	2				1			1		3	
CO5	3			2	2				1			1	3		
CO6	3			2	2				1			1		3	

**Note:** 1-Low, 2-Medium, 3-High

**COURSE CONTENT**

**THEORY:**

**UNIT – 1**

**Why Machine Learning and Security?** Cyber Threat Landscape, The Cyber Attacker's Economy, What Is Machine Learning? Real-World Uses of Machine Learning in Security, Spam Fighting: An Iterative Approach, Limitations of Machine Learning in Security

**Classifying and Clustering:** Machine Learning: Problems and Approaches, Machine Learning in Practice: A Worked Example, Training Algorithms to Learn, Supervised Classification Algorithms, Practical Considerations in Classification, Clustering

### UNIT – 2

**Anomaly Detection:** When to Use Anomaly Detection Versus Supervised Learning, Intrusion Detection with Heuristics, Data-Driven Methods, Feature Engineering for Anomaly Detection, Anomaly Detection with Data and Algorithms, Challenges of Using Machine Learning in Anomaly Detection, Response and Mitigation, Practical System Design Concerns

**Malware Analysis:** Understanding Malware, Feature Generation, From Features to Classification

### UNIT – 3

**Network Traffic Analysis:** Theory of Network Defense, Access Control and Authentication, Intrusion Detection, Detecting In-Network Attackers, Data-Centric Security, Honeypots, Machine Learning and Network Security, From Captures to Features, Threats in the Network, Botnets and You, Building a Predictive Model to Classify Network Attacks, Exploring the Data, Data Preparation, Classification, Supervised Learning, Semi-Supervised Learning, Unsupervised Learning, Advanced Ensembling

### UNIT – 4

**Protecting the Consumer Web:** Monetizing the Consumer Web, Types of Abuse and the Data That Can Stop Them, Authentication and Account Takeover, Account Creation, Financial Fraud, Bot Activity  
Supervised Learning for Abuse Problems, Labeling Data, Cold Start Versus Warm Start, False Positives and False Negatives, Multiple Responses, Large Attacks, Clustering Abuse, Example: Clustering Spam Domains, Generating Clusters, Scoring Clusters

#### PRACTICE:

No	Title of the Experiment
1.	Regression (or prediction) is simple. The knowledge about the existing data is utilized to have an idea of the new data. Take an example of house prices prediction. In cyber security, it can be applied to fraud detection. The features (e.g., the total amount of suspicious transaction, location, etc.) determine a probability of fraudulent actions.. Write a program to perform linear regression on any dataset.



2.	<p>Classification is also straightforward. Imagine you have two piles of pictures classified by type (e.g., dogs and cats). In terms of cybersecurity, a spam filter separating spams from other messages can serve as an example. Spam filters are probably the first ML approach applied to Cybersecurity tasks. type (e.g., dogs and cats). In terms of cybersecurity, a spam filter separating spams from other messages can serve as an example write a program to perform classification of any suitable data using any suitable classification algorithm</p>
3.	<p>Clustering is similar to classification with the only but major difference. The information about the classes of the data is unknown. There is no idea whether this data can be classified. This is unsupervised learning.</p> <p>Implement clustering on a suitable dataset using k means</p>
4.	<p>Forensic Challenge</p> <p>You receive a letter from a friend, who is suspicious that a neighbor is up to no good. Your friend has not heard anything from the neighbor in a while. However, your friend did capture some of the neighbor's packets about a week ago. Putting the ethical sides of the problem aside, help your friend figure out where the neighbor has gone and what the neighbor is up to.</p> <p>What is the neighbor's name?  What is the neighbor's email address?  What is the neighbor's email password?  What are the email addresses (at least two) of the neighbor's correspondents? What is the email of the correspondent the neighbor is most likely have gone to visit?  What is the name of the file containing the meeting location?  Bonus: where are they meeting and what is the correspondent bringing?</p>
5	<p>Touch Biometrics</p> <p>In this question, we explore continuous authentication methods for users who are using a smartphone. Our friends across the bay built 30 features on top of the raw data. You can find the details of the approach and the data at <a href="http://www.mariofrank.net/touchalytics/index.html">http://www.mariofrank.net/touchalytics/index.html</a></p> <p>Implement two more features in addition to the 30 found in the database. Do they have positive information gain? That is, are the features useful?  Report correlation of these feature to the rest of the implemented features.  Train your model on a binary classifier of your choice ("true user" or "false user" classification problem) using the following 4 scenarios in which you use a feature selection method to choose top 10 features. Describe this process. Use 10-fold cross validation to compute precision and recall in the following scenarios. Try to maximize F1 score when optimizing your classifier. Report F1 and any methods you used to optimize your classifier.</p> <ol style="list-style-type: none"> <li>i) 10 top features,</li> <li>ii) 10 top features &amp; your features</li> <li>iii) 30 computed features,</li> <li>iv) 30 computed features &amp; your features</li> </ol> <p>Qualitatively describe which family of features are most discriminating in your classifier.</p>

6.	<p>Merits of Entropy in Attack Detection/Diagnostics (30 points)</p> <p>Consider the following dataset: <a href="http://web.stanford.edu/class/cs259d/hw/server-log.txt">http://web.stanford.edu/class/cs259d/hw/server-log.txt</a></p> <p>ii) Two attacks happened this unfortunate day, both somewhere around 8am and 8pm noon. Please identify the exact date and time. What approach did the attackers use?</p> <p>iii) Columns for the server log are the following:</p> <p>iv) Start Start Src Dest Src Dest</p> <p>v) Date Time Duration Serv Port Port IP IP</p>
7	<p>There has been significant literature discussing how entropy can be used to detect these attacks. To do it effectively, approximation schemes are usually used. You do not have to implement these approximation techniques, but do present an analysis of whether entropy is useful and which combinations you tried, e.g. src ip, dest ip, src-port, dst-port, etc. Do any reveal anomalies when the two attacks happen?</p> <p>i) Sources for literature:</p> <p>ii) Lall, et all 2013. Data Streaming Algorithms for Estimating Entropy of Network Traffic.</p> <p>iii) Clifford, Cosma, 2013. A simple sketching algorithm for entropy estimation over streaming data</p>
8	<p>Supposedly, the best task for clustering is forensic analysis. The reasons, course, and consequences of an incident are obscure. It's required to classify all activities to find anomalies. Solutions to malware analysis (i.e., malware protection or secure email gateways) may implement it to separate legal files from outliers.</p>
9	<p>Another interesting area where clustering can be applied is user behavior analytics. In this instance, application users cluster together so that it is possible to see if they should belong to a particular group.</p>

#### TEXT BOOKS:

1. Clarence Chio, David Freeman, "Machine Learning and Security", O'Reilly Media, Inc, 2018.

#### REFERENCE BOOKS:

1. Soma Halder , Sinan Ozdemir, "Machine Learning for Cybersecurity Cookbook", Packt publisher, 2018
2. Joshua Saxe and Hillary Sanders " Malware Data Science, Attack Detection and Attribution", No starch press publishers, 2018
3. The Cylance Data Science Team, " Introduction to Artificial Intelligence for Security Professionals", Apple Inc publishers, 2017
4. Sumeet Dua and Xian Du, " Data Mining and Machine Learning in Cybersecurity", 2011
5. "Machine Learning and Data Mining for Computer Security", Springer 2006
6. Network Anomaly Detection: A Machine Learning Perspective
7. Machine Learning for Hackers: Case Studies and Algorithms to Get You Started

#### Online Resources:

1. <https://github.com/wtsxDev/Machine-Learning-for-Cyber-Security>
2. <https://github.com/jivoi/awesome-ml-for-cybersecurity#-books>

#### JOURNALS/MAGAZINES

8. <https://www.journals.elsevier.com/journal-of-information-security-and-applications>
9. <https://www.journals.elsevier.com/computers-and-security>
3. [Journal of big data, springer](#)

**SWAYAM/NPTEL/MOOCs:**

7. [https://iisc.talentsprint.com/deeplearning/?utm\\_source=googlesearch&utm\\_medium=tcpa&utm\\_campaign=ts-googlesearch-iisc-dl-tcpa-people-looking-for-training-programs-for-ai-and-deep-tech-deep-learning&utm\\_content=deep-learning-certification&utm\\_term=Deep%20learning%20certificate&gclid=Cj0KCQiApsiBBhCKARIsAN8o\\_4gcH-BYIAUHBTD27DFDoiCGFCKuG7eOi3wnLfXIXerEFWq06DtMRggaAtFkEALw](https://iisc.talentsprint.com/deeplearning/?utm_source=googlesearch&utm_medium=tcpa&utm_campaign=ts-googlesearch-iisc-dl-tcpa-people-looking-for-training-programs-for-ai-and-deep-tech-deep-learning&utm_content=deep-learning-certification&utm_term=Deep%20learning%20certificate&gclid=Cj0KCQiApsiBBhCKARIsAN8o_4gcH-BYIAUHBTD27DFDoiCGFCKuG7eOi3wnLfXIXerEFWq06DtMRggaAtFkEALw)
8. <https://www.udemy.com/course/cybersecurity-data-science/>
9. <https://nptel.ac.in/courses/106/106/106106182/>
10. <https://www.edx.org/learn/python>

**Self-Learning Exercises:**

3. More exploration on GitHub
4. Data Visualization packages

Course Title	Security Analytics				Course Type		Integrated	
Course Code	M21TF0203	Credits	4		Class		IISemester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3	Theory	Practical	CIE	SEE
	Practice	1	2	2				
	-	-	-	-				
	<b>Total</b>	<b>4</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>39</b>	<b>26</b>	<b>50</b>

**COURSE OVERVIEW**

**Security analytics** is the process of using data collection, aggregation, and **analysis** tools for **security** monitoring and threat detection. Depending on the types of tools installed, **security analytics** solutions can incorporate large and diverse data sets into their detection algorithms.

**COURSE OBJECTIVE (S):**

The objectives of this course are to:

1. Understanding basics of IAM
2. Able to understand cloud Resources
3. Understanding basics of IAM Covering ML Modelling around use cases.
4. Knowledge on use cases using Tensor flow/Python and Pyspark.

**COURSE OUTCOMES (COs)**

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Must be able to run the programming and data structures required for data analysis with Python	1,3, 8, 9	1
CO2	Identify Source of Data and how to capture Test and Training Sets from the data.	1, 3, 5	2
CO3	Develop important ML models to predict intrusion detection and User behavior analysis	1,3,5, 9,12	2
CO4	Describe end user behavior model	1,3,5, 9,12	3
CO5	Assess insider threat model for an attack	1,3,5, 9,12	3
CO6	Build ML model for creating data lake	1,3,5, 9,12	3

#### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2	√	√	√	√		
CO3		√	√	√		
CO4		√	√			
CO5					√	√
CO6					√	√

#### COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2				1	1			1	2		
CO2	3	2	3		2				1			1		2	
CO3	3	1	2	1	2				1			1		3	
CO4	3		2	1	2				1			1			3

CO5	3		2		2				1			1			3
CO6	3		2		2				1			1			3

**Note:** 1-Low, 2-Medium, 3-High

**COURSE CONTENT**

**THEORY:**

**UNIT – 1**

Primitive data structures – (constants, variable, data types), Advanced data structures –(list, tuples, dictionary), selection logic, looping logic, functions/methods, file handling Pandas – object model – data loading-exploration – visualization – sampling – data manipulation Project – Network Intrusion Detection System (IDS) data analysis.

**UNIT – 2**

Data Sources – Network via Access Logs and IPS IDS Training Set and Test Set creation, Install Tensor flow and start creating a model via Python.

**UNIT – 3**

Build ML models using Tensor flow and python for user behavioral analysis Bot Analysis End User behavior monitoring.

**UNIT – 4**

Build ML models using Tensor flow and python for, Data Exfiltration, Insider Threats, Threat Hunting Basics, Creating your Data Lake.

**LEARNING RESOURCES:**

1. Security Analytics For Dummies Securonix Special Edition
2. Machine Learning Approaches In Cyber Security Analytics; Springer; Tony Thomas, Athira P Vijayaraghavan, Sabu Emmanuel

**JOURNALS/MAGAZINES:**

1. <https://ieeexplore.ieee.org/document/6725337>
2. <https://ieeexplore.ieee.org/document/8258128>

**SWAYAM/NPTEL/MOOCs:**

1. Security analytics | Coursera
2. Security analytics tools | Coursera

**Self-Learning Exercises:**

5. Explore primitive data structures
6. More exploration on Security challenges
7. Explore on Network Intrusion Detection System (IDS) data analysis

## Lab Components:

1. Install Tensor flow and start creating a model via Python.
2. Build ML models using Tensorflow.

Course Title	Firewall & UTM architecture				Course Type		Softcore	
Course Code	M21TFS204	Credits	3		Class		II Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3	Theory	Practical	CIE	SEE
	Practice	0	0	0				
	-	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>36</b>		<b>50</b>

**COURSE OVERVIEW**

For every class of security problem, there is almost certainly either an open source or proprietary solution designed to combat it. This is particularly true in the areas of network intrusion detection systems and network access control devices—firewalls, filtering routers, and the like. A trend in firewall technology is to combine application layer inspection techniques from the intrusion detection world with the ability to filter network traffic, something firewalls have been doing for a long time. It is the goal of this subject to show that the iptables firewall on Linux systems is well positioned to take advantage of this trend, especially when it is combined with some additional software designed to leverage iptables from an intrusion detection standpoint.

**COURSE OBJECTIVE (S):**

The objectives of this course are to:

1. Gain expertise in Designing secure firewall protected networks.
2. Inculcate knowledge of types of firewalls and how filtering is done..
3. Gain expertise in Evaluating firewalls.
4. Implement UTM architecture and configure firewalls.

**COURSE OUTCOMES (COs)**

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of opensource platform to secure firewall.	1 to 4, 8, 9, 12	1
CO2	Compare different firewalls and will be able to apply filtering.	1 to 3, 5,9,12	1
CO3	Design and develop a open source firewall and evaluate it.	1 to 5, 9, 12	2
CO4	Create UTM architecture and configure based on requirements.	1,4,5,9,12	1
CO5	Demonstrate UTM security concepts	1,4,5,9,12	3
CO6	Appraise UTM firewall rules	1,4,5,9,12	3

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√	√		
CO4					√	√
CO5				√	√	
CO6				√	√	

**COURSE ARTICULATION MATRIX**

CO#/ POs	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02	PS03
CO1	3	1	1	2				1	1			1	3		
CO2	3	2	3		2				1			1	2		
CO3	3	1	2	1	2				1			1		3	
CO4	3			2	2				1			1	3		
CO5	3			2	2				1			1			3
CO6	3			2	2				1			1			3

**Note:** 1-Low, 2-Medium, 3-High

## **COURSE CONTENT**

### **THEORY:**

#### **UNIT – 1**

Firewall Fundamentals: What is firewall, why do you need firewall, How firewalls work, Types of firewalls, Individual and SOHO firewall Options, Uses for Host Software Firewall, Next Generation Firewalls, Types of Filtering, Selecting right firewall for your needs , the difference between buying firewall and building a firewall.

#### **UNIT – 2**

Firewall implementation: examining your network and it's security needs, proper firewall implementation procedure, constructing, configuring, and managing a firewall, PF sense requirements, planning a firewall implementation with PF sense, installing the be up since firewall configuring a firewall with PF sense .

#### **UNIT – 3**

**Firewall deployment considerations:** common security strategies for firewall deployment's, authentication authorization and accounting, placement of network hardware firewalls, benefit and purpose of rivers proxy use and benefit of port forwarding.

Configuring firewalls, firewall rules, composing firewall rules, ordering firewall rules, what should you allow and what should you block , Essential elements of firewall policy limitations of firewalls improving performance,

#### **UNIT – 4**

**UTM Architecture Sophos:** basic UTM security concepts, getting to basic SOPHOS UTM configuration, installing SOPHOS UTM VM, basic system settings configuration, interfaces basic configuration, network definition configuration, DNS configuration, SOPHOS with OSP F routing protocol, Sophos UTM with firewall rules.



**TEXT BOOKS:**

3. Network Security, Firewalls And VPNs, J. Michael Stewart, Jones & Bartlett Learning, 2013, ISBN-10: 1284031675, ISBN-13: 978-1284031676.
4. Unified Threat Management For Dummies®, 2nd Fortinet Special Edition, Published by John Wiley & Sons, Inc.

**REFERENCE BOOKS:**

1. Network Security: Private Communications in a Public World, M. Speciner, R. Perlman, C. Kaufman, Prentice Hall, 2002.
2. Linux iptables Pocket Reference, Gregor N. Purdy, O'Reilly, 2004, ISBN-13: 978-0596005696.
3. Linux Firewalls, by Michael Rash, No Starch Press, October 2007, ISBN: 978-1-59327-141-1.
4. The Network Security Test Lab: A Step-By-Step Guide, Michael Gregg, Dreamtech Press, 2015, ISBN-10:8126558148, ISBN-13: 978-8126558148.

Course Title	Malware Analysis and Design				Course Type		Integrated	
Course Code	M21TFS205	Credits	3		Class		II Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	0	0	0	Theory	Practical	CIE	SEE
	-	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>0</b>	<b>50</b>

**COURSE OVERVIEW**

Malware analysis is the art of dissecting malware to understand how it works, how to identify it, and how to defeat or eliminate it. And you don't need to be an uber-hacker to perform malware analysis. Malware analysis is critical for anyone who responds to computer security incidents. And, with a shortage of malware analysis professionals, the skilled malware analyst is in serious demand. The course aims to give insights about Introduction to Malware Analysis, Data collection methods, windows basics. Dynamic malware analysis, basic static analysis, android malware analysis and recent trends.

**COURSE OBJECTIVE (S):**

**The objectives of this course are to:**

1. Explain the types of malware through analysis methods
2. Illustrate basics and advanced malware analysis techniques
3. Demonstrate the android malware analysis techniques for real world applications
4. Illustrate the various tools of malware analysis

**COURSE OUTCOMES (COs)**

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify various malwares and understand the behavior of malwares in real world applications.	1 to 4, 8, 9, 12	1
CO2	Implement different malware analysis techniques.	1 to 3, 5,9,12	1
CO3	Analyze the malware behavior in windows and android.	1 to 5, 9, 12	2
CO4	Identify the various tools for malware analysis.	1,4,5,9,12	1
CO5	Illustrate File System and Directory structure and Registry	1,4,5,9,12	3
CO6	Demonstrate masterkey vulnerability structure	1,4,5,9,12	3

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√	√		
CO4					√	√
CO5					√	√
CO6					√	√

**COURSE ARTICULATION MATRIX**

CO#/ POs	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02	PS03
CO1	3	1	1	2				1	1			1	3		
CO2	3	2	3		2				1			1	2		
CO3	3	1	2	1	2				1			1		3	
CO4	3			2	2				1			1	3		
CO5	3			1	2				1			1			3
CO6	3			2	2				1			1			3

**Note:** 1-Low, 2-Medium, 3-High

## **COURSE CONTENT**

### **THEORY:**

#### **UNIT – 1**

**Introduction:** Malware Analysis Goals of Malware Analysis, Techniques Static and Dynamic Analysis, Types of Malware Backdoor, Botnet, Downloader, Information Stealing malware, Launcher, Rootkit, Scareware, Worm or Virus.

**Data Collection Methods:** Volatile Data Collection Methodology-Preservation of Volatile Data, Physical Memory Acquisition on a Live Windows System, Identifying Users Logged into the System, Non-Volatile Data Collection Inspect Prefetch Files, Examine the File System, Remote Registry Analysis, Examine Web Browsing Activities, Examine Cookie Files.

#### **UNIT – 2**

**Windows Basics:** Introduction to Windows Malware - Windows Basics Relevant to Malware Behavior- File System and Directory structure, Registry, Boot Sequence, Malware payloads.

**Dynamic Malware Analysis:** Malware activities, Self-Start techniques, Essential setup for executing malware, Executing DLL files, Classifying Malware Based on their Behavior

#### **UNIT – 3**

**Basic Static Analysis:** Number System Static Analysis with File Attributes and PE Header Packet Identification

**Advanced Static Analysis Reverse Engineering:** Advanced Static Analysis Reverse Engineering Assembly level computing Standard x86 instructions, Introduction to IDA, OllyDbg, Advanced Malware Analysis Virus, Trojan. Parsing Basic Analysis of an APK.

#### **UNIT – 4**

**Android Malware Analysis:** APK File Structure Security Model Android Root Brief Description of Spreading and Dis- tribution Introduction to Android Debugging Tools and Their Usage Dex Structure Parsing Basic Analysis of an APK. Exploits MasterKey VulnerabilityFileNameLength Vulnerability Introduction to Obfuscation DEX code obfuscation. Recent Trends.

**TEXT BOOKS:**

5. Cameron H. Malin, Eoghan Casey, James M. Aquilina and Curtis W. Rose, Malware Forensics Field Guide for Windows Systems, Syngress, Elsevier, 2012.
6. Christopher C. Elisan , Advanced Malware Analysis, Tata McGraw Hill, 2015 3.Cameron H. Malin, Eoghan Casey, James M. Aquilina and Curtis W. Rose, Malware

**REFERENCE BOOKS:**

1. Cameron H. Malin, Eoghan Casey, James M. Aquilina and Curtis W. Rose, Malware Forensics Field Guide for Linux Systems, Syngress, Elsevier, 2014.
2. Ken Dunham, Saeed Abu-Nimeh, Michael Becher and Seth Fogie, Mobile Malware Attacks and Defense, Syngress, Elsevier, 2009
3. John Aycocok, Computer Viruses and Malware, Springer, 2006.
4. ErciFiliol, Computer Viruses: from theory to applications, Springer, 2005

**JOURNALS/MAGAZINES**

5. Abhinav Singh, Metasploit Penetration Testing Cookbook, PACKT Publishing, 2012. ISBN 978-1-84951-742-3
6. Ken Dunham, Mobile Malware Attacks and Defence, Syngress Publisher 2009. ISBN: 978-1-59749-298-0

**SWAYAM/NPTEL/MOOCs:**

1. Anti-Virus/Anti-Malware - Detection and Prevention tools | Coursera
2. Malware Continued - Understanding Security Threats | Coursera
3. Malware and Ransomware - A brief overview of types of actors and their motives | Coursera

**Self-Learning Exercises:**

1. Set up of Kali Linux in a Virtual machine and setup with DNS info and collection of local network
2. Scan the network for Windows XP and Windows 7 Target machines in local network and virtual network
3. Identify the open ports and firewall rules setup

Course Title	Web Security				Course Type	Soft Core		
Course Code	M21TFS206	Credits	3		Class		II Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	0	0	0	Theory	Practical	CIE	SEE
	-	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>0</b>	<b>39</b>	<b>0</b>	<b>50</b>

### COURSE OVERVIEW

Web is the platform of choice for writing complex, interactive applications such as from mail clients to image editors to computer games and a medium reaching hundreds of millions of casual users around the globe. The resulting issues have quickly emerged as some of the most significant and prevalent threats to data security today. It provides a systematic and thorough analysis of the current state of affairs in the world of web application security, it aims to shed light on the uniqueness of the security challenges for web security engineers, web developers, and users have to face every day.

### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Outline common web application security vulnerabilities.
2. Identify different web application design assumptions and threats.
3. Discover the capabilities of various Browser scripts and proxies.
4. Illustrate to detect Authentication and Session Vulnerabilities

### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify underlying security principles of the web.	1,2,5	1
CO2	Outline the different concrete threats against web applications	1	2
CO3	Examine common web application attacks and countermeasures	1	2
CO4	Interpret the current best practices for secure web applications	1,2, 5	1
CO5	Categorize extrinsic site privileges	1,2,3,4,5	3

CO6	Analyze Security Model Extension Frameworks and Security Model Restriction Frameworks	1,2,3,4,5	3
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**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2		√				
CO3				√		
CO4		√				
CO5					√	
CO6					√	

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3			1								1		
CO2	2													2	
CO3	3													1	
CO4	2	2			1								1		
CO5	2	3	3	2	1										3
CO6	2	3	3	2	1										3

**Note:** 1-Low, 2-Medium, 3-High

**COURSE CONTENT**

**THEORY:**

**UNIT – 1**

**Security in the World of Web Applications:** Information Security in a Nutshell, a Brief History of the Web, the Evolution of a Threat.

**It Starts With A URL:** Uniform Resource Locator Structure, Reserved Characters and Percent Encoding, Common URL Schemes and Their Function, Resolution of Relative URLs, Security Engineering Cheat Sheet.

**Hypertext Transfer Protocol:** Basic Syntax of HTTP Traffic, HTTP Request Types, Server Response Codes, Keepalive Sessions, Chunked Data Transfers, Caching Behavior, HTTP Cookie Semantics, HTTP Authentication, Protocol-Level Encryption and Client Certificates.

## UNIT – 2

**Hypertext Markup Language:** Basic Concepts Behind HTML Documents, Understanding HTML Parser Behavior, Entity Encoding, HTTP/HTML Integration Semantics, Hyperlinking and Content Inclusion.

**Cascading Style Sheets:** Basic CSS Syntax, Parser Resynchronization Risks, Character Encoding.

**Browser-Side Scripts:** Basic Characteristics of JavaScript, Standard Object Hierarchy, Script Character Encoding, Code Inclusion Modes and Nesting Risks, The Living Dead: Visual Basic.

**Non-Html Document Types:** Plaintext Files, Bitmap Images, Audio and Video, XML-Based Documents, A Note on Nonrenderable File Types.

## UNIT – 3

**Content Rendering With Browser Plug-Ins:** Invoking a Plug-in, Document Rendering Helpers, Plug-in-Based Application Frameworks, ActiveX Controls, Living with Other Plug-ins.

**Content Isolation Logic:** Same-Origin Policy for the Document Object Model, Same-Origin Policy for XML Http Request, Same-Origin Policy for Web Storage, Security Policy for Cookies, Plug-in Security Rules, Coping with Ambiguous or Unexpected Origins.

**Life outside Same-Origin Rules:** Window and Frame Interactions, Cross-Domain Content Inclusion, Privacy-Related Side Channels, Other SOP Loopholes and Their Uses.

**Other Security Boundaries:** Navigation to Sensitive Schemes, Access to Internal Networks, Prohibited Ports, Limitations on Third-Party Cookies.

## UNIT – 4

**Content Recognition Mechanisms:** Document Type Detection Logic, Character Set Handling.

**Dealing with Rogue Scripts:** Denial-of-Service Attacks, Window-Positioning and Appearance Problems, Timing Attacks on User Interfaces.

**Extrinsic Site Privileges:** Browser- and Plug-in-Managed Site Permissions, Form-Based Password Managers, Internet Explorer's Zone Model.

**New and Upcoming Security Features:** Security Model Extension Frameworks, Security Model Restriction Frameworks, Other Developments.

**TEXT BOOKS:**

1. Michal Zalewski, "The Tangled Web: A Guide to Securing Modern Web Applications", No Starch Press, 2011.

**REFERENCE BOOKS:**

1. Dafydd Stuttard, Marcus Pinto, "The Web Application Hacker's Handbook: Discovering and Exploiting Security Flaws", Wiley publications, 2008.
2. O'Reilly, "Web Security, Privacy & Commerce", 2nd Edition, O'Reilly Media, Inc, 2001.

**JOURNALS/MAGAZINES**

1. <https://ieeexplore.ieee.org/abstract/document/8342469>
2. [https://link.springer.com/referenceworkentry/10.1007/978-1-4419-5906-5\\_1235](https://link.springer.com/referenceworkentry/10.1007/978-1-4419-5906-5_1235)
3. <https://link.springer.com/book/10.1007/978-3-319-12226-7>

**SWAYAM/NPTEL/MOOCs:**

11. <https://www.coursera.org/projects/web-application-security-testing-with-owsap-zap>
12. <https://www.coursera.org/projects/web-application-security-testing-burp-suite>
13. <https://www.coursera.org/learn/ibm-cybersecurity-analyst-assessment>

**Self-Learning Exercises:**

8. origin inheritance
9. Other Browser Mechanisms
10. Common Web Vulnerabilities

Course Title	Secure Communications				Course Type		Integrated	
Course Code	M21TFS207	Credits	3		Class		II Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3	Theory	Practical	CIE	SEE
	Practice	0	0	0				
	-	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>0</b>	<b>50%</b>

**COURSE OVERVIEW**

Secure communication is when two entities are communicating and do not want a third party to listen in. In order for this to be the case, entities need to communicate in a way unsusceptible to eavesdropping or interception. Secure communication includes means by which people can share information with varying degrees of certainty that third parties cannot intercept what is said. Other than spoken face-to-face communication with no possible eavesdropper, it is probably safe to say that no communication is guaranteed



to be secure in this sense, although practical obstacles such as legislation, resources, technical issues (interception and encryption), and the sheer volume of communication serve to limit surveillance.

With many communications taking place over long distance and mediated by technology, and increasing awareness of the importance of interception issues, technology and its compromise are at the heart of this debate. For this reason, this article focuses on communications mediated or intercepted by technology.

**COURSE OBJECTIVE (S):**

The objectives of this course are to:

1. Understand the importance and goals of communication network and information security and introduce him to the different types of attacks.
2. Expose the different approaches to handling security and the algorithms in use for maintaining data integrity and authenticity.
3. Enable to appreciate the practical aspects of security features design and their implementation in wired and wireless internetworking domains.

**COURSE OUTCOMES (COs)**

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Demonstrate an understanding of the ways in which communication network security may get compromised and the basic principles of security algorithm design.	1,2,3,4	1,2
CO2	Exposed to the different approaches that handle security and the algorithms in use for maintaining data integrity and authenticity.	1,2,3,4	1,2
CO3	Implement and analyze the different algorithms and compare their performances.	1,2,3,4	1,2
CO4	Apply his knowledge for designing or modifying existing algorithms and implementing them at least by simulation.	1,2,3,4	1,2
CO5	Illustrate key management technique in RSA algorithm	1,2,3,5	1,2
CO6	Demonstrate password management techniques	1,2,3,5	1,2

**BLOOM’S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom’s Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√	√			
CO2	√		√	√		
CO3			√	√	√	
CO4			√	√		
CO5				√	√	
CO6				√	√	

## COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1									3	2	
CO2	2	3	3	2									3	2	
CO3	3	3	2	2									3	2	
CO4	3	3	2	2									3	2	
CO5	3	3	2		2								3	2	
CO6	3	3	2		2								3	2	

**Note:** 1-Low, 2-Medium, 3-High

### COURSE CONTENT

#### THEORY:

#### UNIT – 1

**Introduction on security, security goals and types of attacks:** Passive attack, active attack, attacks on confidentiality, attacks on integrity and availability, Security services and mechanisms.

**Modular arithmetic:** Groups, Ring, Fields. The Euclidean algorithm, Finite fields of the form  $GF(p)$

#### UNIT – 2

Polynomial arithmetic: Finite fields of the form  $GF(2^n)$ .

Symmetric Ciphers, Symmetric Cipher Model, Substitution Techniques, Caesar Cipher, Mono alphabetic Cipher, Play fair cipher, Hill cipher, Poly alphabetic Cipher, one time pad

#### UNIT – 3

Transposition techniques, Block Ciphers, Data encryption Standards, DES Encryption, DES decryption, Differential and Linear Crypt analysis Advanced Encryption standard, The AES Cipher, substitute bytes transformation, Shift row transformation, Mix Column transformation.

Public key cryptosystem, Application for Public key cryptosystem requirements

#### UNIT – 4

RSA algorithm, Key management, Distribution of public key, public key certificates, Distribution of secret keys.

**Intruders:** Intrusion techniques, Intrusion detection, Statistical anomaly detection, Rule based intrusion detection, Distributed intrusion detection, Honey pot, Intrusion detection exchange format.

**Password management:** Password protection, password selection strategies.

#### TEXT BOOKS:

- Behrouz A. Forouzan , "Cryptography and Network security" Tata McGraw-Hill, 3<sup>rd</sup> Edition, 2015
- William Stallings, "Cryptography and Network security: principles and practice", 7th Edition, Prentice Hall of India, New Delhi, 2017

## REFERENCE BOOKS:

7. David S. Dummit & Richard M Foote, "Abstract Algebra", 3rd Edition, Wiley India Pvt. Ltd., 2011.
8. Douglas A. Stinson, "Cryptography, Theory and Practice", 2/e, Chapman & Hall, CRC Press Company, Washington, 4<sup>th</sup> Edition, 2019.
9. Lawrence C. Washington, "Elliptic Curves: Theory and Cryptography", Chapman & Hall, CRC Press Company, Washington, 2008.
10. N. Koblitz: "A course in Number theory and Cryptography", 2008.
11. Thomas Koshy: "Elementary Number Theory with Applications", 2/e, Academic Press, 2007
12. Tyagi and Yadav, "Cryptography and network security", Dhanpatrai, 2012

## JOURNALS/MAGAZINES

1. <https://ieeexplore.ieee.org/document/809184>
2. <https://ieeexplore.ieee.org/document/1221784>
3. <https://www.journals.elsevier.com/computers-and-security>
4. <https://www.springer.com/journal/10207>

## SWAYAM/NPTEL/MOOCs:

14. <https://nptel.ac.in/courses/106/105/106105082/>
15. [https://onlinecourses.swayam2.ac.in/nou19\\_cs08/preview](https://onlinecourses.swayam2.ac.in/nou19_cs08/preview)
16. Coursera – Cryptography, University of Maryland

Course Title	Penetration testing & incident response				Course Type		SC	
Course Code	M21TFS208	Credits	3		Class		II Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	0	0	0	Theory	Practical	CIE	SEE
	-	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>0</b>	<b>50</b>	<b>50</b>

## COURSE OVERVIEW

This course gives background needed to gain Cybersecurity skills, students will learn about the different phases of penetration testing, how to gather data for penetration test and popular penetration testing tools. Furthermore, they will also learn the phases of an incident response, important documentation to collect, and the components of an incident response policy and team.

This course is intended for anyone who wants to gain a basic understanding of cybersecurity.

## COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the fundamental concepts of penetration testing and the different steps involved.

2. Inculcate the knowledge of different phases in penetration testing and ethical hacking.
3. Introduce the concept of incident and incident management.
4. Introduce different types of cyberattacks, and develop understanding of cyber forensics.

### COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understanding of fundamental concepts of penetration testing and the different steps involved	1,2,5	1
CO2	Students would have the knowledge of different phases in penetration testing and ethical hacking.	1,4,6	1
CO3	Understanding of incident and incident management.	2,3,8	2
CO4	Understanding of different types of cyberattacks and cyber forensics	1,4,5,9	1
CO5	Analyze Disk and Network forensics and Log analysis	1,4,5,9	3
CO6	Demonstrate Malware identification and Analysis, Lateral Movement and Side Channel Attack Analysis	1,4,5,9	3

### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√	√		
CO4	√	√				
CO5				√	√	
CO6				√	√	

### COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2				1	1			1	3		

CO2	3	2	3		2				1			1	3		
CO3	3	1	2	1	2				1			1		2	
CO4	3			2	2				1			1	3		
CO5	3			2	2				1						3
CO6	3			2	2				1						3

**Note:**1-Low,2-Medium,3-High

## **COURSE CONTENT**

### **THEORY:**

#### **UNIT – 1**

Introduction to penetration testing, Scope, roles and responsibilities of a penetration tester, Scoping and Exclusions in a Penetration Testing Assignment, Steps of Penetration Testing, Threat Modeling, Using Kali Linux as Penetration testing Tool kit, Web penetration Testing, OWASP top10, network penetration Testing, Network Penetration Testing, Application penetration Testing

#### **UNIT – 2**

Penetration Testing phases/Testing Process, types and Techniques, Blue/Red Teaming, Strategies of Testing, Non Disclosure Agreement Checklist, Phases of hacking, Open-source/proprietary Pentest Methodologies

#### **UNIT – 3**

Introduction to Incident - Incident Response Methodology – Steps - Activities in Initial Response Phase after detection of an incident.

#### **UNIT – 4**

Indicators of Compromise, Attack Motivations and Attack Methods, Profiling an Adversary, Incident readiness- Tools, Techniques and Procedure, Triaging tools, Memory, Disk and Network forensics and Log analysis, Malware identification and Analysis, Lateral Movement and Side Channel Attack Analysis, Lessons Learnt, Mitigation Efforts

### **TEXTBOOKS:**

9. Kali Linux Wireless Penetration Testing Beginner's Guide by Vivek Ramachandran, Cameron Buchanan, 2015 Packt Publishing
10. Travis E. Oliphant, "Guide to NumPy", Trelgol publishers,2006.

11. Kevin Mandia, Chris Prorise, "Incident Response and computer forensics", Tata McGrawHill,2006.

#### REFERENCEBOOKS:

13. Kali Linux 2: Windows Penetration Testing, By Wolf Halton, Bo Weaver , June 2016 Packt Publishing
14. Mastering Modern Web Penetration Testing By Prakhar Prasad, October 2016 Packt Publishing.
- 15.

#### JOURNALS/MAGAZINES

10. <https://www.springer.com/de/book/9781484218563>
11. <http://courses.ncirl.ie/index.cfm/page/module/moduleId/68126>
12. <https://site.ieee.org/spokane/2017/01/23/cyber-security-incident-response-february-16-2017-2/>
13. <https://journal-bcs.springeropen.com/articles/10.1186/s13173-017-0051-1>

#### SWAYAM/NPTEL/MOOCs:

17. <https://www.classcentral.com/course/ibm-penetration-testing-incident-response-forensi-20194>
18. <https://www.coursera.org/learn/ibm-penetration-testing-incident-response-forensics>
19. <https://www.coursera.org/lecture/ibm-penetration-testing-incident-response-forensics/penetration-testing-discovery-oS1qL>

#### Self-Learning Exercises:

11. <http://www.cyberforensics.in/?AspxAutoDetectCookieSupport=1>
12. [https://www.cdac.in/index.aspx?id=cyber\\_security](https://www.cdac.in/index.aspx?id=cyber_security)

Course Title	Mobile and Wireless Security				Course Type		Softcore	
Course Code	M21TFS209	Credits	3		Class		II Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	0	0	0	Theory	Practical	CIE	SEE
	-	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>0</b>	<b>50</b>

#### COURSE OVERVIEW

Wireless security is the prevention of unauthorized access or damage to computers or data using wireless networks, which include Wi-Fi networks. The most common type is Wi-Fi security, which includes Wired Equivalent Privacy (WEP) and Wi-Fi Protected Access (WPA). Mobile security is the protection of smartphones, tablets, laptops and other portable computing devices and the networks they connect to, from threats and vulnerabilities associated with wireless computing.

**COURSE OBJECTIVE (S):**

The objectives of this course are to:

1. Explain network security protocols.
2. Gain knowledge about Wireless Network and Security.
3. Shed light on Mobile Networks and security.
4. Gain insights into Mobile Application Security.

**COURSE OUTCOMES (COs)**

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Summarize concepts of Network Security and Security in Wireless Networks.	1 to 4, 8, 9, 12	1
CO2	Illustrate the concepts of Wireless Network Security.	1 to 3, 5,9,12	1
CO3	Use to solve problems in Mobile Network Security.	1 to 5, 9, 12	2
CO4	Develop security systems for Mobile application.	1,4,5,9,12	1
CO5	Demonstrate Android security model	1,4,5,9,12	3
Co6	Illustrate Mobile Geolocation and Mobile Web Security models	1,4,5,9,12	3

**BLOOM’S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom’s Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√					
CO2	√	√				
CO3			√	√		

CO4			√	√		
CO5				√	√	
Co6				√	√	

### COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	3	1	1	2				1	1			1	3		
CO2	3	2	3		2				1			1	2		
CO3	3	1	2	1	2				1			1		3	
CO4	3			2	2				1			1	3		
CO5	3			2	2				1			1			3
Co6	3			2	2				1			1			3

**Note:** 1-Low, 2-Medium, 3-High

### COURSE CONTENT

#### THEORY:

#### UNIT – 1

**Network Security:** Network Security Protocols, Security and Layered Architecture, Voice-Oriented Wireless Networks, Data-Oriented Wireless Networks.

#### UNIT – 2

**Wireless Network Security:** Wired Equivalent Privacy (WEP), Wi-Fi Protected Access (WPA), Robust Secure Network (RSN) and Virtual Private Network (VPN).

#### UNIT – 3

**Mobile Security:** Security of GSM Networks, Security of UMTS Networks, LTE Security, Wi-Fi and Bluetooth Security, SIM/UICC Security.

#### UNIT – 4

**Mobile Malware and App Security:** Android Security Model, IOS Security Model, Security Model of the Windows Phone, SMS/MMS, Mobile Geolocation and Mobile Web Security, Security of Mobile VoIP Communications, Emerging Trends in Mobile Security.

#### TEXT BOOKS:

1. **Sunilkumar S. Manvi and Mahabaleshwar S. Kakkasageri,** "Wireless and Mobile Networks", Concepts and Protocols, 2<sup>nd</sup> Ed. Wiley Publications, 2010. (Unit 3).



2. **Man Ho Au and Kim-Kwang Raymond Choo**, "Mobile Security and Privacy", Syngress publications, 2016.
3. **Himanshu Dwivedi, Chris Clark and David Theil**, "Mobile Application Security", Tata McGraw-Hill Publication, 2010.

**REFERENCE BOOKS:**

16. Steven Furnell, "Mobile Security – A Packet Guide", IT Governance Publications, 2009.
17. Nouredine Boudriga, "Security of Mobile Communications", CRC Press Publications, 2009.
18. N Asokan, Lucas Davi, "Mobile Platform Security", M & C Publishers, 2014.

**JOURNALS/MAGAZINES**

14. <https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=7742>
15. <http://www.ieee-security.org/TC/SPW2017/MoST/>

**SWAYAM/NPTEL/MOOCs:**

20. <https://www.coursera.org/learn/network-security-database-vulnerabilities>
21. <https://www.coursera.org/learn/smart-device-mobile-emerging-technologies>

**Self-Learning Exercises:**

13. Web Security
14. Firewall
15. DoS Attack
16. Email Security

Course Title	Forensics and VAPT Lab				Course Type		Integrated	
Course Code	M21TF0206	Credits	2		Class		II Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	0	0	0	Theory	Practical	CIE	SEE
	Practice	2	2	2				
	-	-	-	-				
	<b>Total</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>20</b>

**PRACTICE:**

No	Title of the Experiment
1.	Study of Computer Forensics and different tools used for forensic investigation
2.	How to Recover Deleted Files using Forensics Tools
3.	Study the steps for hiding and extract any text file behind an image file/ Audio file using Command Prompt.

4.	How to Extract Exchangeable image file format (EXIF) Data from Image Files using Exifreader Software
5.	How to make the forensic image of the hard drive using EnCase Forensics.
6.	How to Restoring the Evidence Image using EnCase Forensics
7	How to Collect Email Evidence in Victim PC
8	How to Extracting Browser Artifacts
9	How to View Last Activity of Your PC
10	Find Last Connected USB on your system (USB Forensics)
11	Comparison of two Files for forensics investigation by Compare IT software
12	Live Forensics Case Investigation using Autopsy

### THIRD SEMESTER...

Course Title	Security and Resilience				Course Type		Integrated	
Course Code	M21TFS301	Credits	3		Class			
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3		3				
	Practice	0	0	0	Theory	Practical	CIE	SEE
	-	-	-	-				
	<b>Total</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>39</b>	<b>-</b>	<b>50</b>

### COURSE OVERVIEW

The course provides an overview a Cybersecurity and Cyber Resiliency strategies. This course discusses all the steps required from conception of the plan from preplanning, project management directives, cyber threat and vulnerability analysis, cyber risk and controls assessment to reporting and measurement techniques for plan success and overall strategic plan performance. Also guides to implement a truly resilient Cybersecurity framework.

### COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Understand the purpose of cyber resilience strategy and the associated control objectives
2. Develop Cybersecurity and Cyber Resiliency strategies
3. Demonstrates a methodology to target high risk threats
4. Evaluation of risk assessment methodologies

**COURSE OUTCOMES (COs)**

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand the methodologies for efficient utilization of resources and target high risk threats	1,2,5	1
CO2	Develop a unified Cybersecurity and Cyber Resiliency strategies	1,2,3,4,5,9,12	1,2
CO3	Implement security improvement plan, including all risk assessments and project plan	1,2,3,4,5,9,12	1,2
CO4	Evaluating the performance against various risk and performance indicators	1,2,3,4,5,9,12	1,2
CO5	Develop project strategy management flow	1,2,3,4,5,9,12	1,2
CO6	Demonstrate RACI strategy development matrix	1,2,3,4,5,9,12	1,2

**BLOOM’S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom’s Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2			√			√
CO3				√		
CO4				√	√	
CO5				√	√	
CO6				√	√	

## COURSE ARTICULATION MATRIX

CO#/ PO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2			2								3		
CO2	3	2	3	2	2				1			1	3	3	
CO3	3	1	1	1	2				1			1	3	3	
CO4	3	2	1	2	2				1			1	3	3	
CO5	3	2	1	2	2				1			1	3	3	
CO6	3	2	1	2	2				1			1	3	3	

**Note:** 1-Low, 2-Medium, 3-High

### COURSE CONTENT

#### THEORY:

#### UNIT – 1

**Why Cybersecurity and Cyber Resiliency Strategies :***The Value Proposition, The 6 STEPs for Developing and Maintaining a Cyber security and Cyber Resiliency Strategy, Cybersecurity and Cyber Resiliency Strategy Key Players, Initiating the Strategy, Triggers to Create a Corporate Cybersecurity and Cyber Resiliency Strategy, Information Security vs. Cybersecurity, Cyber Resiliency vs. Traditional Resiliency, Cybersecurity and Cyber Resiliency Strategy Life Cycle, Cyber Strategies and Cyber programs, Cybersecurity and Cyber Resiliency Architecture: Standards and Frameworks, Cyber Program Preplanning, Technical Areas of Concentration for a Cyber Program*

#### UNIT – 2

**Steps in Developing and Maintaining a Cybersecurity and Cyber Resiliency Strategy:** *Preplanning: Preparation for Strategy Development, Strategy Project Management, Cyber Threats, Vulnerabilities, and Intelligence Analysis, Cyber Risks and Controls, Assessing Current and Target States, Measuring Strategic Plan Performance and End of Year (EoY) Tasks, Governance Cycles and Processes, Proposing New Initiatives to Mitigate Threats and Reduce Risk, Checklists and Templates*

**Strategy Project Management:** *Vision to Initiative Flow, Strategy Project Charter, Strategy Preparation Checklist, Strategy Timeline, Strategy Gantt Chart, Strategy Swimlane, Data Flow Diagrams for STEPs 2, 3, 4, 5, and 6, RACI Strategy Development Matrix, NIST CSF Initiative Mapping, The Final Strategy Deliverable*

#### UNIT – 3

**Cyber Threats, Vulnerabilities, and Intelligence Analysis:** *Cyber Threats, Vulnerabilities*

**Cyber Risks and Controls:** *Cyber Risk, IT Controls, Cyber Insurance*

**Current and Target State Assessments:** Introduction to Assessments, Current State Assessments, Conducting a Current State Assessment, Unmapped Initiatives Discussion, Target State Assessment, How to Rate Current and Target States

#### UNIT – 4

**Measuring Strategic Plan Performance and End of Year (EOY) Tasks:** Evaluating the Strategy Against the Critical Success Factors, Key Risk Indicators (KRIs), Key Performance Indicators (KPIs), Reporting on the Strategies, Determining New Initiatives for the Next Year, End of Year Tasks

**Checklists and Templates to Help Create an Enterprise-Wide Cybersecurity and Cyber Resiliency Strategy:** Guides to Strategy Preparation, STEP 1: Preplanning: Preparation for Strategy Development, STEP 2: Strategy Project Management, STEPs 3 and 4: Cyber Threats, Vulnerabilities, Intelligence Analysis, Risks, and Controls, STEP 5: Current and Target State Assessments, STEP 6: Measuring Plan Performance and EOY Tasks

#### TEXT BOOKS:

1. Carol A. Siegel Mark Sweeney, Cyber Strategy: Risk-Driven Security and Resiliency, CRS Press, Taylor & Francis Group, Auerbach Publications, 2020
2. Alexander Kott ,Igor Linkov , Cyber Resilience of Systems and Networks (Risk, Systems and Decisions) 1st ed. 2019 Edition

#### SWAYAM/NPTEL/MOOCs:

1. Coursera – Introduction to Cyber Security Specialization
2. [https://onlinecourses.nptel.ac.in/noc21\\_cs30/preview](https://onlinecourses.nptel.ac.in/noc21_cs30/preview)

Course Title	IOT Security				Course Type		Integrated	
Course Code	M21TFS302	Credits	4		Class		III Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	4	4	4	Theory	Practical	CIE	SEE
	Practice	0	0	0				
	-	-	-	-				
	<b>Total</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>52</b>	<b>00</b>	<b>50</b>

#### COURSE OVERVIEW

IoT security is the act of securing **Internet** of Things devices and the networks they're connected to. Hardware, software and connectivity will all need to be **secure** for **IoT** objects to work effectively. Without **security**, any connected object, from refrigerators to manufacturing bots, can be hacked. Once hackers gain control, they can usurp the object's functionality and steal the user's digital data.

**COURSE OBJECTIVE (S):**

The objectives of this course are to:

1. Have a good working understanding of the best practices laid down by the IoT Security Foundation
2. Inculcate knowledge to be able to develop a security patching strategy and product update life-cycle.
3. Know how to research and assess IoT threats and risks as they arise.
4. Able to discuss the main threats and attacks on IoT products and services

**COURSE OUTCOMES (COs)**

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of IOT models and work effectively with security researchers on reported IoT security issues and concerns.	1 , 3, 8, 9 , 12	1
CO2	Recognize IoT security and vulnerability threats.	1 , 3, 5,9,12	1
CO3	Interpret how to secure an IoT environment	1 ,3,4,5, 9, 12	2
CO4	Interpret different IoT types of attacks.	1,4,5,9,12	1
CO5	Formulate Test Device Range-Latency and Capacity for IoT hardware	1,4,5,9,12	3
CO6	Design Trusted IoT Application Platforms	1,4,5,9,12	3

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3		√	√	√		
CO4			√	√	√	
CO5						√
CO6						√

## COURSE ARTICULATION MATRIX

CO#/ POs	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02	PS03
CO1	3	1	1	2				1	1			1	3		
CO2	3	2	3		2				1			1	3		
CO3	3	1	2	1	2				1			1		3	
CO4	3			2	2				1			1	3		
CO5	3			2	2				1			1	3		3
CO6	3			2	2				1			1	3		3

**Note:** 1-Low, 2-Medium, 3-High

### COURSE CONTENT

#### THEORY:

#### UNIT – 1

##### IOT-SECURITY OVERVIEW

**IoT Reference Model**- Introduction -Functional View, **IoT Security Challenges**-Hardware Security Risks -Hardcoded/Default Passwords -Resource Constrained Computations -Legacy Assets Connections -Devices Physical Security, Software Security Risks -Software Vulnerabilities -Data Interception -Identification of Endpoints -Tamper Detection, **Lack of Industrial Standards.**

#### UNIT – 2

##### IOT- SECURITY & VULNERABILITY ISSUES

**IoT Security Requirements** -Data Confidentiality -Data Encryption -Data Authentication -Secured Access Control –**IoT-Vulnerabilities** – Secret-Key, Authentication/Authorization for Smart Devices - Constrained System Resources -Device Heterogeneity -Fixed Firmware.**IoT Attacks** -Side-channel Attacks -Reconnaissance -Spoofing -Sniffing -Neighbour -Discovery -Rogue Devices-Man-in-Middle

#### UNIT – 3

##### SECURED PROTOCOLS FOR IOT

**Infrastructure**-IPv6 -LowPAN , **Identification**-Electronic Product Code -uCode, **Transport**-Bluetooth -LPWAN, **Data** -MQTT -CoAP, **Multi-layer Frameworks**-Alljoyn,-IoTivity

#### UNIT – 4

##### SECURING INTERNET OF THINGS ENVIRONMENT

**IoT Hardware** -Test Device Range-Latency and Capacity -Manufacturability Test -Secure from Physical Attacks, **IoT Software** -Trusted IoT Application Platforms, -Secure Firmware Updating - Network Enforced Policy -Secure Analytics Visibility and Control

#### LEARNING RESOURCES:

4. <https://www.postscapes.com/internet-of-things-protocols/>
5. [https://www.cse.wustl.edu/~jain/cse570-15/ftp/iot\\_prot/index.html](https://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html)
6. <https://www.cisco.com/c/en/us/about/security-center/secure-iot-proposed-framework.html>
7. <https://www.iotforall.com/5-worst-iot-hacking-vulnerabilities/>

#### JOURNALS/MAGAZINES:

1. <https://ieeexplore.ieee.org/document/8600738/>
2. <https://ieeexplore.ieee.org/document/7005393/>
3. [https://scholar.google.com/scholar\\_lookup?title=A%20survey%20of%20secure%20middleware%20for%204.4.he%20Internet%20of%20Things&publication\\_year=2017&author=P.%20Fremantle&author=P.%20Scott](https://scholar.google.com/scholar_lookup?title=A%20survey%20of%20secure%20middleware%20for%204.4.he%20Internet%20of%20Things&publication_year=2017&author=P.%20Fremantle&author=P.%20Scott)
4. [https://scholar.google.com/scholar\\_lookup?title=Internet%20of%20things%3A%20Vision%2C%20applications%20and%20research%20challenges&publication\\_year=2012&author=D.%20Miorandi&author=S.%20Sicari&author=F.%20De%20Pellegrini&author=l.%20Chlamtac](https://scholar.google.com/scholar_lookup?title=Internet%20of%20things%3A%20Vision%2C%20applications%20and%20research%20challenges&publication_year=2012&author=D.%20Miorandi&author=S.%20Sicari&author=F.%20De%20Pellegrini&author=l.%20Chlamtac)

#### SWAYAM/NPTEL/MOOCs:

1. IOT Security: Mobility Security and Deception | Coursera
2. Welcome to Cybersecurity and the Internet of Things! | Coursera
3. Fundamentals of IoT Security-Udemy.

#### Self-Learning Exercises:

17. Explore different IOT security models
18. More exploration on Security challenges
19. Protocols for IOT Security
20. Explore applications of IOT

Course Title	Advanced topics in cyber security				Course Type		Integrated	
Course Code	M21TFS303	Credits	3		Class		III Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	4	4	4	Theory	Practical	CIE	SEE
	Practice	-	-	-				
	-	-	-	-				
	<b>Total</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>52</b>	<b>0</b>	<b>50</b>

#### COURSE OVERVIEW



Cybersecurity is security as it is applied to information technology. All information technology devices and facilities need to be secured against intrusion, unauthorized use, and vandalism. Additionally, the users of information technology should be protected from theft of assets, extortion, identity theft, loss of privacy and confidentiality of personal information, malicious mischief, damage to equipment, business process compromise, and the general activity of cybercriminals. The general public should be protected against acts of cyberterrorism, such as the compromise or loss of the electric power grid. Cybersecurity is a major endeavor of the IT industry. Although billions of dollars are spent annually on cybersecurity, no computer or network is immune from attacks or can be considered completely secure.

**COURSE OBJECTIVE (S):**

- To enable students to develop approaches that are in the frontier of cyber security engineering and research.
- To provide the student with knowledge about the state of the art in a plethora of cutting-edge cyber security topics.
- To provide the student with knowledge about how research is conducted in cyber security.
- To provide the student with knowledge about recent developments in network and application security via the utilization of newly established technologies.

**COURSE OUTCOMES (COs)**

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand the fundamental pillars of cyber security research and evaluation. Must have knowledge on a broad spectrum of innovative technologies and on how they can be applied in the context of cyber security.	1,2,3,4,8,9,12	1
CO2	Identify research questions and challenges for a variety of topics in cyber security. Must be able to use various state of the art frameworks for analyzing network traffic, identifying adversaries, as well as for developing/deploying attacks.	1,2,3,5,9,12	1
CO3	Able to the ability to critically review, summarize and discuss scientific content in cyber security	1,2,3,4,8,9,12	2
CO4	Must be able to use various state of the art frameworks for analyzing network traffic, identifying adversaries, as well as for developing/deploying attacks	1,4,8,9,12	1

CO5	Carry out Computer Forensics Investigation	1,2,3,4,5	3
CO6	Hypothesize for Global Perspective on Cybercrime	1,2,3,4,5	3

### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√	√		
CO4			√	√		
CO5					√	√
CO6					√	√

### COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2				1	1			1	3		
CO2	3	2	3		2				1			1	3		
CO3	3	1	2	1	2				1			1		3	
CO4	3			2	2				1			1	3		
CO5	3	3	3	2	2										3
CO6	3	2	2	2	2										3

**Note:** 1-Low, 2-Medium, 3-High

### COURSE CONTENT

## **THEORY:**

### **UNIT – 1**

**Network Attacks ,Threat Landscape - Network Security:** threats to watch , emerging threats, firewall .**Intrusion Detection And Prevention System:** IDPS - detection technologies, types of intrusion detection and prevention system (IDPS), security information and event management (SIEM), honeypot,

**Network Infrastructure Security Best Practices:** threats to the organization network infrastructure, best practices for network infrastructure security, critical security controls, physical security- information and communications technology: data center security – guidelines, environment security - information and communications technology

### **UNIT 2**

addressing threats, basic deployment questions, installation & configuration, securing the server platform, enforcing and maintaining security best practices, operations & maintenance, incident handling

**web servers security,** email security, database server security, dns servers security, web-application security versus perimeter security, attack surface, secure web application development- best practices, web application security testing, what do we need to secure?, security protocols

### **UNIT 3**

windows security controls essential for home user, principle of least privilege(plp), autorun /autoplay, software restriction policy, browsers and security, mbsa (microsoft baseline security analyser), set up and configure windows firewall, physical security, basic guidelines for enabling security in your desktop, enabling security features in ms office, wireless network security: vulnerabilities, threats and countermeasures, wlan threats, attacks cause loss of integrity, attacks causing loss of availability, authentication attacks, attacks on encryption standards, home wireless threats, public wireless threats, malware analysis fundamentals, setting up malware analysis facility, static analysis, dynamic analysis, automatic analysis, malware collection process with malware honeypots, memory analysis

**Introduction to Cybercrime:** Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals?, Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens. Cyberoffenses: How Criminals Plan Them: How Criminals Plan the Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

#### UNIT – 4

**Understanding Computer Forensics:** Introduction, Historical Background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber forensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting up a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Antiforensics.

#### TEXT BOOKS:

12. [https://www.cemca.org/ckfinder/userfiles/files/PG\\_Diploma\\_in\\_Cyber\\_Security/Course%20VII\\_I\\_Advanced\\_Cyber\\_Security\\_Techniques.pdf](https://www.cemca.org/ckfinder/userfiles/files/PG_Diploma_in_Cyber_Security/Course%20VII_I_Advanced_Cyber_Security_Techniques.pdf)
13. Sunit Belapure and Nina Godbole, Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives, Wiley India Pvt Ltd, 2013
14. Surya Prakash Tripathi, Ritendra Goyal, Praveen Kumar Shukla, Introduction to information security and cyber laws, Dreamtech Press, 2015

#### REFERENCE BOOKS:

19. Thomas J. MowbrayA , Cybersecurity: Managing Systems, Conducting Testing, and Investigating Intrusions, John Wiley & Sons,
20. James Graham, Ryan Olson, Rick Howard, Cyber Security Essentials, CRC Press, 2010

#### JOURNALS/MAGAZINES

- 1) [cybersecurity.springeropen.com](http://cybersecurity.springeropen.com)
- 2) [academic.oup.com > cybersecurity](http://academic.oup.com/cybersecurity)
- 3) <https://www.techscience.com/journal/JCS>
- 4) <https://cyber.fiu.edu/security-journals/>

**SWAYAM/NPTEL/MOOCs:**

- 1) <https://www.mooc-list.com/tags/cybersecurity>
- 2) <https://www.coursera.org/specializations/cyber-security>
- 3) <https://www.cyberdegrees.org/resources/free-online-courses/>

**Self-Learning Exercises:****OPEN ELECTIVES....**

Course Title	Fundamentals of Cybersecurity				Course Type		Integrated	
Course Code	M21CB302 1	Credits	4		Class		I/II Semester	
<b>Course Structure</b>	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	4	4	4				
	Practice	0	0	0	Theory	Practical	IA	SEE
	-	-	-	-				
	<b>Total</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>52</b>	<b>00</b>	<b>50</b>

**COURSE OVERVIEW:**

The fundamentals of cybersecurity course covers various concepts on providing security to networks, data, programs and other cyber infrastructure. The growing usage of internet by individuals and organizations is demanding for cyber security applications that protect cyber infrastructure and other resource to provides, therefore this course is very important and provides fundamental knowledge on cyber security.

**COURSE OBJECTIVE (S):**

The objectives of this course are to:

1. Explain the fundamentals of cyber security and their applications.
2. Inculcate knowledge of attacker techniques.
3. Describe integer and string vulnerabilities

4. Discuss the malicious code to steal information

**COURSE OUTCOMES (COs)**

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of fundamentals of cyber security to solve real world problems.	1 to 4, 8, 9, 12	1
CO2	Develop solutions for defending various attacks in cyber security.	1 to 3, 5,9,12	1
CO3	Apply techniques to develop solutions to address various vulnerabilities	1 to 5, 9, 12	2
CO4	Create cyber security solutions to protect stealing information	1,4,5,9,12	1
CO5	Demonstrate Misdirection, Reconnaissance, and Disruption Methods	1,4,5,9,12	3
CO6	Summarize on stealing in formation and exploitation	1,4,5,9,12	3

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√	√		
CO4						√
CO5					√	
CO6					√	

**COURSE ARTICULATION MATRIX**

CO#/ PO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2				1	1			1	3		
CO2	3	2	3		2				1			1	3		

CO3	3	1	2	1	2				1			1		3	
CO4	3			2	2				1			1	3		
CO5	3			2	2				1			1			3
CO6	3			2	2				1			1			3

**Note:** 1-Low, 2-Medium, 3-High

Course Content:

Theory:

<b>Contents</b>
<p><b>Unit 1:</b>  <b>Cyber security Fundamentals: Network and security concepts:</b> Information assurance fundamentals, cryptography, encryption, public key encryption, domain name system, firewalls, virtualization, radio-frequency identification. <b>security principles:</b>-tokens, messaging, program execution.</p>
<p><b>Unit 2:</b>  <b>Attacker techniques and motivations:</b> Hackers cover tracks, tunneling techniques, fraud techniques, threat infrastructure.</p>
<p><b>Unit 3:</b>  <b>Exploitation: Techniques to gain foothold:</b> shell code, Integer vulnerabilities, stack overflow, string vulnerabilities, SQL Injection, malicious pdf files, race conditions, web tools, DoS conditions, bruteforce <b>and dictionary</b>, Misdirection, Reconnaissance, and Disruption Methods.</p>
<p><b>Unit 4:</b>  <b>Malicious code:</b> self replicating malicious code, evading detection and elevating privileges, rootkits, spyware, attacks against user accounts, token kidnapping, virtual machine detection, stealing information and exploitation.</p>

**Text Book:**

1. James Graham et al, "Cyber security essentials", CRC press, 2010

**Reference Books:**

1. Thomas Johnson et al, "cyber security protecting critical infrastructure from cyber attack and warfare", Springer, 2015.
2. Martti Lehto, "Cyber security", Springer, 2015

**Journals/Magazines**

1. Journal of cyber security
2. [Springer journal of cyber security](#).
3. Elsevier computers and security

**SWAYAM/NPTEL/MOOCs:**

1. udacity – Introduction to cyber security
2. Coursera – cyber security

**Self-Learning Exercises:**

1. Python programming for cyber security
2. Ethical hacking and python

Course Title	Ethical Hacking				Course Type		Soft Core	
Course Code	M21TF3022	Credits	3		Class		II Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	4	4	4	Theory	Practical	CIE	SEE
	Practice	0	0	0				
	-	-	-	-				
	<b>Total</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>52</b>	<b>0</b>	<b>50</b>

**COURSE OVERVIEW**

Ethical hacking refers to the act of locating weaknesses and vulnerabilities of computer and information systems by duplicating the intent and actions of malicious hackers. Ethical hacking is also known as penetration testing, intrusion testing, or red teaming. An ethical hacker is a security professional who applies their hacking skills for defensive purposes on behalf of the owners of information systems. This course offers the insights about Casting the Establishment, Securing Permission, Wireless Hacking and Remote Control Insecurities.

**COURSE OBJECTIVE (S):**

The objectives of this course are to:

1. Learn aspects of security, importance of data gathering, foot printing and system hacking.
2. Learn tools and techniques to carry out a penetration testing.
3. Explain Intrusion Detection, Policy Creation, Social Engineering, DDoS Attacks, Buffer Overflows and Virus Creation.
4. Compare different types of hacking tools.

**COURSE OUTCOMES (COs)**



After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Explain aspects of security, importance of data gathering, foot printing and system hacking	1 to 4, 8, 9, 12	1
CO2	Explain aspects of security, importance of data gathering, foot printing and system hacking	1 to 3, 5,9,12	1
CO3	Demonstrate how intruders escalate privileges.	1 to 5, 9, 12	2
CO4	Demonstrate how intruders escalate privileges..	1,4,5,9,12	1
CO5	Summarize Advanced Techniques Session Hijacking	1,4,5,9,12	3
CO6	Assess Web server hacking and web application hacking	1,4,5,9,12	3

#### BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√	√		
CO4					√	√
CO5				√	√	
CO6				√	√	

#### COURSE ARTICULATION MATRIX

CO#/ POs	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO1	PSO2	PSO3
CO1	3	1	1	2				1	1			1	3		
CO2	3	2	3		2				1			1	2		
CO3	3	1	2	1	2				1			1		3	
CO4	3			2	2				1			1	3		
CO5	3			2	2				1			1			3

CO6	3			2	2				1			1			3
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**Note:** 1-Low, 2-Medium, 3-High

**COURSE CONTENT**

**THEORY:**

**UNIT – 1**

**10hrs**

Casing the Establishment: What is foot printing, Internet Foot printing, Scanning, Enumeration, basic banner grabbing, Enumerating Common Network services. Case study: Network Security Monitoring.

**UNIT – 2**

Securing permission: Securing file and folder permission, Using the encrypting file system, Securing registry permissions. Securing service: Managing service permission, Default services in windows 2000 and windows XP. Unix: The Quest for Root, Remote Access vs Local access, Remote access, Local access, after hacking root.

**UNIT – 3**

Wireless Hacking: Wireless Foot printing, Wireless Scanning and Enumeration, Gaining Access, Tools that exploiting WEP Weakness, Denial of Services Attacks, Firewalls: Firewalls landscape, Firewall Identification-Scanning Through firewalls, packet Filtering, Application Proxy Vulnerabilities, Denial of Service Attacks, Motivation of Dos Attackers, Types of DoS attacks, Generic Dos Attacks, UNIX and Windows DoS.

**UNIT – 4**

Remote Control Insecurities, Discovering Remote Control Software, Connection, Weakness. VNC, Microsoft Terminal Server and Citrix ICA, Advanced Techniques Session Hijacking, Back Doors, Trojans, Cryptography, Subverting the systems Environment, Social Engineering, Web Hacking, Web server hacking web application hacking, Hacking the internet Use, Malicious Mobile code, SSL fraud, E-mail Hacking, IRC hacking, Global countermeasures to Internet User Hacking.

**TEXT BOOKS:**

1. Stuart McClure, Joel Scambray and Goerge Kurtz, Hacking Exposed 7: Network Security Secrets & Solutions, Tata Mc Graw Hill Publishers, 2010.
2. Bensmith, and Brian Komer, Microsoft Windows Security Resource Kit, Prentice Hall of India, 2010.

**REFERENCE BOOKS:**

1. Stuart McClure, Joel Scambray and Goerge Kurtz, "Hacking Exposed Network Security Secrets & Solutions", 5th Edition, Tata Mc Graw Hill Publishers, 2010.
2. Rafay Baloch, "A Beginners Guide to Ethical Hacking".
3. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, "Gray Hat Hacking The Ethical Hackers Handbook", 3rd Edition, McGraw-Hill Osborne Media paperback (January 27, 2011)

#### JOURNALS/MAGAZINES

1. International Journal of Computer Science Trends and Technology (IJCT) – Volume 2 Issue 4, Nov-Dec 2014
2. E. S. Raymond, The New Hacker's Dictionary, MIT Press, Cambridge, MA (1991).
3. S. Garfinkel, Database Nation, O'Reilly & Associates, Cambridge, MA (2000).
4. The first use of the term "ethical hackers" appears to have been in an interview with John Patrick of IBM by Gary Anthens that appeared in a June 1995 issue of Computer World

#### SWAYAM/NPTEL/MOOCs:

1. StationX – The Complete Ethical Hacking Course Bundle.
2. Udemy – Learn Ethical Hacking From Scratch.
3. Cybrary – The Art of Exploitation.
4. EH Academy – The Complete Cyber Security & Hacking Course.
5. Offensive Security – Metasploit Unleashed.
6. Coursera – Cryptography.

Course Title	BLOCK CHAIN TECHNOLOGY				Course Type		Theory	
Course Code	M21TF3023	Credits	3		Class		I semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment in Weightage	
	Theory	4	4	4				
	Practice	0	0	0	Theory	Practical	CIE	SEE
	Tutorial	--	--	---				
	<b>Total</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>52</b>	<b>0</b>	<b>50%</b>

**COURSE OVERVIEW:**

Course Description: Block chain is the distributed and decentralized database technology behind this crypto currency. This course explores the fundamentals of the public, transparent, secure, immutable and distributed database called block chain. Block chains can be used to record and transfer any digital asset not just currency. This course will introduce students to the workings and applications of this potentially disruptive technology. Its potential impact on financial services, government, banking, contracting and identity management.

**COURSE OBJECTIVE**

1. Understand the basic of Cryptography, Blockchain technology and tools
2. Demonstrate Ethereum principles and development cycle from Ethereum to bitcoin with necessary tools and techniques
3. Illustrate Wallets and client software and programming techniques with solidity and DApps
4. Analyse different Blockchain Platforms that can be used in real world applications.

**COURSE OUTCOMES (COs)**

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Analyze various cryptography mechanisms and list out cryptography constructs for blockchain technology	1,2,3,5,6	1,2,3
CO2	Discuss various tools used for blockchain	1,2,3,5,6	1,2,3
CO3	Illustrate the concept of Ethereum for crypto currency and implementation aspects of DAO	1,2,3,5,6	1,2,3
CO4	Infer the concept of Wallets and client hardware and software for building a running client	1,2,3,5,6	1,2,3
CO5	Interpret various applications of Blockchain	1,2,3,5,6	1,2,3
CO6	Point out on Programming with solidity and DApps	1,2,3,5,6	3

**BLOOM'S LEVEL OF THE COURSE OUTCOMES**

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2	√	√				

CO3			√			
CO4		√	√			
CO5			√			

**COURSE ARTICULATION MATRIX**

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	2	3	2		2	3							2	3	2
CO2	3	1	2		3	2							1	3	2
CO3	2	1	2		2	1							2	1	2
CO4	3	2	1		2	3							2	2	3
CO5	3	2	1		2	3							2	2	3
CO6	3	2	1		2	3									3

**Note:** 1-Low, 2-Medium, 3-High

**COURSE CONTENT  
THEORY**

Contents
<b>UNIT-1</b>
<p><b>Introduction to cryptography and Block chain:</b> Introduction to cryptography-Symmetric and Public-key cryptography, Hash function, Digital Signatures-ECDSA, Memory Hard Algorithm,.</p> <p><b>Introduction to Block chain:</b> Cryptographic constructs and block chain technology, Zero Knowledge Proof , Advantage over conventional distributed database, Block chain as Public Ledgers, networks, Types of Block chain.</p>
<b>UNIT-2</b>
<p><b>Ethereum:</b></p> <p>Crypto currency: History, Distributed Ledger, Bitcoin an overview, protocols - Mining strategy and rewards, bitcoin limitations, What Is Ethereum? Development from Bit coin to Ethereum, <a href="#">Ethereum vs Ether</a>, <a href="#">Ethereum</a></p>

networks, components of ethereum ecosystem, Ethereum Virtual Machine (EVM): Accounts, Transactions, Gas, Ether, Memory, Smart contracts, Truffle Design , Implementations of DAO, [DAO and Intellectual Property](#).

### UNIT-3

**Wallets and client software:** Nodes and miners, hardware and software requirements for building a running client, Wallets technology overview, wallet best practices.

**Programming with solidity and DApps:** Data types, pre defined global variables and function, error handling, What is DApp, data storage, communication protocols, Basic DApp example: Auction DApp, Ethereum Name Service (ENS) history, specifications, and layers.

### UNIT-4

**Blockchain Applications:** Internet of Things, Medical Record Management System, and Blockchain in Government and Block chain Security, Block chain Use Cases –Finance, Domain Name Service and future of Block chain.**Enterprise Blockchains and Applications:** Enterprise Blockchains: Hyperledger, R3 Corda, Quorum

#### SELF-LEARNING COMPONENT:

Distributed Ledger in Blockchain, Decentralized Applications.

#### TEXT BOOKS:

1. Joseph J. Bambara Paul R. Allen, "Blockchain, A Practical Guide to Developing Business, Law, and Technology Solutions", McGraw-Hill Education Professional , Second edition, 2018
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).
3. Melanie Swan "Blockchain: Blueprint for a New Economy", O'Reilly Media, Third edition, Aug 2015.
4. Andreas M. Antonopoulos, Gavin Wood "Mastering Ethereum", O'Reilly Media, Inc., November 2018
5. Joseph Holbrook "Architecting Enterprise Blockchain Solutions", Sybex, February 2020

#### REFERENCE BOOKS:

1. Mingjun Dai; Shengli Zhang; Hui Wang; Shi Jin "A Low Storage Requirement Framework for Distributed Ledger in Blockchain" Volume: 6, Pages: 22970 – 22975, Year: 2018.
2. Ruiguo Yu, Jianrong Wang, Tianyi Xu, Jie Gao Yongli An Gong Zhang, And Mei Yu "Authentication With Blockchain Algorithm and Text Encryption Protocol in Calculation of Social Network ", Volume: 5, pp: 24944 – 24951, 09 November 2017.
3. Ashiq Anjum; Manu Sporny; Alan Sill "Blockchain Standards for Compliance and Trust" , Volume: 4, Issue: 4 ,Pages: 84 – 90, Year: 2017.
4. Morgen E. Peck; Samuel K. Moore "The blossoming of the blockchain" , Volume: 54, Issue: 10 Pages: 24 – 25, Year: 2017.
5. Inderscience Journal of blockchain and cryptocurrency.
6. Ledger Journal of Cryptocurrency and Blockchain Technology.

**10** YEARS  
OF UNIVERSITY  
RECOGNITION  
**20** YEARS OF  
ACADEMIC  
EXCELLENCE



**REVA**  
UNIVERSITY  
Bengaluru, India

# School of CSA

## Bachelor of Computer Applications (BCA)

### HANDBOOK 2021-2022

Rukmini Knowledge Park  
Kattigenahalli, Yelahanka, Bengaluru – 560064  
[www.reva.edu.in](http://www.reva.edu.in)



**SCHOOL OF COMPUTER SCIENCE AND  
APPLICATIONS**

**HANDBOOK**

**for**

**Bachelor of Computer Applications (BCA)**

**2021-24**

Rukmini Knowledge Park,  
Kattigenahalli, Yelahanka, Bangalore - 560 064  
Phone No: +91-080-46966966, Mob: 90211 90211



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## Chancellor's Message

*"Education is the most powerful weapon which you can use to change the world."*

- Nelson Mandela.

There was a time when survival depended on just the realization of physiological needs. We are indeed privileged to exist in a time when 'intellectual gratification' has become indispensable. Information is easily attainable for the soul that is curious enough to go look for it. Technological boons enable information availability anywhere anytime. The difference, however, lies between those who look for information and those who look for knowledge.

It is deemed virtuous to serve seekers of knowledge and as educators it is in the ethos at REVA University to empower every learner who chooses to enter our portals. Driven by our founding philosophy of 'Knowledge is power', we believe in building a community of perpetual learners by enabling them to look beyond their abilities and achieve what they assumed impossible.

India has always been beheld as a brewing pot of unbelievable talent, acute intellect and immense potential. All it takes to turn those qualities into power is a spark of opportunity. Being at a University is an exciting and rewarding experience with opportunities to nurture abilities, challenge cognizance and gain competence.

For any University, the structure of excellence lies in the transitional abilities of its faculty and its facility. I'm always in awe of the efforts that our academic board puts in to develop the team of subject matter experts at REVA. My faculty colleagues understand our core vision of empowering our future generation to be ethically, morally and intellectually elite. They practice the art of teaching with a student-centered and transformational approach. The excellent infrastructure at the University, both educational and extra-curricular, magnificently demonstrates the importance of ambience in facilitating focused learning for our students.

A famous British politician and author from the 19th century - Benjamin Disraeli, once said 'A University should be a place of light, of liberty and of learning'. Centuries later this dictum still inspires me and I believe, it takes team-work to build successful institutions. I welcome you to REVA University to join hands in laying the foundation of your future with values, wisdom and knowledge.



**Dr. P. Shyama Raju**

The Founder and Hon'ble Chancellor, REVA University

## Vice-Chancellor's Message

The last two decades have seen a remarkable growth in higher education in India and across the globe. The move towards inter-disciplinary studies and interactive learning have opened up several options as well as created multiple challenges. India is at a juncture where a huge population of young crowd is opting for higher education. With the tremendous growth of privatization of education in India, the major focus is on creating a platform for quality in knowledge enhancement and bridging the gap between academia and industry.



A strong believer and practitioner of the dictum “Knowledge is Power”, REVA University has been on the path of delivering quality education by developing the young human resources on the foundation of ethical and moral values, while boosting their leadership qualities, research culture and innovative skills. Built on a sprawling 45 acres of green campus, this ‘temple of learning’ has excellent and state-of-the-art infrastructure facilities conducive to higher teaching-learning environment and research. The main objective of the University is to provide higher education of global standards and hence, all the programs are designed to meet international standards. Highly experienced and qualified faculty members, continuously engaged in the maintenance and enhancement of student-centric learning environment through innovative pedagogy, form the backbone of the University.

All the programs offered by REVA University follow the Choice Based Credit System (CBCS) with Outcome Based Approach. The flexibility in the curriculum has been designed with industry-specific goals in mind and the educator enjoys complete freedom to appropriate the syllabus by incorporating the latest knowledge and stimulating the creative minds of the students. Bench marked with the course of studies of various institutions of repute, our curriculum is extremely contemporary and is a culmination of efforts of great think-tanks - a large number of faculty members, experts from industries and research level organizations. The evaluation mechanism employs continuous assessment with grade point averages. We believe sincerely that it will meet the aspirations of all stakeholders – students, parents and the employers of the graduates and postgraduates of Reva University.

At REVA University, research, consultancy and innovation are regarded as our pillars of success. Most of the faculty members of the University are involved in research by attracting funded projects from various research level organizations like DST, VGST, DBT, DRDO, AICTE and industries. The outcome of

the research is passed on to students through live projects from industries. **The entrepreneurial zeal of the students is encouraged and nurtured through EDPs and EACs.**

REVA University has entered into collaboration with many prominent industries to bridge the gap between industry and University. Regular visits to industries and mandatory internship with industries have helped our students become skilled with relevant to industry requirements. Structured training programs on soft-skills and preparatory training for competitive exams are offered here to make students more employable. 100% placement of eligible students speaks the effectiveness of these programs. The entrepreneurship development activities and establishment of “Technology Incubation Centers” in the University extend full support to the budding entrepreneurs to nurture their ideas and establish an enterprise.

With firm faith in the saying, “Intelligence plus character –that is the goal of education” (Martin Luther King, Jr.), I strongly believe REVA University is marching ahead in the right direction, providing a holistic education to the future generation and playing a positive role in nation building. We reiterate our endeavor to provide premium quality education accessible to all and an environment for the growth of over-all personality development leading to generating “GLOBAL PROFESSIONALS”.

Welcome to the portals of REVA University!

**Dr. M. Dhanamjaya**  
Vice Chancellor, REVA University

## **Director –Message**

### **Welcome note to students**

It's my pleasure to welcome you to the School of Computer Science and Applications. Computer, being considered as most significant and revolutionary invention of mankind has metamorphosed the planet earth completely. Predominantly School of Computer Science and Applications have acquired the control of the modern life in a myriad way.



The BCA program is designed keeping in view the current situation and possible future developments, both at national and global levels. This program is designed to give greater emphasis on computer applications. There are ample number of courses providing knowledge in specialized areas of network security, python programming and cloud computing etc. facilitating students to choose specialized areas of their interest. Adequate attention is given to provide students the basic concepts in computer applications.

The program is designed to expose students to various subjects having applications in computers, IT and electronics related industries through outcome based teaching and learning process which emphasizes practical exposure rather than memorization. A variety of activities such as mini projects, seminars, interaction with industries, cultural activities and social activities are in place to shape the all-round development of students.

The benefits of choosing BCA program are:

- Flexibility to choose various fields upon graduation.
- Opportunity to work on live problems.
- Opportunity to work on environmental related technologies.
- Opportunity for programmers to develop software for varied applications in different sectors.

Students after successful completion of BCA program:

- Can start-up their career in either government sector or private sector since there are ample employment opportunities in these sectors.
- Can also start their career as software programmers / engineers, testing engineers, data base administers, system and network administrators, multimedia / web programmers, web designers etc.,

- Can seek placements in diversified fields like banking, e-commerce, insurance, entertainment, and such others.
- The computer application trained graduates are sought after by varied firms for their software based skills.
- Can opt for higher studies in computer applications, IT, business management and so on.

The curriculum caters to and has relevance to local, regional, national and global development needs. All courses are focussed on building skill, employability and entrepreneurship of students. Maximum number of courses are integrated with cross cutting issues with relevant to professional ethics, gender, human values, environment and sustainability.

I am sure the students choosing BCA in REVA University will enjoy the curriculum, teaching and learning environment, the vast infrastructure and the experienced teachers involvement and guidance. We will strive to provide all needed comfort and congenial environment for their studies. I wish all students pleasant stay in REVA and grand success in their career.

**Dr. S. Senthil**

**Director – School of Computer Science and Applications**

## **RUKMINI EDUCATIONAL CHARITABLE TRUST**

It was the dream of late Smt. Rukmini Shyama Raju to impart education to millions of underprivileged children as she knew the importance of education in the contemporary society. The dream of Smt. Rukmini Shyama Raju came true with the establishment of Rukmini Educational Charitable Trust (RECT), in the year 2002. **Rukmini Educational Charitable Trust** (RECT) is a Public Charitable Trust, set up in 2002 with the objective of promoting, establishing and conducting academic activities in the fields of Arts, Architecture, Commerce, Education, Engineering, Environmental Science, Legal Studies, Management and Science & Technology, among others. In furtherance of these objectives, the Trust has set up the REVA Group of Educational Institutions comprising of REVA Institute of Technology & Management (RITM), REVA Institute of Science and Management (RISM), REVA Institute of Management Studies (RIMS), REVA Institute of Education (RIE), REVA First Grade College (RFGC), REVA Independent PU College at Kattigenahalli, Ganganagar and Sanjaynagar and now REVA University. Through these institutions, the Trust seeks to fulfill its vision of providing world class education and create abundant opportunities for the youth of this nation to excel in the areas of Arts, Architecture, Commerce, Education, Engineering, Environmental Science, Legal Studies, Management and Science & Technology.

Every great human enterprise is powered by the vision of one or more extraordinary individuals and is sustained by the people who derive their motivation from the founders. The Chairman of the Trust is Dr. P. Shyama Raju, a developer and builder of repute, a captain of the industry in his own right and the Chairman and Managing Director of the DivyaSree Group of companies. The idea of creating these top notched educational institutions was born of the philanthropic instincts of Dr. P. Shyama Raju to do public good, quite in keeping with his support to other socially relevant charities such as maintaining the Richmond road park, building and donating a police station, gifting assets to organizations providing accident and trauma care, to name a few.

The Rukmini Educational Charitable Trust drives with the main aim to help students who are in pursuit of quality education for life. REVA is today a family of ten institutions providing education from PU to Post Graduation and Research leading to PhD degrees. REVA has well qualified experienced teaching faculty of whom majority are doctorates. The faculty is supported by committed administrative and technical staff. Over 13,000 students study various courses across REVA's three campuses equipped with exemplary state-of-the-art infrastructure and conducive environment for the knowledge driven community.

## ABOUT REVA UNIVERSITY

REVA University has been established under the REVA University Act, 2012 of Government of Karnataka and notified in Karnataka State Gazette No. 80 dated 27<sup>th</sup>February, 2013. The University is empowered by UGC to award degrees any branch of knowledge under Sec.22 of the UGC Act. The University is a Member of Association of Indian Universities, New Delhi. The main objective of the University is to prepare students with knowledge, wisdom and patriotism to face the global challenges and become the top leaders of the country and the globe in different fields.

REVA University located in between Kempegowda International Airport and Bangalore city, has a sprawling green campus spread over 45 acres of land and equipped with state-of-the-art infrastructure that provide conducive environment for higher learning and research. The REVA campus has well equipped laboratories, custom-built teaching facilities, fully air-conditioned library and central computer centre, the well planned sports facility with cricket ground, running track & variety of indoor and outdoor sports activities, facilities for cultural programs. The unique feature of REVA campus is the largest residential facility for students, faculty members and supportive staff.

The University is presently offering 23 Post Graduate Degree programs, 20 Degree and PG Degree programs in various branches of studies and has 12000+ students studying in various branches of knowledge at graduate and post graduate level and 302 Scholars pursuing research leading to PhD in 18 disciplines. It has 800+ well qualified, experienced and committed faculty members of whom majority are doctorates in their respective areas and most of them are guiding students pursuing research leading to PhD.

The programs being offered by the REVA University are well planned and designed after detailed study with **emphasis with knowledge assimilation, applications, global job market and their social relevance.** Highly qualified, experienced faculty and scholars from reputed universities / institutions, experts from industries and business sectors have contributed in preparing the scheme of instruction and detailed curricula for this program. **Greater emphasis on practice in respective areas and skill development to suit to respective job environment has been given while designing the curricula. The Choice Based Credit System and Continuous Assessment Graded Pattern (CBCS – CAGP) of education has been introduced in all programs to facilitate students to opt for subjects of their choice in addition to the core subjects of the study and prepare them with needed skills.** The system also allows students to move forward under the fast track for those who have the capabilities to surpass others. These programs are taught by well experienced qualified faculty supported by the experts from



industries, business sectors and such other organizations. REVA University has also initiated many supportive measures such as bridge courses, special coaching, remedial classes, etc., for slow learners so as to give them the needed input and build in them confidence and courage to move forward and accomplish success in their career. The University has also entered into MOUs with many industries, business firms and other institutions seeking their help in imparting quality education through practice, internship and also assisting students' placements.

REVA University recognizing the fact that research, development and innovation are the important functions of any university has established an independent Research and Innovation division headed by a senior professor as Dean of Research and Innovation. This division facilitates all faculty members and research scholars to undertake innovative research projects in engineering, science & technology and other areas of study. The interdisciplinary-multidisciplinary research is given the top most priority. The division continuously liaisons between various funding agencies, R&D Institutions, Industries and faculty members of REVA University to facilitate undertaking innovative projects. It encourages student research projects by forming different research groups under the guidance of senior faculty members. Some of the core areas of research wherein our young faculty members are working include Data Mining, Cloud Computing, Image Processing, Network Security, VLSI and Embedded Systems, Wireless Sensor Networks, Computer Networks, IOT, MEMS, Nano- Electronics, Wireless Communications, Bio-fuels, Nano-technology for coatings, Composites, Vibration Energies, Electric Vehicles, Multilevel Inverter Application, Battery Management System, LED Lightings, Renewable Energy Sources and Active Filter, Innovative Concrete Reinforcement, Electro Chemical Synthesis, Energy Conversion Devices, Nano-structural Materials, Photo-electrochemical Hydrogen generation, Pesticide Residue Analysis, Nano materials, Photonics, Nano Tribology, Fuel Mechanics, Operation Research, Graph theory, Strategic Leadership and Innovative Entrepreneurship, Functional Development Management, Resource Management and Sustainable Development, Cyber Security, General Studies, Feminism, Computer Assisted Language Teaching, Culture Studies etc.

The REVA University has also given utmost importance to develop the much required skills through variety of training programs, industrial practice, case studies and such other activities that induce the said skills among all students. A full-fledged Career Development and Placement (CDC) department with world class infrastructure, headed by a dynamic experienced Professor & Dean, and supported by well experienced Trainers, Counselors and Placement Officers.

The University also has University-Industry Interaction and Skill Development Centre headed by a Senior Professor & Director facilitating skill related training to REVA students and other unemployed students. The University has been recognised as a Centre of Skill Development and Training by NSDC (National Skill Development Corporation) under Pradhan Mantri Kaushal Vikas Yojana. The Centre conducts several add-on courses in challenging areas of development. It is always active in facilitating student's variety of Skill Development Training programs.

The University has collaborations with Industries, universities abroad, research institutions, corporate training organizations, and Government agencies such as Florida International University, Oklahoma State University, Western Connecticut University, University of Alabama, Huntsville, Oracle India Ltd, Texas Instruments, Nokia University Relations, EMC<sup>2</sup>, VMware, SAP, Apollo etc, to facilitate student exchange and teacher-scholar exchange programs and conduct training programs. These collaborations with foreign universities also facilitates students to study some of the programs partly in REVA University and partly in foreign university, viz, M.S in Computer Science one year in REVA University and the next year in the University of Alabama, Huntsville, USA.

The University has also given greater importance to quality in education, research, administration and all activities of the university. Therefore, it has established an independent Internal Quality division headed by a senior professor as Dean of Internal Quality. The division works on planning, designing and developing different quality tools, implementing them and monitoring the implementation of these quality tools. It concentrates on training entire faculty to adopt the new tools and implement their use. The division further works on introducing various examination and administrative reforms.

To motivate the youth and transform them to become innovative entrepreneurs, successful leaders of tomorrow and committed citizens of the country, REVA organizes interaction between students and successful industrialists, entrepreneurs, scientists and such others from time to time. As a part of this exercise great personalities such as Bharat Ratna Prof. C. N. R. Rao, a renowned Scientist, Dr. N R Narayana Murthy, Founder and Chairman and Mentor of Infosys, Dr. K Kasturirangan, Former Chairman ISRO, Member of Planning Commission, Government of India, Dr. Balaram, Former Director IISc., and noted Scientist, Dr. V S Ramamurthy, Former Secretary, DST, Government of India, Dr. V K Aatre, noted Scientist and former head of the DRDO and Scientific Advisor to the Ministry of Defence Dr. Sathish Reddy, Scientific Advisor, Ministry of Defence, New Delhi and many others have accepted our invitation and blessed our students and faculty members by their inspiring addresses and interaction.

As a part of our effort in motivating and inspiring youth of today, REVA University also has instituted awards and prizes to recognize the services of teachers, researchers, scientists, entrepreneurs, social workers and such others who have contributed richly for the development of the society and progress of the country. One of such award instituted by REVA University is 'Life Time Achievement Award' to be awarded to successful personalities who have made mark in their field of work. This award is presented on occasion of the "Founders' Day Celebration" of REVA University in presence of dignitaries, faculty members and students gathering and the first "REVA Life Time Achievement Award" for the year 2015 has been awarded to Shri. Kiran Kumar, Chairman ISRO on the occasion of Founder's Day Celebration, 6<sup>th</sup> January, 2016 and the second "REVA Life Time Achievement Award" for the year 2016 has been awarded to Shri. Shekhar Gupta, Renowned Journalist on the occasion of Founder's Day Celebration, 6<sup>th</sup> January, 2017.

REVA organises various cultural programs to promote culture, tradition, ethical and moral values to our students. During such cultural events the students are given opportunities to unfold their hidden talents and motivate them to contribute innovative ideas for the progress of the society. One of such cultural events is REVAMP conducted every year. The event not only gives opportunities to students of REVA but also students of other Universities and Colleges. During three days of this mega event students participate in debates, Quizzes, Group discussion, Seminars, exhibitions and variety of cultural events. Another important event is Shubha Vidaaya, - Graduation Day for the final year students of all the programs, wherein, the outgoing students are felicitated and are addressed by eminent personalities to take their future career in a right spirit, to be the good citizens and dedicate themselves to serve the society and make a mark in their respective spheres of activities. During this occasion, the students who have achieved top ranks and won medals and prizes in academic, cultural and sports activities are also recognised by distributing awards and prizes. The founders have also instituted medals and prizes for sports achievers every year. The physical education department conducts regular yoga classes everyday to students, faculty members, administrative staff and their family members and organizes yoga camps for villagers around.

Recognizing the fast growth of the university and its quality in imparting higher education, the BERG (Business Excellence and Research Group), Singapore has awarded BERG Education Award 2015 to REVA University under Private Universities category. The University has also been honoured with many more such honors and recognitions.

## **REVA UNIVERSITY VISION**

“REVA University aspires to become an innovative university by developing excellent human resources with leadership qualities, ethical and moral values, research culture and innovative skills through higher education of global standards”.

### **MISSION**

- To create excellent infrastructure facilities and state-of-the-art laboratories and incubation centers
- To provide student-centric learning environment through innovative pedagogy and education reforms
- To encourage research and entrepreneurship through collaborations and extension activities
- To promote industry-institute partnerships and share knowledge for innovation and development
- To organize society development programs for knowledge enhancement in thrust areas
- To enhance leadership qualities among the youth and enrich personality traits, promote patriotism and moral values.

### **OBJECTIVES**

- Creation, preservation and dissemination of knowledge and attainment of excellence in different disciplines
- Smooth transition from teacher - centric focus to learner - centric processes and activities
- Performing all the functions of interest to its major constituents like faculty, staff, students and the society to reach leadership position
- Developing a sense of ethics in the University and Community, making it conscious of its obligations to the society and the nation
- Accepting the challenges of globalization to offer high quality education and other services in a competitive manner

## **ABOUT SCHOOL OF COMPUTER SCIENCE AND APPLICATIONS**

The School of Computer Science and Applications is shouldered by well qualified, experienced and highly committed faculty. The state-of-the-art infrastructure digital classrooms, well equipped advanced computer laboratory, conference rooms and the serene academic atmosphere at REVA University will enhance the transfer as well as creation of knowledge. The School offers BCA, B. Sc. (Honors) in Computer Science with specialization in Cloud Computing and Big Data, Bachelor of Science in Computer Science with Specialization in Cyber Security, Bachelor of Science in Computer Science with Specialization in Multimedia and Animation, MCA and MSc (Data Science) programs. The School also has research program leading to doctoral degree. The curriculum of both graduate and post graduate degree programs have been designed to bridge the gap between industry – academia and hence they are industry oriented. These programs provide ample scope to enter into a wide range of business opportunities, entrepreneurship ventures and as well as job opportunities in different sectors. This is reflected in various core subjects / courses offered within the program. Further the school provides an interactive, collaborative peer tutoring environment that encourages students to break down complex problems and develop strategies for finding solutions across a variety of situations and disciplines. The school aims to develop a learning community of critical thinkers who serve as models of innovative problems solving in the university environment to enrich their academic and professional careers.

### **VISION**

To transform students into responsible citizens with high morale, leadership qualities and competent professionals of global standards emphasizing on Research and Innovation in the domain of Computer Science and Applications.

### **MISSION**

- To impart quality education to meet the needs of profession and society, and achieve excellence in teaching-learning and research in the area of Computer Applications;
- To attract and develop talented and committed human resource, and provide an environment conducive to innovation, creativity, team-spirit and entrepreneurial leadership in Computing field;
- To facilitate effective interactions among faculty and students of the School of Computer Applications, and foster networking with alumni, industries, institutions and other stake-holders; and
- To practice and promote high standards of professional ethics, transparency and accountability.

## **OBJECTIVES**

- To impart programs at graduate, post-graduate and doctoral levels in the field of computer applications;
- To adopt innovative methods of teaching and promote student centric learning process;
- To create infrastructure of international standard and facilitate and create conducive environment for teaching, learning and research;
- To promote faculty development and encourage faculty members and students to organize and participate in national and international level conferences, seminars, symposia and such others;
- To encourage teachers and students to take-up interdisciplinary studies and research;
- To promote students participation in co-curricular and extension activities and develop their personality traits and team spirit.

## ADVISORY BOARD

SL. No	Name and Affiliation
1	Dr. B.S.Anami Principal, KLE Institute of Technology, Hubli.
2	Dr.M N Birje Professor &Head, Department of Computer Applications, VTU, Belagvi.
3	Dr.Sathish Babu Professor & Head, Department of Computer Science, SIT,Tumkur.
4	Dr.P Nagabhusan Director, IIT Allahabad.
5	Dr.Pethuru Raj Chief Architect & Vice President, Site Reliability Engineering (SRE), Division,Reliance Jio Infocomm Limited.
6	Mr.Raja Krishnamoorthy Director, SAP, Cognizant Technology Pvt.Ltd, Bengaluru.
7	Dr.Madan Kumar Srinivasan Associate Vice President, AI Innovation Centre, Accenture, Bengaluru.

## **Bachelor of Computer Applications (BCA)**

### **Programme Overview**

Computer is not new in the context. Advent of computer dated back thousands of years. It may be the fact that computational instruments named differently. But basic human understanding were absolutely centralized on the scope of utilizing technology for making human led operations more and more swift and soft. Abacus was one of such instrument. Use of abacus in counting and other basic mathematical operations were evident even in ancient India. Advancement in the systematized information flow recorded only after advent of modern computer. It influenced the human life to a greater extent. It also entered all the fields of human society.

With the opening up of vast number of career options that stand in front of the students, computer applications is an attractive career choice for the students. Thousands of computer applications are launched every day and each of them has something better than its previous version. It follows the concept of continuous improvement and also offers the developers a large market place to showcase their innovations. This means better commercials involved for every computer application that is sold and hence it also means that large corporations and software firms look for people with a strong background in the computer applications. The better the skill, better are the employment opportunities and better is the pay. Not only this, business opportunities in the field of computer application are vast and do not need a huge financial investment but high level technical skills. A person can utilise his skill set to create a business according to his own industry and make a career out of it.

Computer applications have set a benchmark in terms of innovation and development making it an industry with constant growth and evolution. Technology is advancing at the speed of light and with the advent of bullet trains, super-fast connectivity and artificial intelligence, it has opened up several sub categories to be explored and worked on. This is one of the major factors which makes computer applications such a diverse and futuristic industry. The level of innovation that we see every day is constantly evolving the field and has opened a lot other doors for scope of advancement and innovation. One thought leads to a million ideas and computer application is giving life to these ideas

The BCA program of REVA University has been designed to create motivated, enthusiastic, and creative thinking graduates to fill the roles as computer algorithm developers, computer programmers, computer application developers, teachers, scientists, professionals and administrators.



Indian economy is experiencing an upward growth right from the beginning of 21st century except for a short stint during the mid of present decade necessitating well qualified science graduates to work as teachers, scientists, professionals and often administrators. At present more than 400 million youth are below 18 years of age and government is committed to increase the GER to 30% by 2020. The proposed BCA programme designed will act as a foundation and first degree to prepare computer programmers, software developers for various applications, teachers, scientists, professionals and administrators to meet the challenges of growing economy as well as to fulfill the growing aspirations of the youth.

The BCA programme at REVA University has been developed after a careful study of regional national and international market involving experts from premier institutions, universities industries and established business firms. The curriculum is outcome based and it imbibes required theoretical concepts and practical skills in the domain. By undergoing this programme, students develop critical, analytical thinking and problem solving abilities for a smooth transition from academic to real-life work environment. In addition, students are trained in communication skills and interdisciplinary topics to enhance their scope. The above mentioned features of the programme, advanced teaching and learning resources, and experience of the faculty members with their strong connections with industry and research organizations makes this programme unique.

**Programme Educational Objectives (PEOs)**

The BCA programme is a foundation degree and helps to develop critical, analytical and problem solving skills at first level in computer applications. This foundation degree makes the graduates employable in IT industries, scientific organisations and also to assume administrative positions in various types of organisations. Further acquisition of higher level degrees help the graduates to pursue a career in academics or scientific organisations as a researchers and teacher in higher education institutions.

The Programme Educational Objectives are to prepare the students to:

PEO-1	Be skilled Computer Application Developers, Algorithm developers, Computer Programmers and to operate various commercial software tools to solve scientific and business problems
PEO-2	Adopt lifelong learning philosophy for continuous improvement and acquire higher degrees to act as scientists in research establishments or business administrators or act as administrators in public, private and government organisations.
PEO-3	work as a member of a team and communicate effectively across team members, to be equipped to be competent in the field of computer science

PEO-4	understand environmental, legal, cultural, social, ethical, public safety issues work along with engineering, medical, ICT professionals and scientists to assist them in their research and development work
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### **Program Outcomes (POs)**

PO 1: Disciplinary knowledge: Capable of demonstrating comprehensive knowledge and understanding of computer science with specialization in computer Applications that form a part of under graduate programme BCA-Bachelor of Computer Applications.

PO 2: Scientific reasoning: Ability to analyze, and understand concepts in computer science, critically evaluate ideas, logical reasoning and experiences in programming, algorithm development and application development.

PO 3: Problem solving: Capacity to extrapolate and apply competencies to solve different kinds of non-familiar problems, such as design Algorithms, develop computer programs for specific applications and operate commercially available software tools for solving scientific and business related problems

PO 4: Environment and Sustainability: Understand the issues of environmental contexts and sustainable development and provide solutions for the same using domain knowledge in Computer Applications.

PO 5: Research-related skills: Ability to recognize cause-and-effect relationships, define problems, analyze, interpret and draw conclusions from data.

PO 6: Ethics: Conduct as a responsible citizen by recognizing different value systems and understand the moral dimensions of decisions, and accept responsibility for them.

PO 7: Cooperation/Team work: Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team.

PO 8: Communication Skills: Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups

PO 9: Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

### Programme Specific Outcomes (PSO)

After successful completion of the programme, the graduates will be able to

1. Assimilate technological expertise with practical skills in various fields of computer applications.
2. Use existing algorithms to develop software applications and operate on various software tools for solving scientific and business problems.
3. Provide computer based solutions for real time problems through software applications.

### Mapping of COs with POs

Course Code	POS/ COs	PO1	P2	PO3	PO4	PO5	PO6	P7	PO8	PO9	PSO1	PSO2	PSO3
<b>B21AHK102</b>	<b>CO1</b>	L	L	L	L	M	M	H	H	H	L	L	L
	<b>CO2</b>	L	L	L	L	L	M	H	M	H	L	L	L
	<b>CO3</b>	L	L	L	L	M	H	H	H	M	L	L	L
	<b>CO4</b>	L	L	L	L	L	H	H	H	H	L	L	L
<b>B21AHH102</b>	<b>CO1</b>	L	L	L	L	M	H	M	M	H	L	L	L
	<b>CO2</b>	L	L	L	L	M	M	H	M	H	L	L	L
	<b>CO3</b>	L	L	L	L	H	H	H	H	M	L	L	L
	<b>CO4</b>	L	L	L	L	H	M	H	H	M	L	L	L
<b>B21AHA101</b>	<b>CO1</b>	L	L	L	L	L	L	L	L	M	L	L	L
	<b>CO2</b>	L	L	L	L	L	L	L	H	M	L	L	L
	<b>CO3</b>	L	L	L	L	L	L	L	M	H	L	L	L
	<b>CO4</b>	L	L	L	L	L	L	L	H	H	L	L	L
<b>B21AHE101</b>	<b>CO1</b>	L	L	L	H	L	L	M	H	L	L	L	L
	<b>CO2</b>	L	L	L	L	L	L	M	H	L	L	L	L
	<b>CO3</b>	L	L	L	L	L	L	M	H	L	L	L	L
	<b>CO4</b>	L	L	L	L	L	L	M	H	L	L	L	L
<b>B21DA0101</b>	<b>CO1</b>	H	H	H	L	H	L	H	H	H	M	L	M
	<b>CO2</b>	H	H	H	L	H	L	H	H	H	H	M	H
	<b>CO3</b>	H	H	H	L	H	L	H	H	H	M	M	M
	<b>CO4</b>	H	L	L	L	H	L	H	H	H	H	H	H
<b>B21DA0102</b>	<b>CO1</b>	H	H	H	H	M	L	M	H	M	M	M	M
	<b>CO2</b>	H	M	H	H	M	L	M	L	L	M	M	M
	<b>CO3</b>	H	H	H	M	M	M	H	M	H	M	M	M
	<b>CO4</b>	M	M	H	H	H	L	M	H	H	M	M	M
<b>B21DA0103</b>	<b>CO1</b>	H	H	H	H	M	H	M	H	M	H	H	H
	<b>CO2</b>	M	M	M	M	M	M	M	H	M	M	M	M
	<b>CO3</b>	M	H	H	H	H	M	M	H	M	M	M	M
	<b>CO4</b>	H	H	H	M	M	M	M	H	M	M	M	M
	<b>CO5</b>	M	H	M	M	M	M	M	H	M	M	M	M
	<b>CO6</b>	M	H	H	M	M	M	M	H	M	M	M	M
	<b>CO1</b>	L	L	L	L	M	M	H	H	H	H	M	M

<b>B21DA0104</b>	<b>CO2</b>	L	L	L	L	L	M	H	M	H	H	L	L
	<b>CO3</b>	L	L	L	L	M	H	H	H	M	H	M	L
	<b>CO4</b>	L	L	L	L	L	H	H	H	H	M	M	L
<b>B21DA0105</b>	<b>CO1</b>	L	L	L	L	M	H	M	M	H	H	L	H
	<b>CO2</b>	L	L	L	L	M	M	H	M	H	H	L	H
	<b>CO3</b>	L	L	L	L	H	H	H	H	M	H	L	H
<b>B21AHK202</b>	<b>CO1</b>	L	L	L	H	L	L	L	L	L	H	L	L
	<b>CO2</b>	L	L	L	L	L	L	L	L	H	M	M	M
	<b>CO3</b>	L	L	L	L	L	L	L	L	H	H	M	M
	<b>CO4</b>	L	L	L	L	L	L	L	L	H	H	L	L
<b>B21AHH202</b>	<b>CO1</b>	L	L	L	L	L	L	M	H	M	H	M	L
	<b>CO2</b>	L	L	L	L	L	L	M	H	M	H	L	H
	<b>CO3</b>	L	L	L	L	L	L	M	H	M	H	L	H
	<b>CO4</b>	L	L	L	L	L	L	M	H	M	H	L	H
<b>B21AHA201</b>	<b>CO1</b>	H	H	H	M	H	M	M	L	M	L	L	L
	<b>CO2</b>	M	H	H	M	H	L	L	L	M	L	L	L
	<b>CO3</b>	M	H	H	M	H	M	L	L	M	L	L	L
	<b>CO4</b>	M	H	H	M	M	M	L	L	M	L	L	L
<b>B21AHE201</b>	<b>CO1</b>	H	H	M	L	H	L	H	H	H	H	M	M
	<b>CO2</b>	H	M	M	L	H	L	H	H	H	L	M	M
	<b>CO3</b>	H	M	M	L	H	L	H	H	H	H	H	M
	<b>CO4</b>	H	L	L	L	H	L	H	H	H	H	M	H
<b>B21DA0201</b>	<b>CO1</b>	H	H	L	M	H	L	L	M	H	H	L	L
	<b>CO2</b>	H	L	H	M	L	H	M	L	H	M	M	M
	<b>CO3</b>	M	H	H	L	M	L	H	M	H	H	M	M
	<b>CO4</b>	H	H	H	L	M	L	M	M	H	H	M	M
<b>B21DA0202</b>	<b>CO1</b>	L	L	L	L	L	M	H	H	H	L	L	L
	<b>CO2</b>	L	L	L	L	L	M	H	M	H	L	L	L
	<b>CO3</b>	L	L	L	L	M	H	H	H	M	H	M	M
	<b>CO4</b>	L	L	L	L	L	H	H	H	H	L	M	M
<b>B21DA0203</b>	<b>CO1</b>	L	L	L	L	M	H	M	M	H	H	H	M
	<b>CO2</b>	L	L	L	L	M	M	H	M	H	H	M	H
	<b>CO3</b>	L	L	L	L	H	H	H	H	M	H	L	L
	<b>CO4</b>	L	L	L	L	H	M	H	H	M	M	M	M
<b>B21DA0204</b>	<b>CO1</b>	H	L	H	H	L	L	M	L	H	H	M	M
	<b>CO2</b>	H	L	H	H	L	M	H	L	H	H	M	M
	<b>CO3</b>	H	L	H	H	L	L	H	L	H	M	H	M
	<b>CO4</b>	H	L	H	H	L	M	H	L	H	L	L	H
<b>B21DA0205</b>	<b>CO1</b>	H	L	L	H	L	M	M	L	H	M	M	M
	<b>CO2</b>	H	H	L	H	M	L	L	L	H	H	H	H
	<b>CO3</b>	H	M	H	H	M	L	L	L	H	H	H	H
	<b>CO4</b>	H	H	H	M	M	M	L	L	H	H	H	H
<b>B21AHK302</b>	<b>CO1</b>	H	H	H	H	H	L	H	H	M	H	M	H
	<b>CO2</b>	H	H	H	H	M	M	M	M	M	H	M	H
	<b>CO3</b>	H	H	H	M	M	M	H	M	H	H	H	H
	<b>CO4</b>	H	H	H	H	H	L	H	H	H	L	H	M
	<b>CO5</b>	H	H	H	M	H	L	H	H	H	M	M	M
	<b>CO1</b>	M	H	H	L	L	L	H	H	L	H	L	L

<b>B21AHH302</b>	<b>CO2</b>	L	M	M	L	L	L	H	H	L	M	H	H
	<b>CO3</b>	L	M	M	L	L	L	H	L	L	M	H	H
	<b>CO4</b>	L	M	M	L	L	L	H	L	L	M	H	H
<b>B21AHA301</b>	<b>CO1</b>	H	H	H	M	L	L	H	H	L	H	H	H
	<b>CO2</b>	H	H	H	H	L	L	H	H	L	M	M	H
	<b>CO3</b>	H	M	L	L	L	L	H	H	L	L	M	H
	<b>CO4</b>	L	M	L	L	L	L	H	H	L	M	H	H
<b>B21DA0301</b>	<b>CO1</b>	H	M	H	L	L	L	L	L	L	M	M	L
	<b>CO2</b>	M	H	H	L	M	L	H	L	L	M	M	M
	<b>CO3</b>	H	H	H	L	M	L	H	L	L	M	H	L
	<b>CO4</b>	H	H	H	L	M	L	M	L	L	M	L	L
<b>B21DA0302</b>	<b>CO1</b>	M	H	H	L	H	L	L	L	L	L	L	H
	<b>CO2</b>	L	M	H	L	L	L	L	L	L	L	L	H
	<b>CO3</b>	L	M	L	L	L	L	L	L	L	M	M	H
	<b>CO4</b>	L	L	L	L	L	L	L	L	L	M	M	H
<b>B21DA0303</b>	<b>CO1</b>	L	L	L	L	M	M	H	H	H	H	L	M
	<b>CO2</b>	L	L	L	L	L	M	H	M	H	M	H	L
	<b>CO3</b>	L	L	L	L	M	H	H	H	M	M	H	L
	<b>CO4</b>	L	L	L	L	L	H	H	H	H	M	H	L
<b>B21DAS311</b>	<b>CO1</b>	L	L	L	L	M	H	M	M	H	H	H	L
	<b>CO2</b>	L	L	L	L	M	M	H	M	H	M	M	M
	<b>CO3</b>	L	L	L	L	H	H	H	H	M	L	M	H
	<b>CO4</b>	L	L	L	L	H	M	H	H	M	L	M	M
<b>B21DAS312</b>	<b>CO1</b>	L	L	L	L	L	L	L	L	H	H	H	L
	<b>CO2</b>	L	L	L	L	L	L	L	L	H	H	L	L
	<b>CO3</b>	L	L	L	L	L	L	L	L	H	M	L	H
	<b>CO4</b>	L	L	L	L	L	L	L	L	H	L	L	H
<b>B21DAS313</b>	<b>CO1</b>	H	H	M	L	L	L	M	M	L	L	M	H
	<b>CO2</b>	L	M	M	L	L	L	M	M	L	M	M	M
	<b>CO3</b>	L	L	M	L	H	L	M	M	L	M	M	L
	<b>CO4</b>	L	M	H	L	M	L	M	M	L	L	M	M
<b>B21DA0304</b>	<b>CO1</b>	M	M	H	L	M	L	L	L	L	L	L	H
	<b>CO2</b>	H	H	H	L	M	L	L	L	L	L	M	H
	<b>CO3</b>	M	H	L	L	L	L	L	L	L	L	M	H
	<b>CO4</b>	M	L	L	L	L	L	L	L	L	L	M	H
<b>B21DA0305</b>	<b>CO1</b>	H	H	H	M	M	L	M	L	L	L	M	L
	<b>CO2</b>	H	H	H	M	H	L	M	L	M	M	M	M
	<b>CO3</b>	M	H	H	M	M	L	L	L	M	M	M	M
	<b>CO4</b>	M	H	H	M	H	L	L	L	L	L	H	M
<b>B21AHK402</b>	<b>CO1</b>	H	H	M	M	L	L	M	H	M	L	L	M
	<b>CO2</b>	H	H	M	M	L	L	M	H	M	L	M	M
	<b>CO3</b>	H	L	M	M	L	M	M	H	L	L	M	M
	<b>CO4</b>	H	H	H	H	L	H	L	L	L	M	M	H
	<b>CO5</b>	H	H	H	H	M	H	L	L	L	L	M	M
<b>B21AHH402</b>	<b>CO1</b>	H	M	L	M	M	L	L	M	H	M	L	L
	<b>CO2</b>	H	M	H	L	M	M	M	M	H	H	H	H
	<b>CO3</b>	H	M	H	L	M	M	H	M	H	H	H	H
	<b>CO4</b>	H	M	M	M	M	M	M	M	H	H	M	M
<b>B21AHA401</b>	<b>CO1</b>	H	M	M	L	M	L	L	L	L	M	L	L

	<b>CO2</b>	M	H	H	M	H	L	L	L	L	L	L	L
	<b>CO3</b>	M	H	H	L	M	L	L	L	L	L	L	L
	<b>CO4</b>	H	H	H	M	H	L	L	L	L	L	L	L
<b>B21DA0401</b>	<b>CO1</b>	H	H	L	L	L	L	L	L	H	L	L	L
	<b>CO2</b>	L	H	H	L	L	L	L	L	H	L	L	L
	<b>CO3</b>	L	H	H	H	H	L	L	L	H	H	H	H
	<b>CO4</b>	H	H	H	L	H	L	L	L	H	L	L	H
<b>B21DA0402</b>	<b>CO1</b>	M	M	H	L	M	L	L	L	H	H	H	M
	<b>CO2</b>	H	H	L	H	M	L	L	L	H	H	H	H
	<b>CO3</b>	H	M	H	H	M	L	L	L	H	H	H	M
	<b>CO4</b>	H	H	H	M	M	M	L	L	H	M	H	H
<b>B21DA0403</b>	<b>CO1</b>	H	H	H	H	M	L	H	H	M	H	M	M
	<b>CO2</b>	H	H	H	H	H	M	H	L	L	H	H	L
	<b>CO3</b>	H	H	H	M	M	M	H	M	H	M	H	M
	<b>CO4</b>	M	M	H	H	H	L	M	H	H	L	H	M
<b>B21DAS411</b>	<b>CO1</b>	H	H	H	H	H	L	H	H	H	M	L	M
	<b>CO2</b>	L	H	H	L	M	L	H	H	H	L	M	H
	<b>CO3</b>	M	H	H	H	L	M	M	H	L	H	L	H
	<b>CO4</b>	M	H	L	H	M	L	H	M	M	M	L	L
<b>B21DAS412</b>	<b>CO1</b>	M	H	H	M	M	M	M	L	H	M	L	M
	<b>CO2</b>	M	M	H	M	H	M	H	H	M	H	H	L
	<b>CO3</b>	M	H	M	M	H	L	M	H	H	H	H	L
	<b>CO4</b>	M	H	H	L	H	H	M	M	M	M	M	M
<b>B21DAS413</b>	<b>CO1</b>	M	M	H	L	M	L	L	L	H	H	M	M
	<b>CO2</b>	H	H	L	H	M	L	L	L	H	H	H	H
	<b>CO3</b>	H	M	H	H	M	L	L	L	H	H	H	H
	<b>CO4</b>	H	H	H	M	M	M	L	L	H	H	H	H
<b>B21DAS421</b>	<b>CO1</b>	M	M	H	L	M	L	L	L	H	H	M	M
	<b>CO2</b>	M	H	H	M	H	M	H	H	H	H	H	H
	<b>CO3</b>	H	H	H	M	M	M	L	L	H	H	H	H
	<b>CO4</b>	M	M	H	H	M	L	L	L	H	H	H	H
<b>B21DAS422</b>	<b>CO1</b>	M	M	H	M	M	L	M	L	L	M	M	M
	<b>CO2</b>	M	H	H	H	H	L	M	L	M	H	M	M
	<b>CO3</b>	L	H	H	L	M	L	M	L	H	H	M	M
	<b>CO4</b>	L	M	H	L	M	L	M	L	H	H	M	M
<b>B21DAS423</b>	<b>CO1</b>	M	M	M	L	M	L	M	M	M	L	L	L
	<b>CO2</b>	H	H	H	L	H	L	L	L	H	M	M	M
	<b>CO3</b>	M	H	H	L	H	L	L	L	H	M	M	M
	<b>CO4</b>	H	H	H	L	H	L	L	L	H	M	M	M
<b>B21DA0404</b>	<b>CO1</b>	M	H	H	L	H	L	L	L	M	M	H	L
	<b>CO2</b>	M	H	H	L	M	L	L	L	H	L	M	L
	<b>CO3</b>	M	H	M	L	H	L	L	L	M	L	H	H
	<b>CO4</b>	M	M	H	L	M	L	L	L	M	L	L	M
<b>B21DA0405</b>	<b>CO1</b>	M	M	H	L	M	L	H	L	M	L	M	L
	<b>CO2</b>	M	M	L	L	L	L	H	H	M	L	M	L
	<b>CO3</b>	M	M	H	H	M	L	H	H	M	L	M	H
	<b>CO4</b>	L	L	H	H	L	L	H	L	L	L	M	H
<b>B21DA0501</b>	<b>CO1</b>	M	M	H	L	M	L	L	L	L	M	L	H
	<b>CO2</b>	H	H	H	L	M	L	L	L	L	M	L	H

	CO3	M	H	L	L	L	L	L	L	L	M	L	H
	CO4	M	L	L	L	L	L	L	L	L	M	L	H
B21DA0502	CO1	M	H	M	L	L	L	H	L	H	H	L	L
	CO2	L	M	H	L	L	L	H	L	H	H	L	L
	CO3	L	L	L	L	H	L	H	L	H	M	M	H
	CO4	L	L	M	L	M	L	H	L	H	H	M	H
B21DA0503	CO1	L	M	H	L	L	L	L	M	M	H	M	H
	CO2	H	H	H	M	L	L	L	L	L	L	M	H
	CO3	L	M	M	M	M	L	L	M	L	L	H	H
	CO4	M	H	H	L	M	L	M	M	H	L	H	H
B21DAS511	CO1	M	H	H	M	M	M	M	L	H	M	L	M
	CO2	M	M	H	M	H	M	H	H	M	H	H	L
	CO3	M	H	M	M	H	L	M	H	H	H	H	L
	CO4	M	H	H	L	H	H	M	M	M	M	M	M
B21DAS512	CO1	M	M	H	L	L	L	L	L	L	H	M	H
	CO2	H	L	L	M	H	L	M	M	M	L	L	M
	CO3	L	M	H	H	H	H	L	M	M	L	L	L
	CO4	M	H	H	L	H	M	M	M	M	L	H	M
B21DAS513	CO1	M	M	M	M	M	L	M	M	L	M	H	M
	CO2	M	H	H	M	M	M	H	M	M	M	H	H
	CO3	H	H	H	M	M	M	M	M	H	M	H	M
	CO4	M	M	H	M	M	L	H	M	M	H	M	M
B21DAS521	CO1	H	H	H	M	M	M	L	L	H	M	M	M
	CO2	M	H	H	M	M	M	M	L	H	M	L	L
	CO3	H	H	H	M	H	M	L	M	L	H	M	H
	CO4	H	H	H	M	M	M	L	L	H	M	M	M
B21DAS522	CO1	M	H	L	M	L	L	L	L	H	L	L	L
	CO2	H	H	H	L	L	L	L	M	H	L	L	L
	CO3	L	H	H	H	H	L	L	L	H	H	M	H
	CO4	M	H	H	L	H	L	M	L	H	L	L	M
B21DAS523	CO1	M	M	H	L	M	L	L	L	H	H	H	M
	CO2	H	H	L	H	M	L	L	L	H	H	H	H
	CO3	M	M	H	H	M	L	L	L	H	H	H	M
	CO4	M	H	H	M	M	M	L	L	H	M	H	H
B21DA0504	CO1	L	H	H	H	M	L	H	H	M	H	M	M
	CO2	H	M	H	M	H	M	H	L	L	H	H	L
	CO3	H	H	H	M	M	L	H	M	H	M	H	M
	CO4	M	M	H	H	H	L	M	H	H	L	H	M
B21DA0505	CO1	H	H	H	H	H	L	H	H	H	M	L	M
	CO2	L	H	H	L	M	L	H	H	H	L	M	H
	CO3	H	H	H	H	L	M	M	H	L	H	L	H
	CO4	M	H	L	H	M	L	H	M	M	M	L	L
B21DA0601	CO1	H	H	H	M	M	M	M	L	H	M	L	M
	CO2	M	M	H	M	H	M	H	H	M	H	H	L
	CO3	H	H	M	M	H	L	M	H	H	H	H	L
	CO4	M	H	H	L	H	H	M	M	M	M	M	M
B21DAS611	CO1	M	M	H	L	M	L	L	L	H	H	M	M
	CO2	H	H	L	H	M	L	L	L	H	H	H	H
	CO3	H	M	H	H	M	L	L	L	H	H	H	H

	<b>CO4</b>	H	H	H	M	M	M	L	L	H	H	H	H
<b>B21DAS612</b>	<b>CO1</b>	M	M	H	L	M	L	L	L	L	M	L	H
	<b>CO2</b>	H	H	H	L	M	L	L	L	L	M	L	H
	<b>CO3</b>	M	H	L	L	L	L	L	L	L	M	L	H
	<b>CO4</b>	M	L	L	L	L	L	L	L	L	M	L	H
<b>B21DAS621</b>	<b>CO1</b>	M	H	M	L	L	L	H	L	H	H	L	L
	<b>CO2</b>	L	M	H	L	L	L	H	L	H	H	L	L
	<b>CO3</b>	L	L	L	L	H	L	H	L	H	M	M	H
	<b>CO4</b>	L	L	M	L	M	L	H	L	H	H	M	H
<b>B21DAS622</b>	<b>CO1</b>	L	M	H	L	L	L	L	M	M	H	M	M
	<b>CO2</b>	H	H	H	M	L	L	L	L	L	L	M	M
	<b>CO3</b>	L	M	M	M	M	L	L	M	L	L	H	H
	<b>CO4</b>	M	H	H	L	M	L	M	M	H	L	H	H

**Mapping of PEOS with Respect POs**

	<b>P O1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>P O 10</b>	<b>P O 11</b>	<b>P O 12</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>
<b>PEO1</b>	M	M	M	M	M	L	M	M	L	M	H	M	L	H	M
<b>PEO2</b>	M	H	H	M	M	M	H	M	M	M	H	H	M	M	L
<b>PEO3</b>	H	H	H	M	M	M	M	M	H	M	H	M	H	H	M
<b>PEO4</b>	M	M	H	M	M	L	H	M	M	H	M	M	M	M	H



**SCHOOL OF COMPUTER SCIENCE AND APPLICATIONS**  
**Bachelor of Computer Applications (BCA) Program**  
**Scheme of Instruction - 2021**

**FIRST SEMESTER**

Sl. No	Code	Title	HC/S C/FC	Credit Pattern			Credits	Working Hrs
				L	T	P		
1.	B21AHK102	Language –I: Kannada	FC	1	1	0	2	3
	B21AHH102	Language –I: Hindi						
	B21AHA101	Language –I: Additional English						
2.	B21AHE101	Communicative English_I	FC	1	1	0	2	3
3.	B21DA0101	Basic Mathematics	HC	4	0	0	4	4
4.	B21DA0102	Digital Logic and Computer Architecture	HC	2	1	0	3	4
5.	B21DA0103	Problem solving using C	HC	2	1	0	3	4
<b>Practical Courses</b>								
6.	B21DA0104	C Programming Lab	HC	0	0	2	2	4
7.	B21DA0105	Digital Logic Lab	HC	0	0	2	2	4
<b>*Mandatory - (Non Creditable Courses)</b>								
8.	B21ASM101	Environmental Studies						
9.	B21DAM102	Skill Development Program						
<b>Total</b>				<b>10</b>	<b>4</b>	<b>4</b>	<b>18</b>	<b>26</b>

## SECOND SEMESTER

Sl. No	Code	Title	HC/S C/FC	Credit Pattern			Credits	Working Hrs
				L	T	P		
1.	B21AHK202	Language –II: Kannada	FC	1	1	0	2	3
	B21AHH202	Language –II: Hindi						
	B21AHA201	Language –II: Additional English						
2.	B21AHE201	Communicative English – II	FC	1	1	0	2	3
3.	B21DA0201	Computer Networks	HC	4	0	0	4	4
4.	B21DA0202	Data Structures using C	HC	2	1	0	3	4
5.	B21DA0203	Object Oriented Programming using C++	HC	2	1	0	3	4
<b>Practical Courses</b>								
6.	B21DA0204	Data Structures Lab	HC	0	0	2	2	4
7.	B21DA0205	C++ Programming Lab	HC	0	0	2	2	4
<b>*Mandatory - (Non Creditable Courses)</b>								
8.	B21LSM201	Indian Constitution & Professional Ethics						
9.	B21DAM202	Skill Development Program						
<b>Total</b>				<b>10</b>	<b>4</b>	<b>4</b>	<b>18</b>	<b>26</b>

### THIRD SEMESTER

Sl. No	Code	Title	HC /SC /FC	Credit Pattern			Credits	Working Hrs
				L	T	P		
1.	B21AHK302	Language –III : Kannada	FC	1	1	0	2	3
	B21AHH302	Language – III: Hindi						
	B21AHA301	Language –III: Additional English						
2.	B21DA0301	Software Engineering	HC	4	0	0	4	4
3.	B21DA0302	Java Programming	HC	2	1	0	3	4
4.	B21DA0303	Relational DBMS	HC	2	1	0	3	4
5.	B21DAS311	E-Commerce	SC	2	0	1	3	4
	B21DAS312	Design & Analysis of Algorithms						
	B21DAS313	Enterprise Resource Planning						
<b>Practical Courses</b>								
6.	B21DA0304	Java programming Lab	HC	0	0	2	2	4
7.	B21DA0305	RDBMS Lab	HC	0	0	2	2	4
<b>*Mandatory - (Non Creditable Courses)</b>								
8.	B21PTM301/ B21DAM301	Soft Skills		0	0	0	0	2
9.	B21DAM302	Skill Development Program						
<b>Total</b>				11	3	5	19	29

#### FOURTH SEMESTER

Sl. No	Code	Title	HC/SC/F C	Credit Pattern			Credits	Working Hrs
				L	T	P		
1.	B21AHK402	Language –IV : Kannada	FC	1	1	0	2	3
	B21AHH402	Language – IV: Hindi						
	B21AHA401	Language –IV: Additional English						
2	B21DA0401	Data Mining & Data Warehousing	HC	4	0	0	4	4
3	B21DA0402	Operating Systems with Linux	HC	2	1	0	3	4
4	B21DA0403	Python Programming	HC	4	0	0	4	4
5	B21DAS411	Mobile Computing	SC	2	1	0	3	4
	B21DAS412	Computer Graphics						
	B21DAS413	Artificial Intelligence						
6	B21DAS421	Cyber Security	SC	2	1	0	3	4
	B21DAS422	Advanced Computer Networks						
	B21DAS423	Advanced Java Programming						
<b>Practical Courses</b>								
7	B21DA0404	Linux Lab	HC	0	0	2	2	4
8	B21DA0405	Python Programming Lab	HC	0	0	2	2	4
<b>*Mandatory - (Non Creditable Courses)</b>								
9	B21PTM401/ B21DAM401	Soft Skills		0	0	0	0	2
10	B21DAM402	Skill Development Program						
<b>Total</b>				<b>15</b>	<b>4</b>	<b>4</b>	<b>23</b>	<b>33</b>

## FIFTH SEMESTER

Sl. No	Code	Title	HC/SC/FC	Credit Pattern			Credits	Working Hrs
				L	T	P		
1.	B21DA0501	.NET Programming using C#	HC	2	1	0	3	4
2.	B21DA0502	Web Technology	HC	2	1	0	3	4
3	B21DA0503	Cloud Computing	HC	2	1	0	3	4
4.	B21DAS511	Mobile App Development	SC	2	0	1	3	4
	B21DAS512	Computer Animation						
	B21DAS513	Machine Learning						
5.	B21DAS521	Software Testing & Quality Assurance	SC	2	1	0	3	4
	B21DAS522	Network Administration						
	B21DAS523	Ethical Hacking						
6.	***	<b>Open Elective</b>	<b>OE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>4</b>
<b>Practical Courses</b>								
7.	B21DA0504	.NET Programming Lab	HC	0	0	2	2	4
8.	B21DA0505	Web Technology Lab	HC	0	0	2	2	4
<b>*Mandatory - (Non Creditable Courses)</b>								
9.	B21PTM501/ B21DAM501	Soft Skills		0	0	0	0	2
10	B21DAM502	Skill Development Program						
<b>Total</b>				<b>12</b>	<b>4</b>	<b>6</b>	<b>22</b>	<b>34</b>

**\*\*\* Open Elective offered to other Schools**

B21DAO501	<b>Open Elective - Fundamentals of Computer Programming &amp; Office Automation</b>	<b>OE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>3</b>

**SIXTH SEMESTER**

Sl. No	Code	Title	HC/SC/FC	Credit Pattern			Credits	Working Hrs
				L	T	P		
1	B21DA0601	Data Analytics using R	HC	3	0	1	4	4
2	B21DAS611	OOAD Using UML	SC	2	0	1	3	4
	B21DAS612	Advanced Web Technologies						
3	B21DAS621	Internet Of Things	SC	2	1	0	3	4
	B21DAS622	Digital Marketing						
4	B21DA0602	Project Work	HC	0	0	10	10	20
<b>*Mandatory - (Non Creditable Courses)</b>								
5	B21PTM601/ B21DAM601	Soft Skills		0	0	0	0	2
6	B21DAM602	Skill Development Program						
<b>Total</b>				<b>7</b>	<b>1</b>	<b>12</b>	<b>20</b>	<b>32</b>

### CREDIT SUMMARY

Semester	Credits
First	18
Second	18
Third	19
Fourth	23
Fifth	22
Sixth	20
<b>Total</b>	<b>120</b>

### CREDIT DISTRIBUTION

Sem	Hard Core (HC)	Softcore Course (SC)	FC	Open Elective(OE)	Project	Total Credits
I	14	-	4	-	-	18
II	14	-	4	-	-	18
III	14	3	2	-	-	19
IV	15	6	2	-	-	23
V	13	6	-	03	-	22
VI	4	6	-	-	10	20
	<b>74</b>	<b>21</b>	<b>12</b>	<b>3</b>	<b>10</b>	<b>120</b>

## Detailed Syllabus

### FIRST SEMESTER

Course Code	Course Title	Course Type	L	T	P	C	Hrs./Wk.
B21AHK102	Language – I: Kannada	FC	1	1	0	2	3

#### Course Description:

ಭಾಷೆಯನ್ನು ಮಾತನಾಡುವ ಬರೆಯುವ ಕೌಶಲ್ಯ, ಸಾಹಿತ್ಯದ ಬಗ್ಗೆ ಸ್ಥೂಲವಾಗಿ ಪರಿಚಯಿಸುವ ಮೂಲಕ ವಿದ್ಯಾರ್ಥಿಗಳ ವ್ಯಕ್ತಿತ್ವ ವಿಕಾಸ ಹಾಗೂ ಸ್ಪರ್ಧಾತ್ಮಕ ಪರೀಕ್ಷೆಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು, ಪ್ರಸ್ತುತ ಸಂದರ್ಭಕ್ಕೆ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಸಜ್ಜುಗೊಳಿಸಲು ಪಠ್ಯವನ್ನು ರೂಪಿಸಲಾಗಿದೆ. ಸಾಹಿತ್ಯ, ಕಲೆ, ವಾಣಿಜ್ಯ, ಆಡಳಿತಾತ್ಮಕ ಮತ್ತು ವಿಜ್ಞಾನದ ವಿಚಾರಗಳಿಗೆ ಒತ್ತನ್ನು ನೀಡಲಾಗಿದೆ. ಇದು ಮೊದಲ ಎರಡು ಸೆಮಿಸ್ಟರ್ ಮೂರು ಕ್ರೆಡಿಟ್‌ಗಳನ್ನು; ಮೂರು ಮತ್ತು ನಾಲ್ಕನೇ ಸೆಮಿಸ್ಟರ್ ಎರಡು ಕ್ರೆಡಿಟ್‌ಗಳನ್ನು ಹೊಂದಿದೆ.

#### Prerequisites:

- ಕನ್ನಡ ಭಾಷೆಯ ಬಗೆಗೆ ಪ್ರಾಥಮಿಕ ತಿಳುವಳಿಕೆ ಅಗತ್ಯ..
- ಭಾಷೆಯನ್ನು ಓದಲು ಮತ್ತು ಬರೆಯಲು ತಿಳಿದಿರಬೇಕು.
- ಪದವಿ ಪೂರ್ವ ಶಿಕ್ಷಣದಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯನ್ನು ಓದಿರಬೇಕು.

#### Pedagogy:

- Direct method
- ICT and Digital support
- Collaborative and Cooperative learning
- Differentiated Instruction
- Flipped Classroom

#### Course Objectives:

ನಾಲ್ಕು ಸೆಮಿಸ್ಟರ್‌ಗಳಲ್ಲಿ ಸಮಗ್ರ ಕನ್ನಡ ಸಾಹಿತ್ಯವನ್ನು ಪರಿಚಯಿಸುವ ಉದ್ದೇಶವನ್ನು ಹೊಂದಿದೆ. ಅದರಂತೆ ಮೊದಲನೆಯ ಸೆಮಿಸ್ಟರ್‌ನಲ್ಲಿ ಜನಪದ, ಪ್ರಾಚೀನ, ಮಧ್ಯಕಾಲೀನ ಕಾವ್ಯಗಳು, ಹೊಸಗನ್ನಡದ ಸಣ್ಣಕಥೆಗಳು ಹಾಗೂ ನಾಟಕ ಸಾಹಿತ್ಯವನ್ನು ಪಠ್ಯವನ್ನಾಗಿ ಆಯ್ಕೆ ಮಾಡಿಕೊಂಡು, ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯದ ಬಗ್ಗೆ ಸದಭಿರುಚಿಯನ್ನು ಮೂಡಿಸಲಾಗುತ್ತದೆ. ಸಾಂಸ್ಕೃತಿಕ ತಿಳುವಳಿಕೆಯ ಜೊತೆಗೆ ವ್ಯಕ್ತಿತ್ವ ವಿಕಾಸದ ಕಡೆಗೆ ಗಮನ ನೀಡಲಾಗುತ್ತದೆ.

- ಭಾಷೆ, ಸಾಹಿತ್ಯ, ಇತಿಹಾಸ ಮತ್ತು ಸಂಸ್ಕೃತಿಗಳನ್ನು ಕನ್ನಡ, ಕರ್ನಾಟಕಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ಪರಿಚಯಿಸಲಾಗುತ್ತದೆ.



- ವಿದ್ಯಾರ್ಥಿಗಳ ಸರ್ವತೋಮುಖ ಬೆಳವಣಿಗೆಗೆ ಅನುವಾಗುವಂತೆ ಹಾಗೂ ಅವರಲ್ಲಿ ಮಾನವ ಸಂಬಂಧಗಳ ಬಗ್ಗೆ ಗೌರವ, ಸಮಾನತೆ ಮೂಡಿಸಿ, ಬೆಳೆಸುವ ನಿಟ್ಟಿನಲ್ಲಿ ಪಠ್ಯಗಳ ಆಯ್ಕೆಯಾಗಿದೆ.
- ಅವರಲ್ಲಿ ಸೃಜನಶೀಲತೆ, ಶುದ್ಧ ಭಾಷೆ, ಉತ್ತಮ ವಿಮರ್ಶಾ ಗುಣ, ನಿರರ್ಗಳ ಸಂಭಾಷಣೆ, ಭಾಷಣ ಕಲೆ ಹಾಗೂ ಬರಹ ಕೌಶಲ್ಯಗಳನ್ನು ಬೆಳೆಸುವುದು ಗುರಿಯಾಗಿದೆ
- ಸ್ಪರ್ಧಾತ್ಮಕ ಪರೀಕ್ಷೆಗಳಿಗೆ ಅನುಕೂಲವಾಗುವಂತಹ ವಿಷಯಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ಸೂಕ್ತ ಪಠ್ಯಗಳನ್ನು ಆಯ್ಕೆ ಮಾಡಿಕೊಳ್ಳಲಾಗಿದೆ.

### Course Outcomes:

ಜನಪದ, ಪ್ರಾಚೀನ, ಮಧ್ಯಕಾಲೀನದ ವಿವಿಧ ಪ್ರಕಾರದ ಕಾವ್ಯಗಳು, ಹೊಸಗನ್ನಡದ ಸಣ್ಣಕಥೆಗಳು ಹಾಗೂ ನಾಟಕ ಸಾಹಿತ್ಯ ಕಲಿಕೆಯ ಮೂಲಕ ಕಾಲದ ಸ್ಥಿತ್ಯಂತರಗಳನ್ನು ಅದರ ಒಳನೋಟಗಳನ್ನು ಬೆಳೆಸುತ್ತದೆ.

- ಸಾಮಾಜಿಕ, ರಾಜಕೀಯ, ಧಾರ್ಮಿಕ, ಸಾಂಸ್ಕೃತಿಕ, ಪರಿಸರ ಹಾಗೂ ಲಿಂಗಸಂಬಂಧಿ ವಿಚಾರಗಳೆಡೆ ಗಮನ ಹರಿಸುವುದರೊಂದಿಗೆ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಚರ್ಚಾ ಮನೋಭಾವವು ಬೆಳೆಯುತ್ತದೆ.
- ಜೀವನದಲ್ಲಿ ಬರುವ ಅಭಿಪ್ರಾಯ ಬೇಧಗಳು, ಸಮಸ್ಯೆಗಳನ್ನು ಆಧುನಿಕ ಸಂದರ್ಭದಲ್ಲಿ ಮಾನವೀಯತೆಯೊಂದಿಗೆ ನಿರ್ವಹಿಸುವಂತೆ ಪ್ರೇರೇಪಿಸುತ್ತದೆ.
- ಉತ್ತಮ ಸಂವಹನ ಕಲೆಯನ್ನು ಬೆಳೆಸುವ ಉದ್ದೇಶವನ್ನು ಈಡೇರಿಸುತ್ತದೆ.
- ಸಂಶೋಧನಾ ಮನೋಭಾವ ಮತ್ತು ಸ್ಪರ್ಧಾತ್ಮಕ ಪರೀಕ್ಷೆಗಳಿಗೆ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಸಜ್ಜುಗೊಳಿಸುತ್ತದೆ.

### Course Contents:

#### Unit-I

7 Hours

1. ಜನಪದ: ಕೆರೆಗೆ ಹಾರ
2. ಪಂಪ: ಸಾಮಾನ್ಯವೆ ಬಗೆಯೆ ಭವತ್ಕೇಶಪಾಶ ಪ್ರಪಂಚಂ?
3. ಜನ್ನ: ಪೊಲ್ಲಮೆಯೆ ಲೇಸು ನಲ್ಲರ ಮೆಯ್ಯೊಳ್

#### Unit-II

7 Hours

1. ನಾಗಚಂದ್ರ: ನಳಕೂಬರನ ಪ್ರಸಂಗ
2. ಆಯ್ದ ವಚನಗಳು
3. ಹರಿಹರ: ಇಳೆಯಾಂಡ ಗುಡಿಮಾರನ ರಗಳೆ

#### Unit-III

6 Hours

1. ನಿರಂಜನ: ಕೊನೆಯ ಗಿರಾಕಿ
2. ಬೆಸಗರಹಳ್ಳಿ ರಾಮಣ್ಣ: ಪ್ರಜಾಪ್ರಭುತ್ವ ಮತ್ತು ಮೂರು ಮಂಗಗಳು
3. ವಿಜಯ ಹೂಗಾರ: ಬೆಂದಕಾಳೂರು

#### Unit-IV

6 Hours

1. ಜಲಗಾರ : ಕುವೆಂಪು

**ಪರಾಮರ್ಶನ ಗ್ರಂಥಗಳು :**

1. ಮುಗಳಿ ರಂ.ಶ್ರೀ., ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ, ಪ್ರಕಾಶಕರು ಗೀತಾ ಬುಕ್ ಹೌಸ್, ಮೈಸೂರು. 2014
2. ಸಂಗ್ರಹ. ನಾಗೇಗೌಡ ಎಚ್.ಎಲ್., ಚಾರಿತ್ರಿಕ ಜನಪದ ಕಥನ ಕಾವ್ಯಗಳು, ಪ್ರಕಾಶಕರು ಕರ್ನಾಟಕ ಜಾನಪದ ಪರಿಷತ್ತು, ಬೆಂಗಳೂರು. 2008
3. ಸೀಮಾತೀತ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ ಸಂಪುಟ 1,2,3,4,5 ಮತ್ತು 6, ಕುವೆಂಪು ಕನ್ನಡ ಅಧ್ಯಯನ ಸಂಸ್ಥೆ, ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ಮೈಸೂರು. 2014
4. ಸಂಗ್ರಹ. ನಾಗೇಗೌಡ ಎಚ್.ಎಲ್., ಕನ್ನಡ ಜನಪದ ಕಥನ ಕಾವ್ಯಗಳು, ಪ್ರಕಾಶಕರು ಕರ್ನಾಟಕ ಜಾನಪದ ಪರಿಷತ್ತು, ಬೆಂಗಳೂರು. 2007
5. ನಾರಾಯಣ ಪಿ.ವಿ, ಚಂಪೂ ಕವಿಗಳು, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2010
6. ಕಾಳೇಗೌಡ ನಾಗವಾರ, ತ್ರಿಪದಿ, ರಗಳೆ ಮತ್ತು ಜಾನಪದ ಸಾಹಿತ್ಯ, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2010
7. ಸಂ. ಬೆನಗಲ್ ರಾಮ ರಾವ್ ಮತ್ತು ಪಾನ್ಯಂ ಸುಂದರ ಶಾಸ್ತ್ರಿ, ಪುರಾಣ ನಾಮ ಚೂಡಾಮಣಿ, ಪ್ರಕಾಶಕರು ಪ್ರಸಾರಾಂಗ, ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ. 2010
8. ಡಾ. ಚಿದಾನಂದ ಮೂರ್ತಿ, ವಚನ ಸಾಹಿತ್ಯ, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2013
9. ಸಂ ಮರುಳಸಿದ್ದಪ್ಪ ಕೆ, ನಾಗರಾಜ ಕಿ.ರಂ. ವಚನ ಕಮ್ಮಟ, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2016
10. ಮರುಳಸಿದ್ದಪ್ಪ ಕೆ, ಷಟ್ಪದಿ ಸಾಹಿತ್ಯ, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2010
11. ಸಂ. ಸೇತುರಾಮ ರಾವ್ ಅ.ರಾ., ಶ್ರೀ ಲಕ್ಷ್ಮೀಶನ ಜೈಮಿನಿ ಭಾರತ(ಮೂಲ-ತಾತ್ಪರ್ಯ-ಸಚಿತ್ರ), ಪ್ರಕಾಶಕರು ಕಾಮಧೇನು ಪುಸ್ತಕ ಭವನ, ಬೆಂಗಳೂರು. 2010
12. ಸಂ. ಸೇತುರಾಮ ರಾವ್ ಅ.ರಾ., ಶಿಶುನಾಳ ಶರೀಫರ ನೂರಾರು ತತ್ವಪದಗಳು, ಪ್ರಕಾಶಕರು ಕಾಮಧೇನು ಪುಸ್ತಕ ಭವನ, ಬೆಂಗಳೂರು. 2007
13. ಸಂ. ಜಿ.ಎಸ್.ಭಟ್., ಕುಮಾರವ್ಯಾಸನ ಕರ್ಣಾಟ ಭಾರತ ಕಥಾಮಂಜರಿ ಪ್ರವೇಶ, ಪ್ರಕಾಶಕರು ಅಕ್ಷರ ಪ್ರಕಾಶನ, ಹೆಗ್ಗೋಡು, ಸಾಗರ. 2006
14. ರಂಜಾನ್ ದರ್ಗಾ, ಶರಣರ ಸಮಗ್ರ ಕ್ರಾಂತಿ, ಪ್ರಕಾಶಕರು. ಲೋಹಿಯಾ ಪ್ರಕಾಶನ, ಬಳ್ಳಾರಿ. 2015
15. ಕೀರ್ತನಾಥ ಕುರ್ತಕೋಟಿ, ಕನ್ನಡ ಸಾಹಿತ್ಯ ಸಂಗಾತಿ, ಪ್ರಕಾಶಕರು ಕುರ್ತಕೋಟಿ ಮೆಮೋರಿಯಲ್ ಟ್ರಸ್ಟ್, ಧಾರವಾಡ. 2009
16. ಶಾಮರಾಯ ತ.ಸು., ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ, ಪ್ರಕಾಶಕರು ತಳುಕಿನ ವೆಂಕಣ್ಣಯ್ಯ ಸ್ಮಾರಕ ಗ್ರಂಥಮಾಲೆ, ಮೈಸೂರು - 2014
17. ಶಿವರುದ್ರಪ್ಪ ಜಿ.ಎಸ್. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಸಮೀಕ್ಷೆ, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2013
18. ಸಂ.ಜಿ.ಎಸ್.ಅಮೂರ, ಕನ್ನಡ ಸಣ್ಣ ಕಥೆಗಳು, ನಾಷನಲ್ ಬುಕ್ ಟ್ರಸ್ಟ್, ನವದೆಹಲಿ, 2000
19. ಸಂ. ಡಾ. ಬೈರಮಂಗಲ ರಾಮೇಗೌಡ, ವರ್ತಮಾನದ ಕಥೆಗಳು, ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್ತು, ಬೆಂಗಳೂರು 2011
20. ಸಂ. ಡಾ. ರಾಮಲಿಂಗಪ್ಪ ಟಿ. ಬೇಗೂರು, ವರ್ತಮಾನದ ಕಥೆಗಳು, ಕಣ್ಣು ಪ್ರಕಾಶನ, ಬೆಂಗಳೂರು, 2013

Course code	Course Title	Course Type	L	T	P	C	Hrs./Wk.
B21AHH102	Language I: Hindi	FC	1	1	0	2	3

### Course Description:

यह पाठ्यक्रम नौसिखिया अपनी भाषा ,की क्षमता का विकास करने हेतु तथा विभिन्न साहित्यिक प्रक्रियाओं द्वारा समाज| संस्कृति एवं जीवन के मूल्यों को समझने हेतु अभिकल्पित है ,

### Prerequisites:

- अध्येता, पी.यु.सी के स्तर पर द्वितीय भाषा के रूप में हिन्दी का अध्ययन करना चाहिए |
- हिन्दी साहित्य के इतिहास का संक्षिप्त ज्ञान की आवश्यकता है |
- हिन्दी व्याकरण का अवबोधन आवश्यक है |
- अंग्रेज़ी – हिन्दी अनुवाद से संबंधित जानकारी जरूरी है |

### Course Objectives:

1. संदर्भानुसार उचित भाषा का प्रयोग करने की दक्षता को छात्रों में उत्पन्न करना |
2. साहित्य के माध्यम से समाज एवं मानवीय मूल्यों को समझाकर, उन मूल्यों की रक्षा हेतु प्रेरित करना |
3. छात्रों में पुस्तक पठन एवं लेखन की अकृतिम प्रवृत्ति स्थापित करना |
4. अध्येताओं में साहित्य के माध्यम से प्रभावी एवं कुशल संचार का विकास करना |

### Course Outcomes:

अध्ययन की समाप्ति पर अध्येता –

1. सामाजिक मूल्य एवं नैतिक जवाबदेही को स्वीकार कर सकता है |
2. साहित्य की प्रासंगिकता को जीवन में समझने की दक्षता रखता है |
3. समाज में अंतर्निहित पद्धतियाँ एवं विचारधाराओं का व्याख्यान करने में सक्षम बन सकता है |
4. साहित्य के माध्यम से प्रभावी एवं कुशल संचार का विकास करसकता है |

### Course Contents:

Unit – 1:

[7 Hours]

- 1 कहानी – तावान – प्रेमचंद

- 2 कहानी – उसकी रोटी – मोहन राकेश
- 3 व्यंग्य रचना – वैष्णव की फिसलन – हरीशंकर परसाई

**Unit – 2:**

[7 Hours]

- 4 कहानी – वापसी - उषा प्रियंवदा
- 5 कहानी – तीसरी बेटी के नाम - सुधा अरोड़ा
- 6 निबंध – अच्छी हिन्दी – रवीन्द्रनाथ त्यागी

**Unit –3:**

[6 Hours]

- 7 कहानी – जल्लाद – पांडेय बेचन शर्मा 'उग्र'
- 8 रेखाचित्र – बुधिया कब आएगा – ज्ञानचंद मर्मज्ञ
- 9 एकांकी – अंधेर नगरी – भारतेन्दु हरिश्चंद्र

**Unit -4:**

[6 Hours]

अनुवाद अनुच्छेद ( अंग्रेजी से हिन्दी में)

संक्षेपण

सूचना : प्रत्येक इकाई 25 अंक के लिए निर्धारित है ।

**Text Books:**

- हिन्दी पाठ्य पुस्तक – रेवा विश्वविद्यालय ।

**Reference Book:**

1. सुबोध व्यवहारिक हिन्दी – डॉ. कुलदीप गुप्त
2. अभिनव व्यवहारिक हिन्दी – डॉ.परमानन्द गुप्त
3. हिन्दी साहित्य का इतिहास - डॉ. नागेन्द्र
4. आधुनिक हिन्दी साहित्य का इतिहास - डॉ. बच्चन सिंह
5. हिन्दी साहित्य का नवीन इतिहास - डॉ. लाल साहब सिंह
6. शुद्ध हिन्दी कैसे बोले कैसे लिखे- पृथ्वीनाथ पाण्डे
7. कार्यालय अनुवाद निदेशिका
8. संक्षेपण और पल्लवन - के.सी.भाटिया&तुमन सिंग
9. हिन्दी निबंध लेखन – प्रो. विराज
10. निबंध माला – योगेशचंद जैन

Course code	Course Title	Course Type	L	T	P	C	Hrs./Wk.
B21AHA101	Language I: Additional English	FC	1	1	0	2	3

### Course Description:

This is a 2-credit course designed to help the learner gain competency in language through the introduction of various genres of literature. The course aims to inculcate a critical view among learners while sensitizing them to the contemporary issues around. It facilitates creative learning and helps to appreciate, assimilate and research on the various dimensions of society, culture and life.

### Prerequisites:

The student must possess fundamentals of language skills and be aware of social issues.

**Pedagogy:** Direct method / ICT / Collaborative Learning / Flipped Classroom.

### Course Objectives:

- To develop linguistic prowess of the students.
- To appraise different genres of literature.
- To illustrate the fundamentals of creative language.
- To enhance consistent reading habits.

### Course Outcome:

On completion of the course, learners will be able to:

- Demonstrate a thorough understanding of sensitive and critical social issues.
- Develop reading skills and a wide range of vocabulary.
- Critically analyze a piece of prose or poetry.
- Explain their opinion in a coherent and communicable manner.

### Course Contents:

#### Unit-I: Values & Ethics

7 hours

Literature: Rabindranath Tagore - Where the Mind is Without Fear

Saki – The Lumber-room

William Shakespeare – Extract from Julius Caesar (Mark Antony’s Speech)

Language: Vocabulary Building

#### Unit-II: Natural & Supernatural

6 hours

Literature: John Keats – La Belle Dame Sans Merci

Charles Dickens – The Signal Man

Hans Christian Anderson - The Fir Tree

Language: Collective Nouns

**Unit-III: Travel & Adventure****7 hours**

Literature: R.L. Stevenson – Travel

H.G. Wells – The Magic Shop

Jonathan Swift – Excerpt from Gulliver’s Travels Book – I

Writing Skills: Travelogue

**Unit-IV: Success Stories****6 hours**

Literature: Emily Dickinson – Success is Counted Sweetest

Dr. Martin Luther King - I Have a Dream

Helen Keller – Excerpt from The Story of My Life

Writing Skills: Brochure &amp; Leaflet

**Reference Books:**

- Tagore, Rabindranath. Gitanjali. Rupa Publications, 2002.
- Wordsworth, William. The Complete Works of William Wordsworth. Andesite Press, 2017.
- Munro, Hector Hugh. The Complete Works of Saki. Rupa Publications, 2000.
- Shakespeare, William. The Complete Works of William Shakespeare. Sagwan Press, 2015.
- Chindhade, Shirish. Five Indian English Poets: Nissim Ezekiel, A.K. Ramanujan, Arun Kolatkar, Dilip Chitre, R. Parthasarathy. Atlantic Publications, 2011.
- Dickens, Charles. The Signalman and Other Horrors: The Best Victorian Ghost Stories of Charles Dickens: Volume 2. Createspace Independent Publications, 2015.
- Anderson, Hans Christian. The Fir Tree. Dreamland Publications, 2011.
- Colvin, Sidney (ed). The Works of R. L. Stevenson. (Edinburgh Edition). British Library, Historical Prints Edition, 2011.
- Bishop, Elizabeth. Poems. Farrar, Straus and Giroux, 2011.
- Swift, Jonathan. Gulliver’s Travels. Penguin, 2003.
- Dickinson, Emily. The Complete Poems of Emily Dickinson. Createspace Independent Publications, 2016.
- Brooke, Rupert. The Complete Poems of Rupert Brooke. Andesite Press, 2017.
- King, Martin Luther Jr. & James M. Washington. I Have a Dream: Writings And Speeches That Changed The World. Harper Collins, 1992.
- Keller, Helen. The Story of My Life. Fingerprint Publishing, 2016.
- Green, David. Contemporary English Grammar Structures and Composition. New Delhi: MacMillan Publishers, 2010.
- Thorpe, Edgar and Showick Thorpe. Basic Vocabulary. Pearson Education India, 2012.
- Leech, Geoffrey and Jan Svartvik. A Communicative Grammar of English. Longman, 2003.
- Murphy, Raymond. Murphy’s English Grammar with CD. Cambridge University Press, 2004.

Course Code	Course Title	Course Type	L	T	P	C	Hrs./Wk.
B21AHE101	Communicative English – I	FC	1	1	0	2	3

### Course Description:

This 2-credit course focuses on improving the spoken and written communication of the learners. The course develops personal, inter-personal and group skills among learners. It also addresses the functional aspects of language usage while providing specific linguistic tools through professional language learning software. The widespread reach of this course makes it highly practical and applicable.

### Prerequisites:

The student must have knowledge of intermediate English Grammar and LSRW skills.

**Pedagogy:** Direct method, ICT, Collaborative learning, Flipped Classroom.

### Course Objectives:

- To enhance functional communication skills.
- To develop functional use of language in professional contexts.
- To utilize oral presentations in multiple contexts.
- To apply effective written skills in formal communication.

### Course Outcomes:

After the completion of the course, students will be able to:

- Identify pressing issues relating to society, environment and media.
- Develop a process-oriented approach to writing.
- Apply the grammatical skills developed during the course aptly.
- Demonstrate a good command over language usage and refined interpersonal skills.

### Course Contents:

#### Unit-I: Functional English

7 Hours

Remedial Grammar: Past Simple; Past Continuous; Irregular Verbs

Writing Skills: Paragraph Writing

Activities: Conversations; Leaving Phone Messages

Literature: Chief Seattle – The End of Leaving and Beginning of Survival

#### Unit-II: Interpersonal Skills

6 Hours

Remedial Grammar: Present Simple & Present Continuous; Activity & State Verbs

Writing Skills: Official Letters

Activities: Making Apologies; Invitations & Making Arrangements

Literature: Ruskin Bond – Tiger in the Tunnel

#### Unit-III- Multitasking Skills

7 Hours

Remedial Grammar: Present Perfect; For, Since & How Long; -ed & -ing adjectives; Prefix & Opposites of Adjectives

Writing Skills: Note Making

Activities: Agreeing & Disagreeing with Opinions

Literature: Jesse Owens - My Greatest Olympic Prize

**Unit-IV: Communication Skills**

**6 Hours**

**Remedial Grammar: Collocations; Prepositions**

Writing Skills: Precise Writing

Activities: Offers, Suggestions & Requests

Literature: Avijit Pathak – Onscreen Magic

**Reference Books:**

1. Green, David. *Contemporary English Grammar Structures and Composition*. New Delhi: MacMillan Publishers, 2010.
2. Thorpe, Edgar and Showick Thorpe. *Basic Vocabulary*. Pearson Education India, 2012.
3. Leech, Geoffrey and Jan Svartvik. *A Communicative Grammar of English*. Longman, 2003.
4. Murphy, Raymond. *Murphy's English Grammar with CD*. Cambridge University Press, 2004.
5. Rizvi, M. Ashraf. *Effective Technical Communication*. New Delhi: Tata McGraw-Hill, 2005.
6. Riordan, Daniel. *Technical Communication*. New Delhi: Cengage Publications, 2011.
7. Sen et al. *Communication and Language Skills*. Cambridge University Press, 2015.

<b>B21DA0101</b>	<b>Basic Mathematics</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :14 Wks</b>		<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**Course Description:**

This course, provides an introduction to the basic concepts and techniques of matrices, differential calculus, vectors and set theory, emphasizing their inter-relationships and applications to engineering, the sciences and financial areas, introduces students to the use of computers in mathematics, and develops problem solving skills with both theoretical and practical problems.

**Prerequisites:**

Number System, Algebraic and Logarithmic concepts, and system of equations solving techniques

**Course Objectives:**

The objectives of this course are to:

1. Impart students with an understanding of matrices and determinants, differential calculus, vectors, set theory and functions
2. Enable them to work on problems relative any aspect of matrices, determinants etc
3. Equip students to solve given problems using set theory concepts.

**Course Outcomes:**

On successful completion of this course; the student will be able to:



1. Compute with the characteristic polynomial, eigenvectors and eigenvalues as well as the algebraic multiplicities of an eigenvalue and solve systems of linear equations by use of the matrix
2. Recognize, apply and interpret multiple representations differentiate among diverse cultures through the history of mathematics and solve applied problems by using differentiation
3. Represent vectors analytically and geometrically, and compute dot and cross products for presentations of lines and planes, critical thinking to arrive at conclusions from Venn Diagrams, syllogistic forms and prove elementary results involving sets
4. Demonstrate the ability to apply analytical and theoretical skills to model and solve mathematical problems.

### Course Contents:

#### Unit – 1: [13 Hours]

**Matrices and Determinants:** Matrices-Definition, types of matrices, addition, subtraction, scalar multiplication and multiplication of matrices. Determinants: Definition, properties of determinants, minors, cofactors, Adjoint of a matrix, Cayley Hamilton theorem(without proof), Eigen values and Eigen vectors, inverse of a matrix using Cayley Hamilton simultaneous equations using Cramer’s rule and matrix inversion method.

#### Unit – 2: [13 Hours]

**Differential Calculus:** Limits and continuity: Introduction-Real valued functions- limit of a function, algebra of limits, continuity of a function and points of discontinuity. Differentiation: Derivatives, algebra of derivatives, chain rule, derivatives of composite function, logarithmic and exponential differentiation, and successive differentiation (second order).

#### Unit –3: [13 Hours]

**Vectors:** Definition of a vector and scalar, vector addition, dot and cross product, projection of a vector, area of parallelogram, area of triangle, scalar triple product, volume of a parallelepiped, co-planarity of three vectors, vector triple product.

#### Unit -4: [13 Hours]

**Set Theory:** Introduction, definition and concepts, representation of sets, finite sets, infinite sets, set operators- union, intersection differences, symmetric differences, complement, Cartesian products -basic set identities, de-morgan’s law, cardinality, and results related to all set operators. Relations, types of relations, equivalence relation, equivalence classes, partition of a set, matrix representation of binary relation. Functions: onto, one-one, into, inverse functions, composition of a functions and inverse of compositions.

#### Text Books:

1. Grimaldi, Ralph P, “Discrete and Combinational Mathematics”, Pearson Education, Singapore, 2003.
2. Rao, G. Shanker, “Mathematics for Computer Science”, Kalyani Publishers, New Delhi, 1999.
3. Thomas and Finney, “Calculus with Analytical Geometry”, Narosa Publishing House, 6th edition, 1998.
4. S Narayan and T K Manicavachogam Pillai, “Calculus”- Vol I and Vol II, S.V.Publishers, 2009 Edition.

#### Reference Book:

1. K.D.Joshi : “Foundations of Discrete Mathematics”, 1989 edition, Wiley Eastern Ltd.,

<b>B21DA0102</b>	<b>Digital Logic and Computer Architecture</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :14 Wks</b>		<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>

### Course Description:

Digital Electronics Circuit Design is a very important course for Electronics engineers as it deals with the fundamental aspects of digital circuits design. Both The Combinational and the sequential circuit realization and implementations are studied. This course opens with an introduction to combinational logic, logic gates, minimization techniques, arithmetic circuits. It then moves to deal with sequential circuits: flip-flops, synthesis of sequential circuits, and case studies, including counters, registers. State machines will then be introduced. Different representations of truth table, logic gate, timing diagram, switch representation, state diagram, and state equations,

### Prerequisites:

Before starting this course, the learner should have elementary knowledge in electronics and the core concepts of computer.

### Course Objectives:

The objectives of this course are to:

1. Enable students to acquire basic knowledge of digital logic levels and application of
2. Impart knowledge of understanding digital electronics circuits.
3. Equip with the skill of performing analysis and design of various digital electronic circuits.

### Course Outcomes:

On completion of this course the student will be able to:

1. Understand and explain the fundamental concepts, techniques used in Digital electronics and examine the structure of various number systems and it's Application in digital design.
2. Comprehend the basic gates, define and design the digital logic circuits.
3. Analyze and design various combinational and sequential Logic Circuits.
4. Identify and demonstrate the basic operational concepts of computer system.

### Course Contents:

#### UNIT – 1:

[10 Hours]

**Introduction to Digital Electronics, Number systems, Operations and codes:** What is Digital circuit, where are digital circuits are used, why use digital circuits. Decimal numbers, Binary numbers, Decimal-to-Binary conversion, Binary Arithmetic, 1's and 2's Complements of Binary Numbers, signed numbers, Arithmetic operations with signed numbers, Hexadecimal Numbers, Octal numbers, Binary Coded Decimal(BCD), Digital Codes.

**UNIT – 2:****[10 Hours]**

**Logic Gates, Boolean Algebra and Logic Simplification:**The Inverter, the AND Gate, the OR gate, the NAND Gate, the NOR Gate, the Exclusive-OR and Exclusive-NOR Gates, Basics of Digital Integrated Circuits. Boolean Operations and Expressions, Laws and Rules of Boolean Algebra, DE Morgan's Theorems, Boolean Analysis of Logic Circuits, Simplification Using Boolean Algebra, Standard Forms of Boolean Expressions, Boolean Expressions and Truth Tables, The Karnaugh Map, karnaugh Map SOP Minimization, POS Minimization.

**UNIT – 3:****[10 Hours]**

**Combinational Logic, Sequential Logic, Registers:**Combinational Logic: Introduction, Design Procedure, Adders, sub tractors. Sequential Logic: Introduction, Flip-Flops. Registers: Introduction, Registers, and Shift Registers.

**UNIT – 4:****[09 Hours]**

**Basic Structure of Computers and the Memory System:**Computer types, Functional Units, Basic Operational Concepts, Bus Structures, and Performance. Some Basic Concepts, Semiconductor RAM Memories and Read-Only Memories.

**Text Books:**

1. Tokheim "Digital Electronics Principles and Applications", 6th Edition, McGraw-Hill, 2014. Chapter 1 (1.1, 1.2, 1.3).
2. Thomas L. Floyd, "Digital Fundamentals", Tenth Edition, Pearson, 2015. Chapters (2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10 and 2.11), Chapters (3.1 to 3.7) and (4.1 to 4.9).
3. M. Morris Mano " Digital Logic and Computer Design", Pearson, 2013. Chapters (4.1 to 4.4, 6.1 to 6.2 and 7.1 to 7.3).
4. Hamacher, Vranesic and Zaky, "Computer Organization", Fifth Edition, Tata Mcgraw-Hill, 2015. Chapters (1.1, 1.2, 1.3, 1.4 and 1.6), Chapters (5.1 to 5.3)

**Reference Books:**

1. Digital Electronics: An Introduction To Theory And Practice By William Gothman, Second Edition, PHI Publisher, 2015.
2. Digital Electronics by John Morris, Fifth Edition, 2016.
3. Fundamentals of Digital Circuits by Anand Kumar, Fourth Edition, 2014.
4. Digital Electronics Principles and Integrated Circuits by Anil K. Maini, second Edition, 2013.
5. Computer Organization and Design by David A. Patterson, John L. Hennessy, Fifth Edition, Morgan Kaufmann.

<b>B21DA0103</b>	<b>Problem solving using C</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration:14 Wks</b>		<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>

### Course Description:

Designed to introduce the student the basics of computer concepts and various programming concepts of the C language using the Microsoft Visual C++. Programs, using the console application feature, will be coded and executed to demonstrate the use of variables, constants, control flow, arithmetic, functions, input/output, and dynamic memory allocation. The student will also be introduced to the various library functions available for use within the language compiler.

### Prerequisites:

To start with C programming you should have a basic understanding of Computer Programming terminologies and some knowledge about programming languages.

### Course Objectives:

The objectives of this course are to:

1. Explain the basic programming concepts.
2. Illustrate the importance of Algorithm to write the Program (in small steps).
3. Describe how a good program design can reduce coding and debugging time.
4. Explain the concepts of Files for application data maintenance
5. Equip with detailed understanding of control statements, function and arrays.
6. Illustrate the use of pointers and Strings.

### Course Outcomes:

By the end of the course, the students will be able to

1. Design Algorithms and Draw Flowcharts to model solving real world problems. List various data types and operators and develop programs to evaluate arithmetic expressions and mathematical functions.
2. Analyze various data types and operators and develop programs to evaluate arithmetic expressions and solving mathematical functions using library functions.
3. Identify and analyze the suitable control statements and apply logical reasoning to implement the solution for any mathematical and logical problem
4. Analyze different data structures such as arrays (1D and 2D) and its derived data structures to handle list of data such as string (text) processing.
5. Compare and Apply different categories of user defined functions to solve problems and to implement the concept of procedural and modular programming
6. Explore pointers in implementing programs, especially in memory management and file handling for faster execution of programs

### Course Contents:

#### UNIT -1:

[10 Hours]

**Computer Problem-Solving& Fundamental Algorithms:**Computer Basics, Introduction To Computer

Problem-Solving, Fundamental Algorithms: Introduction, Exchanging the Values of Two variables, Counting, Summation of a Set of Numbers, Factorial Computation, Generation of the Fibonacci Sequence.

**Basics Of C Programming:** Overview of C: History of C, Importance of C, Basic Structure of C Programs, Constants, Variables and Data Types:- Introduction, Character Set, C Tokens, Keywords and Identifiers, Constants, Variables, Data Types, Declaration of Variables, Declaration of Storage Class, Assigning Values to Variables .

**UNIT – 2:** [10 Hours]

**Operators and Expressions:** Introduction, Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operators, Special Operators, Arithmetic Expressions, Evaluation of Expressions, Precedence of Arithmetic Operators. **Structured Constructs:** Decision Making and Branching, Decision Making and Looping.

**UNIT– 3:** [10 Hours]

**Arrays & Functions:** Arrays: Introduction, One-Dimensional Arrays, Initialization of One-Dimensional Arrays, Two Dimensional Arrays, Initializing Two Dimensional Arrays, Multi Dimensional Arrays, Character Arrays and Strings: Introduction, Declaring and Initializing String Variables, Reading Strings from Screen, Writing Strings to Screen, String-Handling Functions.

**User-Defined Functions:** Introduction, Need for User defined Functions-Elements of User defined Functions, Definition of Functions, Return Values and their types, Function Calls, Function Declaration, Category of Functions, No arguments and No return values, Arguments but No return values, Arguments with return values, No arguments but returns a value, **Recursion.**

**UNIT-4:** [09 Hours]

**User Defined Data Types:** Structures and Unions :Introduction, Defining a Structure, Declaring Structure Variables, Accessing Structure Members, Structure Initialization, Copying and Comparing Structure Variables, Operations on Individual Members, Arrays of Structures, Arrays with Structures, Structures within Structures, Unions. Introduction to **Pointers: Introduction and Understanding pointers, Accessing the address of a variable, Declaring pointer variables, Initialization of pointer variables, Accessing a variable through its pointer.** **File Management in C: Introduction, Defining and Opening a File, Closing a File, Input/ Output Operations on Files**

**Text Books:**

1. V. Rajaraman, Neeharika Adabala, “Fundamentals of Computers”, 6th Edition, PHI, 2015. (Chapter 1)
2. R.F Dromey, “How to Solve it by Computer” Pearson, Fourteenth Impression, 2013. (Chapter 1 & 2)
3. E. Balaguruswamy, “Programming In ANSI C”, 3rd edition, McGraw Hill Education, 2006. (Chapter 1 to 12).

**References Books:**

1. Mahapatra, “Thinking in C”, PHI Publications, 1998.
2. Yashwant Kanetkar, “Let Us C”, 13th Edition, PHP, 2013.
3. Ashok N. Kamthane, “Programming with ANSI and Turbo C”, Pearson Education, 6th Impression, 2009.
4. Anami, Angadi, and Manvi, “Computer Concepts and C Programming – A Holistic approach”, PHI - 2008.

<b>B21DA0104</b>	<b>C Programming Lab</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :14 Wks</b>		<b>0</b>	<b>0</b>	<b>2</b>	<b>2</b>

### Prerequisites:

To start with C programming one should have a basic understanding of Computer Programming terminologies and some knowledge about programming languages

### Course Objectives:

The objectives of this course are to:

1. Advance structured and procedural programming understating and to improve C programming Skills.
2. Provide students with understanding of code organization and functional hierarchical decomposition with using complex data types

### Course Outcomes:

On completion of this course the student will be able to:

1. Understanding a functional hierarchical code organization.
2. Define and manage data structures based on problem subject domain.
3. Use textual information, characters and strings.
4. Work with arrays of complex objects.
5. Illustrate the concept of object thinking within the framework of functional model and functional hierarchical code organization.
6. Identify and troubleshoot the possible errors during program execution.

### Lab Experiments

#### Part –A

1. Write a C program to exchange the values of two variables.
2. Write a C program to check whether the given integer is odd or even.
3. Write a C program to find the largest of three numbers.
4. Write a C program to find the area of a circle.
5. Write a C program to simulate a simple calculator using switch case statement.
6. Write a C program to compute the factorial of a number.
7. Write a C program to find the sum of ‘N’ natural numbers.
8. Write a C program to generate and display the first ‘N’ Fibonacci numbers.

#### Part-B

1. Write a C program to solve the roots of quadratic equation.
2. Write a C program to reverse a given integer.
3. Write a C program to sort ‘N’ numbers.
4. Write a C program to search a given number from an array.
5. Write a C program to add two numbers using function.

6. Write a C program to define a structure 'STUDENT'. Also read and display 'N' student details.
7. Write a C Program to read and write character using file.

<b>B21DA0105</b>	<b>Digital Logic Lab</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration:14 Wks</b>		<b>0</b>	<b>0</b>	<b>2</b>	<b>2</b>

### Prerequisites:

Before starting this course, the learner should have elementary knowledge in electronics and the core concepts of computer.

### Course Objectives:

The objectives of this course are to:

1. Acquire the basic knowledge of digital logic levels and application of
2. Impart the knowledge to understand digital electronics circuits.
3. Perform the analysis and design of various digital electronic circuits.

### Course Outcomes:

On successful completion of this course; the student will be able to:

1. Use Boolean algebra and simplify simple Boolean functions by using basic Boolean properties.
1. Design of combinational circuits such as MUX, DEMUX, Encoder and Decoder etc.
2. Illustrate the design of sequential Circuits such as Flip-Flops, Registers, and Counters.
3. Perform the analysis and design of Complex Digital Electronic Circuits.

### Lab Experiments

#### Part – A

1. Study of Logic Gates–AND, OR, NOT, NAND, NOR, XOR (Using respective ICs)
2. Realization of AND, OR and NOT gates using Universal Gates.
3. Design and Realization of Half Adder / Sub tractor using NAND Gates.
4. Design and Realization of Full Adder using Logic Gates.
5. Design and Realization of 4 bit Adder / Sub tractor using IC 7483.
6. Design and Realization of BCD Adder using IC 7483.
7. Realizations of J-K flip flop using IC 7400 and 7410.
8. Realization of T and D flip flop using IC 7476.
9. Implementation of PIPO Shift Registers using flip flops. (IC 7476).
10. Design and implementation of odd and even parity checker Generator using IC 74180.

#### Part – B

11. PC Hardware lab - Components of PC, Assembling and installation.
12. Install and configure nfs server
13. Configure nfs client and work on mount points

14. Work on Linux desktop interface
15. Configure DNS server
16. Install and configure web server

<b>B21ASM101</b>	<b>Environmental Studies</b>
<b>Duration:14 Wks</b>	

### Course Objectives:

The objectives of this course are to:

1. To familiarize students with environmental issues as how to conserve, preserve and protect our Environment.

### Course Outcomes:

On successful completion of this course; the student will be able to:

1. Analyze the environmental conditions and protect it.
2. Observe the role of individual, government and NGO in environmental protection.
3. Search for new renewable energy resources with high efficiency through active research.
4. Analyze the ecological imbalances and protect it.
5. List the causes of environmental pollution & find ways to overcome them.
6. **Design pollution controlled products.**

### Course Contents:

**UNIT – 1:** **[10 Hours]**

**Introduction:** Multidisciplinary nature of environmental studies – Definition -Scope and importance-Need for public awareness.

**UNIT – 2:** **[10 Hours]**

**Natural Resources:** Renewable and non-renewable -Problems associated - Forest resources-Water resources-Mineral resources-Food resources-Energy resources-Land resources and their conservation.

**UNIT – 3:** **[10 Hours]**

**Environmental Pollution:** Definition- Causes - Effects and control measures of air - Water-Soil-Marine-Noise-Thermal -Nuclear pollutions -Solid waste management-Prevention of pollution.

**UNIT – 4:** **[09 Hours]**

**Social Issues and the Environment:** Unsustainable to **sustainable development**, **Environmental ethics**, Climate changes, global warming, Wildlife protection act, **Public awareness,- Human Population and the Environment-** Population growth - Population explosion - Human rights - Value education - Role of information technology in environment and human health - HIV/Aids -Women and child welfare.



**Text Books:**

1. Desai R.G, “Environmental studies”, Himalaya Pub. House.
2. Agarwal, K.C, “Environmental Biology”, Nidi Publ. Ltd. Bikaner, 2001.
3. BharuchaErach, “The Biodiversity of India”, Mapin Publishing Pvt. Ltd.,
4. Jadhav, H &BhosaleV.M.,“Environmental Protection and Laws”, Himalaya Pub. House, Delhi. 1995
5. Rao M N. &Datta, A.K.,“Waste Water treatment”, Oxford & IBH Publ. 1987.

<b>B21DAM102</b>	<b>Skill Development Program</b>
<b>Duration:14 Wks</b>	

## SECOND SEMESTER

Course code	Course Title	Course Type	L	T	P	C	Hrs./Wk.
B21AHK202	Language II: Kannada	FC	1	1	0	2	3

### Course Description:

ಭಾಷೆಯನ್ನು ಮಾತನಾಡುವ ಬರೆಯುವ ಕೌಶಲ್ಯ, ಸಾಹಿತ್ಯದ ಬಗ್ಗೆ ಸ್ಥೂಲವಾಗಿ ಪರಿಚಯಿಸುವ ಮೂಲಕ ವಿದ್ಯಾರ್ಥಿಗಳ ವ್ಯಕ್ತಿತ್ವ ವಿಕಾಸ ಹಾಗೂ ಸ್ಪರ್ಧಾತ್ಮಕ ಪರೀಕ್ಷೆಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು, ಪ್ರಸ್ತುತ ಸಂದರ್ಭಕ್ಕೆ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಸಜ್ಜುಗೊಳಿಸಲು ಪಠ್ಯವನ್ನು ರೂಪಿಸಲಾಗಿದೆ. ಸಾಹಿತ್ಯ, ಕಲೆ, ವಾಣಿಜ್ಯ, ಆಡಳಿತಾತ್ಮಕ ಮತ್ತು ವಿಜ್ಞಾನದ ವಿಚಾರಗಳಿಗೆ ಒತ್ತನ್ನು ನೀಡಲಾಗಿದೆ. ಇದು ಮೊದಲ ಎರಡು ಸೆಮಿಸ್ಟರ್ ಮೂರು ಕ್ರೆಡಿಟ್‌ಗಳನ್ನು; ಮೂರು ಮತ್ತು ನಾಲ್ಕನೇ ಸೆಮಿಸ್ಟರ್ ಎರಡು ಕ್ರೆಡಿಟ್‌ಗಳನ್ನು ಹೊಂದಿದೆ.

### Prerequisites:

- ಕನ್ನಡ ಭಾಷೆಯ ಬಗೆಗೆ ಪ್ರಾಥಮಿಕ ತಿಳುವಳಿಕೆ ಅಗತ್ಯ..
- ಭಾಷೆಯನ್ನು ಓದಲು ಮತ್ತು ಬರೆಯಲು ತಿಳಿದಿರಬೇಕು.
- ಪದವಿ ಪೂರ್ವ ಶಿಕ್ಷಣದಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯನ್ನು ಓದಿರಬೇಕು.

### Pedagogy:

- Direct method
- ICT and Digital support
- Collaborative and Cooperative learning
- Differentiated Instruction
- Flipped Classroom

### Course Objectives:

ನಾಲ್ಕು ಸೆಮಿಸ್ಟರ್‌ಗಳಲ್ಲಿ ಸಮಗ್ರ ಕನ್ನಡ ಸಾಹಿತ್ಯವನ್ನು ಪರಿಚಯಿಸುವ ಉದ್ದೇಶವನ್ನು ಹೊಂದಿದೆ. ಅದರಂತೆ ಎರಡನೆಯ ಸೆಮಿಸ್ಟರ್‌ನಲ್ಲಿ ಮಧ್ಯಕಾಲೀನ ಕಾವ್ಯಗಳು, ಲೇಖನಗಳು ಹಾಗೂ ಸಂಕೀರ್ಣ ಸಾಹಿತ್ಯವನ್ನು ಪಠ್ಯವನ್ನಾಗಿ ಆಯ್ಕೆ ಮಾಡಿಕೊಂಡು, ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯದ ಬಗ್ಗೆ ಸದಭಿರುಚಿಯನ್ನು ಮೂಡಿಸಲಾಗುತ್ತದೆ. ಸಾಂಸ್ಕೃತಿಕ ತಿಳುವಳಿಕೆಯ ಜೊತೆಗೆ ವ್ಯಕ್ತಿತ್ವ ವಿಕಾಸದ ಕಡೆಗೆ ಗಮನ ನೀಡಲಾಗುತ್ತದೆ.

- ಭಾಷೆ, ಸಾಹಿತ್ಯ, ಇತಿಹಾಸ ಮತ್ತು ಸಂಸ್ಕೃತಿಗಳನ್ನು ಕನ್ನಡ, ಕರ್ನಾಟಕಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ಪರಿಚಯಿಸಲಾಗುತ್ತದೆ.
- ವಿದ್ಯಾರ್ಥಿಗಳ ಸರ್ವತೋಮುಖ ಬೆಳವಣಿಗೆಗೆ ಅನುವಾಗುವಂತೆ ಹಾಗೂ ಅವರಲ್ಲಿ ಮಾನವ ಸಂಬಂಧಗಳ ಬಗ್ಗೆ ಗೌರವ, ಸಮಾನತೆ ಮೂಡಿಸಿ, ಬೆಳೆಸುವ ನಿಟ್ಟಿನಲ್ಲಿ ಪಠ್ಯಗಳ ಆಯ್ಕೆಯಾಗಿದೆ.
- ಅವರಲ್ಲಿ ಸೃಜನಶೀಲತೆ, ಶುದ್ಧ ಭಾಷೆ, ಉತ್ತಮ ವಿಮರ್ಶಾ ಗುಣ, ನಿರರ್ಗಳ ಸಂಭಾಷಣೆ, ಭಾಷಣ ಕಲೆ ಹಾಗೂ ಬರಹ ಕೌಶಲ್ಯಗಳನ್ನು ಬೆಳೆಸುವುದು ಗುರಿಯಾಗಿದೆ.
- ಸ್ಪರ್ಧಾತ್ಮಕ ಪರೀಕ್ಷೆಗಳಿಗೆ ಅನುಕೂಲವಾಗುವಂತಹ ವಿಷಯಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ಸೂಕ್ತ ಪಠ್ಯಗಳನ್ನು ಆಯ್ಕೆ ಮಾಡಿಕೊಳ್ಳಲಾಗಿದೆ.

### Course Outcomes:

ಮಧ್ಯಕಾಲೀನದ ವಿವಿಧ ಪ್ರಕಾರದ ಕಾವ್ಯಗಳು, ಲೇಖನಗಳು ಮತ್ತು ಸಂಕೀರ್ಣ ಬರಹ ಸಾಹಿತ್ಯ ಕಲಿಕೆಯ ಮೂಲಕ ಕಾಲದ ಸ್ಥಿತ್ಯಂತರಗಳನ್ನು ಅದರ ಒಳನೋಟಗಳನ್ನು ಬೆಳೆಸುತ್ತದೆ.

- ಸಾಮಾಜಿಕ, ರಾಜಕೀಯ, ಧಾರ್ಮಿಕ, ಸಾಂಸ್ಕೃತಿಕ, ಪರಿಸರ ಹಾಗೂ ಲಿಂಗಸಂಬಂಧಿ ವಿಚಾರಗಳೆಡೆ ಗಮನ ಹರಿಸುವುದರೊಂದಿಗೆ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಚರ್ಚಾ ಮನೋಭಾವವು ಬೆಳೆಯುತ್ತದೆ.
- ಜೀವನದಲ್ಲಿ ಬರುವ ಅಭಿಪ್ರಾಯ ಬೇಧಗಳು, ಸಮಸ್ಯೆಗಳನ್ನು ಆಧುನಿಕ ಸಂದರ್ಭದಲ್ಲಿ ಮಾನವೀಯತೆಯೊಂದಿಗೆ ನಿರ್ವಹಿಸುವಂತೆ ಪ್ರೇರೇಪಿಸುತ್ತದೆ.
- ಉತ್ತಮ ಸಂವಹನ ಕಲೆಯನ್ನು ಬೆಳೆಸುವ ಉದ್ದೇಶವನ್ನು ಈಡೇರಿಸುತ್ತದೆ.
- ಸಂಶೋಧನಾ ಮನೋಭಾವ ಮತ್ತು ಸ್ಪರ್ಧಾತ್ಮಕ ಪರೀಕ್ಷೆಗಳಿಗೆ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಸಜ್ಜುಗೊಳಿಸುತ್ತದೆ.

### Course Contents:

#### Unit –I

7 Hours

1. ರಾಘವಾಂಕ: ಗಾನರಾಣಿಯರ ಸಂವಾದ
2. ಕುಮಾರವ್ಯಾಸ: ಸಿಡಲ ಪೊಟ್ಟಣ ಕಟ್ಟಿ ಸೇಖವ ಕೊಡುವರೆ
3. ಸರ್ವಜ್ಞನ ವಚನಗಳು

#### Unit –II

7 Hours

1. ಪುರಂದರದಾಸ: ಗಿಳಿಯು ಪಂಜರದೊಳಿಲ್ಲ
2. ಕನಕದಾಸ: ಎಲ್ಲಾರು ಮಾಡುವುದು
3. ಶಿಶುನಾಳ ಶರೀಫ: ಎಲ್ಲರಂತವನಲ್ಲ ನನಗಂಡ

#### Unit –III

6 Hours

1. ಎ.ಪಿ.ಜಿ.ಅಬ್ದುಲ್ ಕಲಾಂ: ಪ್ರೈಮೋಟಿಗೆ ಸಜ್ಜಾಗುತ್ತಿರುವ ದೇಶ
2. ಬಿ.ಎ.ಶ್ರೀಧರ: ಬಾಪು ಚಿಂತನೆ
3. ದೇವನೂರು ಮಹದೇವ: ಭಾರತ ಸಂವಿಧಾನಕ್ಕೆ 'ಭೂತ' ಚೇಷ್ಟೆ

#### Unit –VI

6 Hours

1. ಪೂರ್ಣಚಂದ್ರ ತೇಜಸ್ವಿ: ಸಹಜ ಕೃಷಿ (ಆಯ್ದ ಭಾಗ)

**ಪರಾಮರ್ಶನ ಗ್ರಂಥಗಳು :**

1. ಮುಗಳಿ ರಂ.ಶ್ರೀ., ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ, ಪ್ರಕಾಶಕರು ಗೀತಾ ಬುಕ್ ಹೌಸ್, ಮೈಸೂರು. 2014
2. ಸಂಗ್ರಹ. ನಾಗೇಗೌಡ ಎಚ್.ಎಲ್., ಚಾರಿತ್ರಿಕ ಜನಪದ ಕಥನ ಕಾವ್ಯಗಳು, ಪ್ರಕಾಶಕರು ಕರ್ನಾಟಕ ಜಾನಪದ ಪರಿಷತ್ತು, ಬೆಂಗಳೂರು. 2008
3. ಸೀಮಾತೀತ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ ಸಂಪುಟ 1,2,3,4,5 ಮತ್ತು 6, ಕುವೆಂಪು ಕನ್ನಡ ಅಧ್ಯಯನ ಸಂಸ್ಥೆ, ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ಮೈಸೂರು. 2014
4. ಸಂಗ್ರಹ. ನಾಗೇಗೌಡ ಎಚ್.ಎಲ್., ಕನ್ನಡ ಜನಪದ ಕಥನ ಕಾವ್ಯಗಳು, ಪ್ರಕಾಶಕರು ಕರ್ನಾಟಕ ಜಾನಪದ ಪರಿಷತ್ತು, ಬೆಂಗಳೂರು. 2007
5. ನಾರಾಯಣ ಪಿ.ವಿ, ಚಂಪೂ ಕವಿಗಳು, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2010
6. ಕಾಳೇಗೌಡ ನಾಗವಾರ, ತ್ರಿಪದಿ, ರಗಳೆ ಮತ್ತು ಜಾನಪದ ಸಾಹಿತ್ಯ, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2010
7. ಸಂ. ಬೆನಗಲ್ ರಾಮ ರಾವ್ ಮತ್ತು ಪಾನ್ಯಂ ಸುಂದರ ಶಾಸ್ತ್ರೀ, ಪುರಾಣ ನಾಮ ಚೂಡಾಮಣಿ, ಪ್ರಕಾಶಕರು ಪ್ರಸಾರಾಂಗ, ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ. 2010
8. ಡಾ. ಚಿದಾನಂದ ಮೂರ್ತಿ, ವಚನ ಸಾಹಿತ್ಯ, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2013
9. ಸಂ ಮರುಳಸಿದ್ದಪ್ಪ ಕೆ, ನಾಗರಾಜ ಕಿ.ರಂ. ವಚನ ಕಮ್ಮಟ, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2016
10. ಮರುಳಸಿದ್ದಪ್ಪ ಕೆ, ಷಟ್ಪದಿ ಸಾಹಿತ್ಯ, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2010
11. ಸಂ. ಸೇತುರಾಮ ರಾವ್ ಅ.ರಾ., ಶ್ರೀ ಲಕ್ಷ್ಮೀಶನ ಜೈಮಿನಿ ಭಾರತ(ಮೂಲ-ತಾತ್ಪರ್ಯ-ಸಚಿತ್ರ), ಪ್ರಕಾಶಕರು ಕಾಮಧೇನು ಪುಸ್ತಕ ಭವನ, ಬೆಂಗಳೂರು. 2010
12. ಸಂ. ಸೇತುರಾಮ ರಾವ್ ಅ.ರಾ., ಶಿಶುನಾಳ ಶರೀಫರ ನೂರಾರು ತತ್ವಪದಗಳು, ಪ್ರಕಾಶಕರು ಕಾಮಧೇನು ಪುಸ್ತಕ ಭವನ, ಬೆಂಗಳೂರು. 2007
13. ಸಂ. ಜಿ.ಎಸ್.ಭಟ್., ಕುಮಾರವ್ಯಾಸನ ಕರ್ಣಾಟ ಭಾರತ ಕಥಾಮಂಜರಿ ಪ್ರವೇಶ, ಪ್ರಕಾಶಕರು ಅಕ್ಷರ ಪ್ರಕಾಶನ, ಹೆಗ್ಗೋಡು, ಸಾಗರ. 2006
14. ರಂಜಾನ್ ದರ್ಗಾ, ಶರಣರ ಸಮಗ್ರ ಕ್ರಾಂತಿ, ಪ್ರಕಾಶಕರು. ಲೋಹಿಯಾ ಪ್ರಕಾಶನ, ಬಳ್ಳಾರಿ. 2015
15. ಕೀರ್ತನಾಥ ಕುರ್ತಕೋಟಿ, ಕನ್ನಡ ಸಾಹಿತ್ಯ ಸಂಗಾತಿ, ಪ್ರಕಾಶಕರು ಕುರ್ತಕೋಟಿ ಮೆಮೋರಿಯಲ್ ಟ್ರಸ್ಟ್, ಧಾರವಾಡ. 2009
16. ಶಾಮರಾಯ ತ.ಸು., ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ, ಪ್ರಕಾಶಕರು ತಳುಕಿನ ವೆಂಕಣ್ಣಯ್ಯ ಸ್ಮಾರಕ ಗ್ರಂಥಮಾಲೆ, ಮೈಸೂರು - 2014
17. ಶಿವರುದ್ರಪ್ಪ ಜಿ.ಎಸ್. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಸಮೀಕ್ಷೆ, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2013

Course code	Course Title	Course Type	L	T	P	C	Hrs./Wk.
B21AHH202	Language II: Hindi	FC	1	1	0	2	3

### Course Description:

यह पाठ्यक्रम नौसिखिया अपनी भाषा की क्षमता का विकास करने हेतु तथा विभिन्न साहित्यिक प्रक्रियाओं द्वारा , संस्कृति एवं जीवन के ,समाजमूल्यों को समझने हेतु अभिकल्पित है।

### Prerequisites:

- अध्येता, पी.यु.सी के स्तर पर द्वितीय भाषा के रूप में हिन्दी का अध्ययन करना चाहिए।
- हिन्दी साहित्य के इतिहास का संक्षिप्त ज्ञान की आवश्यकता है।
- हिन्दी व्याकरण का अवबोधन आवश्यक है।
- अंग्रेज़ी – हिन्दी अनुवाद से संबंधित जानकारी जरूरी है।

### Course Objectives:

1. संदर्भानुसार उचित भाषा का प्रयोग करने की दक्षता को छात्रों में उत्पन्न करना।
2. साहित्य के माध्यम से समाज एवं मानवीय मूल्यों को समझाकर, उन मूल्यों की रक्षा हेतु प्रेरित करना।
3. छात्रों में पुस्तक पठन एवं लेखन की अकृतिम प्रवृत्ति स्थापित करना।
4. अध्येताओं में साहित्य के माध्यम से प्रभावी एवं कुशल संचार का विकास करना।

### Course Outcomes:

अध्ययन की समाप्ति पर अध्येता –

1. सामाजिक मूल्य एवं नैतिक जवाबदेही को स्वीकार कर सकता है।
2. साहित्य की प्रासंगिकता को जीवन में समझने की दक्षता रखता है।
3. समाज में अंतर्निहित पद्धतियाँ एवं विचारधाराओं का व्याख्यान करने में सक्षम बन सकता है।
4. साहित्य के माध्यम से प्रभावी एवं कुशल संचार का विकास कर सकता है।

### Course Contents:

#### Unit – 1:

[7 Hours]

- 1 कबीरदास के दोहे – कबीरदास
- 2 कविता – अर्जुन की प्रतिज्ञा - मैथिलीशरण गुप्त

3 कविता – वीरों का कैसा हो बसंत – सुभद्रकुमारी चौहान

**Unit – 2:**

**[7 Hours]**

- 4 तुलसीदास के पद –तुलसीदास
- 5 कविता – संध्या सुंदरी – सूर्यकांत त्रिपाठी 'निराला'
- 6 कविता – करमवीर – अयोध्या सिंह उपाध्याय 'हरिऔध'

**Unit –3:**

**[6 Hours]**

- 7 मीराबाई के पद – मीराबाई
- 8 कविता – मधुशाला – हरिवंशराय बच्चन
- 9 कविता – हम झुक नहीं सकते – अतलबिहारी बाजपाई

**Unit -4:**

**[6 Hours]**

अनुवाद अनुच्छेद ( हिन्दी से अंग्रेजी )

सृजनात्मक व्यक्तित्व

अ महादेवी वर्मा, प्रेमचंद

आ महात्मा गांधी, अब्दुल कलाम

सूचना : प्रत्येक इकाई 25 अंक के लिए निर्धारित है।

**Text Books:**

- हिन्दी पाठ्य पुस्तक – रेवा विश्वविद्यालय।

**Reference Book:**

- 1 सुबोध व्यवहारिक हिन्दी – डॉ. कुलदीप गुप्त
- 2 अभिनव व्यवहारिक हिन्दी – डॉ.परमानन्द गुप्त
- 3 हिन्दी साहित्य का इतिहास - डॉ. नागेन्द्र
- 4 आधुनिक हिन्दी साहित्य का इतिहास - डॉ. बच्चन सिंह
- 5 हिन्दी साहित्य का नवीन इतिहास - डॉ. लाल साहब सिंह
- 6 शुद्ध हिन्दी कैसे बोले कैसे लिखे- पृथ्वीनाथ पाण्डे
- 7 कार्यालय अनुवाद निदेशिका
- 8 संक्षेपण और पल्लवन - के.सी.भाटिया&तुमन सिंग

Course Code	Course Title	Course Type	L	T	P	C	Hrs./Wk.
B21AHA201	Language II: Additional English	FC	1	1	0	2	3

### Course Description:

This is a 2-credit course designed to help the learner gain competency in language through an exploration to the various genres of literature. The syllabus is designed to encourage critical ability of the learner to guide them towards career opportunities. This course is intended to develop the capacity to appreciate and assess the various dimensions of society, culture and life.

**Prerequisites:** The student must possess fair knowledge of language and literature.

**Pedagogy:** Direct method / ICT / Collaborative Learning / Flipped Classroom.

### Course Objectives:

- To assess ecological and environmental concerns through literature.
- To identify the unequal structures of power in society.
- To compare and relate the position of men and women in society.
- To interpret the representation of society in popular culture.

### Course Outcome:

On completion of the course, learners will be able to:

- Demonstrate a thorough understanding of sensitive and critical ecological and environmental issues.
- Analyze the rigid structure of center and margin in our society.
- Criticize the subordinate position of women in society.
- Justify the depiction of society in popular culture.

### Course Contents:

#### Unit-I: Ecology & Environment

7 hours

Literature: Toru Dutt - Casuarina Tree  
Gordon J.L. Ramen – Daffodils No More  
C.V. Raman – Water – The Elixir of Life  
Language: Degrees of Comparison

#### Unit-II: Voices from the Margin

6 hours

Literature: Tadeusz Rozewicz – Pigtail  
Jyoti Lanjewar – Mother  
Harriet Jacobs – Excerpt from Incidents in the Life of a Slave Girl  
Language: Prefix and Suffix

#### Unit-III: Women & Society

7 hours

Literature: Kamala Das – An Introduction  
Rabindranath Tagore – The Exercise Book  
Jamaica Kincaid – Girl  
Writing Skills: Dialogue Writing

**Unit-IV: Popular Culture****6 hours**

Literature: Rudyard Kipling – The Absent-minded Beggar

Sir Arthur Conan Doyle – The Adventure of Lion’s Mane

Aldous Huxley – The Beauty Industry

Writing Skills: Story Writing

**Reference Books:**

- Agrawal, K.A. *Toru Dutt the Pioneer Spirit of Indian English Poetry - A Critical Study*. Atlantic Publications, 2009.
- Latham, Edward Connery (ed). *The Poetry of Robert Frost*. Holt Paperbacks, 2002.
- Gale, Cengage Learning. *A Study Guide for Tomas Rivera's The Harvest*. Gale, Study Guides, 2017.
- Basu, Tejan Kumar. *The Life and Times of C.V. Raman*. Prabhat Prakashan, 2016.
- Rozewicz, Tadeusz. *New Poems*. Archipelago, 2007.
- Manohar, Murli. *Critical Essays on Dalit Literature*. Atlantic Publishers, 2013.
- Hansda, Sowvendra Shekhar. *The Adivasi Will Not Dance: Stories*. Speaking Tiger Publishing Private Limited, 2017.
- Jacobs, Harriet. *Incidents in the Life of a Slave Girl*. Createspace Independent Publication, 2014.
- Das, Kamala. *Selected Poems*. Penguin Books India, 2014.
- Tagore, Rabindranath. *Selected Short Stories of Rabindranath Tagore*. Maple Press, 2012.
- Gale, Cengage Learning. *A Study Guide for Jamaica Kincaid's Girl*. Gale, Study Guides, 2017.
- Kipling, Rudyard. *The Absent-Minded Beggar*. Hardpress Publishing, 2013.
- Doyle, Arthur Conan. *The Hound of the Baskervilles*. General Press, 2017.
- Dixon, Robert J. *Everyday Dialogues in English*. Prentice Hall India Pvt Ltd., 1988.
- Turton, Nigel D. *ABC of Common Errors*. Mac Millan Publishers, 1995.
- Samson, T. (ed.) *Innovate with English*. Cambridge University Press, 2010.
- Kumar, E Suresh, J. Savitri and P Sreehari (ed). *Effective English*. Pearson Education, 2009.

Course code	Course Title	Course Type	L	T	P	C	Hrs./Wk.
B21AHE201	Communicative English – II	FC	1	1	0	2	3

**Course Description:**

This 2-credit course focuses on enhancing written proficiency required for professional enhancement. It also polishes the spoken skills of the learners to make them effective and confident presenters. It also addresses the functional aspects of language usage while providing specific linguistic tools through professional language learning software. The practical components discussed in this course enable a fruitful transition from academia to the industry of their choice.

**Prerequisites:** The student must possess functional knowledge of LSRW skills.

**Pedagogy:** Direct method, ICT, Collaborative learning, Flipped Classroom.



## Course Objectives:

- To build skills essential for corporate communication.
- To enhance context specific language skills.
- To discover the creative linguistic potential through language and literature.
- To develop communication skills necessary for employability.

## Course Outcomes:

After the completion of the course, students will be able to:

- Apply acquired skills to communicate effectively in a corporate scenario.
- Demonstrate command over rhetoric of language.
- **Develop critical and creative thinking through assimilated language skills.**
- **Utilize the communication skills learnt to match industry standards.**

## Course Contents:

### Unit-I: Language Acquisition

7 Hours

Remedial Grammar: Questions & Negatives; Questions Tags

Writing Skills: Email Writing

Activities: Group Discussions

Literature: Alphonse Daudet - The Last Lesson

### Unit-II: Persuasive Skills

6 Hours

Remedial Grammar: Past Simple & Past Perfect

Writing Skills: Report Writing

Activities: Book & Movie Reviews

Literature: Lord Alfred Tennyson – Ulysses

### Unit-III: Cognitive Skills

7 Hours

Remedial Grammar: Present & Past Passive; Conditionals

Writing Skills: Creative Writing

Activities: Role Plays

Literature: O. Henry – The Gift of the Magi

### Unit-IV: Employability Skills

6 Hours

Remedial Grammar: Reported Speech; Idioms

Writing Skills: Cover Letter & CV

Activities: Exchanging Information

Literature: Saki – The Open Window

## Reference Books:

1. Bansal, R.K. and J.B. Harrison. *Spoken English*. Orient Blackswan, 2013.
2. Raman, Meenakshi and Sangeeta Sharma. *Technical Communication*. Oxford University Press, 2015.
3. Thorpe, Edgar and Showick Thorpe. *Objective English*. Pearson Education, 2013.
4. Dixon, Robert J. *Everyday Dialogues in English*. Prentice Hall India Pvt Ltd., 1988.
5. Turton, Nigel D. *ABC of Common Errors*. Mac Millan Publishers, 1995.

6. Samson, T. (ed.) *Innovate with English*. Cambridge University Press, 2010.
7. Kumar, E Suresh, J. Savitri and P Sreehari (ed). *Effective English*. Pearson Education, 2009.
8. Goodale, Malcolm. *Professional Presentation*. Cambridge University Press, 2013.

<b>B21DA0201</b>	<b>Computer Networks</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration : 14 WKS</b>		<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

### Course Description:

The main emphasis of this course is introduction to fundamental network architecture concepts and their application in existing and emerging networks. It also covers the explanation of emerging network architecture. It provides a balanced view of all important elements and concepts of networking. The course includes the following topics: transmission media, Open Systems Interconnection (OSI) communication model, error detection and recovery, Routing algorithms and Elements of Transport protocols. On completion of the course, the student should be able in part to design, implement and maintain a typical computer network.

### Prerequisites:

Knowledge about the fundamentals of how computer systems or devices communicate.

### Course Objectives:

The objectives of this course are to:

1. Identify the different components and their respective roles in a communication System
2. Design an enterprise network employing the common LAN technologies and be able to evaluate the advantages and disadvantages
3. Describe the importance and functions of the OSI layers Physical, data link, network and transport layer

### Course Outcomes:

On the successful completion of this course, Students shall be able to

1. To master the fundamentals of data communications and networks by gaining knowledge of data transmission concepts.
2. Understanding the operation of physical and data link layer.
3. Learning the algorithms used to design data networks.
4. Understanding the principles of transport and application layers

### Course Contents:

#### UNIT 1:

[13 Hours]

**Introduction:** Uses of computer networks, Network Hardware, Network Software, Reference Models, Network Standardization.

**The Physical Layer:** Guided Transmission Media, Wireless Transmission, and Digital modulation and multiplexing, Switching: Circuit switching, packet switching. Mobile telephone system.

**UNIT 2:** [13 Hours]

**The Data Link Layer:**Data link layer design issues, Error Detection and Correction, Sliding window protocol, Example Data link protocols. **MAC sub layer:** channel allocation problem, Multiple Access Protocols, Ethernet, Wireless LANs, data link layer switching.

**UNIT 3:** [13 Hours]

**The Network Layer:**Network layer design issues, Routing algorithms, Congestion control algorithms, Quality of Service, The network layer in the internet.

**UNIT 4:** [13 Hours]

**Transport Layer:**Elements of Transport protocols, UDP, TCP, Performance issues.

**Application Layer:**Domain Name system, Electronic Mail, WWW.

**Text Books:**

1. Andrew S Tanenbaim, David J Wetherall “Computer Networks”, Pearson Education, 5th Edition, Elsevier Inc, 2014. (Chapter-1, 2, 3, 4, 5, 6, 7).

**Reference Books:**

2. Prakash C Gupta, “Data Communications and computer Network”, Second Edition, PHI learning Pvt Ltd, Nov 2014.
3. BehrouzFerouzan, “Introduction to Data Communication & Networking” 5th Edition, McGraw Hill Education Pvt Ltd 2013
4. Larry &Peterson & Bruce S Davis, “Computer networks-A System Approach”, 5th Edition, Elsevier Inc, 2014.

<b>B21DA0202</b>	<b>Data Structures using C</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration: 14Weeks</b>		<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>

**Course Description:**

The purpose of this course is to provide the students with solid foundations in the basic concepts of programming: data structures using C. It offers the students a mixture of theoretical knowledge and practical experience. This course is used to solve problems using data structures such as linear lists, stacks, queues, binary trees, heaps, binary search trees, and graphs and writing programs for these solutions. Also recognize which data structure is the best to use to solve a particular problem.

**Prerequisites:**

Familiarity with the Basics of Programming Languages and better knowledge in Logic building skills

## Course Objectives:

The objectives of this course are to:

1. Assess how the choice of data structures and algorithm design methods.
2. Choose the appropriate data structure and algorithm design method for a specified application.
3. Write programs using function-oriented design principles.
4. Solve problems using data structures such as linear lists, stacks, queues, binary trees, heaps, binary search trees, and graphs and writing programs for these solutions.

## Course Outcomes:

On completion of this course the student will be able to

1. Design or select an appropriate data structures for a particular problem
2. Choose the appropriate data structure and design the algorithms and application methods on various data structures.
3. Apply their knowledge of data structures in writing more efficient programs in a programming language
4. Develop Applications using Linear and Non-Linear Data Structures.

## Course Contents:

### UNIT 1:

[10 Hours]

**Basics of Data Structures:** Data Structures, Classifications (Primitive & Non Primitive), Data structure Operations, Review of Arrays-Inserting and deleting operations, String operations, Structures, Unions, Pointers and Dynamic Memory Allocation Functions.

### UNIT 2:

[10 Hours]

**Linear Data Structures: Stack:**Definition, Array representation, Linked list representation, Operations, Recursion, Towers of Hanoi, Applications of stack (Infix to postfix conversion, evaluation of expression).**Queue:**Definition, Array representation, Linked list representation, Operations, Applications; Types of queues: Simple queue, Circular queue, Double ended queue, Priority queue.

### UNIT 3:

[10 Hours]

**Linked List:**Definition, Singly linked list: Representation in memory, Traversing, Insertion, Deletion and Searching; Memory allocation; Garbage collection; Doubly linked list; Header linked list; Circular linked list.**Searching:**Linear and binary search.**Sorting:**Insertion, Selection, Bubble, Quick, Merge. Hashing: Hash table organizations, Hashing Functions, Static and Dynamic Hashing.

### UNIT 4:

[09 Hours]

**Non Linear Data Structures:**Need for non-linear structures, **Trees and its representation**, Binary Tree, types of Binary Trees, Binary tree traversals , applications of trees , Binary Search Tree, Introduction to **Graph, Graph Traversal Techniques**.

### Text Books:

1. Ashok N Kamthane, "Introduction to Data Structures in C", Pearson Education (S) Pvt Ltd., New Delhi: 2005. ( Chapter 1 to 11 )

2. YedidyahLangsam and Moshe J. Augenstein and Aaron M Tenanbanum, “Data Structures Uisng C and C++”, 2nd Edition, Pearson Education Asia, 2002. ( Chapter 1 to 8 )

**Reference Books:**

1. Jean-Paul Tremblay and Paul G Sorenson, “An Introduction to Data Structures with Applications”, Second Edition, Tata McGraw-Hill Publishing Company Lt., New Delhi: 1995.
2. Horowitz, Ellis, Sahni, Sartaj, Anderson-Freed, Susan (2008), Fundamentals of Data Structure in C, 2nd Edition, University Press, India.
3. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education.
4. E. Balaguruswamy, “Data Structures using C”, McGraw Hill Edition India Pvt. Ltd, 2013

<b>B21DA0203</b>	<b>Object Oriented Programming using C++</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration:14 Wks</b>		<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>

**Course Description:**

This course provides in-depth coverage of object-oriented programming principles and techniques using C++. Topics include object, classes, operator overloading, data abstraction, information hiding, encapsulation, inheritance, polymorphism, templates and exception handling.

**Prerequisites:**

Before starting this course one should have a basic understanding of computer programs and computer programming language. If you know the concepts of C programming it will be much easier to understand this course

**Course Objectives:**

The objectives of this course are to:

1. Impart knowledge of object oriented programming concepts and implement them in C++.
2. Enable to differentiate procedure oriented and object-oriented concepts.
3. Equip with the knowledge of concept of Inheritance so that learner understands the need of inheritance.
4. Explain the importance of data hiding in object oriented programming

**Course Outcomes:**

On successful completion of this course, the student is expected to be able to:

1. Analyze the different Programming paradigm such as procedure oriented and object oriented programming methodology and conceptualize elements of OO methodology
2. Identify and Model real world objects and map it into programming objects for a legacy system
3. Explore the polymorphism , generalization and specialization relationship and solve problem using various OO methodology

4. Analyze and Interpretation of run time binding and solve run time errors and generalize solution to the problem using generic programming approach

### Course Contents:

#### UNIT 1: [10 Hours]

**Introduction :** Procedure Languages, definition of OOP, Basic concept of OOP, Object, Class, Data Abstraction, Data Encapsulation, Data Hiding, Reusability, Inheritance, Polymorphism, Overloading, Dynamic binding and Message passing.

**C++ Features:** Basic data types-The iostream class, C++ Comments, C++ Keywords, Variable declaration, The Const Qualifier. Manipulators, The scope resolution operator, new & delete operators.

**Functions:** Simple Functions, Function declaration, calling the function, function definition, passing argument to functions, returning value from function, passing constants, Variables, pass by value; pass by reference, inline function, overloaded functions, default arguments, return statements.

#### UNIT 2: [10 Hours]

**Objects & Classes:** Classes & Objects, Class Declaration, Class members, Data Members, Member functions, Class member visibility, private, public, protected. Constructors and Types of Constructors, Overloaded Constructor, Objects as arguments, returning objects from functions, Destructors, Array of objects.

**Friend function:** Friends for functional notation, friend classes, the pointer; Accessing Member Data with this, using this for returning values.

#### UNIT 3: [10 Hours]

**Operator Overloading:** Overloading unary operator: Operator Keyword, Operator arguments, Operator return. Overloading binary operator: Arithmetic operators, comparison operator. **Inheritance:** Derived Class & Base Class: Specifying the Derived class accessing Base class members, the protected access specifier, Types of inheritance: Single inheritance, Multiple inheritance, Multilevel inheritance, Hybrid inheritance, public and private inheritance, Overriding member functions.

#### UNIT 4: [09 Hours]

**Virtual functions:** Normal member function accessed with pointers, Virtual member functions accessed with pointers, Dynamic binding, pure virtual functions.

**Templates & Exception Handling:** Introduction, Templates, Class Templates, function templates, Member function templates, Template arguments, Exception Handling.

#### Text Books:

1. Lafore Robert, "Object Oriented Programming in Turbo C++", Galgotia Publications, 2012. (Unit I)
2. E. Balaguruswamy: Object Oriented Programming with C++, Tata McGraw Hill Publications, 2011.(Unit II,III &IV)

### Reference Books:

1. Herbert Schildt, "C++: The Complete Reference" Osborne McGraw-Hill, Third edition, 1998.
2. P. B. Kotur, "Object Oriented Programming with C++" Eight Edition.

<b>B21DA0204</b>	<b>Data Structures Lab</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration: 14 Wks</b>		<b>0</b>	<b>0</b>	<b>2</b>	<b>2</b>

### Prerequisites:

Familiarity with the Basics of Programming Languages and better knowledge in Logic building skills

### Course Objectives:

The objectives of this course are to:

1. To impart knowledge of efficient storage mechanisms of data for an easy access.
2. To design and implementation of various basic and advanced data structures.
3. To explain various techniques for representation of the data in the real world.
4. To develop application using data structures.
5. To equip with the concept of protection and management of data.

### Course Outcomes:

On completion of this course the students will be able to:

1. Choose appropriate data structure as applied to specified problem definition.
2. Perform operations like searching, insertion, deletion, traversing mechanism etc. on various data structures.
3. Apply concepts learned in various domains like DBMS, compiler construction etc.
4. Use linear and non - linear data structures like stacks, queues, linked list etc.
5. Choose appropriate data structure as applied to specified problem definition.
6. Perform operations like searching, insertion, deletion, traversing mechanism etc. on various data structures.

### Lab Experiments

#### PART - A

1. Write a menu driven C program to perform the following string operations without using string functions: (i) String Length (ii) String Concatenation
2. Write a C program to search for an element in an array using Binary search
3. Write a C program to sort a list of N elements using Selection Sort Algorithm.
4. Write a C program to demonstrate Queue using Linked List.

5. Write a C program to demonstrate the working of stack using linked list.
6. Write a C program for Towers of Hanoi problem.
7. Write a C program to find GCD of two numbers using recursion
8. Write a C program to convert infix arithmetic expression to post fix expression.
9. Write a C program to simulate the working of Circular Queue using an array.
10. Write a C program to create and traverse a binary search tree.

**PART – B**

Programs may be decided by External and Internal examiners.

<b>B21DA0205</b>	<b>C++ Programming Lab</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration: 14 Wks</b>		<b>0</b>	<b>0</b>	<b>2</b>	<b>2</b>

**Prerequisites:**

Basic understanding of computer programs and computer programming language like C.

**Course Objectives:**

The objectives of this course are to:

1. To familiarize students with object - oriented concepts and their implementation in C++.
2. To facilitate students with the skills required to solve problems using object oriented concepts
3. To impart the knowledge required to write code with good coding practices.

**Course Outcomes:**

On completion of this course the students will be able to:

1. Explain the process of writing, compiling and executing programs in C++ using appropriate predefined functions in C++ .
2. Implement the object oriented concepts in developing application using C++.
3. Develop applications in C++ using the understanding of Inheritance and polymorphism.
4. Use exception handling while developing a C++ application.
5. Illustrate stream I/O, Files and usage of the available classes to handle stream objects in C++ language.
6. Develop complex applications by identifying the appropriate features of object oriented programming to solve real world problems using C++

**Lab Experiments**

**PART – A**

1. An electricity board charges the following rates to domestic users to discourage large consumption of energy:



For the first 100 units – Rs.2 per unit

For the first 200 units – Rs.4 per unit

For the first 300 units – Rs. 6 per unit

All users are charged a minimum of Rs. 50.00. If the total amount is more than Rs. 1000.00 then an additional surcharge of 15% is added.

Write a program to read the names of users and number of units consumed and print out the charges with names.

2. Define a class to represent a bank account. Include the following members:

Data members:

1. Name of the depositor.
2. Account number.
3. Type of account.
4. Balance amount in the account.

Member functions:

1. To assign initial values.
2. To deposit an amount.
3. To withdraw an amount after checking the balance.
4. To display the name and balance.

Write a main program to test the program.

3. Write a program to swap numbers using friend function.
4. Write a program to calculate area and circumference of circle using inline function
5. Write a program to perform addition of two matrices using operator overloading.
6. Write a program to find sum of complex number using operator overloading and friend function.
7. Write a Program to find the area and volume of respective figures using function overloading.
8. Write a program to find factorial of number using function overloading.
9. Write a program to create a student report using inheritance technique.
10. Write a program to find the maximum of two numbers using template.

## **PART – B**

Programs may be decided by External and Internal examiners.

<b>B21LSM201</b>	<b>Indian Constitution &amp; Professional Ethics</b>
<b>Duration :14 Wks</b>	

### **Course Objectives:**

The objectives of this course are to:

1. To impart knowledge on Constitution of India.
2. To facilitate the understanding of Fundamental Rights, Duties and other Rights which is been given by our law.
3. To facilitate the understanding of Constitution perspective and make them face the world as a bonafide citizen.
4. To attain knowledge about ethics and also know about professional ethics.
5. Explore ethical standards followed by different companies.

## Course Outcomes:

On completion of the course, learners will be able to:

1. Explain the Indian constitutional provisions and follow them.
2. Demonstrate the fundamental rights and human rights.
3. Explain the duties and more importantly practice them in a right way.
4. Adopt the habit of raising their voice against a unconstitutionality of any laws and upon any legal discrimination as we have session of debates on Constitutional validity.
5. Demonstrate professional ethics and know about etiquettes about it.

## Course Contents:

### Unit -1: [10 Hours]

Constitution of India: Making of Indian Constitution, features of Indian Constitution, Preamble to the Constitution of India, Fundamental Rights under Part III, Rights to Equality, Right to Freedom, Right against Exploitation, Rights to Freedom of Religion, Cultural and Educational Rights, Constitutional Remedies. Fundamental Duties of the Citizen, Significance and Characteristics. Elements of National Significance, National Flag, National Anthem, National Emblem.

### Unit -2: [10 Hours]

Legislature and Executive: Organs of the Government; Legislature, Executive and Judiciary. Union and State Executives: President, Vice President, Prime Minister, Cabinet, Governor, Council of Ministers, Electoral process, Election Commission.

### Unit -3: Judiciary [06 Hours]

Supreme Court of Indian, High Court, Right to Information Act 2005, Consumer Protection- Consumer Rights- Caveat Emptor and Caveat Venditor.

### Unit 4: [06 Hours]

Professional Ethics: Definition Scope and need of Ethics for professional, Personal Ethics and Business Ethics, Ethical Standards, Duties of Employers and Employees. Due Care theory, Environmental Ethics, Ethical Code of Conduct in ethics. Best Ethical Companies in India and Abroad; Corporate Social Responsibilities, Code of Conduct and Ethical Excellence.

### Text books:

1. M V Pylee, An introduction to Constitution of India
2. M Govindarajan, S Natarajan, V S Senthil Kumar, Engineering Ethics.
3. Dr.Durga Das Basu, Introduction to constitution of India

<b>B21DAM202</b>	<b>Skill Development Program</b>
<b>Duration :14 Weeks</b>	

## THIRD SEMESTER

Course code	Course Title	Course Type	L	T	P	C	Hrs./Wk.
B21AHK302	Language III: Kannada	FC	1	1	0	2	3

### Course Description:

ಭಾಷೆಯನ್ನು ಮಾತನಾಡುವ ಬರೆಯುವ ಕೌಶಲ್ಯ, ಸಾಹಿತ್ಯದ ಬಗ್ಗೆ ಸ್ಥೂಲವಾಗಿ ಪರಿಚಯಿಸುವ ಮೂಲಕ ವಿದ್ಯಾರ್ಥಿಗಳ ವ್ಯಕ್ತಿತ್ವ ವಿಕಾಸ ಹಾಗೂ ಸ್ಪರ್ಧಾತ್ಮಕ ಪರೀಕ್ಷೆಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು, ಪ್ರಸ್ತುತ ಸಂದರ್ಭಕ್ಕೆ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಸಜ್ಜುಗೊಳಿಸಲು ಪಠ್ಯವನ್ನು ರೂಪಿಸಲಾಗಿದೆ. ಸಾಹಿತ್ಯ, ಕಲೆ, ವಾಣಿಜ್ಯ, ಆಡಳಿತಾತ್ಮಕ ಮತ್ತು ವಿಜ್ಞಾನದ ವಿಚಾರಗಳಿಗೆ ಒತ್ತನ್ನು ನೀಡಲಾಗಿದೆ. ಇದು ಮೊದಲ ಎರಡು ಸೆಮಿಸ್ಟರ್ ಮೂರು ಕ್ರೆಡಿಟ್‌ಗಳನ್ನು; ಮೂರು ಮತ್ತು ನಾಲ್ಕನೇ ಸೆಮಿಸ್ಟರ್ ಎರಡು ಕ್ರೆಡಿಟ್‌ಗಳನ್ನು ಹೊಂದಿದೆ.

### Pre-requisite:

- ಕನ್ನಡ ಭಾಷೆಯ ಬಗೆಗೆ ಪ್ರಾಥಮಿಕ ತಿಳುವಳಿಕೆ ಅಗತ್ಯ.
- ಭಾಷೆಯನ್ನು ಓದಲು ಮತ್ತು ಬರೆಯಲು ತಿಳಿದಿರಬೇಕು.
- ಪದವಿ ಪೂರ್ವ ಶಿಕ್ಷಣದಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯನ್ನು ಓದಿರಬೇಕು.

### Pedagogy:

- Direct method
- ICT and Digital support
- Collaborative and Cooperative learning
- Differentiated Instruction
- Flipped Classroom

### Course Objectives:

ನಾಲ್ಕು ಸೆಮಿಸ್ಟರ್‌ಗಳಲ್ಲಿ ಸಮಗ್ರ ಕನ್ನಡ ಸಾಹಿತ್ಯವನ್ನು ಪರಿಚಯಿಸುವ ಉದ್ದೇಶವನ್ನು ಹೊಂದಿದೆ. ಅದರಂತೆ ಮೂರನೆಯ ಸೆಮಿಸ್ಟರ್‌ನಲ್ಲಿ ನವೋದಯ ಕಾವ್ಯ, ನವ್ಯ ಕಾವ್ಯ, ವಾಣಿಜ್ಯ ಕನ್ನಡ, ವೈಜ್ಞಾನಿಕ ಲೇಖನಗಳು ಮತ್ತು ಏಕಾಂಕ ಸಾಹಿತ್ಯವನ್ನು ಪಠ್ಯವನ್ನಾಗಿ ಆಯ್ಕೆ ಮಾಡಿಕೊಂಡು, ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯದ ಬಗ್ಗೆ ಸದಭಿರುಚಿಯನ್ನು ಮೂಡಿಸಲಾಗುತ್ತದೆ. ಸಾಂಸ್ಕೃತಿಕ ತಿಳುವಳಿಕೆಯ ಜೊತೆಗೆ ವ್ಯಕ್ತಿತ್ವ ವಿಕಾಸದ ಕಡೆಗೆ ಗಮನ ನೀಡಲಾಗುತ್ತದೆ.

- ಭಾಷೆ, ಸಾಹಿತ್ಯ, ಇತಿಹಾಸ ಮತ್ತು ಸಂಸ್ಕೃತಿಗಳನ್ನು ಕನ್ನಡ, ಕರ್ನಾಟಕಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ಪರಿಚಯಿಸಲಾಗುತ್ತದೆ.
- ವಿದ್ಯಾರ್ಥಿಗಳ ಸರ್ವತೋಮುಖ ಬೆಳವಣಿಗೆಗೆ ಅನುವಾಗುವಂತೆ ಹಾಗೂ ಅವರಲ್ಲಿ ಮಾನವ ಸಂಬಂಧಗಳ ಬಗ್ಗೆ ಗೌರವ, ಸಮಾನತೆ ಮೂಡಿಸಿ, ಬೆಳೆಸುವ ನಿಟ್ಟಿನಲ್ಲಿ ಪಠ್ಯಗಳ ಆಯ್ಕೆಯಾಗಿದೆ.
- ಅವರಲ್ಲಿ ಸೃಜನಶೀಲತೆ, ಶುದ್ಧ ಭಾಷೆ, ಉತ್ತಮ ವಿಮರ್ಶಾ ಗುಣ, ನಿರರ್ಗಳ ಸಂಭಾಷಣೆ, ಭಾಷಣ ಕಲೆ ಹಾಗೂ ಬರಹ ಕೌಶಲ್ಯಗಳನ್ನು ಬೆಳೆಸುವುದು ಗುರಿಯಾಗಿದೆ.
- ಸ್ಪರ್ಧಾತ್ಮಕ ಪರೀಕ್ಷೆಗಳಿಗೆ ಅನುಕೂಲವಾಗುವಂತಹ ವಿಷಯಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ಸೂಕ್ತ ಪಠ್ಯಗಳನ್ನು ಆಯ್ಕೆ ಮಾಡಿಕೊಳ್ಳಲಾಗಿದೆ.

## Course Outcomes:

ನವೋದಯ ಕಾವ್ಯ, ನವ್ಯ ಕಾವ್ಯ, ವಾಣಿಜ್ಯ ಕನ್ನಡ, ವೈಜ್ಞಾನಿಕ ಲೇಖನಗಳು ಮತ್ತು ಏಕಾಂಕ ನಾಟಕದ ಕಲಿಕೆಯ ಮೂಲಕ ಕಾಲದ ಸ್ಥಿತ್ಯಂತರಗಳನ್ನು ಅದರ ಒಳನೋಟಗಳನ್ನು ಬೆಳೆಸುತ್ತದೆ.

- ಸಾಮಾಜಿಕ, ರಾಜಕೀಯ, ಧಾರ್ಮಿಕ, ಸಾಂಸ್ಕೃತಿಕ, ಪರಿಸರ ಹಾಗೂ ಲಿಂಗಸಂಬಂಧಿ ವಿಚಾರಗಳೆಡೆ ಗಮನ ಹರಿಸುವುದರೊಂದಿಗೆ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಚರ್ಚಾ ಮನೋಭಾವವು ಬೆಳೆಯುತ್ತದೆ.
- ಜೀವನದಲ್ಲಿ ಬರುವ ಅಭಿಪ್ರಾಯ ಬೇಧಗಳು, ಸಮಸ್ಯೆಗಳನ್ನು ಆಧುನಿಕ ಸಂದರ್ಭದಲ್ಲಿ ಮಾನವೀಯತೆಯೊಂದಿಗೆ ನಿರ್ವಹಿಸುವಂತೆ ಪ್ರೇರೇಪಿಸುತ್ತದೆ.
- ಉತ್ತಮ ಸಂವಹನ ಕಲೆಯನ್ನು ಬೆಳೆಸುವ ಉದ್ದೇಶವನ್ನು ಈಡೇರಿಸುತ್ತದೆ.
- ಸಂಶೋಧನಾ ಮನೋಭಾವ ಮತ್ತು ಸ್ಪರ್ಧಾತ್ಮಕ ಪರೀಕ್ಷೆಗಳಿಗೆ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಸಜ್ಜುಗೊಳಿಸುತ್ತದೆ.

## Course Contents:

### Unit – I

7 Hours

1. ದ.ರಾ.ಬೇಂದ್ರೆ: ಇಳಿದು ಬಾ ತಾಯೆ
2. ಕುವೆಂಪು: ದೇವರು ರುಜು ಮಾಡಿದನು
3. ಮಧುರಚೆನ್ನ: ನನ್ನ ನಲ್ಲ

### Unit – II

7 Hours

1. ಗೋಪಾಲ ಕೃಷ್ಣ ಅಡಿಗ: ನೆಲ ಸಪಾಟಿಲ್ಲ
2. ಕೆ.ಎಸ್.ನರಸಿಂಹಸ್ವಾಮಿ: ಇಡದಿರು ನನ್ನ ನಿನ್ನ ಸಿಂಹಾಸನದ ಮೇಲೆ
3. ಪಿ.ಲಂಕೇಶ್: ಅವ್ವ

### Unit – III

6 Hours

1. ಮುರಳೀಧರ ಬಿ. ಕುಲಕರ್ಣಿ : ಅತಿ ಸಣ್ಣ, ಸಣ್ಣ ಪ್ರಮಾಣದ ಉದ್ಯಮಗಳು ಹಾಗೂ ವಿಶೇಷ ಆರ್ಥಿಕ ವಲಯ (ಎಸ್.ಇ.ಝೆಡ್)
2. ಮಹೇಶ್ ಚಂದ್ರ: ಮೊಬೈಲ್ ಬ್ಯಾಂಕಿಂಗ್ ಬಲು ಸುಲಭ
3. ಡಾ. ಜಿ. ರಾಮಕೃಷ್ಣ: ವಿಜ್ಞಾನ ಮತ್ತು ಧರ್ಮ

### Unit – VI

6 Hours

1. ಗಿರೀಶ್ ಕಾರ್ನಾಡ್: ಮಾನಿಷಾದ (ಆಯ್ದ ದೃಶ್ಯಗಳು)

### ಪರಾಮರ್ಶನ ಗ್ರಂಥಗಳು :

1. ಮುಗಳಿ ರಂ.ಶ್ರೀ., ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ, ಪ್ರಕಾಶಕರು ಗೀತಾ ಬುಕ್ ಹೌಸ್, ಮೈಸೂರು. 2014
2. ಸೀಮಾತೀತ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ ಸಂಪುಟ 1,2,3,4,5 ಮತ್ತು 6, ಕುವೆಂಪು ಕನ್ನಡ ಅಧ್ಯಯನ ಸಂಸ್ಥೆ, ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ಮೈಸೂರು. 2014
3. ಡಾ. ಅರವಿಂದ ಮಾಲಗತ್ತಿ, ಸಾಹಿತ್ಯ ಸಂಸ್ಕೃತಿ ಮತ್ತು ದಲಿತ ಪ್ರಜ್ಞೆ, ಪ್ರಕಾಶಕರು ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್ತು, ಬೆಂಗಳೂರು. 2014
4. ಡಾ. ಈ.ಎಸ್. ಆಮೂರ, ಕನ್ನಡ ಕಥನ ಸಾಹಿತ್ಯ : ಕಾದಂಬರಿ, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2016
5. ದೇಶಪಾಂಡೆ ಎಸ್.ಎಲ್., ಬೇಂದ್ರೆ ಶರೀಫರ ಕಾವ್ಯಾನಾಸ, ಪ್ರಕಾಶಕರು ದೇಸಿ ಪುಸ್ತಕ, ಬೆಂಗಳೂರು. 2013
6. QÃvÀøÉÃxÀ PÃÄvÀøPÉÆÃn, PÀÈÀRqÀ ,Á»vÀå ,ÀAUÁw, ¥ÀæPÃ±ÀPÀgÀÄ PÃÄvÀøPÉÆÃn æÉÃÆÉÆÃJiÀÄ`i |æ`iÖ, zsÁgÀ³ÁqÀ. 2009
7. ಶಾಮರಾಯ ತ.ಸು., ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ, ಪ್ರಕಾಶಕರು ತಳುಕಿನ ವೆಂಕಣ್ಣಯ್ಯ ಸ್ಮಾರಕ ಗ್ರಂಥಮಾಲೆ, ಮೈಸೂರು -2014

8. ಸಂ. ಡಾ| ಸಿ. ಆರ್. ಚಂದ್ರಶೇಖರ್, ಮುಂದಾಳಿತನದ ಲಕ್ಷಣಗಳನ್ನು ಬೆಳೆಸಿಕೊಳ್ಳುವುದು ಹೇಗೆ?, ಪ್ರಕಾಶಕರು ನವಕರ್ನಾಟಕ ಪಬ್ಲಿಕೇಷನ್ಸ್ ಪ್ರೈವೇಟ್ ಲಿಮಿಟೆಡ್. 2010
9. ಆಧುನಿಕ ಕನ್ನಡ ಕಾವ್ಯ ಭಾಗ-2, ಕುವೆಂಪು ಕನ್ನಡ ಅಧ್ಯಯನ ಸಂಸ್ಥೆ, ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ಮೈಸೂರು. 2004
10. ಶಿವರುದ್ರಪ್ಪ ಜಿ.ಎಸ್. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಸಮೀಕ್ಷೆ, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2013

Course code	Course Title	Course Type	L	T	P	C	Hrs./Wk.
B21AHH302	Language III: Hindi	FC	1	1	0	2	3

### Course Description:

यह पाठ्यक्रम नौसिखियाअपनी भाषा की क्षमता का विकास करने हेतु तथा विभिन्न साहित्यिक प्रक्रियाओं द्वारा , | संस्कृति एवं जीवन के मूल्यों को समझने हेतु अभिकल्पित है ,समाज

### Prerequisites:

- अध्येता, पी.यु.सी के स्तर पर द्वितीय भाषा के रूप में हिन्दी का अध्ययन करना चाहिए |
- हिन्दी साहित्य के इतिहास का संक्षिप्त ज्ञान की आवश्यकता है |
- हिन्दी व्याकरण का अवबोधन आवश्यक है |
- अंग्रेज़ी – हिन्दी अनुवाद से संबंधित जानकारी जरूरी है |

### Course Objectives:

1. संदर्भानुसार उचित भाषा का प्रयोग करने की दक्षता को छात्रों में उत्पन्न करना |
2. साहित्य के माध्यम से समाज एवं मानवीय मूल्यों को समझाकर, उन मूल्यों की रक्षा हेतु प्रेरित करना|
3. छात्रों में पुस्तक पठन एवं लेखन की अकृतिम प्रवृत्ति स्थापित करना |
4. अध्येताओं में साहित्य के माध्यम से प्रभावी एवं कुशल संचार का विकास करना |

### Course Outcomes:

अध्ययन की समाप्ति पर अध्येता –

- 1 सामाजिक मूल्य एवं नैतिक जवाबदेही को स्वीकार कर सकता है |
- 2 साहित्य की प्रासंगिकता को जीवन में समझने की दक्षता रखता है |
- 3 समाज में अंतर्निहित पद्धतियाँ एवं विचारधाराओं का व्याख्यान करने में सक्षम बन सकता है |
- 4 साहित्य के माध्यम से प्रभावी एवं कुशल संचार का विकास करसकता है |

## Course Contents:

<b>Unit – 1:</b>	<b>[7 Hours]</b>
नाटक -आधे – अधूरे - मोहन राकेश नाटक विधा का परिचय आधे – अधूरे - प्रथम अंक	
<b>Unit – 2:</b>	<b>[7 Hours]</b>
नाटक -आधे – अधूरे - मोहन राकेश आधे – अधूरे - द्वितीय अंक	
<b>Unit –3:</b>	<b>[6 Hours]</b>
नाटक -आधे – अधूरे - मोहन राकेश आधे – अधूरे -तृतीय अंक	
<b>Unit -4:</b>	<b>[6 Hours]</b>
नगदी रहित व्यवहार	
अ कम्प्युटर इंटरनेट प्रणाली द्वारा भुगतान.1	
आ भ्रमणध्वनि द्वारा भुगतान	
इ विभिन्न बैंकों के एप द्वारा भुगतान	

सूचना : प्रत्येक इकाई 25 अंक के लिए निर्धारित है।

### Text Books:

- नाटक -आधे – अधूरे - मोहन राकेश

### Reference Book:

1. हिन्दी नाटक उद्भव और विकास –दशरथ ओझा
2. हिन्दी साहित्य का इतिहास – डॉ.नागेन्द्र
3. आधुनिक हिन्दी साहित्य का इतिहास डॉ. बच्चन सिंह
4. हिन्दी साहित्य का नवीन इतिहास – डॉ. लालसाहब सिंह
5. शुद्ध हिन्दी कैसे बोले कैसे लिखे- पृथ्वीनाथ पांडे
6. हिन्दी नाटक और रंगमंच – डॉ.रामकुमार वर्मा

7. कंप्यूटर सूचना प्रणाली विकास – रामबंसल वाज्ञाचर्या
8. कंप्यूटर के भाषिक अनुपयोग - विजयकुमार मल्होत्रा

Course Code	Course Title	Course Type	L	T	P	C	Hrs./Wk.
B21AHA301	Language III: Additional English	FC	1	1	0	2	3

### Course Description:

This 2-credit course allows the learners to explore the various socio-political aspects represented in literature. The concepts discussed in the course provide learning exposure to real life scenarios. The course is designed to develop critical thinking ability among learners, through the socio-political aspects discussed in literature. Thus, the aim is to produce responsible and sensitive individuals.

**Prerequisites:** The student must possess fair knowledge of language, literature and society.

**Pedagogy:** Direct method / ICT / Collaborative Learning / Flipped Classroom.

### Course Objectives:

- To outline the global and local concerns of gender and identity.
- To identify the complexities of human emotions through literature.
- To assess the struggles of human survival throughout history.
- To compare and contrast between the various dimensions of childhood.

### Course Outcome:

On completion of the course, learners will be able to:

- Evaluate the pressing gender issues within our society.
- Criticize human actions through a humane and tolerant approach.
- Perceive the human conflicts with an empathetic perspective.
- Disprove the assumption of a privileged childhood.

### Course Contents:

#### Unit-I: Gender & Identity

7 hours

Anne Sexton – Consorting with Angels  
 Eugene Field – The Doll's Wooing  
 Vijay Dan Detha – Double Life  
 Charlotte Perkins Gilman – The Yellow Wallpaper

#### Unit-II: Love & Romance

6 hours

Alfred Noyes – The Highway Man  
 William Shakespeare – Sonnet 116  
 Frank Richard Stockton – The Lady or the Tiger?  
 Oscar Wilde – The Nightingale and the Rose

#### Unit-III: War & Trauma

7 hours

Lord Alfred Tennyson – The Charge of the Light Brigade  
 Taufiq Rafat – The Medal

Guy de Maupassant – Two Friends  
 Sadaat Hasan Manto – Toba Tek Singh

**Unit-IV: Children’s Literature**

**6 hours**

William Blake – The Chimney Sweeper  
 D.H. Lawrence – Discord in Childhood  
 Anna Sewell – The Black Beauty (Extract)  
 Rudyard Kipling – The Jungle Book (Extract)

**Reference Books:**

- Sexton, Anne. *The Complete Poems*. Houghton Mifflin, 1999.
- Namjoshi, Suniti. *Feminist Fables*. Spinifex Press, 1998.
- Vanita, Ruth & Saleem Kidwai (ed.) *Same Sex Love in India*. Penguin India, 2008.
- Gilman, Charlotte Perkins. *The Yellow Wallpaper*. Rockland Press, 2017.
- Gale, Cengage Learning. *A Study Guide for Alfred Noyes's "The Highwayman"*. Gale, Study Guides, 2017. (Kindle Edition Available)
- Shakespeare, William. *Poems and Sonnets of William Shakespeare*. Cosimo Classics, 2007.
- Stockton, Frank Richard. *The Lady, or the Tiger?* Createspace Independent Publications, 2017.
- Wilde, Oscar. *The Collected Works of Oscar Wilde*. Wordsworth Editions Ltd., 1997.
- Tennyson, Lord Alfred. *The Complete Works of Alfred Tennyson*. Forgotten Books, 2017.
- Blake, William Erdman, David V. (ed.). *The Complete Poetry and Prose* (Newly revised ed.). Anchor Books, (1988).
- Maupassant, Guy de. *Guy de Maupassant-The Complete Short Stories*. Projapati, 2015.
- Manto, Sadaat Hasan. *Manto: Selected Short Stories*. RHI, 2012.
- Ricks, Christopher. *Metaphysical Poetry*. Penguin, 2006.
- Sewell, Anna. *The Black Beauty*. Maple Press, 2014.
- Kipling, Rudyard. *The Jungle Book*. Amazing Reads, 2018.

<b>B21DA0301</b>	<b>Software Engineering</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration:14 Weeks</b>		<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**Course Description:**

This course is aimed at helping students build up an understanding of how to develop a software system from scratch by guiding them through the development process and giving them the fundamental principles of system development. The course will initiate students to the different software process models, project management, software requirements engineering process, systems analysis and design as a problem-solving activity, key elements of analysis and design, and the place of the analysis and design phases within the system development life cycle.

**Prerequisites:**

Basic knowledge of computer fundamentals, software systems, and software development processes.



## Course Objectives:

The objectives of this course are to:

1. To classify the various Software Process Models.
2. To analyze a given problem and identify requirements.
3. To design a software using standard software engineering techniques.
4. To apply well defined software testing strategies to produce quality software.

## Course Outcomes:

On completion of this course the student shall be able to:

1. Define and understand the concepts, technologies used in the field of software engineering and various types of Models in software engineering.
2. Explain and analyze the different types of requirements which are gathered and model them based on various methods which are available.
3. Apply and identify the solutions through domain knowledge using the different design concepts which are available.
4. Understand, analyze, apply the software tools used for software quality assurance and software testing.

## Course Contents:

### UNIT 1:

[13 Hours]

**Introduction:**The Nature of Software, Software Engineering, the Software Process, and Process Models: A Generic Process Model: Defining a Framework Activity, Identifying a Task Set. Process Assessment and Improvement, Perspective Process Models: The Waterfall Model, Incremental Process Model, Evolutionary Process Models.

**Agile Development:** What is Agility? Agility and the Cost of Change, Agile Process: Agility Principles, Human Factors, Extreme Programming (XP), Other Agile Process Models: Adaptive Software Development (ASD), Scrum, Dynamic System Development Method(DSDM), Crystal, Feature Driven Development(FDD).

### UNIT 2:

[13 Hours]

**Requirements Modeling:**Understanding Requirements: SRS Template (Example Case Study) ,Developing Use Case, Requirements Modeling: Requirements Analysis, Scenario Based Methods, UML Models That Supplement the Use Case, Class-Based Methods, Behavior, Flow oriented models – DFD's and Web/Mobile Apps.

### UNIT 3:

[13 Hours]

**Design Concepts:**Design Concepts: The Design Process, Design Concepts, The Design Model, User Interface Design: The Golden Rules, User Interface Design Patterns. WebApp Design: Design Goals, A design pyramid for web app, WebApp interface design.

### UNIT 4:

[13 Hours]

**Software Quality Assurance and Software Testing:**Elements of Software Quality Assurance, SQA Tasks, Goals, and Metrics, Six Sigma for Software Engineering, Software Reliability.

Software Testing: Humans and Errors, Bugs, Faults and Failures, Purpose of Software Testing, Testing Techniques, Types of Testing, Basic Concepts and definitions. Testing life Cycle, Software Testing Verification and Validation Techniques, Static Testing, Testing Tool: Introduction, Automation Testing Framework, Types of automation tools, Case Study, Test Planning.

**Text Books:**

1. Roger S. Pressman, “SOFTWARE ENGINEERING, A PRACTITIONER’S APPROACH”, 7th Edition, McGRAW-HILL Publication, 2010. (Unit I – IV) (Chapters: 1, 2, 3, 5, 6, 7, 8, 11, 13, 16)
2. Sandeep Desai, Abhishek Srivastava, “SOFTWARE TESTING : A PRACTICAL APPROACH”, 2nd Edition, PHI Learning Pvt Ltd, 2016 (Unit IV –Software Testing) (Chapters: 1, 2, 3, 4, 6, 7)

**Reference Books:**

1. Ian Somerville, “SOFTWARE ENGINEERING”, 9th edition, Pearson education.
2. Stephen Schach, “SOFTWARE ENGINEERING”, 7th ed, McGraw-Hill, 2007.

**Case Study for SRS:**

The railway reservation system functions as follows;

The passenger is required to fill in a reservation form giving detail of his journey. The counter clerk ensures whether the place is available. If so, entries are made in a register, tickets are prepared, amount is computed and cash is accepted. A booking statement is prepared in triplicate format from the reservation register. One copy of it is retained as office copy; the other is pasted on compartment and third is passed on to the train conductor. Besides booking statement, cash statement is prepared at the end of each shift. Prepare SRS and system specification for above system.

<b>B21DA0302</b>	<b>Java Programming</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :14Wks</b>		<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>

**Course Description:**

Java was designed to have the look and feel of the C++ programming language, but is simpler to use and enforces an object-oriented programming model. Java can be used to create complete applications that may run on a single computer or be distributed among servers and clients in a network.

**Prerequisites:**

Basic understanding of the C/C++ programming language.

**Course Objectives:**

The objectives of this course are to:

1. Relate the fundamentals of programming concepts such as variables, conditional and iterative execution, methods, etc.
2. Explore the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
3. Be able to use the Java SDK environment to create, debug and run simple Java programs.

### Course Outcomes:

On completion of this course the student shall be able to:

1. Knowledge of the structure and model of the Java programming language, using fundamentals and existed functionality of java programming (knowledge).
2. Identify and formulate the members of the Java class. Use the Java programming language for solving various programming technologies (understanding).
3. Evaluate user requirements for software functionality (required to decide whether the Java programming language can meet user requirements) and Develop software using techniques and functionalities available in the Java programming language, (application, analysis).
4. As a responsible student in the society with ethical values, propose the use of certain technologies by implementing them in the Java programming language to solve the given problem for the betterment of society. (Synthesis).
5. Choose an engineering approach to solving problems, starting from the acquired knowledge of programming and knowledge of operating systems. (Evaluation).

### Course Contents:

#### UNIT 1:

[10 Hours]

**Introduction to Java:** JAVA Evolution: Java History, Java Features, How Java Differs from C and C++, Java Environment. Overview of JAVA Language: Introduction, Java Program structure, Java Tokens, Java Statements, Java Virtual Machine, Command Line Arguments, Constants, Variables, and Data Types Scope of variables, Type Casting, Operators and Expressions; Arithmetic Expressions, Evaluation of Expressions, Precedence of Arithmetic Operators, Type conversion and associability, Mathematical Functions. Decision Making and Branching: Decision Making Statement and Looping: while, do, for Statement.

#### UNIT 2:

[10 Hours]

**Classes, Arrays, Strings and Vectors:**Classes, Objects and Methods: Introduction, Defining a Class, Adding Variables, Adding Methods, Creating Objects, Accessing Class Members, Constructors, Methods Overloading, Static Members, Nesting of Methods, Inheritance: Extending a Class Overriding Methods, Final Variables and Methods, Finalizer methods, Abstract Methods and Classes, Visibility Control. Arrays, Strings and Vectors: Arrays, One – dimensional Arrays, Creating an Array, Two– dimensional Arrays, Strings, Vectors, Wrapper Classes.

**UNIT 3:****[10 Hours]**

**Interfaces, Packages, and Multithreaded Programming:** Interfaces: Multiple inheritance, Defining Interfaces, Extending Interfaces, Implementing Interfaces, and Accessing Interface Variables. Packages: Putting Classes together, Java API Packages, Using System Packages, Naming Conventions, Creating Packages, Accessing a Package, Using a Package, Adding a Class to a Package, Hiding Classes. Multithreaded Programming, Creating Threads, Extending the Thread Class, Stopping and Blocking a thread, Life Cycle of a thread, Using Thread Methods, Thread Exceptions, Thread Priority, Synchronization, Implementing the 'Runnable' Interface.

**UNIT 4:****[09 Hours]**

**Managing Exceptions, Applet Programming:** Managing Errors and Exception: Types of Errors, Exceptions, Syntax of Exception Handling Code, Multiple Catch Statements, Using Finally Statement, Throwing Our Own Exceptions, Using Exceptions for Debugging. Applet Programming: How Applets Differ from Applications, Preparing to Write Applets, Applet Life Cycle, Creating Executable applet, Applet Tag, Adding Applet to HTML File, running the Applet, More about Applet Tag, Passing Parameters to Applet, Aligning the Display, More HTML Tags, Getting Input from User.

**Text Books:**

1. E Balaguruswamy, "Programming with JAVA", A Primer, TMH, Fourth Edition 2010.
2. Herbert Schildt, Dale Skrien, "Java Fundamentals, A comprehensive Introduction", Tata McGraw Hill Edition, 2013.  
(Chapters: 1,2,3,4,5,6,7,8,9,10,11,12,13,15,22,23,24,25,26)

**Reference Books:**

1. Hari Mohan Pandey, "Java Programming", Pearson Education, 2012.
2. KoGenT, "Java 6 Programming, Black Book", Dream tech Press, 2012.

<b>B21DA0303</b>	<b>Relational DBMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :14Wks</b>		<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>

**Course Description:**

The course, Relational Database Management System, provides an introduction to the management of database systems. The course emphasizes the understanding of the fundamentals of relational systems including data models, database architectures, and database manipulations. The course also provides an understanding of new developments and trends such as Internet database environment and data warehousing. The course uses a problem-based approach to learning.

**Prerequisites:**

Basic knowledge of Database

## Course Objectives:

The objectives of this course are:

1. To introduce the basic concepts in Database Systems and Relational Databases.
2. To expose the students to the steps in building E-R Diagrams and Normalization.
3. To train the students in the practical skills using Oracle9i software to develop and alter tables.
4. To equip the students with skills to manipulate tables using updation, deletion and arithmetic operations.
5. To provide the basic understanding to group data using built-in functions and join multiple tables.

## Course Outcomes:

On completion of this course the student will be able to:

1. Understanding basic concepts of Database Systems and relate the knowledge of mathematical operations in databases.
2. Analyse and design the decomposed relational schema by using dependency algorithms.
3. Understanding the various features of Oracle 9i software tool and programming the various database languages.
4. Applying the knowledge of databases languages to find the solutions for real world database related applications.

## Course Contents:

### UNIT 1:

[10 Hours]

**Introduction:** Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Relational Databases, Databases Design, Data Storage and Querying, Transaction Management, Database Architecture, Database Users and Administrator.

**Relational Model:** Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations.

### UNIT 2:

[10 Hours]

**Database Design:** Overview, Entity-Relationship Model, Constraints, Removing Redundant Attributes, E-R Diagrams, Reduction to Relational Schemas, E-R Design Issues, and Extended E-R Features.

**Relational Database Design:** Features of Good Relational Designs, Atomic Domains and First Normal Form, Decomposition using Functional Dependencies, Functional-Dependency Theory, and algorithms for Decomposition, Decomposition using Multi valued Dependencies, More Normal Forms.

### UNIT 3:

[10 Hours]

**Oracle9i:** Overview: Personal Databases – Client/Server Databases – Oracle9i an introduction – SQL \*Plus Environment – SQL – Logging into SQL \*Plus - SQL \*Plus Commands – Errors & Help – Alternate Text Editors - SQL \*Plus Worksheet - iSQL \*Plus.

**Oracle Tables:** DDL: Naming Rules and conventions – Data Types – Constraints – Creating Oracle Table – Displaying Table Information – Altering an Existing Table – Dropping, Renaming, Truncating Table – Table Types – Spooling – Error codes.

**UNIT 4:****[09 Hours]**

**Working with Table:**Data Management and Retrieval: DML –adding a new Row/Record – Customized Prompts – Updating and Deleting an Existing Rows/Records – retrieving Data from Table – Arithmetic Operations – restricting Data with WHERE clause – Sorting – Revisiting Substitution Variables – DEFINE command – CASE structure.

**Functions and Grouping:**Built-in functions – Grouping Data. Multiple Tables: Join – Set operations.

**Text Books:**

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, “Database System Concepts”, 6th Edition, McGraw Hill. (Units 1 and 2).
2. Nilesh Shah, “Database Systems Using Oracle”, 2nd edition, PHI. (Units 3 and 4)

**Reference Books:**

1. ArunMajumdar&Pritimoy Bhattacharya, “Database Management Systems”, 2007, TMH.
2. Gerald V. Post, “Database Management Systems”, 3rd edition, TMH.

<b>B21DAS311</b>	<b>E-Commerce</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration:14 Weeks</b>		<b>2</b>	<b>0</b>	<b>1</b>	<b>3</b>

**Course Description:**

The subject of E-commerce basic concepts and technologies used in the field of E-Commerce, E-Payment systems, Inter Organizational and Intra Organizational E-Commerce, Advertising and Marketing on Internet, Apply compression and decompression techniques and codec required for Video Conferencing, Follow ethics in the usage of Smart Card and Digital Token, Demonstrate and analyze the difference between functional testing and structural testing, Analyze the performance of fault based testing, planning and Monitoring the process.

**Prerequisites:**

Need business model and technologies, social innovation and marketing strategies

**Course Objectives:**

The objectives of this course are to:

1. Acquaint students with a fundamental understanding of the environment and strategies in the New Economy.
2. Provide analytical tools to understand opportunities in unserved or underserved New Economy markets.
3. Provide a fundamental understanding of the different types and key components on business models in the New Economy.
4. Provide guiding principles behind the design and strategy of the customer web interface.
5. Provide insights on how to implement strategy in the New Economy.

## Course Outcomes:

On completion of this course the student will be able to:

1. Gain Knowledge on:
  - The basic concepts and technologies used in the field of E-Commerce.
  - E-Payment systems.
  - Inter Organizational and Intra Organizational E-Commerce.
  - Advertising and Marketing on Internet.
2. Apply compression and decompression techniques and codec required for Video Conferencing.
3. Follow ethics in the usage of Smart Card and Digital Token.
4. Demonstrate and analyze the difference between functional testing and structural testing.
5. Analyze the performance of fault based testing, planning and Monitoring the process.

## Course Contents:

### UNIT 1:

[10 Hours]

**Introduction:**Electronic Commerce and physical commerce, The DIGITAL phenomenon, Different types of Ecommerce, examples, E-Commerce scenarios, Advantages of E-Commerce, Myths about E-commerce.

**Technologies (Fundamentals):**Internet and WWW, web system architecture, URL, An overview of the internet, overview of HTTP, HTTP.

### UNIT 2:

[10 Hours]

**Internet payment systems:**Characteristics of payment systems, 4C payment methods, SET protocol for credit card payment, E –Cash, E-Check, Micropayment system, Overview of smart card, MONDEX.

**Consumer oriented E-Commerce:**Traditional retailing and e-retailing, Benefits of e-retailing, Key success factors, Models of e-retailing, Features of e-retailing.

### UNIT 3:

[10 Hours]

**Business oriented E- Commerce:**Features of B2B e-commerce, Business models, Integration. E-Services: Categories of e-services, Web-enables services, Matchmaking services.

### UNIT 4:

[09 Hours]

**Web advertising and web publishing:** Traditional versus internet advertising, Internet advertising techniques and strategies, Business models for advertising and their revenue streams, Pricing model and measurement of the effectiveness of advertisements, Web publishing-goals and criteria, web site development methodologies, logical design of the user interface I-abstract user interface object, logical design of the user interface-II flow of interaction, Usability testing and quality assurance, Web presence and visibility

### Text Books:

1. Henry Chan, Raymond Lee, Tharam Dillon, Elizabeth Chang, “E-Commerce, fundamentals and Applications” by, WILEY Edition.(Chapters: 01, 02, 10 to 14).

### Reference Books:

1. Ravi Kalakota, Andrew B. Whinston, “Frontiers of Electronic Commerce”, Pearson Education, 2009.
2. S.Jaiswal, Galgotia, “E-Commerce”, revised edition, 2008.

<b>B21DAS312</b>	<b>Design &amp; Analysis of Algorithms</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration:14 Weeks</b>		<b>2</b>	<b>0</b>	<b>1</b>	<b>3</b>

**Course Description:**

Algorithms are essential to the study of computer science and are increasingly important in the natural sciences, social sciences and industry. In this course the student will learn how to effectively construct algorithms for different problems and apply techniques for analyzing algorithms including sorting, searching, and selection. Gain an understanding of algorithm design technique and work on algorithms for fundamental graph problems including depth-first search, worst and average case analysis, connected components, and shortest paths.

**Prerequisites:**

Basic knowledge of programming and mathematics. The students should know data structure very well.

**Course Objectives:**

The objectives of this course are to:

1. Analyze the asymptotic performance, prove the correctness and analyze the running time of the basic algorithms.
2. Design algorithms using the dynamic programming, greedy method and recite algorithms that employ this strategy.
3. Demonstrate Tree and graph traversal techniques.
4. Evaluation of Backtracking algorithms.

**Course Outcomes:**

On completion of this course the student will be able to:

1. Analyze the fundamental principles underlying algorithm analysis and design and be able to apply them in specific instances
2. Validate algorithms asymptotically and compute the performance analysis of algorithms with the same functionality.
3. Design an efficient algorithm and realize essentiality of the different techniques such as divide-and-conquer, dynamic programming and the greedy methods and many of its applications
4. Implement various algorithms on graph data structures, including finding the minimum spanning tree and shortest path.

**Course Contents:**

**UNIT 1:** **[10 Hours]**

**Introduction and Divide & Conquer technique:** Definition of algorithm, Characteristics of algorithm, Important problem types, Fundamentals of Algorithmic Problem Solving using flow chart, Different methods to find the GCD of two integers, Order of Growth, Basic efficiency classes, Asymptotic Notations, Time and



space complexity of an algorithms.**Divide and Conquer:**General Method, Binary Search, Merge Sort and Quick Sort.

**UNIT 2:** [10 Hours]

**Greedy Method:**General method, Fractional Knapsack Problem, Job Sequencing with deadline, Spanning trees, Minimum cost spanning trees: Prim’s algorithm, Kruskal’s Algorithm, Single Source Shortest Paths problems-Dijkstra’s algorithm.

**UNIT 3:** [10 Hours]

**Dynamic Programming:**Introduction to Graphs, Types of graphs, Representation of graphs, Terms related to graph, General Method, Multi stage Graphs, Warshall’s Algorithm for Transitive Closure, All pair ShortestPaths,0/1–knapsack, Flow Shop Scheduling.

**UNIT 4:** [09 Hours]

**Traversal Techniques for Trees:**Binary Tree, Properties of Binary Tree, Types of Binary Tree, Binary Tree Traversal Techniques: Pre-order traversal, In-order traversal and post-order traversal. Search techniques for graphs: Breadth First Search (BFS), Depth First Search (DFS).

**Backtracking:**General method, 4-Queens Problem, Sum of Subset Problem, Graph Coloring, Hamiltonian Circuit Problem.

**Text Books:**

1. SaraBaase, Allen Van Gelder, “Computer Algorithms, Introduction to design and Analysis”, 3rdedition Pearson Publication, 2006 (Chapters 4, 5, 7, 8 and 9).
2. Horowitz E, Sahani S, Rajasekharan S, “Fundamentals of Computer Algorithms”, Galgotia Publication 2005(Chapters 1, 3- 6 and 7).
3. Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, “Fundamentals of Computer algorithm”, 2005 (Chapters 1, 3, 4, 5, 6 and 7).

**Reference Books:**

1. A. M Padma Reddy, “Design and Analysis of Algorithms”, Sri nandi Publications, 2017(Chapters 1-9).
2. Srikanth S, “Design and Analysis of Algorithms”, Skyward Publishers, 2015 (Chapter 1-8).
3. Chitra Ravi, “Design and Analysis of Algorithms”, Subhas Publishers, 2015 (Chapter 1-8).

<b>B21DAS313</b>	<b>Enterprise Resource Planning</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>2</b>	<b>0</b>	<b>1</b>	<b>3</b>

### Course Description:

Enterprise resource planning (ERP) is defined as the ability to deliver an integrated suite of business applications. This course will introduce about enterprise systems and show how organizations use enterprise systems to run their operations more efficiently and effectively.

### Prerequisites:

Fundamentals of enterprise resource planning (ERP) systems concepts, and the importance of integrated information systems in an organization.

### Course Objectives:

The objectives of this course are to:

1. Build an understanding of the fundamental concepts of ERP systems, their architecture, and working of different modules in ERP.
2. Learn various components of an application software that help computerize functioning of an enterprise such as sales, materials, production, financial , customer relationship AND supply chain modules.
3. Provide a contemporary and forward - looking on the theory and practice of Enterprise Resource Planning Technology.
4. Develop the basic understanding of how ERP enriches the business organizations in achieving a multidimensional growth.
5. Prepare the students technological competitive and make them ready to self - upgrade with the higher technical skills.

### Course Outcomes:

On completion of this course the student shall be able to:

1. Describe the fundamentals of Enterprise software, express ideas its role in integrating business functions and analyze the strategic options for ERP identification and adoption.
2. Design the ERP implementation strategies using ERP tools to solve problems in different areas.
3. Interpret different modules of ERP applications, analyse and discover new Methodologies.
4. Predict the future directions and trends in ERP that adheres to business principles and values.

## Course Contents:

**UNIT 1:** [10 Hours]  
**Introduction to ERP:**Enterprise an Overview – Introduction to ERP - Basic ERP concepts – Justifying ERP investments - Risks of ERP- Benefits of ERP.

**UNIT 2:** [10 Hours]  
**ERP Technology:**ERP and Related Technologies – Business Intelligence – E-Commerce and E-Business - Business Process Reengineering – Data Warehousing – Data Mining – OLAP – Supply Chain Management – Customer Relationship Management.

**UNIT 3:** [10 Hours]  
**ERP Implementation:**Implementation Challenges, Implementation Strategies, Implementation Life Cycle, Implementation Methodologies, Project Management and Monitoring, Post Implementation activities.  
**ERP Business modules & Market:**Business Modules of an ERP Package, Finance, Manufacturing, Human Resource, Quality Management, Marketing, Sales, Distribution and Service. ERP Marketplace and Marketplace Dynamics, SAP AG, Oracle Corporation, PeopleSoft.

**UNIT 4:** [09 Hours]  
**ERP Present and Future:**Turbo Charge the ERP System, Enterprise Application Integration, ERP , Internet and WWW - ERP II – ERP and Total Quality Management - Future directions and Trends in ERP.

### Text Books:

1. Alexis Leon, “ERP Demystified”, Tata McGraw Hill, 1999.( Part I to III, V to VII)

### Reference Books:

1. Joseph A Brady, Ellen F Monk, Bret J. Wangner, “Concepts in Enterprise Resource Planning”, Thomson Learning, 2001.
2. Vinod Kumar Garg and N.K .Venkata Krishnan, “Enterprise Resource Planning - concepts and Planning”, Prentice Hall, 1998.
3. Jose Antonio Fernandz, “ The SAP R /3 Hand book”, Tata McGraw Hill

<b>B21DA0304</b>	<b>Java programming Lab</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>0</b>	<b>0</b>	<b>2</b>	<b>2</b>

## Lab Experiments:

### Part - A

1. Write a program to find factorial of list of number reading input as command line argument.
2. Write a program to display all prime numbers between two limits.
3. Write a program to sort list of elements in ascending and descending order and show the exception handling.
4. Write a program to implement Rhombus pattern reading the limit form user.

5. Write a program to implement all string operations.
6. Write a program to find area of geometrical figures using method.
7. Write a program to implement constructor overloading by passing different number of parameter of different types. .
8. Write a program to calculate bonus for different departments using method overriding.

### Part - B

1. Write a program to implement mouse events.
2. Write a program to implement keyboard events.
3. Write a Applet program to demonstrate Applet Skelton.
4. Write a simple program that sets foreground and background colors and outputs a string.
5. Write a java program to demonstrate creation and importing packages.
6. Write a java program to demonstrate Interface concept in java.
7. Write a java program to demonstrate of creating new thread and starts running.
8. Demonstrate multiple thread concepts in java with help of program.
9. Implement program to handle Exceptions in java programming.

<b>B21DA0305</b>	<b>RDBMS Lab</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>0</b>	<b>0</b>	<b>2</b>	<b>2</b>

### Lab Experiments:

#### Practical List - 1

1. Create the following Tables and Insert the below data.

#### Salesmen

SNUM	SNAME	CITY	COMMISSION
-----			
1001	Piyush	London	12 %
1002	Sejal	Surat	13 %
1004	Miti	London	11 %
1007	Rajesh	Baroda	15 %
1003	Anand	New Delhi	10 %

SNUM : A unique number assigned to each salesman.

SNAME : The name of salesman.

CITY : The location of salesmen.

COMMISSION: The Salesmen's commission on orders.

## Customers

CNUM	CNAME	CITY	RATING	SNUM
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2001	Harsh	London	100	1001
2002	Gita	Rome	200	1003
2003	Lalit	Surat	200	1002
2004	Govind	Bombay	300	1002
2006	Chirag	London	100	1001
2008	Chinmay	Surat	300	1007
2007	Pratik	Rome	100	1004

CNUM : A unique number assigned to each customer.

CNAME: The name of the customer.

CITY : The location of the customer.

RATING: A level of preference indicator given to this customer.

SNUM : The number of salesman assigned to this customer.

## Orders

ONUM	AMOUNT	ODATE	CNUM	SNUM
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3001	18.69	10/03/97	2008	1007
3003	767.19	10/03/97	2001	1001
3002	1900.10	10/03/97	2007	1004
3005	5160.45	10/03/97	2003	1002
3006	1098.16	10/03/97	2008	1007
3009	1713.23	10/04/97	2002	1003
3007	75.75	10/04/97	2004	1002
3008	4723.00	10/05/97	2006	1001
3010	1309.95	10/06/97	2004	1002
3011	9891.88	10/06/97	2006	1001

ONUM : A unique number assigned to each order.

AMOUNT: The amount of an order.

ODATE: The date of an order.

CNUM : The number of customer making the order.

SNUM : The number of salesman credited with the sale.

### **Practical List - 2**

- 1) Alter salesman table by setting snum as primary key.
- 2) Alter customer table by setting cnum as primary key.
- 3) Alter orders table by setting onum as primary key.
- 4) Alter orders table by adding snum and cnum as foreign keys
- 5) Alter customer table by adding snum as foreign keys
- 6) Insert any five records in customers table.
- 7) Update the name of the customer in the customers table from Lalit to Girish
- 8) Remove all orders from customer Chirag from the orders table.

### **Practical List - 3**

1. Produce the order no, amount and date of all orders.
2. Give all the information about all the customers with salesman number 1001.
3. Display the following information in the order of city, sname,snum and commission.
4. List of rating followed by the name of each customer in Surat.
5. List of all orders for more than Rs. 1000.
6. List all customers whose names begins with letter 'A' to 'G'.
7. List of names and cities of all salesmen in London with commission above 10%.
8. List all customers excluding those with rating  $\leq 100$  unless they are located in Rome.
9. List all orders for more than Rs.1000 except the orders of snum<1006 of 10/03/97.
10. List all orders with zero or NULL amount.

### **Practical List - 4**

- 1) Display cnum, cname, city from customer details table.
- 2) Display all snum without duplicates from all orders.
- 3) Display names and commissions of all salespeople in London.

- 4) All customers who were either located in Rome or had a rating above 200.
- 5) All customers with NULL values in city column.
- 6) All orders taken on Oct 3Rd and Oct 4th 1997.
- 7) Largest order taken by each salesperson with order value more than \$3000.
- 8) Select each customer's smallest order.
- 9) Count the number of salespeople currently listing orders in the order table.
- 10) All customers serviced by Piyush or Miti.

**Practical List - 5**

Solve the following using PL/SQL Block.

- 1) Reverse of a Number
- 2) Factorial of a number
- 3) Write a PL/SQL to update the rate field by 20% more than the current rate in inventory table which has the following fields: ProNo, ProName and Rate. After updating the table a new field (Alter) called for Number of item and place for values for the new field without using PL/SQL block.
- 4) Write a PL/SQL to split the student table into two tables based on result (One table for —Pass| and another for —Faill). Use cursor for handling records of student table. Assume necessary fields and create a student details table.

<b>B21PTM301/ B21DAM301</b>	<b>Soft Skills</b>
<b>Duration :16Wks</b>	

<b>B21DAM302</b>	<b>Skill Development Program</b>
<b>Duration :16Wks</b>	

## FOURTH SEMESTER

Course code	Course Title	Course Type	L	T	P	C	Hrs./Wk.
B21AHK402	Language IV: Kannada	FC	1	1	0	2	3

### Course Description

ಭಾಷೆಯನ್ನು ಮಾತನಾಡುವ ಬರೆಯುವ ಕೌಶಲ್ಯ, ಸಾಹಿತ್ಯದ ಬಗ್ಗೆ ಸ್ಥೂಲವಾಗಿ ಪರಿಚಯಿಸುವ ಮೂಲಕ ವಿದ್ಯಾರ್ಥಿಗಳ ವ್ಯಕ್ತಿತ್ವ ವಿಕಾಸ ಹಾಗೂ ಸ್ಪರ್ಧಾತ್ಮಕ ಪರೀಕ್ಷೆಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು, ಪ್ರಸ್ತುತ ಸಂದರ್ಭಕ್ಕೆ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಸಜ್ಜುಗೊಳಿಸಲು ಪಠ್ಯವನ್ನು ರೂಪಿಸಲಾಗಿದೆ. ಸಾಹಿತ್ಯ, ಕಲೆ, ವಾಣಿಜ್ಯ, ಆಡಳಿತಾತ್ಮಕ ಮತ್ತು ವಿಜ್ಞಾನದ ವಿಚಾರಗಳಿಗೆ ಒತ್ತನ್ನು ನೀಡಲಾಗಿದೆ. ಇದು ಮೊದಲ ಎರಡು ಸೆಮಿಸ್ಟರ್ ಮೂರು ಕ್ರೆಡಿಟ್‌ಗಳನ್ನು; ಮೂರು ಮತ್ತು ನಾಲ್ಕನೇ ಸೆಮಿಸ್ಟರ್ ಎರಡು ಕ್ರೆಡಿಟ್‌ಗಳನ್ನು ಹೊಂದಿದೆ.

### Pre-requisite:

- ಕನ್ನಡ ಭಾಷೆಯ ಬಗೆಗೆ ಪ್ರಾಥಮಿಕ ತಿಳುವಳಿಕೆ ಅಗತ್ಯ..
- ಭಾಷೆಯನ್ನು ಓದಲು ಮತ್ತು ಬರೆಯಲು ತಿಳಿದಿರಬೇಕು.
- ಪದವಿ ಪೂರ್ವ ಶಿಕ್ಷಣದಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯನ್ನು ಓದಿರಬೇಕು.

### Pedagogy:

- Direct method
- ICT and Digital support (Links attached)
- Collaborative and Cooperative learning
- Differentiated Instruction
- Flipped Classroom

### Course Objectives:

ನಾಲ್ಕು ಸೆಮಿಸ್ಟರ್‌ಗಳಲ್ಲಿ ಸಮಗ್ರ ಕನ್ನಡ ಸಾಹಿತ್ಯವನ್ನು ಪರಿಚಯಿಸುವ ಉದ್ದೇಶವನ್ನು ಹೊಂದಿದೆ. ಅದರಂತೆ ನಾಲ್ಕನೇ ಸೆಮಿಸ್ಟರ್‌ನಲ್ಲಿ ದಲಿತ - ಬಂಡಾಯ ಕಾವ್ಯ, ಸ್ತ್ರೀವಾದಿ ಕಾವ್ಯ, ಸಮಕಾಲೀನ ಕಾವ್ಯ, ಆಡಳಿತಾತ್ಮಕ ಕನ್ನಡ, ವೈಜ್ಞಾನಿಕ ಲೇಖನಗಳು ಮತ್ತು ಕಾದಂಬರಿ ಸಾಹಿತ್ಯವನ್ನು ಪಠ್ಯವನ್ನಾಗಿ ಆಯ್ಕೆ ಮಾಡಿಕೊಂಡು, ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯದ ಬಗ್ಗೆ ಸದಭಿರುಚಿಯನ್ನು ಮೂಡಿಸಲಾಗುತ್ತದೆ. ಸಾಂಸ್ಕೃತಿಕ ತಿಳುವಳಿಕೆಯ ಜೊತೆಗೆ ವ್ಯಕ್ತಿತ್ವ ವಿಕಾಸದ ಕಡೆಗೆ ಗಮನ ನೀಡಲಾಗುತ್ತದೆ.

- ಭಾಷೆ, ಸಾಹಿತ್ಯ, ಇತಿಹಾಸ ಮತ್ತು ಸಂಸ್ಕೃತಿಗಳನ್ನು ಕನ್ನಡ, ಕರ್ನಾಟಕಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ಪರಿಚಯಿಸಲಾಗುತ್ತದೆ.



- ವಿದ್ಯಾರ್ಥಿಗಳ ಸರ್ವತೋಮುಖ ಬೆಳವಣಿಗೆಗೆ ಅನುವಾಗುವಂತೆ ಹಾಗೂ ಅವರಲ್ಲಿ ಮಾನವ ಸಂಬಂಧಗಳ ಬಗ್ಗೆ ಗೌರವ, ಸಮಾನತೆ ಮೂಡಿಸಿ, ಬೆಳೆಸುವ ನಿಟ್ಟಿನಲ್ಲಿ ಪಠ್ಯಗಳ ಆಯ್ಕೆಯಾಗಿದೆ.
- ಅವರಲ್ಲಿ ಸೃಜನಶೀಲತೆ, ಶುದ್ಧ ಭಾಷೆ, ಉತ್ತಮ ವಿಮರ್ಶಾ ಗುಣ, ನಿರರ್ಗಳ ಸಂಭಾಷಣೆ, ಭಾಷಣ ಕಲೆ ಹಾಗೂ ಬರಹ ಕೌಶಲ್ಯಗಳನ್ನು ಬೆಳೆಸುವುದು ಗುರಿಯಾಗಿದೆ
- ಸ್ಪರ್ಧಾತ್ಮಕ ಪರೀಕ್ಷೆಗಳಿಗೆ ಅನುಕೂಲವಾಗುವಂತಹ ವಿಷಯಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ಸೂಕ್ತ ಪಠ್ಯಗಳನ್ನು ಆಯ್ಕೆ ಮಾಡಿಕೊಳ್ಳಲಾಗಿದೆ.

### Course Outcomes:

ದಲಿತ - ಬಂಡಾಯ ಕಾವ್ಯ, ಸ್ತ್ರೀವಾದಿ ಕಾವ್ಯ, ಸಮಕಾಲೀನ ಕಾವ್ಯ, ಆಡಳಿತಾತ್ಮಕ ಕನ್ನಡ, ವೈಜ್ಞಾನಿಕ ಲೇಖನಗಳು ಮತ್ತು ಕಾದಂಬರಿಯ ಸಾಹಿತ್ಯ ಕಲಿಕೆಯ ಮೂಲಕ ಕಾಲದ ಸ್ಥಿತ್ಯಂತರಗಳನ್ನು ಅದರ ಒಳನೋಟಗಳನ್ನು ಬೆಳೆಸುತ್ತದೆ.

- ಸಾಮಾಜಿಕ, ರಾಜಕೀಯ, ಧಾರ್ಮಿಕ, ಸಾಂಸ್ಕೃತಿಕ, ಪರಿಸರ ಹಾಗೂ ಲಿಂಗಸಂಬಂಧಿ ವಿಚಾರಗಳೆಡೆ ಗಮನ ಹರಿಸುವುದರೊಂದಿಗೆ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಚರ್ಚಾ ಮನೋಭಾವವು ಬೆಳೆಯುತ್ತದೆ.
- ಜೀವನದಲ್ಲಿ ಬರುವ ಅಭಿಪ್ರಾಯ ಬೇಧಗಳು, ಸಮಸ್ಯೆಗಳನ್ನು ಆಧುನಿಕ ಸಂದರ್ಭದಲ್ಲಿ ಮಾನವೀಯತೆಯೊಂದಿಗೆ ನಿರ್ವಹಿಸುವಂತೆ ಪ್ರೇರೇಪಿಸುತ್ತದೆ.
- ಉತ್ತಮ ಸಂವಹನ ಕಲೆಯನ್ನು ಬೆಳೆಸುವ ಉದ್ದೇಶವನ್ನು ಈಡೇರಿಸುತ್ತದೆ.
- ಸಂಶೋಧನಾ ಮನೋಭಾವ ಮತ್ತು ಸ್ಪರ್ಧಾತ್ಮಕ ಪರೀಕ್ಷೆಗಳಿಗೆ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಸಜ್ಜುಗೊಳಿಸುತ್ತದೆ.

## COURSE CONTENT

### Unit – I

7 Hours

1. ಸಿದ್ಧಲಿಂಗಯ್ಯ: ಚೋಮನ ಮಕ್ಕಳ ಹಾಡು
2. ವೀ.ಚಿಕ್ಕವೀರಯ್ಯ: ಇಲ್ಲ ಬಿಡುಗಡೆ ನಮಗೆ
3. ಹೆಚ್.ಎಸ್.ಶಿವಪ್ರಕಾಶ್: ಮಗು ಮತ್ತು ಹೆಣ್ಣುಗಳು

### Unit – II

7 Hours

1. ಚ.ಸರ್ವಮಂಗಲ: ತಡೆ
2. ವಿ.ಆರ್.ಕಾರ್ಪೆಂಟರ್: ಧ್ಯಾನಸ್ತ ಬಂಗಲೆಗಳು
3. ಭುವನ ಹಿರೇಮಠ: ಟ್ರಯಲ್ ರೂಮಿನ ಅಪ್ಪರೆಯರು

### Unit – III

6 Hours

1. ಪತ್ರಲೇಖನ ಮತ್ತು ವರದಿಗಳ ತಯಾರಿ
2. ಟಿ.ಜಿ.ಶ್ರೀನಿಧಿ:ವಿಜ್ಞಾನ ಸಂವನಕ್ಕೆ ಆಧುನಿಕ ತಂತ್ರಜ್ಞಾನದ ಸವಲತ್ತುಗಳು
3. ಹೆಚ್.ಮರಸಿಂಹಯ್ಯ: ವಿಜ್ಞಾನ ಮತ್ತು ಸಮಾಜ

### Unit – VI

6 Hours

## 1. ಶ್ರೀಕೃಷ್ಣ ಆಲನಹಳ್ಳಿ: ಕಾಡು (ಆಯ್ದು ಭಾಗ)

### ಪರಾಮರ್ಶನ ಗ್ರಂಥಗಳು :

1. ಮುಗಳಿ ರಂ.ಶ್ರೀ., ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ, ಪ್ರಕಾಶಕರು ಗೀತಾ ಬುಕ್ ಹೌಸ್, ಮೈಸೂರು. 2014
2. ಸೀಮಾತೀತ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ ಸಂಪುಟ 1,2,3,4,5 ಮತ್ತು 6, ಕುವೆಂಪು ಕನ್ನಡ ಅಧ್ಯಯನ ಸಂಸ್ಥೆ, ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ಮೈಸೂರು. 2014
3. ಡಾ. ಅರವಿಂದ ಮಾಲಗತ್ತಿ, ಸಾಹಿತ್ಯ ಸಂಸ್ಕೃತಿ ಮತ್ತು ದಲಿತ ಪ್ರಜ್ಞೆ, ಪ್ರಕಾಶಕರು ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್ತು, ಬೆಂಗಳೂರು. 2014
4. ಡಾ. ಈ.ಎಸ್. ಆಮೂರ, ಕನ್ನಡ ಕಥನ ಸಾಹಿತ್ಯ : ಕಾದಂಬರಿ, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2016
5. ದೇಶಪಾಂಡೆ ಎಸ್.ಎಲ್., ಬೇಂದ್ರೆ ಶರೀಫರ ಕಾವ್ಯಾಯಾನ, ಪ್ರಕಾಶಕರು ದೇಸಿ ಪುಸ್ತಕ, ಬೆಂಗಳೂರು. 2013
6. ಕೀರ್ತನಾಥ ಕುರ್ತಕೋಟಿ, ಕನ್ನಡ ಸಾಹಿತ್ಯ ಸಂಗಾತಿ, ಪ್ರಕಾಶಕರು ಕುರ್ತಕೋಟಿ ಮೆಮೋರಿಯಲ್ ಟ್ರಸ್ಟ್, ಧಾರವಾಡ. 2009
7. ಶಾಮರಾಯ ತ.ಸು., ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ, ಪ್ರಕಾಶಕರು ತಳುಕಿನ ವೆಂಕಣ್ಣಯ್ಯ ಸ್ಮಾರಕ ಗ್ರಂಥಮಾಲೆ, ಮೈಸೂರು - 2014
8. ಸಂ. ಡಾ! ಸಿ. ಆರ್. ಚಂದ್ರಶೇಖರ್, ಮುಂದಾಳುತನದ ಲಕ್ಷಣಗಳನ್ನು ಬೆಳೆಸಿಕೊಳ್ಳುವುದು ಹೇಗೆ?, ಪ್ರಕಾಶಕರು ನವಕರ್ನಾಟಕ ಪಬ್ಲಿಕೇಷನ್ಸ್ ಪ್ರೈವೆಟ್ ಲಿಮಿಟೆಡ್. 2010
9. ಆಧುನಿಕ ಕನ್ನಡ ಕಾವ್ಯ ಭಾಗ-2, ಕುವೆಂಪು ಕನ್ನಡ ಅಧ್ಯಯನ ಸಂಸ್ಥೆ, ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ಮೈಸೂರು. 2004
10. ಶಿವರುದ್ರಪ್ಪ ಜಿ.ಎಸ್. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಸಮೀಕ್ಷೆ, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2013

Course code	Course Title	Course Type	L	T	P	C	Hrs./Wk.
B21AHH402	Language IV: Hindi	FC	1	1	0	2	3

### Course Description:

यह पाठ्यक्रम नौसिखियाअपनी भाषा की क्षमता का विकास करने हेतु तथा विभिन्न साहित्यिक प्रक्रियाओं द्वारा , | संस्कृति एवं जीवन के मूल्यों को समझने हेतु अभिकल्पित है ,समाज

### Prerequisites:

- अध्येता, पी.यु.सी के स्तर पर द्वितीय भाषा के रूप में हिन्दी का अध्ययन करना चाहिए |
- हिन्दी साहित्य के इतिहास का संक्षिप्त ज्ञान की आवश्यकता है |
- हिन्दी व्याकरण का अवबोधन आवश्यक है |
- अंग्रेज़ी – हिन्दी अनुवाद से संबंधित जानकारी जरूरी है |

### Course Objectives:

1. संदर्भानुसार उचित भाषा का प्रयोग करने की दक्षता को छात्रों में उत्पन्न करना ।
2. साहित्य के माध्यम से समाज एवं मानवीय मूल्यों को समझाकर, उन मूल्यों की रक्षा हेतु प्रेरित करना।
3. छात्रों में पुस्तक पठन एवं लेखन की अकृतिम प्रवृत्ति स्थापित करना ।
4. अध्येताओं में साहित्य के माध्यम से प्रभावी एवं कुशल संचार का विकास करना ।

### Course Outcomes:

अध्ययन की समाप्ति पर अध्येता –

1. सामाजिक मूल्य एवं नैतिक जवाबदेही को स्वीकार कर सकता है ।
2. साहित्य की प्रासंगिकता को जीवन में समझने की दक्षता रखता है ।
3. समाज में अंतर्निहित पद्धतियाँ एवं विचारधाराओं का व्याख्यान करने में सक्षम बन सकता है ।
4. साहित्य के माध्यम से प्रभावी एवं कुशल संचार का विकास करसकता है ।

### Course Contents:

**Unit – 1:** [7 Hours]

उपन्यास -दौड़ – ममता कालिया

**Unit – 2:** [7 Hours]

उपन्यास -दौड़ – ममता कालिया

**Unit –3:** [6 Hours]

उपन्यास -दौड़ – ममता कालिया

**Unit -4:** [6 Hours]

भाषाई कम्प्युटर

1 यूनिकोड की वर्तमान स्थिति

आ ब्लॉग लेखन

1 ब्लॉग लेखन का महत्व

2 हिन्दी में ब्लॉग लेखन की प्रविधि

सूचना : प्रत्येक इकाई 25 अंक के लिए निर्धारित है ।

**Text Books:**

उपन्यास -दौड़ – ममता कालिया

**Reference Book:**

1. हिन्दी उपन्यास का विकास – मधुरेश
2. हिन्दी टंकण सिद्धान्त – शिवनारायण चतुर्वेदी
3. हिन्दी साहित्य का इतिहास - डॉ. नागेन्द्र
4. आधुनिक हिन्दी साहित्य का इतिहास - डॉ. बच्चन सिंह
5. हिन्दी साहित्य का नवीन इतिहास - डॉ. लाल साहब सिंह
6. शुद्ध हिन्दी कैसे बोले कैसे लिखे- पृथ्वीनाथ पाण्डे
7. प्रयोजनमूलक हिन्दी – डॉ.अम्बादास देशमुख
8. कंप्यूटर के भाषिक अनुपयोग-विजयकुमार मलहोत्रा

Course Code	Course Title	Course Type	L	T	P	C	Hrs./Wk.
B21AHA401	Language IV: Additional English	FC	1	1	0	2	3

**Course Description:**

This 2-credit course helps the learner explore various socio-cultural issues through literature. The course provides insight on matters like education and culture that are pertinent in the contemporary society. The course also offers multi-dimensional perspective in the genres of literature and contributes for language enrichment.

**Prerequisites:** The student must possess fair knowledge of language, literature, culture and society.

**Pedagogy:** Collaborative Method, Flipped Classroom, Blended Learning

**Course Objectives:**

- To infer the myths from the contemporary perspective.
- To outline the idea of family represented in literature.
- To interpret horror and suspense as a genre of literature.
- To assess the impact of education in building a society.

**Course Outcome:**

On completion of the course, learners will be able to:

- Examine the relevance of myths and mythology.
- Demonstrate family values and ethics essential to live in the society.
- Analyze horror and suspense as a significant genre of literature.

- Evaluate the applicability of academic contribution in building a society.

### Course Contents:

#### **Unit-I: Myths & Mythology** **6 hours**

John W. May – Narcissus

W.B. Yeats – The Second Coming

Devdutt Pattanaik - *Shikhandi and the Other Stories They Don't Tell you* (Extracts)

#### **Unit-II: Family & Relationships** **6 hours**

Nissim Ezekiel – Night of the Scorpion

Langston Hughes – Mother to Son

Kate Chopin – The Story of an Hour

Henrik Ibsen – A Doll's House (Extract)

#### **Unit-III: Horror & Suspense** **7 hours**

Edgar Allan Poe – The Raven

Bram Stoker – A Dream of Red Hands

Satyajit Ray – Adventures of Feluda (Extract)

#### **Unit-IV: Education** **7 hours**

The Dalai Lama – The Paradox of Our Times

Kamala Wijeratne – To a Student

Sudha Murthy – In Sahyadri Hills, a Lesson in Humility

Frigyes Karinthy – Refund

#### **Reference Books:**

- Finneran, Richard J. *The Collected Works of W.B. Yeats*(Volume I: The Poems: Revised Second Edition). Simon & Schuster, 1996.
- Pattanaik, Devdutt. *Shikhandi: And Other 'Queer' Tales They Don't Tell You*. Penguin Books, 2014.
- Ezekiel, Nissim. *Collected Poems* (With A New Introduction By John Thieme). OUP, 2005.
- Hughes, Langston. *The Collected Poems of Langston Hughes*. Vintage, 1995.
- Chopin, Kate. *The Awakening and Selected Stories of Kate Chopin*. Simon & Schuster, 2004.
- Ibsen, Henrik. *A Doll's House*. Maple Press, 2011.
- Poe, Edgar Allan. *The Complete Poetry of Edgar Allan Poe*. Penguin USA, 2008.
- Stoker, Bram. *Dracula*. Fingerprint Publishing, 2013.
- Ray, Satyajit. *The Complete Adventures of Feluda* (Vol. 2). Penguin Books Ltd., 2015.
- Lama, Dalai. *Freedom In Exile: The Autobiography of the Dalai Lama of Tibet*. Little, Brown Book Group, 1998.
- Murthy, Sudha. *Wise and Otherwise: A Salute to Life*. Penguin India, 2006.

<b>B21DA0401</b>	<b>Data Mining &amp; Data Warehousing</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

### Course Description:

Data Mining studies algorithms and computational paradigms that allow computers to find patterns and regularities in databases, perform prediction and forecasting, and generally improve their performance through interaction with data. The subject of data mining deals with methods for developing useful decision-making information from large databases. Using a combination of procedures from statistics, mathematics, and computer science, analysts “mine the data” in the warehouse to convert it into useful information, hence the name data mining.

### Prerequisites:

Basic knowledge database and Data Warehousing concepts.

### Course Objectives:

The objectives of this course are to:

1. Relate data Mining principles and techniques and introduce Data Mining as a cutting edge business intelligence.
2. Discover interesting patterns, to analyze supervised and unsupervised models and estimate the accuracy of the algorithms.
3. Identify Applications and Trends of Data mining.
4. Expose the students to the concepts of Data Warehousing Architecture and Implementation.

### Course Outcomes:

On completion of this course the student shall be able to:

1. Discover and measure interesting patterns from different kinds of databases.
2. Evolve Multidimensional Intelligent model from typical system.
3. Discover the knowledge imbibed in the high dimensional system.
4. Evaluate various mining techniques on complex data objects.

### Course Contents:

#### UNIT 1:

[13 Hours]

**Data Mining**–Introduction - Basic data mining tasks – data mining versus knowledge discovery in databases – Data mining issues – Data mining metrics – Social implications of data mining – Data mining from a database perspective.

**Data Mining Techniques:**Introduction – A Statistical Perspective on data mining – Similarity Measures – Decision Trees.

**UNIT 2:****[13 Hours]**

**Classification:** Introduction – Issues in Classification - Statistical – based algorithms - Distance – based algorithms – Decision tree - based algorithms.

**Clustering:** Introduction – Similarity and Distance Measures – Outliers – Hierarchical Algorithms: Agglomerative Algorithms – Divisive Algorithms - Partitioned Algorithms: Minimum Spanning Tree – Squared Error Clustering algorithm – K-Means Clustering – Nearest neighbor algorithm.

**UNIT 3:****[13 Hours]**

**Association rules:** Introduction - Large item sets - Basic algorithms: Apriori algorithm –Advanced Association Rules Techniques – Measuring the quality of rules.

**Data Mining Applications:** Data Mining for Financial Data Analysis - Data Mining for the Retail Industry - Data Mining for the Telecommunication Industry - Data Mining for Intrusion Detection.

**UNIT 4:****[13 Hours]**

**Data Warehouse Basic concepts :** What is a Data Warehouse – Differences between operational database systems and Data Warehouses – Multi-tiered Architecture – Data Warehouse models – Extraction, Transformation and Loading – Metadata repository.

**Data Warehouse modeling:** Data Cube and OLAP – Data cube: A Multidimensional Data model – Schemas for multidimensional data models – Dimensions: The role of concept hierarchies – Measures: Their categorization and computation – Typical OLAP operations.

**Text Books:**

1. Margaret H. Dunham, “DATA MINING INTRODUCTORY AND ADVANCED TOPICS”, Pearson education, 2003. (Units 1, 2 and 3)
2. Jiawei Han, Micheline Kamber & Jian Pei, “DATA MINING CONCEPTS AND TECHNIQUES”, Morgan Kaufmaan Publishers, 2011. (Unit 3 and 4)

**Reference Books:**

1. Arun K. Pujari, “DATA MINING TECHNIQUES”, Universities Press (India) Pvt. Ltd., 2003.
2. Alex Berson, Stephen J. Smith, “DATA WAREHOUSING, DATA MINING & OLAP”, TMCH, 2001.
3. G. K. Gupta, “INTRODUCTION TO DATA MINING WITH CASE STUDIES”, Easter Economy Edition, Prentice Hall of India, 2006.
2. 4. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “INTRODUCTION TO DATA MINING”, Pearson Education, 2007.

<b>B21DA0402</b>	<b>Operating Systems with Linux</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>

### Course Description:

It provides a clear description of the concepts that underlie operating systems, what operating systems are, what they do, and how they are designed, constructed, process management and memory management. This Course also covers Linux development, shell programming, System administration. Linux is a family of multitasking, multiuser computer operating systems. The sheer existence of this operating system over the past three decades itself speaks for its strength. It offers word –processing capability, networking facility, information retrieval and processing, and much more.

### Prerequisites:

Basics of Digital Logic, Data structures, programming languages, and computer architecture.

### Course Objectives:

The objectives of this course are to:

1. Enabling Knowledge: the operation, implementation and performance of modern operating systems, and the relative merits and suitability of each for complex user applications
2. Critical Analysis: Ability to compare, contrast, and evaluate the key trade-offs between multiple approaches to operating system design, and identify appropriate design choices when solving real-world problems
3. Expose the design of the LINUX operating system.
4. Illustrate various commands of the LINUX OS.
5. Demonstrate the different types of filters used in LINUX.

### Course Outcomes:

On completion of this course the student shall be able to:

1. Identify the basic principles adopted in the design of modern operating systems.
2. Explain the objectives and functions of modern operating systems.
3. Describe how computing resources are used by application software and managed by system software.
4. Analyze, Design and interpret the concepts of shell programming.

### Course Contents:

#### UNIT 1:

[10 Hours]

**Introduction:**Batch Systems, Multiprogramming and Time Sharing, Parallel, Distributed and real time Systems, Operating System Structures, Components & Services, System calls,.

**Process Management:** Process Concept, Process Scheduling, Threads, Inter process communication, CPU Scheduling Criteria, Scheduling algorithm, Multiple Processor Scheduling,. The Critical Section Problem,



Synchronization hardware, Semaphores, Classical problems of synchronization

**UNIT 2:** [10 Hours]

**Dead locks** – System model, Characterization, Dead lock prevention, avoidance and detection, Recovery from dead lock,. Memory Management: Logical and Physical address space, Swapping, Contiguous allocation, Paging, Segmentation, Virtual memory-Demand paging and its performance, Page replacement algorithms, Allocation of frames.

**UNIT 3:** [10 Hours]

**Introduction and Interacting with shell and Desktop to Linux:**Introduction and Installing of Red Hat and Ubuntu Linux Operating System, History, salient features, Linux system architecture, Linux command format, Linux internal and external commands, Directory commands, File related commands, Disk related commands, general utilities. shell types, shell command line processing, shell script features, executing a shell script, system and user-defined variables, expr command, read and echo statement, command substitution, escape sequence characters, shell script arguments, positional parameters, test command, file test, string test, numeric test.

**UNIT 4:** [09 Hours]

**Basic Linux Administration** :Conditional Control Structures-if statement, case statement Looping Control Structure-while, until, for, statements. Jumping Control Structures – break, continue, and exit. Special Tools and Utilities: Filters, Stream editor SED and AWK, Linux System Communication: Introduction, write, read, wall commands, sending and handling mails. System Administration: Roles of a System Administrator,

**Text Books:**

1. Abraham Silberschatz and Peter Baer Galvin, “OPERATING SYSTEM CONCEPTS”, 8th Edition, Pearson Education, 2002. [chapter : 1,2,3,4,5,6,7,8,]
2. M.G.Venkateshmurthy, “INTRODUCTION TO UNIX & SHELL PROGRAMMING”, First Edition, Pearson Education, 2004. [chapter 8,9,12]
3. Richard Petersen, “THE COMPLETE REFERENCE LINUX “ sixth Edition Petersen Tata McGraw Hill [chapter 1]
4. Kernighan B W & Robert B, “THE UNIX PROGRAMMING ENVIRONMENT”.

**Reference Books:**

1. H.M.Deitel, “OPERATING SYSTEMS”, Pearson Learning Solutions, 3rd Edition, 2003.
2. William Stallings, “OPERATING SYSTEMS”, 6th Edition, Pearson Education, 2010.
3. Sumithaba Das, “UNIX: CONCEPTS AND APPLICATIONS”
4. ArchanaVerma, “UNIX AND SHELL PROGRAMMING”, Firewall Media.

<b>B21DA0403</b>	<b>Python Programming</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

### Course Description:

The Python course is intended to introduce the basics and features of Python Language and functions, classes and objects in python. The Students are suggested to install Python and also install any of the IDEs-Anaconda a Scientific environment for Python, if they wish to. Work with all the simple programs so that they get acquainted with the syntax of the various constructs in Python.

### Prerequisites:

Basic knowledge of programming concepts and Computer Programming terminologies.

### Course Objectives:

The objectives of this course are :

1. Define the implementation of Python Programming Language Features
2. Discuss various Programming Constructs in Python Language
3. Develop the solution for the given problem statement using the concept of Sub Programming
4. Demonstrate OOPs concept

### Course Outcomes:

On completion of this course the student shall be able to:

1. Understand the Basic Terminologies used in python programming
2. Comprehend Branching and Looping statements in Python Programming
3. Apply the concept of Functions in Problem solving.
4. Implement the concepts of Classes, Objects & Inheritance

### Course Contents:

**UNIT 1:** **[13 Hours]**

**Introduction to Python:** Introduction of python, origin, Programming Basics and Strings, Numbers and Operators, Variables Names for Values, Program Files, Directories ,Changing Data Through Names, Copying Data, Accessing a Tuple Through Another Tuple.

**UNIT2:** **[13 Hours]**

**Decision making in Python:** Making Decisions: Comparing Values for Sameness, Comparing Values for Difference, More Than or Equal, Less Than or Equal, Reversing True and False, Repetition, Handling Errors.

**UNIT 3:** **[13 Hours]**

**Functions in Python:** Functions: Grouping Code under a Name, Describing a Function in the Function, Layers

of Functions

**UNIT 4 :**

**[13 Hours]**

**Classes and Objects in Python:**Classes and Objects: What is an Object, Defining a Class, Creating an Object from the Class, Objects and their Scope, Inheritance, Overriding a method, Writing simple programs using classes and object sin Python.

**Text Books:**

1. Bill Lubanovic, “Introducing Python”, Oriely Publications, 1st Edition, (chapters 1-6).
2. Michael Dawson, “Python Programming for absolute beginners”, Course Technology-A part of CENGAGE Learning, 3rd Edition.

<b>B21DAS411</b>	<b>Mobile Computing</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>

**Course Description:**

With the increasing popularity of mobile devices, mobile computing has become part of our daily life. This course will cover various topics of mobile computing, networking, and systems, including but not limited to: applications of smartphones, cellular networks, embedded sensor systems, localization systems, energy efficiency of mobile devices, wearable and vehicular mobile systems, mobile security, virtual reality and augmented reality.

**Prerequisites:**

General understanding of computer networks, basic programming skills, and interpreting skills in algorithms.

**Course Objectives:**

The objectives of this course are to:

1. Identify the basic concepts of mobile computing.
2. Familiar with the network protocol stack.
3. Illustrate the basics of mobile telecommunication system.
4. Exposed to Ad-Hoc networks.
5. Explore about different mobile platforms and application development.

**Course Outcomes:**

On completion of this course the student shall be able to:

1. Explain the basics of mobile Computing
2. Describe the functionality of Mobile IP and Transport Layer
3. Classify different types of mobile telecommunication systems

4. Demonstrate the Adhoc networks concepts and its routing protocols
5. Make use of mobile operating systems in developing mobile applications

### Course Contents:

#### **UNIT 1:** [10Hours]

**Introduction:** Mobile Computing – Mobile Computing Vs wireless Networking – Mobile Computing Applications – Characteristics of Mobile computing – Structure of Mobile Computing Application. MAC Protocols – Wireless MAC Issues – Fixed Assignment Schemes – Random Assignment Schemes – Reservation Based Schemes.

#### **UNIT 2:** [10 Hours]

**Mobile Internet Protocol and Transport Layer:** Overview of Mobile IP – Features of Mobile IP – Key Mechanism in Mobile IP – route Optimization. Overview of TCP/IP – Architecture of TCP/IP- Adaptation of TCP Window – Improvement in TCP Performance.

#### **UNIT 3:** [10 Hours]

**Mobile Ad Hoc Networks:** A Few Basics Concepts, How is an Ad Hoc Network Set Up without the Infrastructure Support- Why is Routing in a MANET a Complex Task? -Battery Basics - Characteristics of Mobile Ad Hoc Networks (MANETs) - MANET Operational Constraints - Applications of MANETs- MANET Design Issues- Routing - Essentials of Traditional Routing Protocols, Link State Protocols (LSP) - Distance Vector (DV) Protocols -Routing in MANETs: A Few Basic Concepts, Routing in MANETs vs. Routing in Traditional Networks- A Classification of Unicast MANET Routing Protocols - Features of MANET Routing Protocols -Security Issues in a MANET.

#### **UNIT 4:** [09Hours]

**Mobile Platforms And Applications:** Basic Concepts, Mobile Device Operating Systems – Special Constrains & Requirements ,A survey of Commercial Mobile Operating Systems –windows mobile, palm OS, Symbian,iOS, Android, BlackBerry, OS for Sensor Networks.

#### **Text Book:**

1. Prasant Kumar Pattnaik, Rajib Mall, “FUNDAMENTALS OF MOBILE COMPUTING”, PHI Learning Pvt. Ltd, New Delhi – 2012.(unit 1 to 4)

#### **References:**

1. Jochen H. Schller, “MOBILE COMMUNICATIONS”, Second Edition, Pearson Education, New Delhi, 2007.
2. Dharma Prakash Agarwal, Qing and AnZeng, “INTRODUCTION TO WIRELESS AND MOBILE SYSTEMS”, Thomson Asia Pvt Ltd, 2005.
3. UweHansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, “PRINCIPLES OF MOBILE COMPUTING”, Springer, 2003.
4. William.C.Y.Lee, “MOBILE CELLULAR TELECOMMUNICATIONS-ANALOG AND DIGITAL SYSTEMS”, Second Edition, Tata McGraw Hill Edition ,2006.
5. C.K.Toh, “ADHOC MOBILE WIRELESS NETWORKS”, First Edition, Pearson Education, 2002.

6. Android Developers : <http://developer.android.com/index.html>

<b>B21DAS412</b>	<b>Computer Graphics</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>

### Course Description:

This 21st century is characterized as Knowledge based society where Computers plays vital role. Computer graphics is an interesting branch of computer applications. There exist voluminous amount of data to be visualized in Engineering, Science, Education, Business, Government, Industry, Agriculture, Medical...etc. These data is to be processed and depicted as pictorial representation using computers. Computers graphics deals with creation, manipulation , display and storage of pictures using digital computers.

### Prerequisites:

Knowledge on C/C++/ Java programming , basic mathematics.

### Course Objectives:

The objectives of this course are to:

1. Explain the procedure to design of graphics systems for Two Dimensional and Three dimensional graphics with their transformation, viewing and clipping techniques
2. Provide a comprehensive introduction to computer graphics with applications
3. Illustrate both graphics hardware and graphics software
4. Introduces 3D graphics display methods and object representation

### Course Outcomes:

On completion of this course the student shall be able to:

1. Recall basic algebra using mathematics and conceptualize the basics of computer graphics, analyze different graphics systems and applications of computer graphics
2. Implement and analyze various algorithms for creating geometric primitives and construct novel and complex geometric shapes
3. Compare and Apply various basic geometric transformations on graphics objects and their application in composite form and Extract scene with different clipping
4. Explore projections and visible surface detection techniques for display of 3D

### Course Contents:

#### UNIT 1:

[10 Hours]

**A Survey of Computer Graphics, Overview of Graphics Systems:** Video Display Devices, Refresh Cathode-Ray Tubes, Raster-Scan Displays, Random Scan Displays, Color CRT Monitors, Input Devices. Output Primitives: Points and Lines, Line-Drawing Algorithms, DDA Algorithm, Bresenham's Line Algorithm, Circle-Generating Algorithms, Properties of Circles, Midpoint Circle Algorithm.

**UNIT 2:** [10 Hours]  
**Two Dimensional Geometric Transformations:** Basic Transformation, Matrix Representations and Homogeneous co-ordinates- Composite Transformations, Other Transformations

**UNIT 3:** [10 Hours]  
**Two Dimensional Viewing&Clipping:**The Viewing Pipeline- Viewing Coordinate Reference Frame, Window-to-Viewport Coordinate Transformation, Clipping Operations, Point Clipping, Line Clipping: Cohen-Sutherland Line Clipping, Polygon Clipping: Sutherland-Hodgeman Polygon Clipping, Curve Clipping, Text Clipping, Exterior Clipping

**UNIT 4:** [9 Hours]  
**Three Dimensional Graphics:**Three Dimensional Concepts: Three Dimensional Display Methods, Three Dimensional Object Representations: Polygon Surfaces, Polygon Tables, Plane Equations, Polygon Meshes, Bezier Curves and Surfaces, Octrees. Three Dimensional Geometric and Modeling Transformations

**Textbook:**

1. Donald Hearn & M. Pauline Baker, “COMPUTERGRAPHICS CVERSION”, Second Edition, Pearson, 2013 (Chapter 1, 2,3,5,6,9,10& 11)

**Reference Books:**

1. YeshwantKanetkar, “GRAPHICS UNDERC”, BPB publications, 2003.
2. J.D. Foley, A.V.Dam, S.K. Feiner& J.F. Hughes, “COMPUTERGRAPHICS”, Addison Wesley ,1996
3. Cooley, “THEESSENCEOFCOMPUTERGRAPHICS”, Prentice Hall, 2000.

<b>B21DAS413</b>	<b>Artificial Intelligence</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>

**Course Description:**

Artificial Intelligence is the second booming field after Data mining and Data Science. Although research on this carried out from 1956 after that had seen many ups and downs. Way back from the year 2015 because of the commercial success in Artificial Intelligence, once again AI field has taken up charge. This course not only gives the broad perspective of Artificial intelligence process but also the various techniques, methods and approaches carried out.

**Prerequisites:**

Strong knowledge of Mathematics, Good command over programming languages, Good Analytical Skills, Ability to understand complex algorithms Basic knowledge of Statistics, and modeling.

**Course Objectives:**

The objectives of this course are to:

1. Relate the Artificial Intelligence principles and techniques
2. Introduce the facts and concepts of cognitive science by computational model and their applications
3. Explore problem-solving paradigms, search methodologies and learning algorithms
4. Develop intelligent systems by assembling solutions to concrete computational problems.
5. Explore the role of knowledge representation, problem solving, and learning in intelligent-system engineering.

### Course Outcomes:

On completion of this course the student shall be able to:

1. Apply knowledge of computing and mathematics appropriate to the discipline
2. Analyze a problem, identify and define the computing requirements appropriate to its solution
3. Design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs
4. Design efficient algorithm to achieve optimized solution in complex situation
5. Apply heuristic methodologies in state-space problems
6. Characterize various ways to represent the environmental knowledge and to infer from it.

### Course Contents:

#### UNIT 1:

[10 Hours]

**Artificial Intelligence:** Definition, AI Problems-Task Domains of Artificial Intelligence; The Underlying Assumption - Physical Symbol System Hypothesis; AI technique - Knowledge properties, Knowledge Representation.

**Problems, Problem Spaces and Search:** Steps in building a System; Production Systems; Control Strategies-Requirements of a good control strategy; Problem Characteristics; Production System Characteristics; Issues in the Design of Search programs.

**Heuristic search techniques:** Generate-and-test, Hill Climbing-Simple Hill Climbing, Best First Search, Constraints satisfactions.

#### UNIT 2:

[10 Hours]

**Planning:** Components of a Planning System, Goal Stacks Planning - A very Simple Blocks World Problem; Reactive Systems; Other Planning techniques.

**Knowledge Representation:** Introduction, Definition, Importance, Representation and Mappings-mappings between facts and representations, Representation of Facts; Approaches to Knowledge Representation-Properties, Types of Knowledge; Issues in Knowledge Representation-Important Attributes, Relationship among Attributes.

#### UNIT 3:

[10 Hours]

**Symbolic Reasoning under Uncertainty:** Introduction to Non monotonic Reasoning; Logics for Non monotonic Reasoning-Default Reasoning and Minimalist Reasoning;

**Learning:** Introduction, Different methods of Learning – Rote Learning, Inductive Learning, Reinforcement Learning, Unsupervised Learning, Supervised Learning, Analogy – Derivational and Transformational

**Expert Systems:** Introduction, Rule based and Knowledge based, knowledge acquisition, Maintenance and Manipulations.

**UNIT 4:**

**[09 Hours]**

**Parallel and Distributed AI:** Psychological modeling; Parallelism in Reasoning Systems; Distributed Reasoning Systems

**Prolog:** Introduction; Converting English to Prolog Facts and Rules; Goals; Prolog Terminology; Variables; Control Structures; Arithmetic Operators; Matching in Prolog; Backtracking; Recursion.

**LISP:** Introduction, Syntax and Numeric Functions, Basic List Manipulation Functions, Functions, Predicates and Conditionals Input, Output and Local variables, Iteration and Recursion, Property List and Arrays.

**Text Books:**

1. Elaine Rich, Kevin Knight, Shivashankar B Nair, "Artificial Intelligence", 3rd Edition, Tata McGraw Hill, 2013 – ( Chapter 1 to 7 and Chapter 13 to 17).
2. Dan W. Patterson, " Introduction to Artificial Intelligence and Expert Systems", Prentice Hall of India, 2006 – ( Chapter 4,5,6 and 11 ).

**Reference Books:**

1. Jean-Louis Ermine, "Expert Systems : Theory and Practice", Prentice Hall of India, 1995
2. Stuart Russel, Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Pearson 3rd edition 2013.

<b>B21DAS421</b>	<b>Cyber Security</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>

**Course Description:**

The course covers theory and practice of computer security, focusing on the security aspects of the web and Internet. It surveys cryptographic tools used to provide security, such as shared key encryption (DES, 3DES, RC-4/5/6, etc.); public key encryption, key exchange, and digital signature (Diffie-Hellmann, RSA, DSS, etc.). It then reviews how these tools are utilized in the internet protocols and applications such as SSL/TLS, IPSEC, Kerberos, PGP, S/MIME, SET, and others. System security issues, such as intrusion and firewalls, will also be covered.

**Prerequisites:**

Knowledge on Computer Networks

**Course Objectives:**

The objectives of this course are to:

1. Explain security concepts, Ethics in Network Security.
2. Identify security threats, and the security services and mechanisms to counter them



3. Comprehend and apply relevant cryptographic techniques
4. Comprehend security services and mechanisms in the network protocol stack
5. Illustrate the integrity and authentication process
6. Familiarize various cyber threats, attacks, vulnerabilities and defensive mechanisms

### Course Outcomes:

On completion of this course the student shall be able to:

1. Understand the fundamental concepts of cyber security and explain the encryption process using cryptographic algorithms.
2. Apply software tools and technology to analyze, design and develop applications that can solve real life problems.
3. Explain the concept of cybercrime , analyze cyber offenses using logical reasoning according to Indian ITA 2000
4. Analyze security tools and methods, interpret legal perspective and explore Indian IT Act to understand the values and ethics to be followed by cyber experts

### Course Contents:

#### UNIT 1:

[10 Hours]

**Security and Cryptography:** Security Trends, Security Services, Security attacks, Security mechanisms, A Model for Network security. A short History of Cryptography, Cryptographic techniques, Symmetric and asymmetric key algorithm, Cryptography Tools, Attacks on Cryptosystems.

#### UNIT 2:

[10 Hours]

**Security Technology:** Physical design; Firewalls; Protecting Remote Connections, Intrusion Detection Systems (IDS), Honey Pots, Honey Nets.

#### UNIT3:

[10 Hours]

**Cybercrime and cyber offenses:** Introduction to Cybercrime and Laws Introduction, Cybercrime: Definition and Origins of the word, Cybercrime and information Security, Cybercriminals, Classifications of Cybercrimes, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cyber offenses: How Criminals Plan the Attacks, Social Engineering, Cyber talking, Cyber cafe and Cybercrimes, Bot nets: The Fuel for Cybercrime, Attack Vector, Cloud Computing

#### UNIT 4:

[09 Hours]

**Tools and Methods:** Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, identity theft.

**Cybercrimes and Cyber security:** The Legal Perspectives, Cybercrime and the Legal Landscape around the World, Why Do We Need Cyberlaws: The Indian Context, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Amendments to the Indian IT Act, Cybercrime and Punishment.

**Text Books:**

1. Nina Godbole, SunitBelapur, “CYBER SECURITY UNDERSTANDING CYBER CRIMES, COMPUTER FORENSICS AND LEGAL PERSPECTIVES”, Wiley India Publications, April, 2011.
2. Robert Jones, “INTERNET FORENSICS: USING DIGITAL EVIDENCE TO SOLVE COMPUTER CRIME”, O’Reilly Media, October, 2005.
3. Michael E. Whitman and Herbert J. Mattord, “PRINCIPLES OF INFORMATION SECURITY”, 2nd Edition, Thomson, 2005.
4. William Stallings, “NETWORK SECURITY ESSENTIALS: APPLICATIONS AND STANDARDS”, Pearson Education, 2000.

**Reference Books:**

1. Marjie T. Britz, “COMPUTER FORENSICS AND CYBER CRIME: AN INTRODUCTION” – Pearson Education.
2. Chwan-Hwa (John) Wu, J. David Irwin, “INTRODUCTION TO COMPUTER NETWORKS AND CYBER SECURITY” - CRC Press
3. Bill Nelson, Amelia Phillips, Christopher Steuart, “GUIDE TO COMPUTER FORENSICS AND INVESTIGATIONS” Cengage Learning.

<b>B21DAS422</b>	<b>Advanced Computer Networks</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>

**Course Description:**

The focus is on principles, architectures, and protocols used in modern networked systems, such as the Internet itself, wireless and mobile networks and high performance networks. The Internet protocols have revolutionized communications. This advanced networking course will equip you with a deep knowledge of network concepts, protocol design, and performance analysis that make the Internet work, help you develop critical insight into their design, and obtain a firsthand feel for implementation through homework and project exercises.

**Prerequisites:**

Basic knowledge about computer communication network design, operations and implementation

**Course Objectives:**

The objectives of this course are to:

1. Identify and work on different routing protocols
2. Propose knowledge of Internetworking
3. Describe different types of routing mechanisms
4. Describe the Transport layer protocols and its functionality.
5. Understand motivation, parameters and Functions of Quality of service.

## Course Outcomes:

On completion of this course the student shall be able to:

1. Expose the fundamentals of data communications and networks by gaining knowledge of data transmission concepts.
2. Analyze the computer network with suitable network protocols and routing algorithms.
3. Analyze different routing protocols and traffic engineering methods deployed in networking.

## Course Contents:

### UNIT 1:

[10Hours]

**Transmission Networks:**Introduction, PDH Networks, SONET/SDH Networks, DWDM Network, and and Wireless Transmission: Wireless media, Wireless Systems, Spread Spectrum Technology.

### UNIT 2:

[10 Hours]

**Routing and Internet Protocol:**Routing, Static routing, Dynamic routing, Distance Vector Routing Algorithm, Link State Routing, Open Shortest Path First Routing protocol.

Address types of the TCP/IP stack, IP Address format, IPv4 Packet Format, Hierarchical Addressing, Sub netting, ICMP, IPv6.

### UNIT 3:

[10Hours]

**End-To-End Protocols:**Simple De-multiplexer (UDP), Reliable Byte Stream (TCP), Remote Procedure Call, Congestion Control and Resource Allocation-Issues in Resource Allocation, Queuing Disciplines, TCP Congestion Control.

### UNIT 4:

[09 Hours]

**Quality Of Service:**Motivation for QoS, Parameters, Functions required for supporting QoS, Traffic Control, Leaky Bucket algorithm, Token Bucket Algorithm, Explicit Congestion Notification (ECN), Resource Reservation Protocol (RSVP).

### Text Books:

1. Natalia Olifer, Victor Olifer, "COMPUTER NETWORKS", First Edition, John Wiley, 2015. UNIT-1: Chapter 10, 11
2. Larry & Peterson & Bruce S Davis, "COMPUTER NETWORKS-A SYSTEM APPROACH", 5th Edition, Elsevier Inc, 2014. Chapter 4, 5, 6.
3. Prakash C Guptha, "DATA COMMUNICATIONS AND COMPUTER NETWORK", Second Edition, PHI learning Pvt Ltd, Nov 2014. Chapter 23.

### Reference Books:

1. BehrouzFerouzan "INTRODUCTION TO DATA COMMUNICATION &NETWORKING", 5th Edition, McGraw Hill Education Pvt Ltd 2013
2. Andrew S Tanenbaim, "COMPUTER NETWORKS", Pearson Education, 5th Edition, Elsevier Inc, 2014.

<b>B21DAS423</b>	<b>Advanced Java Programming</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>

### Course Description:

The goal of the course is to help students gain knowledge in the basic concepts of object-oriented programming and build skills to develop modern software programmers using the language Advanced Java. The course helps to provide an overview of working principles of web related functionalities in Java, understand and apply the fundamentals core java, packages, database connectivity for computing.

### Prerequisites:

Java Fundamentals, OOPs concept.

### Course Objectives:

The objectives of this course are to:

- To provide an overview of working principles of web related functionalities in Java
- To understand and apply the fundamentals core java, packages, database connectivity for computing .
- To enhance the knowledge to server side programming
- To provide knowledge on advanced features like Sockets.

### Course Outcomes:

On completion of this course the student shall be able to:

- Understand the basic principles of creating Java applications with graphical user interface (GUI).
- An ability to design, implement and evaluate a computer-based Applications, process, component, or program to meet desired needs.
- An ability to use current techniques, skills, and tools necessary for computing practices.
- Create rich user-interface applications using modern API's such as servlets and JSP.

### Course Contents:

#### Unit -1: Collections&Multithreading

[10 Hours]

Collections : Collection Interfaces, Concrete Collections, The Collections Framework.

Multithreading : Creating thread and running it, Multiple Thread acting on single object, Synchronization, Thread communication, Thread group, Thread priorities, Daemon Thread, Life Cycle of Thread.

**Unit-2:JDBC****[10 Hours]**

Datagrams.Java Database Connectivity (JDBC): Merging Data from Multiple Tables: Joining, Manipulating .Databases with JDBC, Prepared Statements, Transaction Processing, Stored Procedures.

**Unit -3: Servlets and JSP****[10 Hours]**

Servlets: Servlet Overview and Architecture, Interface Servlet and the Servlet Life Cycle, Handling HTTP get Requests, Handling HTTP post Requests, Redirecting Requests to Other Resources, Session Tracking, Cookies, Session Tracking with HttpSession. JavaServer Pages (JSP): Introduction, JavaServer Pages Overview,A First JavaServer Page Example, Implicit Objects, Scripting, Standard Actions, Directives, Custom Tag Libraries.

**Unit-4: Remote Method Invocation****[09 Hours]**

Remote Method Invocation: Defining the Remote Interface, Implementing the Remote Interface, Compiling and Executing the Server and the Client.Enterprise Java Bean: Preparing a Class to be a JavaBean, Creating a JavaBean, JavaBean Properties,Types of beans, Stateful Session bean, Stateless Session bean, Entity bean.

**Text Books:**

1. “Advanced Java 2 Platform HOW TO PROGRAM” by H. M.Deitel, P. J. Deitel, S. E. Santry – PrenticeHall
2. “Beginning Java™ EE 6 Platform with GlassFish 3 From Novice to Professional” by Antonio Goncalves– Apress publication

**Reference Books:**

1. Keyur shah, Gateway to Java Programmer Sun Certification , Tata McGraw Hill,2002.
- 2.Deitel&Deitel, Java How to Program, Prentice Hall,1999.

<b>B21DA0404</b>	<b>Linux Lab</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>0</b>	<b>0</b>	<b>2</b>	<b>2</b>

### Lab Experiments:

#### Part A

Write Shell programs for the following:

1. To count the number of characters in a given string
2. To find whether the given year is leap year or not
3. To check whether a given number is even or odd
4. To find the factorial of a given number.
5. To count the number of vowels and consonants in a given string.
6. To print all prime numbers between m and n ( $m < n$ ).
7. To check whether a given string is a palindrome or not.
8. To generate the Fibonacci series.
9. To find the sum of series of n numbers.
10. To find the maximum and minimum from the list of given n numbers .

#### Part B

1. Write a Shell script to perform basic arithmetic operations.
2. Write a shell script that displays all the files in the current directory.
3. To write a shell script that creates a file and compresses it.
4. Write a script to convert the contents of a given file from uppercase to lowercase and also count the number of lines, words and characters of the resultant file.
5. Write a shell script to find the reverse of a given number.
6. Write a shell script to find the sum of digits of a given number.

<b>B21DA0405</b>	<b>Python Programming Lab</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>0</b>	<b>0</b>	<b>2</b>	<b>2</b>

### Lab Experiments:

#### PART-A

1. Demonstrate runtime reading of Strings.
  - i) Illustrate the concept of String Slicing.
  - ii) Also demonstrate a minimum of 5 functions defined on Strings.
2. Write a program to add two integers and print the result on the screen. Accept the values at runtime.
3. Demonstrate the usage of math and cmath module.(For Ex. Program to find the roots of a Quadratic Equation)
4. Illustrate the usage of files with the help of different functions defined on Files(such as write, read(demonstrate all four forms), open, and close(use both the forms of closing a file)
5. Write a program to find the largest of two numbers
6. Write a program to find the biggest of three numbers
7. Design a menu driven program to check whether the number is
  - i)A perfect number or not
  - ii)Armstrong number or not
  - iii)Palindrome or not
8. Show the different operations defined on Lists, Tuples and Dictionaries
9. Write a program to find the factorial of a number using functions and without using functions. Accept the input at runtime.
10. Demonstrate the i) Designing of a class ii) Creation of Object of that class iii) accessing the methods and instance variables in the class. The student is at the liberty of choosing their own Description of the object for designing the class.

#### PART-B

1. Design Jumble Game. Enjoy Playing it.
2. Design Guess My Number Game. Check if you are able to guess the correct Number.

<b>B21PTM401 / B21DAM401</b>	<b>Soft Skills</b>
<b>Duration :16Wks</b>	

<b>B21DAM402</b>	<b>Skill Development Program</b>
<b>Duration :16Wks</b>	

## FIFTH SEMESTER

<b>B21DA0501</b>	<b>.NET Programming using C#</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>

### Course Description:

This course will cover two major types of application development aspects using DotNet Framework. Although .DotNet Framework supports more than 72+ programming language we shall be using only C# programming language for developing console application and windows-based type application. ADO.NET will be connecting bridge between front-end and back end. Overall this course sets a platform to get big picture on designing, coding, connecting, building and deploying all the above type of application.

### Prerequisites:

To start learning C#, firstly you should have computer knowledge. C# is closely tied to .NET framework. So if you program in C# then you will learn .NET framework as well.

### Course Objectives:

The objectives of this course are to:

1. Knowledge about different Object Oriented Features.
2. Identify disconnected architecture of .Net.

### Course Outcomes:

On completion of this course the student shall be able to:

1. Will Understand .Net Framework and Describe some of the major enhancements to the new versions of C#
2. Design the Basic structure of C# for Various programming Technologies
3. Evaluate user requirements for software functionality required to decide whether the programming language C# can meet user requirements Analysis
4. propose the use of certain technologies by implementing them in the C# programming language to solve the given problem

### Course Contents:

#### UNIT 1:

[10 Hours]

**Introduction:** Introduction to .Net, Two tier and Three tier client server model, .Net Architecture, Features of .Net, Advantages of .Net, .Net Framework, CLR, CTS, CLS, Assemblies, Memory management issues – Garbage Collector and collection process, Exception Handling, Code Access Security



**UNIT 2:****[10 Hours]**

**C# Languages Fundamentals:**Need of c# ,C# pre-processor Directives , Features of C# , Creating a Simple c# Console Application, Identifiers and keywords , Data Types ,Variables and Constants Value type and reference types ,Boxing and un boxing types , Iterators Constructs ,Control flow constructs Arrays ,C# Enumerations.

**UNIT 3:****[10 Hours]**

**Object- oriented Programming with C#:**Namespaces, Class and objects, using this keyword, creating array of objects, defining partial Classes and Methods, Properties ,Constructors and Destructors Static classes and static method, static variables Encapsulations using properties ,Inheritances ,Interface, Exception Handling

**UNIT 4:****[09 Hours]**

**Graphical User interface with Windows Forms:**Event Handling Control properties and layout labels, Textboxes ,buttons, Group boxes and panels , checkboxes and radio button, Tooltips, List Box and Combo Box ,Group boxes Mouse-Even handling, Keyboard –Event Handling ,Understanding ADO.NET and Creating Connection string.

**TEXT BOOKS:**

1. BlackBook,“NET4.0 Programming(6-in-1)”, Kogent Learning Solution Inc, Wiely-Dream Tech Press [chapter 1,10,11,12,19]
2. PaulDeitel and Harvey Deitel, “C#2010 for Programmers”,4th Edition, Pearson Education.

<b>B21DA0502</b>	<b>Web Technology</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>

**Course Description:**

This course is an overview of the modern Web technologies used for the Web development. The purpose of this course is to give students the basic understanding of how things work in the Web world from the technology point of view as well as to give the basic overview of the different technologies. The topics include (although in some cases briefly): History of the Web, Hypertext Markup Language (HTML), Extensible HTML (XHTML), Cascading Style Sheets (CSS), and JavaScript. We will follow the guidance of the World Wide Web Consortium (W3C) to create interoperable and functional websites.

**Prerequisites:**

Basic knowledge of Computer fundamentals.

**Course Objectives:**

The objectives of this course are to:

1. Describe rich internet applications that use most recent client-side programming technologies.

2. Apply client-side validations using Java Script.
3. Capture core technical skills necessary for a complete understanding of front-end web development, including HTML5 and CSS, JavaScript, DOM.

### Course Outcomes:

On completion of this course the student shall be able to:

1. Understand the fundamental concepts of HTML and XHTML scripting tools.
2. To Learn and implement the programming concepts of CSS and Java Script
3. Understand the principles of creating an effective web page
4. Design and develop web applications using the web technology tools

### Course Contents:

#### UNIT 1:

[10 Hours]

**Fundamentals of Web:** Fundamentals of Web: A Brief Introduction to the Internet, The World Wide Web, Web Browsers, Web Servers, Uniform Resource Locators, Multipurpose Internet Mail Extensions, The Hypertext Transfer Protocol.

Introduction to XHTML: Basic Syntax, Standard XHTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, Syntactic Differences between HTML and XHTML.

#### UNIT 2:

[10 Hours]

**CSS & Basics of JavaScript:** CSS: Levels of Style Sheets, Style Specification Formats, Selector Forms, Property Value Forms, Font Properties, List Properties, Color, Alignment of Text, The Box Model, Background Images, The <span> and <div> Tags, Conflict Resolution.

The Basics of JavaScript: Overview of JavaScript, Object Orientation and JavaScript, General Syntactic Characteristics, Primitives Operations and Expressions

#### UNIT 3:

[10 Hours]

**JavaScript and XHTML Documents** JavaScript: Screen Output and Keyboard Input, Control Statements, Object Creation and Modification, Arrays, Functions, Pattern Matching Using Regular Expressions, Errors in Scripts.

XHTML Documents: The JavaScript Execution Environment, The Document Object Model, Element Access in JavaScript, Events and Event Handling.

#### UNIT 4:

[09 Hours]

**Event Handling & Dynamic Documents with Java Script** Event Handling: Handling Events from Body Elements, Handling Events from Button Elements, Handling Events from Text Box and Password Elements, The DOM 2 Event Model.

Dynamic Documents with JavaScript: Introduction, Positioning Elements, Moving Elements, Element Visibility, Changing Colors and Fonts, Dynamic Content, Stacking Elements, Locating the Mouse Cursor, Reacting to a Mouse Click, Slow Movement of Elements.

**Text Books:**

1. Robert W Sebesta, "PROGRAMMING THE WORLD WIDE WEB", 5th Edition, Pearson Education, 2008. (Chapters: 1, 2, 3, 4, 5 and 6)

**Reference Books:**

1. M.Deitel, P.J.Deitel, A.B.Goldberg, "INTERNET & WORLD WIDE WEB HOW TO PROGRAM", 3rd Edition, Pearson Education / PHI, 2004.
2. 2.Chris Bates, "WEB PROGRAMMING BUILDING INTERNET APPLICATIONS", 3rd Edition, Wiley India, 2006.
3. XueBai et al, "The Web Warrior Guide to Web Programming", Thomson, 2003.
3. Sklar, "THE WEB WARRIOR GUIDE TO WEB DESIGN TECHNOLOGIES", 1st Edition, Cengage Learning India.

<b>B21DA0503</b>	<b>Cloud Computing</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>

**Course Description:**

The course is composed to enable to the student to gain the knowledge of multi-tenant server enabled computing services that can be provided as pay-per-use basic. The course gives the theoretical description of the cloud computing technologies in terms of hardware, software, architectures, limitations, advantages and disadvantages, issues, constraints, and security problems on data content that has been exchanged.

**Prerequisites:**

Knowledge in Virtualization concepts, operating system, Networking, and coding skills

**Course Objectives:**

The objectives of this course are to:

1. Introduce the broad perceptive of cloud architecture and model
2. Explain the concept of Virtualization and design of cloud Services
3. Identify and familiar with the lead players in cloud.
4. Explain the features of cloud simulator
5. Apply different cloud programming model as per need.
6. Design the trusted cloud Computing system

**Course Outcomes:**

On completion of this course the student shall be able to:

1. Compare the strengths and limitations of cloud computing
2. Identify the architecture, infrastructure and delivery models of cloud computing.
3. Apply suitable virtualization concept.
4. Choose the appropriate cloud player, Programming Models and approach.
5. Illustrate the core issues of cloud computing such as security, privacy and interoperability.

## Course Contents:

### UNIT 1:

[10 Hours]

**Fundamentals of Cloud Computing:** Cloud computing at a glance, the vision of cloud computing, defining a cloud, a closer look, Historical developments, Building cloud computing environments Application development. Characteristics of Cloud computing. Scalability, types of scalability. Horizontal Scalability and Cloud Computing, Computing platforms and technologies.

### UNIT2:

[10 Hours]

**Fundamental concept and Models:**Basics of Virtualization, Characteristics of virtualized environments, Taxonomy of virtualization techniques, - Types of Virtualization, Virtualization and cloud computing.

### UNIT3:

[10 Hours]

**Cloud Infrastructure Mechanisms and Architecture:**Fundamentals of Cloud Architecture, The cloud reference model, Cloud Delivery Models: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), Software-as-a-Service (SaaS), Comparing Cloud Delivery Models, Cloud Deployment Models: Public Clouds, Community Clouds, Private Clouds, Hybrid Clouds, Introduction to Cloud Software Environments , Architecture of Open Stack, Aneka.

### UNIT4:

[09 Hours]

**Cloud Applications and parallel programming paradigms:**Scientific applications, Healthcare: ECG analysis in the cloud, Biology: protein structure prediction, Geo science: satellite image processing, Business and consumer applications, CRM and ERP, Social networking, media applications. Open cloud platforms AWS, Distributed file systems (HDFS) and the cloud, Cloud storage systems, Introduction to NoSQL databases. Programming Models: Map Reduce.

#### Text Book:

1. RajkumarBuyya, Christian Vechiolla, ThamaraiSelvi, “MASTERING CLOUD COMPUTING”, Elsevier publications, 2013, USA. Unit 1: Chapter 1,Unit 2: Chapter 3,5.1, Unit 3:Chapter 4, Unit 4:Chapter 8.1,9.1,and 10.

#### Reference Books:

2. RajkumarBuyya, James Broberg, AndrzejGoscinski, “CLOUD COMPUTING: PRINCIPLES AND PARADIGMS”, Wiley, India.
3. Kai Hwang, Geoffrey C Fox, Jack G Dungaree, “DISTRIBUTED AND CLOUD COMPUTING FROM PARALLELPROCESSING TO THE INTERNET OF THINGS”, Morgan Kaufmann Publishers, 2012.
4. Thomas Erl, Zaigham,Mahmood, Ricardo Puttini, “CLOUD COMPUTING:CONCEPTS, TECHNOLOGY & ARCHITECTURE”, Prentice Hall/Pearson.

<b>B21DAS511</b>	<b>Mobile App Development</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>2</b>	<b>0</b>	<b>1</b>	<b>3</b>

### Course Description:

Android application development is the process by which new applications are created for devices running the Android operating system. Learn to setup Android application development environment. Illustrate user interfaces for interacting with apps and triggering actions .Interpret tasks used in handling multiple activities. Identify options to save persistent application data. Create, test and debug Android application by setting up Android development environment. Analyse performance of android applications and understand the role of permissions and security.

### Prerequisites:

Knowledge on Object Oriented Programming and Java Programming

### Course Objectives:

The objectives of this course are to:

1. Learn to setup Android application development environment
2. Illustrate user interfaces for interacting with apps and triggering actions
3. Interpret tasks used in handling multiple activities
4. Identify options to save persistent application data

### Course Outcomes:

On completion of this course the student shall be able to:

1. To define and understand the concepts, tools used in the developing android applications.
2. To Design and develop different types of widgets used in Android Studio.
3. To understand, analyze, apply the various tools used for adding extra features to Android Application and make it interactive.
4. To apply and identify the solutions through domain knowledge of database and to store data using shared preferences and SQLite.

### Course Contents:

#### UNIT 1:

[10 Hours]

**Basic Android Concepts:** Introduction to Android - History of android ,The Open Handset Alliance, Android SDK installation ,Android SDK & their codenames , Advantages of android ,The Android O/S Architecture, Over view of IDE for Android application, What is AVD , How to launch and start the AVD (android virtual device) Managing Application Resources - What are resources, resource value types, storing different resource values types (string, string arrays, Boolean, colors, integer, animation, & menus) Android Application

Components - Activities & its life cycle , Services & its lifecycle, Broadcast receiver, Content provider, Intents, shutting down component , Android Manifest File in detail ,Use of Intent Filter.

**UNIT 2:**

**[10Hours]**

**Widgets – User Interface Elements:**Form Widgets – Text View, basic Button, Toggle Button, Check Box, Checked Text View, Radio Buttons, Radio Group, Spinner Control, Date Picker, Time Picker , Chronometer, Progress bar, Rating bar, Option menu, Image View Text Fields - Various type of Text Fields (Plain text, Password Text, Numeric Text, Email Text, Phone Text, Multiline Text etc ) Working with various type of dialog - Simple dialog, alert dialog, character picker dialog, date picker dialog, progress dialog , List Dialog, Custom Dialog Toast – (Custom Toast)

**UNIT 3:**

**[10 Hours]**

**Features of Android:**Styles and Themes - Basic Styles & Themes in XML layout Various Layouts - What is layout, Layouts common attribute, Types of Layout ( Linear layout, Relative layout, Table layout , Frame layout ,Tab layout ) Using Data-Driven Containers - List View, Grid View, and Gallery View (Using the Array Adapter) App widgets - What is app widget, Use of App Widgets, Creating app widget configuration activity

**UNIT 4**

**[09 Hours]**

**Data Storage :**Introduction to data storage - Introduction to various storage options available in android system Working with Application Preferences - Creating Private and Shared Preferences, Manipulating with Shared Preferences, Read/Write Data on the Android File System [Internal Storage] Storing Structured Data Using SQLite Databases - Creating a SQLite Database, Creating Tables and Other SQLite Schema Objects, Creating, Updating, and Deleting Database Records, Querying SQLite Databases, Working with Cursors, Closing and Deleting a SQLite Database

**Text Book:**

1. Rick rogers, John Lombardo, “ANDROID APPLICATION DEVELOPMENT”, -O“Reilly (unit 1 & 2)
2. Reto Meier Wrox, “PROFESSIONAL ANDROID 2 APPLICATION DEVELOPMENT” (unit 4)

**Reference Books:**

1. Lauren Darcey and Shane Conder, “ANDROID WIRELESS APPLICATION DEVELOPMENT”, Pearson Education, 2nd edition.
2. ByWei-MengLee, “BEGINNING ANDROID APPLICATION DEVELOPMENT”, Wrox Publication.
3. Frank Ableson, Charlie Collins and RobiSen, “UNLOCKING ANDROID DEVELOPER“SGUIDE”, Manning Publication Co.

**MOBILE APP DEVELOPMENT LAB**

1. Display Hello World
2. Add two Edit Text. When a number is entered in Edit Text 1, the square of that number should be displayed in Edit Text 2.
3. Add an Edit Text and a button. When the button is clicked, the text inputted in Edit Text should be retrieved and displayed back to the user.

4. Add two Edit Text and a button. When the button is clicked, the text inputted in Edit Text 1 should be retrieved and displayed in EditText2.
5. Program a calculator
6. Create applications to include Action Bar, Menus, Dialogs and Notifications
7. Create a user login form and registration form. First time users have to register through the registration form and the details should be stored in the database. Then they can login using the login page.

<b>B21DAS512</b>	<b>Computer Animation</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>2</b>	<b>0</b>	<b>1</b>	<b>3</b>

### Course Description:

The Computer Animation subjects focus on creation of animations using image sequence. It also gives the practical exposure to the students on two animation software's adobe photoshop and flash software's. Using these software's users easily design images and edit the images and also to design the animation using various tweening techniques.

### Prerequisites:

Introduction to Computer Graphics is a prerequisite, which introduces the fundamental concepts of computer graphics which are essential in such an advanced computer animation course.

### Course Objectives:

The objectives of this course are to:

1. Gain knowledge in Animation
2. Recognize, locate and navigate through all aspects of the Photoshop user interface.
3. Create, manipulate, and edit text and graphics to obtain desired graphical outcomes.
4. Design, create, edit, and manipulate animation using several animation tools and techniques

### Course Outcomes:

On completion of this course the student shall be able to:

1. Visualize the sequence of animation process
2. Apply different filters and tools of adobe photoshop to enhance the quality of an image
3. Design and develop an animation using selection and transformation tools of flash software
4. Apply the action buttons and action frames of flash for creating small movie clips

### Course Contents:

#### UNIT 1:

[10 Hours]

**Animation and Photoshop:** Basic Concepts, Specification of Animations, Methods of Controlling Animation, Display of Animation, Transmission of Animation, Virtual Reality Modeling Language, PHOTOSHOP:

Fundamentals ,Opening and Importing Images ,Resolution ,Models and Color Spaces ,Layers. PAINTING PIXELS: The Painting Tools, Erasing, Fills, Type. SELECTION AND ALLIED OPERATIONS: Marquee selection and cropping, Lasso Selection, Paths ,Combining and Transforming Selections.

**UNIT 2:**

**[10 Hours]**

**Adjustments &Retouching And Effects And Filters:**Tonal Adjustment, Color Adjustments, Retouching By Hand, Blurring and Sharpening, Special Effects and Distortion, Layer Effects and Layer Styles.

**UNIT 3:**

**[10 Hours]**

**Flash:**Animation with Interacting, Basic Concepts, Drawing, Lines and Shapes, Strokes and Fill, Shapes and Brushes, Selection, Transformation and Reshaping ,Importing Artwork and Manipulating Images. ANIMATION: Animating One Frame at a Time, Motion Tweening, Symbols and Instances, Shape Tweening, Sound.

**UNIT 4:**

**[09 Hours]**

**Actions:**Buttons, Button action, Frame Action, Action and Movie Clip Symbols, Actions, Browsers and Networks, Beyond the Basic Actions. FLASH MX275: Interface Elements, Panels, Tools, Layer Folders, Accessibility, Video User Interface Components, Changing the Appearance of Components.

**Text Books:**

1. Nigel Chapman and Jenny Chapman, "PRACTICAL MULTIMEDIA". Wiley ,Dream Tech Pvt. Ltd, 2nd Ed., 2003
2. Ralf Steinmetz, KlaraNarstedt, "MULTIMEDIA FUNDAMENTALS", Media Coding and Content Processing, 2ndEdition, Pearson Education, 2007.(chapter:6)

**Reference Books:**

1. Thiagarajan and Anbumani, "FLASH MX 2004", Tata McGraw Hill, New Delhi.
2. Laurie Ulrich Fuller and Robert C. Fuller, "PHOTOSHOP CS3 BIBLE", Willey India Pvt. Ltd.

**ANIMATION LAB**

1. Design a poster with images and text using Photoshop
2. Overlap multiple images with different opacities using concept of layers using Photoshop
3. Demonstrate different selection tools by applying on a image using Photoshop
4. Demonstrate different filters using Photoshop
5. Create a gif file using Photoshop
6. Create an animation using flash for growing moon
7. Create an animation using flash for with two balls
8. Procedure to create an animation with the following features. WELCOME \* Letters should appear one by one \* The fill color of The text should change to a different color after the display of the full word
9. Procedure To Create An Animated Cursor Using Start drag ("Ss", True); Mouse.Hide()
10. Design A Visiting Card Containing At least One Graphic And T



<b>B21DAS513</b>	<b>Machine Learning</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>2</b>	<b>0</b>	<b>1</b>	<b>3</b>

### Course Description:

Machine Learning is concerned with computer programs that automatically improve their performance through experience. This course covers the theory and practical algorithms for machine learning from a variety of perspectives. Topics such as Bayesian networks, decision tree learning, Support Vector Machines, statistical learning methods and unsupervised learning are covered. Short programming assignments include hands-on experiments with various learning algorithms gives students a chance to dig into an area of their choice. This course is designed to give a thorough grounding in the methodologies, technologies, mathematics and algorithms currently needed by people who do research in machine learning.

### Prerequisites:

Familiarity with Statistics, Linear Algebra, Calculus, Probability and Programming Languages

### Course Objectives:

The objectives of this course are to:

1. Describes the basic components of Machine Learning with concepts of Python
2. Differentiates broad categories of Machine learning
3. Compare different types of algorithms used in Machine Learning domain with limitations
4. Examine the limitations of various machine learning algorithms and the way to evaluate performance of machine learning algorithms

### Course Outcomes:

On completion of this course the student shall be able to:

1. Understand the fundamental concepts and theories of Machine Learning
2. Analyze and Apply techniques of Supervised machine learning and solve the real world problems
3. Interpret and Apply Unsupervised Machine Learning algorithms for specific problems.
4. Understand the Reinforcement Learning Technique and Understand Q Learning.

### Course Contents:

#### UNIT 1:

[10 hours]

**Introduction:** Overview of ML, broad categories of Machine learning- Supervised, Unsupervised, Semi-supervised, and Reinforcement Learning, Applications areas of Machine Learning. Examples and case studies.

#### UNIT 2

[10 hours]

**Supervised Learning:** Introduction, Classification and Linear Regression, k-Nearest Neighbor, Linear models, Decision Trees, Naive Bayes Classifiers, Support Vector Machines (SVM) Algorithms. Neural Networks (deep learning), discussions on case studies

**UNIT 3:****[10 hours]**

**Unsupervised Learning:** Introduction, types and challenges, preprocessing and scaling of datasets, Dimensionality reduction, feature extraction. Principal Component Analysis (PCA), k-means and agglomerative clustering, comparison of cluster algorithms, discussions on Case studies.

**UNIT 4:****[09 hours]**

**Semi-supervised:** Introduction, discussion on Generative models and Graph-based methods. Reinforcement: Introduction, the learning task, Q learning Algorithm, relationship to dynamic programming, discussions on Case studies

**Text Books:**

1. Andreas C Muller & Sarah Guidp, "Introduction of Machine Learning with Python", O'Reilly & Shroff publishers. Chapters 1, 2 and 3.
2. Tom M Mitchell, "Machine Learning", McGraw Hill Education publication – 2013. Chapter 13.
3. Peter Flach, "Machine Learning: The Art and Science of algorithms", Cambridge University Press, Chapter 12.

**References Books:**

1. EthemAlpaydin, "Machine Learning", PHI learning private limited. Chapter 1, 7, 16, 18, 19
2. David barber and Bayesian, "Reasoning and Machine Learning", Cambridge University Press. Chapter 13, 15
3. Olivier Chapelle, Bernhard Schölkopf and Alexander Zien, "Semi-Supervised Learning", MIT Press Cambridge
4. Trevor Hastie, Robert Tibshirani and Jerome Friedman, "The Elements of Statistical Learning", Springer 2017 publication.

**LAB MODULES:**

1. Implementation of regression algorithm
2. Implementation of Naïve Bayes algorithm
3. Implementation of Decision Tree algorithm
4. Implementation of K-means algorithm
5. Implementation of PCA algorithm
6. Implementation of SVM algorithm
7. Implementation of Q- algorithm

The above algorithms has to be executed on different sets/types of datasets

<b>B21DAS521</b>	<b>Software Testing &amp; Quality Assurance</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>

### Course Description:

This course describes the key aspects of a Software Testing and Quality Assurance. It begins with the overview of project planning and elaborates software evaluation and testing. This course also includes those topics relevant to successful software testing and quality assurance management, Risk and quality management.

### Prerequisites:

Knowledge on Software engineering

### Course Objectives:

The objectives of this course are to:

1. Explain the concepts and process of testing activities that occur within the process.
2. Describe the various Testing Technique and Design different type of Test cases.
3. Characterize the look and feel and usage aspects of Usability and Accessibility Testing.
4. Analyze the different perspective of test metrics and measurements.

### Course Outcomes:

On completion of this course the student shall be able to:

1. Knowledge about testing principles and analyze, evaluate software Development life cycle models.
2. Explain and Design the test case for black box, white box and integration testing
3. Analyze system, acceptance, performance testing and interpret these test cases to a particular problem.
4. Evaluate software quality maturity models and apply capability maturity model for a particular project.

### Course Contents:

#### UNIT 1:

[10 Hours]

**Principles of Testing:**Context of testing in producing software, the complete car, Dijkstra's Doctrine, A test in time! The act and the Saint, Test the Tests first, the pesticide paradox, The convoy and the Rags, The policemen on the Bridge, The ends of the Pendulum, Men in Black, Automation Syndrome.

#### **Software Development Life Cycle Models:**

Phases of Software Project, Quality , Quality Assurance and Quality Control, Testing, Verification and validation, Process models to represent different phases, Life cycle models.

#### UNIT 2:

[10 Hours]

**White Box Testing-** Static Testing, Structural Testing, Challenges in white box testing.

**Black Box Testing:**Introduction, How to do black box testing?

**Integration Testing:**Introduction, Integration testing as a type of Testing, Integration testing as a phase of Testing, Scenario Testing.

**UNIT 3:****[10 Hours]**

**System and Acceptance Testing:** Overview, Functional Vs Non-Functional Testing, Functional System Testing, Non-Functional Testing, Acceptance Testing.

**Performance Testing:** Introduction, Factors Governing Performance Testing, Methodology for Performance Testing, Tools for performance testing, Process for performance testing.

**UNIT 4:****[09 Hours]**

**Software Quality, Maturity Models:** Five views of software quality, McCall's quality and criteria, ISO 9126 Quality characteristics, ISO 9000:2000 Software Quality Standards.

**Maturity Models:** The basic idea in Software Process, Capability Maturity Model, Test Process Improvement, Testing Maturity Model.

**Text Books:**

1. Srinivasan Desikan and Gopaldaswamy Ramesh, "SOFTWARE TESTING - PRINCIPLES AND PRACTICES", Pearson India Education, 2016. Chapters 01 to 07
2. Kshirasagara Naik, Priyadarshi Tripathy, "SOFTWARE TESTING AND QUALITY ASSURANCE", Wiley India 2012. (Chapters 17 & 18)

**Reference Books:**

1. Mauro Pezze, Michael Young, "SOFTWARE TESTING AND ANALYSIS- PROCESS, PRINCIPLES AND TECHNIQUES", Wiley India, 2012.
2. M.G. Limaye, "SOFTWARE TESTING-PRINCIPLES, TECHNIQUES AND TOOLS" – McGraw Hill, 2009.

<b>B21DAS522</b>	<b>Network Administration</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>

**Course Description:**

This current topics course will focus on the design, installation, configuration, and operation of local area networks. This course provides students with the knowledge and skills necessary to install and configure a stand-alone and client computer that are part of a workgroup or domain. We will also discuss alternate local area network methodologies including Microsoft Windows 2000, Novell NetWare, UNIX, Windows NT, and Windows 98. Every class will include a lecture or discussion on network topic along with demonstration of the concepts.

**Prerequisites:**

Basic knowledge on Operating Systems, their functionalities and Unix/Linux basic commands and Shell script.

**Course Objectives:**

The objectives of this course are to:

1. Develop and Applying technology in an environment
2. Describe the working of local area network (LAN) technologies for wired and wireless networks as well as analyze the working of virtual LANs and different networking devices, Network administration models, Network management technologies,
3. Construct and use routing tables for datagram forwarding and study the different categories of Internet routing protocols
4. Describe the responsibilities of the different layers of TCP/IP protocol stack as well as the use of different fields in the packet headers corresponding to these layers
5. Explain the different classes of IP addresses, Setting up the DNS name service, Setting up a WWW server, E-mail configuration

### Course Outcomes:

On completion of this course the student shall be able to:

1. Understand the role of operating systems and computer networks in information technology applications within organizations.
2. Understand the appropriate use of networking hardware and software
3. Install, configure, and maintain an operating system and applications software on a personal computer
4. Select hardware and software components, build, configure, and maintain a computer network.
5. Explain the different classes of IP addresses, Setting up the DNS name service, Setting up a WWW server, E-mail configuration

### Course Contents:

#### UNIT 1: [10 Hours]

**Introduction:** Network and system administration, Applying technology in an environment, The human role in systems , Discipline, challenges, Common practice and good practice System Administration, Network Infrastructure, Operating Systems, File systems, IPv4 Networks, Address space in IPv4, Host identities and name services. Common network sharing models, Local network orientation and analysis

#### UNIT 2: [10 Hours]

**User management:**Issues, User registration, Account policy, Login environment, User support services, Controlling user resources, online user services, Ethical conduct of administrators and users, Computer usage policy

#### UNIT 3: [10 Hours]

**Network-level services:**Network administration models, Network management technologies, The Internet, Getting traffic to its destination, Alternative network transport and connection technologies, IP routing and forwarding.

#### UNIT 4: [09 Hours]

**Application-level services:**Proxies and agents, installing a new service, setting up the DNS name service, Setting up a WWW server, E-mail configuration.

**Text Book:**

1. Mark Burgess, "PRINCIPLES OF NETWORK AND SYSTEM ADMINISTRATION" 2nd Edition, John Wiley Chapter 1, 2, 3, 5, 10, 9.

<b>B21DAS523</b>	<b>Ethical Hacking</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>

<b>B21DA0504</b>	<b>.NET Programming Lab</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>0</b>	<b>0</b>	<b>2</b>	<b>2</b>

**Lab Experiments:**

**PART-A**

1. Solve simple problems using the fundamental syntax and semantics of the C# programming language
2. Write a Program in C# to demonstrate Command line arguments processing.
3. Write a program in c# to implement stack operations
4. Write C# programs that use selection (if, switch, conditional operator)
5. Write C# programs that use loops (while, do while, for)
6. Write a program to reverse a given string using C#
7. Write C# programs that use one-dimensional arrays
8. Apply simple searching and sorting algorithms
9. Write a Program in C# to find the second largest element in single dimensional arrays.
10. Write programs in C# to demonstrate boxing and unBoxing
11. Write simple object oriented programs using objects and classes

**PART B**

1. Develop graphical user interfaces for C# programs using GUI components such as labels, buttons, text boxes, radio button and check boxes
2. Use the C# event-handling model to respond to events arising from the GUI components

<b>B21DA0505</b>	<b>Web Technology Lab</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>0</b>	<b>0</b>	<b>2</b>	<b>2</b>

### Lab Experiments:

#### PART-A

1. Create a web page to display the course syllabus.
2. Design student details in first page and result in next page, link both pages using hyper links.
3. Create a web page for class time table
4. Develop a web page with 2 or more images, move images in different directions and write hyper link to any one image.
5. Create a web page to display the following content using list tag.

#### General Aviation

1. Single Engine Aircraft
  - a. Tail Wheel
  - b. Tricycle
2. Dual Engine Aircraft
  - i. Wing Mounted
  - ii. Push Pull Mounted

#### Commercial Aviation

- I. Dual Engine
  - Wing Mounted
  - Push Pull Mounted
- II. Tri Engine

#### Third Engine

#### Second Engine

6. Design login page and validate it using JavaScript
7. Develop a HTML Form which accepts two numbers. Write JavaScript code to execute arithmetic operations and displays the result.
8. Create a student form and write JavaScript code to count the number of elements used in the form.

#### PART-B

1. Create a form for Employee information. Write JavaScript code to find DA, HRA, PF, TAX, Gross pay, Deduction and Net pay.
2. Create a form for Student information. Write JavaScript code to find Total, Average, Result and Grade.
3. Develop web page with one text box and Write a JavaScript code to convert the text entered in textbox to upper case.
4. Create a web page using two image files, which switch between one another as the mouse pointer moves over the images. Use the on Mouse Over and on Mouse Out
5. Develop a HTML Form, which accepts any Mathematical expression. Write JavaScript code to Evaluates the expression and Displays the result.

6. Create a HTML form with 3 Textboxes. Write JavaScript code to validate input for numbers, alphabets, alphanumeric and verify that all 3 textboxes has been filled.
7. Write a user-defined function in JavaScript to find sum of N Numbers
8. Write a JavaScript code to find factorial of a number using recursive function

<b>B21PTM501 / B21DAM501</b>	<b>Soft Skills</b>
<b>Duration :16Wks</b>	

<b>B21DAM502</b>	<b>Skill Development Program</b>
<b>Duration :16Wks</b>	

<b>B21DAO501</b>	<b>Open Elective - Fundamentals of Computer Programming &amp; Office Automation</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Description:(3-4 lines-course aim and summary be added)**

The main emphasis of this course is introduction to structure and function of computers. Its purpose is to present, as clearly and completely as possible, the nature and characteristics of modern day computer systems. This covers all aspects of computer technology from the underlying basics of computers and operating systems and its types. The focus of this course is on business productivity software applications and professional behavior in computing, including word processing (as needed), spreadsheets, databases, presentation graphics, and to explore various methods where Information Technology can be used to support existing businesses and strategies.

**Prerequisites:**

Basic knowledge on computers

**Course Objectives:**

The objectives of this course are to:

1. To understand how to use software packages in day to day activities
2. Learn the essential and use of internet

**Course Outcomes:**

On completion of this course the student shall be able to:

1. To provide an in-depth training in use of office automation packages, internet etc. essential for common man for day to day office management, and e-governance.
2. Describe the Basics of Operating systems & computers.



## Course Contents:

### Unit 1:

[13 Hours]

**Fundamentals of computer:** Overview Of a Computer, Functional Components of a computer (Working of each unit), Evolution Of Computers, Generations Of Computers, Classification Of Computers, Applications Of Computers. **Hardware:** Block diagram of computer, Input and Output devices, Memory and storages devices, Different ports and its uses, Different type of printers

### Unit 2:

[13 Hours]

**Operating system (Windows XP):** Windows concepts, Features, Windows Structure, Desktop, Task bar, Start Menu, My Computer, Recycle Bin, Windows Accessories, calculator, Notepad, Paint, Word pad, Character Map, Windows Explorer, Entertainment, Installation of Hardware and Software, Using scanner, system tools, communication, sharing information between computers.

### Unit 3:

[13 Hours]

**Word Processing:** Typing, Editing, Proofing & Reviewing, Formatting Text & Paragraphs, Automatic Formatting and Styles, Working with Tables, Graphics and Frames, Mail Merge, Automating Your Work & printing Documents. **Excel Spreadsheet:** Working & Editing In Workbooks, Creating Formats & Links, Formatting a Worksheet & creating graphic objects, Creating Charts (Graphs), formatting and analyzing data, Organizing Data in a List (Data Management), Sharing & Importing Data, Printing.

### Unit 4:

[13 Hours]

**PowerPoint Presentations:** Getting started in PowerPoint, Creating a presentation, Creating & editing slides, Previewing a slide show, Adding picture & graph, Adding sound & video, Adding auto shape, Animating objects. **Introduction to Internet:** Intranet tools: E-mail: Anatomy of e-mail, e-mail address, finding e-mail address, adding signature, attaching files, opening attachments, managing e-mail account, Webmail.

### Text Book:

1. Archana Kumar, "Computer Basics with Office Automation", I.K. International Publishing House Pvt. Limited, 2010

## SIXTH SEMESTER

<b>B21DA0601</b>	<b>Data Analytics using R</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>3</b>	<b>0</b>	<b>1</b>	<b>4</b>

### Course Description:

Data Analytics is the science of analyzing data to convert information to useful knowledge. This knowledge could help us understand our world better, and in many contexts enable us to make better decisions. This course seeks to present you with a wide range of data analytic techniques and is structured around the broad contours of the different types of data analytics, Fundamentals of Big Data, Big Data Analytics, Big Data Management, and Applications of Big Data Analytics.

### Prerequisites:

Basic knowledge in Programming languages, Algorithm and Data Structure, Database concepts, and Strong knowledge in statistics and mathematics.

### Course Objectives:

The objectives of this course are to:

1. Introduce students to the basics of Big Data and Big Data Analytics.
2. Equip the students with the concepts of storing Big Data using Hadoop Distributed File System.
3. To provide the students with the foundation of Big Data analysis using Map Reduce.
4. To expose students to data analytics features using R.

### Course Outcomes:

On completion of this course the student shall be able to:

1. Understand the fundamentals of various Big data analysis techniques.
2. Deploy a structured lifecycle approach to data science and big data analytics projects and understand and work with big data analytics platform/tools like R and RStudio to create statistical models and to visualize.
3. Understand the association of analytics with other domains.
4. Deployment of big data analytic techniques for useful business applications.

### Course Contents:

#### UNIT 1:

[13 Hours]

**Introduction To Big Data:** Types of Digital Data, Introduction to Big Data, Elements of Big Data (Facts, capabilities, benefits, where it is used), Big Data Analytics, How to analyze Big Data, History of Big Data, Big Data in the real world (Myths, Challenges, Future), Big Data Management.

#### UNIT 2:

[13 Hours]

**Hadoop and HDFS (Hadoop Distributed File System):** Introduction and History of Hadoop, Hadoop Echo System, The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data

flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.

**UNIT 3:** **[13 Hours]**

**Map Reduce:** Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.

**UNIT 4:** **[13 Hours]**

**Data Analytics with R:** Take your first steps with R, data types, missing values, basics of R syntax, The R workspace, Vectors, System- and user-defined objects, Matrices, Lists, Functions, Statistics methodology, Factors and Data frames, Basic Graphics.

**Text Books:**

1. Tom White “Hadoop: The Definitive Guide” Third Edit on, O’reily Media, 2012.
2. Seema Acharya, SubhasiniChellappan, "Big Data Analytics" Wiley 2015.

**Reference Books:**

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis”, Springer, 2007.
2. Jay Liebowitz, “Big Data and Business Analytics” Auerbach Publications, CRC press (2013)
3. Tom Plunkett, Mark Hornick, “Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop”, McGraw-Hill/Osborne Media (2013), Oracle press.
4. AnandRajaraman and Jeffrey David Ulman, “Mining of Massive Datasets”, Cambridge University Press, 2012.

<b>B21DAS611</b>	<b>OOAD Using UML</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>2</b>	<b>0</b>	<b>1</b>	<b>3</b>

**Course Description:**

Object Oriented Approach is innovative and modern approach of designing the system by focusing primarily on Data elements of the application domain. it differs from the functional/traditional approach by providing features like data hiding, encapsulation and better reuse. Modeling is not a separate phase but it is involved in every phase of software engineering. Modeling is all about making models/prototypes of the system/situations needed to do better analysis, design, coding and testing Object Oriented Modeling and Design is thinking about the problem using models organized around the real world concepts.

**Prerequisites:**

Ideally students should have some working knowledge of a procedural programming language and syntax, such as C. Attendees should have a working knowledge of developing software applications. Designing and analysis experience is also extremely beneficial

## Course Objectives:

The objectives of this course are to:

1. Introduce the concept of Object-oriented design
2. Acquire knowledge of Basic UML Concepts, Life Cycle of Object oriented Development, Modeling Concepts
3. Produce conceptual models for solving operational problems in software and IT
4. Environment using UML
5. Analyze the development of Object Oriented Software models

## Course Outcomes:

On completion of this course the student shall be able to:

1. Develop a working understanding of formal object-oriented analysis and design processes
2. Ability to abstract object-based views for generic software systems.
3. Ability to analyze and model software specifications.
4. Demonstrate object-based views for generic software systems

## Course Contents:

### UNIT 1:

[10 Hours]

**Modeling Concepts & Class Modeling:** Introduction to OO development, OO themes; Evidence for usefulness of OO development; OO modeling history, Modeling as Design Technique: Modeling; abstraction; The three models. Object and class concepts; Link and associations concepts; Generalization and inheritance; A sample class model; Navigation of class models; Practical tips. Advanced object and class concepts; Association ends; N-array associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived data; Packages;

### UNIT 2:

[10 Hours]

**State Modeling and Interaction Modeling:** State Modeling: Events, States, Transitions and Conditions; State diagrams; State diagram behavior; Practical tips. Advanced State Modeling: Nested state diagrams; Nested states; Signal generalization; Concurrency; A sample state model; Relation of class and state models; Interaction Modeling: Use case models; Sequence models; Activity models. Use case relationships; Procedural sequence models; Special constructs for activity models

### UNIT 3

[10 Hours]

**System Conception and Analysis:** System Conception: Devising a system concept; elaborating a concept; preparing a problem statement. Overview of analysis; Domain class model; Domain state model; Domain interaction model; Iterating the analysis. Application Analysis: Application interaction model; Application class model; Application state model; adding operations.

### UNIT 4

[09 Hours]

**System Design and Class Design:** Overview of system design; Estimating performance; Making a reuse plan; Breaking a system in to sub-systems; Identifying concurrency; Allocation of sub-systems; Management of

data storage; Handling global resources; Choosing a software control strategy; Handling boundary conditions  
 Class Design: Overview of class design; Bridging the gap; Realizing use cases; Designing algorithms;  
 Recording downwards, Refactoring; Design optimization; Reification of behavior.

**Text Books:**

1. Michael Blaha, James Rumbaugh, “OBJECT-ORIENTED MODELING AND DESIGN WITH UML”, 2nd Edition, Pearson Education / PHI, 2005. (Chapters 1 to 9, 11 to 14.10, 15.1 to 15.8)
2. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal, “PATTERN-ORIENTED SOFTWARE ARCHITECTURE, A SYSTEM OF PATTERNS”, Volume 1, John Wiley and Sons, 2006. (Chapters 1, 2.4, 3)

**Reference Books:**

1. Grady Booch, “OBJECT-ORIENTED ANALYSIS AND DESIGN WITH APPLICATIONS”, 3rd Edition, Pearson, 2007.
2. Mark Priestley, “PRACTICAL OBJECT-ORIENTED DESIGN WITH UML”, 2nd Edition, Tata McGraw-Hill, 2003.
3. K. Barclay, J. Savage, “OBJECT-ORIENTED DESIGN WITH UML AND JAVA”, Elsevier, 2008.
4. Booch, G, Rumbaugh, J and Jacobson, I, “THE UNIFIED MODELING LANGUAGE USER GUIDE”, 2nd Edition, Pearson, 2005.
5. E. Gamma, R. Helm, R. Johnson, J. Vlissides, “DESIGN PATTERNS-ELEMENTS OF REUSABLE OBJECT-ORIENTED SOFTWARE”, Addison-Wesley, 1995.
6. Michael R Blaha, James R Rumbaugh, “OBJECT ORIENTED MODELING AND DESIGN WITH UML”, 2nd Edition, Prentice Hall, 2004.

<b>B21DAS612</b>	<b>Advanced Web Technologies</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>2</b>	<b>0</b>	<b>1</b>	<b>3</b>

**Course Description:**

Students following this theme will gain an understanding and insight into the technologies that deliver the Web as we see it today. The topics covered include underlying languages and standards used to represent information on the web; techniques for understanding and managing data and information in a web context; and techniques and technology used to design and deliver web infrastructure.

**Prerequisites:**

To get started with web technology you should have the basic knowledge of Computer fundamentals

**Course Objectives:**

- The objectives of this course are to:
1. Review the need of Angular JS

2. Discuss the perl scripting and concepts of server programming by using PHP
3. Differentiate use of AJAX objects over normal HTML objects

### Course Outcomes:

On completion of this course the student shall be able to:

1. Construct Angular views and templates by implementing expressions and built-in directives
2. Design server webpage by using perl scripting
3. Describe a server side webpage by using PHP
4. Apply AJAX objects over normal HTML objects
5. Develop a server side scripting by using SOAP architecture

### Course Contents:

#### UNIT 1:

[10 Hours]

**Introduction to XML:** Introduction to XML: Introduction, The Syntax of XML, XML Document Structure, Document Type Definitions, Namespaces, XML Schemas, Displaying Raw XML Documents, Displaying XML Documents with CSS. XSLT Style Sheets, XML Processors, Web Services

#### UNIT 2:

[10 Hours]

**Introduction to PHP:** Introduction to PHP: Origins and Uses of PHP, Overview of PHP, General Syntactic Characteristics, Primitives Operations and Expressions, Output, Control Statements, Arrays, Functions, Pattern Matching, Form Handling.

Database Access through the Web: Relational Databases, An Introduction to the Structured Query Language, Database Access with PHP and MySQL.

#### UNIT 3:

[10 Hours]

**Introduction to Ruby& Rails:** Introduction to Ruby: Origins and Uses of Ruby, Scalar Types and Their Operations, Simple Input and Output, Control Statements, Fundamentals of Arrays, Hashes, Methods, Classes, Blocks and Iterators, Pattern Matching.

**Introduction to Rails:** Overview of Rails, Document Requests.

#### UNIT 4:

[09 Hours]

**Angular JS:** Angular JS: Introduction, Client – Side Templates, Model View Controller(MVC), Data Binding, Dependency Injection, Directives, Examples. Anatomy of an Angular JS Application, Invoking Angular, Model View Controller, Templates and Data Binding, Organizing Dependencies with Modules, Formatting Data with Filters, Changing Views with Routes and \$location, Talking to Servers, Changing the DOM with Directives Validating User Input.

#### Text Books:

1. Robert W Sebesta, “PROGRAMMING THE WORLD WIDE WEB”, 6th Edition, Pearson Education, 2008. (Chapters: 7, 9, 10, 13, 14 and 15)
2. Brad Green & ShyamSeshadri, “ANGULAR JS”, O’Reilly Publications, 2015. (Chapter 1 & 2)

**Reference Books:**

1. M.Deitel, P.J.Deitel, A.B.Goldberg, "INTERNET & WORLD WIDE WEB HOW TO PROGRAM", 3rd Edition, Pearson Education / PHI, 2004.
2. Chris Bates, "WEB PROGRAMMING BUILDING INTERNET APPLICATIONS", 3rd Edition, Wiley India, 2006.
3. XueBai, "THE WEB WARRIOR GUIDE TO WEB PROGRAMMING", Thomson, 2003.
4. Sklar, "THE WEB WARRIOR GUIDE TO WEB DESIGN TECHNOLOGIES", 1st Edition, Cengage Learning India.

**LAB****PART - A**

1. Write a Perl Script which counts the words in a given file
2. Using PHP and My SQL develop a program to accept book information viz. isbn, title, authors, edition and publisher from a web page and store the information in a database, search for a book with the title and display the search results with proper headings.
3. Create a registration form using PHP which contains name, email, contact no, address and gender, display the details in other server page when user clicks the submit button.
2. Create a program to order product by customer using PHP and store the details in My SQL Database.
3. Develop a web application for Student Admission System using PHP & MySQL database.

**PART – B**

Design a simple server side web pages using PHP and MYSQL by following the constraints listed below

- Should be minimum of three pages
- Create database and store details in database
- Java script can be used for client scripting and php can be used for server side scripting.

<b>B21DAS621</b>	<b>Internet Of Things</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>

### Course Description:

The students will be able to understand the potential of the Internet of Things for our society, in terms of impact on the lives of billions of people and on the world economy. The students will also understand the underlying technology that powers the Internet of Things, as well as the challenges that comes with such technologies. Will explore many real-life examples of IoT devices that are commercially available, and you will have a glimpse of the future of the Internet of Things.

### Prerequisites:

General knowledge of networking, sensing, databases, programming, and related technology.

### Course Objectives:

The objectives of this course are to:

1. Discuss the basics of Microcontroller & Microprocessor
2. Identify different IoT applications and their application areas.
3. Explain the emerging field of wireless sensor networks and IoT, which consist of many tiny, low-power devices equipped with sensing, computation, and wireless communication capabilities.
4. Describe operating systems, radio communication, networking protocols, Methodologies of IoT.

### Course Outcomes:

On completion of this course the student shall be able to:

1. Create the IoT applications with the help of IoT enabled Technologies
2. Sketch protocols for IoT Applications
3. Analyze low-power devices equipped with sensing, computation, and wireless communication capabilities.
4. Develop the operating systems, radio communication, networking protocols, using Methodologies of IoT

### Course Contents:

#### UNIT 1:

**[10 Hours]**

**Microprocessors and microcontroller Introduction :**Microprocessors and microcontroller, Introduction, Microprocessors and Microcontrollers, RISC & CISC CPU Architectures, Harvard & Von-Neumann CPU architecture, Computer software. The 8051 Architecture: Introduction, Architecture of 8051, Pin diagram of 8051, Memory organization, External Memory interfacing, stacks.



**UNIT 2:****[10 Hours]**

**Introduction to Internet of Things :**Definition & Characteristics of IoT, Physical Design of IoT, Things in IoT, IoT Protocols, Logical Design of IoT, IoT Functional Blocks , Communication Models , IoT Communication APIs,

**UNIT 3:****[10Hours]**

**Domain Specific IoTs:**Introduction, Home Automation, Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/Gas Detectors, Cities, Smart Parking, Smart Lighting, Smart Roads, Structural Health Monitoring, Surveillance, Emergency Response, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Lifestyle

**UNIT 4:****[10Hours]**

**Developing Internet of Things:**IoT Design Methodology, Step 1: Purpose & Requirements Specification, Step 2: Process Specification, Step 3: Domain Model Specification, Step 4: Information Model Specification, Step 5: Service Specifications , Step 6: IoT Level Specification, Step 7: Functional View Specification, Step 8: Operational View Specification ,Step 9: Device & Component Integration, Step 10: Application Development.

**Text Books:**

1. Godse, Atul P. "MICROPROCESSORS & MICROCONTROLLERS", Technical publications, 2008.
2. Vijay Madiseti, ArshdeepBahga "INTERNET OF THINGS-AN HANDS ON APPROACH", 2014 (chapter 1, 2, 5, 6, 7).

**Reference Books:**

1. CunoPfister,"GETTING STARTED WITH THE INTERNET OF THINGS", OReilly, 2011.
2. FrancisDaCosta, Rethinking,"INTERNET OF THINGS", Apress Open Edition, 2013
3. Adrian McEwen, Hakim Cassimally, "DESIGN OF INTERNET OF THINGS", 2014 John Wiley and Sons, Ltd.

<b>B21DAS622</b>	<b>Digital Marketing</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>

**Course Description:**

The subject of Digital Marketing basic concepts and technologies used in the field of Marketing, comparing traditional marketing vs internet based marketing strategies. Goals achieved through internet like search engine, making advertising using banner, ads, email, social media postings. Targeting the audience through various strategies and helping them in buy cross selling and upselling.

**Prerequisites:**

Knowledge on Social Networking sites

## Course Objectives:

The objectives of this course are to:

1. Develop industry background knowledge to knowledgeably navigate Internet Marketing topics including online advertising, search, social media, and online privacy.
2. Evaluate an experiment quantitatively and qualitatively to measure the effectiveness of business decisions and online advertising effectiveness in particular.
3. Design and implement an experiment.
4. Apply best practices for social media marketing.

## Course Outcomes:

On completion of this course the student shall be able to:

1. To identify the techniques involved in formulating the search engine optimization.
2. To analyze and evaluate the process involved digital advertisement.
3. To Design and develop the process involved in digital marketing using Email.
4. To Analyze and interpret the techniques involved in social media marketing

## Course Contents:

### UNIT 1:

[10 Hours]

**Introduction To Digital Marketing:**Start with the Customer and Work Backward, What Are the 3i Principles?

#### **Search Engine Optimization (Seo):**

An Introduction, Search Engine Result Pages: Positioning, Search Behavior, Goals, On-Page Optimization, Off-Page Optimization, Analyze.

### UNIT 2:

[10 Hours]

**Pay Per Click:**An Introduction, Goals, Setup, Manage, Analyze

**Digital Display Advertising:**An Introduction, Display Advertising: An Industry Overview, Define, Format, Configure, Analyze

### UNIT 3:

[10Hours]

**Email Marketing:**An Introduction, Data—Email Marketing Process, Design and Content, Delivery, Discovery.

**Mobile Marketing:**An Introduction, Opportunity, Optimize, Advertise, Analyze.

### UNIT 4:

[09 Hours]

**Social Media Marketing (Smm):**An Introduction, Goals, Channels, Implementation, Analyze, Laws and Guidelines

#### **Text Books:**

1. Ian Dodson, “THE ART OF DIGITAL MARKETING: The Definitive Guide to Creating Strategic, Targeted and Measurable Online Campaigns”,1st Edition, Wiley Publications, 2016. (Chapters : 1, 2, 3, 4, 5, 6, 7, 8, 9).

**Reference Books:**

1. Damian Ryan, "UNDERSTANDING DIGITAL MARKETING: Marketing Strategies for engaging the digital generation" 4th Edition, Kogan Page, 2017.
2. Ryan Deiss and Russ Henneberry, "DIGITAL MARKETING : For Dummies", John Wiley & Sons, Inc, 2017.
3. Alan Charlesworth, " DIGITAL MARKETING : A Practical Approach", 2nd Edition, Routledge, 2009.

<b>B21DA0602</b>	<b>Project Work</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration :16Wks</b>		<b>0</b>	<b>0</b>	<b>10</b>	<b>10</b>

**Course Description:**

Knowledge on Software engineering and any of Programming languages

**Course Objectives:**

The objectives of this course are to:

**Course Outcomes:**

On completion of this course the student shall be able to:

**Course Contents:****MESSAGE TO THE STUDENTS**

The Bachelor of Computer Applications (BCA) programme prepares the students to take up positions as Programmers, Systems Analysts, Systems Designers in the field related to computer science and information technology. We had therefore imparted the comprehensive knowledge covering the skills and core areas of computer science courses with equal emphasis on the theory and practice in BCA programme.

The BCA students are encouraged to involve themselves completely on the project work in their final semester. It is advised to students to develop their project for solving problems of software industry or any research organization. Doing this will give more exposure to handle real life problems of project development.

This project work is kept in BCA program to give you opportunity to develop quality software solution. During the development of the project you should involve in all the stages of the software development life cycle (SDLC) like requirements analysis, systems design, software development/coding, testing and documentation, with an overall emphasis on the development of reliable software systems. The primary emphasis of the project work is to understand and gain the knowledge of the principles of software engineering practices, and develops good understanding of SDLC.

Students should take this project work very seriously. Project should be taken as an opportunity to develop software, which gives exposure to SDLC. Topics selected, should be complex and large enough to justify as a BCA project. The project should be genuine and original in nature and should not be copied from anywhere else.

## **GUIDELINES FOR PROJECT FORMULATION**

### **TYPE OF PROJECT**

As majority of the students are expected to work out a real life project in some industry/research and development laboratories/educational institutions/software companies, it is suggested that the project is to be chosen which should have some direct relevance in day-to-day activities of the candidates in his/her institution. Students are encouraged to work in the areas listed at the end. However, it is not mandatory for a student to work on a real life project. The student can formulate a project problem with the help of Guide.

### **PROJECT PROPOSAL (SYNOPSIS)**

The project proposal should be prepared in consultation with your guide. The project proposal should clearly state the project objectives and the environment of the proposed project to be undertaken. The project work should compulsorily include the software development. The project proposal should contain complete details in the following form:

1. Title of the Project
2. Introduction and Objectives of the Project
3. Project Category (RDBMS/OOPS/Networking/Multimedia/Artificial Intelligence/Expert Systems etc.)
4. Analysis (DFDs at least up to second level , ER Diagrams/ Class Diagrams/ Database Design etc. as per the project requirements).
5. A complete structure which includes: Number of modules and their description to provide an estimation of the student's effort on the project. Data Structures as per the project requirements for all the modules. Process Logic of each module. Testing process to be used. Reports generation ( Mention tentative content of report)
6. Tools / Platform, Hardware and Software Requirement specifications
7. Are you doing this project for any Industry/Client? Mention Yes/No. If Yes, Mention the Name and Address of the Industry or Client
8. Future scope and further enhancement of the project.

### **ITEMS TO BE INCLUDED IN THE PROJECT REPORT**

The following items should be included in the Project Report:

The project report must contain the following:

1. Introduction Objectives
2. Tools/Environment Used
3. Analysis Document (This should include SRS in proper structure based on Software Engineering concepts, E-R diagrams/Class diagrams/any related diagrams (if the former are not applicable), Data flow diagrams/other similar diagrams (if the former is not applicable), Data dictionary).

4. Design Document (Modularization details, Data integrity & constraints including database design, Procedural design, User interface design) Program code (Complete code (well indented)/Detailed specification instead of code\*, Comments & Description. The program code should always be developed in such a way that it includes complete error handling, passing of parameters as required, placement of procedure/function statements as needed.)
5. Testing (Test case designs are to be included separately for Unit testing, Integration testing, System testing; Reports of the outcome of Unit testing, Integration testing, System testing are to be included separately. Also, details of debugging and code improvement are to be included.)
6. Input and Output Screens
7. Limitations of the Project
8. Future Application of the Project
9. Bibliography

#### **LIST OF BROAD AREAS OF APPLICATION AND RELATED TOOLS**

FRONT END / GUI Tools:	Visual Basic, Power Builder, X-Windows (X/lib, X/motif, X/Intrinsic), Oracle Developer 2000, VC++, Jbuilder
RDBMS/BACK END:	Oracle, Ingres, Sybase, Progress, SQL Plus, Versant, MY SQL, SQL Server, DB2
LANGUAGES:	C, C++, Java, VC++, C#, Python
SCRIPTING LANGUAGES:	PERL, SHELL Scripts (UNIX), Tcl/TK
RDBMS/BACK END:	Oracle, Ingres, Sybase, Progress, SQL Plus, Versant, MY SQL, SQL Server, DB2
INTERNET TECHNOLOGIES:	Java script, VB Script, Perl & CGI script, HTML, Java, Active X, RMI, CORBA, SWING, JSP, ASP, XML, EJB, Java Beans, Java Servlets, UML, CSS, VB.Net, J2EE.
OPERATING SYSTEMS:	WINDOWS 95/98/2000/ME, WINDOWS NT, UNIX, LINUX, WINDOWS XP, DOS
APPLICATIONS:	Financial/ Manufacturing/ Multimedia/ Computer Graphics/ Instructional Design/ Database Management System/ Internet/ Intranet/ Computer Networking/ Communication Software/ E-Commerce/ ERP / MRP/ TCP/IP Internals/ Routing protocols/ Socket Programming/ Implementation of Switches & Routers

<b>B21PTM601/ B21DAM601</b>	<b>Soft Skills</b>
<b>Duration :16Wks</b>	

<b>B21DAM602</b>	<b>Skill Development Program</b>
<b>Duration :16Wks</b>	

## **CAREER DEVELOPMENT AND PLACEMENT**

Having a degree will open doors to the world of opportunities for you. But Employers are looking for much more than just a degree. They want graduates who stand out from the crowd and exhibit real life skills that can be applied to their organizations. Examples of such popular skills employers look for include:

1. Willingness to learn
2. Self motivation
3. Team work
4. Communication skills and application of these skills to real scenarios
5. Requirement of gathering, design and analysis, development and testing skills
6. Analytical and Technical skills
7. Computer skills
8. Internet searching skills
9. Information consolidation and presentation skills
10. Role play
11. Group discussion, and so on

REVA University therefore, has given utmost importance to develop these skills through variety of training programs and such other activities that induce the said skills among all students. A full-fledged Career Counseling and Placement division, namely Career Development Center (CDC) headed by well experienced senior Professor and Dean and supported by dynamic trainers, counselors and placement officers and other efficient supportive team does handle all aspects of Internships and placements for the students of REVA University. The prime objective of the CDC is to liaison between REVA graduating students and industries by providing a common platform where the prospective employer companies can identify suitable candidates for placement in their respective organization. The CDC organizes pre-placement training by professionals and also arranges expert talks to our students. It facilitates students to career guidance and improves their employability. In addition, CDC forms teams to perform mock interviews. It makes you to enjoy working with such teams and learn many things apart from working together in a team. It also makes you to participate in various student clubs which helps in developing team culture, variety of job skills and overall personality.

The need of the hour in the field of Computer Science is not only knowledge in the subject, but also the skill to do the job proficiently, team spirit and a flavour of innovation. This kept in focus, the CDC has designed the training process, which will commence from second semester along with the curriculum. Special coaching in personality development, career building, English proficiency, reasoning, puzzles, and communication skills to every student of REVA University is given with utmost care. The process involves continuous training and monitoring the students to develop their soft skills including interpersonal skills that will fetch them a job of

repute in the area of his / her interest and March forward to make better career. The School of Computer Science and Applications also has emphasised subject based skill training through lab practice, internship, project work, industry interaction and many such skilling techniques. The students during their day to day studies are made to practice these skill techniques as these are inbuilt in the course curriculum. Concerned teachers also continuously guide and monitor the progress of students.

The University has also established University-Industry Interaction and Skill Development Centre headed by a Senior Professor & Director to facilitate skill related training to REVA students and other unemployed students around REVA campus. The center conducts variety of skill development programs to students to suite to their career opportunities. Through this skill development centre the students shall compulsorily complete at least two skill / certification based programs before the completion of their degree. The University has collaborations with Industries, Corporate training organizations, research institutions and Government agencies like NSDC (National Skill Development Corporation) to conduct certification programs. REVA University has been recognised as a Centre of Skill Development and Training by NSDC (National Skill Development Corporation) under Pradhan Mantri Kaushal Vikas Yojana.

The University has also signed MOU's with Multi-National Companies, research institutions, and universities abroad to facilitate greater opportunities of employability, students' exchange programs for higher learning and for conducting certification programs.



## Programme Regulations

(Framed as per the provisions under Section 35 (ii), Section 7 (x) and Section 8 (xvi) & (xxi) of the REVA University Act, 2012)

### 1. Title and Commencement:

1.1 These Regulations shall be called “**REVA University Academic Regulations – Bachelor Degree Programs 2020-21 Batch subject to amendments from time to time by the Academic Council on recommendation of respective Board of Studies and approval of Board of Management**”

1.2 These Regulations shall come into force from the date of assent of the Chancellor.

### 2. The Programs:

These regulations cover the following Bachelor Degree Programs of REVA University offered during 2020-21:

B Com (Industry Integrated)  
B Com (Honors)  
BBA (Industry Integrated)  
BBA (Honors)  
BBA (Entrepreneurship)  
BA - Journalism, English, Psychology  
BA - Tourism, History & Journalism  
BA - Political Science, Economics & Journalism  
BA - Performing Arts, English Psychology  
BCA  
BSc (Honours) Cloud Computing & Big Data  
BSc in Physics, Chemistry, Maths  
BSc in Maths, Statistics, Comp Sci.  
BSc in Bioinformatics Biology, Maths, Computer Science  
BSc in Biotechnology, Biochemistry, Genetics  
BSc in Medical Lab Technology  
BSc in Physics, Maths, Computer Science

### 3. Duration and Medium of Instructions:

3.1 **Duration:** The Bachelor Degree program is of 6 Semesters duration. A candidate can avail a maximum of 12 semesters - 6 years as per double duration norm, in one stretch to complete the Bachelor Degree, including blank semesters, if any. Whenever a candidate opts for blank semester, s/he has to study the prevailing courses offered by the School when s/he resumes his/her studies.

3.2 The medium of instruction shall be English.

4. **Definitions:**

4.1 **Course:** “Course” means a subject, either theory or practical or both, listed under a program; Example: “Business Research Methodology” in BBA (Honors) program, “Auditing and Corporate Governance” in B Com (Industry Integrated) program are examples of courses to be studied under respective programs.

Every course offered will have three components associated with the teaching-learning process of the course, namely:

<b>L</b>	<b>Lecture</b>
<b>T</b>	<b>Tutorial</b>
<b>P</b>	<b>Practice</b>

Where:

**L** stands for **Lecture** session consisting of classroom instruction.

**T** stands for **Tutorial** session consisting participatory discussion / self-study/ desk work/ brief seminar presentations by students and such other novel methods that make a student to absorb and assimilate more effectively the contents delivered in the Lecture classes.

**P** stands for **Practice** session and it consists of Hands on Experience / Laboratory Experiments / Field Studies / Case Studies / Project Based Learning or Course end Project/Self Study/ Online courses from listed portals that equip students to acquire the much required skill component.

4.2 **Classification of Courses**

**Courses offered are classified as: Foundation Courses, Core Courses, Hard Core Courses, Soft Core Courses, Open Elective Courses, Project work/Dissertation**

4.2.1 **Foundation Course:** The foundation Course is a mandatory course which should be completed successfully as a part of graduate degree program irrespective of the program of study

4.2.2 **Core Course:** A course which should compulsorily be studied by a candidate choosing a particular program of study

4.2.3 **Hard Core Course (HC) simply core course:** The **Hard Core Course** is a Core Course in the main branch of study and related branch(es) of study, if any, that the candidates have to complete compulsorily

#### 4.2.4 **Soft Core Course (SC) (also known as Professional Elective Course)**

A Core course may be a **Soft Core** if there is a choice or an option for the candidate to choose a course from a pool of courses from the main branch of study or from a sister/related branch of study which supports the main branch of study

#### 4.2.5 **Open Elective Course (OE):**

An elective course chosen generally from other discipline / subject, with an intention to seek exposure to the basics of subjects other than the main discipline the student is studying is called an **Open Elective Course**

#### 4.2.6 **Project Work / Dissertation:**

School can offer project work/dissertation as a course. Depending on the duration required for completing the project/dissertation work, credits can be assigned. Normally 26 hours of practical work/project work/dissertation work is considered to be equivalent to a credit. School can classify project as a minor or a major project depending on the credits allotted. Normally, a minor project carries 4-6 credits and a major project carries double the number of credits of a minor project.

**4.2.7 “Program”** means the academic program leading to a Degree, Post Graduate Degree, Post Graduate Diploma or such other degrees instituted and introduced in REVA University.

### 5. **Eligibility for Admission:**

5.1. The eligibility criteria for admission to **Three Years Bachelor Degree Programs** (6 Semesters) is given below:

<b>Sl. No</b>	<b>Program</b>	<b>Duration</b>	<b>Eligibility</b>
1	Bachelor of Commerce (Industry Integrated)	6 Semesters (3 years)	Pass in PUC/10+2 with minimum 50% marks of any recognized Board / Council or any other qualification recognized as equivalent there to.
2	Bachelor of Commerce (Honours)		Pass in PUC/10+2 with minimum 75% marks of any recognized Board / Council or any other qualification recognized as equivalent there to.

3	Bachelor of Business Administration (Industry Integrated)	6 Semesters (3 years)	Pass in PUC/10+2 with minimum 50% marks of any recognized Board / Council or any other qualification recognized as equivalent there to.
4	Bachelor of Business Administration (Honours)	6 Semesters (3 years)	Pass in PUC/10+2 with minimum 75% marks of any recognized Board / Council or any other qualification recognized as equivalent there to.
5	Bachelor of Business Administration (Entrepreneurship)	6 Semesters (3 years)	
6	<b>Bachelor of Arts in</b> a) Journalism, English & Psychology (JEP) b) Political Science, Economics, Journalism (PEJ) c) Tourism, Journalism & History (TJH)	6 Semesters (3 years)	Pass in PUC /10+2 of any recognized Board / Council or any other qualification recognized as equivalent there to.
7	Bachelor of Arts in Performing Arts, English & Psychology	6 Semesters (3 years)	
8	Bachelor of Computer Applications	6 Semesters (3 years)	Pass in PUC/10+2 with at least 45% marks (40% in case of candidate belonging to SC/ST category) of any recognized Board/Council of any other qualification recognized as equivalent there to.
9	Bachelor of Science (Hons.) in Computer Science (with specialization in Cloud Computing & Big Data)	6 Semesters (3 years)	Pass in PUC/10+2 examination with Mathematics / Computer Science / Statistics as compulsory subject along with other subjects and obtained minimum 45% marks (40% in case of candidates belonging to SC/ST category) in the above subjects taken together from any Board recognized by the respective State Government /Central Government/Union Territories or any other qualification recognized as equivalent thereto.
10	<b>B Sc in</b> a) Physics, Chemistry and Mathematics (PCM) b) Mathematics, Statistics and Computer Science (MStCs) c) Physics, Mathematics and Computer Science (PMCs)	6 Semesters (3 years)	Pass in PUC/10+2 with Mathematics as compulsory subjects and at least 45% marks (40% in case of candidate belonging to SC/ST category) of any recognized Board/Council or any other qualification recognized as equivalent there to.
11	<b>B Sc in</b> a) Bioinformatics – Biology, Computer Science & Mathematics (BCsM) b) Biotechnology, Biochemistry, Genetics	6 Semesters (3 years)	Pass in PUC/10+2 with Biology as compulsory subject and at least 45% marks (40% in case of candidate belonging to SC/ST category) of any recognized Board/Council or any other qualification recognized as equivalent there to.

c) Medical Laboratory Technology (BMLT)		
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5.2 Provided further that the eligibility criteria are subject to revision by the Government Statutory Bodies, University from time to time.

## 6. Courses of Study and Credits

6.1 Each course of study is assigned with certain credit value

6.2 Each semester is for a total duration of 20 weeks out of which 16 weeks dedicated for teaching and learning and the remaining 4 weeks for IAs and final examination, evaluation and announcement of results.

6.3 The credit hours defined as below

In terms of credits, every one hour session of L amounts to 1 credit per Semester and a minimum of two hour session of T or P amounts to 1 credit per Semester or a three hour session of T / P amounts to 2 credits over a period of one Semester of 16 weeks for teaching-learning process.

1 credit = 13 credit hours spread over 16 weeks or spread over the semester

**The total duration of a semester is 20 weeks inclusive of semester-end examination.**

**For Example:** The following table describes credit pattern

<b>Lectures (L)</b>	<b>Tutorials (T)</b>	<b>Practice (P)</b>	<b>Credits (L:T:P)</b>	<b>Total Credits</b>	<b>Total Contact Hours</b>
4	2	0	4:1:0	5	6
3	2	0	3:1:0	4	5
3	0	2	3:0:1	4	5
2	2	2	2:1:1	4	6
0	0	6	0:0:3	3	6
4	0	0	4:0:0	4	4
2	0	0	2:0:0	2	2

a. The concerned BoS will choose the convenient Credit Pattern for every course based on size and nature of the course

## 7. Different Courses of Study:

Different **Courses of Study** are labeled as follows:

- a. Foundation Course (FC)
- b. Core Course (CC)
- c. Hard Core Course (HC)
- d. Soft Core Course (SC)
- e. Open Elective Course (OE)
- f. Project Work / Dissertation: School can offer project work/dissertation as a course. Depending on the duration required for completing the project/dissertation work, credits can be assigned. Normally 26 hours of practical work/project work/dissertation work is considered to be equivalent to a credit. School can classify project as a minor or a major project depending on the credits allotted. Normally, a minor project carries 4-6 credits and a major project carries double the number of credits of a minor project.

These are defined under Section 4 of these regulations.

## 8. Credits and Credit Distribution

Registered candidates are required to earn the credits stated in the below table for the award of degree in the respective program:

<b>Credits</b>	<b>Programs</b>
<b>120</b>	<b>B.Com (Industry Integrated) degree, BBA (Industry Integrated) degree, and BCA</b>
<b>140</b>	<b>B.Com (Honors), BBA (Honors), BBA (Entrepreneurship) and B Sc (Honors)</b>
<b>144</b>	<b>BA - Journalism, English, Psychology, BA - Tourism, History &amp; Journalism, BA - Political Science, Economics &amp; Journalism, BA - Performing Arts, English Psychology, BSc in Physics, Chemistry, Maths, BSc in Maths, Statistics, Comp Sci., BSc in Bioinformatics Biology, Maths, Computer Science, BSc in Biotechnology, Biochemistry, Genetics, BSc in Medical Lab Technology, and BSc in Physics, Maths, Computer Science</b>

The following courses are foundation courses and they are mandatory courses. Students registering for any of the programs mentioned in the table above are required to successfully complete the courses for the award of the degree.

1. Communicative English
2. Languages K / H / Additional English
3. Indian Constitution

#### 4. Human Rights

- 8.2. The concerned BoS shall prescribe the credits to various types of courses and shall assign title to every course including project work, practical work, field work, self-study elective and classify the courses as **Foundation Course (FC), Hard Core (HC), Soft Core (SC) and Open Elective (OE)**.
- 8.3. The concerned BoS shall specify the desired Program Educational Objectives, Program Outcomes, Program Specific Outcomes and Course Outcomes while preparing the curriculum of a particular program.
- 8.4. A candidate can enrol during each semester for credits as prescribed in the scheme of the program.
- 8.5. Only such full time candidates who register for a minimum prescribed number of credits in each semester from I semester to VI semester and complete successfully prescribed number of credits for the award of the degree for three year program in 6 successive semesters shall be considered for declaration of Ranks, Medals, Prizes and are eligible to apply for Student Fellowship, Scholarship, Free ships, and such other rewards / advantages which could be applicable for all full time students and for hostel facilities.
- 8.6 Add on Proficiency Diploma / Minor degree/ Honor Degree:**  
To acquire Add on Proficiency Diploma/ Minor degree/ Honor Degree:, a candidate can opt to complete a minimum of 18-20 extra credits either in the same discipline /subject or in different discipline / subject in excess to prescribed number of credits for the award of 3 year degree in the registered program.

The Add on Proficiency Certification / Diploma/ Minor degree/ Honor Degree: so issued to the candidate contains the courses studied and grades earned.

#### 9 Assessment and Evaluation

- 9.1 The Scheme of Assessment will have two parts, namely;
- i. Internal Assessment (IA); and
  - ii. Semester End Examination (SEE)

9.2 Assessment and Evaluation of each Course shall be for 100 marks. The Internal Assessment (IA) and Semester End Examination (SEE) of for 3 year programs shall carry 50:50 marks respectively (i.e., 50 marks internal assessment; 50 marks semester end examination).

9.3 The 50 marks of internal assessment shall comprise:

Internal Test	30 marks
Assignments / Seminars / Quizzes / Presentations / Case Studies etc.	20 marks

9.4 There shall be **two Internal Tests** conducted as per the schedule announced below. **The Students' shall attend both the Tests compulsorily.**

- 1<sup>st</sup> test is conducted for 15 marks during **8<sup>th</sup> week** of the Semester;
- 2<sup>nd</sup> test is conducted for 15 marks during **16<sup>th</sup> week** of the of the Semester;
- Suitable number of Assignments/quizzes/presentations are set to assess the remaining 20 marks of IA at appropriate times during the semester

9.5 The coverage of syllabus for the said tests shall be as under:

- Question paper of the **1st test should be based on first 50% of the total syllabus;**
- Question paper of the **2<sup>nd</sup> test should be based on second 50% of the total syllabus;**

9.6 The Semester End Examination for 50 marks shall be held in the 18<sup>th</sup> and 19<sup>th</sup> week of the beginning of the semester and the syllabus for the semester end examination shall be entire syllabus.

9.7 A test paper is set for a maximum of 30 marks to be answered as per the pre-set time duration (1 hr / 1 hr 15 minutes / 1 hr 30 minutes). Test paper must be designed with School faculty members agreed pattern and students are assessed as per the instructions provided in the question paper. Questions must be set using Bloom's verbs. The questions must be set to assess the students outcomes described in the course document.

9.8 The question papers for internal test shall be set by the internal teachers who have taught the course. If the course is taught by more than one teacher all the teachers together shall devise a common question paper(s). However, these question papers shall be scrutinized by School specific Question Paper Scrutiny Committee formed by the respective School Head /Director to bring in the uniformity in the question paper pattern and as well to maintain the necessary standards.



- 9.9 The evaluation of the answer scripts shall be done by the internal teachers who have taught the course and set the test paper.
- 9.10 Assignment/seminar/Project based learning/simulation based problem solving/field work should be set in such a way, students be able to apply the concepts learnt to a real life situation and students should be able to do some amount self-study and creative thinking. While setting assignment care should be taken such that the students will not be able to plagiarise the answer from web or any other resources. An assignment / Quiz or combination thereof can be set for a maximum of 20 marks. Course instructor at his/her discretion can design the questions as a small group exercise or individual exercise. This should encourage collaborative learning and team learning and also self-study.
- 9.11 Internal assessment marks must be decided well before the commencement of Semester End examinations
- 9.12 Semester End Examination: The Semester End Examination is for 50 marks shall be held in the 18<sup>th</sup> and 19<sup>th</sup> week of the semester and the entire course syllabus must be covered while setting the question paper.
- 9.13 Semester End Examination paper is set for a maximum of 100 marks to be answered in 3 hours duration. Each main question be set for a maximum of 25 marks, main questions can have 3-4 sub questions. A total of 8 questions are set so that students will have a choice. Each question is set using Bloom's verbs. The questions must be set to assess the students outcomes described in the course document. (Please note question papers have to be set to test the course outcomes)
- 9.14 There shall be three sets of question papers for the semester end examination of which one set along with scheme of examination shall be set by the external examiners and two sets along with scheme of examination shall be set by the internal examiners. All the three sets shall be scrutinized by the Board of Examiners. It shall be responsibility of the Board of Examiners particularly Chairman of the BOE to maintain the quality and standard of the question papers and as well the coverage of the entire syllabus of the course.
- 9.15 There shall be single evaluation by the internal teachers who have taught the subject. However, there shall be moderation by the external examiner. In such cases where sufficient number of external examiners are not available to serve as moderators internal senior faculty member shall be appointed as moderators.
- 9.16 Board of Examiners, question paper setters and any member of the staff connected with the examination are required to maintain integrity of the examination system and the quality of the question papers.
- 9.17 There shall also be an **Program Assessment Committee (PAC)** comprising at-least 3 faculty members having subject expertise who shall after completion of examination process and declaration of results review the results sheets, assess the performance level of the students, measure the attainment of course outcomes, program outcomes and assess whether the program educational objectives are achieved and report to the Director of the School. **Program Assessment Committee (PAC)** shall also review the question papers of both Internal Tests as well Semester End Examinations

and submit reports to the Director of the respective School about the scope of the curriculum covered and quality of the questions.

9.18 The report provided by the **Program Assessment Committee (PAC)** shall be the input to the Board of Studies to review and revise the scheme of instruction and curriculum of respective program

9.19 During unforeseen situation like the Covid-19, the tests and examination schedules, pattern of question papers and weightage distribution may be designed as per the convenience and suggestions of the board of examiners in consultation with COE and VC

9.20 University may decide to use available modern technologies for writing the tests and SEE by the students instead of traditional pen and paper

9.21 Any deviations required to the above guidelines can be made with the written consent of the Vice Chancellor

9.22 Online courses may be offered as per BACHELOR norms.  
For online course assessment guidelines would be as follows:

1. If the assessment is done by the course provider, then the School can accept the marks awarded by the course provider and assign the grade as per REVA University norms.
2. If the assessment is not done by the course provider then the assessment is organized by the concerned school and the procedure explained in the regulation will apply
3. In case a student fails in an online course, s/he may be allowed to repeat the course and earn the required credits

IAs for online courses could be avoided and will remain at the discretion of the School.

9.23 The online platforms identified could be SWAYAM, NPTEL, Coursera, Edx.org, Udemy, Udacity and any other internationally recognized platforms like MIT online, Harvard online etc.

9.24 Utilization of one or two credit online courses would be:

4 week online course – 1 credit – 15 hours

8 week online course / MOOC – 2 credits – 30 hours

12 week online course / MOOC – 3 credits – 45 hours

9.25 **Summary of Internal Assessment, Semester End Examination and Evaluation** Schedule is provided in the table given below.

### Summary of Internal Assessment and Evaluation Schedule

S. No	Type of Assessment	when	Syllabus Covered	Max Marks	Reduced to	Date by which the process must be completed
1	Test-1	During 8 <sup>th</sup> week	First 50%	30	15	8 <sup>th</sup> week
2	Assignment / quiz / presentation / any other assessment method as decided by the School	On or before 8 <sup>th</sup> week (10 marks)				
3	Test -2	During 16 <sup>th</sup> Week	Second 50%	30	15	16 <sup>th</sup> Week
4	Assignment / quiz / presentation / any other assessment method as decided by the School	On or before 16 <sup>th</sup> Week (10 marks)				
5	SEE	19/20 <sup>th</sup> Week	100%	100	50	20 <sup>th</sup> Week

**Note:** 1. Examination and Evaluation shall take place concurrently and Final Grades shall be announced as per the notification from COE.

2. Practical examination wherever applicable shall be conducted after 2nd test and before semester end examination. The calendar of practical examination shall be decided by the respective School Boards and communicated well in advance to the Controller of Examination who will notify the same immediately

#### 10 Assessment of Students Performance in Practical Courses

The performance in the practice tasks / experiments shall be assessed on the basis of:

- a) Knowledge of relevant processes;
- b) Skills and operations involved;
- c) Results / products including calculation and reporting.

10.1 The 50 marks meant for Internal Assessment (IA) of the performance in carrying out Practical shall further be allocated as under:

i	Conduction of regular practical / experiments throughout the semester	20 marks
ii	Maintenance of lab records	10 marks
iii	Performance of mid-term test (to be conducted while conducting second test for theory courses); the performance assessments of the mid-term test includes performance in the conduction of experiment and write up about the experiment.	20 marks
	<b>Total</b>	<b>50 marks</b>

10.2 The 50 marks meant for Semester End Examination (SEE), shall be allocated as under:

i	Conducting of semester end practical examination	30 marks
ii	Write up about the experiment / practical conducted	10 marks
iii	Viva Voce	10 marks
	<b>Total</b>	<b>50 marks</b>

The duration for semester-end practical examination shall be decided by the concerned School Board.

10.3 For MOOC and Online Courses assessment shall be decided by the BOS of the School.

#### 11. Evaluation of Minor Project / Major Project / Dissertation:

Right from the initial stage of defining the problem, the candidate has to submit the progress reports periodically and also present his/her progress in the form of seminars in addition to the regular discussion with the supervisor. At the end of the semester, the candidate has to submit final report of the project / dissertation, as the case may be, for final evaluation. The components of evaluation are as follows:

Component – I	Periodic Progress and Progress Reports (25%)
Component – II	Demonstration and Presentation of work (25%)
Component – III	Evaluation of Report (50%)

All assessments must be done by the respective Schools as per the guidelines issued by the Controller of Examinations. However, the responsibility of announcing final examination results and issuing official transcripts to the students lies with the office of the Controller of Examinations.

#### 12. Requirements to Pass a Course:

A candidate's performance from IA and SEE will be in terms of scores, and the sum of IA and SEE scores will be for a maximum of 100 marks (IA = 50 , SEE = 50) and have to secure a minimum of 40% to declare pass in the course. However, a candidate has to secure a minimum of 25% (13 marks)

in Semester End Examination (SEE) which is compulsory.

**The Grade and the Grade Point:** The Grade and the Grade Point earned by the candidate in the subject will be as given below:

Marks, P	Grade, G	Grade Point (GP=V x G)	Letter Grade
90-100	10	v*10	O
80-89	9	v*9	A+
70-79	8	v*8	A
60-69	7	v*7	B+
55-59	6	v*6	B
50-54	5.5	v*5.5	C+
40-49	5	v*5	C
0-39	0	v*0	F
ABSENT			AB

*O - Outstanding; A+-Excellent; A-Very Good; B+-Good; B-Above Average; C+-Average; C-Satisfactory; F – Unsatisfactory.*

Here, P is the percentage of marks (P=[IA + SEE]) secured by a candidate in a course which is **rounded to nearest integer**. V is the credit value of course. G is the grade and GP is the grade point.

**a. Computation of SGPA and CGPA**

The Following examples describe computation of Semester Grade Point Average (SGPA).

The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student in a given semester, i.e : **SGPA (Si) =  $\sum(C_i \times G_i) / \sum C_i$**  where  $C_i$  is the number of credits of the  $i$ th course and  $G_i$  is the grade point scored by the student in the  $i$ th course.

### Examples on how SGPA and CGPA are computed

#### Example No. 1

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade)
Course 1	3	A+	9	3X9=27
Course 2	3	A	8	3X8=24
Course 3	3	B+	7	3X7=21
Course 4	4	O	10	4X10=40
Course 5	1	C	5	1X5=5
Course 6	2	B	6	2X6=12
	16			129

Thus, **SGPA = 129 ÷ 16 = 8.06**

#### Example No. 2

Course	Credit	Grade letter	Grade Point	Credit Point (Credit x Grade point)
Course 1	4	A	8	4X8=32
Course 2	4	B+	7	4X7=28
Course 3	3	A+	9	3X9=27
Course 4	3	B+	7	3X7=21
Course 5	3	B	6	3X6=18
Course 6	3	C	5	3X5=15
	20			141

Thus, **SGPA = 141 ÷ 20 = 7.05**

#### b. Cumulative Grade Point Average (CGPA):

Overall Cumulative Grade Point Average (CGPA) of a candidate after successful completion of the required number of credits for the respective programs are calculated taking into account all the courses undergone by a student over all the semesters of a program, i. e : **CGPA =  $\sum(C_i \times S_i) / \sum C_i$**

Where  $S_i$  is the SGPA of the  $i$ th semester and  $C_i$  is the total number of credits in that semester.

**Example:**  
**CGPA after Final Semester**

Semester (ith)	No. of Credits (Ci)	SGPA (Si)	Credits x SGPA (Ci X Si)
1	20	6.83	20 x 6.83 = 136.6
2	19	7.29	19 x 7.29 = 138.51
3	21	8.11	21 x 8.11 = 170.31
4	20	7.40	20 x 7.40 = 148.00
5	22	8.29	22 x 8.29 = 182.38
6	18	8.58	18 x 8.58 = 154.44
<b>Cumulative</b>	<b>120</b>		<b>930.24</b>

Thus,  $CGPA = 930.24/120 = 7.75$

**c. Conversion of grades into percentage:**

Conversion formula for the conversion of CGPA into Percentage is:

Percentage of marks scored = CGPA Earned x 10

**Example: CGPA Earned 7.75 x 10=77.5**

d. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

**13. Classification of Results**

The final grade point (FGP) to be awarded to the student is based on CGPA secured by the candidate and is given as follows.

CGPA	Grade (Numerical Index)	Letter Grade	Performance	FGP
	G			Qualitative Index
9 >= CGPA 10	10	O	Outstanding	Distinction
8 >= CGPA < 9	9	A+	Excellent	
7 >= CGPA < 8	8	A	Very Good	First Class
6 >= CGPA < 7	7	B+	Good	
5.5 >= CGPA < 6	6	B	Above average	Second Class
> 5 CGPA < 5.5	5.5	C+	Average	
> 4 CGPA < 5	5	C	Satisfactory	Pass
< 4 CGPA	0	F	Unsatisfactory	Unsuccessful

**Overall percentage=10\*CGPA**

- a. **Provisional Grade Card:** The tentative / provisional grade card will be issued by the Controller of Examinations at the end of every semester indicating the courses completed successfully. The provisional grade card provides **Semester Grade Point Average (SGPA)**.
- b. **Final Grade Card:** Upon successful completion of three year Degree a Final Grade card consisting of grades of all courses successfully completed by the candidate will be issued by the Controller of Examinations.

**14. Attendance Requirement:**

- 14.1 All students must attend every lecture, tutorial and practical classes.
- 14.2 In case a student is on approved leave of absence (e g:- representing the University in sports, games or athletics, placement activities, NCC, NSS activities and such others) and / or any other such contingencies like medical emergencies, the attendance requirement shall be minimum of 75% of the classes taught.
- 14.3 Any student with less than 75% of attendance in aggregate of all the courses including practical courses / field visits etc., during a semester shall not be permitted to appear to the end semester examination and such student shall seek re-admission

**15. Re-Registration and Re-Admission:**

- 15.1 In case a candidate's class attendance in aggregate of all courses in a semester is less than 75% or as stipulated by the University, such a candidate is considered as dropped the semester and is not allowed to appear for semester end examination and S/he shall have to seek re-admission to that semester during subsequent semester / year within a stipulated period.
- 15.2 In such case where in a candidate drops all the courses in a semester due to personal reasons, it is considered that the candidate has dropped the semester and s/he shall seek re-admission to such dropped semester.

**16. Absence during Internal Test:**

In case a student has been absent from an internal tests due to the illness or other contingencies s/he may give a request along with necessary supporting documents and certification from the concerned class teacher / authorized personnel to the concerned Director of the School, for conducting a separate internal test. The Director of the School may consider such request depending on the merit of the case and after consultation with course instructor and class teacher, and arrange to conduct a special



internal test for such candidate(s) well in advance before the Semester End Examination of that respective semester. Under no circumstances internal tests shall be held / assignments are accepted after Semester End Examination.

**17. Provision for Appeal**

If a candidate is not satisfied with the evaluation of Internal Assessment components (Internal Tests and Assignments), s/he can approach the Grievance Cell with the written submission together with all facts, the assignments, and test papers, which were evaluated. S/he can do so before the commencement of respective semester-end examination. The Grievance Cell is empowered to revise the marks if the case is genuine and is also empowered to levy penalty as prescribed by the University on the candidate if his/her submission is found to be baseless and unduly motivated. This Cell may recommend for taking disciplinary/corrective action on an evaluator if s/he is found guilty. The decision taken by the Grievance committee is final.

**18. Grievance Committee:**

In case of students having any grievances regarding the conduct of examination, evaluation and announcement of results, such students can approach Grievance Committee for redressal of grievances. Grievance committees will be formed by CoE in consultation with VC.

For every program there will be one grievance committee. The composition of the grievance committee is as follows:-

- The Controller of Examinations - Ex-officio Chairman / Convener
- One Senior Faculty Member (other than those concerned with the evaluation of the course concerned) drawn from the school / department/discipline and/or from the sister schools / departments/sister disciplines – Member.
- One Senior Faculty Members / Subject Experts drawn from outside the University school / department – Member.

**19. Eligibility to Appear for Semester End Examination (SEE)**

Only those students who fulfil a minimum of 75% attendance in aggregate of all the courses including practical courses / field visits etc., as part of the program shall be eligible to appear for Semester End Examination

**20. Provision for Supplementary Examination**

In case a candidate fails to secure a minimum of 25% (13 marks) in Semester End Examination (SEE)

and a minimum of 40% marks together with IA and SEE to declare pass in the course, such candidate shall seek supplementary examination of only such course(s) wherein his / her performance is declared unsuccessful. The supplementary examinations are conducted after the announcement of even semester examination results. The candidate who is unsuccessful in a given course(s) shall appear for supplementary examination of odd and even semester course(s) to seek for improvement of the performance.

**21. Provision to Carry Forward the Failed Subjects / Courses:**

A student who has failed in a given number of courses in odd and even semesters shall move to next semester of immediate succeeding year and final year of the study. However, s/he shall have to clear all courses of all semesters within the double duration, i.e., with six years of admission of the first semester failing which the student has to re-register to the entire program.

**22. Challenge Valuation:**

- a. A student who desires to apply for challenge valuation shall obtain a photo copy of the answer script(s) of semester end examination by paying the prescribed fee within 10 days after the announcement of the results. S/he can challenge the grade awarded to him/her by surrendering the grade card and by submitting an application along with the prescribed fee to the Controller of Examinations within 10 days after the announcement of the results. This challenge valuation is only for semester end examination.
- b. The answer scripts (in whatever form) for which challenge valuation is sought for shall be evaluated by the external examiner who has not involved in the first evaluation. The higher of two marks from first valuation and challenge valuation shall be the final.

**23.** With regard to any specific case of ambiguity and unsolved problem, the decision of the Vice-Chancellor shall be final.

## School of Computer Science and Applications

### Faculty list 2021 - 2022

Sl. No	Name	Designation
1	Dr. S Senthil	Professor & Director
2	Dr. M Vinayaka Murthy	Professor
3	Dr. Anand Kumar	Professor
4	K. Vijaya Lakshmi	Assoc. Professor
5	Dr. Rajeev Ranjan	Assoc. Professor
6	Dr. Anand R	Assoc. Professor
7	Dr. Hemanth K S	Assoc. Professor
8	Dr. Sasikala G	Assoc. Professor
9	Dr. Ambili P S	Assoc. Professor
10	Dr. Vijayalakshmi A Lepakshi	Assoc. Professor
11	Dr. Devi A	Asst. Professor
12	Dr. G Kadiravan	Asst. Professor
13	Dr. N Thrimoorthy	Asst. Professor
14	Dr. Thontadari	Asst. Professor
15	Prof. Lokesh C K	Asst. Professor
16	Prof. Ravi Dandu	Asst. Professor
17	Prof. R Pinaka Pani	Asst. Professor
18	Prof. Vijaya Kumar H	Asst. Professor
19	Prof. Vijayalaxmi. P. Chiniwar	Asst. Professor
20	Prof. Deepa B G	Asst. Professor
21	Prof. Vidya S	Asst. Professor
22	Prof. Krishnamurthy R	Asst. Professor

23	Prof. Md Abdul Khader Jailani	Asst. Professor
24	Prof. Shobhana Saxena	Asst. Professor
25	Prof. P Sree Lakshmi	Asst. Professor
26	Prof. Shreetha Bhat	Asst. Professor
27	Prof. Sneha N	Asst. Professor
28	Prof. Vinay G	Asst. Professor
29	Prof. A P Bhuvaneswari	Asst. Professor
30	Prof. Abhay Kumar Srivastav	Asst. Professor
31	Prof. Aryamol	Asst. Professor
32	Prof. Kusha K R	Asst. Professor
33	Prof. Aditya V	Asst. Professor
34	Manju B	Asst. Professor
35	Prof. Pallavi M O	Asst. Professor
36	Prof. Jesla	Asst. Professor
37	Prof. Komala	Asst. Professor
38	Prof. Anushree Raj	Asst. Professor
39	Prof. Pradeepa D	Asst. Professor
40	Prof. P Sathish	Asst. Professor
41	Prof. Pradeep Udupa	Asst. Professor
42	Prof. Apoorva M C	Asst. Professor
43	Prof. Nagaraj S	Asst. Professor



**10** YEARS  
OF UNIVERSITY  
RECOGNITION  
**20** YEARS OF  
ACADEMIC  
EXCELLENCE



**REVA**  
UNIVERSITY

Bengaluru, India

# (School) HANDBOOK

Rukmini Knowledge Park  
Kattigenahalli, Yelahanka, Bengaluru – 560064  
[www.reva.edu.in](http://www.reva.edu.in)



**REVA**  
UNIVERSITY

Bengaluru, India

# **SCHOOL OF LEGAL STUDIES**

## **LL.M (Criminal Law) Program**

**Handbook**

Batch: 2022-2023

Rukmini Knowledge Park,

Kattigenahalli, Yelahanka, Bangalore-560064

Phone No: 080 4696 6966

**Rukmini Educational**  
Charitable Trust

[www.reva.edu.in](http://www.reva.edu.in)

## Chancellor's Message

*“Education is the most powerful weapon which you can use to change the world.”*

- Nelson Mandela.

There was a time when survival depended on just the realization of physiological needs. We are indeed privileged to exist in a time when ‘intellectual gratification’ has become indispensable. Information is easily attainable for the soul that is curious enough to go look for it. Technological boons enable information availability anywhere anytime. The difference, however, lies between those who look for information and those who look for knowledge.



It is deemed virtuous to serve seekers of knowledge and as educators it is in the ethos at REVA University to empower every learner who chooses to enter our portals. Driven by our founding philosophy of ‘Knowledge is Power’, we believe in building a community of perpetual learners by enabling them to look beyond their abilities and achieve what they assumed impossible.

India has always been beheld as a brewing pot of unbelievable talent, acute intellect, and immense potential. All it takes to turn those qualities into power is a spark of opportunity. Being at a University is an exciting and rewarding experience with opportunities to nurture abilities, challenge cognizance and gain competence.

For any University, the structure of excellence lies in the transitional abilities of its faculty and its facility. I'm always in awe of the efforts that our academic board puts in to develop the team of subject matter experts at REVA. My faculty colleagues understand our core vision of empowering our future generation to be ethically, morally, and intellectually elite. They practice the art of teaching with a student-cantered and transformational approach. The excellent infrastructure at the University, both educational and extra-curricular, magnificently demonstrates the importance of ambience in facilitating focused learning for our students.

A famous British politician and author from the 19th century - Benjamin Disraeli, once said ‘A University should be a place of light, of liberty and of learning’. Centuries later this dictum still inspires me, and I believe, it takes teamwork to build successful institutions. I welcome you to REVA University to join hands in laying the foundation of your future with values, wisdom, and knowledge.

**Dr. P. Shyama Raju**

The Founder and Hon'ble Chancellor, REVA University



## Vice-Chancellor's Message

The last two decades have seen a remarkable growth in higher education in India and across the globe. The move towards inter- disciplinary studies and interactive learning have opened up several options as well as created multiple challenges. India is at a juncture where a huge population of young crowd is opting for higher education. With the tremendous growth of privatization of education in India, the major focus is on creating a platform for quality in knowledge enhancement and bridging the gap between academia and industry.



A strong believer and practitioner of the dictum “Knowledge is Power”, REVA University has been on the path of delivering quality education by developing the young human resources on the foundation of ethical and moral values, while boosting their leadership qualities, research culture and innovative skills. Built on a sprawling 45 acres of green campus, this ‘temple of learning’ has excellent and state-of-the-art infrastructure facilities conducive to higher teaching-learning environment and research. The main objective of the University is to provide higher education of global standards and hence, all the programs are designed to meet international standards. Highly experienced and qualified faculty members, continuously engaged in the maintenance and enhancement of student-centric learning environment through innovative pedagogy, form the backbone of the University.

All the programs offered by REVA University follow the Choice Based Credit System (CBCS) with Outcome Based Approach. The flexibility in the curriculum has been designed with industry-specific goals in mind and the educator enjoys complete freedom to appropriate the syllabus by incorporating the latest knowledge and stimulating the creative minds of the students. Bench marked with the course of studies of various institutions of repute, our curriculum is extremely contemporary and is a culmination of efforts of great think-tanks - a large number of faculty members, experts from industries and research level organizations. The evaluation mechanism employs continuous assessment with grade point averages. We believe sincerely that it will meet the aspirations of all stakeholders – students, parents and the employers of the graduates and postgraduates of REVA University.

At REVA University, research, consultancy and innovation are regarded as our pillars of success. Most of the faculty members of the University are involved in research by attracting funded projects from various research level organizations like DST, VGST, DBT, DRDO, AICTE and industries. The outcome of the research is passed on to students through live projects from industries. **The entrepreneurial zeal of the students is encouraged and nurtured through EDPs and EACs.**

REVA University has entered into collaboration with many prominent industries to bridge the gap between industry and University. Regular visits to industries and mandatory internship with industries have helped our students. REVA University has entered into collaboration with many prominent industries to bridge the gap between industry and University. Regular visits to industries and mandatory internship with industries have helped our students become skilled with relevant to industry requirements. Structured training programs on soft-skills and preparatory training for competitive exams are offered here to make students more employable. 100% placement of eligible students speaks the effectiveness of these programs. The entrepreneurship development activities and establishment of “Technology Incubation Centres” in the University extend full support to the budding entrepreneurs to nurture their ideas and establish an enterprise.

With firm faith in the saying, “Intelligence plus character –that is the goal of education” (Martin Luther King, Jr.), I strongly believe REVA University is marching ahead in the right direction, providing a holistic education to the future generation and playing a positive role in nation building. We reiterate our endeavour to provide premium quality education accessible to all and an environment for the growth of over-all personality development leading to generating “GLOBAL PROFESSIONALS”.

Welcome to the portals of REVA University

## Director's Message

At his best, man is the noblest of all animals; separated from law and justice he is the worst.

- Aristotle

Ubi jus ibi remedium, where there is right there is remedy. Law is a powerful tool for bringing positive social change. The duty of legal professionals is to identify the rights and seek the remedies to make the real promise of “equal justice”. The privilege of being a part of the legal profession compels us to promote the rule of law and its commitment to justice and equality.



Today, the best legal education must include an integration of theory, doctrine, and practice and must be delivered by a diverse faculty to a diverse student body. Legal education is no longer restricted to the traditional core subjects but it has interaction with public policy, business, information technology, bio medical technology, socio-political issues, ethical issues, cyber space environmental issues among others. The scope of legal education again is transgressing to international realm and providing a global perspective to students is a must.

Our school's commitment is to provide all round excellence to make our students adept to chart their own paths through unique programs that cross traditional disciplinary boundaries and provide opportunities to learn by doing. At REVA School of Legal Studies, students will not just learn to practice law, but they would learn to shape it. It is our aim to inculcate rigorous analytical skills needed as practitioner or as a Stewart of social, political and legal change. We aspire to prepare future leaders, lawyers, legal journalists, managers, business heads to serve their clients, the justice system and the public with a high level of accomplishment and a commitment to the highest ideals of the legal profession. We recognize the essential role of human creativity, intelligence, and initiative in education and therefore we strive to channelize the energies of our students for productive and creative purposes to develop their professional capacity. As a law school, we are committed to a healthy and respectful environment of free intellectual inquiry and exchange, and the protection of freedom of thought. BBA LL. B program is designed keeping in view the current demographic need highlighted above and possible future developments, both at

national and global levels. The course is a unique amalgamation of two professional degrees BBA and LLB and therefore provides an edge to our students for their future endeavour. While students will learn intricacies of business, they will be equally well-versed in nuances of regulatory affairs and corporate laws. The scheme of instruction and curriculum is prepared by the Board of Studies consisting of notable scholars, academicians, lawyers, legal experts specialized in the field. Greater emphasis is laid on the practical aspects of legal education, internships, tutorials etc. School of Legal Studies intends to measure student's growth and development in the area of legal reasoning, analytical skills, refinement and conceptualization, assimilation of large amount of data and acquisition of the breadth of understanding and depth in the areas that interest the students most. Students will have access to various electives and this flexibility will be supported by a rigorous core program involving theory, study of doctrines, case-laws, case studies and practical training involving writing of research reports, internships, moots etc. The curriculum caters to and has relevance to Local, regional, National and global developmental issues. Maximum number of courses are integrated with cross-cutting issues with relevant to professional ethics, Gender, Human Values, environment and sustainability. This program is under CBCS and CAGP system where students have the opportunity to choose the subjects of their choice from wide era of subjects as soft core study and open elective.

The personal and professional interests in the above course are matched by our faculty's discipline-leading research providing manifestation of contemporary issues throughout the study period. Our well-qualified, experienced and committed faculty will guide you, monitor your progress, mould you and make your study interesting and fruitful. Exciting opportunities will be available to students to expand their practical know-how in the field through internships, judicial clerkships, participation on moot-courts, MUN's among others. The facilities for curricular and co-curricular activities in REVA University with dedicated supportive staff provide you conducive ambience for learning. The University fully understands that engagement with professionally relevant aspects in Business Administration as well as Legal Studies is what will make our graduates sought after future leaders in their respective fields.

I am sure the students choosing BA LLB in REVA University will enjoy the curriculum, learning environment as well as make the best use of the vast infrastructure and experienced teacher's guidance. We will strive to provide all needed comfort and congenial environment for your studies. I wish all students pleasant stay in REVA and grand success in their career.

**Dr. Bharathi. S**  
**Director, School of Legal Studies**

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## **RUKMINI EDUCATIONAL CHARITABLE TRUST**

It was the dream of late Smt. Rukmini Shyama Raju to impart education to millions of underprivileged children as she knew the importance of education in the contemporary society. The dream of Smt. Rukmini Shyama Raju came true with the establishment of Rukmini Educational Charitable Trust (RECT), in the year 2002. Rukmini Educational Charitable Trust (RECT) is a Public Charitable Trust, set up in 2002 with the objective of promoting, establishing and conducting academic activities in the fields of Arts, Architecture, Commerce, Education, Engineering, Environmental Science, Legal Studies, Management and Science & Technology, among others. In furtherance of these objectives, the Trust has set up the REVA Group of Educational Institutions comprising of REVA Institute of Technology & Management (RITM), REVA Institute of Science and Management (RISM), REVA Institute of Management Studies (RIMS), REVA Institute of Education (RIE), REVA First Grade College (RFGC), REVA Independent PU College at Kattigenahalli, Ganganagar and Sanjaynagar and now REVA University. Through these institutions, the Trust seeks to fulfil its vision of providing world class education and create abundant opportunities for the youth of this nation to excel in the areas of Arts, Architecture, Commerce, Education, Engineering, Environmental Science, Legal Studies, Management and Science & Technology.

Every great human enterprise is powered by the vision of one or more extraordinary individuals and is sustained by the people who derive their motivation from the founders. The Chairman of the Trust is Dr. P. Shyama Raju, a developer and builder of repute, a captain of the industry in his own right and the Chairman and Managing Director of the DivyaSree Group of companies. The idea of creating these top notched educational institutions was born of the philanthropic instincts of Dr. P. Shyama Raju to do public good, quite in keeping with his support to other socially relevant charities such as maintaining the Richmond road park, building and donating a police station, gifting assets to organizations providing accident and trauma care, to name a few.

The Rukmini Educational Charitable Trust drives with the main aim to help students who are in pursuit of quality education for life. REVA is today a family of ten institutions providing education from PU to Post Graduation and Research leading to PhD degrees. REVA has well qualified experienced teaching faculty of whom majority are doctorates. The faculty is supported by committed administrative and technical staff. Over 15,000+ students study various courses across REVA's three campuses equipped with exemplary state-of-the-art infrastructure and conducive environment for the knowledge driven community.

## ABOUT REVA UNIVERSITY

REVA University has been established under the REVA University Act, 2012 of Government of Karnataka and notified in Karnataka State Gazette No. 80 dated 27<sup>th</sup>February, 2013. The University is empowered by UGC to award degrees any branch of knowledge under Sec.22 of the UGC Act. The University is a Member of Association of Indian Universities, New Delhi. The main objective of the University is to prepare students with knowledge, wisdom and patriotism to face the global challenges and become the top leaders of the country and the globe in different fields.

REVA University located in between Kempegowda International Airport and Bangalore city, has a sprawling green campus spread over 45 acres of land and equipped with state-of-the-art infrastructure that provide conducive environment for higher learning and research. The REVA campus has well equipped laboratories, custom-built teaching facilities, fully air-conditioned library and central computer centre, the well planned sports facility with cricket ground, running track & variety of indoor and outdoor sports activities, facilities for cultural programs. The unique feature of REVA campus is the largest residential facility for students, faculty members and supportive staff.

REVA consistently ranked as one of the top universities in various categories because of the diverse community of international students and its teaching excellence in both theoretical and technical education in the fields of Engineering, Management, Law, Science, Commerce, Arts, Performing Arts, and Research Studies. REVA offers 28 Undergraduate Programmes, 22 Full-time and 2 Part-time Postgraduate Programmes, 18 Ph. D Programmes, and other Certificate/ Diploma/Postgraduate Diploma Programmes in various disciplines.

The curriculum of each programme is designed with a keen eye for detail by giving emphasis on hands-on training, industry relevance, social significance, and practical applications. The University offers world-class facilities and education that meets global standards. The programs being offered by the REVA University are well planned and designed after detailed study with **emphasis with knowledge assimilation, applications, global job market and their social relevance.** Highly qualified, experienced faculty and scholars from reputed universities / institutions, experts from industries and business sectors have contributed in preparing the scheme of instruction and detailed curricula for this program. **Greater emphasis on practice in respective areas and skill development to suit to respective job environment has**

been given while designing the curricula. The Choice Based Credit System and Continuous Assessment Graded Pattern (CBCS – CAGP) of education has been introduced in all programs to facilitate students to opt for subjects of their choice in addition to the core subjects of the study and prepare them with needed skills. The system also allows students to move forward under the fast track for those who have the capabilities to surpass others. These programs are taught by well experienced qualified faculty supported by the experts from industries, business sectors and such other organizations. REVA University has also initiated many supportive measures such as bridge courses, special coaching, remedial classes, etc., for slow learners so as to give them the needed input and build in them confidence and courage to move forward and accomplish success in their career. The University has also entered into MOUs with many industries, business firms and other institutions seeking their help in imparting quality education through practice, internship and also assisting students' placements.

REVA University recognizing the fact that research, development and innovation are the important functions of any university has established an independent Research and Innovation division headed by a senior professor as Dean of Research and Innovation. This division facilitates all faculty members and research scholars to undertake innovative research projects in engineering, science & technology and other areas of study. The interdisciplinary-multidisciplinary research is given the top most priority. The division continuously liaisons between various funding agencies, R&D Institutions, Industries and faculty members of REVA University to facilitate undertaking innovative projects. It encourages student research projects by forming different research groups under the guidance of senior faculty members. Some of the core areas of research wherein our young faculty members are working include Data Mining, Cloud Computing, Image Processing, Network Security, VLSI and Embedded Systems, Wireless Sensor Networks, Computer Networks, IOT, MEMS, Nano- Electronics, Wireless Communications, Bio-fuels, Nano-technology for coatings, Composites, Vibration Energies, Electric Vehicles, Multilevel Inverter Application, Battery Management System, LED Lightings, Renewable Energy Sources and Active Filter, Innovative Concrete Reinforcement, Electro Chemical Synthesis, Energy Conversion Devices, Nano-structural Materials, Photo-electrochemical Hydrogen generation, Pesticide Residue Analysis, Nano materials, Photonics, Nano Tribology, Fuel Mechanics, Operation Research, Graph theory, Strategic Leadership and Innovative Entrepreneurship, Functional Development Management, Resource Management and Sustainable Development, Cyber



Security, General Studies, Feminism, Computer Assisted Language Teaching, Culture Studies etc.

The REVA University has also given utmost importance to develop the much required skills through variety of training programs, industrial practice, case studies and such other activities that induce the said skills among all students. A full-fledged Career Development and Placement (CDC) department with world class infrastructure, headed by a dynamic experienced Professor & Dean, and supported by well experienced Trainers, Counsellors and Placement Officers.

The University also has University-Industry Interaction and Skill Development Centre headed by a Senior Professor & Director facilitating skill related training to REVA students and other unemployed students. The University has been recognised as a Centre of Skill Development and Training by NSDC (National Skill Development Corporation) under Pradhan Mantri Kaushal Vikas Yojana. The Centre conducts several add-on courses in challenging areas of development. It is always active in facilitating student's variety of Skill Development Training programs.

The University has collaborations with Industries, universities abroad, research institutions, corporate training organizations, and Government agencies such as Florida International University, Oklahoma State University, Western Connecticut University, University of Alabama, Huntsville, Oracle India Ltd, Texas Instruments, Nokia University Relations, EMC2, VMware, SAP, Apollo etc, to facilitate student exchange and teacher-scholar exchange programs and conduct training programs. These collaborations with foreign universities also facilitates students to study some of the programs partly in REVA University and partly in foreign university, viz, M.S in Computer Science one year in REVA University and the next year in the University of Alabama, Huntsville, USA.

The University has also given greater importance to quality in education, research, administration and all activities of the university. Therefore, it has established an independent Internal Quality division headed by a senior professor as Dean of Internal Quality. The division works on planning, designing and developing different quality tools, implementing them and monitoring the implementation of these quality tools. It concentrates

on training entire faculty to adopt the new tools and implement their use. The division further works on introducing various examination and administrative reforms.

To motivate the youth and transform them to become innovative entrepreneurs, successful leaders of tomorrow and committed citizens of the country, REVA organizes interaction between students and successful industrialists, entrepreneurs, scientists, and such others from time to time. As a part of this exercise great personalities such as Bharat Ratna Prof. C. N. R. Rao, a renowned Scientist, Dr. N R Narayana Murthy, Founder and Chairman and Mentor of Infosys, Dr. K Kasturirangan, Former Chairman ISRO, Member of Planning Commission, Government of India, Dr. Balaram, Former Director IISc., and noted Scientist, Dr. V S Ramamurthy, Former Secretary, DST, Government of India, Dr. V K Aatre, noted Scientist and former head of the DRDO and Scientific Advisor to the Ministry of Defence Dr. Sathish Reddy, Scientific Advisor, Ministry of Defence, New Delhi and many others have accepted our invitation and blessed our students and faculty members by their inspiring addresses and interaction.

REVA organises various cultural programs to promote culture, tradition, ethical and moral values to our students. During such cultural events, the students are given opportunities to unfold their hidden talents and motivate them to contribute innovative ideas for the progress of the society. One of such cultural events is REVAMP conducted every year. The event not only gives opportunities to students of REVA but also students of other Universities and Colleges. During three days of this mega event students participate in debates, Quizzes, Group discussion, Seminars, exhibitions, and variety of cultural events. Another important event is Shubha Vidaaya, - Graduation Day for the final year students of all the programs, wherein, the outgoing students are felicitated and are addressed by eminent personalities to take their future career in a right spirit, to be the good citizens and dedicate themselves to serve the society and make a mark in their respective spheres of activities. During this occasion, the students who have achieved top ranks and won medals and prizes in academic, cultural and sports activities are also recognised by distributing awards and prizes. The founders have also instituted medals and prizes for sports achievers every year. The physical education department conducts regular yoga class is every day to students, faculty members, administrative staff and their family members and organizes yoga camps for villagers around.

### **Vision**

REVA University aspires to become an innovative university by developing excellent human resources with leadership qualities, ethical and moral values, research culture and innovative skills through higher education of global standards.

### **Mission**

- To create excellent infrastructure facilities and state-of-the-art laboratories and incubation centres
- To provide student-centric learning environment through innovative pedagogy and education reforms
- To encourage research and entrepreneurship through collaborations and extension activities
- To promote industry-institute partnerships and share knowledge for innovation and development
- To organize society development programs for knowledge enhancement in thrust areas
- To enhance leadership qualities among the youth and enrich personality traits, promote patriotism and moral values.

### **Objectives**

- Creation, preservation and dissemination of knowledge and attainment of excellence in different disciplines
- Smooth transition from teacher - centric focus to learner - centric processes and activities
- Performing all the functions of interest to its major constituents like faculty, staff, students and the society to reach leadership position
- Developing a sense of ethics in the University and Community, making it conscious of its obligations to the society and the nation
- Accepting the challenges of globalization to offer high quality education and other services in a competitive manner.

## **ABOUT SCHOOL OF LEGAL STUDIES**

The School of Legal Studies has experienced faculty members specialized in Law and Business Administration and supported by well experienced professors, legal experts and practicing advocates as visiting faculty members. The school has the state-of-art class rooms and well equipped laboratories, drawing and seminar halls. The school offers BA. LL.B (Honours), BBA. LL.B (Honours) and LL.M. in (Business and Corporate Law) & (Criminal Law) program. The curriculum of post graduate degree program has been designed to bridge the gap between judiciary, industry and academia and hence they are practical oriented. Criminal Law specialization is one of the most popular branch of law. The study of criminal law includes the statutes, rules, and regulations which define conduct that is prohibited by the law due to the threat it poses as well as the harm it can cause to public safety and welfare. Apart from that, Criminal Law also lays down the punishment that can be imposed on any individual or group of people if they break any law.

### **VISION**

“To achieve excellence in educating professionals, advancing legal scholarship, serving the public, fostering justice and the well-being of society”

### **MISSION**

To provide quality legal education at bachelors and masters level through technologically advanced learning resources and a highly respected and experienced faculty to prepare our students to succeed in a dynamic and ever-evolving legal and business environment and to do research to contribute to the advancement of justice

### **OBJECTIVES**

- Educate graduates who will be excellent professionals: knowledgeable, innovative, thoughtful, practical, ethical, and well-prepared for the practice of law;
- Engage with the community and the University at all levels of our work, including teaching, scholarship, public service, and public policy;
- Create and disseminate knowledge to solve social and legal problems and to promote justice;
- Integrate programs of instruction that connect skills and knowledge, apply theory to practice, and respect and engage diverse points of view and diverse experiences;

- Produce graduates of high quality scholarship, enhance our national and international stature, attract excellent students, and take our place among the very best providers of legal education.

## BOARD OF STUDIES MEMBERS

1. Prof. Dr. Bharathi. S	Chairperson
2. Prof. Dr. Nagaraja V	Members
3. Prof. Dr. Aarti Tyagi	Members
4. Prof. Dr Kalicharan M L	Members
5. Prof. Prof. Dr G R Jagadeesh	External Members
6. Prof. Dr. Pranitha B S	External Members
7. Prof. Dr. V.Sudesh	External Members
8. Dr. Sandeep M N	External Members
9. Naman Jhabakh	External Members
10. P V Miranda Kumar	Student Representatives
11. Milind Kallappa Toravi	Student Representatives

## **REGULATIONS**

### **1. Title and Commencement:**

1.1 These Regulations shall be called **“REVA University Academic Regulations –Law Degree (LL.M) (1 year) Program 2022-23 Batch subject to amendments from time to time by the Academic Council on recommendation of respective Board of Studies and approval of Board of Management**

1.2 These Regulations shall come into force from the date of assent of the Chancellor.

### **2. The Programs:**

These regulations cover the Post Graduate - 1 year Law Degree (LL.M) Program of REVA University offered during 2020-21:

LL. M (specialization in Criminal Law)

### **3. Duration and Medium of Instructions:**

**3.1 Duration:** The One Year Post Graduate Degree program is of 2 Semesters duration. A candidate can avail a maximum of 4 semesters - 2 years as per double duration norm, in one stretch to complete the One Year Post Graduate Degree, including blank semesters, if any. Whenever a candidate opts for blank semester, s/he has to study the prevailing courses offered by the School when s/he resumes his/her studies.

**3.2** The medium of instruction shall be English.

### **4. Definitions:**

**4.1 Course:** “Course” means a subject, either theory or practical or both, listed under a programme; Example: “Criminology” in LL. M in Criminal Law program is an example of courses to be studied under respective programs.

Every course offered will have two components associated with the teaching-learning process of the course, namely:

<b>L</b>	<b>Lecture</b>
<b>T</b>	<b>Tutorial</b>

Where:

**L** stands for **Lecture** session consisting of classroom instruction.

**T** stands for **Tutorial** session consisting participatory discussion / self-study/ desk work/ brief seminar presentations by students and such other novel methods that make a student to absorb and assimilate more effectively the contents delivered in the Lecture classes.

## **4.2 Classification of Courses**

**Courses offered are classified as: Core Courses and Dissertation**

**4.2.1 Core Course:** A course which should compulsorily be studied by a candidate choosing a particular program of study

### **4.2.2 Dissertation:**

School can offer project work/dissertation as a course. Depending on the duration required for completing the project/dissertation work, credits can be assigned. Normally, a minor project carries 4-6 credits and a major project carries double the number of credits of a minor project.

**4.2.3 “Program”** means the academic program leading to a Degree, Post Graduate Degree, Post Graduate Diploma or such other degrees instituted and introduced in REVA University.

## **5. Eligibility for Admission:**

5.1. The eligibility criteria for admission to **One Year Master Degree Program** (2 Semesters) is given below:



Sl. No.	Program	Duration	Eligibility
1	Master of Law in Criminal Law (LL.M)	2 Semesters (1 year)	3 years/ 5 years Degree in Law from recognized university / Institution with minimum 50% (45% in case of SC/ST) marks in aggregate from any Recognized University/Institution. Admission is based on CLAT / LSAT/REVA CET.

5.2 Provided further that the eligibility criteria are subject to revision by the Government Statutory Bodies, such as BCI from time to time.

## 6. Courses of Study and Credits

6.1 Each course of study is assigned with certain credit value

6.2 Each semester is for a total duration of 20 weeks out of which 16 weeks dedicated for teaching and learning and the remaining 4 weeks for IAs and final examination, evaluation and announcement of results.

6.3 The credit hours defined as below:

In terms of credits, every one hour session of L amounts to 1 credit per Semester and a minimum of two hour session of T or P amounts to 1 credit per Semester or a three hour session of T / P amounts to 2 credits over a period of one Semester of 16 weeks for teaching-learning process.

1 credit = 13 credit hours spread over 16 weeks or spread over the semester

**The total duration of a semester is 20 weeks inclusive of semester-end examination.**

## 7. Different Courses of Study:

Different Courses of Study are labeled as follows:

- a. Core Course (CC)

- b. Dissertation: School can offer project work/dissertation as a course. Depending on the duration required for completing the project/dissertation work, credits can be assigned. Normally, a minor project carries 4-6 credits and a major project carries double the number of credits of a minor project

## **8. Credits and Credit Distribution**

**Registered candidates are required to earn the 48 credits for successful completion of a Post Graduate Law Degree**

- 8.1 The concerned BoS based on the credits distribution pattern given above shall prescribe the credits to various types of courses.
- 8.2 The concerned BoS shall specify the desired Program Educational Objectives, Program Outcomes, Program Specific Outcomes and Course Outcomes while preparing the curriculum of a particular program.
- 8.3. A candidate can enrol during each semester for credits as prescribed in the scheme of the program.
- 8.4. Only such full time candidates who register for a minimum prescribed number of credits in each semester from I semester to II semester and complete successfully prescribed number of credits for the award of the degree for one year program in 2 successive semesters shall be considered for declaration of Ranks, Medals, Prizes and are eligible to apply for Student Fellowship, Scholarship, Free ships, and such other rewards / advantages which could be applicable for all full time students and for hostel facilities.

## **9 Assessment and Evaluation**

- 9.1 The Scheme of Assessment will have two parts, namely;
  - i. Internal Assessment (IA); and
  - ii. Semester End Examination (SEE)

- 9.2 Assessment and Evaluation of each Course shall be for 100 marks. The Internal Assessment (IA) and Semester End Examination (SEE) of 1 year Post Graduate Law degree program shall carry 50:50 marks respectively (i.e., 50 marks internal assessment; 50 marks semester end examination).
- 9.3 There shall be **two Internal Tests** conducted as per the schedule announced below. **The Students' shall attend both the Tests compulsorily.**
- 1<sup>st</sup> test is conducted for 15 marks during **8<sup>th</sup> week** of the Semester;
  - 2<sup>nd</sup> test is conducted for 15 marks during **16<sup>th</sup> week** of the of the Semester;
  - Suitable number of Assignments/quizzes/presentations are set to assess the remaining 20 marks of IA at appropriate times during the semester
- 9.4 The coverage of syllabus for the said tests shall be as under:
- Question paper of the **1st test should be based on first 50% of the total syllabus;**
  - Question paper of the **2<sup>nd</sup> test should be based on second 50% of the total syllabus;**
- 9.5 The Semester End Examination for 50 marks shall be held in the 18<sup>th</sup> and 19<sup>th</sup> week of the beginning of the semester and the syllabus for the semester end examination shall be entire syllabus.
- 9.6 A test paper is set for a maximum of 30 marks to be answered as per the pre-set time duration (1 hr / 1 hr 15 minutes / 1 hr 30 minutes). Test paper must be designed with School faculty members agreed pattern and students are assessed as per the instructions provided in the question paper. Questions must be set using Bloom's verbs. The questions must be set to assess the students outcomes described in the course document.
- 9.7 The question papers for internal test shall be set by the internal teachers who have taught the course. If the course is taught by more than one teacher all the teachers together shall devise a common question paper(s). However, these question papers shall be scrutinized by School specific Question Paper Scrutiny Committee formed by the respective School Head /Director to bring in the uniformity in the question paper pattern

and as well to maintain the necessary standards. The evaluation of the answer scripts shall be done by the internal teachers who have taught the course and set the test paper.

- 9.8 The evaluation of the answer scripts shall be done by the internal teachers who have taught the course and set the test paper.
- 9.9 Assignment/seminar should be set in such a way, students be able to apply the concepts learnt to a real life situation and students should be able to do some amount self-study and creative thinking. While setting assignment care should be taken such that the students will not be able to plagiarise the answer from web or any other resources. An IA1 and IA2 assignment / Quiz can be set each for a maximum of 5 marks, totals to 10 marks. Course instructor at his/her discretion can design the questions as a small group exercise or individual exercise. This should encourage collaborative learning and team learning and also self-study.
- 9.10 Internal assessment marks must be decided well before the commencement of Semester End examinations
- 9.11 Semester End Examination: The Semester End Examination is for 50 marks shall be held in the 19th and 20th week of the semester and the entire course syllabus must be covered while setting the question paper.
- 9.12 Semester End Examination paper is set for a maximum of 100 marks to be answered in 3 hours duration. Question paper must be prepared as per the respective School set format.
- 9.13 Each question is set using Bloom's verbs. The questions must be set to assess the students outcomes described in the course document. (Please note question papers have to be set to test the course outcomes)
- 9.14 There shall be three sets of question papers for the semester end examination of which one set along with scheme of examination shall be set by the external examiners and two sets along with scheme of examination shall be set by the internal examiners. All the three sets shall be scrutinized by the Board of Examiners. It shall be responsibility of the Board of Examiners particularly Chairman of the BOE to maintain the quality and standard of the question papers and as well the coverage of the entire syllabus of the course.

- 9.15 There shall be double evaluation, viz, first valuation by the internal evaluator who has taught the course and second evaluation shall be an external examiner who is familiar with the course. The average marks of the two evaluations (internal examiner & external examiner) shall be the marks to be considered for declaration of results
- 9.16 Board of Examiners, question paper setters and any member of the staff connected with the examination are required to maintain integrity of the examination system and the quality of the question papers
- 9.17 There shall also be an **Program Assessment Committee (PAC)** comprising at-least 3 faculty members having subject expertise who shall after completion of examination process and declaration of results review the results sheets, assess the performance level of the students, measure the attainment of course outcomes, program outcomes and assess whether the program educational objectives are achieved and report to the Director of the School. **Program Assessment Committee (PAC)** shall also review the question papers of both Internal Tests as well as Semester End Examinations and submit to the Director of the respective School about the scope of curriculum covered and quality of the questions.
- 9.18 The report provided by the **Program Assessment committee (PAC)** shall be the input to the Board of Studies to review and revise the scheme of instruction and curriculum of respective program
- 9.19 During unforeseen situation , the tests and examination schedules, pattern of question papers and weightage distribution may be designed as per the convenience and suggestions of the board of examiners in consultation with COE and VC
- 9.20 University may decide to use available modern technologies for writing the tests and SEE by the students instead of traditional pen and paper
- 9.21 Any deviations required to the above guidelines can be made with the written consent of the Vice Chancellor
- 9.22 **Summary of Internal Assessment, Semester End Examination and Evaluation** Schedule is provided in the table given below.

### Summary of Internal Assessment and Evaluation Schedule

Sl. No.	Type of Assessment	when	Syllabus Covered	Max Marks	Reduced to	Date by which the process must be completed
1	IA- 1	During 8 <sup>th</sup> week	First 50%	30	15	8 <sup>th</sup> week
2	Assignment 1	On or before 8 <sup>th</sup> week (5 marks)				
3	Presentations 1	On or before 8 <sup>th</sup> week (5 marks)				
4	IA -2	During 16 <sup>th</sup> Week	Second 50%	30	15	16 <sup>th</sup> Week
5	Assignment 2	On or before 16 <sup>th</sup> Week (5 marks)				
6	Presentations 2	On or before 16 <sup>th</sup> Week (5 marks)				
7	SEE	19/20 <sup>th</sup> Week	100%	100	50	20 <sup>th</sup> Week

- Note:** 1. Examination and Evaluation shall take place concurrently and Final Grades shall be announced as per notification from the Controller of Examination.
2. Practical examination wherever applicable shall be conducted after 2nd test and before semester end examination. The calendar of practical examination shall be decided by the respective School Boards and communicated well in advance to the Controller of Examination who will notify the same immediately

#### 10 Assessment of Students Performance in Dissertation

The performance in dissertation shall be assessed on the basis of:

- a) Knowledge of relevant processes;
- b) Skills and operations involved;
- c) Research outcome

The duration for semester-end practical examination shall be decided by the concerned School Board.

#### 11. Evaluation of Dissertation:

Right from the initial stage of defining the problem, the candidate has to submit the progress reports periodically and also present his/her progress in the form of seminars in addition to the regular discussion with the supervisor. At the end of the semester, the candidate has to submit final report of the dissertation, as the case may be, for final evaluation. The components of evaluation are as follows:

Component – I	Progress Report 1 (25%)
Component – II	Progress Report 2 (25%)
Component – III	Evaluation of Report and final viva voce (50%)

All assessments must be done by the respective Schools as per the guidelines issued by the Controller of Examinations. However, the responsibility of announcing final examination results and issuing official transcripts to the students lies with the office of the Controller of Examinations.

#### 12. Requirements to Pass a Course:

A candidate's performance from all 3 components will be in terms of scores, and the sum of all three scores will be for a maximum of 100 marks (25 + 25 + 50). A candidate who secures a minimum of 40% in the SEE and an overall 40% (IA1+IA2+SEE) in a course is said to be successful.

**The Grade and the Grade Point:** The Grade and the Grade Point earned by the

candidate in the subject will be as given below:

Marks, P	Grade, G	Grade Point (GP=V x G)	Letter Grade
90-100	10	v*10	O
80-89	9	v*9	A+
70-79	8	v*8	A
60-69	7	v*7	B+
55-59	6	v*6	B
50-54	5.5	v*5.5	C+
40-49	5	v*5	C
0-39	0	v*0	F
ABSENT			AB

*O - Outstanding; A+-Excellent; A-Very Good; B+-Good; B-Above Average; C+-Average; C-Satisfactory; F – Unsatisfactory.*

Here, P is the percentage of marks ( $P=[IA + SEE]$ ) secured by a candidate in a course which is **rounded to nearest integer**. V is the credit value of course. G is the grade and GP is the grade point.

**a. Computation of SGPA and CGPA**

The Following procedure to compute the Semester Grade Point Average (SGPA).

The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student in a given semester, i.e :  $SGPA (S_i) = \frac{\sum(C_i \times G_i)}{\sum C_i}$  where  $C_i$  is the number of credits of the  $i$ th course and  $G_i$  is the grade point scored by the student in the  $i$ th course.



### Examples on how SGPA and CGPA are computed

#### Example No. 1

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade)
Course 1	4	A+	9	4X9=36
Course 2	4	A	8	4X8=32
Course 3	4	B+	7	4X7=28
Course 4	4	O	10	4X10=40
Course 5	4	C	5	4X5=20
	<b>20</b>			<b>156</b>

Thus, **SGPA = 156 ÷ 20 = 7.8**

#### Example No. 2

Course	Credit	Grade letter	Grade Point	Credit Point (Credit x Grade point)
Course 1	4	A	8	4X8=32
Course 2	4	B+	7	4X7=28
Course 3	4	A+	9	4X9=36
Course 4	4	B+	7	4X7=28
Course 5	12	B	6	12X6=72
	<b>28</b>			<b>196</b>

Thus, **SGPA = 196 ÷ 28 = 7**

#### b. Cumulative Grade Point Average (CGPA):

Overall Cumulative Grade Point Average (CGPA) of a candidate after successful completion of the required number of credits for the respective programs are calculated taking into account all the courses undergone by a student over all the

semesters of a program, i. e :  $CGPA = \frac{\sum(C_i \times S_i)}{\sum C_i}$  Where  $S_i$  is the SGPA of the  $i$ th semester and  $C_i$  is the total number of credits in that semester.

**Example:**

**CGPA after Final Semester**

Semester (ith)	No. of Credits ( $C_i$ )	SGPA ( $S_i$ )	Credits x SGPA ( $C_i \times S_i$ )
1	20	7.8	20 x 7.8 = 156
2	28	7.0	28 x 7.0 = 196
<b>Cumulative</b>	<b>48</b>		<b>352</b>

Thus,  $CGPA = 352/48 = 7.33$

**c. Conversion of grades into percentage:**

Conversion formula for the conversion of CGPA into Percentage is:

Percentage of marks scored = CGPA Earned x 10

**Example: CGPA Earned 7.33 x 10=73.3**

d. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

### 13. Classification of Results

The final grade point (FGP) to be awarded to the student is based on CGPA secured by the candidate and is given as follows.

CGPA	Grade (Numerical Index)	Letter Grade	Performance	FGP
	G			Qualitative Index
9 >= CGPA 10	10	O	Outstanding	Distinction

$8 \geq \text{CGPA} < 9$	9	A+	Excellent	First Class
$7 \geq \text{CGPA} < 8$	8	A	Very Good	
$6 \geq \text{CGPA} < 7$	7	B+	Good	
$5.5 \geq \text{CGPA} < 6$	6	B	Above average	Second Class
$> 5 \text{ CGPA} < 5.5$			5.5	
$> 4 \text{ CGPA} < 5$	5	C	Satisfactory	Pass
$< 4 \text{ CGPA}$	0	F	Unsatisfactory	Unsuccessful

**Overall percentage=10\*CGPA**

- a. **Provisional Grade Card:** The tentative / provisional grade card will be issued by the Controller of Examinations at the end of every semester indicating the courses completed successfully. The provisional grade card provides **Semester Grade Point Average (SGPA)**.
- b. **Final Grade Card:** Upon successful completion of two year Degree a Final Grade card consisting of grades of all courses successfully completed by the candidate will be issued by the Controller of Examinations.

#### **14. Attendance Requirement:**

- 14.1 All students must attend every lecture.
- 14.2 Any student with less than 75% of attendance in aggregate of all the courses during a semester shall not be permitted to appear to the end semester examination and such student shall seek re-admission

#### **15. Re-Registration and Re-Admission:**

- 15.1 In case a candidate's class attendance in aggregate of all courses in a semester is less than 75% or as stipulated by the University, such a candidate is considered as dropped the semester and is not allowed to appear for semester end examination and s/he shall have to seek re-admission to that semester during subsequent semester / year within a stipulated period.

15.2 In such case where in a candidate drops all the courses in a semester due to personal reasons, it is considered that the candidate has dropped the semester and s/he shall seek re-admission to such dropped semester.

**16. Absence during Internal Test:**

In case a student has been absent from an internal tests due to the illness or other contingencies s/he may give a request along with necessary supporting documents and certification from the concerned class teacher / authorized personnel to the concerned Director of the School, for conducting a separate internal test. The Director of the School may consider such request depending on the merit of the case and after consultation with course instructor and class teacher, and arrange to conduct a special internal test for such candidate(s) well in advance before the Semester End Examination of that respective semester. Under no circumstances internal tests shall be held / assignments are accepted after Semester End Examination.

**17. Provision for Appeal**

If a candidate is not satisfied with the evaluation of Internal Assessment components (Internal Tests and Assignments), s/he can approach the Grievance Cell with the written submission together with all facts, the assignments, and test papers, which were evaluated. S/he can do so before the commencement of respective semester-end examination. The Grievance Cell is empowered to revise the marks if the case is genuine and is also empowered to levy penalty as prescribed by the University on the candidate if his/her submission is found to be baseless and unduly motivated. This Cell may recommend for taking disciplinary/corrective action on an evaluator if s/he is found guilty. The decision taken by the Grievance committee is final.

**18. Grievance Committee:**

In case of students having any grievances regarding the conduct of examination, evaluation and announcement of results, such students can approach Grievance Committee for redressal of grievances. Grievance committees will be formed by CoE in consultation with VC

For every program there will be one grievance committee. The composition of the grievance committee is as follows:-

- The Controller of Examinations - Ex-officio Chairman / Convener
- One Senior Faculty Member (other than those concerned with the evaluation of the course concerned) drawn from the school / department/discipline and/or from the sister schools / departments/sister disciplines – Member.
- One Senior Faculty Members / Subject Experts drawn from outside the University school / department – Member.

**19. Eligibility to Appear for Semester End Examination (SEE)**

Only those students who fulfil a minimum of 75% attendance in aggregate of all the courses including practical courses / field visits etc., as part of the program shall be eligible to appear for Semester End Examination

**20. Provision for Supplementary Examination**

In case a candidate fails to secure a minimum of 30% (15 marks) in Semester End Examination (SEE) and a minimum of 40% marks together with IA and SEE to declare pass in the course, such candidate shall seek supplementary examination of only such course(s) wherein his / her performance is declared unsuccessful. The supplementary examinations are conducted after the announcement of even semester examination results. The candidate who is unsuccessful in a given course(s) shall appear for supplementary examination of odd and even semester course(s) to seek for improvement of the performance.

**21. Provision to Carry Forward the Failed Subjects / Courses:**

A student who has failed in a given number of courses in odd and even semesters shall move to next semester of immediate succeeding year and final year of the study. However, s/he shall have to clear all courses of all semesters within the double duration, i.e., with four years of admission of the first semester failing which the student has to re-register to the entire program.

22. With regard to any specific case of ambiguity and unsolved problem, the decision of the Vice-Chancellor shall be final.

**Course Matrix**  
**LL.M Criminal Law I (one) Year**

Sl. No	Course Code	Course Title	Course Type	Credit Pattern and Credit Value				No. of Hrs.
				L	T	P	Total	
<b>FIRST SEMESTER</b>								
1	M21LM1110	Research Methodology & Legal Writing*	HC	3	1	0	4	5
2	M21LM1120	Comparative Public Law*	HC	3	1	0	4	5
3	M21LM1130	International Criminal Justice System	HC	3	1	0	4	5
4	M21LM1140	Socio-Economic Offences and White-Collar Crimes	HC	3	1	0	4	5
5	M21LM1150	Criminology, Penology & Victimology	HC	3	1	0	4	5
6	M21LM1160	Dissertation	HC	0	1	1	2	3
		<b>Total Credits</b>		<b>15</b>	<b>6</b>	<b>1</b>	<b>22</b>	<b>28</b>
<b>SECOND SEMESTER</b>								
1	M21LM2110	Law and Justice in a Globalizing World*	HC	3	1	0	04	5
2	M21LM2120	Comparative Criminal Procedural Law	HC	3	1	0	04	5
3	M21LM2130	Human Rights Law	HC	3	1	0	04	5
4	M21LM2140	Contemporary Challenges to Criminal Law	HC	3	1	0	04	5
5	M21LM2150	Dissertation	HC	0	2	4	06	9

		<b>Total Credits</b>		<b>12</b>	<b>6</b>	<b>4</b>	<b>22</b>	<b>29</b>
	<b>Total Credits of all semesters</b>			<b>27</b>	<b>12</b>	<b>5</b>	<b>44</b>	<b>57</b>

*\*Mandatory Papers*

### **Detailed Syllabus LL.M Criminal Law I Year**

#### **FIRST SEMESTER**

*\*Mandatory Papers*

<b>Course Code</b>	<b>Course Title</b>	<b>Course Type</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>Research Methodology &amp; Legal Writing*</b>	<b>HC</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

#### **Course Objectives:**

1. To acquaint the student of law with the scientific method of social science research.
2. To provide knowledge of the technique of selection, collection and interpretation of primary and secondary data in socio-legal research.
3. Use and application of scientific method in legal and socio-legal issues.
4. Emphasis would be laid on practical training in conducting research in this course.

#### **UNIT I: Basics of Legal Research**

Meaning, Objectives of legal research – Interdisciplinary research, Kinds of Legal research – doctrinal, traditional and non-doctrinal, empirical research, descriptive and analytical research, applied and fundamental research, historical research - sociological research, Characteristics of scientific method – applicability of scientific method - Relationship between theory and fact - Stages of Research Process.



## **UNIT II: Research design and Research techniques**

Research Design – Meaning and essentials of Research Design, Forms of Research Design, Major steps in Research Design - Research Problem – Definition, Determination, Sources of Data; Hypothesis – Meaning and definitions, Characteristics, Research Questions and Hypothesis - Testing of Hypothesis – Census and Sampling techniques – Advantages and disadvantages – Various kinds of Sampling - Survey and Case study method - scaling and content analysis

## **UNIT III: Data Collection techniques**

Sources of data collection - Social and legal survey - Primary and Secondary Sources - Sociometrics and Jurimetrics - Questionnaire Schedule; Literature Review - Observation and interview - Use of Modern Technology/ Computer Assisted Research – Data processing

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## **UNIT IV: Tabulation and Interpretation**

Classification and Tabulation of Data - Analysis and interpretation of Data– Inductive and deductive method - Use of Statistical methods and computers in legal research - socio- metric and jurimetrics.

## **UNIT V: Legal Writing**

Reporting and Methods of Citations – Use of legal maxims and idioms in legal writing - Doctrines in legal research - Book review and case comments - Ethical and Legal Issues: Plagiarism and Copyright Violation.

## **Reference Books:**

1. William J. Goode, P.K. Hatt, Methods in Social Research, 1952, McGraw-Hill
2. Pauline Vislick Young, Calvin Fisher Schmid, Scientific Social Surveys and Research, 4th ed., 2008, Prentice-Hall
3. Morris L. Cohen, Kent C. Olson, Legal Research in a Nutshell, 2010
4. Victor Tunkel, Legal Research - Law Finding & Problem Solving, 1991, Gaunt
5. Shashi Kant Verma, Mohammad Afzal Wani, Legal Research and Methodology, 2001, Indian Law Institute
6. Anwarul Yaqin, Legal Research and Writing, 2007, Lexis Nexis
7. C.R. Kothari, Research Methodology: Methods and Techniques, 2011, New Age

International

8. John A. Yogis, I.M. Christie, Legal Writing and Research Manual, 1988, Butterworth Pub. Ltd

9. Harvard Law School, The Bluebook: A Uniform Style of Citation

10. Whitney, F.L, The elements of Research.

11. Amy E Sloan, Basic Method Research – Tools and Materials

12. Robert Watt- Concise book on Legal Research

13. Ram Ahuja-Research Method

Course Code	Course Title	Course Type	L	T	P	C
	Comparative Public Law*	HC	3	1	0	4

**Course Objectives:**

1. To provide a comparative study of public law in various jurisdictions.
2. Detailed analysis of the system of government in various jurisdictions.
3. To make students comprehend the system of law that they follow with special emphasis on their constitutional, administrative and criminal justice processes.

Course Content:

**UNIT-I: Public Law**

Concept of Public Law – Origin and development - Expanding role of Public Law in Private Law – Comparative Public Law in the context of globalization – Division of powers – Legislature, Executive, Judiciary – Powers and functions.

**UNIT-II: Forms of Governance**

Constitutional Law in Common Law and Civil Law systems – Unitary and Federal type of governments - USA, UK, India, France, Germany – Organisation of legislatures - Parliamentary Sovereignty

**UNIT-III: Comparative Constitutional Law**

Constitutionalism - Fundamental rights - Amendment of the Constitution – Public Interest Litigation - Judicial Review - Judicial activism – Judicial self-restraint - Judicial independence

#### **UNIT-IV: Comparative Criminal Law**

Comparative Criminal Law: Accusatorial and Inquisitorial Systems - Structure and hierarchy of courts in UK, India, US, France, Germany - burden of proof - comparative perspective - jury trial - Plea bargaining – Juvenile justice – Protection of women - victim participation in criminal proceedings

#### **UNIT – V Comparative Administrative Law**

Rule of law and Separation of Powers - Delegated legislation - Principles of natural justice - Administrative Tribunals - Control of corruption and maladministration – Ombudsman – Lokpal and Lokayukta - Right to information.

#### **Reference Books:**

1. A.M Bhattacharjee, Equality, Liberty and Property under the Constitution of India, Eastern Law House, 1997
2. A.V. Dicey, An Introduction to the study of the Law of the Constitution, Universal Law Publishing Co. Pvt.Ltd., New Delhi, 2003, Part II- Chapter IV,V,VI,VII.
3. A.V. Dicey, An Introduction to the study of the Law of the Constitution, Universal Law Publishing Co. Pvt.Ltd., New Delhi, 2003
4. D.D. Basu, Comparative Federalism, Prentice-Hall, 1987
5. Granville Austin, The Indian Constitution - Cornerstone of a Nation, Oxford University Press, 7th Ed, 2004, Chapter III, IV.
6. Granville Austin, Working of a Democratic Constitution: a history of the Indian experience, Oxford University Press, 2003
7. K. C. Wheare, Federal Government, 4th ed., 1963
8. Konrad Zweigert, Hein Kötz, Introduction to Comparative Law, 2. ed. (Oxford: Clarendon Press, 1993)
9. M. Delmas-Marty, J. R. Spencer (eds.), European Criminal Procedures, Cambridge 2002
10. M.P. Singh, Comparative Constitutional Law, Eastern Book Co. 2011
11. M.V. Pylee, Our Constitution, Government and Politics, Universal Law Publishing Co. Pvt.Ltd., New Delhi, 2002

12. S.K Agarwal, Public Interest Litigation in India-A Critique, N.M. Tripathi, 1985
13. V. V. Devasia, Leelamma Devasia, Principles - Women, Social Justice, and Human Rights, APH Publishing, New Delhi, 2nd edn. (2009)
14. Wade, Administrative Law, Oxford University Press, 2009

Course Code	Course Title	Course Type	L	T	P	C
	<b>International Criminal Justice System</b>	HC	3	1	0	4

**Course Objectives:**

1. Evaluate the nature and forms of International Crime.
2. Critique the various strategies for Prevention and Control of International Crimes.
3. Appraisal about the contemporary challenges of International Criminal Justice System

**UNIT-I - Nature and forms of International Crimes**

- The crime of aggression, Genocide, War crimes, Terrorism as International crime
- Mechanism in dealing cases related to International Crime
- Rights of Accused and Protection of Victims and Witnesses
- Obligation of State Parties and Non-Party States to International Criminal Court
- Emerging issues under International Criminal Jurisprudence

**UNIT-II: Development of International criminal law**

- The concept and sources of International Criminal Law
- Evolution of the Concept of Individual Criminal Responsibility
- The objectives and policies of International Criminal Law; including issues of amnesty, truth and justice
- Principle of Liability and Participation in International Criminal Law
- International Military Tribunals (Nuremberg and Tokyo Tribunals).

### **UNIT-III: Strategies for Prevention, Control and Correctional Actions**

- Extradition Act 1962 (Relevant Provisions) and Extradition Treaty
- International investigative agencies (Interpol etc.), Adjudication authorities (including ad hoc and permanent criminal tribunals),
- Conflicting issues between International humanitarian law and International Crimes (Case Study).
- Sentencing policy, prosecution in International crime

### **UNIT-IV - International criminal courts and tribunals**

- Rome statute
- War crimes
- Other crimes (Genocide, Crimes of Aggression and other Crimes against Humanity)
- International Criminal Court and ICC Jurisdiction over the Nationals of Non-States parties
- International Criminal Court and Prosecution of Individuals for International Crimes.
- International Criminal Tribunal for Yugoslavia (ICTY)
- International Criminal Tribunal for Rwanda (ICTR)

### **UNIT-V – Critical evaluation of International Criminal Justice System & Contemporary Challenges**

- Effectiveness of the Contemporary International Criminal Justice System.
- Sexual and Gender-Based Violence: Cooperation in Obtaining Evidence
- Outreach: Challenges Communicating with Victims, Witnesses, and Other Stakeholders
- The ICC Withdrawal Issue
- Measuring Success: The Performance Issue
- The Crime of Aggression Issue

### **Suggested References:**

1. Convention on the Prevention and Punishment of the Crime of Genocide, 1948
2. Principles of International Co-operation in the Detection, Arrests, Extradition and Punishment of Persons Guilty of War Crimes, and Crimes against Humanity, 1973
3. Rome Statute of the International Criminal Court, 1998
4. Cassese, Antonio, International Criminal Law (Oxford University Press, London, 2008) ed.2nd
5. L. W Cecil Turner, Kenny's Outline on Criminal Law.
6. Schabas, William A., An Introduction to the International Criminal Court, (Cambridge University Press, Cambridge, 2001)
7. Ambos, K., "General Principles of Criminal Law in Rome Statute" Criminal Law Forum, Vol.10, (1999), pp. 1-32.
8. Arnold, R, "The Mens Rea of Genocide under the Statute of the International Criminal Court" Criminal Law Forum, vol.14, n.2 (2003), pp. 127-151.
9. Arsanjani, Mahnoush H., "The Rome Statute of the International Criminal Court" American Journal of International Law, vol. 93, n.1 (1999),
10. Bassiouni, M.C., "From Versailles to Rwanda in Seventy-Five Years: The Need to Establish a Permanent International Criminal Tribunal", Harvard Human Rights Journal, vol.10 (1997), pp. 11-62.
11. Cryer, Robert, "International Criminal Law vs State Sovereignty: Another Round?" The European Journal of International Law, Vol. 16 No. 5, 979-1000.
12. Cassese, Antonio, International Criminal Law, (Oxford University Press, London, 2008), ed.2.
13. "The Nicaragua and Tadić Tests Revisited in Light of the ICJ Judgment on Genocide in Bosnia" The European Journal of International Law Vol. 18 no. 4, pp.649-668.
14. Elsea, Jennifer K., "U.S. Policy Regarding the International Criminal Court"
15. Graefrath, Bernhard, "Universal Criminal Jurisdiction and International Criminal Court", European Journal of International Law, vol.1 (1990), pp.67-88.
16. Greppi, E., "The Evolution of Individual Criminal Responsibility under International Law" Review of the International Committee of the Red Cross, n.835 (1999), pp.531-553.

16. Helen Duffy, "National Constitutional Compatibility and the International Criminal Court," *Duke Journal of Comparative and International Law*, vol.11, n.5 (2001), pp. 6-38.
17. Heyder, Corrina, "The UN Security Council's Referral of the Crimes in Darfur to the International Criminal Court in the Light of U.S. Opposition to the Court: Implications for the International Criminal Court's Functions and Status", *Berkeley Journal of International Law*, vol. 24(2006).
18. Jamison, Sandra L., "A Permanent International Criminal Court: A Proposal that Overcomes Past Objections", *Denver Journal of International Law and Policy*, n.23 (1995).
19. Maogoto, Jackson Nyamuya, "War Crimes and Real Politick: International Justice from World War I to the 21st Century" available at <http://www.rienner.com> Mutua, Makau, "America and the International Criminal Court"
20. Nsereko, Daniel D. Ntanda, "The International Criminal Court: Jurisdictional and Related Issues" *Criminal Law Forum*, vol.10, n.1(1999), pp. 87-120
21. Ramji, Jaya, "A Collective Responses to Mass Violence: Reparation and Healing in Cambodia, in *Bringing the Khmer Rogue to Justice: Prosecuting Mass Violence before the Cambodian Courts*", Santa Clara University School of Law, Working Paper No. 06-02, August 2006.
22. Schabas, William A., *An Introduction to the International Criminal Court*, (Cambridge University Press, Cambridge, 2001)
23. Justice, Democracy, and Impunity in Post-genocide Rwanda: Searching for Solutions to Impossible Problems", *Criminal Law Forum*, vol.7 (1996)
24. "United States Hostility to the International Criminal Court: It's All About the Security Council", *European Journal of International Law*, vol.15, n.4 (2004), pp.701-720.
25. Tallgren, I., "The Sensibility and the Sense of International Criminal Law" *European Journal of International Law*, vol.13 (2002), pp. 561-595.

Course Code	Course Title	Course Type	L	T	P	C
	<b>Socio-Economic Offences and White-Collar Crimes</b>	HC	3	1	0	4

**Course Objectives:**

1. Examine the multiple theories of deviance and socio-economic offences.
2. Analyze the typical forms of deviance and their impact.
3. Evaluate the Indian Legal Order designed to respond to such deviances.

**UNIT-I**

**1. Introduction:**

- Crime and deviance; theories of deviance
- Indian approaches to socio-economic offences
- Notions of privileged class deviance as providing a wider categorization of understanding Indian development
- Typical forms of deviance – official deviance; professional deviance; electoral deviance; police deviance; trade union deviance; landlord deviance
- Concept of white-collar crimes – socio economic offences – Santhanam committee – wanchoo committee – 29 & 47 report of law commission of India - Growth of white-collar crime; legislations against white collar crimes in India

**UNIT-I**

**2. Official deviance (deviance by legislators, judges, bureaucrats)**

- Conception of Official deviance- Malfeasance; Misfeasance; Non- Misfeasance - permissible limit of discretionary powers.
- Deviance by legislators, judges, bureaucrats
- The Chambal valley dacoit Vinoba Mission and Jai Prakash Narain Mission- in 1959 and 1971.
- Enforcement Directorate, Money Laundering & FEMA



- Commission reports (The Chagla Commission Report on LIC-Mundra Affair, The Das Commission Report on Pratap Singh Kairon, The Grover Commission Report on Dev Raj Urs, Various reports on Black Money)

### **UNIT-III**

#### **3. Professional deviance: journalists, teachers, doctors, lawyers, engineers, architects and publishers**

- Unethical practices at the Indian bar
- The Lentin Commission Report
- The Press Council on Unprofessional and Unethical journalism
- Medical malpractice.
- Response of Indian Legal Order to the deviance of privileged classes.

### **UNIT-IV**

#### **4. Police deviance**

- Structures of legal restraint on police powers in India
- Unconstitutionality of “third-degree” methods and use of fatal force by police - “Encounter” killings - Police atrocities
- The plea of superior orders
- Rape and related forms of gender-based aggression by police and para-military forces.
- Reform suggestions especially by the National Police Commission
- Deviance on electoral process (rigging, booth capturing, impersonation, corrupt practices)
- Gender-based aggression by socially, economically and politically powerful.

### **UNIT-V**

#### **5. Indian Legal order**

- Vigilance Commission
- Public Accounts Committee
- Ombudsman

- Commissions of Enquiry
- Prevention of Corruption Act, 1988
- The Antulay Case.
- Lokpal and lokayukta

**Suggested References:**

1. Upendra Baxi, The Crisis of the Indian Legal System (1982),. Vikas Publishing House, New Delhi
2. Upendra Baxi (ed.), Law and Poverty: Assays (1988)
3. Upendra Baxi, Liberty and Corruption: The Antulay Case and Beyond (1989)
4. Surendranath Dwivedi and G.S.Bhargava, .Political Corruption in India
5. A.R.Desai (ed.), Violation of Democratic Rights in India (1986)
6. A.G.Noorani, Minister's Miscounduct (1974)
7. B.B.Pande. "The Nature and Dimensions of Privileged Class Deviance" in The Other Side of Development 136 (1987, K.S.Shukla ed.)
8. K.S. Shukla, "Sociology of Deviant Behaviour" in 3 ICSSR Survey' of Sociology and Social Anthropology 1969-179 (1986)

Course Code	Course Title	Course Type	L	T	P	C
	<b>Criminology, Penology &amp; Victimology</b>	HC	3	1	0	4

**Objective:**

- This course of Crime and Punishment would attempt to answer such queries of the human mind and afford explanations to criminal behavior and reactions to crime.
- It is an ongoing study with numerous researches and surveys been conducted all over the world to find the most suitable explanation of criminality and criminal behavior, nevertheless, there is no final answer, which will be examined.

- Concern for the Victims of crime would be another facet of the study of the subject with emphasis on concepts of restorative justice, compensatory jurisprudence and rehabilitative techniques.

### **Unit I: INTRODUCTION: CRIMES AND CRIMINOLOGY**

- Notions of Crime
- Who is the Criminal?
- Criminology-Nature and Scope, whether criminology is a science?
- Current Trends in Criminology
- Classical Theories of Criminology
- Cesare Beccaria, Jeremy Bentham
- Neo Classical Perspectives
- Rossi, Garraud, Joly
- Biological Trait Theory
- Cesare Lombroso, Raffaele Garafalo, Enrico Ferri

### **Unit II: PSYCHOLOGICAL THEORIES.**

- Psychoanalytic Explanation of Crime
- Freud
- Behavioural Approach to Criminality
- Pavlov, Skinner, Eysenck
- Cognitive Approach
- Tolman, Piaget, Kohlberg
- Intelligence and Crime
- Goddard, Hirshi, Hindelang
- Mental Disorder and Crime Neuroses, Psychosis

### **Unit III: FACTORS ENHANCING CRIMINALITY**

- Drug, Alcohol and Crime
- Media Influences

- Politics and Crime
- Youth and Criminality
- Race, Culture and Gender
- Religion & Family Theories

#### **Unit IV: REACTIONS TO CRIME**

- Penology - Meaning, Nature & Scope
- Theories of Punishment - Expiative, Deterrent, Retributive, Reformative
- Types of Punishment - Fine, Imprisonment, Capital Sentence, Solitary Confinement, Transportation & Juvenile Delinquency

#### **Unit V: VICTIMOLOGY**

- Problems of Crime Victims and types of victims
- Victims\* Right within Criminal Justice System
- Caring for the victim
- Compensation to victim
- Rehabilitation of victim or victim's family

#### **Recommended Readings:**

##### **Criminology:**

1. Larry Siegel, *Criminology*, 7th Edition, Wadsworth Pub. Australia 1999.
2. Katherine S. Williams, *Textbook on Criminology*, 3rd Edition, Universal Law Pub., New Delhi 1997.
3. Clive Coleman & Clive Norris, *Introducing Criminology*, 1st Edition, Willian Pub., USA 2000.
4. John Salmond, *Jurisprudence: Responsibility and Criminal Liability*, 11th Edition, Sweet and Maxwell Publication. London, 1989.
5. Ahmed Siddiqui, *Criminology: Problems and Perspectives*, 4th Edition, Eastern Book Co. Lucknow 1997.
6. Roger Hopkins Burke, *An Introduction to Criminological Theory*, 1st Edition, Lawman India Pvt. Ltd., New Delhi 2001, Chapter 5.

7. Clive Coleman & Clive Norris, *Introducing Criminology*, 1st Edition, Willian Pub., USA 2000.
8. Maguire, Morgan and Reiner, *The Oxford Handbook of Criminology*, 31 Edition, Oxford Univ Pres, New York 2002.

**Victimology:**

1. Walklate, Sandra, *Handbook of Victims and Victimology*
2. Roberts, Julian V; Bottoms, A. E *Hearing the victim: adversarial justice, crime victims and the state.*
3. Daigle, Leah E, *Victimology: The Essentials.*
4. Davies, Pamela; Greer, Chris (Chris R. H.); Francis, Peter, *Victims, crime & society: an introduction.*
5. Davis, Robert C. (Robert Carl); Herman, Susan; Lurigio, Arthur J, *Victims of crime*, 2013, 4th ed
6. Doak, Jonathan, *Victims' Rights, Human Rights and Criminal Justice.*
7. Maguire, Mike; Reiner, Robert; Morgan, Rod, *The Oxford handbook of criminology.*

**Penology:**

1. Coyle, A. *Understanding Prisons*
2. Sean McConville, *The Use of Punishment*
3. Ashworth, Andrew; Roberts, Julian; Von Hirsch, Andrew, *Principled sentencing: readings on theory and policy*
4. J. C Chaturvedi, *Penology and Correctional Administration.*
5. Paranjape, N.V., *Criminology and Penology.*
6. Babel, B.L. (2013). *Criminology & Penology.* (4th ed.) E

## SECOND SEMESTER

Course Code	Course Title	Course Type	L	T	P	C
	<b>Law and Justice in a Globalizing World*</b>	HC	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

### Course Objectives:

1. To understand the process of globalization and its impact on law and justice in a historical perspective.
2. To critically analyze the concept of global justice and the mechanisms designed to achieve it.
3. To better appreciate the demands for change raised by different groups to the international legal order and institutions in the light of globalization.

### Course Contents:

#### UNIT-I: Law - Theoretical perceptions

Law – Meaning and purpose – Jurisprudential dimensions – Law and social change — Concept of Globalization - Different dimensions of Globalization: Social, Political, and Economic - Globalization and right to development.

#### UNIT-II: Justice - Theoretical perceptions

Concept of Justice - Law and Justice – Individual and social justice – Distributive and Corrective justice - Theories of Rawls and Amartya Sen - Access to justice and Challenges - Legal aid and law reform - Effect of globalization on the law and justice

#### UNIT-III: Globalization and its impact

Emergence of Transnational Law in a Globalizing World - Impact of globalization on Sovereignty of States - Human Rights and Trade Law - International Economic law - WTO,

Investment laws & IPRs - Globalization and Free Market - Impact of globalization on Natural Resources, Environment and people at large.

#### **UNIT-IV: Globalization and TNCs**

Globalization and its effect on Human Rights - International Human Rights Law Institutions – Transnational Corporations and Human Rights Responsibility – Role of international institutions such as ILO, ICC and ICJ.

#### **UNIT-V: Need for Reforms**

Limitations of domestic law - Need for Reforms in International Law and global institutions – Globalization and Third World - MNC as a subject of international law – Reforms in International Criminal Law.

#### **Reference Books:**

1. Andrew Kuper, Democracy Beyond Borders: Justice and Representations in Global Institutions (OUP, 2006).
2. Anthony McGrew, David Held (eds.), Governing Globalization: Power, Authority and Global Governance (Polity Press, 2002).
3. David B. Goldman, Globalization and the Western Legal Tradition: Recurring Patterns of Law and Authority (Cambridge University Press, 2008)
4. David Held, A Globalizing World? Culture, Economics, Politics.
5. David Kinley, Civilizing Globalization: Human Rights and the Global Economy (Cambridge University Press, 2009).
6. Upendra Baxi, The Future of Human Rights (OUP)
7. Laura Valentini, Justice in a Globalizing World: A Normative Framework, (OUP, 2011)
8. Jean-Marc Coicaud, Michael W. Doyle et al (eds.), The Globalization of Human Rights (United Nations University Press, 2003)
9. John Rawls, A Theory of Justice, Harvard University Press, 2009
10. Amartya Sen, The Idea of Justice, Belknap Press; Reprint edition (2011)
11. R.W.M. Dias, Jurisprudence (1994) Indian Reprint, Adithya Books, Delhi
12. Edgar Bodenheimer, Jurisprudence, Harvard University Press, 1974

13. Andrew Clapham, Human Rights In The Private Sphere (1996)
14. Andrew Clapham, Human Rights Obligations Of Non-State Actors (Oxford University Press 2006)
15. Antonio Cassere, International Law In A Divided World (Clarendon Press, Oxford 1988)
16. Anuradha Dayal-Gulati, Global Corporate Citizenship (Northwestern University Press, 2007)
17. Christine A. Mallin (Ed.), Corporate Social Responsibility: A Case Study Approach (Edgar Elgar, UK 2009)

Course Code	Course Title	Course Type	L	T	P	C
	<b>Comparative Criminal Procedural Law</b>	HC	3	1	0	4

**Course Objectives:**

1. Evaluating the different systems of Criminal Law.
2. Understanding the diverse systems and models of criminal law.
3. Design and Construct a parallel between the multiple systems of criminal law around the world.

**UNIT-I**

**1. Introduction – comparative criminal law(US, UK, France, Germany & India)**

- Significance of comparative criminal procedure
- Principles of legality – *nulla poena sine lege*
- General principles of criminal liability
- Impact of international criminal jurisprudence on comparative criminal law
- Hierarchy of criminal courts and jurisdiction.
- Interpretation of Criminal Statutes.



## **UNIT-II**

### **2. Diverse systems and Models of Criminal Proceedings (US, UK, France, Germany & India)**

- Adversarial / Accusatorial and Inquisitorial Systems
- Core features of inquisitorial and adversarial systems
- Trends of borrowing the best under both systems
- Crime Control Model and Due Process Model
  - Common elements
  - Differing points of emphasis
- Indian system of Justice Administration and its challenges

## **UNIT-III**

### **3. Pre-trial Processes (US, UK, France, Germany & India)**

- Bringing information about crime incident before the formal system (Police or Magistrate) Sections 154 & 155 and 190 (complaint)
- Investigation of Crime- Sections 157 to 173
- Bail and Remand
- Rights of Accused and Victim
- Right to Counsel and Legal Aid
- Principal Features of a Fair Trial

## **UNIT-IV**

### **4. Trial Processes (US, UK, France, Germany & India)**

- Taking Cognizance by courts and committal proceedings
- Hierarchy of Criminal Courts and types of trials
- Framing of Charge and Discharge Proceedings
- Acquittal or Conviction
- Revision, Appeal and transfer of case for trial

## **UNIT-V**

### **5. Sentence Process (US, UK, France, Germany & India)**

- Pre-sentence hearing Ss 235(2) and 248(2)
- Transfer of Cases
- Sentences- Execution, Suspension, remission and commutation of sentences
- Reformative Sentence
- Withdrawal from prosecution
- Plea Bargaining
- Compounding of Offences

### **Suggested Readings**

1. K.N. Chandrasekhan Pillai: R.V. Kelkar's Criminal Procedure (2008) Eastern.
2. K.N.S. Pillai : Lectures on Criminal Procedure
3. K.I. Vibhute : Criminal Justice (2004) Eastern
4. R.V. Kelkar's : Criminal Procedure (4th Edn.) Eastern
5. Justice Malimath Committee Report on Reforms of Criminal Justice System (2003)
6. Government of India, Ministry of Home Affairs
7. Law Commission of India Reports
8. Woodroffe: Commentaries on Code of Criminal Procedure, Vol. I & II (2000) Universal.
9. Celia Hamptom, Criminal Procedure
10. Wilkins and Cross, Outline of the Law of Evidence
11. Archbold, Pleading, Evidence and Practice in Criminal Cases
12. Sarkar, Law of Evidence
13. K.N.Chandrasekharan Pillai(ed.), R.V. Kelkar's Outlines of Criminal Procedure (2000), Eastern, Lucknow.
14. Patric Devlin, The Criminal Prosecution in England
15. American Series of Foreign Penal Codes Criminal Procedure Code of People's Republic of China.
16. John N. Ferdico, Criminal Procedure (1996), West
17. Sanders & Young, Criminal Justice (1994)

18. Christina Van Den Wyngart, Criminal Procedure Systems in European Community Joel Samaha,
19. Criminal Procedure Code,1973
20. The French Code of Criminal Procedure,
21. 14th and 41st Reports of Indian Law Commission.
22. Criminal Law Amendment Act 2018.

Course Code	Course Title	Course Type	L	T	P	C
	<b>Human Rights Law</b>	<b>HC</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**Course Objective:**

1. Understand and Analyze the development of Human Rights around the world and India.
2. Evaluate the International Instruments and Criminal Justice System.
3. Analyzing the Rights of the Vulnerable Groups and relevant enforcement mechanism.

**UNIT-I - The Concept, History and Development of human Rights.**

- History of human rights civilization
- Magna Carta
- British Bill of Rights
- International Bill of Rights
- Theories of rights

**UNIT-II – International Instruments and Criminal Justice System**

- Universal Declaration on Human Rights: History of the Declaration; Structure of the Declaration; Legal Significance
- Rights under Criminal Justice System and International Covenants: ICCPR and ICESCR Nature and Characteristic; Optional Protocols
- Rights under Criminal Justice System and Regional Instruments - European Convention on Human Rights; American Convention on Human Rights; African Charter on Human and People’s Rights; Asia and Human Rights

### **UNIT-III – Indian perspective**

- History and Development of Human Rights in Indian Constitution -. Constitutional Philosophy.
- police atrocities - Protection of Human Rights in Criminal Justice Administration.
- Art. 20 Protection against Ex-Post Facto Laws, Protection against Double Jeopardy and Protection against Self Incrimination
- Art. 21 Impact of expansive interpretation on criminal jurisprudence, Meaning of terms: Life and Personal liberty Fair Procedure Due Process of Law - Death Penalty in Light of Art. 21
- Right of Accused Arrest, Hand Cuffing Bail, Speedy Trial Torture Custodial
- Art. 22 Protection to Accused in case of punitive detention Protection against Preventive Detention.

### **UNIT-IV – Rights of Vulnerable Groups**

- Rights of Vulnerable Groups
- Defining Vulnerability
- Women
- Children
- Disabled Persons
- Minorities
- Refugees, Migrants, Displaced Persons
- Indigenous Persons

### **UNIT-V Enforcement of Human Rights**

- Protection of Human Rights Act.
- Commissions of Human Rights.
- Role of Courts in India.
- Role of International Organizations.

### **Suggested Readings:**

1. Agarwal, H.O. Implementation of Human Rights Covenants with Special Reference to India(New Delhi: D.K. Publishers, 1993)
2. Aroras, Nirman, "Custodial torture in Police Stations in India: A Radical Assessment", Journal of Indian Law Institute, vol.41, nos.3, and 4, 1999, pp. 513-29
3. Bajwa, G.S. and D.K. Bajwa, Human Rights in India:  
4. Implementation and Violations (New Delhi: D.K. Publishers, 1996)
5. Baxi, Upendra, "Clemency, Extradition and death: The Judicial Discourse in Kehar Singh ", Journal of Indian Law Institute, vol.30, no.4, Oct- Dec. 1998, pp.501-86.
6. Bhargava, G.S., "National Human Rights Commission: An Assessment of Its Functioning", in K.P. Saksena, ed.,Human Rights: Fifty Years of India's Independence (New Delhi: Gyan Publishing House, 1999), pp.106-118.
7. Amnesty International, "Campaign for the Abolition of Torture", Philosophy and Science Action, vol.5, nos. 3-4 1984, pp.205-208.
8. Aroras, Nirman "Custodial Torture in Police Station in India :A Radical Assessment", Journal of Indian Law Institute, vol. 41, nos.3 and 4, 1999, pp.513-29
9. Bag, R.K., "Domestic Violence and Crime Against Women: Criminal Justice Response in India ", Journal of Indian Law Institute, vol. 39, nos.2- 4, 1997, pp.359-75.
10. Batra,Manjula, Protection of Human Rights in Criminal Justice Administration : A study of the right of Accused in Indian and Soviet Legal System (New Delhi: Deep and Deep, 1989)
11. Bava,Noorjahan, ed., Human Rights and Criminal Justice Administration in India (New Delhi : Uppal Publishing House, 2000)
12. Bhagwati, P.N., " Human Rights in the Criminal Justice System", Journal of the Indian Law Institute, vol. 27, no.1, 1985, pp 1-22.
13. Blackshield, A.R."Capital Punishment in India ", Journal of Indian Law Institute vol. 21 no.2, 1979, pp 137-226.
14. Burgers, J.H., "The Fights against Torture ", International Commission of Jurists, no.32, 1984,pp.47-48

15. Jaswal, P.S. and N. Jaswal, "Right to Personal Liberty and Handcuffing: Some Observations", Journal of the Indian Law Institute, vol.33, no.2, April- June 1991, pp.246-53
16. Sharma, S.C., Police and Human Rights (1999).
17. Upadhyay, C.M., Human Rights in Pre-trial Detention (1999).
18. Robert Cryer, HakanFriman, Darryl Robinson, An Introduction to International Criminal Law and Procedure Paperback – June 28, 2010, Cambridge University Press, 2003.
19. Philippe Sands, From Nuremberg to the Hague: The Future of International Criminal Justice, Cambridge University Press, 2003.
20. The International Criminal Court: Challenges to Achieving Justice and Accountability in the 21st Century by Mark S. Ellis; Richard J. Goldstone. International Debate Education Association, 2008
21. International Criminal Law: Cases and Commentary (Paperback) By (author) Antonio Cassese, By (author) Guido Acquaviva, By Mary De Ming Fan, Alex Whiting
22. Criminal Law Amendment Act 2018.

<b>Course Code</b>	<b>Course Title</b>	<b>Course Type</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>Contemporary Challenges to Criminal Law</b>	<b>HC</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

1. Understand and appreciate broad classification of contemporary issues and their affects in society and the role of criminal law.
2. Sketch the role of judicial Institutions and investigating authorities in this regard for preventing & control strategies.
3. Evaluating and Creating systems which shall allow for these challenges to be better addressed.

#### **Unit I – Women and law/ Crimes against Women:**

- **Introduction to International Conventions**

- CEDAW, Declaration on the Elimination of Violence against Women,
- Convention on the Political rights of Women,
- Convention on Consent to Marriage, Minimum Age for Marriage and Registration of Marriages
- Declaration on the Protection of Women and Children in Emergency and Armed Conflict.
- Evolving rights of LGBT.

#### **UNIT II- Child Rights & Juvenile justice.**

- Convention on the rights of the child
- Violence against children
- Juvenile justice & delinquency – Juvenile Justice Act, 2015
- Prevention of Children from Sexual Offences Act, 2012 (with latest amendments)

#### **UNIT III- Cyber Crimes**

- Introduction to Cyber Crimes
- Law relating to Cyber Crimes (Latest Cases & Challenges)
- Procedural Law relating to Cyber Crimes
- Right to Privacy in Cyberspace
- Freedom of Speech & Expression in Cyberspace.
- The International Criminal Court and Cyber Crimes
- International Criminal Tribunal for Cyber space
- Budapest Convention

#### **UNIT IV- Hate Crimes**

- Communal violence in India
- Sedition other such offences under IPC and UAPA
- Honor Killing
- Hate Speech and Laws
- Freedom of Speech & Expression under the Constitution of India vis -a -vis Hate Speech.

## **UNIT- V Rethinking Sentencing policies**

- Introduction to Sentencing
- History of Sentencing
- Goals of punishment and Sentencing.
- Various theories of sentencing.
- Comparative analysis of sentencing policies.

### **Suggested Readings:**

1. O'Rourke, C. (2020). *Women's Rights in Armed Conflict under International Law*. Cambridge: Cambridge University Press. doi:10.1017/9781108667715
2. **Women's Human Rights** CEDAW in International, Regional and National Law, Anne Hellum, Universitetet i Oslo Henriette Sinding Aasen, Universitetet i Bergen, Norway
3. Justice Malimath Committee Report on Reforms of Criminal Justice System (2003)
4. Government of India, Ministry of Home Affairs
5. Law Commission of India Reports
6. Woodroffe: Commentaries on Code of Criminal Procedure, Vol. I & II (2000) Universal
7. An Introduction to Cyber Crime and Cyber Law; Dr. R.K. Chaubay
8. Cybercrime in India: Dr. M. Dasgupta
9. Cyber laws and crimes: Barkha & U. Ramamohan Information Technology Act 2000
10. Albert J. Marcella and Robert S. Greenfield (Ed) (2002) Cyber
11. Ashok Kumar: 'Challenges to Internal Security of India'
12. Archana Sharma: Threats to India's Internal Security Need for A New Strategy
13. Shrikant Paranjpe: India's Internal Security: Issues and Perspectives.
14. Criminal Law Amendment Act 2018.



<b>Course Code</b>	<b>Course Title</b>	<b>Course Type</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>Dissertation</b>	<b>HC</b>	<b>0</b>	<b>2</b>	<b>10</b>	<b>12</b>

**Course Objective:**

1. This course is designed to test the research and analytical skills of the students.
2. It is aimed at enabling the students to hone their skills as a researcher that would be of immense help to them in their career.
3. Highlighting the contemporary challenges of law and suggest requisite advances in the system.

Students are required to select their dissertation topic at the beginning of the academic year (1st Semester) and register with a faculty member for Guidance.

Dissertation work carries 100 marks in total and research report has to be submitted before the commencement of the examination of 2nd semester.

## **CAREER DEVELOPMENT AND PLACEMENT**

Having a degree will open doors to the world of opportunities for you. But Employers are looking for much more than just a degree. They want graduates who stand out from the crowd and exhibit real life skills that can be applied to their organizations. Examples of such popular skills employers look for include:

1. Willingness to learn
2. Self motivation
3. Team work
4. Communication skills and application of these skills to real scenarios
5. Requirement of gathering, design and analysis, development and testing skills
6. Analytical and Technical skills
7. Computer skills
8. Internet searching skills
9. Information consolidation and presentation skills
10. Role play
11. Group discussion, and so on

REVA University therefore, has given utmost importance to develop these skills through variety of training programs and such other activities that induce the said skills among all students. A full-fledged Career Counseling and Placement division, namely Career Development Center (CDC) headed by well experienced senior Professor and Dean and supported by dynamic trainers, counselors and placement officers and other efficient supportive team does handle all aspects of Internships and placements for the students of REVA University. The prime objective of the CDC is to liaison between REVA graduating students and industries by providing a common platform where the prospective employer companies can identify suitable candidates for placement in their respective organization. The CDC organizes pre-placement training by professionals and also arranges expert talks to our students. It facilitates students to career guidance and improve their employability. In addition, CDC forms teams to perform mock interviews. It makes you to enjoy working with such teams and learn many things apart from working together in a team. It also makes you to participate in various student clubs which helps in developing team culture, variety of job skills and overall personality.

The need of the hour in the field of Legal Studies is not only knowledge in the subject, but also the skill to do the job proficiently, team spirit and a flavour of innovation. This kept in focus, the CDC has designed the training process, which will commence from second semester along with the curriculum. Special coaching in personality development, career building, English proficiency, reasoning, puzzles, and

communication skills to every student of REVA University is given with utmost care. The process involves continuous training and monitoring the students to develop their soft skills including interpersonal skills that will fetch them a job of repute in the area of his / her interest and march forward to make better career. The School of Legal Studies of REVA University also has emphasised subject based skill training through lab practice, internship, project work, industry interaction and many such skilling techniques. The students during their day to day studies are made to practice these skill techniques as these are inbuilt in the course curriculum. Concerned teachers also continuously guide and monitor the progress of students.

The University has also established University-Industry Interaction and Skill Development Centre headed by a Senior Professor & Director to facilitate skill related training to REVA students and other unemployed students around REVA campus. The center conducts variety of skill development programs to students to suite to their career opportunities. Through this skill development centre the students shall compulsorily complete at least two skill / certification based programs before the completion of their degree. The University has collaborations with Industries, Corporate training organizations, research institutions and Government agencies like NSDC (National Skill Development Corporation) to conduct certification programs. REVA University has been recognised as a Centre of Skill Development and Training by NSDC (National Skill Development Corporation) under Pradhan Mantri Kaushal Vikas Yojana.

The University has also signed MOU's with Multi-National Companies, research institutions, and universities abroad to facilitate greater opportunities of employability, students' exchange programs for higher learning and for conducting certification programs.