School of Electronics & Communication Engineering

Handbook

B. Tech in Electronics & Communication Engineering

First Year to Fourth Year

(First Semester to Eighth Semester)

2018-2022

Rukmini Knowledge Park,
Kattigenahalli, Yelahanka, Bangalore - 560 064
Phone No: +91-080-66226622, Fax: 080-28478539

Rukmini Educational
Charitable Trust

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-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!

Director's –Message

Since the inception of REVA University, School of Electronics and Communication Engineering is involved in implementing following best practices in various dimensions such as academics, research, outreach activities, student development programs, project based and research based learning, student centric learning, student competitions, industry and in-house internships, abroad internships, skill enhancement activities, motivation for competitive exams, mini projects, major projects, industry mentored projects, multidisciplinary projects, industry visits, technical talks by industry and academicians, certification programs, etc. Individual students are taken care by strong mentoring system wherein faculty members are not only allotted as mentors to students, but also they will act as local guardians and they will have constant follow up with mentees in regard to academic and personal issues till students complete the degree.

The curriculum is carefully designed to meet the current industry trends and also to provide insight into future technology developments that lead to inculcate lifelong learning abilities in students. Board of Studies (BoS) comprises people from academics, industry, alumni and current students which form the strong backbone for our programs wherein constant updates happen in contents/subjects every semester based on current industry needs. Curriculum has good mix of foundation courses, hardcore courses, softcore courses, practicals and projects along with open electives, softskill and skill development courses. The curriculum caters to and has relevance to local, regional, national, global, developmental need. Maximum number of courses are integrated with cross cutting issues with relevant to professional Ethics, Gender, Human values, Environment, and Sustainability.

Student's welfare is given utmost priority at School of Electronics and Communication Engineering. Advanced learning methods are adopted to make learning truly interactive. More focus is on discussion and practical applications rather than rote learning. Notes/handouts/video contents/quizzes are given and critical thinking questions are asked to test understanding. Experienced, well qualified and friendly faculty members always strive hard to provide best of education to students. The faculty members have number of publications in reputed national and international journals/conferences. The school is also involved in funded research projects.

I am sure the students choosing B Tech and M. Tech programs in School of Electronics and Communication Engineering in REVA University will enjoy the curriculum, teaching and learning environment, well equipped laboratories, digital classrooms infrastructure and the experienced teachers involvement and guidance.

CONTENTS

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 27thFebruary, 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 Censor 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, Nana 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, Okalahoma State University, Western Connecticut University, University of Alabama, Huntsville, Oracle India Ltd, Texas Instruments, Nokia University Relations, EMC^2, 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's everyday 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

Misson

- 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 ELECTRONICS AND COMMUNICATION ENGINEERING

The School of Electronics and Communication Engineering headed by a highly experienced Professor and is supported by well qualified faculty members. The school has the state-of-art class rooms and well equipped laboratories. It offers B. Tech. and M. Tech. and PhD programs in various specialized streams. The curriculum of both the graduate and the post graduate degree programs have been designed to meet the current industry trends. B. Tech program aims to prepare human resources to play a leading role in the continuing adventure of modern automated systems and communications. The program offers numerous choices of study for the students based on interest in the current state of art technology. Apart from fundamental courses in Electronics and Communication Engineering, the school facilitates to study in four streams such as Circuits and Devices, Communication Engineering, Signal Processing and Programming. Students are at liberty to choose from these streams in higher semesters. This is reflected in various core subjects offered within the program.

The Master degree programs focus on research and design in the core and IT industries, building and marketing the next generation of product development. These programs provide an opportunity to explore newer dimensions in cutting edge technologies like VLSI, Embedded Systems, Communication and Networking and pursue research in interested domains for doctoral degree.

Vision

The School of Electronics and Communication Engineering is envisioned to be a leading center of higher learning with academic excellence in the field of electronics and communication engineering blended by research and innovation in tune with changing technological and cultural challenges supported with leadership qualities, ethical and moral values.

Mission

- Establish a unique learning environment to enable the students to face the challenges in the field of Electronics and Communication Engineering and explore multidisciplinary which serve the societal requirements.
- Create state-of-the-art laboratories, resources and exposure to the current industrial trends to enable students to develop skills for solving complex technological problems of current times and also provide a framework for promoting collaborative and multidisciplinary activities.
- Promote the establishment of Centers of Excellence in niche technology areas to nurture the spirit of innovation and creativity among faculty and students.
- Offer ethical and moral value based education by promoting activities which inculcate the leadership qualities, patriotism and set high benchmarks to serve the society.

Programme Overview

The B. Tech in Electronics and Communication Engineering is designed keeping in view the current situation and possible future developments, both at national and international levels. This course is designed to give greater emphasis on core Electronics and Communication Engineering with a flexibility to explore any one of the four areas like circuits and devices, signal processing, communication engineering and programming where in an ample number of courses the included that provide knowledge in these specialized areas. This facilitates the students to choose specialized areas of their interest. Adequate attention is given to provide students the basic concepts and support to explore the areas of their interest.

In recent past, Electronics and Communication Engineering is emerged as bridging course that connects the technologies from core Electrical Engineering and Semiconductor Physics to the modern technologies such as VLSI Circuits, seamless high bandwidth communication, advanced signal processing, and finally, merging all the hardware devices of these technologies with IT. The structure of the course has undergone a face-lift with the introduction of subjects from computer science and engineering and thereby provides the flexibility for students choose for IT sectors apart from core Electronics and Communication Engineering. Thus, students in Electronics and Communication Engineering have the flexibility to broaden their horizons in software related industries. The advantage for Electronics and Communication Engineering students is that they are required in both hardware development sectors as well as software development sectors that broadens the area from core electrical engineering to multidisciplinary areas such as robotics, mechatronics, aviation, medical electronics, space exploration, etc.

The program is thus designed to expose students to various subjects having applications in VLSI design, smart system design, wired and wireless communication technologies, information processing, security systems, control engineering, power electronics, cloud based applications, information technology 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. Electronics and Communication Engineering provides the students to choose their career in any one of the following areas.

1. *Analog and Radio Frequency Electronic Circuits:* Without these, there would be no cell phones, no Wifi, not even television.
2. *Communication and Signal/ Image Processing:* It is concerned with the transmission, storage, and analysis of information signals. While traditionally electronics engineers worked on communicating and analyzing speech, audio, image, and video signals, nowadays they work on a much wider variety of problems, such as recovering and analyzing physiological and genomic signals, ecological and environmental signals,

consumer preference data, financial time series, and many others. These technologies make it possible for computers to analyze data from magneto-resonance imaging and other medical imaging devices to not only display images but identify diseases. Computer vision experts teach computers how to recognize faces, while image processing people can de-blur images, extract features, and even make art.

3. *Computer and Digital Systems:* Our society is advancing faster technologically than ever before with the help of computers. These digital systems are everywhere, from your dishwasher and wristwatch to the Mars rovers, and everything in between.
4. *Networking:* The Internet is having a profound impact on society, bringing people across the world together to work collaboratively from different countries. It also spreads and promotes democracy.
5. *Control Systems, Robotics, and Intelligent Transportation:* Automation to reduce human toil in the workplace; enhance safety in manufacturing systems, automobiles (via anti-skid braking systems or self-driving vehicles), and aircraft (e.g., via auto-pilots); biomedical applications including automatic drug delivery (e.g., insulin control for diabetics), controlled prostheses, and robotic surgery; pollution reduction in automobiles and aircraft.
6. *Electromagnetics and Microwaves:* Communication via radio waves is essential for mobile devices, radios, and the internet. Radio- and microwaves can also be used for sensing, for example in air traffic control radar. The ability of microwaves to see through clouds and rain also makes them very useful for measuring Earth's climate and the influence of global change.
7. *Fiber Optics:* Using light to solve engineering problems runs the gamut from fiber optics to lasers for eye surgery. A thorough understanding of the interaction of light with matter even helps animators creativity. Optics are widely applicable in many fields, including all types of engineering, as well as medicine, architecture (lighting), entertainment, and many others.

The benefits of choosing Electronics and Communication Engineering are as follows.

- Ample opportunities exist in the field of embedded systems, signal processing, and communication engineering jobs including the IT sector. Flexibility to choose various fields upon graduation
- Great number of opportunities also exists in the field of defense to work in the areas of signal processing and communication.
- Provides a platform to venture into a startup and establish as an entrepreneur.
- Provides a platform to focus on the research and innovation which leads to socio-economic reforms.

Program Educational Objectives (PEO's)

The programme educational objectives of the Electronics and Communication Engineering of REVA University is to prepare graduates

PEO-1	To have successful professional careers in industry, government, academia and military as innovative engineers.
PEO-2	To successfully solve engineering problems associated with the lifecycle of Electronics and Communication Systems by communicating effectively either leading a team or as a team member
PEO-3	To continue to learn and advance their careers through activities such as participation in professional organizations, attainment of professional certification for lifelong learning and seeking higher education.
PEO-4	To be active members ready to serve the society locally and internationally and will take up entrepreneurship for the growth of economy and to generate employment.

Program Outcomes (POs)

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals for the solution of complex problems in Electronics and communication Engineering.

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.

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.

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.

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.

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.

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.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

9. **Individual and team work**: Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.

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.**

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.

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.

Programme Specific Outcomes (PSO)

After successful completion of the programme, the graduates shall be able to

1. Isolate and solve complex problems in the domains of Electronics and Communication Engineering using latest hardware and software tools and technologies, along with analytical and managerial skills to arrive at cost effective and optimum solutions either independently or as a team.
2. Implant the capacity to apply the concepts of electronics, communications, signal processing, VLSI, embedded systems, etc. in the design, development and implementation of application oriented engineering systems.
3. Design, Model, Analyze and Build Electronics and Communication Systems to solve real life and industry problems.

REVA University Regulations for Choice Based Credit System (CBCS) and Continuous Assessment Grading Pattern (CAGP) for Engineering Graduate Degree Programs, 2020

(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 the **"REVA University Regulations for Choice Based Credit System (CBCS) and Continuous Assessment Grading Pattern (CAGP) for Engineering Graduate Degree Programs, 2020".**

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

2. The Programs:

The following programs and all Engineering Graduate Degree programs to be instituted and introduced in REVA University in coming years shall follow these regulations.

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

3. Definitions:

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

(i) L= Lecture (ii) T= Tutorial (iii) 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 that equip students to acquire the much required skill component.

4. Courses of study and Credits

4.1. The study of various subjects in B Tech degree program are grouped under various courses. Each of these course carries credits which are based on the number of hours of teaching and learning.

4.1.1. In terms of credits, every **one hour session of L amounts to 1 credit per Semester.**
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** over a period of one Semester of 16 weeks for teaching-learning process.

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

4.1.3. A course shall have either or all the four components. That means a course may have only lecture component, or only practical component or combination of any two or all the three components.

4.1.4. The concerned BoS will assign Credit Pattern for every course based on the requirement. However, generally, courses can be assigned with 1-4 Credits depending on the size of the course.

4.1.5. Different C**ourses of Study** are labeled and defined as follows:

a. Core Course:

A course which should compulsorily be studied by a candidate as a core-requirement is termed as a Core course. The CORE courses of Study are of THREE types, viz – (i) Foundation Course, (ii) Hard Core Course, and (iii) Soft Core Course.

b. Foundation Course (FC):

The foundation Course is a core course which should be completed successfully as a part of graduate degree program irrespective of the branch of study.

c. Hard Core Course (HC):

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.

d. Soft Core Course (SC):

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.

e. O**pen Elective Course:**

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 O**pen Elective Course.**

f. Project Work / Dissertation:

Project work / Dissertation denoted as "D" is a special course involving application of knowledge in solving / analyzing /exploring a real life situation / difficult problem. A Minor project normally will be assigned with 4-6 credits and a major project/dissertation will be assigned with 8-16 credits. **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.**

5. 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	Passed 10+2 examination with Physics and Mathematics as compulsory subjects along with one of the Chemistry Biotechnology / Biology / 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. **(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. **(E)** Provided further that students, who have passed Diploma in Engineering & 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.
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.
4	B Sc (Honors) in Computer Science (with specialization in Cloud and Big Data)	4 Years (8Semesters)	Pass in PUC /10+2 examination with Physics, Mathematics as compulsory subject along with at least one of the Chemistry,/ Bio-Technology / Biology / Computer Science / Electronics / Technical Vocational subjects and 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.

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

6. Scheme, Duration and Medium of Instructions:

6.1. B Tech degree program is of 8 semesters - 4 years duration. 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.

6.2. The medium of instruction shall be English.

7. Credits and Credit Distribution

7.1. A candidate has to earn 192 credits for successful completion of B Tech degree with the distribution of credits for different courses as given in **Table-1** below:

Course Type	**Credits**
	For B Tech Degree (8 Semesters)
Foundation Core Course	A minimum of 08
Hard Core Course	A minimum of 136, but not exceeding 156

Soft Core Course	A minimum of 24 but not exceeding 44
Open Elective	A minimum of 04
Total	**192**

7.2. 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
1	English for Technical Communication	4
2	Environmental Studies	2
3	Indian Constitution and Professional Ethics	2

7.3. A candidate can enrol for a maximum of 32 credits and a minimum of 20 credits per Semester. However he / she may not successfully earn a maximum of 32 credits per semester. This maximum of 32 credits does not include the credits of courses carried forward by a candidate.

7.4. 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 192 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.

8. Assessment

b) Each course is assessed for a total weight of 100%. Out of the total 100% weight; 50% weight is for Continuous Internal Assessment (CIA or IA) and the remaining 50% for the Semester End Examination (SEE). This applicable for theory, laboratory, workshop, studio and any such courses

c) Out of 50% weight earmarked for Internal Assessment (IA)- 10% is for Quizzes, 15% for test-1, 15% for test-2 and 10% for Assignments and this is applicable for theory based courses

d) The quizzes, tests and assignments are conducted as per the semester academic calendar provided by the University

The details as given in the table

Component	*Description*	*Conduction*	*Weight Percentage*

C1	*Quizzes*	*At the end of each class*	*10*
C2	*Test-1: IA1*	*6th week from the starting date of semester*	*15*
	Test-2: IA2	*12th week from the starting date of semester*	*15*
C3	*1 Assignment*	*7th week*	*05*
	2 Assignment	*13 th week*	*05*
C4	*SEE including practical*	*between 17th Week-20th Week*	*50*
Results to be Announced			*By the end of 21st Week*

Note: IA or CIA includes C1, C2, and C3

Each test must be conducted for a duration of 60 minutes, setting the test question paper for a maximum of 30 marks. The final examination must be conducted for a duration of 3 hours and the question paper must be set for a maximum of 100 marks.

e)Students are required to complete courses like communication skills, technical English, Professional ethics and Indian Constitution, Environmental Sciences, technical skills, placement related courses, Open electives and any such value addition or specialized courses through online platforms like SWAYAM/NPTEL/Any other reputed online education aggregator. Students are required to choose the courses on the advice of their course coordinator/Director and required to submit the course completion certificate along with percentage of marks/grade scored in the assessment conducted by the online education aggregator. If the online education aggregator has issued a certificate along with the grade or marks scored to students, such courses will be considered for SGPA calculations, in case the aggregator has issued only a certificate and not marks scored, then such courses will be graded through an examination by concerned School, in case, if grading is not possible, students will be given a pass grade and award the credit and the credits will not be considered for SGPA calculations. The Online/MOOCs courses will not have continuous internal assessment component

f) Such of those students who would like to discontinue with the open elective course that they have already registered for earning required credits can do so, however, they need to complete the required credits by choosing an alternative open elective course.

9. Setting question paper and evaluation of answer scripts.

i. For SEE, three sets of question papers shall be set for each theory course out of which two sets will be by the internal examiners and one set will be by an external examiner. In subsequent years by carrying forward the unused question papers, an overall three sets of question papers should be managed and depending on the consumption of question ppaers either internal or external examiner be called for setting the question paper to maintain an overall tally of 3 papers with the conditioned mentioned earlier. The internal examiner who sets the question paper should have been course tutor

ii. The Chairman of BoE shall get the question papers set by internal and external examiners.

iii. The Board of Examiners shall scrutinize and approve the question papers and scheme of valuation. It is the responsibility of the BoE to see that all questions contained in the question paper are within the prescribed syllabus of the concerned course.

iv. There shall be single valuation for all theory papers by internal examiners. However, there shall be moderation by the external examiner who has the subject background. In case no external examiner with subject background is available, a senior faculty member within the discipline shall be appointed as moderator.

v. The SEE examination for Practical work / Field work / Project work/Internship will be conducted jointly by internal and external examiners as detailed below: However, the BoE on its discretion can also permit two internal examiners.

vi. If a course is fully of (L=0):T:(P=0) type or a course is partly P type i.e, (L=3): (T=0) (P=1), then the examination for SEE component will be as decided by the BoS concerned.

[

10. Evaluation of Practical's and Minor Project / Major Project / Dissertation

10.3.1. A practical examination shall be assessed on the basis of:

a) Knowledge of relevant processes;

b) Skills and operations involved;

c) Results / products including calculation and reporting.

10.3.2. In case a course is fully of P type (L=0:T=0:P=4), the performance of a candidate shall be assessed for a maximum of 100 marks as explained below:

- ***a) Continuous Internal assessment (CIA) = 50 marks***
- ***b) Semester end practical examination (SEE) = 50 marks***

The 25 marks for continuous assessment shall further be allocated as under (IA or CIA):

i	*Conduction of regular practical throughout the semester*	*20 marks*
ii	*Maintenance of lab records*	*10 marks*
iii	*Laboratory test and viva*	*20 marks*
	Total	*50 marks*

The 50 marks meant for Semester End Examination, shall be allocated as under:

i	*Conduction of semester end practical examination*	*30 marks*
ii	*Write up about the experiment / practical conducted*	*10 marks*
iii	*Viva Voce*	*10 marks*
	Total	*50 marks*

10.3.3. The SEE for Practical work will be conducted jointly by internal and external examiners. However, if external examiner does not turn up, then both the examiners will be internal examiners.

10.3.4. In case a course is partly P type i.e, (L=3): (T=0) (P=1), then the examination for SEE component will be as decided by the BoS concerned.

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

10.4. 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:

1	*First project presentation describing the problem definition*	*Should be done a semester before the project semester*	*Weightage: 0%*
2	*Project Progress presentation-1*	*7th week from the start date of project semester*	*Weightage: 25%*
3	*Project progress presentation-2*	*14th Week from the start date of project semester*	*Weightage -25%*
4	*Final project Viva and Project Report Submission*	*17th -20th Week of project Semester*	*Weightage: 30% for Project Report Weightage : 20% for Final Viva Voce*

11. Provision for Appeal

If a candidate is not satisfied with the evaluation of C1,C2 and C3 components, he/she can approach the grievance cell with the written submission together with all facts, the assignments, test papers etc, which were evaluated. He/she can do so before the commencement of 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 taking disciplinary/corrective action on an evaluator if he/she is found guilty. The decision taken by the grievance cell is final.

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

- The Registrar (Evaluation) - 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.

12. Eligibility to Appear for Semester End Examination

12.1. 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 course(s), as provided in the succeeding sections, shall be eligible to appear for SEE examination.

12.2. Requirements to Pass a Course

Students are required to score a total minimum of 40% (Continuous Internal assessment and SEE) in each course offered by the University/ Department for a pass (other than online courses) with a minimum of 13 (25% of 50) marks in final examination

12.3. Requirements to Pass the Semester

To pass the semester, a candidate has to secure minimum of 40% marks in each subject / course of the study prescribed in that semester.

13. Provision to Carry Forward the Failed Subjects / Courses:

13.1. The student who has failed in a maximum of 4 courses in odd and even semesters together shall move to next semester of immediate succeeding year of study. And he / she shall appear for C4 examination of failed courses of previous semesters concurrently with odd semester end examinations (C4) and / or even semester end examinations (C4) of current year of study. However, he / she shall have to clear all courses of both odd and even semesters of preceding year to register for next succeeding semester.

Examples:-

b. 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 C4 examination of 1 failed Course of First Semester concurrently with Third Semester C4 examination. Likewise, he / she is eligible to appear for C4

examination of 3 failed Courses of Second Semester concurrently with Fourth Semester C4 examination. However, he / she has to clear all the failed Courses of First and Second Semesters before seeking admission to Fifth Semester.

c. Student "B" has failed in 2 Courses in Third 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 C4 examination of 2 failed Courses of Third Semester concurrently with Fifth Semester C4 examination. Likewise he / she is eligible to appear for C4 examination of 2 failed Courses of Fourth Semester concurrently with Sixth Semester C4 examination. However, he / she is not eligible to seek admission to Seventh Semester unless he / she passes in all the failed courses of Third and Fourth Semesters.

d. Student "C" has failed in 4 Courses in Fifth Semester but has cleared all the courses in Sixth Semester. He / She has also passed all the courses of First to Fourth Semesters. Student "C" is eligible to seek admission for Seventh Semester and appear for C4 examination of 4 failed Courses of Fifth Semester concurrently with Seventh Semester C4 examination. However, he / she has to pass all the failed courses of Fifth Semester along with Seventh and Eighth Semesters courses to earn B Tech Degree.

e. Student "D" passed in 1to 4 semesters, but failed in 3 courses of 5^{th} Semester and in 1 course of 6^{th} Semester. He / She has also passed all the courses of First to Fourth Semesters. Student "D" is also eligible to seek admission for 7^{th} Semester and appear for C4 examination of 3 failed courses of 5^{th} Semester concurrently with 7^{th} Semester C4 examination and one failed course of 6^{th} Semester concurrently with 8^{th} Semester C4 examination. However, he / she has to pass all the 3 failed courses of Fifth Semester and 1 course Sixth Semester along with Seventh and Eighth Semester courses to earn B Tech Degree.

13.1. Re-Registration and Re-Admission:

a) 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 end semester examination (C4) and he / she shall have to seek re-admission to that semester during subsequent semester / year within a stipulated period.

b) 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.

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 (C4) examination and such

student shall seek re-admission as provided in 7.8.4.

14.4. Teachers offering the courses will place the above details in the School Board meeting during the last week of the semester, before the commencement of C4, and subsequently a notification pertaining to the above will be brought out by the Director of the School before the commencement of C4 examination. A copy of this notification shall also be sent to the office of the Registrar & Registrar (Evaluation).

15. Absence during Mid Semester Examination:

In case a student has been absent from a mid-semester (C1,C2 and C3) examination 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 Head of the School, for make-up examination. The Head 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 test for such candidate(s) well in advance before the C4 examination of that respective semester. Under no circumstances C1, C2 & C3 test shall be held after C4 examination.

16. Grade Card and Grade Point

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

16.2. **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 Registrar (Evaluation).

16.3. **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
91-100	10	v*10	O
81-90	9	v*9	A+
71- 80	8	v*8	A
61-70	7	v*7	B+
55-60	6	v*6	B
50- 54	5.5	v*5.5	C
40-49	5	v*5	P
0-39	0	v*0	F
ABSENT			AB

O - Outstanding; A-Excellent; B-Very Good; C-Good; D-Fair; E-Satisfactory; F - Fail

Here, P is the percentage of marks (P= [C1+C2+C3+C4] 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.

16.3.1. 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 (Si) = ∑(Ci x Gi) / ∑Ci where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

Illustration for Computation of SGPA and CGPA

Illustration 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	3	B+	7	3X7=21
Course 4	3	O	10	3X10=30
Course 5	3	P	5	3X5=15
Course 6	3	B	6	3X6=18
Course 7	2	O	10	2X10=20
Course 8	2	A	8	2X8=16
	24			188

Thus, **SGPA = 188 ÷ 24 = 7.83**

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	P	5	3X5=15
Course 7	2	B+	7	2X7=21
Course 8	2	O	10	2X10=20
	24			175

Thus, **SGPA = 175 ÷ 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
	24			199

Thus**, SGPA = 199 ÷ 24 = 8.29**

16.4. Cumulative Grade Point Average (CGPA):

16.4.1. Overall Cumulative Grade Point Average (CGPA) of a candidate after successful completion of the required number of credits (192) 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 = ∑(Ci x Si) / ∑Ci**

Where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

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

Illustration:
CGPA after Final Semester

Semester (ith)	No. of Credits (Ci)	SGPA (Si)	Credits x SGPA (Ci X Si)
1	24	6.83	24 x 6.83 = 163.92
2	24	7.29	24 x 7.29 = 174.96
3	24	8.11	24 x 8.11 = 192.64
4	26	7.40	26 x 7.40 = 192.4
5	26	8.29	26 x 8.29 = 215.54
6	24	8.58	24 x 8.58 = 205.92
7	24	9.12	24 x 9.12 = 218.88
8	24	9.25	24 x 9.25 =222
Cumulative	196		1588.26

Thus, **CGPA** = $\frac{24x6.83+24x7.29+24x8.11+26x7.40+26x8.29+24x8.58+24x9.12+24x9.25}{196}$ = 8.10

16.4.2. *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 8.10 x 10=81.0

16.4.3. 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	P	Pass	Satisfactory

Overall percentage=10*CGPA

17. Challenge Valuation:

a. A student who desires to apply for challenge valuation shall obtain a photo copy of the answer script 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 Registrar (Evaluation) within 10 days after the announcement of the results. This challenge valuation is only for C3 component.

b. The answer scripts 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.

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

B. Tech in Electronics and Communication Engineering

Scheme 2018-2022

Sl. No.	Course Code	Course Title	Course Type	Credit Pattern and Value				Weekly Contact Hours	Teaching School/Dept.
				L	T	P	C		
First Semester: Physics Cycle									
1	B18EC1010	Engineering Mathematics-I	HC	3	1	0	4	5	Mathematics
2	B18EC1020	Engineering Physics	HC	2	1	0	3	4	Physics
3	B18EC1030	Elements of Mechanical Engineering	HC	1	1	0	2	3	Mech.
4	B18EC1040	Basic Electrical and Electronics	HC	2	1	0	3	4	ECE
5	B18EC1050	Computer Concepts and C Programming (I)	HC	2	0	1	3	5	C&IT
6	B18EC1060	Constitution of India and Professional Ethics	FC	2	0	0	2	2	LAW
7	B18EC1070	Technical English-1	FC	0	0	2	2	4	Arts and Humanities
8	B18EC1080	Basic Electrical and Electronics Lab	HC	0	0	2	2	3	ECE
9	B18EC1090	Engineering Physics Lab	HC	0	0	2	2	3	Physics
Total Credits for the First Semester:							23	33	
Second Semester: Chemistry Cycle									
1	B18EC2010	Engineering Mathematics-II	HC	3	1	0	4	5	Mathematics
2	B18EC2020	Engineering Chemistry	HC	3	0	0	3	3	Chemistry
3	B18EC2030	Analog Electronics	HC	3	0	0	3	3	ECE
4	B18EC2040	Python Programming (I)	HC	2	0	1	3	5	C&IT/ECE
5	B18EC2050	Environmental Sciences	FC	2	0	0	2	2	Chemistry
6	B18EC2060	Technical English -2	FC	0	0	2	2	4	Arts and Humanities
7	B18EC2070	Computer Aided Engineering Drawing (I)	HC	1	0	1	2	5	Mech.
8	B18EC2080	Analog Electronics lab	HC	0	0	2	2	3	ECE
9	B18EC2090	Chemistry Lab	HC	0	0	2	2	3	Chemistry
Total Credits for the Second Semester:							**23**	**33**	

Note: Analog Electronics subject is a project based learning. Students are required to do Mini Project on Electronic Circuits

Sl. No.	Course Code	Course Title	Course Type	Credit Pattern and Value				Weekly Contact Hours	Teaching School/ Dept.
				L	T	P	C		
Third Semester:									
1	B18EC3010	Engineering Mathematics-III	HC	2	1	0	3	4	Mathematics
2	B18EC3020	Linear Integrated Circuits	HC	3	0	0	3	3	ECE
3	B18EC3030	Digital Electronics & VHDL	HC	3	1	0	4	5	ECE
4	B18EC3040	Signals & Systems (I)	HC	2	1	1	4	5	ECE
5	B18EC3050	Network Theory	HC	2	1	0	3	4	ECE
6	B18EC306X	Soft Core – 1 (SC-1)	SC	3	0	0	3	3	ECE
7	B18EC3070	Linear Integrated Circuits Lab	HC	0	0	2	2	3	ECE
8	B18EC3080	Digital Electronics and VHDL Lab	HC	0	0	2	2	3	ECE
9	B18EC3090	Soft Skill - 1	RULO	0	0	2	2	2	UIIC/ECE
10	B18EC3X10	YOGA/MUSIC/SPORTS/ DANCE/ THEATRE	RULO	0	0	2	2	2	Physical Education/ Performing Arts
Total Credits for the Third Semester:							**28**	**34**	
Note: Linear Integrated Circuit subject is project based learning. Students are required to do Mini Project on the basics. ***RULO:R**EVA **U**nique **L**earning **O**pportunity									
Fourth Semester:									
1	B18EC4010	Engineering Mathematics-IV	HC	2	1	0	3	4	Mathematics
2	B18EC4020	Analog Communication	HC	3	0	0	3	3	ECE
3	B18EC4030	Electromagnetic Field Theory	HC	2	1	0	3	4	ECE
4	B18EC4040	Microcontrollers and Applications	HC	3	0	0	3	3	ECE
5	B18EC4050	Control systems (I)	HC	3	0	1	4	5	ECE
6	B18EC406X	Soft Core -2 (SC-2)	SC	3	0	0	3	3	ECE
7	B18EC4070	Microcontrollers and applications Lab	HC	0	0	2	2	3	ECE
8	B18EC4080	Analog Communication Lab	HC	0	0	2	2	3	ECE
9	B18EC4091	Soft Skill-2	RULO	0	0	2	2	2	UIIC/ECE
10	B18EC4101	Skill Development	RULO	0	0	0	2	2	UIIC/SDC
Total Credits for the Fourth Semester:								**27**	**33**
Note: Students are required to do Mini Project and Compulsory for Project Exhibition									

Sl. No.	Course Code	Course Title	Course Type	Credit Pattern and Value				Weekly Contact Hours	Teaching School/ Dept.
				L	T	P	C		
Fifth Semester									
1	B18EC5010	Digital Communication	HC	2	1	0	3	3	ECE
2	B18EC5020	RF and Microwave Engineering	HC	2	1	0	3	4	ECE
3	B18EC5030	Digital Signal Processing (I)	HC	2	1	1	4	5	ECE
4	B18EC5040	Entrepreneurship and Innovator Skills	HC	2	0	0	2	2	Mgmt./ECE
5	B18EC505X	Soft Core – 3 (SC-3)	SC	3	0	0	3	3	ECE
6	B18EC506X	Soft Core – 4(SC-4)	SC	3	0	0	3	3	ECE
7	B18EC507X	Soft Core – 5(SC-5)	SC	3	0	0	3	3	ECE
8	B18EC5080	RF and Microwave Lab	HC	0	0	2	2	3	ECE
9	B18EC5090	Digital Communication Lab	HC	0	0	2	2	3	ECE
10	B18EC5X10	Soft Skill-3	RULO	0	0	2	2	2	UIIC/ECE
11	B18EC5X20	MOOCs-Swayam/NPTEL /EDx/COURSERA/ Mini Project	RULO	0	0	2	2	2	Others
Total Credits for the Fifth Semester:							**29**	**33**	
Note: Industrial visits will be organized for a day to Public/Private Sectors in Bengaluru. Aptitude development program will be conducted for two days.									
Sixth Semester									
1	B18EC6010	Antenna and wave Propagation	HC	2	1	0	3	4	ECE
2	B18EC6020	CMOS VLSI Circuits	HC	3	0	0	3	3	ECE
3	B18EC6030	Computer Communication and Networks (I)	HC	3	0	1	4	5	ECE
4	B18EC604X	Soft Core – 6(SC-6)	SC	3	0	0	3	3	ECE
5	B18EC605X	Soft Core – 7(SC-7)	SC	3	0	0	3	3	ECE
6	B18EC606X	Soft Core – 8(SC-8)	SC	3	0	0	3	3	ECE
7	B18EC6070	Antenna Lab	HC	0	0	2	2	3	ECE
8	B18EC6080	CMOS VLSI Circuits Lab	HC	0	0	2	2	3	ECE
9	B18EC6090	Soft Skill -4	RULO	0	0	2	2	3	UIIC/ECE
10	B18EC6X10	MOOCs / SWAYAM/ NPTEL /EDx/COURSERA/Mini Project	RULO	0	0	2	2	2	Others
Total Credits for the Sixth Semester:							**27**	**32**	
Note: All students must participate in a Mini Project Exhibition. Industrial visits will be organized for a day to Public/ Private Sectors related to Communication.									

Sl. No	Course Code	Course Title	Course Type	Credit Pattern and Value				Weekly Contact Hours	Teaching Dept.
				L	T	P	C		
Seventh Semester									
1	B18EC7010	IOT and Cyber physical systems (I)	HC	3	0	1	4	5	ECE
2	B18EC702X	Soft Core –9 (SC-9)	SC	3	0	0	3	3	ECE
3	B18EC703X	Soft Core – 10(SC-10)	SC	3	0	0	3	3	ECE
4	B18EC704X	Soft Core – 11(SC-11)	SC	3	0	0	3	3	ECE
5	B18EC705X	Open Elective	OE	4	0	0	4	4	ECE
6	B18EC7060	Project Dissertation Phase-I	HC	0	0	4	4	4	ECE
Total Credits for the Seventh Semester:							**21**	**22**	
Note: The project work phase-1 of project dissertation of 8th Semester will begin in 7th Semester, where student has to form a project group and perform literature survey and define the problem tools and technologies to be used. Options for 8th Semester must be selected in 7th Semester.									
Eighth Semester									
1	B18EC801X	Internship/Global Certification Program/ Soft Core-12 (SC-12)	SC	3	0	0	3	3	ECE/Others
2	B18EC802X	Internship/Global Certification Program/ Soft Core-13 (SC-13)	SC	3	0	0	3	3	ECE/Others
3	B18EC8030	**Project & Dissertation Phase - II**	**HC**	0	0	8	8	8	ECE
Total Credits for the Eighth Semester							**14**	**14**	
Total Credits for all Eight Semesters:							**192**		

Total Credits = 192 (including Credits for Sports/Yoga/Music/Dance/Theatre)

Scheme of Soft Core (SC) & Open Elective (OE) with Specialization Groups

A: Electronics/VLSI, B: Computers & IT, C: Communication Engg. D: Interdisciplinary

Sl. No.	Soft-core Group No. / Semester	Name of the Course	Course Code	L	T	P	C	Specialization Group
1	SC-1 / Semester-3	Instrumentation Engineering	B18EC3061	3	0	0	3	A
2		Computer Organization and Architecture	B18EC3062	3	0	0	3	B
3		Object Oriented Programming Using C++	B18EC3063	3	0	0	3	B
5	SC-2 / Semester - 4	Solid state Devices Theory (SSDT)	B18EC4061	3	0	0	3	A
6		Data Structures Using C & C++	B18EC4062	3	0	0	3	B
7		Power Electronics	B18EC4063	3	0	0	3	A
8		Probability & Random Processes	B18EC4064	3	0	0	3	D
9	SC-3/ Semester-5	Microelectronics	B18EC5051	3	0	0	3	A
10		JAVA Programming	B18EC5052	3	0	0	3	B
11		Optical Fiber Communication	B18EC5053	3	0	0	3	C
12		Research Methodology & IPR	B18EC5054	3	0	0	3	D
13	SC-4 / Semester 5	ARM Processors and applications	B18EC5061	3	0	0	3	A
14		Theory of Algorithms	B18EC5062	3	0	0	3	B
15		Biomedical Signal Processing	B18EC5063	3	0	0	3	C
16		Automotive Electronics	B18EC5064	3	0	0	3	D
17	SC-5 / Semester 5	System Verilog	B18EC5071	3	0	0	3	A
18		Relational Data Base Management System (RDBMS)	B18EC5072	3	0	0	3	B
19		Digital signal Processor Architecture(DSPA)	B18EC5073	3	0	0	3	C
20		Mechatronics	B18EC5074	3	0	0	3	D
21	SC-6 / Semester 6	Embedded Systems	B18EC6041	3	0	0	3	A
22		Data Mining	B18EC6042	3	0	0	3	B
23		Image Processing	B18EC6043	3	0	0	3	C
24		Machine Learning & Deep Learning	B18EC6044	3	0	0	3	D
25	SC-7 / Semester 6	Real Time Systems	B18EC6051	3	0	0	3	A
26		UNIX fundamentals	B18EC6052	3	0	0	3	B
27		Adaptive Filters	B18EC6053	3	0	0	3	C
28		Project Management	B18EC6054	3	0	0	3	D
29		Component Engineering	B18EC6055	3	0	0	3	D
30	SC-8 / Semester 6	MEMS	B18EC6061	3	0	0	3	A
31		Web Programming	B18EC6062	3	0	0	3	B

32		Information Theory and Coding	B18EC6063	3	0	0	3	C
33		Alternate Engineering	B18EC6064	3	0	0	3	D
34	SC-9 / Semester 7	Analog Mixed Mode VLSI	B18EC7021	3	0	0	3	A
35		Cloud Computing	B18EC7022	3	0	0	3	B
36		Wireless Communication	B18EC7023	3	0	0	3	C
37		Robotics & Automation	B18EC7024	3	0	0	3	D
38		Software Engineering	B18EC7025	3	0	0	3	D
39	SC-10 / Semester 7	ASIC Design	B18EC7031	3	0	0	3	A
40		Big data and Data Science	B18EC7032	3	0	0	3	B
41		Satellite Communication	B18EC7033	3	0	0	3	C
42		Medical Electronics	B18EC7034	3	0	0	3	D
43	SC-11 / Semester 7	SOC Design	B18EC7041	3	0	0	3	A
44		Grid computing	B18EC7042	3	0	0	3	B
45		Multi Media Communication (MMC)	B18EC7043	3	0	0	3	C
46		Reliability Engineering	B18EC7044	3	0	0	3	D
47	SC-12 / Semester 8	Low power VLSI	B18EC8011	3	0	0	3	A
48		Parallel Processing	B18EC8012	3	0	0	3	B
49		Ad-hoc Networks	B18EC8013	3	0	0	3	C
50		Avionics	B18EC8014	3	0	0	3	D
51	SC-13 / Semester 8	Digital Testing & Testability	B18EC8021	3	0	0	3	A
52		Pervasive & Ubiquitous Computing	B18EC8022	3	0	0	3	D
53		Network Security	B18EC8023	3	0	0	3	B
54		Radar and Navigational Aids	B18EC8024	3	0	0	3	C
55	OE / Semester 7	Embedded Systems	B18EC7051	4	0	0	4	*
56		Robotics and Automation	B18EC7052	4	0	0	4	*
57		IOT and Cyber physical system	B18EC7053	4	0	0	4	*

Detailed Syllabus

Semester I:

B18EC1010	Engineering Mathematics-I	L	T	P	C
Duration:14 Wks		3	1	0	4

Prerequisites:

Knowledge of basics limits, continuity, differentiation, integration, matrices, determinants, and geometry.

Course Description:

This course covers the topics: Successive derivatives, mean value theorems, Taylor's series, partial derivatives, extreme values, multiple integrals, differential equations. The purpose of this course is to provide students with skills and knowledge required to perform mathematical procedures and processes for solution of engineering problems. This course is widely used particularly in the field of Electronics and Communication Engineering, for ex., Differential equations are used in AC power analysis, AC circuit analysis, E&M, transmission lines, control systems, signal conditioning/processing, etc.

Course Objectives:

The objectives of this course are:

1. To understand the concepts of differential calculus and its applications.
2. To familiarize with partial differentiation and its applications in various fields.
3. To familiarize with linear algebraic applications and different reduction techniques.
4. To familiarize with concept of vector calculus and its applications.

Course Outcomes:

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

1. Apply the knowledge of differential calculus in the field of wave theory and communication systems.
2. Apply the knowledge of Differential Equations in the field of Engineering.
3. Analyze and implement the concepts of Divergence and curl of vectors which play significant roles in finding the Area and volume of the closed surfaces.
4. Apply the knowledge of convergence of the series, which help in forming JPEG image compression.

Mapping of Course Outcomes with Program Outcomes

Course Code	POS/ COs	PO 1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
B18EC1010	CO1	3	3	3		1				3			3	3	1	1
	CO2	3	3	3		1				3			3	3	1	1
	CO3	3	3	3		1				3			2	3	1	1
	CO4	3	3	3	1	1				3			3	3	1	1

Course Contents:

Unit-1: Differential Calculus-I [10L+7T]

Successive differentiation-nth derivatives (no proof and simple problems), Leibnitz Theorem (without proof) and problems. Mean value theorem theorems-Rolle's theorem (no proof), Lagrange's mean-value theorems, Cauchy's mean-value theorem problems, mean value theorem of integral calculus (no proof). Taylors series and Maclaurin'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.

Unit-2: Differential Calculus-II [11L+7T]

Derivative of arc length – concept and formulae (without proof) Radius of curvature-Cartesian, parametric, polar and pedal forms (without proof) problems.

Indeterminate forms and solution using L'Hospital's rule.

Partial Differentiation: Partial derivatives-Euler's theorem-problems, Total derivative and chain rule.

Unit-3: Differential Calculus-III and Differential equations [10L+7T]

Jacobians-definition and problems (only to find *J*and illustrative example to verify JJ'=1). Taylor's Expansion of function of two variables (only problems- up to 2nd order).Maxima and Minima for a function of two variables (simple problems). Differential equations: Exact equation and reducible to exact form (1. Close to expression M or N and find IF, 2. y f(x) dx+x g(y) dy).

Unit-4: Integral Calculus [11L+7T]

Reduction formulae for the integrals of$\sin^n x$, $\cos^n x$,$\sin^m x \cos^n x$ and evaluation of these integrals with standard limits(direct result) - Problems.

Multiple Integrals **–** Double integrals, change of order of integration (simple problems), and triple integrals. Beta and Gamma functions, properties, Relation between beta and gamma functions and simple problems.

Text books:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43nd edition, 2015.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Publications, 10th edition, 2015.

Reference Books:

1. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publications, 19th edition, 2013.
2. R. K. Jain and S. R. K. Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House, 5thedition, 2014.

B18EC1020	Engineering Physics	L	T	P	C
Duration :14 Wks		2	1	0	3

Prerequisites:

Knowledge of Basic physics and mathematics of pre-university level

Course Description:

Engineering Physics provides the fundamental knowledge of basic principles of Physics which is required for foundation in engineering education irrespective of branch, it provides the knowledge of quantum mechanics and its importance and applications. It also provides the knowledge of different theories of solids to explain electrical conductivity of materials and recent trends in NDT and nano technology.

Course Objectives:

The Course Objectives are

1. To make students learn and understand basic concepts and principles of physics to analyse practical engineering problems and apply its solutions effectively and meaningfully.
2. To understand building up of models, design issues, practical oriented skills and problem-solving challenges are the great task of the course.
3. To know about Semiconductors and practical applications is the prime motto to introduce new technology at the initial stage of Engineering.
4. Students should be getting knowledge of different physical systems, basic quantum mechanics and nanomaterials etc.

Course Outcomes:

By the end of the course, the students will be able to….

1. Describe wave mechanics and apply knowledge to solve quantum mechanics basic problems.
2. Understand the basics of quantum computation
3. Explain the basics of semiconductors, diodes & transistor
4. Summarize superconductivity with applications. Compare the different display technologies.
5. Distinguish synthesis of nanomaterials.

Mapping of Course Outcomes with Program Outcomes

Course Code	POs / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
B18EC1020	CO1	3	3	1						2	1		3	1	1	
	CO2	3	3	2	3	2				1	1		3	2	1	2
	CO3	3	1		3	1				2			1	2	1	
	CO4	3	1		3	1				1			1	1	2	1

Course Contents:

Unit- 1: Wave mechanics [7L+7T]

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.

Quantum Physics: Heisenberg's uncertainty principle, its significance and its applications (nonexistence of electron inside the nucleus). 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. Problems.

Unit -2: Semiconductors and Semiconductors devices [7L+7T]

Review of band theory. Intrinsic Semiconductors – extrinsic Semiconductor- expression for carrier concentration (derivation for both holes and electrons) – impurity states in energy band diagram. Formation of P-N junction, depletion region, Biased P-N junction, Zener diode – characteristics.Photo diodes, LED (principle, working and applications). Transistors: Transistor action, Characteristics (CB,CC,CE mode), Bipolar Junction Transistors - Junction Field-Effect Transistors- Metal-Semiconductor FETs (MeSFETs) - Metal-Oxide-Semiconductor FETs working and characteristics.

Unit- 3: Superconductors [7L+7T]

Critical temperature (T_c), Critical field (H_c), Critical current density (Jc), Perfect diamagnetism, Meissner effect, Type I and Type II superconductors, Isotope effect, BCS theory of superconductivity, Applications- Superconducting magnets and Maglev vehicle.

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

Unit- 4: Nanomaterials [7L+7T]

Introduction to nanoscience, nanomaterials and their applications, Synthesis of nanomaterials using bottom-up method (arc-discharge method), top-down methods (ball milling method),

Carbon Nanotubes: properties and applications.

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.

Self-learning component:

Magnetic storage devices, solid state storage devices, optical storage devices, and characteristics of materials used in manufacture of Microprocessors/desktops (body, internal circuit connection), heat sink cooling, liquid cooling, fan based cooling, laser printer working, accelerometers. Gold Nano particles as storage devices.

Text Books:

1. R. K. Gaur and S.L. Gupta, "Engineering Physics", DhanpatRai Publications (P) Ltd, New Delhi, 2014.

2. M.N. Avadhanulu and P.G. Kshirsagar, “A Text book of Engineering Physics”, S. Chand and company, New Delhi, 2018.
3. S. O. Pillai, “Solid State Physics”, New Age International publishers, New Delhi, 2018.
4. Janglin Chen, Wayne Cranton, Mark Fihn, “Handbook of Visual Display Technology” Springer Publication, 2012.
5. William T. Silfvast, “Laser Fundamentals”, Cambridge University press, New York, 2004.
6. D. Halliday, R. Resnick and J. Walker, “Fundamentals of Physics”, John Wiley and Sons, New York, 2020.
7. Charls Kittel, “Introduction to Solid State Physics”, Wiley, Delhi, 2019
8. Arthur Beiser, “Concepts of modern Physics”, Tata McGraw Hill publications, New Delhi 8th Edition, 2017.

Reference 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, 2020.
3. Charls Kittel, “Introduction to Solid State Physics”, Wiley, Delhi, 2019
4. Arthur Beiser, “Concepts of modern Physics”, Tata McGraw Hill publications, New Delhi 8th Edition, 2017.

B18EC1030	Elements of Mechanical Engineering	L	T	P	C
Duration:14 Wks		1	1	0	2

Prerequisites:

Basics of Physics

Course Description:

This is a basic course which explains the basics of mechanical engineering which is required to the knowledge of B Tech students irrespective of their branch. This course deals with working operations of certain motors and machines and gives the insight to materials and their structures, combustion engines, steam engines, power transfer pulleys etc.

Course Objectives:

The objectives of this course are:

1. To develop the basic knowledge of steam utilization, working of various turbines and IC engines.
2. To incorporate the concepts of metal joining process, their applications and power transmission modes like belt drives, gears and gear trains.
3. To understand various machines and its operations in Mechanical Engineering.
4. To give exposure to basic power transmission elements.

Course Outcomes:

By the end of the course, the students will be able to

1. Explain the formation of steam, turbines and solve the numerical on steam properties.
2. Describe the construction and working of IC engines, refrigeration systems, air conditioning and solve the numerical on IC engines.
3. Distinguish between the machine tools, metal joining processes and choose the machine tool operation.
4. Illustrate the transmission systems, solve the numerical on gears trains.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO1	P2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
B18EC1030	CO1	3	2	2	-	1	-	-	-	-	3	-	-	-	1	1
	CO2	3	2	2	-	1	-	-	-	-	3	-	-	-	1	1
	CO3	3	2	1	-	1	-	-	-	-	3	-	-	-	1	1
	CO4	3	1	1	-	1	-	-	-	-	3	-	-	-	-	-

Course Contents:

Unit - 1: Properties of steam **[3L+4T]**

Introduction**,** Steam formation, Types of steam. Steam properties, Specific Volume, Enthalpy and Internal energy, Steam table and simple numerical problems.

Turbines- Introduction to turbines, Classification of turbines, Working principle and applications of impulse and reaction steam turbines, gas turbines (open and closed cycle type) and pelton turbine.

Unit - 2: Internal Combustion Engines **[4L+4T]**

Introduction, Classification of IC engines, parts of IC engine, working principle of four stroke (petrol and diesel), differences between petrol & diesel engines, Numerical on BP, IP and Mechanical efficiency.

Refrigeration and Air conditioning- Introduction, Principle of refrigeration, parts of refrigerator, Principle and working of vapor compression refrigeration and vapor absorption refrigeration systems. Refrigerants, Properties of refrigerants Ton of Refrigeration, COP, Working of window air conditioner.

Unit – 3: Machine Tools **[3L+4T]**

Introduction, working principle and classification of lathe, major parts of a lathe and their functions, lathe operations, specifications of lathe, introduction of drilling, parts of radial drilling machine, drilling operations.

Metal joining processes: Introduction, classification of metal joining processes, principle of welding, electric arc welding, soldering and brazing and their differences.

Unit – 4: Power Transmission **[4L+4T]**

Introduction to transmission systems and its classification, types of belt drives**,** velocity ratio, idler pulley,

stepped pulley, fast & loose pulley.**Gears** - Definitions, Spur gear terminology, Types and applications of Gears. **Gear Trains** – Simple and compound gear trains, Simple problems on gear trains

Text Books:

1. K.R. Gopalkrishna, "A Text Book of Elements of Mechanical Engineering", Subhash Publishers, 2017.
2. Kestoor Praveen and M.R. Ramesh, "Elements of Mechanical Engineering", Suggi Publications, 2nd Edition, 2011.

Reference Books:

1. SKH Chowdhary, AKH Chowdhary , Nirjhar Roy, "The Elements of Workshop Technology", Media Promotors and Publishers Vol I & II, 11th edition 2001.

B18EC1040	Basic Electrical and Electronics	L	T	P	C
Duration :14 Wks		2	1	0	3

Prerequisites:

Basics of Physics, Mathematics and Number systems.

Course Description:

The Basic Electrical and Electronics typically deals with the study of Electrical parameters like AC and DC voltage and current and behavior of voltage and current in passive elements also in active elements like: BJT, Diodes and FET. The concepts of Electromotive force and Magneto motive force generated in motors, generators and transformers are explained. The concepts of electrical circuits and electromagnetism are applied to analyze the complex problems arise in the power system networks. Through this course Students will get extensive exposure to digital and analog electronics basics.

Course Objectives:

The objectives of this course are to:

1. Make the students to understand basics of electrical circuits.
2. Study the working principle and construction details of electrical machines.
3. Understand the diode characteristics and its applications.
4. Understand the working principle and characteristics of BJT,FETs
5. Familiarize the students with the number systems
6. Carry out validation of logical expressions using Boolean algebra.

Course Outcomes:

On completion of this course, the student will be able to:

1. Describe basic composition of electrical circuits and their behavior.
2. Analyze the working principle and construction details of electrical machines.
3. Analyze the working applications and characteristics of Diode, BJT, FET
4. Design the digital circuits using various logic gates.

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
B18EC1040	CO1	3	3		2								3		3	
	CO2	3	3		2								3		3	
	CO3	3	3		2								2		3	
	CO4	3	2		2								2		2	

Course Contents:

Unit -1: Basics of Electrical Engineering [7L+7T]

Introduction to electrical engineering, AC, Sinusoidal voltage and currents, Magnitude and phase, polar and rectangular representation R-L, R-C and R-L-C series and parallel circuits(both admittance and impedance method), power factor, phasor diagrams Kirchhoff's Current Law, Kirchhoff's Voltage law, Mesh and Nodal analysis, Source transformation, Star-delta transformation (for DC Circuits only).

Unit -2: Magnetic Circuits, Motors and Transformers [7L+7T]

Definition of magnetic circuit and basic analogy between electric and magnetic circuits, Faradays laws, permittivity, permeability, EMF, MMF equations, Reluctance, Energy and power , 3 phase AC(introduction), Comparison between 1 phase and 3 phase AC.

Principle of operation, Construction and EMF equations: DC Generator, DC Motors, Transformers, types of transformer. Numerical examples as applicable.

Unit -3: Digital Electronics and Number Systems [7L+7T]

Introduction, Switching and Logic Levels, Digital Waveform. Number Systems and its conversions: Decimal Number System, Binary Number System, Octal Number System, Hexadecimal Number System. Binary addition, Binary subtraction. Boolean Algebra Theorems, De Morgan's theorem.

Digital Circuits: Logic gates, Algebraic Simplification, Realization of all logic and Boolean expressions using Universal gates. Half adder and Full adder Implementations.

Unit -4: Semiconductor Diodes and Transistors [7L+7T] P-N junction diode, V-I Characteristics, Half-wave rectifier, Full-wave rectifier, Bridge rectifier, Capacitor filter circuit, Zener diode voltage regulators, Clipping and clamping circuit, Numerical examples as applicable.

Bipolar junction Transistors BJT configuration: BJT Operation, Common Base, Common Emitter and Common Collector Characteristics, Numerical examples as applicable, SCR, Introduction to FETs.

Text Books:

1. Kulshreshtha C,"Basic Electrical Engineering" Tata McGraw Hill, 2nd Edition, 2011.

2. David A. Bell, “Electronic Devices and Circuits”, Oxford University Press, 5th Edition, 2008.
3. D.P. Kothari, I. J. Nagrath, “Basic Electronics”, McGraw Hill Education (India) Private Limited, 2014.

References:

1. Robert L. Boylestad and Louis Nashelsky, “Introduction to Electricity, Electronics and Electromagnetics”, Prentice Hall, 5th edition, 2001.

B18EC1050	Computer Concepts and C programming (I)	L	T	P	C
Duration :14 Wks		2	0	1	3

Prerequisites:

Basics of Mathematics

Course Description:

The objectives of this course is to make students learn basic principles of problem solving, present the syntax and semantics of the “C” language, implement through C language using constructs offered by the language.

Course Objectives:

The objectives of this course are to:

1. Explain the different programming constructs of C to be used for a given application.
2. Illustrate the Usage of control Statements for solving the real world problems.
3. Demonstrate the use of parameter passing mechanism in functions for solving real world problems.
4. Illustrate the use of structures and unions for solving the real world problems.

Course Outcomes:

On successful completion of this course, the student will be able to:

1. Identify the basic constructs of C program, suitable for computing the roots of quadratic equation.
2. Develop a C program to find transpose of a matrix using iterative statements (loops) and Arrays.
3. Design a C program to concatenate two strings by using parameter passing mechanism.
4. Apply the basic concepts Union & Structures to read and print employee’s details.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
B18EC1050	CO1	3	2	3	3	2						1		1		3
	CO2	3	2	2	3	2								3	2	2
	CO3	2	1	2	3	1								2	2	3
	CO4	2	1	3	3	1						1		2	1	3

Course Contents:

Unit -1: Fundamentals of problem solving and introduction to C-language [7L+7P]

Algorithm and flowchart & advantages of algorithm (pseudo code),basic flow chart symbols**,** structure of c program with example**,** c language & its features, c tokens, data types in c**,** variables, constants, input / output functions

Operators: (unary operator, assignment operator, arithmetic operator, relational operators, logical operators & bitwise operator, conditional operator, increment and decrement operator, special operator).
Expressions & statements: Postfix, primary, prefix, unary, binary, ternary & assignment

Unit 2: Branching constructs Conditional statements: [7L+7P]
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, difference between while and do while for loop.
Arrays: one dimensional array, two dimensional array, searching techniques, sorting.

Unit -3: Functions [7L+7P]
Function definition, types of function, location of function in a program, structure of a function, parameter passing mechanisms, call by value & call by address
Strings: string operations with and without using inbuilt string functions (string length, string compare, string copy, string concatenation, string reverse).

Unit -4: Structures & Union [7L+7P]
Derived types: structures- declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, Union, Type def.
Pointers: Introduction to pointers.
File Operations: Formatted Input & Output, Character Input and Output Functions, Direct Input and Output Functions, File Positioning Functions, Error Functions.

Self-Learning component:
Fundamentals of computer graphics: output primitives – Line, Circle and Ellipse drawing algorithms - Attributes of output primitives Two dimensional Geometric transformation.

Text Books:

1. B.W. Kernighan & D.M. Ritchie, "C Programming Language", 2nd Edition, Pentice Hall Software Series, 2005.
2. Herbert Schildt, "C: The Complete Reference", 4th edition, Tata McGraw Hill, 2000.
3. B.S. Anami, S.A. Angadi and S. S. Manvi, "Computer Concepts and C Programming: A Holistic Approach", second edition, PHI, 2008.
4. NanjeshBennur, Dr. C. K. Subbaraya, "Programming in C", 2nd Edition, Excellent Publishing House, 2015.

Reference Books:

1. E. Balaguruswamy," Programming in ANSI C", 4th edition, Tata McGraw Hill, 2008.
2. Donald Hearn, Pauline Baker, "Computer Graphics C Version", second edition, Pearson Education, 2004.

Computer Concepts and C Programming Lab

Lab Objectives:

The objectives of this course are to:

1. Learn basic and fundamental C programming concepts
2. Learn searching and sorting algorithms
3. Develop a C program that contains functions and parameters.
4. Develop a C program that contains sequence, selection and iteration control structures.

Lab Outcomes:

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

1. Illustrate the Representation of Numbers, Alphabets and other Characters in the memory of Computer System;
2. Analyze the Software Development Tools; like Algorithms, Pseudo Codes and Programming Structures;
3. Apply different programming constructs to develop a Computer Program.
4. Demonstrate the use of Engineering Solutions to simple (moderate) mathematical and logical problems.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
B18EC1050(L)	CO1	3	2	3	3	2								1	1	3
	CO2	3	2	2	3	2								3	2	2
	CO3	2	1	2	3	1								2	2	3
	CO4	2	1	3	3	1								2	1	3

Lab Experiments:

Experiment No.	Program	Course Outcome
1	Introduction to Computer Software & hardware. Types of Operating System. Basic Commands in Unix. Assembling hardware's of computer.	1,2
2	a) Program to print the name, college name, Address of a student. b) A company for aadhar card want's to collect its employees information. Write a program to take input of employee name and age.	1,2
3	a) Program to read and print the size of variables of different data type. b) A person has deposited some amount in bank. Write a program to calculate simple interest and compound interest on amount for a period.	1,2

4	a) Arithmetic operations are widely used in many programs. Write a program to perform addition, subtraction, multiplication, modulo division, and division operations. b) In Delhi, four wheelers run on the basis of even or odd number. Write a program to identify whether vehicle registration number is even or odd.	1,2
5	People frequently need to calculate the area of things like rooms, boxes or plots of land where quadratic equation can be used. Write a program to find the coefficients of a quadratic equation and compute its roots.	2,3
6	a) Consider the age of 3 persons in a family, Write a program to identify the eldest person among three of them. b) Consider student's marks in Computer Test. Write a Program display the grade obtain by student in Computer Test based on range.	2,3
7	Calculator allows you to easily handle all the calculations necessary for everyday life with a single application. Write a program to design a basic calculator that performs the basic operations and you want to give choice to user to perform a. Addition of two numbers b. Subtraction of two numbers c. Multiplication of two numbers. d. Division of two numbers. e. Wrong choice	2,3
8	In a stock market at the end of the day we do the summation of all the transactions. a. Write a program to display numbers (transactions) from1 to n. b. Write a program to find the sum of n natural numbers.	2,3
9	**a) Read your ATM Pin Number. Write a program to identify your Pin Number is palindrome or not.** b) Read your Landline Number. Write a program to print the reverse of it and also find sum of digits of your Landline Number.	2,3
10	a) Create a Contact list of n friends, Write a program to read and print the Phone number of your friend's. b) In computer based applications, matrices play a vital role in the projection of three dimensional image into a two dimensional screen, creating the realistic seeming motions. Write a program to perform matrix Multiplication and check compatibility of matrix.	2,3
11	You have joined a startup company of N employees; Write a program is to sort all employee ID.	2,3

12	A student has taken 10 books from the library. Every time he takes the book, Librarian read's its ISBN Number. Write a program to identify whether book is issued to him or not based on ISBN Number.	2,3
13	Suppose students have registered for workshop, and their record is maintained in ascending order based on student id. Write a program to find whether a particular Student has registered for that particular workshop or not.	2,3
14	In a CCP test you scored less marks compared to your friend, Write a program to swap your marks with your friend.	2,3
15	a) In a memory game, you first enter a string wait for a time and again enter second string, Write a program to check both sting were same or not. b) Read your first and last name in two different strings; Write a program to combine these two strings into third string.	2,3
16	a) Assume a person has entered a Password ,Write a program so that he can know the length of his password, b) Read a meaningful word in English, Write a program to identify the word when inversed yields the same or not.	2,3
17	a) Write a c program to implement Digital Differential Analyzer line generating algorithm	3,4
	b) Write a C program to generate a circle using Bresenham's midpoint algorithm.	3,4
	c) Write a C program to implement Bresenham's line drawing algorithm	3,4

B18EC1060	**Constitution of India and Professional Ethics**	**L**	**T**	**P**	**C**
Duration :14 Wks		**2**	**0**	**0**	**2**

Prerequisites:

Basics of Indian Constitution, fundamental rights and duty

Course Description:

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 values. It also helps to know the meaning of ethics and need of ethics in personal and professional life.

Course Objectives:

Course objectives are:

1. To explain basic knowledge required to understand Constitution of India.
2. To summarize the Fundamental Rights, Duties and other Rights.

3. To apply the knowledge of Constitution and more importantly practice it in a right way.
4. To explore Ethical standards followed by different companies.

Course Outcomes:

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

1. Analyze the Fundamental Rights, Duties and other Rights protected under Indian Constitution.
2. Demonstrate the practicality of Constitution perspective and make them face the world as a bonfire citizen.
3. Summarize ethical standards followed by different companies.

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
B18EC1060	CO1						3	1								1
	CO2						3	1								1
	CO3								3		2		2			

Course Contents:

Unit -1: Constitution of India [7 Hrs]

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: Legislature and Executive [7 Hrs]

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 [7 Hrs]

Supreme Court of Indian, High Court, Right to Information Act 2005, Consumer Protection- Consumer Rights- Caveat Emptor and Caveat Venditor.

Unit 4: Professional Ethics [7 Hrs]

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. 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.

Reference Books:

1. M V Pylee, “An Introduction to Constitution of India”.
2. MGovindarajan, S Natarajan, V S Senthil Kumar, Engineering.
3. Dr. Durga Das Basu, “Introduction to constitution of India”.
4. M V Pylee, “An introduction to constitution of India”.

B18EC1070	Technical English - 1	L	T	P	C
Duration:14 Wks		0	0	2	2

Prerequisites

Fundamentals in Spoken English.

Course Description

This course is aimed 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 workplace context, to examine that the learners use the electronic media such as internet and supplement the learning materials used in the classroom.

Course Objectives

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

On successful completion of this course, the student will be able to:

1. Interpret audio files and comprehend different spoken discourses/ excerpts in different accents.
2. Demonstrate speaking ability with clarity, confidence and comprehension and communicate with one or many listeners using appropriate communicative strategies.
3. Make use of reading different genres of texts adopting various reading strategies.
4. Develop the ability to write cohesively, coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO1	P2	PO3	PO4	PO5	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
B18EC1070	CO1		1					3	3			3			
	CO2		1					2	3			3			
	CO3		2					2	3			3			
	CO4		1					3	3			3			

Course Contents:

Unit -1: Functional English **[7P]**

Grammar: Prepositions; Modal Auxiliaries

Listening: Listening to audio (verbal & sounds)

Speaking: Debating Skills

Reading: Skimming a reading passage; Scanning for specific information

Writing: Email communication

Unit -2: Interpersonal Skills **[7P]**

Grammar: Tenses; Wh-questions

Listening& Speaking: Listening and responding to video lectures / talks

Reading: Reading Comprehension; Critical Reading; Finding key information in a given text **Writing:** Process descriptions (general/specific); Recommendations

Unit -3: Multitasking skills **[7P]**

Grammar: Conditional Sentences

Listening & Speaking: Listening to specific task; focused audio tracks and responding

Reading: Reading and interpreting visual material

Writing: Channel conversion (flowchart into process); Types of paragraph (cause and effect / compare and contrast / narrative / analytical); Note Taking/ Note Making

Unit -4: Communication skills **[7P]**

Grammar: Direct and indirect speech

Listening & Speaking: Watching videos / documentaries and responding to questions based on them; Role plays.

Reading: Making inference from the reading passage; predicting the content of a reading passage.

Writing: Interpreting visual materials (line graphs, pie charts etc.); Different types of Essay Writing

Text 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.

B18EC1080	Basic Electrical and Electronics Lab	L	T	P	C
Duration :14 Wks		0	0	2	2

Prerequisites:

Semiconductor Physics, Basics of Electrical & Electronics, Principles of Electronics.

Course Description:

All basic electronic devices and their characteristics, applications will be studied. Using these devices the small electronic circuits can be constructed and checked. In order to introduce the students with basic components of electronics this lab is furnished with advanced CROs, function generators and digital multimeters. Students can perform practical on P-N junction diode, Zener Diode, rectifiers and filters, transistor biasing and their characteristics in different modes, RC coupled amplifiers and FETs.

Course Objectives:

The objectives of this course are to:

1. Demonstrate the application of KCL and KVL in DC circuit
2. Make students understand about leading and lagging concepts of electrical circuits.
3. Demonstrate working of DC motor.
4. Demonstrate the basic operation of diode and diode circuits like rectifiers, clippers and Clampers.
5. Demonstrate the basic operation of Zener diode circuit.
6. Analyse the input and output characteristics of Common Emitter configuration of BJT.
7. Demonstrate the characteristics of SCR.
8. Design various logic circuits.

Course Outcomes:

On completion of this course the student will be able to:

1. Demonstrate the application of KCL and KVL in DC circuit.
2. Design and test various diode circuits like rectifiers, clippers and clampers.
3. Assess the voltage and current characteristics of nonlinear devices like Diode, Zener diode and BJT.
4. Design and test the characteristics of an electronics device like SCR. and logic gates.

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
B18EC 1080	CO1	3	3		3								3	3		
	CO2	3	3		3								3	3		
	CO3	3			3								3	3		

	CO4	3	3										3	3		

Lab Experiments

Introduction to basics of electronic components and instruments

1. To verify KCL and KVL
2. Testing of Lead & Lag networks by using R-C components.
3. To Study and test the working of DC motor
4. Study and analysis of V-I Characteristics of Silicon, Germanium and Zener PN Junction diodes (Both Forward and Reverse Characteristics).
5. To find the Voltage regulation of Zener diode
6. Design half wave, **Full wave-center tap** and Bridge rectifier with and without capacitive filter and measure efficiency and ripple factor.
7. Design of Clippers and clampers with reference voltages.
8. Study and analysis of V-I Characteristics of SCR.
9. Study and analysis of input output characteristic of CE configuration of BJT.
10. Verification of basic logic gates using discrete components.

Text Books:

1. Kulshreshtha C,"**Basic Electrical Engineering**" Tata McGraw Hill, 2nd Edition, 2011.
2. David A. Bell, "**Electronic Devices and Circuits**", Oxford University Press, 5th Edition, 2008.
3. D.P. Kothari, I. J. Nagrath, "**Basic Electronics**", McGraw Hill Education (India) Private Limited, 2014.

Reference Books:

1. Robert L. Boylestad and Louis Nashelsky, "**Introduction to Electricity, Electronics and Electromagnetics**" Prentice Hall, 5th edition, 2001

B18EC1090	Engineering Physics Lab	L	T	P	C
Duration:14 Wks		0	0	2	2

Prerequisites:

Knowledge of Higher secondary/Pre University level Physics.

Course Description:

Engineering Physics lab provides the fundamental knowledge of basic principles of Physics experiments which is required for foundation in engineering education irrespective of branch, it provides the knowledge of quantum mechanics and its importance and applications. It also provides the knowledge of different practical aspects of solids to explain electrical conductivity of materials, series and parallel resonance circuits.

Course Objectives:

The objectives of this course are:

1. To make the students gain practical knowledge to co-relate with the theoretical studies.
2. To achieve perfectness in experimental skills and the study of practical applications will bring more confidence and ability to develop and fabricate engineering and technical equipment.
3. To design of circuits using new technology and latest components and to develop practical applications of engineering materials and use of principle in the right way to implement the modern technology.

Course Outcomes:

On successful completion of this course, the student will be able to:

1. Gain knowledge of new concept in the solution of practical oriented problems and develop skills to impart practical knowledge in real time solution.
2. Apply the knowledge of new technology and comparison of results with theoretical calculations.
3. Design circuits with practical knowledge.
4. Use measurement technology, usage of instruments for real time applications in engineering studies.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO1	P2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
B18EC1090	CO1	3	3	3	2					2			2	2	2	1
	CO2	2	3	3	1	1				2			2	2	2	2
	CO3	1	2	3	2	1				2			2	2	1	2
	CO4	2	2	2	1					2			2	1	1	2

Lab Experiments

1. Velocity of ultrasonic waves in non-conducting medium by piezo-electricmethod.
2. Band gap of intrinsic Semi-conductor using four probe method
3. Value of planck's constant by using light emitting diode
4. I–V Characteristics of Zener Diode. (Determination of knee voltage, zener voltage and forward resistance)
5. To find the laser parameters–wavelength and divergence of laser light by diffraction method.
6. Photo Diode Characteristics (Study of I–V characteristics in reverse bias and variation of photocurrent as a function of reverse voltage and intensity)
7. Dielectric constant of a capacitor by charging and discharging of a capacitor.
8. Attenuation and propagation characteristics of optical fibre cable.
9. Determination of particle size using laser.
10. Construction and study of IC regulation properties of a given power supply
11. Determination of numerical aperture of a given optical fibre.
12. Determination of electrical resistivity of germanium crystal and study the variation of resistivity with temperature by four probe method
13. Characteristics of Transistor (Study of Input and Output characteristics and calculation of input resistance, output resistance and amplification factor.
14. Series and parallel LCR Circuits (Determination of resonant frequency and quality factor

Text books:

1. Thiruvadigal, J. D., Ponnusamy, S.Sudha.D. and Krishnamohan M., “Physics for Technologists”, Vibrant Publication, Chennai, 2013.

2. R.K.Shukla and Anchal Srivastava, “Practical Physics”, 1st Edition, New Age International (P) Ltd, New Delhi, 2006.

Reference Books:

1. G.L.Souires, “Practical Physics:”, 4th Edition, Cambridge University, UK, 2001.
2. D. Chattopadhyay, P. C. Rakshit and B. Saha, “An Advanced Course in Practical Physics”, 2nd ed., Books & Allied Ltd., Calcutta, 1990.
3. B.L. Worshnop and H.T. Flint, “Advanced Practical Physics”, Littlehampton Book Services Ltd, United Kingdom, 1951.
4. S. L. Gupta &V. Kumar, “Practical Physics”, Pragati prakashan, New Delhi, 2018.
5. Chauhan & Singh, “Advanced Practical Physics” Vol. I& II –, PragatiPrakashan, 2013.

DETAILED SYLLABUS

Semester - II:

B18EC2010	Engineering Mathematics – II	L	T	P	C
Duration: 14 Weeks		3	1	0	4

Prerequisites:

Knowledge of basics of derivatives, vectors, and complex numbers.

Course Description:

This course covers the topics: Linear Algebra differential equations Vector calculus, inverse Laplace transforms, This course is widely used in all streams of Engineering, particularly in the field of Electronics and Communication Engineering, for ex., Electromagnetic field theory, Control systems, Analog and Digital communication.

Course Objectives:

The objectives of this course are to:

1. To understand the concepts of Linear algebra and its applications in various fields of engineering and Technology.
2. To understand the concepts of Integral calculus and its applications.
3. To familiarize with partial differential equations and its applications to standard problems like Heat, Wave and Laplace.
4. To impart the Knowledge of Laplace transforms and its applications in the field of engineering.

Course Outcomes:

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

1. Apply the knowledge of Linear Algebra in Image processing and digital signal processing.
2. Apply the knowledge of Integral calculus to perform integration and other operations for certain types of functions and carry out the computation fluently.
3. Apply the knowledge of partial differential equations in the field of signals and systems, control systems, magnetic wave theory.
4. Apply the knowledge of Laplace transformation from the time domain to the frequency domain, which transforms differential equations into algebraic equations and convolution into multiplication.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COs	PO 1	P 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P O 10	P O 11	P O 12	PSO 1	PSO 2	PSO 3
B18EC2010	CO1	3	3	2	1					3			3	3	2	1
	CO2	3	3	3	1					3			3	3	2	1
	CO3	3	3	3	1					3			3	3	2	1
	CO4	3	3	3	1					3			3	3	2	1

Course Contents:

Unit-1: Linear Algebra **[10L+7T] Hrs**

Rank of matrix, Echelon form, (*reference-Normal form: one example), Solution of a system of linear equations by Gauss elimination (*reference-Gauss –Jordan methods: one example), Gauss seidel iterative method, Rayleigh Power method to find the largest eigen value and corresponding eigen vector. Linear and Inverse transformation.

Diagonalisation of a matrix, Reduction of a quadratic form to canonical form by orthogonal transformation.

Unit-2: Differential Equations: **[11L+7T] Hrs**

Linear Differential Equations: Definitions, Complete solution, Operator D, Rules for finding the complementary function, Inverse operator, Rules for finding the particular integral.

Method of variation of parameters (simple problems), Cauchy's and Legendre's linear differential equations.

Partial differential equations: Formation of Partial differential equations, Solution of Lagranges linear PDE.

Unit-3: Vector Calculus **[10L+7T] Hrs**

Curves in space, tangents and normal, Velocity and acceleration related problems, scalar and vector point functions-Gradient, Divergence and curl, directional derivatives. Solenoidal and irrotational vector fields. Vector identities-div ($\emptyset A$), curl ($\emptyset A$), curl (grad$\emptyset$), div (curl A).

Line integral-Circulation-work, Surface integral: Green's Theorem, Stokes Theorem.

Volume integral: Divergence theorem. (All theorems without proof, no verification, only evaluation).

Unit-4: Laplace Transforms: **[11L+7T] Hrs**

Definition, Transforms of elementary functions, properties of Laplace Transforms (without proof) problems. Transforms of periodic functions (only statement and problems), Unit step functions and unit impulse functions.

Inverse Laplace transforms- Problems, convolution theorem (without proof) no verification and only evaluation of problems, solution of linear differential equation using Laplace transforms.

Text Books:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43nd edition, 2015.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Publications, 10th edition, 2015.

Reference Books:

1. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publications, 19th edition, 2013.

2. R. K. Jain and S. R. K. Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House, 5th edition, 2014.

B18EC2020	Engineering Chemistry	L	T	P	C
Duration : 14 WKS		2	1	0	3

Prerequisites:

Pre University level Knowledge in Chemistry, Physics and Mathematics.

Course Description:

Engineering chemistry provides the very basic knowledge required for engineering students to understand its importance in technology. It provides the knowledge of quantum mechanics, battery technology its importance and applications. It also provides knowledge about corrosion science, construction of PCB's and engineering materials.

Course Objectives:

The course objectives are to:

1. Explain the basic concepts of Atomic and Molecular Structure, energy level diagram and quantum chemistry
2. Design construction and applications of Batteries, fuel cells and solar cells
3. Classify the types of Corrosion, corrosion control and metal finishing techniques
4. Discuss the use of engineering materials like Nano, Polymers Semiconductors, superconductors, magnetic materials, liquid crystals in various applications.

Course Outcomes:

On the successful completion of this course, Students shall be able to

1. Analyze the basic concepts of Atomic and Molecular structure, energy level diagrams and quantum mechanics
2. Discuss the construction and working of batteries fuel cells and solar cells
3. Apply the knowledge of corrosion science and metal finishing essential for corrosion control of commercially available materials like PCB and circuits
4. Explain the applications of engineering materials in various fields.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ Cos	PO1	P2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
B18EC2020	**CO1**	**2**	**1**		**1**		**1**						**2**	**1**	**1**	
	CO2	**2**	**1**	**3**	**2**	**2**	**3**	**3**		**1**	**1**	**1**	**1**	**1**	**1**	**2**
	CO3	**2**	**2**	**3**	**2**	**1**	**3**	**1**		**1**	**1**		**1**	**2**	**2**	**1**
	CO4	**2**	**2**	**2**	**2**	**2**	**1**	**2**					**1**	**1**	**1**	

Course Contents:

Unit –1: **Atomic, Molecular Structure and Periodic Properties [7L+7T]**

Atomic, molecular structure: Classical to quantum mechanical transition, Origin of quantum mechanics, dual nature of light and matter, concept of quantization – Max Planck, Einstein, de Broglie, Schrödinger wave equation, particle in a box (1D)-Energy solutions, quantum states of electron, wave functions in bonding in molecules (H2).

Periodic properties: Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electro negativity.

Self-Study: Molecular orbitals of diatomic molecules and plots of the multicentre orbitals. polarizability, oxidation states, coordination numbers and geometries.

Unit – 2: Energy Storage and Conversion Devices [7L+7T]

Battery: Introduction to electrochemistry, Basic concepts of Cells and Battery, Battery characteristics Primary (Leclanche Cell), Secondary (Lead-Acid), Lithium batteries, Advantage of use of Li as electrode material (Lithium & Lithium ion), super capacitors.

Fuel cells: Difference between battery and fuel cell, types of fuel cells- construction working, applications, advantages & limitations of Solid oxide fuel cells and phosphoric acid fuel cell

Photovoltaic cell: Introduction to Electromagnetic spectrum and light-mater interaction, Production of Si from chemical method, Single crystal Si Semiconductor by Crystal pulling technique (Czocharlski method), and zone refining.

Band structure of solids and the role of doping on band structures. Properties of Silicon, advantages, P-N Junction diode, antireflective coatings. Construction, working of photovoltaic cells, applications, advantages and disadvantages.

Self-Study: Reserve battery, Alkaline Fuel Cell, Design of solar cells-Modules, Panels and arrays.

Unit-3: Science of Corrosion and Its Control [7L+7T]

Corrosion: Electrochemical theory of corrosion, galvanic series, types of Corrosion- differential metal corrosion, differential aeration corrosion (Pitting & water line), boiler corrosion, and grain boundary corrosion, Factors

affecting rate of corrosion-Primary, secondary.

Corrosion control: Galvanizing & tinning, cathodic protection & Anodic Protection.

Metal Finishing: Theory of electroplating. Factors required to study electroplating. Effect of plating variables on the nature of electro-deposit- electroplating process, Electroplating of gold. Electro less plating of copper and nickel, PCB manufacture by Electro less plating of copper. **Self Study:** Energy concept (Pourbiax) under different pH conditions. Corrosion Studies on Al, Fe with pourbiax diagram. Inorganic Coatings-Anodizing &Phospating, and Corrosion Inhibitors

Unit -4: Chemistry of Engineering Materials [7L+7T]

Semiconducting and Super Conducting materials-Principle and some example.

Magnetic materials: Principle and types of magnetic materials-applications of magnetic materials in storage devices.

Polymers: Introduction, Glass transition temperature (tg) - definition, significance. Structure-Property relationship – tensile strength, plastic, deformation, chemical resistivity, crystallinity and elasticity.

Adhesives: properties, synthesis and applications of epoxy resin.

Polymer composites: (carbon fibre and Kevlar, synthesis, advantages, applications).

Conducting polymers: Mechanism, synthesis and applications of polyacetyline, synthesis of polyaniline and its applications. Liquid Crystals: Introduction, classification and applications.

Nanomaterials-Introduction – Definition, classification based on dimensionality (0D, 1D and 2D), quantum confinement (electron confinement). Size dependent properties- surface area, magnetic properties (GMR phenomenon), thermal properties (melting point), optical properties and electrical properties. Properties and applications of Carbon Nanomaterials (Fullerenes, Carbon nanotubes, Graphenes).

Self-Study: Types of polymerization - Addition and Condensation (two example; Polyester and Teflon), Biocompatible materials, Nano electronics, Nano medicines and energy conversion devices, Applications of Nano materials- in hyperthermia (magnetic property), in corrosion control (Nano-coatings).

Text Books:

1. S. S. Dara, S. S. Umare, “A Text book of Engineering Chemistry”. S. Chand Publications, New Delhi, 1986.
2. S. Chawla, “Text Book of Engineering Chemistry”. Dhanapathirai Publications.
3. P.W. Atkins, “Physical Chemistry”. Oxford University press, UK, 2018.
4. S. Agarwal, “Engineering Chemistry: Fundamentals and Applications”. Cambridge University Press, UK, 2015.

Reference Books:

1. V. R. Gowrikar, N.N. Viswanathan, J. Sreedhar, “Polymer chemistry”. Wiley Eastern Ltd, 1986.
2. Fontana G. Mars, “Corrosion engineering”. Tata McGrail Publishing Pvt. Ltd, 3rd edition, 2005.
3. Charles P. Poole Jr., Frank J. Owens, “Introduction to Nanotechnology”. Wiley India Publishers, 2004.
4. Krishan K Chawla, “Composite materials – Science and Engineering”. Springer International edition, Second edition, 2012.

B18EC2030	Analog Electronics	L	T	P	C
Duration: 14Weeks		3	0	0	3

Prerequisites:

Basic Electrical and Electronics,

Course Description

Analog Electronics is the base of Electronics & Communication stream. In this course the working of various amplifiers is explained. Students learn how BJT work at low and high frequencies, what happens in FET amplifiers, Power amplifiers, feedback amplifiers, tuned amplifiers and different types of oscillators and their working is analyzed. Introduction to Op-Amps is given in the end of the course.

Course Objectives:

The objectives of this course are:

1. To understand operation of semiconductor devices.
2. To understand how devices such as semiconductor diodes and Bipolar Junction transistors are modeled and how the models are used in the design and analysis of useful circuits.
3. To apply concepts for the design of Amplifiers
4. To verify the design and construct circuits, take measurements of circuit behavior and performance, compare with predicted circuit models and explain discrepancies using simulators.
5. To implement mini projects based on concept of electronics circuit.

Course Outcomes:

On completion of this course the student will be able to

1. Analyze dc circuits and relate ac models of semiconductor devices with their physical Operation.
2. Develop the capability to analyze and design simple circuits containing non-linear elements such as transistors using the concepts of load lines, operating points and incremental analysis.
3. Develop experience in building and trouble-shooting simple electronic analog and digital circuits (PBL).
4. Assess the concepts of both positive and negative feedback in electronic circuits.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
B18EC2030	CO1	3	2	1		3								1	2	1
	CO2				1	3									2	1
	CO3					1				3	2	1		3		1
	CO4	2	2	1		1										1

Course Contents:

Unit-1: Transistor Biasing and BJT AC analysis **[11 Hrs]**

Transistor Biasing: (BJT Version) Operating Point, Fixed Bias, Voltage-Divider Bias Configurations, Emitter-Follower, Bias Stabilization, Problems linked to above topics, Simulation using TINA/PSPICE/Multisim Simulator.
BJT AC Analysis: The r_e Transistor Model, Modeling of Voltage-Divider Bias and Emitter-Follower Configurations, Two-Port Systems Approach, Cascaded Systems, Darlington Connection, Problems linked to above topics, Simulation using TINA/PSPICE/Multisim Simulator.

Unit-2: BJT Frequency Response Feedback Amplifiers [10 Hrs]

Logarithms, Decibels, General Frequency Considerations, Normalization Process, Low-Frequency Response-BJT Amplifier with R_L, Millers Effect Capacitance, High Frequency Response-BJT Amplifier, Multistage Frequency Effects. Problems linked to above topics, Simulation using TINA/PSPICE/Multisim Simulator.
Feedback Amplifiers: Feedback Concepts, Feedback Connection Types, Practical Feedback Circuits- Voltage Series Feedback and Current-Series Feedback. Problems linked to above topics. Simulation using TINA/PSPICE/Multisim Simulator.

Unit-3: Oscillator Circuits and Power Amplifiers [11 Hrs]

Oscillator Circuits: Condition for oscillations, Oscillator operation, Phase Shift Oscillator, Colpitts, Hartley and Crystal Oscillators. Problems linked to above topics. Simulation using TINA/PSPICE/Multisim Simulator.
Power Amplifiers: Series-Fed Class A Amplifier, Transformer-Coupled Class A Amplifier, Class B Amplifier Ciruits-Transformer-coupled Push-Pull Circuits, Complementary-symmetry Circuits, Class C and Class D amplifiers. Problems linked to above topics. Simulation using TINA/PSPICE/Multisim Simulator.

Unit-4: FETs and Op-Amps [10 Hrs]

Field Effect Transistors: Construction and Characteristics of JFETs, Transfer Characteristics, Important relations, Depletion-Type MOSFET, Enhancement-Type MOSFET.
Introduction to Operational Amplifiers: Basic Operational Amplifier Circuit, The 741 IC Op-Amp, Voltage Follower, Non-inverting and Inverting Amplifiers. Operational Amplifier Parameters. Problems linked to above topics. Simulation using TINA/PSPICE/Multisim Simulator.

Project Based Learning

Design a public address system which includes a DC Power supply, Two-stage audio preamplifier and a power amplifier connected to speaker.

Text Books:

1. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", PHI/Pearson Education, 11th edition, 2015.
2. David A. Bell, "Electronic Devices & Circuits", Prentice Hall of India/Pearson Education, 4th edition, 2007.
3. David A. Bell, "Operational Amplifiers and Linear ICs", Prentice Hall of India, 2nd edition, 2006.

Reference Books:

1. Jacob Millman & Christos. C. Halkias, Satyabrata Jit, "Electronic Devices and Circuits ", Tata McGraw Hill, 2nd edition, 2008.
2. Floyd, "Electronic Devices", Prentice Hall of India, Pearson Education, 6th Edition, 2010.
3. Anil Kumar Maini, VarshaAgrawal,"Electronic Devices and Circuits", John Wiley & Sons, 2009.

B18EC2040	Python Programming (I)	L	T	P	C
Duration:14 Wks		2	0	1	3

Prerequisites:

Computer concepts and C programming

Course Description:

Python is a language with a simple syntax, and a powerful set of libraries. This course is an introduction to the Python programming language for students without prior programming experience. We cover data types, control flow, object-oriented programming, and graphical user interface-driven applications. The purpose of this course is to provide the solid foundations in the basic concepts of Python programming language. The Python Programming Language are a very important to develop Application Software, System Software, Operating Systems, and Network Simulators as it employs Object Oriented Programming (OOP) aspect. This course has important features of OOP like Polymorphism, Inheritance which are not present in C Programming Language.

Course Objectives:

The objectives of this course are:

1. To present the syntax and semantics of the python, as well as basic data types offered by the language.
2. To provide the insight into python functions, modules, and packages.
3. To demonstrate the files and exception handling in python programming.
4. To present the object-oriented concepts like encapsulation, inheritance, and polymorphism.

Course Outcomes:

On successful completion of this course, the student is expected to be able to:

1. Use the built-in data types and operators in python programming.
2. Build effective python programs using functions, modules, and packages and by accessing files and directories.
3. Design object-oriented programs using python classes and objects.
4. Demonstrate and use the concept of inheritance and polymorphism for code reusability.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
B18EC2040	CO1	3	3	2	1	2				2			1	3	3	2
	CO2	3	3	3	1	3				2			1	3	3	3
	CO3	3	3	3	1	3				2			1	3	3	3
	CO4	3	3	2	1	3				2			1	3	3	2

Course Contents:

Unit 1: Introduction to python: [3L+7T+7P]

Features of python programming**,** application of python, Getting started, keywords and identifier, Python Indentation, statements and comments, variables, Data types: numbers, list, tuple, strings, set, dictionary, type conversion, arrays v/s lists, python I/O, python operators, branching and looping statements.

Unit 2: Python functions and file handling [4L+7T+7P]

Python functions: Syntax of functions, arguments and return values, scope and lifetime of variables, python global keyword, python modules and packages.

Python files: Python file operation, directory, exceptions, exception handling and user defined exceptions.

Unit 3: Classes and objects: [3L+7T+7P]

Introduction to object-oriented programming, class, objects, attributes and methods, creating an object in python, self-parameter, constructors in python, deleting attributes and objects.

Unit 4: Inheritance, Polymorphism, and Advanced concepts [4L+7T+7P]

Inheritance: Python inheritance syntax, Examples on single inheritance and multiple inheritance.

Polymorphism: Method overloading, operator overloading examples.

Advanced concepts: Introduction to Iterators, generators, and decorators.

Text Books:

1. Allen Downey, "Think Python: How to Think like a Computer Scientist", Green Tea Press Needham, Massachusetts, 2nd edition, 2017.
2. Kenneth A. Lambert, "Fundamentals of Python: First Programs (introduction to Programming)", 1st Edition, CENAGE Learning, 2016.
3. Charles R. Severance, "Python for everybody: Exploring data using python 3", Shroff publishers, 2017.

Reference Books:

1. John M. Zelle, "PYTHON Programming: An Introduction to Computer Science", Franklin, Beedle& Associates, 2nd edition, 2015.
2. Michael Dawson, "Python Programming for the Absolute Beginners", 3rd Edition, CENAGE Learning, 2016.

3. Springer, Kent D. Lee, “Python Programming Fundamentals”, 2nd Edition,2015.
4. John V. Guttag, “Introduction to Computation and Programming using Python”, MIT Press, 2016.

Python Programming Lab

1. Write a Python program that reads input from the keyboard. The input will consist of some number of lines of text. The input will be terminated by a blank line. Your program should print every third line.
   For instance, if the input is the following:
   "Spot the mistake
   in the following argument",
   Jack challenged
   1+(-1+1)+(-1+1)+... = (1+ -1)+(1+ -1)+...
   so therefore,
   1 = 0
   ??
   then the output should be:
   Jack challenged
   1 = 0
2. "99 Bottles of coke" is a traditional song. It is popular to sing on long trips, as it has a very repetitive format which is easy to memorize, and can take a long time to sing. The song's simple lyrics are as follows:
   99 bottles of coke on the wall, 99 bottles of coke.Take one down, pass it around, 98 bottles of coke on the wall.
   The same verse is repeated, each time with one fewer bottle. The song is completed when the singer or singers reach zero.
   Your task here is to write a Python program capable of generating all the verses of the song.
3. Write a function matched(s) that takes as input a string s and checks if the brackets "(" and ")" in s are matched: that is, every "(" has a matching ")" after it and every ")" has a matching "(" before it. Your function should ignore all other symbols that appear in s. Your function should return True if s has matched brackets and False if it does not.
   Here are some examples to show how your function should work.
   >>>matched("zb%78")
   True
   >>> matched("(7)(a")
   False
4. In cryptography, a Caesar cipher is a very simple encryption techniques in which each letter in the plain text is replaced by a letter some fixed number of positions down the alphabet. For example, with a shift of 3, A would be replaced by D, B would become E, and so on. The method is named after Julius Caesar, who used it to communicate with his generals. ROT-13 ("rotate by 13 places") is a widely used example of a Caesar cipher where the shift is 13. In Python, the key for ROT-13 may be represented by means of the following dictionary:

key = {'a':'n', 'b':'o', 'c':'p', 'd':'q', 'e':'r', 'f':'s', 'g':'t', 'h':'u', 'i':'v', 'j':'w', 'k':'x', 'l':'y', 'm':'z', 'n':'a', 'o':'b', 'p':'c', 'q':'d', 'r':'e', 's':'f', 't':'g', 'u':'h', 'v':'i', 'w':'j', 'x':'k', 'y':'l', 'z':'m', 'A':'N', 'B':'O', 'C':'P', 'D':'Q', 'E':'R','F':'S', 'G':'T', 'H':'U', 'I':'V', 'J':'W', 'K':'X', 'L':'Y', 'M':'Z', 'N':'A', 'O':'B', 'P':'C', 'Q':'D', 'R':'E', 'S':'F', 'T':'G', 'U':'H', 'V':'I', 'W':'J', 'X':'K', 'Y':'L', 'Z':'M'}

Your task is to implement an encoder/decoder of ROT-13. Once you're done, you will be able to read the following secret message:

Pnrfnepvcure? V zhpucersrePnrfnefnynq!

5. A bank needs an application to keep track of the customer's account balance. The customer has name and balance as the attributes. Build the application to have a class customers, with the following methods:
   set_balance
   withdraw
   deposit
   check_balance
6. Define three classes: Bear , Rabbit , and Octothorpe . For each, define only one method: eats() . This should return 'berries' (Bear), 'clover' (Rabbit), or 'campers' (Octothorpe). Create one object from each and print what it eats.
7. Define a simple "spelling correction" function correct() that takes a string and sees to it that 1) two or more occurrences of the space character is compressed into one, and 2) inserts an extra space after a period if the period is directly followed by a letter. E.g. correct("This is very funny and cool.Indeed!") should return "This is very funny and cool. Indeed!" Tip: Use regular expressions!
8. HTMLParser which serves as the basis for parsing text files formatted in HTML (HyperText Mark-up Language) and XHTML. Write a program to illustrate all the methods in the parser class
9. Write a program to use DOM API's to parse movies.xml file. The phrase calls the parse(file [,parser]) function of the minidom object to parse the XML file designated by file into a DOM tree object.
10. Implement a function which lets you define parsers that take any input source (URL, pathname to local or network file, or actual data as a string) and deal with it in a uniform manner. Returned object is guaranteed to have all the basic stdio read methods (read, readline, readlines). Just .close() the object when you're done with it.

B18EC2050	Environmental Sciences	L	T	P	C
Duration:14 Wks		2	0	0	2

Prerequisites:

Basic knowledge of Environmental Science studied at higher secondary & school level.

Course Description:

Environmental Science is a multidisciplinary subject which includes various aspects from physics, chemistry,

Ecology, Biology, Earth science & Engineering etc. Environmental Studies includes the introduction to environment, Objectives & guiding principles of Environmental education, environmental ethics, Components of Environment, Impacts of Engineering/human activities on environment, Sustainable development, Role of individual and government in environmental Protection, and various topics related to environmental science imparted through this course.

Course Objectives:

The objectives of this course are to:

1. Discuss Foster clear awareness and concern about economic, social, political and ecological interdependence in urban and rural area
2. Influence the new patterns of behaviors of individuals, groups and society as a whole towards the environment
3. List the knowledge values, attitudes, commitment and skills needed to protect and improve the environment
4. Explain the environmental measures and education programs.

Course Outcomes:

After successful completion of the course, the students will be able to

1. Adapt the environmental conditions and protect it
2. Estimate the role of individual, government and NGO in environmental protection.
3. Interpret the new renewable energy resources with high efficiency through active research.
4. Analyze the ecological imbalances and protect it.

Mapping of Course Outcomes with Programme Outcomes

urse de	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
18EC2050	**CO1**	1			2	1	3	3			1	1	1		1	1
	CO2						3	3		1		1	1	1		1
	CO3		1			2	3	3			1		2		1	1
	CO4	1					3	3		1			1	1	1	

Course Contents:

Unit-1: Multidisciplinary Nature of Environmental Studies [7 Hrs]

Introduction 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, Environmental Legislations, Initiative and Role of Non-government organizations in India and world.

Self-study: Need for public awareness on the environment, Gaia Hypothesis

Unit-2: Environmental pollution, degradation & Waste management **[7 Hrs]** 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.Solid Waste management – Municipal solid waste, Biomedical waste, Industrial solid waste and Electronic waste (E-Waste).

Self study: Case studies of London smog, Bhopal gas tragedy, marine pollutions and study of different waste water treatment processes. Disaster management, early warning systems-bio indicators for Tsunami and other natural disasters.

Unit-3: Energy & Natural resources **[7 Hrs] 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)

Self-study: Remote sensing and its applications, Chernobyl (USSR) nuclear disaster and Fukushima (Japan) nuclear disaster. Hydrology & modern methods adopted for mining activities.

Unit-4: Ecology and ecosystem **[7 Hrs] 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-abiotic 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.

Self-study: Need for balanced ecosystem and restoration of degraded ecosystems.

Text Books:

1. R.J. Ranjit Daniels, Jagadish Krishnaswamy, M.S. Reddy, Chandrasekhar, “Environmental Studies” Wiley India Pvt. Ltd., New Delhi, 2017.
2. Benny Joseph, “Environmental Studies” Revised Edition, Tata McGraw Hill Publishing Company Limited, 2017.
3. Ashish Shukla, Renu Singh, Anil Kumar, “Environmental Science” Revised Edition, IK International Publishing

House Pvt. Ltd, 2018.
4. S. M. Prakash, "Environmental Studies" Elite Publishers Mangalore, 2017.
5. R.J. Ranjit Daniels and Jagadish Krishnaswamy, "Environmental Studies" Wiley India Private Ltd., New Delhi, 2009.
6. G. Tyler Miller, S. E. Spoolman, "Environmental Sciences" Cengage Learning, l4th Edition, 2015.

Reference Books:

1. Bharucha Erach, "The Biodiversity of India" Mapin Publishing Pvt. Ltd., Ahmedabad, India, 20l7.
2. R. Rajagopalan, "Environmental Studies – from Crisis to cure" Oxford University Press, 2017.
3. Arvind Walia, "Environmental Science" Kalyani Publications, 2018.
4. H. Jadhav, V. M. Bhosale, "Environmental Protection and Laws" Revised Edition, Himalaya Pub. House, Delhi, 2018.
5. B.K Sharma, "Environmental Chemistry" Goel Pub. House, Meerut, 2018.

B18EC2060	Technical English - 2	L	T	P	C
Duration :14 Wks		0	0	2	2

Prerequisites:

Technical English- 1

This course is aimed 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 workplace context, to examine that the learners use the electronic media such as internet and supplement the learning materials used in the classroom.

Course Description:

This course is aimed 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 workplace context, to examine that the learners use the electronic media such as internet and supplement the learning materials used in the classroom.

Course Objectives:

The objectives of this course are:

1. To utilize the ability of using language skills effectively in real-life scenarios.
2. To develop the learners' competence in employability skills.
3. To improve the habit of writing, leading to effective and efficient communication.
4. To prioritize specially on the development of technical reading and speaking skills among the learners.

Course Outcomes:

On completion of the course, learners will be able to:

1. Organize their opinions clearly and meaningfully.
2. Demonstrate the ability to speak appropriately in social and professional contexts.

3. Build inferences from the text.
4. Take part in interviews confidently & develop accurate writing skills using different components of academic writing.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO1	P2	PO3	PO4	PO5	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
B18EC2060	CO1	0	1	0	0	0	0	3	3	0	0	3	0	0	0
	CO2	0	1	0	0	0	0	2	3	0	0	3	0	0	0
	CO3	0	3	0	0	0	0	2	3	0	0	3	0	0	0
	CO4	0	2	0	0	0		2	3	0	0	3	0	0	0

Course Contents:

Unit-1: Language Acquisition [7P Hrs]

Grammar: Active and passive voice, **Listening & Speaking:** Listening to informal conversations and interacting, **Reading:** Developing analytical skills; Deductive and inductive reasoning, **Writing:** Giving Instructions; Dialogue Writing

Unit-2: Persuasive Skills [7P Hrs]

Grammar: Compound words; Phrasal verbs, **Listening:** Listening to situation based dialogues **Speaking:** Group Discussions, **Reading:** Reading a short story or an article from newspaper; Critical reading, **Writing:** Formal letters (Accepting/ inviting/ declining); Personal letters (Inviting your friend to a function, congratulating someone for his / her success, thanking one's friends / relatives)

Unit-3: Cognitive Skills [7P Hrs]

Grammar: Homonyms; homophones, **Listening:** Listening to conversations; Understanding the structure of conversations, **Speaking:** Presentation Skills, **Reading**: Extensive reading **Writing:** Report Writing (Feasibility/ Project report - report format – recommendations/ suggestions - interpretation of data using charts, PPT); Precis Writing

Unit-4: Employability Skills [7P Hrs]

Grammar: Idioms; Single Word Substitutes, **Listening:** Listening to a telephone conversation; Viewing model interviews (face-to-face, telephonic and video conferencing), **Speaking:** Interview Skills, Mock Interviews, **Reading:** Reading job advert Semen's and the profile of the company concerned, **Writing:** Applying for a job; Writing a cover letter with Resume / CV

Text 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. Dixson, 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.

B18EC2070	Computer Aided Engineering Drawing (I)	L	T	P	C
Duration :14 Weeks		1	0	1	2

Prerequisites:

Basic Knowledge on geometry and their construction

Course Description:

Computer Aided engineering drawing is the primary medium for communicating engineering design. In this course, to begin with Students are trained on skills of Sketching, Scaling and Dimensioning. The students are introduced to orthographic projections and they are trained to draw orthographic projections of Points, Lines, Planes and Solids. They are further trained to draw Development of Lateral surfaces, Isometric Projections.

Course Objectives:

The objectives of this course are to:

1. Comprehend general projection theory, with emphasis on orthographic projection to represent in two-dimensional views.
2. Introduce dimension and annotation for two-dimensional engineering drawings.
3. Emphasize freehand sketching to aid in the visualization process to efficiently communicate ideas graphically and best practices applied in engineering graphics
4. Introduction of CAD software for the creation of 2D engineering drawings.

Course Outcomes:

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

1. Identify industry Drawings and able to develop independent thinking and problem solving capabilities
2. Express components descriptions as per the commonly practiced standards
3. Visualize 2D and simple 3D drawings of simple machine component.
4. Comprehend the computer aided drawing of simple objects/tools/instruments /elements/ structures belonging to the engineering field and industry specific drawings

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
B18EC2070	CO1	3	2	1		2								2	1	2
	CO2	3	2			1								1		2
	CO3	3	2	1		2								2		2
	CO4	3	3	2		3				2	1			3	2	3

Course Contents:

Unit – 1: Introduction to Drawing **[3L+7P]**

Introduction to Engineering Drawing: Introduction, Drawing Instruments and their uses, BIS conventions, Drawing sheets, Dimensioning, regular polygons and their construction and brief introduction to solid edge software.

Projection of points: Points in different quadrants.

Projection of Straight Lines (First-angle Projection only): Parallel to one or both planes – Perpendicular to one plane and parallel to other plane, Inclined to one plane and parallel to the other, Inclined to both planes.

Projection of Planes: Types of Planes, Projection of Planes, perpendicular to VP and inclined to HP – Inclined to both the planes.

Unit – 2: Projection of Prisms **[4L+7P]**

Square, pentagonal and hexagonal prisms, cylinder, Solids in simple position (only resting on HP on one of the base corner or base edge of solid), Axis parallel to VP plane and inclined to HP, Axis inclined to both plane (only change of position method).

Unit – 3: Projection of Pyramids **[3L+7P]**

Square, pentagonal and hexagonal pyramids, cone, Solids in simple position (only resting on HP on one of the base corner or base edge of solid), Axis parallel to VP p and inclined to HP, Axis inclined to both plane (only change of position method).

Unit - 4: Development of Lateral surfaces of solids **[4L+7P]**

Regular prisms and pyramids only.

Isometric Projection: Isometric axes, Lines and Planes, Isometric Scale, Isometric Projection of Planes, Prisms, Pyramids, Cylinders, Cone and Sphere, Combination of Solids (Maximum Two solids).

Text Books:

1. Dr. K S Narayanswamy and Prof.Mahesh L, "Text Book on Engineering Drawing", REVA University, WILEY Publishers 2017.
2. N.D.Bhatt and V.M. Panchal "Engineering Drawing ", Charotar Publishing, 48th Edition, 2005.
3. K.R. Gopalakrishna "Engineering Graphics", Subhas Publishers, 32nd Edition, 2005.

Reference Books:

1. P. S. Gill "Engineering Drawing", S. K. Kataria& Sons, 11th Edition, 2001.
2. K L Narayan and P Kannaiah, "Engineering Drawing", Scitech Publications, 2015.

B18EC2080	Analog Electronics Lab	L	T	P	C
Duration: 14 Weeks		0	0	2	2

Prerequisites:

Basic Electrical and Electronics lab

Course Description:

Analog Electronics lab is first step in the design of Amplifiers for the ECE students. The practical design aspects of various amplifiers is introduced and measurements are taken. Power amplifiers are designed and the efficiency is measured. The concepts of positive feedback amplifiers is also introduced by desigining various oscillators. The students also design the circuits using simulators.

Course Objectives:

The objectives of this course are to:

1. Understand and estimate the gain and input/output resistances of single and two-stage amplifiers.
2. Perform DC and AC analysis of the BJT amplifier and understand the bode plots.
3. Learn different biasing techniques and behavior of BJT amplifiers, at low and high frequencies.
4. Understand the principle of operation of different oscillator circuits.
5. Simulation and design of electronic circuits using SPICE or other analog simulator.

Course Outcomes:

On completion of this course the student will be able to:

1. Design different BJT negative and positive feedback amplifiers.
2. Design and Assess the amplifier parameters like gain, BW, Zin and Zout, efficiency, etc.
3. Compile the experiment's procedures and results by writing a formal report.
4. Analyze all the above experiments using suitable simulation software.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC2080	CO1	3	2	1		3								1	2	1
	CO2				1					3					2	1
	CO3					3				3	3	1		2		1
	CO4	2	2	1		3										1

Lab Experiments

1. Design a Single stage BJT CE Amplifier and obtain frequency response curve and find Bandwidth, Input & Output Impedances.
   Challenging Experiment: Connect above amplifier to Analog Discovery Module & find frequency response curve.
2. Design a Two stage voltage series BJT Amplifier and Obtain frequency response curve, also find Bandwidth, Input & Output Impedances
3. Design a CE mode Cascode amplifier and plot frequency response. Also find Gain & Bandwidth.
4. Design a Class - C tuned Amplifier & find its Efficiency.
   Challenging Experiment: FindFrequency response of Class - C tuned Amplifier by using Analog Discovery Module.

5. Design a BJT Darlington emitter follower and find Gain, Input & Output Impedances.
6. Rig-up an R-C Phase Shift oscillator for $f_o \leq 10$ KHz & Crystal oscillator for f_o>1MHz.
7. Design a BJT Hartley &Colpitt's Oscillators for frequency ≥100kHz & simulate the circuit in Multisim.
8. Demonstrate the working of Class-B push pull power amplifier using transistors find its Efficiency & also simulate the same in Multisim.
9. Design an OPAMP Inverting & Non Inverting Amplifier.

   Challenging Experiment: Conduct the Experiment by using Analog Discovery Module.
10. Mini Project.

B18EC2090	Chemistry Lab	L	T	P	C
Duration : 14 WKS		0	0	2	2

Prerequisites:

Students taking this course shall have the knowledge of the following:
Handling glassware, apparatus, Acids, Bases toxic chemicals and safety precautions in the laboratory. Chemical awareness and basic chemical reactions.

Course Description:

Engineering chemistry lab provides the very basic knowledge required for engineering students to understand its importance in technology and practical life. It provides the knowledge of quantum mechanics, battery technology its importance and applications. It also provides knowledge about corrosion science, construction of PCB's and engineering materials, testing the chemicals in laboratory etc.

Course Objectives:

The course objectives are to:

1. Distinguish qualitative and quantitative analysis of materials by classical and instrumental methods for developing experimental skills in building technical competence
2. Analyze different instrumental and titrimetric methods for estimation of the samples

Course Outcomes:

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

1. Analyze the amount of material present in the sample by different instrumental methods.
2. Evaluate the amount of oxygen demand, alkalinity, and hardness of the different water samples.
3. Estimate impurities in water.
4. Test the ions present in unknown substance/ores using titrimetric and instrumental metals

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3

B18EC2090	**CO1**	**1**	**1**	**1**	**1**		**2**						**1**	**1**		
	CO2	**1**		**1**			**2**	**2**					**1**			
	CO3	**1**	**1**				**2**	**2**					**1**			**1**
	CO4	**1**	**2**	**1**			**1**	**1**					**1**			**1**

List of Experiments	
1.	Potentiometric Estimation of Mohrs salt.
2.	Colorimetric estimation of copper.
3.	Conductometric estimation of acid mixture using standard NaOH.
4.	Determination of pKa of given weak acid using pH meter.
5.	Determination of viscosity co-efficient of a given organic Liquid.
6.	Determination of total hardness of the given water sample.
7.	Determination of calcium oxide in the given cement sample.
8.	Determination of COD of the given waste water sample.
9.	Determination of percentage of copper in the given brass sample.
10	Determination of iron in the given sample of Haematite ore using Potassium dicromate.
11	Estimation of Alkalinity of the given water sample using standard HCl solution
12	Flame photometric estimation of sodium in the given water sample.
13	Electroplating of Copper and Nickel.
14	Determination of Calcium in a milk sample.

Text Books:

1. P.W. Atkins, “Physical Chemistry”. Oxford University press, UK, 2018.

2. S. Agarwal, “Engineering Chemistry: Fundamentals and Applications”. Cambridge University Press, UK, 2015.

Reference books:

1. S.S. Dara , “A text book on experiments and calculation in Engineering”. S. Chand and company Pvt Ltd, 2008.
2. Gurdeep Chatwal, Sham Anand, ”Instrumental methods of chemical analysis” , Himalaya Publications, 1984.

DETAILED SYLLABUS

Semester III:

B18EC3010	Engineering Mathematics – III	L	T	P	C
Duration: 14 Weeks		2	1	0	3

Prerequisites:

Engineering Mathematics –I & II

Course Description:

Fourier series, Fourier transform, Z-transform and application of Z-transform are used to solve difference equations. This course is widely used in all streams of Engineering, particularly in the field of Electronics and Communication Engineering, for ex., Fourier series is used in transmission and processing of digital signals, it can transform time domain into frequency domain and this domain is used as a mathematical tool to analyze the signals, Z-transform is used to simulate the continuous system, etc.

Course Objectives:

The objectives of this course are to:

1. To apply the knowledge of Fourier series and few of its applications.
2. To apply Fourier transform and Z-transform concepts to solve various engineering problems related to time domain.
3. Study the elements of complex variables and fundamental concepts such as analytic functions, complex integrals, Taylor series and Laurent series.
4. To apply the knowledge of Vector spaces, Basis and dimension.

Course Outcomes:

After the completion of the course the student will be able

1. To apply the knowledge of Fourier series and few of its application.
2. To apply Fourier transform and Z-transform concepts to solve various engineering problems related to time domain.
3. To demonstrate knowledge of integration in the complex plane, use the Cauchy integral theorem and Cauchy integral formula, manipulate and use power series, understand residues and their use in integration.
4. To apply the knowledge of vector spaces in the field electronics engineering.

Mapping of Course Outcomes with Program Outcomes

Course Code	POS / COs	PO 1	Po 2	PO 3	PO 4	PO 5	PO 6	Po 7	PO 8	PO 9	P O 10	P O 11	P O 12	PSO 1	PSO 2	PSO 3
B18EC3010	CO1	3	3	2	1					3			3	3	2	1
	CO2	3	3	3	1					3			3	3	2	1
	CO3	3	3	3	1					3			3	3	2	1
	CO4	3	3	3	1					3			3	3	2	1

Course Contents:

Unit-1 Fourier series [7L+7T Hrs]

Convergence and divergence of infinite series of positive terms - definition, Periodic functions, Dirichlet's conditions and Fourier series of period functions of period 2π and arbitrary period , half range Fourier series , Complex form of Fourier series and Practical Harmonic analysis. Illustrative examples from engineering field.

Unit-2: Fourier Transform and Z -Transform [7L+7T Hrs]

Infinite Fourier Transform, Fourier sine and cosine transforms, properties, inverse transforms and evaluation of integrals. Z-transforms - Definition, standard Z-transforms, damping rule, shifting rule, initial value and final value theorems (proof), inverse Z-transform, application of Z-transform to solve difference equations.

Unit-3: Complex Analysis [7L+7T Hrs]

Function of a complex variable, Analytic functions-Cauchy-Riemann equations in Cartesian and polar forms (no proof). Properties of analytic functions.

Complex line integrals-Cauchy's theorem, Cauchy's integral formula. Taylor's and Laurent's series. Poles and residues, residue theorem(no Proof) problems.

Unit-4 : Vector spaces [7L+7T Hrs]

Introduction to vector spaces and sub-spaces, definitions, illustrative examples and simple problems. Linearly independent and dependent vectors-definition and problems. Basis vectors, dimension of a vector space. Linear transformations- definition, properties and problems. Rank- Nullity theorem (without proof). Matrix form of linear transformations-Illustrative examples.

Text Books:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43nd edition, 2015.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Publications, 10th edition, 2015.

Reference Books:

1. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publications, 19th edition, 2013.
2. R.K. Jain and S.R.K. Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House, 5th edition, 2014.

B18EC3020	Linear integrated circuits	L	T	P	C
Duration:14 Weeks		3	0	0	3

Prerequisites:

Basic Electronics, Analog Electronic Circuits, Basics of OP-AMP

Course description

This course is basically a study of the characteristics, operations, stabilization, testing, and feedback techniques of linear integrated circuits. The course includes applications in computation, measurements, instrumentation, and active filtering.

Course Objectives:

The objectives of this course are to:

1. Interpret and explain frequency response and compensation techniques of Operational amplifier.
2. Illustrate how operational amplifiers can be used in linear and nonlinear applications.
3. Introduce the concepts of waveform generation and introduce some special function ICs.
4. Explain and introduce the theory and applications of analog multipliers, PLL, voltage regulators, IC555 timer applications.
5. Introduce the basic building blocks of linear integrated circuits and explain System design.

Course Outcomes:

On completion of this course the student will be able to:

1. Examine the stability of an op-amp circuit using frequency compensation techniques.
2. Design and simulate op-amp circuits for linear and non-linear applications.
3. Apply experience in building and trouble-shooting simple electronic analog and digital circuits(PBL)
4. Analyze systems like PLL, counters , Converters, frequency synthesizers function generators for simple applications.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC3020	CO1	3	2	1		3								1	2	1
	CO2				1	3									2	1
	CO3					3				3	2	1		1		3
	CO4	2	2	1		1										1

Course Contents:

Unit -1: OP-AMPS Frequency Response, Compensation and applications [11 Hrs]

Circuit stability, frequency and phase response, frequency compensating methods, bandwidth, and slew rate effects, Z_{in} mod compensation.

Linear Applications: Voltage sources, current sources and current sinks, Current amplifiers, Instrumentation amplifier, precision rectifiers,

Unit -2: Non-linear applications of ICs [10 Hrs]

Clamping circuits, peak detectors, Sample and hold circuit, V-I and I-V converter, Log and Antilog amplifiers, Multiplier and Divider, Triangular/Rectangular waveform generators, waveform generator design.Crossing detectors, Inverting Schmitt trigger circuits, Active filters- first and second order low pass and high pass filters,

Unit-3: Voltage regulators, 555 timer and PLL [10 Hrs]

Series op-amp regulator, IC voltage regulator, 723 general purpose regulators, 555 timer-basic timer circuit, 555 timer used as Astable and Monostable multivibrator, Basic block of PLL, Applications of PLL.

Unit-4: System design using ICs [11 Hrs]

System design Principles, Frequency counter, DACs and ADCs, Digital voltmeter, Digital programmable frequency generator, frequency synthesizer, function generator, Display system design, Traffic controller design.

Text Books:

1. D. Roy Choudhury and Shail B Jain, " Linear Integrated Circuits", New Age International, 2nd edition, 2006
2. David A Bell, "Operational amplifiers and Linear ICs", PHI/Pearson, 2nd edition, 2004
3. B. S. Sonde, " Introduction to System Design Using Integrated Circuits", New Age International, 1992,

Reference Books:

1. Thomas L. Floyd, David Buchla, "Basic Operational Amplifiers and Linear Integrated Circuits", Prentice Hall, 1999
2. Gayakwad, "Op-amp and linear Integrated circuits", , Pearson, 4th edition, 2004
3. Bruce Carter," Op Amps for Everyone", ISBN: 978-0-12-391495-8, Fourth Edition.
4. BIS, ISO standards and Datasheets

B18EC3030	Digital Electronics & VHDL	L	T	P	C
Duration :14Wks		3	1	0	4

Prerequisites:

Number system, Logic gates, Boolean algebra

Course Description

Electronics is classified based on the type of signal/information in to Analog Electronics and Digital Electronics. Digital Electronics deals with signal/information represented using discrete values of 0's and 1's (Binary). Digital electronics are designed using logic gates/circuits and are usually represented using Boolean Equations. Digital Electronics is further classified in to Combinational Logic/Circuits and Sequential Logic/Circuits.

Hardware Description Language (HDL) is a computer –Aided Design tool for modern design and synthesis of digital systems. Due to the complexity in design of digital systems, such systems cannot be realized using discrete integrated circuits. They are usually realized using high density, programmable chips, such as Field

programmable Gate Arrays (FPGAs). This course develops students' ability to understand and design the basic building blocks of modern digital systems and provides them with a fundamental knowledge for complicated digital hardware design using VHDL

Course Objectives:

The objectives of this course are to:

1. Provide the basics behind the digital circuit design in terms of all the necessary building blocks.
2. Illustrate Boolean laws and systematic techniques for minimization of expressions.
3. Introduce the Basic concepts of combinational and sequential logic.
4. Provide foundations of different styles of descriptions in HDLs.
5. Highlight the Design techniques of digital modules by using different styles of HDL descriptions.

Course Outcomes:

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

1. Design digital circuits using gates, encoders, decoders, multiplexers and de-multiplexers
2. Interpret the output and performance of given combinational and sequential circuits.
3. Summarize the different styles of VHDL programming and its applications.
4. Distinguish VHDL models for realizing combinational and sequential circuits

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	Po 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC3030	CO1	2	3	1							3			2		3
	CO2		2	3	1	3					3	3		2		3
	CO3	2	1		2	3					3			2		3
	CO4	1		2	3	2					3	3		2		3

Course Contents:

Unit -1: Principle and Minimization Techniques of combinational Circuits [10L+7T]

Introduction to combinational logic circuits, generation of switching equation from truth table. Minimization Techniques: Boolean algebra, expression minimization. Min-term, Max-term, Sum of Products (SOP), Product of Sums (POS), Karnaugh map, incompletely specified functions, Introduction to Digital Logic Families.

Analysis and Design of Combinational Circuits

Adder/Subtractor, Carry Look Ahead adder, BCD adder. Principle of Encoder and Decoder with cascading of decoders. Principle of Multiplexers and Demultiplexer with cascading of Mux and Boolean function implementation using Mux and decoders, Comparators.

Unit -2: Introduction to Sequential circuits [11L+7T]

Basic bi-stable element, S R Latch, Flip-flops - SR, JK, D, T, and Master-Slave – Characteristic table and equation. Registers, Shift Register, Counters: Binary Ripple Up/Down Counter, Design of synchronous Mod- n counter using flip-flop.

Design & Applications of Digital Circuits

Sequential Design: Introduction to Mealy and Moore Model circuits. State machine notation, Synchronous sequential circuit analysis and construction of state table and diagram. Case study: sequence generator.

Unit -3: VHDL Programming concepts [10L+7T]

Structure of VHDL Program, Operators, Data types, Types of Descriptions: Data Flow description, Behavioral Description, Structural Description

Data Flow Description:

Highlights of Data-Flow Descriptions, Structure of Data-Flow Description, Data Type –Vectors, Programs based on Data Flow Description.

Unit -4: Introduction to Behavioral Description [11L+7T] Highlights of Behavioral Description, Structure of HDL Behavioral Description, Introduction to The VHDL Variable–Assignment Statement and Introduction to formats of sequential statements with examples. Programs Based on Behavioral Description and Booth algorithm.

Structural Description: Highlights of Structural Description, Organization of the Structural Description,

Text Books:

1. John M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 1st Edition, 2001.
2. Nazeih M Botros ,"HDL Programming : VHDL and Veriolog" Dreamtech Press, 6th Edition 2006

Reference Books:

1. Samir Palnitkar **"**Verilog HDL**"**–-Pearson Education
2. Douglas perry **"VHDL"**--Tata McGraw-Hill
3. J Bhaskar **"A Verilog HDL Primer"**-– BS Publications
4. **Volnei A pedroni "Circuit Design with VHDL"**--PHI
5. Donald D Givone, "Digital Principles and Design", Tata McGraw-Hill 1st Edition, 2002.
6. D P Leach, A P Malvino, & Goutham Saha, "Digital Principles and applications", Tata McGraw-Hill, 7th Edition, 2010.
7. Moshe Morris Mano, "Digital Design" Prentice Hall, 3rd Edition, 2008.
8. Chales H Roth, Jr., "**Fundamentals of Logic Design**", Cengage learning, 5th Edition, 2004

B18EC3040	Signals and Systems (I)	L	T	P	C
Duration :14Wks		2	1	1	4

Prerequisites:

Differential and Integral Calculus, Geometric Series.

Course Description:

The course covers the fundamentals of signal and system analysis tackling both continuous-time (CT) and discrete-time (DT) systems. The course provides the necessary background needed for understanding analog and digital signal processing, automatic control, analog and digital communications, and probability and random processes. The course focuses on the study of linear time-invariant (LTI) systems and their analysis in the time domain or in the frequency domain. Fourier analysis in the course includes Fourier series for periodic continuous-time signals, the continuous-time Fourier transform (CTFT) and the discrete-time Fourier transform (DTFT). In addition the course includes a chapter on Z transform.

Course Objectives:

The objectives of this course are to:

1. Provide insight into fundamentals of Continuous and Discrete-time signals and systems, their properties and representations.
2. Introduce time domain representation of Linear Time invariant Systems such as Convolution Sum, Convolution Integral.
3. Provide understanding of signal representation in Fourier domain such as Fourier Series, Fourier transform, discrete time Fourier transform.
4. Provide insights into applications of Fourier transform and brief understanding of signal representation in Z-domain.

Course Outcomes:

On completion of this course the student will be able to:

1. Illustrate the operations on Signals and summarize the properties of Systems.
2. Apply Convolution operation on an LTI System.
3. Represent continuous time periodic signals in frequency domain using Fourier technique.
4. Represent the discrete time signals in Z-domain and determine the behavior of Causal LTI system using properties of Z-Transform.

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
B18EC3040	CO1	3	2	1	1					3	1				2	3
	CO2	3	3	2	1					3	1				2	
	CO3	3	2	1	1					3	1	1				3
	CO4	1	3	1						3	1	1			1	2

Course Contents:

Unit-1: Introduction to Signals and Systems [7 L+7T+7P]

Definitions of a signal and system, Elementary signals, Basic operations on signals, Classification of signals.

Unit-2: Analysis of Linear Time Invariant System [7 L+7T+7P]

Properties of systems. Time domain representation of LTI system: Impulse response representation, Convolution Sum, Convolution Integral.

Unit-3: Fourier Representation for Aperiodic signals [7 L+7T+7P]

Fourier Representation of Periodic Signals: Introduction to CTFS and DTFS, definition.
FT representation of aperiodic CT signals – FTdefinition, FT of standard CT signals, Properties of FT, Inverse FT.
FT representation of aperiodic discrete signals-DTFT definition.
Application of FT: Solving differential equations, Sampling theorem and reconstruction of signals.

Unit-4: Z-Transforms [7L+7T+7P]

Introduction, Z – transform, Properties of ROC, properties of Z – transforms, Inversion of Z – transforms, transform analysis of LTI Systems, Unilateral Z-Transform and its application to solve difference equations.

Text Book:

1. Simon Haykins, "Signals and Systems", John Wiley, India Pvt Ltd, Second Edition, 2008.

Reference Books:

1. Michael Roberts, "Fundamentals of signals and systems", TATA McGraw Hill, Second Edition ,2010
2. Allan V. Oppenheim, S. Wilsky and S. H. Nawab, "Signals and Systems", Pearson Education, Second Edition, 1997.
3. D. Ganesh Rao and Satish Tunga, "Signals and Systems", Pearson/Sanguine Technical Publishers, 2004
4. Uday Kumar S. "Signals and Systems", Prism books Pvt. Ltd, 6th Edition 2015

Signals and Systems Lab Experiments

List of Experiments to be done using MATLAB/Octave/Scilab

Introduction to MATLAB/ Octave

1. a) Generation and Plotting of Sine Waves
   b) Generation and Plotting of Elementary Signals
2. Perform Operations on Dependent Variable of a Signal.
3. Perform Operations on Independent Variable of a Signal.
4. To Calculate Signal Power and Signal Energy
5. To Compute the Linear Convolution of The Given Input Sequence x(n) & The Impulse Response of The System h(n). (Causal Sequences)
6. To Compute the Linear Convolution of The Given Input Sequence x(n) & The Impulse Response of The System h(n). (Non-Causal Sequences)

7. Solve Any Given Difference Equation of An LTI System Without Initial Conditions.

8. Solve Any Given Difference Equation of An LTI System with Initial Conditions.

9. Representation of LTI systems in MATLAB.

10. a) Fourier synthesis of square wave in MATLAB

b) Fourier synthesis of a triangular wave in MATLAB

11. Demonstration of Sampling Theorem

B18EC3050	Network Theory	L	T	P	C
Duration:14 Weeks		2	1	0	3

Prerequisites:

Ohm's Law, KVL, KCL, Calculus, Cramer's rule, Basic concepts on passive elements, Laplace transforms.

Course Description:

This course introduces the concepts to determine voltage, current and power in branches of any circuits excited by dc and ac voltages and current sources by simplifying techniques to solve dc circuit problems using basic circuit theorems and structured methods like node voltage and mesh current analysis. The goal also includes derivation of the transient responses of RC and RL circuits, steady state response of circuits to sinusoidal excitation in time domain, introduction to two port networks and application of Laplace transform in network theory. It also explains about the concepts of network graph theory to simplify and analyze the complex network.

Course Objectives:

The objectives of this course are to:

1. Analyse the concepts of super mesh, super node and network theorems.
2. Illustrate the mathematical and graphical analysis of electrical circuits.
3. Construct an analysis strategy to determine a particular transient response of an electrical network.
4. Analyse the excitation response of the electrical network and the techniques for characterizing the networks using network parameters.

Course Outcomes:

On completion of this course the student will be able to:

1. Evaluate the branch currents and node voltages of any given electrical circuit by the application of super-mesh, super-node and various network theorems.
2. Determine branch voltage and node current by drawing cut set schedule and tie set schedule of electrical circuit.
3. Analyse transient behaviour of electrical circuit by applying Laplace Transforms.
4. Determine the condition of resonance for series/parallel RLC circuits and to model the circuit as two port networks.

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
B18EC3050	CO1	3	3	3						3	1			1	1	2
	CO2	3	3	3						3	1			1	1	2
	CO3	3	3	3						3	1	1		1	1	2
	CO4	3	3	3						3	1	1		1	1	2

Course Contents:

Unit-1: Network Analysis Techniques [8 L+ 7 T]

Concepts of super node and super mesh for ac and dc networks, Network Theorems: Superposition theorem, Thevenin's & Norton's theorem, Maximum power transfer theorem and Reciprocity theorem for ac and dc networks. Numerical examples on each topic. (Text 1: Ch 4 & 5)

Unit-2: Network Graph theory [8 L+ 7 T]

Concept of network graph, Terminology used in network graph, relation between twigs and links, properties of tree in a graph, formation of incidence matrix, number of trees in a graph, cut-set matrix, tie-set matrix, Network equilibrium equations. Procedure to find branch voltages and branch currents, Principle of duality. Numerical examples on each topic. (Text 2: Ch16, Text 1: Ch17)

Unit- 3: Transient Analysis using Laplace transforms [8 L+ 7 T]

A procedure for evaluating initial conditions, Initial & Final State of a network element, Transient response of passive circuits. Time-domain to s-domain transformation, Definition and properties of Laplace transform, Application of Laplace transform technique for analysis of R-L-C circuits, step response of series R-L & series R-C circuit, impulse response of series R-L & series R-C network. Numerical examples on each topic. (Text2: Ch 8 & 9)

Unit-4: Resonant Circuits and Two Port Networks [8 L+ 7 T]

Resonance-Series R-L-C circuit (derivation of resonant frequency, bandwidth, quality factor, expression for upper and lower cut off frequencies, relation between Q, BW &f_r), Parallel resonance of R-L-C circuit (derivation of resonant frequency, bandwidth, quality factor, expression for upper and lower cut off frequencies), Condition for resonance of two branch parallel RC-RL circuit. Numerical examples on each topic. (Text 2: Ch 4) Two port network parameters: Definition of z, y, h and transmission parameters, and relationship between parameters. Numerical examples on each topic. (Text 1: Ch 17)

Text Books:

1. W H Hayt, J E Kemmerly, S M Durbin, " Engineering Circuit Analysis", 6thEdition,Tata McGraw-Hill Publication
2. A. Chakrabarti, " Circuit Theory (Analysis and Synthesis)", Dhanpat Rai & Co.,2013

Reference Books:

1. Nahvi and Edminister, "Electric Circuits" Schaum's Outline Series, McGraw Hill, 2003.

2. J. David Irwin and R. Mark Nelms, "Basic Engineering Circuit Analysis", 8th Edition, John Wiley, 2006.

B18EC3070	Linear Integrated Circuits Lab	L	T	P	C
Duration:14 Weeks		0	0	2	2

Prerequisites:

Electronic Circuits

Course Description:

This laboratory course is introduced for the students to explore the applications in linear ICs. The students will learn filtering concepts of various filters. Precision rectifier concepts are also introduced. Fundamental concepts in system design is introduced by desigining waveform generators and PLL. The students also design the applications using industry standard simulators.

Course Objectives:

The objectives of this course are to:

1. Understand and design various applications of Op-Amp and measure the physical Parameters.
2. Structured systematically to upgrade graduates skills and knowledge to the more advanced in- depth skills and knowledge in electronics.
3. Infer the DC and AC characteristics of operational amplifiers and design the linear and non-linear applications using operational amplifiers.
4. Simulation and design of electronic circuits using SPICE or other analog simulators.

Course Outcomes:

On completion of this course the student will be able to:

1. Design and test amplifiers, precision rectifiers, filters and waveform generators.
2. Experiment with as part of a team effectively.
3. Compile the experiment's procedures and results by writing a formal report
4. Demonstrate linear and non linear applications using simulator tools.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC2070	CO1	3	2	1		3								1	2	1
	CO2				1					3					2	1
	CO3					3				3	3	1		2		1
	CO4	2	2	1		3										1

Lab Experiments

1. Study the characteristics of negative feedback amplifiers and design of Instrumentation amplifier.

2. Designing and testing of second order low pass filter and high pass filter
3. Design of second order band pass.
4. Designing and testing of Schmitt Trigger circuit for the given values of UTP and LTP
5. Designing and testing of Astable multi-vibrator circuits using IC 555 for given frequency and duty cycle
6. Designing and testing of PLL.
7. Design a function generator and convert it into VCO/FM generator.
8. Designing and testing of a rectangular and triangular wave generator.
9. Designing and testing of integrator and differentiator circuit.
10. Designing and testing of a voltage regulator circuit using op-Amp

B18EC3080	Digital Electronics and VHDL Lab	L	T	P	C
Duration :16Wks		0	0	2	2

Prerequisites:

Number system, Fundamentals of Digital Electronics, programming skills.

Course Description:

Electronics is classified based on the type of signal/information in to Analog Electronics and Digital Electronics. Digital Electronics deals with signal/information represented using discrete values of 0's and 1's (Binary). Digital electronics are designed using logic gates/circuits and are usually represented using Boolean Equations. Digital Electronics is further classified in to Combinational Logic/Circuits and Sequential Logic/Circuits.

Hardware Description Language (HDL) is a computer –Aided Design tool for modern design and synthesis of digital systems. Due to the complexity in design of digital systems, such systems cannot be realized using discrete integrated circuits. They are usually realized using high density, programmable chips, such as Field programmable Gate Arrays (FPGAs).

The two widely used hardware description languages are VHDL and Verilog. This course develops students' ability to understand and design the basic building blocks of modern digital systems and provides them with a fundamental knowledge for complicated digital hardware design

Course Objectives:

The objectives of this course are to:

1. Design, realization and verification of Boolean Theorems, logic expressions
2. Realize various arithmetic, data path modules, memory modules
3. Understand the FPGA design flow
4. Simulate, synthesize various digital blocks by using Verilog code

Course Outcomes:

On completion of this course the student will be able to:

1. Demonstrate circuits using combinational gates/MSI chips
2. Develop and debug the codes for various digital combinational and sequential blocks
3. Implement and analyze the digital blocks on the targeted FPGA device

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	Po 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC3080	CO1	2		1	3						3	3			1	2
	CO2	2		3	1	3					3	3			1	2
	CO3	1		2	3	3					3	3			1	2

Lab Experiments

1. Realization of parallel Adder and Subtractor.
2. Realization of 3 bit Binary to Grey code conversion and vice versa using basic/Universal gates.
3. Realization of 4:1 MUX and 1:4 DEMUX using basic/universal gates.
4. Arithmetic circuit realization (Half/Full, Adder/Subtractor) using MUX.
5. Construction and verification of JK master slave, T, D flip flop using logic gates.
6. Construction and realization of n- bit ripple up/down counter using IC 7476 and other logic gates.
7. Design and verification of n-bit synchronous counter using 7476 JK, T and D flip flops.
8. Write a VHDL program for the following modules.
    a. Decoder
    b. Encoder with and without priority
    c. Multiplexer
    d. De-multiplexer
    e. Comparator
9. Write a VHDL code to describe function of full adder in data flow, behavioral and structural style
10. Write VHDL code for a 4-bit binary, BCD counters with synchronous and asynchronous reset
11. Write a HDL code to control speed and directions of a Stepper motor

Demo experiments

12. Write a HDL code to generate waveforms of different frequency and amplitude using a DAC.
13. Simulation of digital circuit

DETAILED SYLLABUS

Semester IV:

B18EC4010	Engineering Mathematics – IV	L	T	P	C
Duration: 14 Weeks		2	1	0	3

Prerequisites:

Engineering Mathematics : Fourier transform, Fourier Series, Z Transform

Course Description:

This course introduces probability, distributions and statistics with applications. Topics include: Mean, Median, Mode, Correlation, Curve fitting, Random variables, Probability distributions, Joint densities, Hypothesis testing. Probability theory deals with many real-life problems, which either inherently involves the chance phenomena or describing the behavior of the system explicitly with statistical properties. Interpretation of the system behavior in many engineering and computing sciences depends on concept probability and statistics that familiarize with the computational aspects. The course deals with basic properties of various distributions and other related things.

Course Objectives:

The objective of this course is to:

1. Solve algebraic and transcendental equation, interpolation, differentiation and integration using Numerical methods.
2. Solve the first order differential equations using different numerical techniques.
3. Expose the students to probability theory and random processes essential for their subsequent study of analog and digital communication.
4, Illustrate sampling distributions, test of hypothesis for means, Student's t-distribution and Chi-square distributions and joint probability distributions.

Course Outcomes:

After the completion of the course the student will be able

1. To apply the knowledge of finite differences in the fields of engineering
2. Solve the simultaneous 1st order ODE, 2nd order ODE and PDE using numerical Techniques.
3. To solve the problems of Probability and statistics.
4. To apply Sampling Theory and joint probability distributions concepts to solve various Engineering problems.

Mapping of Course Outcomes with Program Outcomes

Course Code	POS/ COs	PO 1	P o 2	PO 3	PO 4	PO 5	P O 6	P o 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
B18EC 4010	CO1	3	3	3	2					3			3	3	2	1
	CO2	3	3	3	1					3			3	3	2	1
	CO3	3	3	3	1					3			3	3	2	1
	CO4	3	2	3	2					3			3	3	2	1

Course Contents:

Unit -1: Numerical Methods –I [6L+7T]

Solution of algebraic and Transcendental equation-Regula- falsi method, Newton -Raphson method. Finite differences and Interpolation :-Forward and Backward differences , Newton's forward and Backward interpolation formulae, Divided differences-Newton's divided difference formula, Lagrange's Interpolation formula and Inverse Interpolation formula and Problems.

Numerical Differentiation:-Derivatives using Newton's forward and backward difference formula.

Numerical Numerical Integration: Trapezoidal Rule, Simpson's 1/3rd, 3/8th Rule, Weddle's formula and Problems.

Unit -2: Numerical Methods –II [6L+7T] Numerical solutions to ODE: Solution of First order and first degree ODEs- Picards Method , Modified Euler's method , Runge-Kutta method of fourth order, Milne's Predictor-corrector method.

Numerical solution of simultaneous first order ODE: Picard's and Runge-Kutta method of fourth order.

(ii) Numerical solution of second order ordinary differential equations, Picards method, Runge-Kutta method, Milne's predictor-corrector method.

Unit-3: Probability and Statistics [7L+7T]

Mean, Mode, Median and standard deviation. Correlation, Coefficient of correlation and lines of regression. Random variables (discrete and continuous), Probability density function, probability distribution – Binomial, Poisson's, Exponential and Normal distributions and problems.[without proof for mean & SD for all distributions]

Unit-4: Sampling theory & Joint Probability distribution [7L+7T]

Sampling, Sampling distributions, standard error, test of hypothesis for means and confidence limits, Student's t-distribution and Chi-square distributions.

Joint Probability distribution:-Concept of joint probability, joint distributions –discrete random variables, independent random variables, problems on expectation and variance.

Text books:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43nd edition, 2015.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Publications, 10th edition, 2015.

Reference Books:

1. B.V. Ramana, “Higher Engineering Mathematics”, Tata McGraw Hill Publications, 19th edition, 2013.
2. R.K.Jain and S.R.K.Iyengar, “Advanced Engineering Mathematics”, Narosa Publishing House, 5th edition, 2014.

B18EC4020	Analog Communication	L	T	P	C
Duration :14Wks		3	0	0	3

Prerequisites:

Fourier Transform, Gaussian Process, Correlation and Co-variance function.

Course Description:

This course provides the basics of analog communication systems such as amplitude modulation and demodulation, DSB-SC modulation and demodulation, SSB and VSB modulation and demodulation. Later, comparison of various modulation schemes is carried out to differentiate all amplitude modulation schemes. Frequency division multiplexing and frequency translation are demonstrated with block diagram. Angle modulation and demodulation techniques are illustrated to provide a better insight of the course. Finally, the course provides introduction to noise and analyze the receiver model in presence of the noise. This fundamental knowledge on analog communication helps to explore and apply the techniques in design of various analog communication systems.

Course Objectives:

The objectives of this course are to:

1. Introduce the various Analog modulation & demodulation schemes.
2. Sketch the time domain and frequency domain description of Analog modulation schemes.
3. Present the concept of Phase locked loop (PLL).
4. Introduce the fundamental concepts of noise in communication systems and demonstrate the receiver model in presence of noise.

Course Outcomes:

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

1. Apply Fourier analysis to communication signals.
2. Analyze and differentiate types of modulators Such as AM, DSBSC, SSB, VSB and FM.
3. Apply the concept of Phase locked loop in FM detection.
4. Compute PSD, SNR, Figure of Merit for different Modulation techniques.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
B18EC 4020	CO1	1			4									1		
	CO2		2	3											2	3
	CO3		2	3												3
	CO4	1	2											1		

Course Contents:

Unit -1: Amplitude Modulation [10 Hrs]

Introduction, AM: Time-Domain Description, Frequency–Domain Description. Generation of AM Wave: Square Law Modulator, Detection of AM Waves: Envelope Detector. Double Side Band Suppressed Carrier Modulation (DSBSC): Time-Domain Description, Frequency-Domain Representation. Generation of DSBSC Waves: Balanced Modulator, Coherent Detection of DSBSC Modulated Waves, Costas Loop.

Unit -2: Single Side-Band Modulation (SSB) and Vestigial Side-Band Modulation (VSB) [11 Hrs]

Quadrature Carrier Multiplexing, Single Side-Band Modulation, Frequency-Domain Description of SSB Wave, Phase Discrimination Method for Generating an SSB Modulated Wave. Demodulation of SSB Waves, VSB: Frequency Domain Description, Generation of VSB Modulated Wave, Coherent detection of VSB, Comparison of Amplitude Modulation Techniques. Frequency Division Multiplexing, Superheterodyne Receiver.

Unit -3: Angle Modulation and Demodulation [10 Hrs]

Basic Definitions, FM, PM, Narrow Band FM, Wide Band FM(with Bessel function), Transmission Bandwidth of FM Waves, Generation of FM Waves: Indirect FM And Direct FM. Demodulation of FM Wave- Balanced Frequency discriminator, Phase Locked Loop, Non-linear Model of Phase Locked Loop, Linear Model of Phase Locked Loop.

Unit -4: Introduction to Noise and Noise in Continuous Wave Modulation Systems [11 Hrs]

Introduction, Autocorrelation and power spectral density, Mean, co-variance, Shot Noise, Thermal Noise, White Noise, Noise Equivalent BW, Narrow Bandwidth, Noise Figure, Equivalent Noise Temperature, Cascade Connection of Two-Port Networks, Receiver Model, Noise In DSB-SC Receivers, Pre-Emphasis And De-Emphasis in FM.

Text Books:

1. Simon Haykins, "An Introduction to Analog and Digital Communication", John Wiley, 3rd Edition 2003.
2. Simon Haykins, "Communication Systems", John Willey 4th Edition, 2001.

Reference Books:

1. B. P. Lathi, "Modern digital and analog Communication systems", Oxford University press, 3rd Edition, 2005.
2. Kennedy, Davis,"Electronic Communication Systems", Tata Mcgraw-Hill, 4th Edition, 1999

B18EC4030	Electromagnetic Field Theory	L	T	P	C
Duration: 14 Wks		2	1	0	3

Prerequisites:

Knowledge of Vector algebra and calculus, Basics of physics on Electrostatics and Magnetism.

Course Description:

The course covers the basic principles of electromagnetics: The experimental laws, electrostatics, magnetic fields of steady currents, potential, Laplace's and Poisson's law, Maxwell's equations, propagation and radiation of electromagnetic waves. The course mainly deals with understanding the properties of electric and magnetic fields which helps to understand the Maxwell's equations which are governing communication in any media. The course also gives an insight to generation of electromagnetic waves and to understand their behavior in different media.

Course Objectives:

The objectives of this course are to:

1. Explain different coordinate systems and apply them appropriately to study the laws of electromagnetics.
2. Solve boundary conditions and compute various circuit parameters.
3. Execute Maxwell's equations for various applications.
4. Demonstrate the idea of electromagnetic waves and their behavior in different medium and at plane boundaries.

Course Outcomes:

On the successful completion of this course, the student will be able to:

1. Explain the physical quantities of electromagnetic fields in different media using the fundamental laws.
2. Analyze and compute various circuit parameters at boundaries of various media.
3. Relate Maxwell's equations and justify the use of electromagnetic waves in various applications.
4. Examine and Compare the behavior of uniform plane waves in different mediums with planar boundaries.

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC4030	**CO1**	**3**	**3**	**2**											**2**	
	CO2	**3**	**3**	**2**											**2**	**3**
	CO3	**3**	**3**	**3**	**3**						**2**				**3**	
	CO4	**3**	**3**		**3**						**3**				**3**	

Course Contents:

Unit-1: Static Electric Fields Gauss law and Divergence [9L+7T]

Introduction to co-ordinate system, Rectangular Cylindrical and Spherical, The experimental law of Coulomb. Electric Field Intensity field of line charge, Electric flux density, Gauss Law, Applications of Gauss Law, Some symmetrical charge distributions, Differential volume element, Concept of divergence. Solve the relevant problems.

Unit-2: Energy Potential, Poisson's and Laplace's Equations [5L+7T]

Definition of Electric potential, work, Energy potential difference, Potential field of different types of charges, Potential gradient, Energy density in the electric field, Capacitance, Derive boundary conditions for electric field, Derivations of Poisson's and Laplace equation uniqueness theorem solutions of Laplace's and Poisson's equation.

Unit-3: Magnetic Fields and Maxwell's Equations [9L+7T]

Biot Savart Law, Ampere's circuital law, Curl, Stoke's Theorem, Magnetic flux and magnetic flux density, The scalar and vector magnetic potentials, Derive boundary conditions for magnetic field, Time varying fields and Maxwell's equations: Faradays law, displacement current, Maxwell's equations in point and integral forms, retarded potentials

Unit-4: Uniform Plane wave and Dispersive Media [5L+7T]

Wave propagation in free space and dielectrics, Poynting's theorem and wave power, propagation in good conductors, skin effect, reflection of uniform plane waves at normal incidence, SWR, Plane wave propagation in general direction.

Add on: Demonstrations using MATLAB for any topics of all units.

Text Book:

1. William H.Hayt, Jr and John A. Buck., "**Engineering Electromagnetics**", Tata McGraw-Hill Publishing Ltd, 8th edition, 2012.

Reference Books:

1. Edward Jordan and Balmain. K. G., "Electromagnetic Waves and Radiating Systems", Pearson Education, 2nd edition, 2001.
2. Matthew N. Sadiku. O, "Elements of Electromagnetics", Oxford University Press, 3rd Edition, First Indian edition, 2006.
3. John D. Kraus, "Electromagnetics", McGraw Hill book Company, New York, 4th edition, 1991.

B18EC4040	Microcontrollers and Applications	L	T	P	C
Duration :14 Wks		3	0	0	3

Prerequisites:

Number system, combinational circuits, sequential circuits

Course Description:

This course introduces 8051 microcontroller to provide basic understanding of architecture, instruction set, assembly level programming, interfacing to various sensors, relays, motors, actuators through various types of serial and parallel communication. Timers and interrupt functions are illustrated through the selection and control activities using suitable programming platforms such as Assemblers, C compilers, Kiel, , etc. This

fundamental knowledge on microcontrollers lead to explore large number of controller families like Raspberry Pi, ATMEGA, TI and PIC that are used in industrial and automation applications.

Course Objectives:

Course objectives are to:

1. Introduce Microcontroller 8051 Architecture.
2. Give an insight into instruction set of microcontroller 8051.
3. Introduce assembly and C programming for 8051.
4. Provide insight into timer, serial communication and interrupts modules of 8051.
5. Interface a microcontroller with peripheral devices.

Course Outcomes:

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

1. Describe the Architecture of 8051 microcontroller.
2. Describe Instruction Set of 8051
3. Calculate Program Execution Time
4. Write Assembly and C Programs for 8051.

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC4040	CO1	3	2	1	1	3									2	1
	CO2				1	3									2	1
	CO3										2	1	2			
	CO4	2	1	3	3						2	3	1		1	2

Course Contents:

Unit -1: 8051 Architecture, Addressing Modes [10 Hrs]

Introduction to Microprocessors and Microcontrollers, RISC & CISC CPU Architectures, Harvard & Von Neumann CPU architecture. The 8051 Architecture, Memory organization, Addressing Modes, Data transfer Instructions, Stack, Assembly language programs.

.

Unit -2: Instruction Set, Interrupts [11 Hrs]

Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instruction. Assembler Directives. Instruction delay calculations.

Basics of interrupts, 8051 interrupt structure. Assembly and C programs.

Unit -3: Introduction to Timers/countersand Serial Communication. [11 Hrs]

Introduction to Timers and Counters, Timer delay calculations,

Serial Communication: Data communication, connections to RS-232, UART. Timers/counters, Interrupts and Serial communication programming in Assembly and C.

Unit -4: Interfacing and Applications **[10 Hrs]**

8051 Memory Interfacing, Interfacing 8051 to LCD, parallel and serial ADC0804, DAC, Stepper motor and DC Motor, Interfacing Programming in C.

Add on: Overview of microcontroller families and their applications

Text books:

1. Kenneth J. Ayala, "The 8051 microcontroller architecture, programming and applications" Thomson publication, 3rd edition, 2007
2. Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D, McKinlay "The 8051 Microcontroller and Embedded Systems using assembly and C" PHI, 2006/Pearson 2006.

Reference Books:

1. V. Udayashankar and Malikarjunswamy, "The 8051 Microcontroller", TMH, 2009.
2. Raj Kamal, "Microcontrollers: Architecture, Programming, Interfacing and System Design", Pearson Education, 2005.

B18EC4050	Control Systems (I)	L	T	P	C
Duration :14 Wks		2	1	1	4

Prerequisites:

Knowledge of Network analysis, Integration and differentiation, Matrix equations, Laplace Transform.

Course Description:

In this course covers the transfer function modelling and state space modelling of electrical and mechanical system . The dynamic and steady state time domain response system is discussed. This course also covers stability criteria and stability analysis of system by root locus, RH criteria, Bode plot and Nyquist plot. The state space modelling methods in different canonical form and transformation from transfer function model to state space and vice versa and different methods of calculating state variable and calculating output variable is covered. The concept of controllability and observabilty and control system design using state space is briefly discussed.

Course Objectives:

The objectives of this course are:

1. Explain modeling of system and to find overall gain of complex system by applying standard reduction technique.
2. Explain time response of first order and second order system and to find system response to test input signals.

3. Explain stability criteria requirement of system in Laplace domain and different stability analysis methods
4. Provide a detailed understanding of state space modelling, analysis and design of system.

Course Outcomes:

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

1. Apply the concept of mathematics, science, engineering fundamentals to formulate model of systems for simple mechanical and electrical system and analyze the model using simulation tools.
2. Apply the knowledge of mathematics, science, engineering fundamentals to find time domain response of system for test input signals analytically and select suitable controller for desired time response and verify the result using simulation tools.
3. Identify the stability of system by applying various stability analysis method and verify the result using simulation tools.
4. Apply the knowledge of mathematics to formulate and analyze state space model of system and design closed loop state model for given time domain specification and verify the result using simulation tools.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
B18EC 4050	CO1	3	3	2	2	3								2		2
	CO2	3	3	2	2	3								2		2
	CO3	2	3	2	3	3								2		2
	CO4	3	3	3	2	3								2		2

Course Contents:

Unit-1: Modeling of Systems [7L+7T+7P]

Modeling and writing Transfer function (Both Electrical & Mechanical), Block Diagram reduction, Signal flow graph. **Case Study**

Unit-2: Time Domain Stability Analysis [7L+7T+7P]

Performance of feedback control system, Test input signals, performance of first order, second order system(No derivation), S-plane Root location and Transfer function, steady state errors, PD, PI, PID controllers. Concept of stability, RH Criteria, Relative Stability.

Root locus: Introduction to root locus, Procedure and problems, Effect of addition of pole zero to open loop systems. Case study

Unit-3: Frequency Domain Stability Analysis [7L+7T+7P]

Introduction to Bode plots Performance measurement from Bode plots, problems on Bode plots case study. Introduction to Nyquist criteria, Relative Stability, Comparison (Time domain & frequency domain), Problems on Time domain & frequency domain, case study

Unit-4: state space analysis: **[7L+7T+7P]**

Introduction, concept of state variable and state model, state model for linear continuous time systems, state variable and linear discrete-time systems, Diagonalization, solution of state equation, concept of controllability and observability, pole placement by state feedback, problems.

Text Books:

1. J. Nagarath and M.Gopal, "Control Systems Engineering", New Age International (P) Limited, Publishers, Fourth edition – 2005
2. K. Ogata, "Modern Control Engineering ", Pearson Education Asia/ PHI, 4th Edition, 2002

Reference Books:

1. W.Bolton, "Instrumentation and control Systems", Addison Wesley Publishing, ISBN: 0 2 -0 1997.
2. Richard Dorf& Robert H Bishop, "Modern Control Systems", Addison Wesley Publishing; ISBN: 0-201-32677-9, 2008.
3. Benjamin C. Kuo and Farid Golnaagi, "Automatic Control Systems", Wiley Student 8th Edition, 2009.
4. Joseph J Distefano III et al., Schaum'sOutlines, "Feedback and Control System", TMH, 2nd Edition 2007.

Lab Experiments

1. Introduction to Control System
2. Time response of first order system
3. Time response of second order system
4. Steady-state Error
5. Stability of system based on pole position
6. Root Locus Analysis.
7. Stability analysis of a system based using Bode Plot
8. Time response of PID controller.
9. Stability analysis of a system using Nyquist Plot
10. Design of control system in state space using pole placement.

B18EC4070	Microcontrollers and Applications Lab	L	T	P	C
Duration :14 Wks		0	0	2	2

Prerequisites:

Number system, combinational circuits, sequential circuits, theory concepts of microcontroller

Course Description:

This course introduces 8051 microcontroller practical and programming aspects to provide basic understanding of architecture, instruction set, assembly level programming, interfacing to various sensors, relays, motors, actuators through various types of serial and parallel communication. Timers and interrupt functions are illustrated through the selection and control activities using suitable programming platforms such as Assemblers, C compilers, Kiel, , etc. This fundamental knowledge on microcontrollers lead to explore large

number of controller families like Raspberry Pi, ATMEGA, TI and PIC that are used in industrial and automation applications.

Course Objectives:

Course objectives are to:

1. Introduce Microcontroller 8051 Architecture.
2. Give an insight into instruction set of microcontroller 8051.
3. Introduce assembly and C programming for 8051.
4. Provide insight into timer, serial communication and interrupts modules of 8051.
5. Interface a microcontroller with peripheral devices.

Course Outcomes:

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

1. Analyze a given problem and design a suitable embedded system using microcontroller 8051.
2. Apply the knowledge of programming in assembly language and C language to receive data, process it and control the various actuators.
3. Summarize the embedded system design and operations using microcontroller 8051.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
	CO1	3	2	1	1	3									2	1
	CO2				1	3									2	1
	CO3										2	1	2			

Lab Experiments

Section-A (Assembly Language Programming)

1. Data Transfer Instructions: Block Data Transfer and Exchange between internal and external Data memory with and without overlap, Sorting, largest and smallest number in an array.
2. Arithmetic Instructions: 32-bit multi-precision Addition, Subtraction, Multiplication of 2 16-bit numbers and Division (16-bit by 8 bit).
3. Logical Instructions: 8x8 multiplication using shift Add technique. ASCII to packed BCD and Vice versa, Code Conversions. Exchange Two numbers without the use of 3rd location. Implementation of Boolean expressions (Bit Manipulation).
4. Timers: Wave form generation with varying Duty Cycle using Interrupt and Polling Techniques.
5. Serial Communication: Serial data transmission with Polling and Interrupt technique (Regular and Look up table).

Section-B (Embedded C Programming)

1. Display the ASCII value of Key pressed on LCD.
2. Count the incoming pulses using counters.
3. DC Motor speed control using external interrupt.
4. Stepper motor interfacing by controlling the steps and direction.
5. Interfacing DAC to generate various waveforms with output voltage varying between -12V to 12V with Amplitude and Frequency control.
   Case Studies on Arduino and RaspberryPi Microcontrollers

B18EC4080	Analog Communication Lab	L	T	P	C
Duration :14 Wks		0	0	2	2

Prerequisites:

Circuit theory, Amplifiers, 555 Timers, Communication basics.

Course Description:

Analog communication laboratory is meant for experiments at the instructional level for undergraduate students. In this course students will conduct experiments to demonstrate the frequency characteristics of an IF amplifier, Amplitude modulation and demodulation, DSB-SC modulation and demodulation, pulse modulation schemes, frequency modulation and demodulation, Pre-Emphasis and De-Emphasis, mixer design. Simulation of amplitude modulation, AM-DSBSC modulation and frequency modulation using LabVIEW/MATLAB programming software. These Experiments helps students to correlate the concepts studied in theory and the results obtained from experiments.

Course Objectives:

The objectives of this course are to:

1. Demonstrate the basics of Analog Modulation/Demodulation principles
2. Provide the understanding of Pulse Modulation/Demodulation Schemes
3. Introduce the basics of Phase locked Loop (PLL), Pre-Emphasis and De-Emphasis
4. Demonstrate AM and FM techniques using LabVIEW/MATLAB programming software

Course Outcomes:

After completion of the course a student shall be able to:

1. Design an IF Amplifier to select a particular signal in super heterodyne Receiver
2. Design AM/FM Modulators and demodulators
3. Apply the concept of Pulse Width Modulation to control a speed of DC motor
4. Apply the concept of PLL to synthesize the frequency

Mapping of Course Outcomes with programme outcomes

Course Code	POS/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
B18EC 4080	CO1	1		3		5			3					2	1	
	CO2	1		3		5			3					2	1	
	CO3	1	2	3	3									1	2	
	CO4	1	2											2	1	

Lab Experiments

1. To Study the Frequency Characteristics of IF Amplifier
2. To Generate Amplitude Modulation and Demodulation.
3. AM-Double Sideband Suppressed Carrier (DSBSC) Generation and Detection
4. Design and test Pulse Amplitude Modulation and Demodulation circuits.
5. Design and test Pulse Width Modulationand Demodulation
6. Design and test Pulse Position Modulation and Demodulation
7. To Generate Frequency Modulated wave for suitable modulation index (β) and Demodulate the signal.
8. Frequency Synthesis using PLL.
9. Design of a Mixer circuit using BJT.
10. To Illustrate Pre-Emphasis and De-Emphasis of a given signal.

Demo experiment:

1. To Demonstrate Frequency Division Multiplexing of two Analog signals.

Challenge Experiments:

1. AM transmitter /Receiver Design and simulation
2. FM transmitter /Receiver Design and simulation

DETAILED SYLLABUS

Semester - V

B18EC5010	Digital Communication	L	T	P	C
Duration: 14Wks		2	1	0	3

Prerequisites:

Fundamentals of Communication, Probability and Random Process.

Course Description:

Digital communication has proliferated in a big way in previous and today's electronic and telecommunication industries. It allows devices to exchange information digitally while making the communication more clear and accurate without losses. In addition to changing our daily lives, the transformation in digital communications paves a way to many applications in fields such as signal processing, video compression, data compression, mobile technology, etc. This course helps students to get a good idea of how the signals are digitized and why digitization is needed. Various waveform coding techniques are discussed in detail. The clear intentions behind choosing an appropriate digital modulation scheme are taught. This course also covers different techniques to share a common channel among multiple devices for data transmission. Finally, it presents various methods of spread spectrum technology in pursuit of achieving secured communication.

Course Objectives:

The objectives of this course are to:

1. Provide the basics of digital Communication with respect to Sampling & Quantization.
2. Introduce the fundamentals of Pulse Code Modulation (PCM), Differential pulse code modulation (DPCM) and Delta Modulation (DM) and Adaptive DM methods.
3. Describe the optimum coherent receivers such as correlation receiver and matched filter receiver for AWGN channel.
4. Familiarize with several digital modulation methods like BPSK, BFSK, QPSK, M-ary QAM , M-ary PSK and DPSK schemes, draw constellation diagrams, and compute their probability of error.
5. Present baseband signal shaping.
6. Render the understanding of multiple access techniques.
7. Provide the notion of spread spectrum technique and familiarize the conceptual elements of spread spectrum.
8. Introduce the applications of spread spectrum.

Course Outcomes:

On completion of this course the student will be able to:

1. Describe the importance of sampling and quantization on signals.
2. Apply suitable coding and multiplexing techniques.
3. Illustrate the different digital modulation techniques with transmitter and receiver.
4. Compare multiple access and spread spectrum techniques.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
B18EC5010	CO1	3	3	1	2								2	1	3	1
	CO2	1	3	1	2								2	1	2	1
	CO3	3	3	1	2								2	1	3	1
	CO4	3	2	1	1								3	1	2	1

Course Contents:

Unit -1: Digital Communication Fundamentals and Sampling Process [7L+7T]

Digital communication System- Advantage, functionality of blocks, transmission medium, Sampling theorem, Natural sampling, Flat top sampling, sample and hold circuit, Quadrature sampling of band pass signal, Quantization noise and SNR ,Robust quantization, Pulse Code Modulation.

Unit -2: Waveform Coding Techniques [7L+7T]

Time division multiplexing, Line coding, Differential pulse code modulation, Delta modulation, errors in delta modulation (Slope overload and granular), Adaptive delta modulation, Coding speech at low bit rate (Adaptive DPCM, Adaptive Sub-band coding).

Unit -3: Optimum Detection and Digital Modulation Techniques [7L+7T]

Optimum Detection: AWGN Channel, Probability of Error, Correlation receiver, Matched Filter receiver, Detection of signals with unknown phase in noise,

Digital Modulation Techniques: Generation, Coherent Detection, Constellation and error probability of BPSK, BFSK, QPSK, M-ary QAM, M-ary PSK, Non-coherent binary modulation techniques-DPSK.

Unit -4: Baseband Shaping, Multiple Access and spread spectrum techniques [7L+7T]

Synchronization, Inter symbol interference, Eye pattern.

Multiple access: TDMA, FDM/FDMA, CDMA, SDMA, OFDM/OFDMA

Spread spectrum –Pseudo noise sequence, Notion of spread spectrum, DSSS- Direct sequence spread spectrum, FHSS-Frequency Hop spread spectrum, application of spread spectrum, Applications of spread spectrum (CDMA and Multipath Suppression).

Text Book:

1. Simon Haykin, “Digital Communication Systems”, John Wiley publication, 3rd edition, 2008.

Reference Books:

1. Simon Haykin, “Digital Communication Systems”, John Wiley publication, 1st edition, 2014.

2. K. Sam Shanmugam, “An introduction to analog and digital Communication system”, John Wiley publication, 3rd edition, 2008.
3. BernadSklar, “Digital Communication”, Pearson education 2007.
4. T L Singal, “Digital Communication”, McGraw Hill Education 2015.

B18EC5020	RF and Microwave Engineering	L	T	P	C
Duration 14 Wks		2	1	0	3

Prerequisites:

Fundamentals of Transmission lines, network theory micro wave frequency, solid state physics, wave theory and optics.

Course Description:

This Course introduces to understand the fundamental principles involved in design, analysis of RF and Microwave transmission lines , Wave guides, Microwave amplifiers Microwave monolithic integrated circuit (MMIC) and theory behind the working of Microwave passive components like Directional coupler, E plane Tee, H- plane Tee – Magic Tee, Circulators –Isolators, Attenuators, cavity resonator and its applications. This course gives perception of Microwave tubes and Microwave Solid state devices and its applications. This fundamental knowledge on Microwave design helps to explore and apply the techniques in design of RF and Microwave systems.

Course Objectives:

The Course Objectives are to

1. To understand the structure and the various electrical parameters related to Microwave transmission lines and Wave guides.
2. To apply the knowledge of microwave theory in distinguishing the applications of Microwave passive and active devices.
3. To understand the working of Microwave Amplifiers and Oscillators
4. To understand the various design parameters for Microwave matching networks and Microwave monolithic integrated circuit (MMIC).

Course Outcomes:

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

1. Analyze the various performance parameters related to Microwave transmission lines and waveguides.
2. Identify Microwave passive and active devices for several applications.
3. Classify Microwave amplifiers and Oscillators
4. Summarize MMIC-materials and fabrication techniques

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC5020	CO1	3	2	2	2					2	3		2	3	1	
	CO2	3	3							2	3		2	2	1	
	CO3	3	2	2	2					2	3		2	2	1	
	CO4	3	3							2	3		2	1	1	

Course Contents:

Unit-1: Transmission Lines [7L+7T]

Introduction, Transmission lines equations and solutions, reflection and transmission coefficients, standing waves and SWR, line impedance Characteristics of Transverse Electric Waves- Group velocity and phase velocity. Smith chart for impedance matching

Unit-2: Wave guides Microwave passive components [7L+7T]

Rectangular wave guides: TE waves and TM waves in Rectangular waveguides, Dominant mode, cutoff frequency in wave guides. Introduction to circular waveguides.

S-parameters Microwave passive Components: Directional coupler, E plane Tee, H- plane Tee – Magic Tee, Circulators –Isolators, Attenuators, cavity resonator.

Unit-3: Microwave Semiconductors and tubes [7L+7T]

Principles of tunnel diodes , Transferred Electron Devices, Gunn diode, Avalanche Transit time devices IMPATT and TRAPATT devices, parametric amplifiers High frequency limitations,

principle of operation of Multicavity Klystron, Reflex Klystron,Traveling Wave Tube, Magnetron (Introduction).

Unit 4: RF-transistor Amplifier Design and Matching Networks [7L+7T]

Amplifier power relation, stability considerations, gain considerations noise figure, impedance matchingnetworks, frequency response, T and Π matching networks, microstripline matching networks.Microwave monolithic integrated circuit (MMIC) materials and fabrication techniques

Text Books:

1. John D. Ryder, “Networks, Lines and Fields”, PHI, 2009.
2. Samuel Y. Liao, “Microwave Devices and Circuits”, Pearson education, 3rd Edition, 2011.
3. Reinhold.Ludwig and Pavel Bretshko ‘RF Circuit Design”, Pearson Education, Inc., 2006.

Reference Books:

1. Robert. E.Collin, “Foundation of Microwave Engg” Mc Graw Hill,2001.
2. Annapurna Das and Sisir K Das, “Microwave Engineering”, Tata Mc Graw Hill Inc., 2004.
3. M.M.Radmanesh, “RF & Microwave Electronics Illustrated”, Pearson Education, 2007.
4. D.M.Pozar, “Microwave Engineering.”, John Wiley & sons, Inc., 2006.

B18EC5030	Digital Signal Processing (I)	L	T	P	C
Duration:14 Wks		2	1	1	4

Prerequisites:

Fourier Transform, Z-transform, LTI System Representation.

Course Description:

The signal for processing is mathematically modeled as a function or a sequence of numbers that represent the state or behavior of a physical system. The examples of the signals range from speech, audio, image and video in multimedia systems, electrocardiograms in medical systems, to electronic radar waveforms in military. Signal processing is concerned with the representation, transformation, and manipulation of signals and the information they contain. For example, we may wish to remove the noise in speech to make it clear, or to enhance an image to make it more natural. Signal processing is one of the fundamental theories and techniques to construct modern information systems. During the last half century, lots of theories and methods have been proposed and widely studied in digital signal processing. In this semester, we only study the Discrete Fourier Transform and Fast Fourier Transform and IIR and FIR filter designs.

Course Objectives:

The objectives of this course are to:

1. Explain the concept of DFT and FFT.
2. Apply the concept of FFT algorithms to compute DFT.
3. Design IIR filter using impulse invariant, bilinear transform.
4. Describe the concept of linear filtering Technique and to demonstrate FIR & IIR filters for digital filter structures.

Course Outcomes:

On completion of this course the student will be able to:

1. Apply the DFT for the analysis of digital signals
2. Explain the different properties of DFT and Compute DFT using FFT algorithms
3. Design and analyze DSP systems like IIR and FIR filters
4. Describe the significance of various filter structures.

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC5030	CO1	3	2	1	1										2	3
	CO2	3	3	2	1										2	
	CO3	3	2	1	1											3
	CO4	1	3	1											1	2

Course Contents:

Unit 1: Discrete Fourier Transforms and its Properties [10L+7T+7P]

The Discrete Fourier Transform (DFT), Time domain concepts of Circular time shift, time reversal, auto correlation and cross correlation. **Properties of the DFT:** Periodicity, Linearity, Circular time shift, time reversal, circular frequency shift, Symmetry Properties, auto correlation, cross correlation, parseval's theorem.

Unit 2: Fast Fourier Transform Algorithms [11L+7T+7P]

Circular Convolution Concept and Its DFT Property, Examples on Time and Frequency domain. A linear filtering approach to computation of the DFT using overlap - add method, efficient computation of the DFT: FFT algorithms, direct computation of the FFT. Radix–2 FFT algorithms.

Unit 3: Design of IIR Filters [10L+7T+7P]

Characteristics of commonly used analog filters and design of Butterworth and chebyshev analog filters. Frequency transformations in the analog domain, design of IIR filters from analog filters, IIR butterworth and chebyshev filter design using impulse invariance, and bilinear transformation method.

Unit 4: Design of FIR Filters and Digital Filter Structures [11L+7T+7P]

Design of FIR filters, Symmetric and Anti symmetric FIR Filter, Design of Linear phase FIR Filter using Windows (Rectangular, Hamming, & Kaiser Windows).

Implementation of Discrete Time System: Direct Form -I, Direct Form II structures, Cascade Form Structures, Parallel Form Structures for IIR systems, Structure for FIR systems: Direct Form, Cascade Form Structures.

Text Books:

1. Proakis & Monalakis, "Digital signal processing – Principles Algorithms & Applications", PHI, 4th Edition, New Delhi, 2007.

Reference Books:

1. Oppenheim & Schaffer, "Discrete Time Signal Processing", PHI, 2003.
2. S.K. Mitra, "Digital Signal Processing", Tata Mc-Graw Hill, 2nd Edition, 2004.
3. Sanjit K Mitra, "Digital signal Laboratory using MATLAB", MGH Edition.2000.
4. Ashok Ambardar, "Digital signal processing: A modern Introduction", Cengage Learning, 2009.

Lab Experiments

A. List of Experiments using MATLab/Octave:

1. Computation of N point DFT of a given sequence using the definition of DFT and plot magnitude and phase spectrum and verify using built in function (using FFT).
2. Obtain the Auto correlation of a given sequence and verify its properties.
3. Obtain the cross correlation of a given sequence
4. Verification of Sampling theorem.
5. Perform the Circular convolution of two given sequences in time domain.
6. Perform Circular convolution of any two given sequences in frequency domain by using DFT and IDFT.
7. Design of digital Low-pass and Butterworth IIR filter to meet the given specifications using Bilinear transformations and verification.
8. Design of digital Low-pass Chebyshev IIR filter to meet the given specifications using Bilinear transformations and verification.
9. Design of digital Low-pass FIR filter to meet the given specifications using windowing technique and verify using Simulink.

B. List of Experiments using DSP Processor and CCS Studio:

1. Computation of N-point DFT of a given sequence.
2. Solving a linear constant coefficient difference equation.
3. Circular convolution of two given sequences.
4. Design and Implementation of IIR digital filter for audio signals.
5. Design and Implmentation of FIR digital filter for audio signals.

B18EC5040	Entrepreneurship and Innovator Skills	L	T	P	C
Duration :14Wks		2	0	0	2

Prerequisites:

No Pre-requisite required

Course Description:

Management and Entrepreneurship will teach you how to start your own business, grow a family business or innovate inside an existing organization. Studying this entrepreneurship will not only provide you with the management skills and entrepreneurial qualities, it will also offer you networking opportunities to enable you to start and run businesses effectively and imaginatively.

Course Objectives:

The objectives of this course are to:

1. Provides a platform to sensitize the hidden entrepreneurial traits of management students.
2. Expose students to the Entrepreneurial and project management concepts and processes used in practice.

Course Outcomes:

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

1. Explain the fundamental concepts and process of managing an Entrepreneurial project.
2. Demonstrate the skill of managing an Entrepreneurial project.
3. Identify & manage an Entrepreneurial project in practice.

Course Code	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC5030	CO1								2	3	3	2			2	3
	CO2								2	3	3	2			2	1
	CO3								2	3	3	2			1	3
	CO4								2	3	3	2			1	2

Course Contents:

Unit-1: Entrepreneurship [7 Hrs]

Meaning, Evolution and Development; Functions of an Entrepreneur; Types of entrepreneur; Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneur – an emerging class. Family Business History: Types and Importance of family business; Succession in family business; Pitfalls of the family business; Improving family business performance.

Unit-2: Creativity and Innovation [7 Hrs]

Sources of New Ideas, Ideas into Opportunities; Creative problem solving: Heuristics, Brainstorming, Synaptic; Sources and Transfer of Innovation. International Entrepreneurship The nature, Importance & Opportunities; International versus domestic entrepreneurship; Entrepreneurship entry into international business, exporting, direct foreign investment, barriers to international trade. Managing growth and diversification: strategies; franchising, joint ventures, Acquisitions and mergers.

Unit-3: Institutions Supporting Entrepreneurs [7 Hrs]

A brief overview of financial institutions in India Central level and state level institutions; SIDBI, NABARD, IDBI, SIDO, Indian Institute of Entrepreneurship, DIC, Single window system; Latest Industrial policy of Government of India; FMME; Guidelines for starting new SMEs. Sources and ways of raising capital; Informal risk capital and venture capital; Business Planning Meaning and Business planning process.

Unit-4: Project Management [7 Hrs]

Definition and Process; Project Management hierarchy programs, projects, processes, activities, tasks; Conceptual idea of the triple constraint: Time, cost, scope; Planning & scheduling Tools Brainstorming, Fishbone diagrams, Bar charts, Gantt Charts, WBS, Network diagrams CPM and PERT – Concept and applications; Accelerating projects “crashing”.

Text books:

1. Hisrich, Robert D. Peters, Michael P. Shepherd, Dean A , "Entrepreneurship", Tata McGraw Hill, 9th Edition, 2014.
2. Vasant Desai, "The Dynamics of Entrepreneurial Development and Management",Himalaya Publishing House, 5th Edition, 2014.
3. Clements, James P. Gido, Jack., "Effective Project Management", Cengage Learning, New Delhi, 2006.
4. Mantel, Samuel J. Meledith, Jack R. Shafer, Scott M , "Project Management : Core Text Book", John Wiley & Sons, New Delhi, 8th Edition, 2012.

B18EC5080	RF and Microwave Lab	L	T	P	C
Duration :14 Wks		0	0	2	2

Prerequisites:

Circuit theory, Electromagnetic field theory and fundamentals of Microwave Engineering.

Course Description:

Microwave Laboratory is meant for experiments at the instructional level for undergraduate students. In this course students will conduct experiments to demonstrate the characteristics of Microwave generators like Klystron tube, GUNN diode and Voltage controlled oscillators. Determine the performance parameters for Directional couplers, Micro strip couplers, Ring resonators, H plane and E-plane Tees. These Experiments helps the students to correlate the concepts studied in theory and the results obtained from experiments.

Course Objectives:

The Course Objectives are to

1. Demonstrate the working of Microwave generators like Klystron Tube, GUNN diode and Voltage controlled Oscillators.
2. Understand the Experimental procedure to Determine the S parameters of Microwave passive components like Directional couplers, Power dividers, Magic tees
3 Understand the experimental procedure to determine the performance parameters of Microstrip power dividers , Phase shifters and circulators.

Course Outcomes:

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

1. Demonstrate the working of microwave bench to measure frequency, Wavelength, guided wavelength of Microwave oscillations.
2. Determine different parameters like Insertion loss, Coupling loss, Directivity of Directional Couplers, Power dividers, Phase shifters and Circulators as applicable to passive components.
3. Determine the S parameters of H-plane, E-plane and Magic Tees

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC5080	CO1	3	2	2	2					2	3		2	3	1	
	CO2	3	3							2	3		2	2	1	
	CO3	3	2	2	2					2	3		2	2	1	

Lab Experiments

1. Identification and study Microwave Components in a microwave bench
2. Study the Characteristics of Klystron Tube
3. Study the characteristics of GUNN oscillator
4. Measurement of frequency of microwave source and demonstrate relationship among frequency, free space wave length and guided wave length.
5. Measurement of insertion loss and isolation loss of directional coupler
6. Measurement of scattering matrix of Magic Tee
7. Measurement of scattering matrix of E plane and H plane Tee
8. Measurement of insertion loss of various cables, microwave devices
9. Study of VCO characteristics like Tuning voltage Vs frequency, Frequency Vs power output up to 10GHz
10. Study of phase shifter and calculate the degree of phase shift
11. Determination of coupling and isolation characteristics of strip line directional coupler.
12. Measurement of resonance characteristics of micro strip ring resonator.
13. Measurement of power division and isolation characteristics of micro strip 3 dB power Divider

Challenging Experiments

1. Study of open source microwave software to design microwave experiments
2. Design of transmission line using software for a given parameter
3. Mini project on Microwave design.

B18EC5090	Digital Communications Lab	L	T	P	C
Duration :14 Wks		0	0	2	2

Prerequisites:

Fundamentals of communications

Course Description:

Digital communication has proliferated in a big way in previous and today's electronic and telecommunication industries. It allows devices to exchange information digitally while making the communication more clear and accurate without losses. In addition to changing our daily lives, the transformation in digital communications paves a way to many applications in fields such as signal processing, video compression, data compression,

mobile technology, etc. This course helps students to get a good idea of how the signals are digitized and why digitization is needed. Various waveform coding techniques are discussed in detail. The clear intentions behind choosing an appropriate digital modulation scheme are taught. This course also covers different techniques to share a common channel among multiple devices for data transmission. Finally, it presents various methods of spread spectrum technology in pursuit of achieving secured communication.

Course Objectives:

The objectives of this course are to:

1. Demonstrate the Digital communication experiments.
2. Verify Sampling theorem for different frequencies.
3. Demonstrate different waveform coding techniques.
4. Demonstrate different digital modulation techniques.
5. Demonstrate losses and multiplexing techniques over an OFC.

Course Outcomes:

On completion of this course the student will be able to

1. Develop ability to verify sampling theorem.
2. Demonstrate multiplexing of two signals.
3. Construct the circuits for various digital modulation techniques.
4. Develop ability to generate PCM signals.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC5090	CO1	1	2	3	3									1	2	1
	CO2	1	2	4	3									1	2	2
	CO3	1	2	2	3									1	2	3
	CO4	2	2	3	3									1	2	3

Lab Experiments

All Experiments can be conducted using discrete components after testing with available kits

1. Verification of Sampling Theorem
2. TDM of two band limited signals.
3. ASK generation and detection
4. FSK generation and detection.
5. PSK generation and detection.
6. DPSK generation and detection.
7. QPSK generation and detection.
8. PCM generation and detection using a CODEC Chip.
9. Optical Fiber (Attenuation loss, Bending loss, Numerical aperture).
10. Analog and digital (with TDM) communication link using OFC.
11. Delta Modulation.

12. Adaptive delta modulation.
13. Line coding and decoding

Challenge Experiments

14. Verification of Channel capacity theorem (MATLAB Simulation)
15. a. FSK generation and Detection(MATLAB Simulation)
    b. Modify the above simulation to get BER < 10^{-6}
    c. Demonstrate Constellation diagram

DETAILED SYLLABUS

Semester – VI

B18EC6010	Antenna and Wave Propagation	L	T	P	C
Duration :14 Wks		2	1	0	3

Prerequisites:

Basics of Electromagnetic field Theory, Vector Algebra, Transmission Lines, Microwave theory.

Course Description:

This course introduces to understand the principle involved in Radiation mechanism in Antenna which is a primary component in Wireless communication system. The course defines all related antenna terminologies for evaluation of performance of different structures of antennas and to comprehend the fundamental and advanced topics in Antenna and its properties, which in turn with Communication Engineering designs. After studying this Course the student will be able to develop the analytical skills in designing the antenna and acquaint with the industry requirements in Telecom defense and Space organization regarding antenna design and analysis. Students can analyze the various losses in the signal flow in different propagation.

Course Objectives:

The Course Objectives are to

1. Understand the basic terminologies related to antenna in wireless communication applications.
2. Apply the knowledge of antenna arrays in designing and analyzing Broadside and End fire arrays.
3. Acquainted with design of Micro strip patch antennas and feeding mechanism.
4. Understand the basic concepts of Electromagnetic Wave propagation

Course Outcomes:

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

1. Analyze the various performance parameters related to antenna in wireless communication applications
2. Differentiate the types of antenna arrays and types of Antennas for RF and Microwave applications.
3. Analyze The Micro strip patch and antenna and feeding mechanism.
4. Summarize the characteristics of different types of Wave propagation

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC6010	CO1	3	2	2	2					2	3		2	3	1	
	CO2	3	3		1					2	3		2	2	1	
	CO3	3	2	2	2					2	3		2	2	1	

	CO4	3	2		1					2	3		2	1	1	

Course Contents:

Unit-1: Antenna Fundamentals [7L+7T]

Introduction to antenna, advantages ,Parameters of antenna:-Radiation Pattern, Radiation intensity, Solid angle, Beam width, directivity and gain, Relationship b/w directivity and beam area and effective aperture , Effective length ,Bandwidth and polarization, efficiency and radiation, Antenna temperature and field zone, Friss free space equation.

Unit-2: Antenna Array and Point Source [7L+7T]

Array of two isotropic point sources and its types, n-element broadside array and end fire array, short dipole(no field derivation required), radiation resistance of short dipole and half wave dipole with derivation, folded dipole , Slot antenna and its radiation phenomenon. Horn ,Yagi-uda antenna, Parabolic and Helical antenna.

Unit-3: Microstrip antenna Design [7L+7T]

Basic characteristics of patch antennas , feeding mechanism method of analysis ,Rectangular patch antenna design using transmission model. Introduction to smart antennas

Unit-4: Wave Propagation [7L+7T]

Ground wave propagation, free space propagation, ground reflection, multipath phenomenon, surface wave propagation, fading, diversity, tropospheric scatter, ionosphere propagation, electrical properties of ionosphere.

Text Books:

1. Constantine Balanis A., "Antenna Theory: Analysis and Design", John Wiley and Sons, 3rd Edition, 2012.
2. John d. Krauss, "Antennas and Wave propagation" McGraw-Hill International 4th Edition, 2010
3. Harish and Sachidananda." Antennas and Wave Propogation"., Oxford press.

Reference Book: 1. John d

Krauss, "Antennas and Wave propagation" McGraw-Hill International 4th Edition, 2010

B18EC6020	CMOS VLSI Circuits	L	T	P	C
Duration :14Wks		3	0	0	3

Prerequisites:

Semiconductor Physics and devices, BJTs and FETs, Digital Electronics.

Course Description:

The course introduces basic theories and techniques of digital VLSI design using CMOS and its variants. The student will understand how the digital circuits can be integrated into the semiconductor chip (ICs). The students will develop the skills required to become VLSI designers, researchers and design tool builders. The course is conceptual, problematic and application oriented.

Course Objectives:

The objectives of this course are to:

1 Understand the characteristics of CMOS circuits
2 Provide knowledge to design integrated circuits using Computer Aided Design (CAD) Tools.
3 Describe the general steps required for processing of ICs
4 Design of digital sub blocks of integrated circucits
5 Introduce the concepts and techniques of modern integrated circuit design and testing.

Course Outcomes:

On completion of this course the student will be able to:

1 Illustrate the engineering behind the design and analysis of integrated circuits with fabrication technology details.
2 Sketch the physical design/layouts in CMOS and nMOS technology
3 Contrast different flavors of CMOS technology.
4 Express the basic storage concept ,memory circuits and VLSI testing concepts

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC6020	CO1	1	2	3		3				2	3			1	2	3
	CO2		2	3	1	2				2	3			1	2	3
	CO3	2	1		3					2	3			1	2	
	CO4	1			2	3				2	3			2	1	

Course Contents:

Unit 1: Basic MOS Technology [11 Hrs]

Integrated circuits era. Moore's law and its implications. Classification of MOS transistors, Enhancement mode transistor action, depletion mode transistor action, NMOS IC fabrication. CMOS, N-well, P-well and Twin tub process details. Introduction to BiCMOS technology.

MOS Transistor Theory: Introduction, MOS Device Design Equations, second order effects, The Complementary CMOS Inverter – DC Voltage Transfer Characteristics, Noise margin. Static Load MOS Inverters. Pass transistors transmission Gate, problems on pass transistors and TGs, CMOS Tristate Inverter.

Unit 2: Circuit Design Process [10 Hrs]

Stick Diagrams and Layout of Digital Circuits Stick diagram concept, examples for standard gates. Design Rules, Basic Physical Design/Layout of logic gates and logic functions.

Unit 3: CMOS Logic Structure [11 Hrs]

Basic Circuit Concepts: MOS layers. Sheet resistance, Area capacitances, Capacitance calculation, Delay UNIT, Inverter delays, Problem of driving large capacitive loads.

CMOS Logic Structures CMOS Logic, Bi CMOS Logic, Pseudo-NMOS Logic, Dynamic CMOS Logic, Clocked CMOS Logic, Pass Transistor Logic, CMOS Domino Logic and Cascaded Voltage Switch Logic (CVSL)

Unit 4: Memories and Testing **[10 Hrs]**

Memory: Timing considerations, Memory elements, Memory cell arrays.

Testing and Verification: Introduction, Testers, Test Fixtures and Test Programs, Logic Verification Principles, Manufacturing Test Principles, DFT

Text Books:

1. Neil H. E. Weste, David Money Harris, "CMOS VLSI Design- a circuits and systems perspective", 2th Edition, Addison-Wesley, 2010.
2. Sung- Mo Kang and Yusuf Leblebici, "CMOS Digital Integrated Circuits: Analysis and Design", Tata McGraw-Hill, 3rd Edition, 2007.
3. Douglas A Pucknell, Kamran Eshraghian "Basic VLSI DESIGN" , EEE 3rd Edition

Reference Books:

1. R. Jacob Baker, "CMOS Circuit Design, Layout and Simulation", John Wiley India Pvt. Ltd, 2008.
2. Wayne Wolf, "Modern VLSI Design: System on Silicon", Prentice Hall PTR/Pearson Education, 2nd Edition, 1998.

B18EC6030	Computer Communication and Networks (I)	L	T	P	C
Duration:14 Wks		3	0	1	4

Prerequisites:

Digital Communication, C and C++.

Course Description:

The main objective of this course is to provide a foundational view of communication networks: the principles upon which the Internet and other computer networks are built; how those principles translate into deployed protocols and hands-on experience on solving challenging problems with network protocols. Computer communication networks course will include topics such as link-layer technology, routing protocols, the Internet Protocol, reliability, flow control, congestion control, and their embodiment in TCP and UDP. The course will involve a significant amount of network simulator tool to design the basic network topologies and protocols

Course Objectives:

The objectives of this course are to:

1. Understand the basics of data communication and networking.
2. Classify multiple access methods and identify different LANs.
3. Illustrate functions of network layer and Demonstrate different routing protocols
4. Discuss transport layer and application layer protocols

Course Outcomes:

On completion of this course the student will be able to:

1. Explain the fundamental concepts of basic networking, Protocols, Standards and Layered models
2. Differentiate multiple access methods and LANs
3. Demonstrate the concepts of network layer and build sub-nets and routing mechanism.
4. Evaluate different transport t layer protocols and application layer protocols

Mapping of Course Outcomes with Program Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC6030	CO1	3	2	1											2	1
	CO2	3	2	1											2	1
	CO3	3	2	1		3								3	2	1
	CO4	3	2	1		3								3	2	1

Course Contents:

Unit-1: Introduction to Data Communication and Networking. [11L+7P]

Layered tasks, OSI Model, TCP/IP Suite, and Comparison of OSI Model & TCP/IP Suite. Addressing of TCP/IP Model. Framing, Flow and Error Control, Protocols**:** Noiseless channels and noisy channels, HDLC

Unit-2: Multiple Access &LANs. [10L+7P]

Random access, Controlled access, Channelization. Wired LAN, Ethernet, IEEE standards, Standard Ethernet. Changes in the standards, Fast Ethernet, Gigabit Ethernet, Wireless LAN IEEE 802.11

Unit -3: Network Layer. [11L+7P]

Network Layer**:** Logical addressing, Ipv4 addresses, Ipv6 addresses, Internetworking, Ipv4 Header Format and Ipv6 Header Format, Transition from Ipv4 to Ipv6. Distance vector routing, link state routing.

Unit-4: Transport layer & Application Layer. [11L+7P]

Process to Process Delivery, UDP, TCP, SCTP, Domain Name System, Resolution,

Text Books:

1. B Forouzan “Data Communication and Networking”, 4th Ed, TMH 2006.

Reference Books:

1. James F. Kurose, Keith W. Ross “Computer Networks”, Pearson Education, 2nd Edition, 2003.
2. Wayne Tomasi”Introduction to Data communication and Networking” Pearson Education 2007.
3. S. Keshav, “An Engineering Approach to Computer Networking”, Pearson Education.

Lab Experiments

Part A (Programs [illegible])

1. Write a program for bit stuffing & de-stuffing using HDLC.
2. Write a program for character stuffing & de-stuffing using HDLC.
3. Perform the Encryption and Decryption of a given message using substitution method.
4. Choose the two prime numbers, p=17 and q=11.Write a program for public key encryption system using RSA algorithm to encrypt and decrypt the message.
5. Write a program to implement the congestion control b using the leaky bucket algorithm. Examine node transmitting/receiving packets to/from other nodes. Using a random function; vary the packet size.
6. Write a program for distance vector algorithm to find the shortest path for transmission.

Part B – Programs on Networking

1. Create a three node network topology and connect the duplex links between them. Tcl script to observe the packet flow for the given network in network animator (NAM)
2. Simulate a four node point-to-point network, and connect the links as follows: n0-n2, n1-n2 and n2-n3. Apply TCP agent between n0-n3, n1-n3. Apply relevant applications over TCP agents by changing the parameters and hence determine the number of packets transmitted.
3. Simulate a four node point-to-point network, and connect the links as follows: n0-n2, n1-n2 and n2-n3. Apply UDP agent between n0-n3, n1-n3. Apply relevant applications over UDP agents by changing the parameters and hence determine the number of packets transmitted.
4. Simulate a three nodes point-to-point network and connect the duplex links between them. Set the queue size, vary the transmission speeds (bandwidth)and find the number of packets dropped.
5. Simulate an Ethernet LAN using N-nodes (6-10) with UDP/TCP connection. Apply relevant applications over UDP/TCP agents by changing the parameters and hence determine the number of packets transmitted.
6. Simulate a wireless network for n nodes. For a wireless network consisting of three mobile nodes (n0-n2), Nodes are configured with the specific parameters of a wireless node. Initial location of the node is fixed. Nodes are given mobility with fixed speed and fixed destination location. TCP agent is attached to node0 and TCP sink agent is attached to node1. Both the agents are connected and FTP application is attached to TCP agent. Write a Tcl script and make an ad-hoc simulation to analyze the output in the trace file. Use the routing protocol as Adhoc on demand distance vector (AODV).

B18EC6070	Antenna Lab	L	T	P	C
Duration :14 Wks		0	0	2	2

Prerequisites:

Electromagnetic field theory Microwave and antenna concepts.

Course Description:

Antenna lab is meant for experiments at the instructional level for undergraduate students. In this course students will conduct experiments to plot the radiation patterns of Horn antenna, E-sectorial, H-sectorial ,

Dish antennas in X band, Micro strip Mono pole, Yagi antenna, Slotted array antennas in C band. These experiments will help in determining the Directivity, Gain and efficiency of tested antennas.

Course Objectives:

The course objectives are to:

1. Demonstrate the working Horn antenna, Sectorial and Dish antennas in X band range.
2. Understand the Experimental procedure to Determine Directivity, Gain and Efficiency of Microstrip patch antennas.
3. Understand the experimental procedure to find the VSWR for various types of loads connected to Rectangular Wave guide.

Course Outcomes:

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

1. Demonstrate the working of Horn, Sectorial, Dish antenna in X band to plot the radiation pattern.
2. Determine different parameters like Directivity, Gain and efficiency of Microstrip patch antennas.
3. Determine the VSWR for different loads connected to Microwave bench.

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC6070	CO1	3	2	2	2					2	3		2	3	1	
	CO2	3	3		1					2	3		2	2	1	
	CO3	3	2	2	2					2	3		2	2	1	

Lab Experiments

1. Measure the gain, directivity of Pyramidal Horn Antenna.
2. Measure Gain, Directivity of Parabolic Disc Antenna.
3. Plot Radiation Pattern of Horn Antenna, E Sectorial Horn Antenna, H Sectorial Antenna.
4. Study of various types of antennas with defective ground plane
5. Measure of Co Polarization and Cross Polarization level of an antenna.
6. Measure the variation of Field Strength/Inverse Square Law.
7. Plot Radiation of Array Antenna.
8. Impedance Measurement of various types of loads using smith chart.
9. Measure VSWR, Reflection Co-efficient of Given Antenna.
10. Plot Radiation Pattern of Wired Mono Pole Antenna, Slot patch Antenna, Antenna with Defective Ground Plane.
11. Study frequency scanning of an array antenna
12. Determine Gain, directivity, Band Width of a given Micro strip Patch Antenna

Challenge Experiments:

Design of micro-strip antenna using HFSS

B18EC6080	CMOS VLSI Circuits Lab	L	T	P	C
Duration:14 Wks		0	0	2	2

Prerequisites:

Digital Electronics, fundamentals of CMOS

Course Description:

The lab introduces basic theories and techniques of digital VLSI design using CMOS and its variants. The student will understand how the digital circuits can be integrated into the semiconductor chip (ICs). The students will develop the skills required to become VLSI designers, researchers and design tool builders. The course is conceptual, problematic and application oriented.

Course Objectives:

The course objectives are to:

1. Introduce the concepts and techniques of modern integrated circuit design and testing
2. Provide experience in designing integrated circuits using Computer Aided Design (CAD) Tools.
3. Be able to design CMOS combinational and sequential logic at the transistor level, with mask layout.

Course Outcomes:

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

1. Design and implement digital integrated circuits
2. Measure the performance parameters of digital integrated circuits & systems using CAD tools
3. Demonstrate and calculate device parameters & system aspects of analog IC design

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC6080	CO1	2	3	1		1				1	2	3		1	2	2
	CO2		2	1	1	1				1	2	3		1	2	2
	CO3	2	1		1	1				1	2	3		1	2	2

Lab Experiments

Part A

Basic Digital Gates

Write Verilog Code for the following circuits and their Test Bench for verification, observe the waveform and synthesize the code with technological library with given constraints*. Do the initial timing verification with gate level simulation.

1. CMOS Inverter
2. CMOS Buffer
3. Transmission Gate
4. Basic/universal gates

5. Flip flops - RS, D, JK, MS, T
6. Serial & Parallel adder
7. 4-bit counter [Synchronous and Asynchronous counter]
8. Adder circuits – full adder cascading to build 4-bit parallel adder (RCA)

Part B
Analog Circuits

1. Design the circuit of CSA with given specifications*, completing the design flow mentioned below:
a. Draw the schematic and verify the following
i) DC Analysis
ii) AC Analysis
iii) Transient Analysis
b. Draw the Layout and verify the DRC, ERC
c. Check for LVS

2. Design the circuit of CDA with given specifications*, completing the design flow mentioned below:
a. Draw the schematic and verify the following
i) DC Analysis
ii) AC Analysis
iii) Transient Analysis
b. Draw the Layout and verify the DRC, ERC
c. Check for LVS

3. Design an op-amp with given specification** using given differential amplifier Common source amplifier in library*** and completing the design flow mentioned below:
a. Draw the schematic and verify the following
i) DC Analysis
ii). AC Analysis
iii) Transient Analysis
b. Draw the Layout and verify the DRC, ERC

4. Design a 4 bit R-2R based DAC for the given specification and completing the design flow mentioned using given op-amp in the library***.
a. Draw the schematic and verify the following
i) DC Analysis
ii) AC Analysis
iii) Transient Analysis
b. Draw the Layout and verify the DRC, ERC

* An appropriate constraint should be given.
** Appropriate specification should be given.
*** Applicable Library should be added & information should be given to the Designer.

NOTE: The design handouts to be given to students wherever required

DETAILED SYLLABUS

Semester: VII

B18EC7010	Internet of Things & Cyber Physical Systems (I)	L	T	P	C
Duration:14 Wks		3	0	1	4

Prerequisites:

Embedded systems, Computer concept networking Course

Course Description:

IoT is the technology enabling the inter-connection of all types of devices through the internet to exchange data, optimize processes, monitor devices in order to generate benefits for the industry, the economy, and the end user. It is composed of network of sensors, actuators, and devices, forming new systems and services. Many protocols are used for faithful transmission data based on the applications. The Cyber Physical Systems (CPS) is an engineering discipline and specifies the integrations of and interaction between computation and physical processes. CPS integrates the dynamics of the physical processes with those of the communications, computation and networking, and analysis techniques for the integrated systems.

Course Objectives:

The objectives of this course are to:

1. Discuss the architecture of Internet of Things and connected world.
2. Contrast various hardware, communication and sensing technologies, cloud services to build IoT applications
3. Understand about modelling of cyber-physical systems
4. Describe the design of cyber physical system.

Course Outcomes:

On completion of this course the student will be able to:

1. Describe the IoT system architecture and system design.
2. Use protocols, cloud services and communication API's for developing Applications
3. Apply the core principles behind Cyber physical system
4. Discuss the abstraction in designing the cyber physical system

Mapping of Course Outcomes with Program Outcomes

Course Code	CO# / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
B18EC7010	CO1	3	2	3	2	3	2	2		1		1		3	2	3
	CO2	3		3		3								3	2	3
	CO3	3	2	3	2	3					2			3	3	3
	CO4	3	1				1							3	2	

Course Contents:

Unit -1: Introduction & Concepts of IoT [7L+7P]

IoT Definition & Characteristics of IoT, Physical Design of IoT: Thing in IoT, IoT Protocols, Logical Design of IoT: Function Block, Communication Models, Communication API, IoT Enabling Technologies: WSN, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded System, IoT Levels and Deployment Templates, Applications of IoT

Unit -2: IoT System Design [7L+7P]

IoT Design methodology, IoT Protocol – MQTT, CoAP, Introduction to Cloud storage Models: WAMP, Xively Cloud for IoT, Python Web Application Framework-Django, Designing a RESTful based Web API. Data Analytics for IoT – Apache Hadoop, Apache Oozie. Case studies illustrating IoT design – Home Automation, Cities, Environment, Agriculture

Unit -3: Introduction & Modelling of Cyber Physical System [7L+7P]

Definition & Example of CPS system, Design Process, Modelling Dynamic Behaviours – Continuous Dynamics: Newtonian Mechanics, Actor Model, Discrete Dynamics: Discrete Systems, Notion of State, Finite-State Machines, Extended State machines

Unit -4: Designing of Cyber Physical System [7L+7P]

Embedded architecture: Types of processors, Parallelism, Pipelining, Multicore Architectures, Multitasking: Process, Process Management, States of Process, Process Schedulers, Process Control Block, Interrupts, Threads & its types. Scheduling: Levels, Different of Types, Different process scheduling algorithms.

Textbooks:

1. Arshdeep Bagha and Vijay Madisetti Internet of Things: A Hands-on Approach
2. Edward A. Lee and Sanjit A. Seshia, "Introduction to Embedded Systems, A Cyber-Physical Systems Approach", Second Edition, MIT Press

Reference Books:

1. Pethuru Raj and Anupama C. Raman (CRC Press), The Internet of Things: Enabling Technologies, Platforms and Use Cases
2. Adrian McEwen, Hakim Cassimally, 'Designing the Internet of Things', Wiley, 2014.
3. Olivier Hersent, David Boswarthick, Omar Elloumi, 'The Internet of Things: Key Applications and Protocols', Wiley, 2015.
4. Rajeev Alur, "Principles of Cyber-Physical Systems", MIT Press
5. Danda B. Rawat, Joel J.P.C. Rodrigues, Ivan Stojmenovic, "Cyber-Physical Systems: From Theory to Practice", CRC Press

Internet of Thing and Cyber Physical System lab

List of Experiments:

1. To simulate an IoT based smart home wireless system using cisco packet tracer
2. To simulate an IoT based smart home wired system using cisco packet tracer
3. To simulate an IoT based automate web camera system using cisco packet tracer
4. To simulate an IoT based smart RFID system using cisco packet tracer
5. To simulate an IoT based automatic lawn sprinklers system using cisco packet tracer
6. To simulate an IoT based smoke detection with fire prevention system using cisco packet tracer
7. To simulate an IoT based humidity monitoring system through programming the MCU using cisco packet tracer
8. To simulate an IoT a smart streetlamp system by programming the MCU using cisco packet tracer
9. To simulate the working of IoT protocol (MQTT) using cisco packet tracer
10. To Simulate an IoT smart home system with has an internet service provider, cable model client & 3g/4g cell client using cisco packet tracer.

SC-1

B18EC3061	Instrumentation Engineering	L	T	P	C
Duration: 14Weeks		3	0	0	3

Prerequisites:

Engineering Physics, Principles of Electronics.

Course description:

Instrumentation Engineering refers to the study of all measuring instruments that are required for engineering the systems. This course deals with measuring equipments such as voltmeter, multimeter, signal generator, function generator, bridges and transducer. Principal and working of all the above equipments is dealt in detail. This course also covers measurement errors faced during engineering the systems.

Course Objectives:

The objectives of this course are to:

1. Illustrate various measurement errors.
2. Analyze the operation of different voltmeters and multimeters, signal generators.
3. Appraise different electronic component measuring methods.
4. Evaluate various transducers used in electronic applications.

Course Outcomes:

On completion of this course the student will be able to,

1. Identify various types of measurement errors in measuring instruments.
2. Evaluate the concepts of voltmeters, multimeters and function generators.
3. Analyze the circuits used for the measurement of Resistance, Capacitance, Inductance, and Frequency.
4. Demonstrate the application of different transducers.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC3061	CO1	3	3	1										3	3	3
	CO2	3	2	1										3	3	3
	CO3	3	2	1										3	3	3
	CO4	3	2	1										3	3	3

Course Contents:

Unit-1: Introduction **[10 Hrs]**

Measurement Errors: Introduction, Significance of measurements, methods of Measurements, Gross errors and systematic errors, Absolute and relative errors, Accuracy, Precision, Resolution and Significant figures.

Oscilloscope: Principle of operation and specifications.

Unit-2: Voltmeters and Multimeters **[11 Hrs]**

Introduction, Multirange voltmeter, extending voltmeter ranges, Loading, AC voltmeter using Rectifiers – Half wave and full wave, Peak responding and True RMS voltmeters

Digital Voltmeters: Introduction, RAMP technique, DVM's based on V–T, V–F and Successive approximation principles, $3\frac{1}{2}$ Digit, Resolution and sensitivity, Digital Multimeters, Digital frequency meters, Digital measurement of time: Time base selector, Time measurement.

Unit-3: Signal Generators **[10 Hrs]**

Introduction, Fixed and variable AF oscillator, Standard signal generator, Laboratory type signal generator, AF sine and Square wave generator, Function generator, Square and Pulse generator, Sweep generator, Frequency synthesizer.

Unit-4: Bridges and Transducers **[11 Hrs]**

Measurement of resistance, inductance and capacitance: Introduction, Wheatstone's bridge, Kelvin Bridge, AC bridges, Capacitance Comparison Bridge, Maxwell's bridge, Wien's bridge, Wagner's earth connection.

Transducers: Introduction, Electrical transducers, selecting a transducer, Resistive transducer, Resistive position transducer, Strain gauges: Resistance wire gauge, Inductive transducer, Differential output transducer and LVDT.

Text Books:

1. H. S. Kalsi, "Electronic Instrumentation", TMH, Third edition 2012
2. David A Bell, "Electronic Instrumentation and Measurements, Pearson Education, 2006.

Reference Books:

1. John P. Beately, "Principles of measurement systems", 3rd Edition, Pearson Education, 2000
2. Cooper D & A D Helfrick, "Modern electronic instrumentation and measuring techniques", PHI, 1998.

B18EC3062	Computer Organization and Architecture	L	T	P	C
Duration :14 Wks		3	0	0	3

Prerequisites:

Basic electronics, Numbering system, Digital fundamentals

Course Description:

The course covers the basic principles of computer organization, operation and performance and peripheral devices. It provides an overview of computer hardware and software and how the basic functional units are interconnected to form a complete computer system. The basics of I/O data transfer synchronization, interrupts and Direct Memory Access methods are presented. Bus protocols and standards are also presented with PCI, SCSI, and USB standards being used as representative commercial examples. Detailed coverage of the use of pipelining and multiple function units in the design of high-performance processors.

Course Objectives:

Course objectives are to:

1. Illustrate the fundamental concepts of computer system architecture.
2. Interpret significance of interrupts.
3. Differentiate the various ways of communicating with I/O devices and standard I/O interfaces.
4. Examine the different hierarchical memory system including cache memories and virtual memory.

Course Outcomes:

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

1. Summarize the computer system organization and its operations
2. Appraise the concepts of hardware interface.
3. Interpret the various bus operations and protocols
4. Distinguish the different types of memories and their performance.

Mapping of Course Outcomes with Program Outcomes

Course Code	POS/ COs	PO 1	P2	PO 3	PO 4	PO 5	PO 6	P7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC3062	CO1	1						3			2	3	3	3		
	CO2	1	2					3		1	2	3	3	3		
	CO3	1	2	2			1	3		1	1		3	3	2	
	CO4	1	2	3			1	3				2	3			

Course Contents:

Unit-1: Basic Structure of Computers: [11Hrs]

Computer types, Functional units, Basic operational concepts, Bus structures, Performance-processor clock, Basic performance equation, clock rate, performance measurement.

Machine Instructions and Programs: Numbers, arithmetic operations and characters, Memory location and Addresses, Memory operations, Instructions and instruction sequencing, Addressing modes, Assembly language, Stack and Queues and Subroutines.

Unit-2: Basic Input/Output and Processing Unit [10Hrs]

Accessing I/O Devices; Interrupts; enabling and disabling interrupts, Handling multiple devices, Device requests, Exceptions.

Basic processing unit: Instruction Execution, Load Instructions, Arithmetic and Logic Instructions, Store Instructions, Hardware Components, Register File, ALU, Datapath.

Unit-3: Input/output Organization [10Hrs]

Direct Memory Access, Bus Operation:Synchronous Bus,Asynchronous Bus, Arbitration, Interface Circuits, Parallel Interface, Serial Interface, Interconnection Standards: Universal Serial Bus (USB), PCI Bus, SCSI Bus, UART.

Unit-4: Memory system [11Hrs]

Basic Concepts, Semiconductor RAM Memories, Static Memories, Dynamic RAMs, Synchronous DRAMs, Read-only Memories, ROM, PROM, EPROM, EEPROM, Flash Memory, Memory Hierarchy, Cache Memories, Performance Considerations, Virtual Memory.

Text Book:

1. Carl Hamacher, Z Varnesic and S Zaky, "**Computer Organization**", Fifth Edition, McGraw Hill 2002.

Reference Books:

1. David A. Patterson and John L. Hennessey, "Computer Organization and Design", Fifth edition, Morgan Kauffman / Elsevier, 2014.

2. William Stallings “Computer Organization and Architecture”, Seventh Edition , Pearson Education, 2006.
3. Morris Mano, “Digital Logic and Computer Design”, Pearson Education Asia.
4. Morris Mano and Charles R Kime, “Logic and Computer Design Fundamentals”, Second Edition, Pearson Education Asia.

B18EC3063	Object oriented Programming using C++ (I)	L	T	P	C
Duration :14Wks		3	0	0	3

Prerequisites:

Programming with C.

Course Description:

The purpose of this course is to provide the solid foundations in the basic concepts of C++ programming language. The C++ Programming Language are a very important to develop Application Software, System Software, Operating Systems, and Network Simulators as it employees Object Oriented Programming (OOP) aspect. This course has important features of OOP like Polymorphism, Inheritance, and exception handling, which are not present in C Programming Language. By studying this course, it will help students to get placed in IT Company.

Course Objectives:

The objectives of this course are to:

1. Discuss insights of object oriented programming (OOP) features and basics of C++ language.
2. Explain the syntax and Semantics of the C++ language as well as basic data types offered by the language.
3. Implement the fundamental OOP concepts like Classes, Objects, Inheritance and Polymorphism.
4. Discuss advanced C++ features file handling and exception handling.

Course Outcomes:

After completion of the course a student will be able to

1. Identify and classify C++ data types and operators.
2. Apply object-oriented features like classes and objects in C++ programs.
3. Demonstrate and use the concept of inheritance and polymorphism for code reusability.
4. Apply concepts like exception handling, threads, and files to write robust programs in C++.

Mapping of Course Outcomes with Program Outcomes

Course Code	POS / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC3063	CO1	3	3	2		2				2			1	3	3	3
	CO2	3	3	3		3				2			1	3	3	3
	CO3	3	3	3		2				2			1	3	3	3
	CO4	3	3	3		3				2			1	3	3	3

Course Contents:

Unit-1: The Basic C++ Language [11 Hrs]

The General Form of a C++ Program, Basic Datatypes: Literal, Variables, const-Qualifier, Pointer, Strings, Reference, Bool, Enumeration, Array types. Operators: Arithmetic Operators, Equality, Relational and Logical operators, Assignment operators, Increment and Decrement operator, Conditional Operator, Branching and Looping Statements.

Teaching is supported by programming examples

Unit-2: Classes and Objects [10 Hrs]

Functions, Procedure Oriented vs Object-Oriented Programming, Features of Object-Oriented Programming, Class, Object, Data Member, Member Functions, Static Class Members, Constructors and its Types, Destructors, Friend Functions, Dynamic Memory allocation-New and Delete Keywords.

Teaching is supported by programming examples

Unit-3: Inheritance and Polymorphism [11 Hrs]

Inheritance: Different types of Inheritances, Single Inheritance – Public, Private and Protected. Multiple Inheritance, Polymorphism: Introduction, Compile Time Polymorphism (function overloading) and Run Time Polymorphism(Virtual Functions).Operator Overloading: + operator

Teaching is supported by programming examples

Unit-4: Files and Exception Handling [10 Hrs]

Files and Streams: Opening a file, Closing a file, Writing to a file, Reading from a file, File Position Pointers. Exception Handling: Exception handling fundamentals, Throwing exceptions, Catching exceptions, Standard Exceptions, Defining a New Exception.

Teaching is supported by programming examples

Text Books:

1. Stanley B. Lippmann, JoseeLajore: "C++ Primer", 4th Edition, Pearson Education, 2005
2. Herbert Scheldt, "The Complete Reference C++", Fourth Edition, McGraw-Hill, 2003.

Reference books:

1. Bjarne Stroustrup, " The C++ Programming Language", 4th Edition, Pearson Education, 2003
2. R. G. Dromey, "How to Solve it by Computer", 2nd Edition, Prentice Hall International Series in Computer Science.

Supporting experimentation

1. a) Write a simple C++ program to read and display a student Name and SRN.
   b) Write a C++ program using Pointers and References concept to solve theProgram-1a
   c) Write a C++ program using arrays to read and display four student's SRN.
2. Write a C++ program to read 2 students 6 subject marks (out of 100), calculate the total marks of each student and display total marks of both students. Also find and display who has scored the highest total among the two students.
3. Write a C++ program to read 4 students 6 Subjects marks (out of 100) using any looping structure, calculate and display the total marks of each student?
4. Write a C++ program to create a Student class with two data members StudentName, SRN and member functions get_data, put_data to read and display the contents of the data members. Create two objects of Student class. Read and display the contents of the objects using member functions of the Student class.
5. Rewrite the code in Program 4 by using the concept of class constructor and destructor.
6. Rewrite the code in Program-4 by making use of dynamic memory allocation.
7. Write a C++ program to implement single inheritance. Create a base class Student with two data members SRN,Total Marks and with two member functions get_data, put_data to read and display information. Create a derived class EligibleStudent using public inheritance from base class. Create objects of base and derived classes and display information? (Note: class EligibleStudent should contain list of students those are eligible for final C3 exam).
8. Write a C++ program to implement exception handling mechanism?

SC-2

B18EC4061	Solid state Devices Theory (SSDT)	L	T	P	C
Duration :14 Wks		3	0	0	3

Prerequisites:

Fundamentals of Physics

Course description:

This course is about basic semiconductor physics and the physics devices like PN junction, (BJT), and MOSFET. The course contents gives insight into basics of quantum mechanics and solid-state physics (energy bands, electrons and holes, the Fermi function), doping and carrier densities, carrier transport and generation-recombination, in addition the semiconductor equations, which provide a complete, semi-classical, mathematical description of electrons and holes in semiconductors, subject to some important simplifying assumptions. In addition the course applies these concepts to PN junction, (BJT), and MOSFET with their fabrication procedures.

Course Objectives:

The objectives of this course are to:

1. Present a brief idea about the Solid State Devices.
2. Describe various Fabrication Processes.
3. Understand the idea of Energy Band Diagrams.
4. Describe the construction and working of BJT and MOSFET.

Course Outcomes:

After the completion of the course, a student shall be able to:

1. Describe the operation of PN Junction Diode
2. Explain the various processes involved in an IC Fabrication
3. Compare the different configurations and operations of a Bipolar Transistor
4. Describe the construction and operation of a MOSFET

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC4061	CO1	1	2	2							3					
	CO2		2								3			2		
	CO3	2	1	2							3					2
	CO4	1		2	3	3					3			2	3	2

Course Contents:

Unit 1: The PN Junction Diode **[10 Hrs]**

Introduction, Space Charge Region, Analytical relations at Equilibrium, Conditions in the diode with voltage applied, Currents in diode.

Unit 2: Fabrication Technology **[10 Hrs]**

Introduction, Why Silicon, Purity of Silicon, Czochralski process, Fabrication process, Fabrication of resistors and capacitors

Unit 3: Bipolar Transistors **[11 Hrs]**

Structure and Basic operation, Fabrication, Circuit arrangements, Currents in active region, BJT as a current amplifier, Transistor parameters, modes of operation.

Unit 4: Metal-Oxide-Silicon Systems **[11 Hrs]**

Energy band diagrams, Band Bending and effect of Bias voltages, Analytical relations for charge densities, Construction and operation of MOSFET, Regions of operation, Secondary effects.

Text Book:

1. Kanaan Kano, "**Semiconductor Devices**", Pearson Education, 2004.

Reference Book:

1. Streetman, Banerjee, "Solid State Electronic Devices", PHI Learning, 2006.

B18EC4062	Data Structures Using C & C++	L	T	P	C
Duration :14Wks		3	0	0	3

Prerequisites:

Programming language C++

Course Description:

This course covers the design, analysis, and implementation of basic data structures using C++. This course shall implement some of the data structures and basic aspects of C++ are also covered. A brief discussion of the C++ programming language is done. Survey of fundamental data structures (array, vector, lists, queue, stack, trees) and how to use them in C++. This course then delves deeper into the design, analysis and implementation of such data structures.

Course Objectives:

The objectives of this course are to:

1. Discuss insights into the basic concepts of data structures and algorithms.
2. Implement basic concepts about stacks, queues, lists, and Trees
3. Explain a concise about searching and sorting techniques.
4. Discuss insights into programming skills to implement data structures for real time applications.

Course Outcomes:

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

1. Identify and classify various types of data structures.
2. Write C++ programs to implement data structures like stack, queue, linked list, and tress.
3. Classify and describe various sorting and searching techniques.
4. Write C++ programs to implement sorting and searching techniques.

Mapping of Course Outcomes with Program Outcomes

Course Code	POS / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC4062	CO1	2	1	2					2	3			3			
	CO2	2	3	3	3		2		3	2	1	2	3		2	3
	CO3	1	2	3					2	2			2		2	
	CO4	3	2	3			3		3		2		3	2	3	

Course Contents:

Unit-1: Introduction and Linear Data Structures: Stack & Queues [11 Hrs]

Introduction to Data Structure: Types of Data Structure, Concept of Files; Stack: Concept, operations, Array Representation of Stack, Applications; Queues: Concept, Operations, Array Representation of Simple Queue, Circular Queue, Applications;

Unit-2: Linear Data Structure: Linked List [10 Hrs]

Array Vs Linked List, Linked List concept, Operations on Linked List, Types of Linked List, Application of Linked List.

Unit-3: Non-Linear Data Structure: Trees [11 Hrs]

Binary Tree Concept, Binary Tree representation, Operations on Binary Tree, Binary Tree traversal, Binary search tree implementation; The Huffman Algorithm.

Unit-4: Sorting and Searching Techniques [10 Hrs]

Sorting: Concept, Insertion Sort, Quick Sort, and Heap Sort.

Searching: List Search,Linear Index Search, and Index Sequential Search

Text Books:

1. Langsam, Augenstein, Tenenbaum, "Data Structures Using C and C+", 2nd edition, Pearson Education India, 2015.
2. Seymour Lipschutz, “Data Structure with C”, TMH.

Reference Books:

1. G. A. V. Pai, “Data Structures and Algorithms”, TMH, 2008.
2. Debasis , Sarnanta, “Classic Data Structures” , 2nd edition, PHI, 2009.

B18EC4063	Power Electronics	L	T	P	C
Duration :14 Wks		3	0	0	3

Prerequisites:

Basic Electronics, Analog Electronic circuits.

Course Description:

In this course power, semiconductor devices control characteristics and application is discussed. It also covers analysis of power converters for R, RL, RLE load conditions. The different types of modulation technique for control and conversion of power is also discussed.

Course Objectives:

The Course objectives are to:

1. Explain various power Semiconductor devices and applications.
2. Prepare the students to analyze different power converter circuits.
3. Provide understanding of modulation techniques used in power electronics.

Course Outcomes:

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

1. Identify suitable semiconductor device for a given application.
2. Apply knowledge of engineering fundamentals to analyze AC to DC and DC-DC, DC-AC and AC-AC converters for different load conditions.
3. Identify suitable converters for a given application.
4. Analyze and identify different types of modulation techniques used for control and conversion of power.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
B18EC4063	CO1	3	3	1	1	2								3	3	3
	CO2	3	3	3	3	2								3	3	3
	CO3	3	3	2	1	2								3	3	2
	CO4	3	3	1										2	2	2

Course Contents:

Unit-1: Power semiconductor devices [11Hrs]

Survey of power Semiconductor devices, Power diode, SCR, GTO, LASCR, RCT, SITH, BJT, MOSFET, IGBT etc., Switching losses, applications .

Controlled Rectifiers (Converters): Single Phase, Half wave / full wave, half controlled /fully controlled converters with R and RL loads, Dual converters.

Unit-2: DC- DC Converters [10Hrs]

Introduction, Principle of step down operation, step down converter with RL load, Principle of step up operation, step up converter with R-load, performance parameters, converter classification.

Unit-3: Inverters [11Hrs]

Introduction, Single Bridge inverters with R load, Voltage control, modulation techniques, SPWM, Boost inverter. Current source inverters.

Multi-level inverters: Introduction, multilevel concept, diode clamped multilevel inverter.

Unit-4: AC voltage controllers [10Hrs]

Introduction, principle of on- Off control, single phase bidirectional controllers with R-load, single phase controllers with inductive loads.

Text Books:

1. M. H. Rashid, "Power Electronics - Circuits, Devices and Applications", P.H.I Private Ltd. New Delhi, Third Edition, 2004
2. M. H. Rashid, "Power Electronics - Circuits, Devices and Applications", P.H.I Private Ltd. New Delhi, Second Edition, 1994

Reference Books:

1. Joseph Vithayathil, "Power Electronics - Principles and Applications", McGraw Hill Inc., New York, 1995.
2. Vedam Subrahmanyam, "Power Electronics", New Age International (P) Limited, New Delhi, 1996.

B18EC4064	Probability and Random Processes	L	T	P	C
Duration :14 Wks		3	0	0	3

Prerequisites:

Basic Mathematics, Calculus and fundamentals of probability.

Course Description:

This course introduces probability, distributions and statistics with applications. Topics include: Mean, Median, Mode, Correlation, Curve fitting, Random variables, Probability distributions, Joint densities, Hypothesis testing. Probability theory deals with many real-life problems, which either inherently involves the chance phenomena or describing the behavior of the system explicitly with statistical properties. Interpretation of the system behavior in many engineering and computing sciences depends on concept probability and statistics that familiarize with the computational aspects. The course deals with basic properties of various distributions and other related things.

Course Objectives:

The objectives of this course are:

1. Understand the basic concepts of probability theory and random variables
2. Operations one random variables. conditional probability and conditional expectation, joint distribution and independence, mean square estimation
3. Study and analyze random processes
4. Apply the concept of probability and random processes in engineering problems

Course Outcomes:

On completion of this course the student will be able to:

1. Concepts of probability theory and random variables.
2. Single and multiple 0random variables. conditional probability and conditional expectation, joint distribution and independence, mean square estimation
3. Understand analyze random processes
4. Apply the concept of probability and random processes in engineering problems

Mapping of Course Outcomes with program Outcomes

Course Code	POS / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B20EC4064	CO1	3	3	3	2					3			3	3	2	1
	CO2	3	3	3	1					3			3	3	2	1
	CO3	3	3	3	1					3			3	3	2	1
	CO4	3	2	3	2					3			3	3	2	1

Course Contents:

Unit 1: Probability Theory **[10 Hrs]**

Introduction to probability theory: Experiments, Sample space, Events, Axioms, Assigning probabilities, Joint and conditional probabilities, Baye's theorem, Independence, Discrete random variables, Engineering examples.

Unit 2: Random Variables **[11 Hrs]**

Random variables, Distributions, Density functions: CDF, PDF, Gaussian random variable, Uniform, Exponential, Laplace, Gamma, Erlang, Chi-square, Rayleigh, Rician and Cauchy types of random variables.

Operation on a single random variable: Expected value, EV of random variables, EV of functions of random variables, Central moments, Conditional expected values.

Unit 3: Functions **[10 Hrs]**

Characteristics functions: Probability generating functions, Moment generating function, Engineering applications, Scalar quantization,

Pairs of random variables: Joint PDF, Joint probability mass functions, Conditional distribution, Density and mass functions,

Unit 4: Random Process **[11 Hrs]**

Random process: Definition and characterization, Mathematical tools for studying random processes, Stationery and Ergodic random processes, Properties of ACF.

Example Processes: Markov processes, Gaussian processes, Poisson processes, engineering applications

Reference books:

1. S. L. Miller and D. C. Childers, "Probability and random processes: application to signal processing and communication", Academicpress/ Elsevier 2004, 2nd Edition.

2. A. Papoullis and S. U. Pillai, "Probability, random variables and stochastic processes", McGraw Hill 2002, 2nd Edition.
3. Peyton Z. Peebles, "Probability, Random variables and random signal principles", TMH, 4th edition, 2007, 3rd Edition.
4. H Stark and Woods, "Probability, random processes and application", PHI, 2001

SC-3

B18EC5051	Microelectronics	L	T	P	C
Duration: 14 Wks		3	0	0	3

Prerequisites:

Basic Electronic Circuits.

Course Description:

Microelectronics is the miniaturized electronic circuits that make up integrated circuits such as micro-controllers, micro- processors, FPGAs, operational amplifiers, analog-to-digital converters and many other functions. Microelectronics deals with the designing and manufacturing of very small electronic designs and components made up of semiconductor materials. The ability to use large number of components at relative low cost and the ability to match components accurately on-chip makes the design of integrated circuits and systems different from a similar design using discrete components.

Course Objectives:

The objectives of this course are to:

1. Understand the basic operation & design of single stage amplifiers.
2. Acquaint with frequency response of amplifier circuits.
3. Provide small signal analysis of amplifier with different loads.
4. Analyze the performance of digital logic circuits.

Course Outcomes:

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

1. Illustrate device structure and its physical operation, leading to a description of its terminal characteristics
2. Summarize operation of a transistor of either type as an amplifier, with emphasis on small-signal operation and modeling.
3. Compare the MOSFET and BJT characteristics

4. Produce delay model for digital circuits to analyze the propagation delay

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC5051	CO1	1	3	2						3				1	2	
	CO2	2		1	3									1	2	
	CO3	2	1		3						3			1	2	
	CO4	3	2	1							3			2	1	

Course Contents:

Unit 1: MOSFETS **[10 Hrs]**

Device Structure and Physical Operation, Current –Voltage Characteristics, MOSFET Circuits at DC, MOSFET as an amplifier and as a switch, Examples using SPICE simulations.

Unit 2: Single Stage MOS Amplifiers **[11 Hrs]**

Biasing in MOS amplifier circuits, Small Signal operations & model, Single Stage MOS Amplifier, Introduction to High frequency MOSFET model, Examples using SPICE simulations.

Unit 3: Integrated Circuit Amplifiers **[10 Hrs]**

IC design philosophy, Comparison of MOSFET and BJT, IC biasing- Current sources, current mirrors, current steering circuits, High frequency response-general considerations, Miller's Theorem and examples using theorem.

Unit 4: Digital CMOS Logic Circuits **[11 Hrs]**

Digital circuit design overview, Design and performance analysis of CMOS inverter, CMOS logic gate circuits, Pseudo NMOS logic circuits, Pass transistor logic circuits, Dynamic logic circuits.

Text Books:

1. Adel Sedra and K.C. Smith, "Microelectronic Circuits", 5th Edition, Oxford University Press, Interantional Version, 2009.
2. Behzad Razavi, "Fundamentals of Microelectronics", John Wiley India, Pvt. Ltd, 2008.
3. Sundaram Natarajan ,"Microelectronics – Analysis and Design", , Tata McGraw-Hill, 2007

B18EC5052	Java Programming	L	T	P	C
Duration :14 Wks		3	0	0	3

Prerequisites:

Programming fundamentals, C, C++.

Course Description:

Java is among the most popular programming languages out there, mainly because of how versatile and compatible it is. Java can be used for a large number of things, including software development, mobile applications, and large systems development. Knowing Java opens a great deal of doors for you as a developer. Java is the one of the most popular programming languages in the world today. It works on any platform (Windows, Mac, Linux, etc), and is the core language used in developing Android apps.

Course Objectives:

The Objectives of this course are to:

1. Introduce difference data types, operators, and control flows in Java Programming
2. Provide strong foundation for "object Oriented Programming Language (OOPL)"
3. Demonstrate the proper code organization using packages, sub packages and interfaces
4. Provide insight into file handlings, exception handling, and multithreading.

Course Outcomes:

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

1. Identify different Java properties which are unique compared to C++ language
2. Use an appropriate programming environment to design, code, compile, run and debug object-oriented Java programs.
3. Demonstrate basic problem-solving skills: analyzing, modeling, creating, and implementing programs in an object-oriented language (using concepts like classes, objects, abstract classes, interfaces, inheritance, packages).
4. Apply concepts like exception handling, threads, and files to write robust programs in Java

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
B18EC 5052	CO1	3	3	2		3				2			1	3	2	2
	CO2	3	3	3		3				2			1	3	3	3
	CO3	3	3	3		2				2			1	3	3	2
	CO4	3	3	3		2				2			1	3	3	3

Course Contents:

Unit-1: Java Revolution and Object-Oriented Fundamentals [10]

Revolutionary programming language; Object -Oriented Fundamentals: Object oriented programming, how java is better than C++; Java Language Introduction: Hello World, Step by step, Variables; Types; Operators; Flow Control, Java User input, Input types.

Unit-2: Classes and Inheritance [11]

Object references, Instance variables, the new operator, The Dot operator, Method declaration, Method calling, this, Constructors, Method overloading; Inheritance: Super, Method Overriding, Dynamic method dispatch; final, finalize, static.

Unit-3: Packages, Interfaces and String Handling [10]

Abstract, Interfaces: The interface statement, The implement statement, Variables in interfaces; The package statement, Compiling classes in packages, the import statement, Access protection; String Handling: Constructors, Special String Syntax, Character Extraction, Comparison, String copy modification

Unit-4: Exception Handling, Threads, and Files [11]

Fundamentals, Exception types, try and catch, Multiple catch clauses, Nested try statements; Threads: Single threaded event loop, The java thread model, Thread, Runnable, Thread priorities; Input/output: Files, Input Stream, Output Stream, File streams

Text book:

1. Patrick Naughton, "The Java Handbook", Tata McGraw-Hill, 2006 (Chapters 1 to 11, 13)

Reference Books:

1. Herbert Schildt "The Complete Reference – Java 2", Fifth Edition, Tata McGraw-Hill 2002
2. Bruce Eckel, "Thinking in Java", III Edition, Pearson 2004.

B18EC5053	Optical Fibre Communication	L	T	P	C
Duration: 14 wks		3	0	0	3

Prerequisites:

Communication Basics, Analog and Digital Modulation schemes, EM waves, Physics Optics.

Course Description:

Optical Fiber communications is necessary to communication engineers to address future needs of high data rate communications. The course will give you the knowledge in order to understand both

the fundamentals and the rapid development, that you as professional engineer can use the fibre optics efficiently. The course treats important devices as optical fibres, laser diodes, optical detectors, and receivers from physical and transmission system point of view. Finally, the course will conclude with outlook for future research in extending the capabilities of these networks to higher bandwidths and secured communications.

Course Objectives:

The objectives of this course are to:

1. Conceptualize and analyze mathematically propagation of optical signals over optical Fiber cables.
2. Conceptualize the degradation of signals during propagation of optical signals over optical fiber.
3. Explain the construction and characteristics of optical sources and detectors.
4. Analyze various techniques for coherent transmission and system performance factors in optical Communication system.

Course Outcomes:

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

1. Analyze the optical fiber communication link, structure, propagation, fiber configurations, and modes of transmission in fiber.
2. Estimate the signal degradation factors/losses associated with optical fibers and optical components in optical communication systems.
3. Analyze the characteristics of optical sources and photo detectors, and design short haul and long haul analog/digital optical fiber communication system
4. Analyze the performance of optical receiver based on receiver sensitivity/channel selectively, fiber optic link based on link budgets and power budgets and design a reliable/lossless optical fiber communication system

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
B18EC 5053	CO1	3	1								2					
	CO2	3	1	1							2				2	1
	CO3	3	1	1		1					2				2	1
	CO4	3	2		1						2	1	1		2	1

Course Contents:

Unit – 1: Overview to Optical Fiber Communication [11Hrs]

Electromagnetic spectrum; Optical spectral Bands; General system; Advantages and Applications of fiber optic transmission systems; Basic Optical laws and Definitions - Ray theory transmission - TIR, Numerical Aperture, Acceptance angle; Optical Fiber Modes and Configurations - Step-index and Graded-index fiber, Single mode and Multi-Mode fibers; Modal Concepts - V Number ; Single mode fibers - Cutoff wavelength , Mode Field Diameter, Fiber Birefringence; Average optical power; Fiber Materials.

Unit – 2: Signal Distortion in Optical Fibers [10Hrs]

Attenuation; Scattering Losses - Concepts of Rayleigh, Mie, Brillouin and Raman Scattering; Fiber Bend Loss; Dispersion - Concepts of Modal Dispersion, Material Dispersion, Waveguide Dispersion, Polarization Mode Dispersion; Optical Amplifier EDFA Amplification Mechanism, EDFA Architecture, Basic parameters – PCE, QCE, Gain ; Fiber Alignment - Joint Loss, Fiber Couplers **–** FBT coupler, Star couplers , Practical parameters of Couplers; Fiber Connectors **–** Butt Joint Connector, Expanded Beam Connector; Fiber Splices - Fiber Splicing Techniques.

Unit – 3: Optical Transmitter and Receiver [11hrs]

Optical sources **–** LED structures, Materials, Practical parameters - Quantum efficiency, LED Power ; Laser Diodes - Modes & threshold conditions, Principle operation of Semiconductor Laser, Configuration of Fabry-Perot resonator for laser diode, Practical parameters - Quantum efficiency, Resonant frequency; Optical detectors/ Photo detectors - Physical Principle of PIN and APD, Practical parameters - Quantum efficiency, Detector responsitivity, Cutoff wavelength**,** Photo Detector Noise, Response Time; Optical Receiver **–** Fundamental Receiver Operation, Practical parameters - Receiver sensitivity, Quantum Limit, Eye diagrams, Concepts of Coherent detection.

Unit – 4: OFC System Design Considerations [10 Hrs]

Analog Links **–** Overview of Analog Links, CNR, Multichannel Transmission Techniques, Link Parameters Definitions **–** Gain, Noise Figure, SFDR; Digital Links **–** Simplex Point to point link, System Considerations, Link Power Budget and Rise Time Budget with examples, Power Penalties, Modal noise, Mode-Partition Noise ,Reflection Noise, Chirping.

Text Books:

1. Gerd Keiser “Optical Fiber Communications”, TMH, 4th Edition, 2008.
2. John M. Senior, “Optical Fiber Communications”, Pearson Education, 3rd Edition, 2009.

Reference Books:

1. D.K. Mynbaev, S.C. Gupta and Lowell L. Schemer, “Fiber Optic Communications”, Pearson Education, 2005.
2. G. P. Agarawal, “Fiber Optics Communication Systems”, John Wiley New York, 1997.
3. Joseph C Palais ,“Fiber Optic Communication”, 4th Edition, Pearson Education.

B18EC5054	Research Methodology & IPR	L	T	P	C
Duration:14Wks		3	0	0	3

Prerequisites:

No Prerequisites

Course Description:

The course aims to give a broad understanding of research methodology, including qualitative and quantitative methods. The main components of a research framework i.e., problem definition, research design, data collection, ethical issues in research, report writing, and presentation are discussed. Once equipped with this knowledge, participants would be well-placed to conduct disciplined research under supervision in an area of their choice. In addition to their application in an academic setting, many of the methodologies discussed in this course would be similar to those deployed in professional research environments. Also IPR frameworks are discussed to give them insight into the patent drafting.

Course Objectives:

The objectives of this course are to:

1. Develop the most appropriate methodology for their research studies, irrespective of their discipline.
2. Explain the research skills and equip them to carry out individual or team research work according to scientific/technology requirements.
3. Illustrate different IPR Legislations and IPR filing procedures.

Course Outcomes:

On completion of this course the student will be able to:

1. Identify and describe researchable ideas, projects and themes.
2. Develop the thesis layout and document using the LATEX tool.
3. Identify different IPR Legislations.
4. Formulate IPR norms for different case studies.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC 5054	CO1	2	3	1	3				2	2	2				2	1
	CO2	1	3	2	2						2		1		2	1
	CO3	1	2	1	3						2	1	1		2	1
	CO4	2	2	1	1				3	2	3	2	2		2	1

Course Contents:

Unit-1: Research and Types of research [11 Hrs]

Meaning of Research- Objectives of Research- Motivation in Research. Research methods v/s Methodology. Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical. Research Process. Criteria of good Research. Defining the Research Problem - Defining and formulating the research problem - Selecting the problem - Necessity of defining the problem, Technique Involved in Defining a Problem, Research design – Basic Principles- Need of research design –– Features of good design – Important concepts relating to research design, Different Research Designs.

Unit-2: Thesis writing and Ethics. [11 Hrs]

Structure and components of scientific reports - Types of report – Technical reports and thesis, Significance –Different steps in the preparation – Layout, structure and Language of typical reports – Illustrations and tables - Bibliography, referencing and footnotes - Oral presentation – Planning – Preparation – Practice – Making presentation – Use of visual aids - Importance of effective communication. **LATEX**: Introduction to LATEX and it's usage in documentation, preparation of thesis, technical papers and articles.

Unit- 3: Intellectual Property Rights [10 Hrs]

Intellectual Property Rights: Introduction, Legislations covering IPR in INDIA; Patents: Conditions to be satisfied by an invention to be patentable, Patentable inventions under patent Act 1970,Types of patents which are not patentable in INDIA, Term of patent in INDIAN system, Essential patent documents to be submitted, Criteria for naming inventors in an application of patent, Where to apply ?How to apply?, Why provisional specification, Complete specification, Hierarchy of officers in patent office, Register of patents ,working of patents and company licensing, Revocation of patents, Term of patents, Patent of addition

Unit-4: Other Intellectual Property Rights **[10 Hrs]**

Copy Right; Trade Marks; Geographical Indications; Industrial Designs; Layout Design of Integrated designs; Plant verity; International Patenting; Case studies

Text Books:

1. Kothari, C. R. **"**Research methodology: Methods & techniques". New Delhi: New Age International (P) Ltd, 2nd Edition, 2004.

References:

1. "LATEX Documentation" available at http://www.latex-project.org/
2. "Patent Manual", available at http://www.bits-pilani.ac.in/uploads/Patent_ManualOct_25th_07.pdf

SC-4

B18EC5061	ARM Processors and Applications	L	T	P	C
Duration :14 Wks		3	0	0	3

Prerequisites:

Familiarity with Digital Electronic Circuits, Hexadecimal Number System

Course Description:

Progress in the ARM microcontroller community since the publication of the first edition of this book has been impressive, significantly exceeding our expectations and it is no exaggeration to say that it is revolutionizing the world of Microcontroller Units (MCUs). There are many thousands of end users of ARM-powered MCUs, making it the fastest growing MCU technology on the market. As such, the second edition of Joseph's book is very timely and provides a good opportunity to present updated information on MCU technology.

Course Objectives:

Course objectives are to

1. Explain the architecture of ARM Cortex M3.
2. Demonstrate programing ARM Cortex M3.
3. Apply the knowledge of ARM Cortex M3 to design an embedded systems using various interfaces.
4. Summarize the embedded system design with the specified constraints using ARM Cortex M3.

Course Outcomes:

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

1. Analyze a given problem and design a suitable embedded system using ARM Cortex M3.
2. Apply the knowledge of programming in assembly language and C language to receive data, process it and control the various actuators.
3. Summarize the embedded system design and operations using ARM Cortex M3.

Mapping of Course Outcomes with programme Outcomes

POS / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	3									2	1
CO2				1	3									2	1
CO3										2	1	2			

Course Contents:

Unit 1: ARM-32 bit Microcontroller. [10]

Architecture of ARM Cortex M3, Various Units in the architecture, Debugging architecture. General Purpose Registers, Special Registers,

.

Unit 3: Instruction Sets. [11]

Assembly basics, Instruction list and description, Useful instructions, Memory mapping, Bit-band operations and CMSIS, Assembly and C language Programming Time delay calculations,

Unit 3: Exceptions and Interrupts. [10]

Exceptions, interrupts, stack operation, reset sequence, programming in Assembly and C

Unit 4: Programming. [11]

Timers/counters, Serial Communication: Data communication, connections to RS-232 programming in Assembly and C.

Text book:

1. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", 2nd Edition, Newnes, (Elsevier), 2010.

Laboratory experiments.

1. Data Transfer Instructions: Data Transfer between internal and external RAM with and without overlap, Sorting, largest and smallest number in an array and exchange.
2. Arithmetic Instructions: 32 bit multi-precision Addition, Subtraction, Multiplication of 2 numbers

3. Logical Instructions: 8x8 multiplication using shift Add technique. ASCII to packed BCD and vice versa.
4. Timers: Wave form generation with varying Duty Cycle using Interrupt and Polling Techniques.
5. Serial Communication: Serial data transmission with Polling and Interrupt technique (Regular and Look up table).
6. Serial Reception and Display the ASCII value.
7. Count the incoming pulses using counters.

B18EC5062	Theory of Algorithms	L	T	P	C
Duration :14 Wks		3	0	0	3

Prerequisites:

Data structures and C or C++

Course Description:

Algorithms are the heart of computer science, and the subject has countless practical applications as well as intellectual depth. This course is an introduction to algorithms for learners with at least a little programming experience. The course is rigorous but emphasizes the big picture and conceptual understanding over low-level implementation and mathematical details. After completing this course, you will be well-positioned to ace your technical interviews and speak fluently about algorithms with other programmers and computer scientists. Specific topics include: "Big-oh" notation, sorting and searching, divide and conquer, randomized algorithms, data structures, graph primitives.

Course Objectives:

Course objectives are to:

1. Provide an understanding of fundamentals of algorithms to solve Engineering challenges.
2. Provide an understanding of various aspects of analysis of the problem domain and arrive at a suitable algorithm.
3. Understanding of arriving at a Pseudo code level of any challenge.
4. Provide a comprehensive look at the challenges in engineering problems to provide an effective and efficient solution.

Course Outcomes:

At the end of this course, student will be able to:

1. Apply various aspects of Algorithm development of any Engineering challenge.
2. Analyze the Divide – conquer and Decrease-conquer approach for various problems.
3. Summarize Describe Dynamic approach for various engineering problems.
4. Summarize limitations and coping of algorithm power.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
B18EC5062	**CO1**	3	3	2	1								2	3	1	
	CO2	3	3		1								1	3		
	CO3	3	3	2	1								1	3	1	
	CO4	3	3	1	1								1	3		

Course Contents:

Unit 1: Introduction to algorithms [10Hrs]

Fundamentals of algorithmic problem solving and data structures, Analysis Framework, Asymptotic Notations, Mathematical Analysis of Nonrecursive and Recursive Algorithms, Brute Force Approach: Selection sort, Bubble sort, Sequential search, and String Matching.

Unit 2: Divide - Conquer and Decrease - Conquer Approach [11Hrs]

Divide and Conquer: Mergesort, Quicksort, Binary Search; Decrease-and-Conquer Approaches: Insertion Sort, Depth First Search and Breadth First Search. Summary of Space and time tradeoffs.

Unit 3: Dynamic Approach and Greedy technique [10Hrs]

Dynamic Programming: Warshall's Algorithm, Floyd's Algorithm for the All-Pairs Shortest Paths Problem, Greedy technique: Dijkstra's Algorithm and Huffman trees.

Unit 4: Limitations and Coping of Algorithmic Power [11Hrs]

Limitations and Coping of Algorithmic Power: Lower-Bound Arguments, Decision Trees, P, NP, and NP-Complete Problems, Backtracking, Branch-and-Bound.

Text Books:

1. Anany Levitin: "Introduction to the Design & Analysis of Algorithms", 2nd Edition, Pearson Education, 2007.
2. Ellis Horowitz, SatrajSahni and Rajasekaran :"Computer Algorithms/C++", 2nd Edition, 2014, Universities Press.

Reference Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein: "Introduction to Algorithms", 3rd Edition, PHI, 2010.

2. Alfred V. Aho , John E. Hopcroft Jeffrey D. Ullman,Addison: "The design and analysis of computer algorithms", Wesley Pub. Co., 1974.

B18EC5063	Biomedical Signal Processing	L	T	P	C
Duration :14 Wks		3	0	0	3

Prerequisites:

Signals & Systems, Digital Signal Processing, Linear Algebra.

Course Description

This course presents the fundamentals of digital signal processing with particular emphasis on problems in biomedical research and clinical medicine. It covers principles and algorithms Nature of Biomedical Signals, Examples of Biomedical Signals (ENG, EMG, ECG, EEG, ERP, EGG, PCG, CP, VMG, VAG), Biomedical Signal Analysis and Computer aided Diagnosis. Topics include Basic Electrocardiography, ECG lead systems, ECG Signal characteristics, ECG QRS Detection, ECG Analysis Systems. The focus of the course is in Neurological Signal Processing, processing physiological data, with examples from cardiology, speech processing, and medical imaging. Lectures cover signal processing topics relevant to the Data Acquisition and Classification of sleep stages, The Markov Model and Markov Chains, Dynamics of Sleep-Wake Transitions, Hypnogram Model parameters, Event History Analysis for modeling Sleep.

Course Objectives:

The objectives of this course are to:

1. Identify the application of the main signal processing tools to the analysis of biomedical signals.
2. Describe how clinically relevant information can be extracted from these signals.
3. Relate advanced signal processing for uni and multi-modal medical signals.
4. Discuss advanced signal processing for multidimensional medical signals.
5. Interpret and analyse medical signals from a set of specific medical applications.
6. Describe and apply signal processing methods for removal of artefacts in medical signals.
7. Estimate unique segments or regions in medical signals an - images using automatic signal processing methods for classification.

Course Outcomes:

At the end of this course, student will be able to:

1. Apply statistical and adaptive signal modelling for multidimensional medical signals.
2. List the various ECG systems.
3. Define and apply signal processing methods for removal of artefacts in medical signals

4. Illustrate unique segments or regions in medical signals an - images using automatic signal processing methods for classification.
5. Explain Smear signal processing methods for characterization of physiological and pathological phenomena

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC506 3	CO1	2	2											2		
	CO2		2	2	3									2		2
	CO3		3	3	2								3	3		2
	CO4		2	3	4								3			3
	CO5		2	2	2											3

Course Contents:

Unit-1: Introduction to Biomedical Signals [10 Hrs]

Nature of Biomedical Signals, Examples of Biomedical Signals (ENG, EMG, ECG, EEG, ERP, EGG, PCG, CP, VMG, VAG), Objectives of Biomedical Signal Analysis, Difficulties in (this text can be removed) Biomedical Signal Analysis, Computer aided Diagnosis.

Unit-2: Electrocardiography [11 Hrs]

Basic Electrocardiography, ECG lead systems, ECG Signal characteristics, ECG QRS Detection, ECG Analysis Systems.

Unit-3: Neurological Signal Processing [11 Hrs]

The Brain and its potentials, The Electrophysiological Origin of Brain Waves, EEG signal and its characteristics, EEG Analysis, Linear Prediction Theory, The AR method, Recursive Estimation of AR Parameters.

Unit-4: Sleep EEG [10 Hrs]

Data Acquisition and Classification of sleep stages, The Markov Model and Markov Chains, Dynamics of Sleep-Wake Transitions, Hypnogram Model parameters, Event History Analysis for modeling Sleep.

Text Books:

1. Rangaraj M Rangayyan, “Biomedical Signal Analysis” A case study approach, John Wiley publications. Second Edition 2009
2. Willis J Tompkins, ED, “Biomedical Digital Signal Processing”, Prentice-Hall of India, 1993.

3. DC Reddy, “Biomedical Signal Processing Principles and Techniques”, Tata McGraw-Hill,First Edition 2005.

B18EC5064	Automotive Electronics	L	T	P	C
Duration :14 Wks		3	0	0	3

Prerequisites:

Microcontroller, Instrumentation and Transducers.

Course Description:

Electronics plays a major role in the current automobile industry. From a temperature sensor recording, the temperature outside the car to the Engine Control Unit (ECU), electronics has made driving relatively simpler and safer. It covers the topics on engine management systems, Sensors and actuating systems, Exhaust treatment systems, Automotive Diagnostics. It majorly concentrates on Communication Protocols used to communicate between different ECU’s and finally it describes Electronic systems for Passenger Safety and convenience systems

Course Objectives:

Course objectives are to:

1. Understand the functions of electronic systems in modern automobiles, modern electronics technology to improve the performance, safety, comfort and related issues
2. Study the principles of automotive sensors and interfacing techniques, design, model and simulate interfacing systems with sensors
3. Know the principles and functionalities of various Automotive Communication Protocols (ACPs), Design ACP based In-Vehicle Networks(IVNs), selection of ACPs for various application in Automotive
4. Know the industry standard practices for ECU design for automotives, modeling and analysis of application software for ECU design and development, design of ECUs for automobiles, design of HIL and fault diagnostics

Course Outcomes:

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

1. Implement and Interface sensors for various automotive applications
2. Design and diagnose the faults in the systems Implement automotive fault diagnostics and faults.
3. Analyze on and off board diagnostics, diagnostics protocol
4. Explain the different types of ECUs

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC5064	CO1		2	3		1								1	2	
	CO2							1		2	3				1	
	CO3				3			1	1							1
	C04		2		2											1

Course Contents:

Unit-1: Automotive Industry and Modern Automotive Systems [11 Hrs]

Vehicle classifications and specifications, need for electronics in automobiles, Automotive Fundamentals Overview – Four Stroke Cycle, Engine Control, Spark and Compression Ignition Engines, Ignition systems, Spark plug, Spark pulse generation, Ignition Timing.
Transmission Control - Automotive transmissions, Drive Train, Brakes,
Steering System - Steering Control,
Starting System- Battery, Air/Fuel Systems, Fuel Handling, Air Intake System,

Unit-2: Introduction to automotive sensors and instrumentation [10 Hrs]

Sensors and actuators, Air/ Fuel Management Sensors – Oxygen (O2/EGO) Sensors, Throttle Position Sensor (TPS), Engine Crankshaft Angular Position (CKP) Sensor, Magnetic Reluctance Position Sensor, Engine Speed Sensor, Ignition Timing Sensor, Hall effect Position Sensor, Shielded Field Sensor, Optical Crankshaft Position Sensor, Manifold Absolute Pressure (MAP) Sensor - Strain gauge and Capacitor capsule, Engine Coolant Temperature (ECT) Sensor, Intake Air Temperature (IAT) Sensor, Knock Sensor, Airflow rate sensor, Throttle angle sensor
Sensors in Engine control, adaptive cruise control, braking control, traction control, steering, stability, Lighting, wipers, climate control, Sensors for occupant safety,
Sensor and actuator interfacing techniques and electronic displays.
Actuators – Fuel Metering Actuator, Fuel Injector, Ignition Actuator

Unit 3: Exhaust After-Treatment Systems [11 Hrs]

Exhaust After-Treatment Systems – AIR, Catalytic Converter, Exhaust Gas Recirculation (EGR), Evaporative Emission Systems
Electronic Engine Control – Engine parameters, variables, Engine Performance terms, Electronic Fuel Control System, Electronic Ignition control, Idle speed control, EGR Control
Communication – Serial Data, Communication Systems, Power windows, Remote keyless entry systems, GPS, **Automotive Communication Protocols**
Protection, Body and Chassis Electrical Systems, Remote Keyless Entry,

Vehicle Motion Control – Cruise Control, Chassis, , Power Brakes, antilock braking systems, Electronic stability and other technologies, Traction Control, Electronic Stability Control, Electronically controlled suspension
Fundamentals of electronically controlled steering system, Power Steering,

Unit 4: Electronics for Passenger Safety and Convenience [10 Hrs]

Electronics for Passenger Safety and Convenience – SIR, Air bag and seat belt pretension systems, Tire pressure monitoring systems,
Automotive Instrumentation – Sampling, Measurement & Signal Conversion of various parameters
Integrated Body – Climate Control Systems, Electronic HVAC Systems,
Lighting, Entertainment Systems
Automotive Diagnostics – Timing Light, Engine Analyzer, Process of Automotive Fault Diagnostics, Fault Codes, On-board diagnostics, Off-board diagnostics, Expert Systems.
Future Automotive Electronic Systems – Alternative Fuel Engines, Collision Avoidance Radar warning Systems, Low tire pressure warning system, Radio navigation, Advance Driver Information System, AFS.

Text Books:

1. Denton, "Automotive Electrical and Electronic Systems, Burlington", MA 01803, Elsevier Butterworth-Heinemann, 2004.
2. Ronald K. Jurgen, "Automotive Electronics Handbook", 2nd Edition, McGraw-Hill, 2007.
3. William B. Ribbens, "Understanding Automotive Electronics, 5th Edition, Newnes, 2006.
4. Robert Bosch GmbH, "Bosch Automotive Electrics & Electronics: Systems and Components, Networking and Hybrid Drive", Robert Bosch GmbH, 3rd Edition, 1999.

SC-5

B18EC5071	System Verilog	L	T	P	C
Duration :14Wks		3	0	0	3

Prerequisites:

Logic Design, Verilog, C++, Digital system.

Course Description:

This course aims to give an in-depth introduction to the System Verilog which is an enhancement to the Verilog hardware description language (HDL). It also discusses the benefits of the new features,

and demonstrates how design and verification can be more efficient and effective when using System Verilog constructs.

Course Objectives:

The objectives of this course are to:

1. Understand logic verification using Verilog simulation.
2. Learn the features of System Verilog,
3. SVA and basics of UVM for verification, and understand the improvements in verification efficiency.
4. Demonstrate the advanced verification features, such as the practical use of classes, randomization, checking, and coverage.
5. Illustrate the advanced coverage driven verification environments using advanced System Verilog features, SVA and UVM.

Course Outcomes:

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

1. Develop the test benches for digital systems.
2. Perform the functional coverage for a given digital circuit.
3. Apply the constrained random stimulus to a digital circuit.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
B20 EC 5071	CO1	3		3		2								2	3	1
	CO2	2		3	1									2	3	1
	CO3	2		3	1	3								2	3	1

Course Contents:

Unit 1: Verification guidelines and Introduction to data types [10]

The verification process, basic test bench functionality, directed testing, methodology basics, constrained random stimulus, randomization, functional coverage, test bench components.

Data Types: Built in Data types, fixed and dynamic arrays, Queues, associative arrays, linked lists, array methods, choosing a storage type, creating new types, creating user defined structures, Enumerated types, constants and strings, Expression width.

Unit 2: Procedural statements, routines & connecting the test bench and Design [11]

Procedural statements, Tasks, Functions and void functions, Task and function overview, Routine arguments, returning from a routine, local data storage, time values

Separating the test bench and design, the interface construct, Stimulus timing, Interface driving and sampling, System Verilog assertions.

Unit 3: Threads and Inter process Communication **[10]**

Working with threads, Disabling threads, Inter process communication, Events, Semaphores, Mailboxes, Building a test bench with threads and IPC.

Unit 4: Functional Coverage **[11]**

Coverage types, Coverage strategies, Simple coverage example, Anatomy of Cover group and Triggering a Cover group, Data sampling, Cross coverage, Generic Cover groups, Coverage options, Analyzing coverage data, measuring coverage statistics during simulation.

Text Books:

1. Chris Spear, "System Verilog for Verification – A guide to learning the Test bench language features", Springer Publications, 2nd Edition, 2010.

Reference Books:

1. Stuart Sutherland, Simon Davidmann, Peter Flake, "System Verilog for Design-A guide to using system verilog for Hardware design and modeling", Springer Publications, 2nd Edition, 2006.

B18EC5072	Relational Data Base Management Systems (RDBMS)	L	T	P	C
Duration :14 Wks		3	0	0	3

Prerequisites:

This subject requires the student to know about Basics of computer and fundamental concepts of set theory.

Course Description:

Database Management Systems (DBMS) are vital components of modern information systems. ... In the first half of the course the relational data model, relational query languages, relational database design and conceptual data modeling are reviewed. It then focuses on XML, RD, OWL, parallel, and noSQL databases.

Course Objectives

The course objectives are to:

1. Memorize the basics terminologies of Databases, Conceptual design using ERD.
2. Demonstrate the relational database system using relational algebra.
3. Apply to create the Relation or a Table in a DATABASE using SQL.
4. Analyse the Database applications for real world problems by using different Normalization techniques.

Course Outcomes

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

1. Define the basic terminologies of RDBMS.
2. Discuss the relational data model and relational algebra
3. Demonstrate the table or a relation in Database and ER Model.
4. Survey the different database applications for real word problems using normalization techniques.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO1	PO2	PO3	PO 4	PO 5	PO6	PO 7	PO 8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC5072	CO1	3	1	2										2	3	1
	CO2	3	2	1										3	2	1
	CO3	3	1	2										2	3	1
	CO4	3	1	2										1	2	3

Course Contents:

Unit-1: Introduction to Databases and Conceptual Modelling [11 Hrs]

Introduction, 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.

Unit-2: Relational Data Model and Relational algebra [10 Hrs]

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.

Unit-3: SQL [11 Hrs]

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.

Unit-4: Database Design Theory and Normalization [10 Hrs]

Informal design guidelines for relation schemas, Functional dependencies, Normal forms based on primary keys, General definitions of second and third normal forms, Other Normal forms.

Text Books:

1. Elmasri and Navathe, "Fundamentals of Database Systems", 5th Edition, Pearson Education, 2007.
2. Raghu Ramakrishnan and Johannes Gehrke, **"**Database Management Systems", 3rd Edition, McGraw Hill, 2003

Reference Book:

1. Silberschatz, Korth and Sudharshan, "Database System Concepts", Fourth Edition, Mc-GrawHill, 2002

B18EC5073	Digital signal Processor Architecture (DSPA)	L	T	P	C
Duration 14 Weeks		3	0	0	3

Prerequisites:

Fourier Transform, Fast Fourier transform, Filter Design, Data structure, Behavior Modeling.

Course Description:

DSP Processor Architecture course provides an introduction on the industry-based DSP processor's architecture and their algorithms. Students will learn about the addressing modes, instruction set and memory allocation of the TMS320C67XX processor.

Course Objectives:

Course objectives are to:

1. Summarize the architecture, programming, and interfacing of commercially available programmable DSP devices and to use them effectively and optimally in system implementations.
2. Discuss the knowledge of basic DSP filter algorithms.
3. Introduce the concepts of digital signal processing techniques, implementation of DFT & FFT algorithms by programming the DSP TMS320C54XX Processor.
4. Analyze about interfacing of serial & parallel communication peripherals.

Course Outcomes:

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

1. Describe various issues that need to be addressed when implementing DSP algorithms.
2. Explain the architecture details and instruction sets of specific DSP Processors.
3. Illustrate the features of on-chip peripheral devices & its interfacing and pipeline operations along with its programming details.
4. Apply signal processing algorithms like DIT,DIF, IIR/FIR.

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC5073	CO1	3	2	1									1		2	1
	CO2	2	1	1	1	1	1						1		2	1
	CO3	3	1	1											2	1
	CO4	2	1	1	1								1		2	1

Course Contents:

Unit-1: Introduction to Digital Signal Processing and Architectures for Programmable Digital Signal Processors. [11hrs]

Introduction, A Digital Signal-Processing System, The Sampling Process, Discrete Time Sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear Time-Invariant Systems, Digital Filters, Decimation, and Interpolation. Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Features for External Interfacing.

Unit-2: Programmable Digital Signal Processors [10hrs]

Introduction, Commercial Digital Signal-processing Devices, Data Addressing Modes of TMS32OC54xx., Memory Space of TMS32OC54xx Processors, Program Control. Detail Study of TMS320C54X & 54xx Instructions and Programming, On-Chip peripherals, Interrupts of TMS32OC54xx Processors, Pipeline Operation of TMS32OC54xx Processor.

Unit-3: Implementation of Basic DSP Algorithms and Implementation of FFT Algorithms [11hrs]

Introduction, the Q-notation, FIR Filters, IIR Filters, Interpolation and Decimation Filters (one example in each case). Introduction, an FFT Algorithm for DFT Computation, Overflow and Scaling, Bit-Reversed Index Generation & Implementation on the TMS32OC54xx.

Unit 4: Interfacing Memory and Parallel I/O Peripherals to DSP Devices and Interfacing and Applications' Of DSP Processor. [10hrs]

Introduction, Memory Space Organization, External Bus Interfacing Signals. Memory Interface, Parallel I/O Interface, Programmed I/O, Interrupts and I / O Direct Memory Access (DMA). Introduction, Synchronous Serial Interface, A CODEC Interface Circuit. DSP Based Bio-Telemetry Receiver, A Speech Processing System, An Image Processing System.

Text Books:

1. Avatar Singh and S. Srinivasan, "Digital Signal Processing", Thomson Learning 2004.
2. Venkataramani and M. Bhaskar, "Digital Signal Processors", TMH, 2002

Reference Books:

1. Ifeachor E. C., Jervis B. W, "Digital Signal Processing: A practical approach", Pearson-Education, PHI 2002
2. Peter Pirsch, "Architectures for Digital Signal Processing", John Weily, 2007

B18EC5074	Mechatronics	L	T	P	C
Duration: 14 Wks		3	0	0	3

Prerequisites:

Knowledge of elements of mechanical engineering, digital electronics and Microprocessor.

Course Description:

This course is an introduction to Mechatronic systems, which require integration of the mechanical and electronics engineering disciplines within a unified framework. Topics covered in the course include: Sensors, Transducers, elements of electrical actuation systems and signal conditioning circuits. It also describes the different concepts of system models and controllers. Finally, it covers the concept of programming logic controllers.

Course Objectives:

The objectives of this course are to:

1. Understand the requirements of Mechatronics systems and recognize its various elements.
2. Understand the actuation systems and signal conditioning circuits.
3. Understand the concepts of system models and controllers
4. Understand the implementation of programmable logic controllers for Mechanical drives.

Course Outcomes:

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

1. Define Mechatronics systems and recognize its various elements.
2. Compile the key elements of electrical actuation systems and signal conditioning circuits.
3. Demonstrate the concepts of system models and controllers.
4. Understand the concepts of programming logic controllers.

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC5074	CO1	2	3												2	
	CO2				3			2						2		1
	CO3		1	2		3								2	1	
	CO4		2	3			1								2	

Course Contents:

Unit-1: Sensors and Transducers [11 Hrs]

Introduction to Mechatronics Systems, Measurement Systems, control Systems, Microprocessor b ased Controllers. Sensors and Transducers , PerformanceTerminology , Sensors for Displaceme nt, Position and Proximity; Velocity, Motion,Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature, Light Sensors Selection of Sensors.

Unit-2: Actuation Systems [10 Hrs]

Rotary Actuators, MechanicalActuation Systems, Cams, Gear Trains,Ratchet and pawl Beltand C hain Drives, Bearings.Electrical Actuation Systems, Mechanical Switches Solid State Switches ,Solenoids Constructionand working principle of DC and AC Motorsspeed controlof AC and DC drives, Stepper Motorsswitching circuitries for stepper motor,AC & DC Servo motors.

Unit-3: System Models and Controllers [11 Hrs]

Building blocks of Mechanical, Electrical, Fluid and Thermal systems, Rotational, Translation systems, electromechanical systems, Hydraulic Mechanical Systems. Continuous and discrete process Controllers, Control Mode, Step mode, Proportional Mode, Derivative Mode, Integral Mode, PID Controllers, Digital Controllers, Velocity Control, Adaptive Control, Digital logic control, Microprocessors control.

Unit-4: Programming Logic Controllers **[10 Hrs]**

Programmable Logic Controllers, Basic Structure , Input / Output Processing ,Programming ,Mnem onics , Timers, Internal relays and counters , Shift Registers , Master and Jump Controls , DataH andling , Analogs Input / Output, Selection of a PLC.

Text Books:

1. W. Bolton, Longman ,"Mechatronics"-, 2nd Pearson Publications, 2007
2. R.S. Ganokar ,"Microprocessor Architecture, programming and applications with 8085.8085A"-, Wiley Eastern.

Reference Books:

1. Godfrey C. Canwerbolu, Butterworth- Heinemann ,"Mechatronics Principles & applications" 2006.
2. DanNecsulescu ,"Mechatronics"-, Pearson Publication, 2007
3. David. G. Aliciatore& Michael B. Bihistand ,"Introduction Mechatronics & Measurement systems", , tata McGraw Hill, 2000.
4. Sabricentinkunt ,"Mechatronics", John wiley& sons Inc. 2007

SC-6

B18EC6041	Embedded Systems	L	T	P	C
Duration :14 Wks		3	0	0	3

Prerequisites:

Microcontroller, Operating Systems.

Course Description:

An *embedded system* is a computer *system* with a dedicated function within a larger mechanical or electrical *system*, often with real-time computing constraints. It is *embedded* as part of a complete device often including hardware and mechanical parts. *Embedded systems* control many *devices* in common use today.

Unit1 gives an introduction to the basic elements of embedded system such as sensors, interfaces, firmware etc.

Unit2 discusses about the various aspects of hardware software co design.

Unit3 covers the complete aspects on real time embedded system design.

Unit4 briefly covers the various topics on embedded integrated development environment.

Course Objectives:

Course objectives are to:

1. Give a brief idea about the embedded system components, memory, communication interfaces and other firmware components.
2. Understand the Quality attributes, hardware and Software co-design, Computational models in embedded systems, Unified Modelling languages etc.
3. Understand the firmware system development and firmware development languages.
4. Give a brief description of RTOS, Integrated Development Environment, Simulators and Emulators.
5. Understand the trends in embedded system development.

Course Outcomes:

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

1. Design a module of embedded system
2. Elaborate the quality attributes, hardware-software co-design in embedded systems.
3. Develop a firmware module.
4. Analyze the various tools in RTOS.

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC6041	CO1	3	2		1	3	1				2	1	2		1	1
	CO2	3	2	2	1	3									1	1
	CO3						1				2	1	2			
	CO4	3	2	2	1	3									1	1

Course Contents:

Unit-1: Typical Embedded System **[10 Hrs]**

Core of the Embedded System, Memory, Sensors and Actuators, Communication Interface, Embedded Firmware, Other System Components.

Unit-2: Characteristics and Quality Attributes of Embedded Systems **[11 Hrs]**

Hardware Software Co-Design and Program Modeling: Fundamental Issues in Hardware Software Co-Design, Computational Models in Embedded Design, Introduction to Unified Modeling Language **(Self Study/Case Study)**, Hardware Software Trade-offs

Embedded Firmware Design and Development: Embedded Firmware Design Approaches, Embedded Firmware Development Languages

Unit-3: Real-Time Operating System (RTOS) based Embedded System Design [10Hrs]

Operating System Basics, Types of OS, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Threads, Processes and Scheduling: Putting them altogether, Task Communication, Task Synchronization, Device Drivers, How to Choose an RTOS **(Self Study/Case Study)**.

Unit-4: The Embedded System Development Environment [11 Hrs]

The Integrated Development Environment (IDE) **(Self Study/Case Study)**, Types of Files Generated on Cross-compilation, Disassembler/Decompiler, Simulators, Emulators and Debugging, Target Hardware Debugging, Boundary Scan.

Trends in the Embedded Industry: **(Self Study/Case Study)**, Processor Trends in Embedded Systems, Embedded OS Trends, Development Language Trends, Open Standards, Frameworks and Alliances, Bottlenecks.

Text Books:

1. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2009
2. James K Peckol , "Embedded Systems – A contemporary Design Tool", John Weily, 2008.

B18EC6042	Data Mining	L	T	P	C
Duration :14 Weeks		3	0	0	3

Prerequisites:

Probability and statistics, Database Management Systems

Course Description:

In this course the fundamental knowledge of extract usable data from a larger set of any raw data. It implies analysing data patterns in large batches of data using one or more software. The major techniques of data mining is concentrated and numerical problem to achieve the desired result is concentrated upon the course covers the detail description about various algorithms, learning of predictive and descriptive models.

Course Objectives

To introduce DM as a cutting edge business intelligence method and acquaint the students with the DM techniques for building competitive advantage through proactive analysis, predictive modeling, and identifying new trends and behaviors.

The course objectives are to:

1. Learning how to gather and analyze large sets of data to gain useful business understanding.

2. Learning how to produce a quantitative analysis report/memo with the necessary information to make decisions.
3. Describing and demonstrating basic data mining algorithms, methods, and tools
4. Identifying business applications of data mining
5. Overview of the developing areas - web mining, text mining, and ethical aspects of data mining.
6. encourage students to develop and apply critical thinking, problem-solving, and decision-making skills, and apply enthusiasm for learning. Class participation is encouraged in this course.

Course Outcomes

On completion of this course the students will be able to:

1. Define knowledge discovery and data mining ,recognize the key areas and issues in data mining.
2. Apply the techniques of clustering, classification, association finding, feature selection and visualization to real world data.
3. Determine the real world problem and apply evaluation metrics to select data mining techniques.
4. Apply clustering technique for data mining problems.

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
B18EC6042	CO1	2					2	1					2			1
	CO2		2	1		2				2				1		
	CO3	2	3		3	2						1	1			2
	CO4	2	3		3	2						1	1			2

Course Contents

Unit-1 **[11hrs]**

Introduction to Data Mining and Preprocessing Techniques: What is Data Mining, Motivating Challenges, The Origins of Data Mining, Data Mining Tasks, Types of Data, Data Preprocessing techniques, Measures of Similarity: Similarity Measures for binary data, Jaccard Coefficient, and Cosine similarity, Applications of DM.

Unit-2 **[10hrs]**

Association Analysis: Basic Concepts and Algorithms-Basic Concepts and Algorithms: Problem Definition, Frequent Item set Generation: The Apriori principle, frequent Item set generation in the Apriori algorithm, Rule Generation, Alternative methods for generating Frequent Item sets, FP GROWTH Algorithm: FP Tree representation, Frequent Items et generation in FP Growth Algorithm.

Unit-3 **[11 hrs]**

Classification: Basic Concepts, Decision Trees-Basics concepts, General Approach to solve classification problem, Decision Tree Induction: How a decision tree works, How to build decision tree and Hunt's algorithm.

Classification: Alternative Techniques-Rule Based Classifiers: sequential covering algorithm. The Nearest Neighbor Classifiers, Bayesian Classifiers: Bayes theorem, using the Bayes theorem for classification, Naïve Bayes Classifier.

Unit-4 **[10 hrs]**

Clustering Analysis: Basic Concepts and Algorithms-Overview, What is Cluster Analysis, Different types of clustering, and Different types of clusters. The Basic K-means algorithm, Basic Agglomerative hierarchical clustering, The DBSCAN algorithm. Graph Based Clustering, Scalable Clustering Algorithms.

Text Books:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, "Introduction to Data Mining", Pearson Education, 2005.
2. G.K. Gupta, "Introduction to Data Mining with Case Studies", 3rd Edition, PHI, New Delhi, 2009.

Reference Books:

1. Jiawei Han and MichelineKamber , "Data Mining – Concepts and Techniques", 2nd Edition, Morgan Kaufmann Publisher, 2006
2. Alex Berson and Stephen J. Smith, "Data Warehousing, Data Mining and OPAL", Computing McGraw Hill Publisher, 1997.
3. EthemAlpaydam, "Introduction to Machine Learning", PHI Publication, 2006
4. Arun K. Pujari, "Data Mining Techniques", 2nd Edition, Universities Press, 2009.

B18EC6043	Image Processing	L	T	P	C
Duration :14 Wks		3	0	0	3

Prerequisites

Signals & Systems, Digital Signal Processing, Linear Algebra

Course Description

This course covers the investigation, creation and manipulation of digital images by computer. The course consists of theoretical material introducing the mathematics of images and imaging. Topics include representation of two-dimensional data, time and frequency domain representations,

filtering and enhancement, , convolution, color images, compression and segmentation. This course found wide applications not only in the space program, but also in the areas such as medicine, biology, industrial automation, astronomy, defense and intelligence.

Course Objectives:

The course objectives are to:

1. Study the image fundamentals and mathematical transforms necessary for image processing.
2. Study the image enhancement techniques
3. Study image restoration procedures.
4. Study the image compression procedures.

Course Outcomes

On completion of this course the student shall be able to

1. Review the fundamental concepts of a digital image processing system.
2. Analyze images in the frequency domain using various transforms and evaluate the techniques for image enhancement
3. Analyze image restoration techniques and Categorize various compression techniques.
4. Design image segmentation techniques

Mapping of Course Outcomes with Program Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	Po 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC6043	CO1	3	3	2			1	1			3	3	2	1	1	1
	CO2	3	3	3	2			1		3	3	2	2	2	2	3
	CO3	3	3	3	2			1		3	3	2	2	2	2	3
	CO4	3	3	3	2			1		3	3	2	2	2	2	3

Course Contents:

Unit-1: Introduction [11]

Image Sampling, Quantization, Resolution, Classification of Digital Images, Image Types, Image File Formats,2D signals, Separable Sequence, Periodic Sequence, 2D convolution, 2D Convolution using graphical Method, Circular and linear Convolution Through matrix Analysis and its applications, 2D Auto correlation, cross correlation. Light and color, Color Formation, Human Perception of color, color Model, The chromaticity Diagram.

Unit-2: Image Transforms [10]

2D Discrete Fourier Transform, Properties of 2D-DFT, DCT , properties ,Haar Transform, properties, Hadamard transform, properties, slant transform ,properties. Image Enhancement in spatial Domain, Enhancement through point operation, Types of Point operation, Histogram Equalization (problems), Linear and Non Linear Grey-level Transformation, Median Filter.

Unit-3: Image Restoration and De-noising [10]

Image Degradation, Types of Image Blur, Classification of Image Restoration Techniques, Image restoration model, Linear Image restoration techniques and non-linear Image restoration techniques, Wiener filter, Inverse filter, Blind Deconvolution and classification, Image Denoising.

Unit 4: Image Segmentation and Compression [11]

Classification of Image-Segmentation Techniques, Region approach to image segmentation, Clustering Techniques, Image segmentation based on Thresholding, Edge Based Segmentation, Classification of Edges, Edge Detection. Image Compression Scheme, Classification, Huffman Coding, JPEG

Text Books:

1.S. Jayaraman, S Esskairajan "Digital Image Processing", illustrated, Tata McGraw-Hill Education, 2011

2.R. C. Gonzalez and R. E. Woods, "Digital Image Processing" 2nd edition, Pearson Education (Asia) Pte. Ltd/Prentice Hall of India, 2004.

3.Anil K. Jain, "Fundamentals of Digital Image Processing," Pearson Education (Asia) Pte. Ltd./Prentice Hall of India, 2004.

Reference Books:

1. Z. Li and M.S. Drew, "Fundamentals of Multimedia" Pearson Education (Asia) Pte. Ltd., 2004.

2. M. Tekalp, "Digital Video Processing", Prentice Hall, USA, 1995.

B18EC6044	Machine Learning and Deep Learning	L	T	P	C
Duration:14 Weeks		3	0	0	3

Prerequisites:

Statistics, Linear Algebra, Probability, calculus

Course Description:

The Course introduces to the world of machine learning with various aspects involved, types of learning like supervised, unsupervised and reinforcement learning. It includes concepts from design of learning systems, neural networks, different aspects involved in neural networks, their activation function, back propagation algorithm etc. It describes algorithms like Bayes Theorem, Bayes Theorem Concept Learning, Maximum Likelihood, Gibbs Algorithm, Naïve Bayes Classifier and Decision tree. The course also focusses on fundamentals of deep learning and Reinforcement learning.

Course Objectives:

The objectives of this course are to:

1. Introduce some concepts and techniques that are core to Machine Learning.
2. Introduce concepts of learning and decision tree.
3. Provide knowledge of neural networks, reinforced learning and Bayesian techniques.
4. provide insights into deep learning fundamentals

Course Outcomes:

On completion of this course the student will be able to:

1. Design mathematical models used across Machine Learning algorithms.
2. Apply paradigms of supervised and un-supervised learning.
3. Identify a real world problem and apply the learned techniques of Machine Learning to solve the problem.
4. Explain the basics of Deep learning concepts.

Mapping of Course Outcomes with Program Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2	PSO 3
B18EC6044	CO1	2	3	2										3	2	3
	CO2	2	3	1										3	2	3
	CO3	2	3	2	2									3	2	3
	CO4	2	1	1										3	2	3

Course Contents:

Unit 1: Introduction to Machine Learning [11 Hrs]

Designing Learning systems, Perspectives and Issues, Types of machine learning algorithms- Supervised Learning, Unsupervised Learning, Semi-supervised and Reinforcement Learning. Concept Learning and the General-to-Specific Ordering: A Concept Learning Task, Concept Learning as Search, FIND-S, Version Spaces and Candidate Elimination Algorithm, Inductive bias

Unit 2: Bayesian and Decision Tree [11 Hrs]

Bayes Theorem, Bayes Theorem Concept Learning, Maximum Likelihood, Bayes Optimal Classifier, Gibbs Algorithm, Naïve Bayes Classifier.

Decision Tree: Decision Tree Representation, Hypothesis Space Search, Inductive bias in decision tree, issues in Decision tree.

Unit 3: ANN and Reinforcement Learning [10 Hrs]

Artificial Neural Networks: Introduction, Neural Network Representations, Perceptrons, Multilayer Networks and the Backpropagation Algorithm. Reinforcement Learning: Introduction, Learning task, Q-learning.

Unit 4: Deep Learning **[10 Hrs]**

Introduction, Modern Practices-Example: Learning XOR, Gradient based Learning, Hidden Units, Architectural design, back-propagation Algorithm.

Text Books:

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education, (INDIAN EDITION), 2013.
2, Ian Goodfellow and Yoshua Bengio and Aaron Courville, "Deep Learning", An MITPress book

Reference Books:

1. Ethem Alpaydin, "Introduction to Machine Learning", 2nd Ed., PHI Learning Pvt. Ltd., 2013

SC-7

B18EC6051	Real Time Systems	L	T	P	C
Duration 14 Weeks		3	0	0	3

Prerequisites:

Basics of Embedded Systems, Structure of Embedded System, Programming assembly Language in C.

Course Description:

This course is intended to provide the understanding of hard and soft real-time systems. This is a course on the design and applications of all real time aspects of various system components, like OS, memory, communication, quality of service system principles, resource management and focus on their functionality and implementation platforms. A range of methodologies for specifying and designing hardware and software components of the real time systems is discussed. It also explains about the programming knowledge required to code the real time systems.

Course Objectives:

The objectives of this course are to:

1. Illustrate the basic concepts of real-time systems and their important hardware building blocks for computer used for control.
2. Summarize the concepts of RTOS, tasks scheduling, resource management and task communication.

3. Define specific language features desirable in real-time system and identify widely used programming languages in real-time system design.
4. Understand the methodologies to help in the specification, design and construction of real-time software and real-time systems.

Course Outcomes:

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

1. Describe the characteristics of Real-Time Systems and identify the hardware building blocks for Real-Time Systems.
2. Design and analyze various task scheduling and management mechanisms.
3. Categorize programming languages for different real-time systems.
4. Apply the different methodologies for designing and developing Real-Time Systems.

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	Po 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
B18EC 6051	CO1	3	3	1						3	3	2	1	3	3	3
	CO2	3	3	3	2	3				3	3	2	1	3	3	3
	CO3	3	2	3	1	3				3	3	2	3	3	3	3
	CO4	3	3	3	1	3				3	3	3	3	3	3	3

Course Contents:

Unit 1: Introduction to Real-Time Systems [11 Hrs]

Real Time Systems- Definition, Classification of Real-Time Systems, Time Constraints, Classification of Programs.

Advanced Hardware Fundamentals: Microprocessors, Buses, Direct Memory Access, Interrupts, Other Common Parts, Built-Ins on the Microprocessor, Conventions Used on Schematics. Interrupts-Basics, The Shared-Data Problem, Interrupt Latency.

Unit 2: Operating Systems [11 Hrs]

Introduction, Real-Time Multi-Tasking OS, Scheduling Strategies, Priority Structures, Task Management, Scheduler and Real-Time Clock Interrupt Handler, Memory Management, Code Sharing, Resource Control, Task Co-Operation and Communication, Mutual Exclusion.

Unit 3: Programming Languages for Real-Time Systems [10 Hrs]

Coding of Real-Time Software, Assembly Language, Procedural Languages, Object-Oriented Languages, Overview of Programming Languages, Automatic Code Generation, Complier Optimizations of Code.

Unit 4: Design of RTS **[10 Hrs]**

General Introduction: Introduction, Specification Document, Preliminary Design, Single-Program Approach, Foreground/Background System.

RTS Development Methodologies: Introduction, Yourdon Methodology, Ward and Mellor Method, Hately and Pirbhai Method.

Text Books:

1. Stuart Bennett, "Real-Time Computer Control", Pearson, Second Edition, 1994.
2. David E. Simon, "An Embedded Software Primer", Pearson Education, 1999.
3. Phillip A. Laplante, Seppo J. Ovaska, " Real-Time System Design and Analysis: Tool for the Practitioner", Wiley, Fourth Edition, 2012.

References:

1. C.M. Krishna and Kang G. Shin, "Real Time Systems", MGH, 1997.
2. Jane W. S. Liu, "Real Time Systems," Pearson Education, 2000.
3. Raj Kamal , "Embedded Systems Architecture, Programming and Design," Second Edition, TMH, 2003

B18EC6052	UNIX Fundamentals	L	T	P	C
Duration:14 Weeks		3	0	0	3

Prerequisites:

Basic computer skills, Working knowledge of UNIX, Administering the various services of UNIX environment.

Course Description:

The course is aims to present the UNIX environment and to provide the most basic commands to students with UNIX knowledge. The course covers UNIX system and use different commands, UNIX directories and files, File attributes and permissions, changing file permissions. Course also provides basic knowledge about Vi editor-Input mode commands. Command mode commands, the ex-mode commands, Use of editors and regular expressions, Filters, File links – hard and soft links, the shells interpretive cycle and illustrating the mechanism of process creation. After studying this course, students will be able to Explain UNIX system and use different commands, Compile certain functions on different subsystems and demonstrate use of editors and its usage in UNIX environment.

Course Objectives:

This course will enable the students to:

1. Illustrate the UNIX system architecture and use of basic Commands.
2. Use of editors and networking commands.
3. Recognize the services of Unix and manage the services
4. Categorize, compare and make use of UNIX system calls

Course Outcomes:

After studying this course, students will be able to:

1. Explain UNIX system and use different commands.
2. Understand the UNIX directories and files.
3. Demonstrate use of editors and regular expressions
4. Illustrating the mechanism of process creation.

Mapping of Course Outcomes with Program Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	Po 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC6052	CO1	3	3	2										3	2	1
	CO2	3	2	1										2	1	3
	CO3	3	1	2										3	2	1
	CO4	3	2	1										3	2	1

Course Contents:

Unit-1: Introduction to Linux: [10]

Introduction, Brief history. UNIX Components/Architecture. Features of UNIX. Posix and Single Unix specification. Open source licensing - History of Linux - Unix Vs Linux - Flavors of Linux - Benefits and characteristics of Linux The login prompt. General features of Linux commands/ command structure. Command arguments and options. Understanding of some basic commands such as echo, printf, ls, who, date, passwd, cal, combining commands. Meaning of Internal and external commands. The type command: knowing the type of a command and locating it. Man command.

Unit –2: Directories and files: [11]

Files, Naming files, Basic file types/categories. Organization of files. Hidden files. Standard directories. Parent child relationship. The home directory and the HOME variable. Reaching required files- the PATH variable, manipulating the PATH, Relative and absolute pathnames. Directory commands, pwd, cd, mkdir, rmdir commands. The dot (.) and double dots (..) notations to represent present and parent directories and their usage in relative path names. File related commands – cat, mv, rm, cp, wc and od commands. File attributes and permissions and knowing them. The ls

command with options. Changing file permissions: the relative and absolute permissions changing methods. Recursively changing file permissions. Directory permissions.

Unit-3: The Vi editor [10]

The vi editor, Basics, Different modes of vi. Input mode commands. Command mode commands. The ex-mode commands. Illustrative examples Navigation commands. Repeat command. Pattern searching. The search and replace command. The set, map and abbr commands. Simple examples using these commands. The shells interpretive cycle: Wild cards. Removing the special meanings of wild cards. Three standard files and redirection.

Unit-4: Regular Expressions, Filters, Process [11]

Basic and Extended Regular Expressions: The grep, egrep. Typical examples involving different regular expressions. File inodes and the inode structure. File links – hard and soft links. Filters. Head and tail commands. Cut and paste commands. The sort command and its usage with different options. Meaning of a process. Mechanism of process creation. Parent and child process. The ps command with its options. Executing a command at a specified point of time: at command. Background processes. The bg and fg command. The kill command. The find command with illustrative examples.

Text books:

1. Sumitabha Das., "UNIX Concepts and Applications", 4th Edition. Tata McGraw Hill
2. Behrouz A. Forouzan, Richard F. Gilberg: "UNIX and Shell Programming",- Cengage Learning – India Edition. 2009.

Reference books:

1. Orsaria Jang, "RHCSA/RHCE Red Hat Linux Certification Study Guide Exams Ex200 & EX300", McGraw-Hill Education, July 2017
2. M.G. Venkatesh Murthy: "UNIX & Shell Programming", Pearson Education.
3. Richard Blum, Christine Bresnahan : "Linux Command Line and Shell Scripting Bible", 2nd Edition , Wiley,2014.

B18EC6053	Adaptive Filters	L	T	P	C
Duration :14 Wks		3	0	0	3

Prerequisites:

Digital Signal Processing, Probability Theory and basics of Linear Algebra.

Course Description:

The course covers structures, algorithms and convergence properties for adaptive filters, with emphasis on applications in communications and signal processing.
The term adaptive filter implies changing the characteristic of a filter in some automated fashion to obtain the best possible signal quality in spite of changing signal/system conditions. Adaptive filters are usually associated with the broader topic of statistical signal processing.
The operation of signal filtering implies extracting the desired signal from a signal containing both desired and undesired components.
An optimum linear filter in the minimum mean square sense can be designed to extract a signal from noise by minimizing the error signal formed by subtracting the filtered signal from the desired signal. For noisy signals with time varying statistics, this minimization process is often done using an adaptive filter.

Course Objectives:

The course objectives are to:

1. Provide a significant understanding of adaptive filters in signal processing.
2. Introduce the mathematical framework necessary in understanding the adaptive filtering process.
2. Present the perspectives of adaptive filters towards present day communication systems.
3. Study the differences between algorithms adopted in adaptive filtering.
4. Know the performance measures used in comparing different adaptive filtering algorithms.

Course Outcomes:

On completion of this course the student will be able to:

1. Define adaptive linear combiner, performance function-gradient, minimum mean square error, and filtering, smoothing, Prediction and performance surface.
2. Summarize the adaptive Searching performance surface stability and rate of convergence**.**
3. Appraise the LMS algorithm convergence of weight vector.
4. Illustrate the Applications of adaptive filters.

Mapping of Course Outcomes with Program Outcomes

Course Code	POS/ COs	PO 1	Po 2	PO 3	PO 4	PO 5	PO 6	Po 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC6 053	CO1	2	2											2		
	CO2		2	2	3									2		2

	CO3		**3**	**3**	**2**								**3**	**3**		**2**
	CO4		**2**	**3**	**3**								**3**			**3**

Course Contents:

Unit-1: Adaptive systems **[11hrs]**

Definitions and characteristics, applications, properties and examples of adaptive linear combiner. Definitions of input signal and weight vectors, performance function-gradient and minimum mean square error, introduction to filtering, smoothing and prediction, performance surface.

Unit-2: Searching performance surface stability and rate of convergence **[10hrs]**

Learning curve, gradient search - Newton's method and method of steepest descent, comparison, gradient estimation, performance penalty: variance, excess MSE and time constants, mis-adjustments.

Unit- 3 LMS algorithm convergence of weight vector: **[10hrs]**

LMS/Newton algorithm, properties, sequential regression algorithm, comparisons

Unit-4 Applications of adaptive filters: **[11hrs]**

Multipath communication channel, geophysical exploration, FIR digital filter synthesis, inverse adaptive modeling, equalization, and deconvolution, adaptive equalization of telephone channels-adapting poles and zeros for IIR digital filter synthesis.

Text Books:

1. Bernard Widrow and Samuel D. Stearns, “Adaptive Signal Processing”, Person Education, 2005.
2. Simon Haykin, “Adaptive Filter Theory”, Pearson Education, 2003.

Reference Books:

1. John R. Treichler, C. Richard Johnson, Michael G. Larimore, “Theory and Design of adaptive Filters”, Prentice-Hall of India, 2002.
2. S. Thomas Alexander, “Adaptive Signal Processing - Theory and Application”, Springer-Verlag.
3. D. G. Manolokis, V. K. Ingle and S. M. Kogar, “Statistical and Adaptive Signal Processing”, Mc Graw Hill International Edition, 2000.

B18EC6054	Project Management	L	T	P	C
Duration: 14 Wks		3	0	0	3

Prerequisites:

No Prerequisites

Course Descriptions:

Project management course provides concept of project management that is very much essential to handle projects efficiently. It covers the topics on phases of project life cycle, roles and responsibilities of leaders, Project management and estimation. It also covers the concepts of Project scheduling, coordination and control. Finally, it covers the concept of performance measure in Project management to estimate the quality of project management.

Course Objectives:

Course objectives are to:

1. Understand project management and methodology
2. Know the use of project management tools, techniques and skills.
3. Understand how to manage the project cost, quality and delivery.
4. Learn the skill of selection and initiation of individual projects and portfolios of projects In the enterprise.

Course Outcomes:

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

1. Identify specific management needs in the execution of projects at tactical and strategic level.
2. Analyze the project proposals for scope, time and cost to consider its feasibility.
3. Summarize the strategies to evolve suitable approach to accomplish the project with effective usage of the resources.
4. Interpret the team building and leadership skills in planning and implementation of the project.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	Po 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC6054	CO1	3	3	2	3		2	2	3	1	2	3	2	3	2	1
	CO2	3	3	2	2						2	3	2	3		1
	CO3	3	3	2	3	3	2					3		3	2	
	CO4	3	3	2	3		2					3		3	2	1

Course Contents:

Unit 1: Concept of Project Management [10Hrs]

Concept of Project Management: Concept of project, categories of projects, phase of project life cycle, roles and responsibility of a project leader, tools and technology for project management. Organizing and Staffing: Project leader: skills/abilities required for project manager, authorities and responsibilities of project manager, project organization, types of accountability in project execution and control

Unit 2: Project Planning and Estimation [11Hrs]

Project Planning and Estimation: Feasibility study and report, phased planning, project planning steps: objectives and goals of the project, preparation of cost estimation, finalization of project implementation, evaluation of the project profitability. Project Procedure Manual: Contract management, configuration management, communication management, man management, time management, materials management, cost management, needs for flexibility.

Unit 3 Project Scheduling, Coordination and Control [10 Hrs]

Project Scheduling, Coordination and Control: Project implementation, scheduling-different techniques GANTT charts: case study, bar charts for combined activities, Project direction, communication in a project, project coordination, project control, scope and progress control performance control, schedule control and cost control.

Unit 4: Performance Measures in Project Management [11 Hrs]

Performance Measures in Project Management and Project Inventory Management: Performance indicators, nature of project inventory, supply and transportation of materials. Project Implementation: project work system design, work break down structure(WBS), project execution plan(PEP), closing a project.

Text Books:

1. Herold Kerzner: “Project Management, a system approach to planning, scheduling and controlling”, CBS publishers and distributors, 2002
2. Meri Williams: “The Principles of Project Management”, Sitepoint publishers, 2008

Reference Books:

1. Harvey Maylor: “Project Management”, 3rdedition, Pearson, 2003.
2. Chaudhry S: “Project Management”, McGraw Hill 2010

B18EC6055	Component Engineering	L	T	P	C
Duration: 14weeks		3	0	0	3

Prerequisites:

Basics of Physics, Electrical Components, Electro Mechanical Components.

Course Descriptions:

About course: Component engineering involves the selection, maintenance, design and construction of smaller components for larger machines. Component engineers are needed in all manufacturing industries, from the auto and space industries to defence. A degree in mechanical, electrical or metallurgical engineering may be required for those seeking a job in component engineering.

Course Objectives:

The objectives of this course are to:

1. Understand the students to ensure specific components used in manufactured products and systems to make reliable and effective.
2. Comprehend the knowledge in the field of design, assembly, and testing of components to meet the specifications for quality and performance.
3. Develop the knowledge about the basic manufacturing mechanical and electrical systems used in the industry

Course Outcomes:

On completion of this course the student will be able to:

1. Examine and Compare the applications of various types of cables, connectors and fuses.
2. Differentiate the various Switches and their usage.
3. Interpret the construction, working and applications of various types of relays.
4. Summarize the various types of heat sink and heat cooling process.
5. Appraise the reliability and maintainability in industries.

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC6055	CO1	3	3										3	3		
	CO2	3											3	2		
	CO3	3	2										3	2		

	CO4	**3**	**2**										**3**	**2**		
	CO5	**3**	**3**											**3**		**2**

Unit 1: **Cables, Connectors and Fuses** **[11 Hrs]**

Cables: General specifications of cables- characteristic impedance, current carrying capacity, flexibility. Types of cables - construction and applications of coaxial cable, 600 E telephone cable-PASP, Alpeth sheathed cable, FRC cable, twin core cable twisted & shielded type, optical fibre cable

Connectors: General specifications of connectors- contact resistance, breakdown voltage, insulation resistance, Constructional diagram, applications of BNC, D series, Audio, Video, printer, edge, FRC, RJ 45 connectors. Constructional diagram and applications of phone plug & jacks

Fuses: Glass, ceramic fuse, resettable fuse, shunt fuse- MOV, HRC fuse

Unit 2: Switches and Relays **[10 Hrs]**

Switches: Switch specifications – voltage rating, contact current rating, contact resistance, characteristics of switch & relay – operating time, release time, bounce time, constructional diagram, application of toggle, rotary, push to on & push to off, rocker.

Relays: Construction, working and application of general-purpose relay, NO, NC contact, reed relays, solid state relays, difference between switch & relay.

Unit 3: Heat Management and parasitic electrical effects **[10 Hrs]**

Heat Transfer, Thermal resistance, Heat sinking, Forced Cooling, advanced heat-removal techniques, parasitic circuit elements, Distributed parameter circuits, problems related to above topics.

Unit 4: Electromagnetic effects and Reliability and maintainability **[11 Hrs]**

Electromagnetic interference, application studies, Failure, The “bathtub” curve, measures of reliability and maintainability, High reliability systems and Maintenance, problems**.**

Text Books:

1. Stephen Sangwine, “Electronic Components and Technology”, 3rd Edition, ISBN 9781315221779
2. Grover & Jamwal, “Electronic Components and Materials”, 2nd edition, New Delhi: Shroff Publishers and Distributors, ISBN 81-7366-549-4.
3. SK Bhattacharya, “Electrical and Electronic Engineering Materials”, Khanna Publishers, Delhi ISBN: 9788187394247
4. SK Sahdev, “Electrical Engineering Materials”, Unique International Publications, Pearson Education India, 2015, ISBN: 9332547114, 9789332547117
5. SM Dhir, “Electronic Components and Materials”, Tata Mc Graw Hill, New Delhi, 0074630822, 9780074630822

SC-8

B18EC6061	MEMS	L	T	P	C
Duration: 14 Wks		3	0	0	3

Prerequisites:

Engineering Physics, Upper Division standing in Engineering, Chemistry or Chemical Engineering and Material Science, VLSI Technology, Elements of Mechanical Engineering.

Course Description:

Micro-Electro-Mechanical Systems (**MEMS**) is a multidisciplinary area that includes a design and fabrication of sensors and actuators which are capable of micron-size mechanical movements. Lectures cover a wide range of topics in design, fabrication and packaging of MEMS.

Course Objectives:

The objectives of this course are to:

1. Describe the various MEMS materials, devices and applications.
2. Demonstrate the three fundamental pillars of MEMS, i.e. design, fabrication and micromachining techniques.
3. Evaluate different packaging materials used for MEMS.
4. understand the unique demands, environments and applications of MEMS devices

Course Outcomes:

On completion of this course, the student will be able to:

1. Demonstrate the application of scaling laws in the design of microsystems.
2. Describe the various steps involved in MEMS fabrication.
3. Evaluate among different packaging techniques.
4. Analyze the critical performance aspects of electromechanical transducers, including sensors and actuators.

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC6061	CO1	1	2		3			2		3			3	1		2
	CO2	1	2	1	2	3		2		3		3		1		2
	CO3	3	2	1			1	3					3	1		2
	CO4	3	2	1	2	3	1			3			3	1		2

Course Contents:

Unit -1: Introduction to MEMS [11 Hrs]

Why Miniaturization? Microsystems versus MEMS, Why Microfabrication? MEMS and Microsystems, Typical MEMS and Microsystem Products, Evaluation of Microfabrication, Microsystem and Microelectronics, The Multidisciplinary Nature of Microsystem Design and Manufacture, Microsystem Miniaturization, Smart Materials, Structures and Systems, Integrated Microsystems, Applications of Smart Materials and Microsystems.

Materials for MEMS and Microsystems: Substrates and Wafers , Silicon as a Substrate Material, Silicon Compounds, Silicon piezoresistors Gallium Arsenide, Quartz, Piezoelectric Crystals, Polymers.

Unit -2: Microsystems Fabrication Process [11 Hrs]

Lithography: Introduction, Photolithography, Ion-implantation, Diffusion, Oxidation, Chemical Vapour Deposition (CVD), Physical Vapour Deposition (PVD) - Sputtering, Epitaxy: Introduction, Vapor-Phase Epitaxy, Molecular Beam Epitaxy: Overview of Micro Manufacturing: Introduction, Bulk micromachining, Surface Micromachining, LIGA process.

Unit -3: Microsystems Design and Microsystem Packaging [10 Hrs]

Design Considerations, Process Design, Mechanical Design, Design of a Silicon Die for a Micropressure Sensor, Computer Aided Design, Overview of Mechanical Packaging of Microelectronics, Microsystem Packaging, Interfaces in Microsystem Packaging, Essential Packaging Technologies, Three Dimensional Packaging, Assembly of Microsystems, Selection of Packaging Materials, Signal Mapping and Transduction, Design Case: Pressure Sensor Packaging.

Unit – 4: Micro Sensors, Actuators, Systems and Smart Materials [10 Hrs]

Case Studies – Silicon Capacitive Accelerometer, Piezo-resistive Pressure Sensor, Conduct Metric Gas Sensor, Fiber-Optic Sensors, Electrostatic Comb-Drive, Magnetic Microrelay, Microsystems at Radio Frequencies, Portable Blood Analyze, Piezoelectric Inkjet Print Head, Micromirror Array For Video Projection.

VLSI Process Integration: Introduction, Fundamental Considerations for IC Processing, NMOS IC technology, CMOS IC Technology, MOS Memory IC Technology, Bipolar IC Technology, IC Fabrication.

Text books:

1. G.K. Ananthasuresh, K.J. Vinoy, S. Gopalakrishnan, K.N. Bhat, V.K. Aatre, “Micro and Smart Systems”, Wiley India, 2010.
2. Tai Ran Hsu, “MEMS and Microsystems: Design, Manufacture, and Nanoscale Engineering”, Wiley, 2008.
3. Chang Liu, “Foundation of MEMS” Pearson Education International, 2006.
4. S. M. Sze, “VLSI Technology”, McGraw-Hill, Second Edition.

5. Nadim Maluf, Kirt Williams “An Introduction to Microelectromechanical Systems Engineering” Second addition.

B18EC6062	Web Programming	L	T	P	C
Duration :14 Weeks		3	0	0	3

Prerequisites

Basic programming knowledge, Object oriented concepts

Course Description:

This course introduces students to basic web design using HTML,CSS,JavaScript and PHP. Throughout the course students are introduced to planning and designing effective web pages. Implementing web pages by writing HTML and CSS code, enhancing web pages with the use of page layout techniques, text formatting, tables, images, and multimedia; and producing a functional, multi-page website. Validating the user data using Client side scripting language JavaScript and PHP is used to process the forms. Upon successful completion of this course, students will have a good foundation in web design and data validation using HTML, CSS, JavaScript and PHP and students will be prepared to study more advanced web design topics.

Course Objectives:

The objectives of this course are to:

1. Illustrate the Semantic Structure of HTML and CSS.
2. Compose forms and tables using HTML and CSS.
3. Design Client-Side programs using JavaScript.
4. Design Server-Side programs using PHP.
5. Impart skills required to develop web applications and services.
6. Provide students with conceptual and practical knowledge of web applications.

Course Outcomes:

On completion of this course, the student will be able to:

1. Adapt XHTML and CSS syntax and semantics to build web pages.
2. Identify tools and technologies for Web applications.
3. Develop Client-Side Scripts using JavaScript and Server-Side Scripts using PHP to Generate and display the contents dynamically.
4. Develop user-interfaces for Web applications and Web services.

Mapping of Course Outcomes with Program Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC6062	CO1	3	2	1										2	1	3
	CO2	4	2	1										3	1	2
	CO3	3	1	2										3	2	1
	CO4	3	2	1										2	3	1

Course Contents:

Unit-1

Fundaments of Computers and Internet **[11]**

Introduction to Computers and Internet, World Wide Web, Web Browsers, Web Servers, Uniform Resource Locators, MIME, Hypertext Transfer Protocol.

Introduction to XHTML-1: Standard XHTML document structure, Basic Text Markup, Images, Hypertext Links, Creation of Lists in XHTML, Creation of Forms.

Unit- 2 **[10]**

XHTML-2: Creation of Tables and Frames in XHTML, Syntactic differences between HTML and XHTML.

Cascading Style Sheets: Introduction, Levels of Style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, The Box Model, Background Images, The and tags.

Unit-3 **[11]**

The Basics of JavaScript: Overview of JavaScript, Object Orientation and JavaScript, General Syntactic characteristics, Screen output and keyboard input, Control statements, Functions, Arrays in JavaScript, Constructors, Pattern Matching using Regular Expressions, Events and Event handling.

Unit-4 **[10]**

Introduction, PHP Basics, General Syntactic characteristics, Control statements, Arrays, Functions, Pattern Matching, Files, Cookies, Session Tracking, Database Access with PHP and MySQL.

List of Experiments:

1. Create a XHTML form which includes Name, Address and Comment, Hyperlinks, Images Lists.
2. Validate the user input using JavaScript. (Ex: Validating the student SRN).
3. Create a XHTML form with SRN, Name, and Address fields and it also includes tables and Forms. On submitting the form, it should store the values in MySQL table.
4. PHP code to store current date-time in a COOKIE and display the 'Last visited on' date-time on the web page.
5. PHP code to store page views count in SESSION and to show the count on web page.

Text Books:

1. Robert W. Sebesta, "Programming the World Wide Web**"**, 7th Edition. Addison-Wesley, 2012.
2. Kogent Learning Solutions Inc., **"**Web Technologies HTML, CSS, JavaScript, ASP.NET, Servlets, JSP, PHP, ADO.NET, JDBC and XML Black Book**",** Dream tech Press, ISBN-13: 978-9351192510, Paperback – 19 Dec 2013
3. Robin Nixon, **"**Learning PHP, MySQL &JavaScript with jQuery, CSS and HTML **5",** 4th Edition, O'Reilly Publications, 2015.

Reference Books:

1. Navneet Mehra, Bunny Mehra, **"**Website Development Using HTML and CSS - A Practical Step-By-Step Guide to Develop E-Commerce Store**"**, Unicorn Books (2012)

2. Jon Duckett, "HTML and CSS: Design and Build Websites**",** Wiley; 1 edition, ISBN-13: 978-1118008188

B18EC6063	Information Theory and Coding	L	T	P	C
Duration :14Wks		3	0	0	3

Prerequisites:

Digital Communication, Fourier analysis, Probability Theory and Bayesian Inference.

Course Description:

It is a concept oriented course which deals with the measure of information, modelling of information source, source coding and channel coding. This course enables the students to become a master in coding, detecting and correcting error and develops problem solving skills. The student shall be able to understand and explore the state of art technology such as Viterbi decoding, modelling the source, estimating channel capacity and calculating entropy, etc.

Course Objectives:

The objectives of this course are to

1. Explain fundamental concept of information theory and entropy.
2. Illustrate various source coding techniques.
3. Summarize reliability of data transmission using error-control coding techniques,
4. Develop procedures for designing efficient coding schemes for controlling various types of errors in digital communication system.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Solve the information content of dependent and independent sequences.
2. Illustrate the efficiency and redundancy of information using various source encoding methods.
3. Develop linear block codes and binary cyclic codes for error detection and correction.
4. Design convolution codes for encoding.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC6063	CO1	3	3	2										1	2	1
	CO2	2	3	3	1									1	2	2
	CO3	1	2	3	1									1	2	3
	CO4	2	3	3	2									1	2	3

Course Contents:

Unit-1: Fundamentals of Information Theory [11 Hrs]

Introduction: Historical Background, The Communication Process,

Information Theory: Measure of Information, Information content of a message, Average information content of symbols in long independent sequences, Properties of Entropy, Average information content of symbols in long dependent sequences, Markoff statistical model for information sources, Entropy and Information rate of Markoff Sources.

Unit-2: Source Coding [10 Hrs]

Source coding theorem, Prefix coding- Kraft-McMillan inequality theorem, Huffman coding-minimum and maximum variance, Discrete memory less channels-Binary symmetric channel, Mutual information, Properties of mutual information, Shannon-Hartley theorem and its implications, Rate of information Transmission over a Discrete channel.

Unit-3: Linear Block Codes and Binary Cyclic codes [11 Hrs]

Introduction, Examples of error control coding, Methods of controlling errors, Types of errors, types of codes, Linear Block Codes (LBC): Matrix description of LBC, Error detection and Correction capabilities of Linear Block Codes, single error correcting hamming codes, Table Lookup decoding using the standard array.

Binary Cyclic codes: Algebraic structure of cyclic codes, Encoding using an (n-k) bit shift register, Syndrome Calculation, Error detection and error correction.

Unit-4: Convolutional Codes and Special Codes **[10 Hrs]**

Convolutional encoder, Time-Domain Approach, Transform-Domain approach, Code tree, State diagram, Trellis diagram. Special Codes: Cyclic Redundancy Check Codes, Golay codes, Bose-Chaudhuri-Hocquenqhem (BCH) Codes, Reed-Solomon Codes Viterbi decoding.

Text Books:

1. Simon Haykin "Digital Communication Systems", Wiley student edition, reprint: 2013. John Wiley & Sons, ISBN: 978-81-265-4231-4.
2. K. Sam Shanmugam, "Digital and Analog Communication Systems" reprint: 2014, by John Wiley & Sons. ISBN: 978-81-265-3680-1

B18EC6064	Alternate Engineering	L	T	P	C
Duration :14 Wks		3	0	0	3

Prerequisites:

Basic Engineering Physics, Basic Electronics.

Course Description:

This course gives an overview of key aspects in solar energy, wind energy, biomass for bioenergy and all other renewable Energy Sources in engineering. A general insight to the fundamental disciplines such as wind measurements, biomass sources, processing systems, human health effects, pollution abatement, energy generating systems using renewable and non-renewable sources of energy on the population.

This course also provide an overview of the basic process, by which solar energy is collected and converted to biomass. Emphasis will be given on different strategies to convert biomass to biofuels, the review of the available technologies and how these could meet the growing demand for energy in the future.

Course Objectives:

The course objectives are to:

1. Identify the basic concepts, principles, potentials, efficiencies and limitations of various renewable energy sources.
2. Identify formulate and solve problems of renewable energy conversion and storage.
3. Explore society's present needs and future energy demands.

4. Identify the new methodologies / technologies for effective utilization of renewable energy sources.

Course Outcomes:

Upon completion of this course, the students can able to

1. Describe the challenges and problems associated with the use of the current energy sources and the potentials for having renewable energy.
2. Convert units of energy in order to quantify energy demands and make comparisons among energy uses, resources, technologies, challenges, global warming and greenhouse effect.
3. Collect and organize information on renewable energy technologies as a basis for further analysis and evaluation.
4. Evaluate, compare and select energy systems based on economic and environmental considerations.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC6064	CO1	3	1	3	1		3	3	3	3			3	1		2
	CO2	3	1	3	1		3	3	3	3			3	1		2
	CO3	3	1	3	1		3	3	3	3			3	1		2
	CO4	3	1	3	1		3	3	3	3			3	1		2

Course Contents:

Unit- 1: Solar Energy [11 Hrs]

Solar Radiation – Measurements of Solar Radiation – Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation – Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

Unit-2: Wind Energy [10 Hrs]

Wind Data and Energy Estimation – Types of Wind Energy Systems – Performance – Site Selection – Details of Wind Turbine Generator – Safety and Environmental Aspects.

Unit-3: Bio – Energy [11 Hrs]

Biomass direct combustion – Biomass gasifiers – Biogas plants – Digesters – Ethanol production – Bio diesel – Cogeneration – Biomass Applications.

Unit- 4: Other Renewable Energy Sources [10 Hrs]

Tidal energy – Wave Energy – Open and Closed OTEC Cycles – Small Hydro-Geothermal Energy – Hydrogen and Storage – Fuel Cell Systems – Hybrid Systems.

Text Books:

1. Rai. G.D., "Non Conventional Energy Sources", Khanna Publishers, New Delhi, 2011.
2. Twidell, J.W. & Weir, A., "Renewable Energy Sources", EFN Spon Ltd., UK, 2006.

References:

1. Sukhatme. S.P., "Solar Energy", Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.
2. Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future", Oxford University Press, U.K., 1996.
3. Tiwari. G.N., Solar Energy – "Fundamentals Design, Modelling & Applications", Narosa Publishing House, New Delhi, 2002.
4. Freris. L.L., "Wind Energy Conversion Systems", Prentice Hall, UK, 1990.
5. Johnson Gary, L. "Wind Energy Systems", Prentice Hall, New York, 1985
6. David M. Mousdale – "Introduction to Biofuels", CRC Press, Taylor & Francis Group, USA 2010
7. Chetan Singh Solanki, Solar Photovoltaics, "Fundamentals, Technologies and Applications", PHI Learning Private Limited, New Delhi, 2009.

SC-9

B18EC7021	Analog Mixed Mode VLSI	L	T	P	C
Duration :14 Wks		3	0	0	3

Prerequisites:

MOSFET, Transistor Level Circuit Design, Analog CMOS IC's,

Course Description:

This course focuses on transistor-level design of mixed-signal CMOS integrated circuits. After reviewing fundamentals of MOSFET operation, the course will cover design of analog building blocks such as current-mirrors, bias references, amplifiers, and comparators, leading up to the design of digital to-analog and analog-to-digital converters. Aspects of subthreshold operation, structured design, scalability, parallelism, low power-consumption, and robustness to process variations are discussed in the context of larger systems

Course Objectives:

The objectives of this course are to:

1. Introduce the concept of analog and digital discrete signals.

2. Provide specifications of data converters.
3. Calculate DAC & ADC parameters
4. Design R-2R Ladder for given parameter.
5. Introduce non linear analog circuits like comparators, and analog multipliers.
6. Demonstrate the sub micron CMOS process flow.
7. Present capacitors, resistors and switches using MOSFETs.

Course Outcomes:

On completion of this course the student will be able to:

1. Compare Analog and Digital Converters specifications
2. Design different types of ADCs and DACs
3. Analyze different types of Non linear analog circuits
4. Design switch, relay adder circuits using Submicron technology

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
B18EC 7021	CO1	3	2	2		1					2		2	3	2	2
	CO2	3	2	2		1					2		2	3	2	2
	CO3	3	2	2		1					2		2	3	2	2
	CO4	3	2	2		1					2		2	3	2	2

Course Contents:

Unit-1: Data Converter Fundamentals [11 Hrs]

Analog versus Digital, Discrete Time Signals, Converting Analog Signals to Data Signals, Sample and Hold Characteristics, DAC Specifications, ADC Specifications, Mixed-Signal Layout Issues.

Unit-2:Data Converter Architectures [10 Hrs]

DAC Architectures, Digital Input Code, Resistors String, R-2R Ladder Networks, Current Steering, Charge Scaling DACs, Cyclic DAC, Pipeline DAC. ADC Architectures, Flash, 2-Step Flash ADC, Pipeline ADC, Integrating ADC, Successive Approximation ADC.

Unit-3: Non Linear Analog Circuits [11 Hrs]

Basic CMOS Comparator Design, characterizing the comparator, Analog Multipliers, Multiplying Quad (excluding stimulation), Level Shifting (excluding input level shifting for multiplier).

Unit-4: Sub-Micron CMOS Circuit Design [10 Hrs]

Process Flow, Introduction to triple gate MOSFETs, Capacitors and Resistors, MOSFET Switch &

Bidirectional Switches, Delay and adder Elements, Analog Circuits Design, MOSFET Biasing, Basic Op-Amp design.

Text Books:

1. R. Jacob Baker, Harry W Li, David E Boyce, —"Design, Layout, Stimulation, CMOS Circuit",PHI Education, 3rd Edition 2005.

2. R. Jacob Baker, "CMOS- Mixed Signal Circuit Design,(Vol II of CMOS: Circuit Design,Layout and Stimulation)", John Wiley India Pvt. Ltd, 2008. 2nd Edition

Reference Books:

1. B Razavi, "Design of AnalogCMOS Integrated Circuits", First Edition, McGrawHill, 2001.
2. Phillip. E. Allen and D R Holberg, "CMOS Analog Circuit Design", 2ndEdition, OxfordUniversity Press, 2002.
3. Gray, Meyer, Lewis and Hurst "Analysis and design of Analog Integrated Circuits", 4thEdition Willey International, 2002

B18EC7022	Cloud Computing	L	T	P	C
Duration:14 Weeks		3	0	0	3

Prerequisites:

Computer Networks, Operating Systems.

Course Description:

The course introduces the cloud environment in detail and explains how to use cloud infrastructure in real time environment .Virtualization in Cloud Computing. Virtualization is the creation of a virtual (rather than actual) version of something, such as a server, a desktop, a storage device, an operating system or network resources. The fundamental knowledge about cloud and virtualisation technique is explained which helps in creating real time application connecting with IoT.

Course Objectives:

The objective of this course is to:

1. Provide knowledge in different layers of cloud computing, Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS);
2. Illustrate the use of various cloud computing technologies, cloud deployment models.
3. Illustrate how to store the data in cloud storage.
4. Introduce Virtualization technologies: Hypervisor, emulation, and application VM; Platform virtualization, storage virtualization, and network virtualization;

Course Outcomes:

On successful completion of this course, the student is expected to be able to:

1. Explain virtualization and their role in elastic computing.
2. Characterize the distinctions between Infrastructure, Platform and Software as a Service (IaaS, PaaS, SaaS) abstractions.
3. Analyze the advantages and disadvantages of cloud deployment models.
4. Create and deploy various cloud applications, storage of data in cloud, accessing the resources

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
B18EC7022	CO1	**2**		**1**			2				2	3				**1**
	CO2		2	1		2		3			3		1			
	CO3	2	1		2		3		2			2		2		2
	CO4	1	2			3		1		3			2		3	

Course Contents:

Unit-1: Introduction to Cloud Computing Overview [11 Hrs]

Cloud Computing Overview, Origins of Cloud computing, Cloud components, Essential characteristics – On-demand self-service, Broad network access, Location independent resource pooling, Rapid elasticity, Measured service. Cloud scenarios – Benefits: scalability, simplicity, vendors, security. Risks and Challenges.

Unit-2: Cloud architecture, Service & Deployment models [10 Hrs]

SPI framework, SPI V/s traditional IT Model. Cloud Service Models: Software as a Service, Platform as a Service, Infrastructure as a service, SaaS service providers – Google App Engine, Salesforce.com and Google platform, Benefits, Evaluating SaaS. PaaS service providers – Right Scale and Salesforce.com, Benefits of PaaS. IaaS: IaaS service providers – Amazon EC2.

Cloud Deployment Models: Public clouds, Private clouds, Community clouds and Hybrid clouds, Advantages of Cloud computing.

Unit-3: Cloud Databases and File Systems in cloud [11 Hrs]

Cloud database, Cloud file system, Cloud programming model. Cloud data security and existing solutions.

Cloud Middleware and Best Practices: Concept and need of Cloud middleware, QoS Issues in Middleware, Data migration and streaming in cloud, Best practices of Cloud computing.

Unit-4: Virtualization Techniques **[10 Hrs]**

Virtualization and cloud computing, Need of virtualization, Virtualization Technology, Overview of Virtualization, Types of virtualization: CPU virtualization, Memory virtualization, Device and I/O virtualization, OS Level virtualization, Network virtualization, Server virtualization, Desktop, Data, Storage and Application virtualization.

Text Books:

1. Anthony T.Velte , Toby J. Velte Robert Elsenpeter, "Cloud computing a practical approach", TATA McGraw- Hill , New Delhi – 2010.
2. A. Srinivasan and J. Suresh. "Cloud Computing: A practical approach for learning and implementation", Pearson publication, Second addition 2017.
3. Rishabh Sharma, "Cloud Computing: Fundamentals, Industry Approach and Trends", Wiley Publications, First Edition 2015.

Reference Books:

1. Michael Miller, "Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online", Que 2008.
2. Sandeep Gupta, Frank Adelstein, Golden Richard, Loren Schweibert. "Fundamentals of Mobile and Pervasive Computing", McGraw Hill Publication 2004.

B18EC7023	Wireless Communication	L	T	P	C
Duration :14 Wks		3	0	0	3

Prerequisites:

Computer Communication Networks, Analog-Digital Modulation techniques, Introduction to Antenna and wave propagation.

Course Description:

This course introduces students to wireless communication and networks and concentrates on building a firm foundation for understanding the concepts of Cellular communication, Wireless Network Architecture. This course also covers the cellular wireless technologies (Global System for Mobile communication and Coded Division Multiple Access). Students are also introduced to the modern digital modulation techniques and other encoding methods which are used to mitigate wireless propagation effects.

Course Objectives:

The objectives of this course are to:

1. Understand the evolution and various generations of wireless networks
2. Understand the needful concepts behind the wireless architecture and operation
3. Understand the system operation for GSM networks
4. Understand the various modulation and coding techniques.

Course Outcomes:

On completion of this course the student will be able to:

1. Categorize wireless telecommunication systems and networks
2. Review wireless network architecture and operation
3. Analyze global system for mobile communication
4. Compare wireless modulation-coding techniques

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC7023	CO1	3	2	2							1		1	2	2	1
	CO2	3	2	2							1	2	1	2	2	1
	CO3	3	3	1				1			1	2	1	2	2	1
	CO4	3	3	1							1	2	1	2	1	1

Course Contents:

Unit- 1: Wireless Telecommunication Systems and Networks [11 Hrs]

Introduction, History and Evolution, Different generations of wireless cellular networks 1G, 2G, 3G and 4G networks, Common Cellular System and network components, views of cellular networks, 3G cellular systems components, Cellular component identification Call establishment.

Unit-2: Wireless Network Architecture and Operation [10 Hrs]

Introduction, Cellular concept and fundamentals, Capacity expansion techniques, Cellular backbone networks, Mobility management, Radio resources and power management, GSM system overview, GSM and TDMA techniques, GSM Network and system Architecture, GSM channel concepts, GSM identifiers

Unit-3: Global System for Mobile Communication (GSM): [11 Hrs]

Introduction, System operation, Traffic cases, Cal handoff, Roaming, GSM protocol architecture.

TDMA systems. CDMA technology, CDMA overview, CDMA channel concept CDMA operations.

Unit- 4: Wireless Modulation-Coding Techniques [10 Hrs]

Introduction, Air interface, Path loss models, Wireless coding techniques, Digital modulation techniques, OFDM, UWB radio techniques, Diversity techniques, Typical GSM Hardware.

Text Book:

1. Gary J Mullett, "Introduction to wireless Telecommunications Systems and Networks", Thomson/Cengage Learning, 2006.

Reference Books:

1. William C. Y. Lee, "Mobile Cellular Telecommunication", MGH, 2nd, 2009.
2. D P Agrawal, "Wireless communication" Thomson learning, 2nd Edition 2007.
3. David TSE, Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge 2005.
4. S. S. Manvi, M. S. Kakkasageri, "Wireless and Mobile Network Concepts and Protocols", John Wiley India Pvt. Ltd, 1st edition, 2010.
5. T. S. Rappaport, "Wireless Communication – Principles & Practice", PHI, 3rd Edition, 2001.

B18EC7024	Robotics and Automation	L	T	P	C
Duration:14 Wks		3	0	0	3

Prerequisites:

Embedded System Design, Control systems, Programming skills

Course Description:

Robotics is the interdisciplinary branch of engineering and science that includes mechanical engineering, electrical engineering, computer science, and others. Robotics deals with the design, construction, operation, and use of robots as well as computer systems for their control, sensory feedback, and information processing. Automation and Robotics are two closely related technologies. Automation as the technology that is concerned with the use of mechanical, electronic, and computer based systems in the operation and control of production. The course provides robot classification and anatomy, Robot kinematics, Trajectory Planning and control, Sensors and vision systems used in robots and Robot Programming.

Course Objectives:

Course objectives are:

1. Classify Robots and anatomy.
2. Understand Robot kinematics
3. Determine Sensors and vision systems used in robots.
4. Write Robot Program.

Course Outcomes:

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

1. Summarize the basic applications and advantages of using robots in the industry
2. Do the robot motion analysis
3. Relate mathematical modeling and trajectory planning scheme in robots
4. Recognize the different types of sensors and cameras used in the field of robotics

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC7024	CO1	3			3		3	1		2	2		2	3	3	2
	CO2	3			3		3	1					2	3	3	2
	CO3	3			3		3	1		2			2	3	3	2
	CO4	3			3		3	1		2	2		2	3	3	2

Course Contents:

Unit -1: Introduction to robotics [11 Hrs]

Definition, anatomy of robot, classification configurations, robot links and joints, robot specifications, resolution accuracy and repeatability, simple numerical problems, robot drive systems, hydraulic, pneumatic and electric drive systems, wrist and its motions, end effectors, types of end effectors, mechanical grippers, methods of constraining parts in grippers, types of gripper mechanisms, simple numerical problems, vacuum cups, magnetic grippers, adhesive grippers, hooks, scoops and other gripper devices, tool as end effectors, examples.

Unit -2: Robot motion analysis & Robot control [10 Hrs]

Direct kinematics and inverse kinematics, 3D homogeneous transformations, rotation, translation and displacement matrix, composite rotation matrix, rotation matrix about an arbitrary axis, links, joints and their parameters, Denavit-Hertenberg (D-H) representation, application of D-H matrices to different robot configurations.

Basic control systems and models, transfer function with examples, transfer function for spring-mass-damper system, transient response of a second order system, transfer function of a robot joint, different types of controllers, proportional (P) controller, integral (I) controller, derivative (D) controller, PID controller, simple numerical problems

Unit -3: Robot trajectory planning & Robot sensors [11 Hrs]

Trajectory planning, definition, steps in trajectory planning, joint space techniques, use of a p-degree polynomial as interpolation function, cubic polynomial trajectories, linear function with parabolic blends, joint space verses Cartesian space trajectory planning, simple numerical problems on joint space trajectory planning. Classification of robot sensors and their functions, touch sensor, tactile sensor, binary sensor, analog sensor, proximity sensor, range sensor, force and torque sensor.

Unit -4 Robot sensors and Machine Vision & Robot programming [10 Hrs]

Machine vision, functions of machine vision system, sensing and digitizing, imaging devices, analog to digital signal conversion, quantization and encoding, simple numerical problems, image storage, image processing and analysis, image data reduction, segmentation, feature extraction, object recognition, robotic machine vision applications, inspection, identification, visual servoing and navigation.

Introduction to robot programming, robot cell layout, work cell control and interlocks, manual programming, lead through and walkthrough programming, off-line programming, VAL programming language, example, AML and VAL-II robot programming languages, examples, Programming with graphics, example.

Text Books:

1. Mikell P. Groover, Mitchel Weiss, Roger N. Nagel, Nicholas G. Odrey, " Industrial Robotics,", McGraw-Hill Publications, International Edition, 2008.
2. James G. Keramas, " Robot Technology Fundamentals", Cengage Learning, International Edition 1999.

Reference Books:

1. Fu K. S., Gonzelez R. C., Lee C. S. G: Robotics, " Control, Sensing, Vision, Intelligence ", McGraw Hill Book Co., International edition, 2008.
2. Appu Kuttan K. K, " Robotics, International Publications", First Edition, 2007
3. R. K. Mittal, I. J. Nagrath, " Robotics and Control", Tata-McGraw-Hill Publications, 2007.

B18EC7025	Software Engineering	L	T	P	C
Duration :14 Wks		3	0	0	3

Prerequisites:

No need

Course Description:

The course Software engineering **is** important because specific software is needed in almost every industry, in every business, and for every function. It becomes more important as time goes on – if something breaks within your application portfolio, a quick, efficient, and effective fix needs to happen as soon as possible.

Course Objectives:

The course objectives are :

1. To impart the knowledge of basic SW engineering methods and practices, and their appropriate application;
2. To give an understanding of approaches to verification and validation including static analysis, and reviews.
3. To give an understanding of software testing approaches such as unit testing and integration testing.
4. To give an understanding of some ethical and professional issues those are Important for software engineers.

Course Outcomes:

On completion of this course the student will be able to:

1. Analyze the requirements of a software development project
2. Verify and validate a software development project.
3. Describe and manage the core ethical issues of software development process.
4. Develop a positive attitude towards the development of a software project in a team and develop skill to work as software designer.

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
B18EC7025	CO1	1		2	2		1			2			1			
	CO2		2		3	2		2			1			2		
	CO3			3		2	3		2			1			3	
	CO4		2		2		1		3			2				2

Course Contents:

Unit 1: Overview [11hrs]

Introduction: FAQ's about software engineering, Professional and ethical responsibility. Software Processes: Software Processes: Models, Process iteration, Process activities; The Rational Unified Process; Computer-Aided Software Engineering.

Unit 2: Requirements [10hrs]

Software Requirements: Functional and Non-functional requirements; User requirements; System requirements; Interface specification; the software requirements document.

Requirements Engineering Processes: Feasibility studies; Requirements elicitation and analysis; Requirements validation; Requirements management.

Unit 3: System Models, Software Design & Development [11hrs]

System Models: Context models; Behavioral models; Data models; Object models; structured methods. Architectural Design: Architectural design decisions; System organization; An Object-Oriented design process; Design evolution. Rapid Software

Development: Agile methods; Extreme programming; Rapid application development. Software Evolution: Program evolution dynamics; Software maintenance; Evolution processes; Legacy system evolution.

Unit 4: Verification and Validation [10hrs]

Planning; Software inspections; automated static analysis; Verification and formal methods. Software testing: System testing; Component testing; Test case design; Test automation. Project Management: Management activities; Project planning; Project scheduling; Risk management.

Text Books:

1. Ian Sommerville, “Software Engineering”, Eighth *Edition, Person Education, 2007*.
2. Roger.S.Pressman,“Software Engineering -A Practitioners Approach”, Seventh *Edition, McGraw-Hill, 2007*

Reference Books:

1. PankajJalote, “An Integrated Approach to Software Engineering”, *Wiley India, 2009*.

SC-10

B18EC7031	ASIC Design	L	T	P	C
Duration :14 Wks		3	0	0	3

Prerequisites:

Fundamentals of Digital Circuits & CMOS.

Course Description:

This course aims to provide a strong foundation for students in understanding the principle aspects of ASIC design. It helps the students in getting familiarized with the methodologies and tools used in designing ASIC chips. Helps in understanding the applying various floor planning, placement and routing aspects and methodologies in refining the ASIC designs.

Course Objectives:

The objectives of this course are to:

1. Present an idea about the flow and economics of ASIC design.
2. Understand the different design aspects and metrics of ASIC design.
3. Analyze the different methodologies and tools available for ASIC design.
4. Understand the role of floor planning, Placement and Routing in ASIC design.

Course Outcomes:

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

1. Describe the complete flow and economics involved in ASIC design
2. Design customized and library-based ASICs
3. Develop optimized ASIC designs with suitable methodologies and metrics
4. Evaluate various algorithms for floor planning, placement and routing in ASIC design.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 3	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC7031	CO1	1		2		3		3						1		2
	CO2	1			2	3		3						1		2
	CO3	1		2		3	3							1		2
	CO4	1					2					3	3	1		2

Course Contents:

Unit 1: Introduction **[11 Hrs]**

Full Custom ASICs, Standard Cell based ASICs, Gate array based ASICs, Channeled gate array, Channelless gate array, structured gate array, Programmable logic devices, FPGA, Design flow, Economics of ASICs, ASIC cell libraries, I/O cells, Cell Compilers.

Unit 2: ASIC Library Design and Design entry **[10 Hrs]**

ASIC Library Design: Logical effort: predicting delay, logical area and logical efficiency, logical paths, multistage cells, optimum delay, optimum number of stages, library cell design. Low-Level Design Entry: Schematic Entry: Hierarchical design. The cell library, Names, Schematic, Icons & Symbols, Nets, schematic entry for ASIC'S, connections, vectored instances and buses, Edit in place, Attributes, Netlist screener, Back annotation.

Unit 3: ASIC Construction Floor Planning **[11 Hrs]**

Physical Design, CAD Tools, System Partitioning, Estimating ASIC size, partitioning methods. Floor planning tools, I/O and power planning, clock planning

Unit 4: Placement and Routing **[10 Hrs]**

Placement algorithms, iterative placement improvement, Time driven placement methods. Physical Design flow, global Routing, Detail Routing, Special Routing, Circuit Extraction and DRC.

Text Book:

1. M.J.S .Smith, "Application - Specific Integrated Circuits", Pearson Education, Edition 1, 2003.

Reference Books:

1. Jose.E.France, YannisTsividis, "Design of Analog-Digital VLSI Circuits for Telecommunication and Signal Processing", Prentice Hall, Edition 1, 1994.
2. Malcolm. R. Haskard, Lan. C. May, "Analog VLSI Design – NMOS and CMOS", Prentice Hall, edition 1,1998.
3. Mohammed Ismail and Terri Fiez, "Analog VLSI Signal and Information Processing", McGraw Hill, edition 1, 1994.

B18EC7032	Big Data and Data Science	L	T	P	C
Duration :14 Weeks		3	0	0	3

Prerequisites:

Database Management Systems, Data Mining basics, Probability and Statistics.

Course Description:

In this course the fundamentals of large volume, variety and velocity of data is described in detail. Big data analytics is the process of extracting useful information by analysing different types of big data sets. Big data analytics is used to discover hidden patterns, market trends and consumer preferences, for the benefit of organizational decision making. In this, the map-reduce programming, components of hadoop, architecture of map- reduce is taught. It also covers the tools of big data like PIG and HIVE.

Course Objectives:

The objectives of this course are to

1. Explain Big data for business intelligence and the main trends of Big Data concepts.
2. Describe map-reduce analytics using hadoop and related tools.
3. Process large data sets using Hadoop to extract value.
4. Provide big data analytics using R programming.

Course Outcomes:

On completion of this course the student will be able to:

1. Explain Hadoop Architecture.
2. Write Simple MapReduce programs.
3. Implement best practices for Hadoop development.
4. To Write R programming for data science.

Mapping of Course Outcomes with Program Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC7032	CO1	2	1	2					2	3			2			
	CO2	2	3	3	3	1	2		3	2	1	2			2	3
	CO3	1	2	3					2	2					2	
	CO4	3	2	3			3		3		2			2	3	

Course Contents:

Unit-1: Introduction to Big Data **[10 Hrs]**

Classification of digital data, characteristics of data, Evolution of big data, Challenges with big data, what is big data, traditional business intelligence (BI) versus big data, A typical data warehouse environment, A typical hadoop environment, Top challenges facing big data.

Unit-2: Introduction to Hadoop **[10 Hrs]**

Hadoop Basics, why Hadoop, why not RDBMS, RDBMS versus Hadoop, HDFS, Processing data with

Hadoop, Features of Hadoop. NoSQL-Types of NoSQL Databases, Advantages of NoSQL, SQL versus NoSQL.

Unit-3: Map Reduce **[11 Hrs]**

Anatomy of a MapReduce job run, Classic MapReduce, YARN, Job scheduling, Shuffle and Sort. **Hadoop Related Tools**: Introduction to PIG, What is PIG, The anatomy of PIG, PIG on Hadoop, PIG Latin, Data types in PIG, running PIG, Execution modes, HDFS Commands, Relational operators.

Unit-4: Introduction to R Programming **[11 Hrs]**

History and overview of R, What is R, Basic features of R, Design of the R system, Limitations of R, R nuts and bolts, Entering Input, Evaluation, R objects, Numbers, Attributes, Creating objects, Mixing objects, Explicit Coercion, Matrices, Lists, Factors, Missing values, Data frames, Names, Control Structures, Functions, Loop functions.

Text Books:

1. Seema Acharya, Subhashini Chellappan, “Big Data and Data Analytics”, Wiley, First Edition, 2015.
2. Tom White, "Hadoop: The Definitive Guide", O'Reilley, Third Edition, 2012
3. Roger D. Peng “R Programming for Data Science”, Leanpub, First Edition, 2015

Reference Books:

1. Vignesh Prajapati, “Big data analytics with R and Hadoop”, Packt Publishing, 2013
2. Alan Gates, "Programming PIG", O'Reilley, 2011
3. Eric Sammer, "Hadoop Operations", O'Reilley, 2012

B18EC7033	Satellite Communication	L	T	P	C
Duration :14 Wks		3	0	0	3

Prerequisites:

Knowledge of Basic Geometry, Insight of Geography, Fundamentals of Communication Systems and information coding.

Course Description:

The course introduces the students to the basic concept in the field of satellite communication. This will enable the students to know how to place a satellite in an orbit and about the earth & space segment. The satellite services like broadcasting are also studied thoroughly.

Course Objectives:

The objectives of this course are to:

1. Make the student understand the historical background, basic concepts and frequency allocations for satellite communication
2. Understand Earth and space component.
3. Knowledge of every aspects of satellite communication like satellite link design, earth station technology and different access system towards a satellite
4. Know application of satellite communication.

Course Outcomes:

On successful completion of this course, the student should be able to:

1. Describe orbital mechanics and launch methodologies
2. Describe space segment and earth segment
3. Analyse and evaluate a satellite link and suggest enhancements to improve the link performance.
4. Explain satellite access techniques and understand role of satellite in various applications

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC 7033	CO1	3	1				2	1					2		2	1
	CO2	3	1					1		2			2		2	
	CO3	3	3	3	2	2		1	1			2	2	1	3	2
	CO4	3	2	1				1					2		2	1

Course Contents:

Unit-1: Satellite Systems and Orbits **[11 Hrs]**

Overview of satellite systems: Introduction, Frequency allocations for satellite systems.

Orbits and launching methods: Kepler's three laws of planetary motion, terms used for earth orbiting satellites, orbital elements, apogee and perigee heights, orbit perturbations, inclined orbits, standard time.

The Geostationary orbit: Introduction, antenna look angles, polar mount antenna, limits of visibility, near geostationary orbits, earth eclipse of satellite.

Unit-2: Space Segment & Earth Segment **[10 Hrs]**

The Space segment: Introduction, power supply, attitude control, station keeping, thermal control, TT&C subsystem, transponders.

The Earth segment: Introduction, receive-only home TV systems, master antenna TV system, Community antenna TV system, transmit-receive earth station.

Unit-3: Communication Satellite and Satellite link Design [10 Hrs]

Communication Satellites- Satellite subsystem; Attitude control, station keeping, Thermal control , Telemetry, Tracking, Command and Monitoring (TTC&M); power systems, transponders, satellite wide band receiver.

Satellite link design and Satellite access: Atmospheric losses, Basic transmission theory, system noise temperature and G/T ratio; Downlink design-link budget; Uplink design; communication link design procedure.

Unit-4: Satellite Access Techniques and Application [11 Hrs]

Satellite Access: SPADE system, satellite switched TDMA, CDMA.

Satellite Applications: Satellite Mobile Services, VSAT, Radarsat, GPS, Iridium.

Text books:

1. Dennis Roddy, "Satellite Communications", McGraw-Hill international, 4th Edition, 2006.

Reference Books:

1. Timothy Pratt, Charles Bostian, Jeremy Allnutt. "Satellite Communications", John Wiley Pvt Ltd & Sons, 2nd Edition, 2008.
2. W. L. Pitchand, H. L. Suyderhoud, R.A. Nelson., "Satellite Communication system Engineering", Pearson Education, 2ndEdition 2007.
3. Raja Rao: "Fundamentals of Satellite communications", PHI Learning.
4. MonojitMitra: "Satellite Communication": PHI Learning

B18EC7034	Medical Electronics	L	T	P	C
Duration: 14 Weeks		3	0	0	3

Prerequisites:

Signals and Systems

Course Description:

Medical electronics is a branch of electronics that deals with design, implementation and use of electrical devices and equipment for medical purposes such as research, examination, diagnosis, treatment, assistance and care. Students will be introduced with concepts of medical diagnostics, anesthesia control, bio-potentials etc.

Course Objectives:

The objectives of this course are to:

1. Make students to understand the applications of electronics in diagnostic, anesthesia control, cardiac control, surgery and therapeutic area.
2. Know the various functional blocks present is bio-signal acquisition system so that the students capable to design the data acquisition system.

3. Study the methods of recording various bio-potentials.
4. Understand the need and technique of electrical safety in Hospitals.

Course Outcomes:

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

1. Analyze and evaluate the effect of different diagnostic and therapeutic methods, their risk potential, physical principles, opportunities and possibilities for different medical procedures.
2. have a basic understanding of medical terminology, relevant for biomedical instrumentation.
3. Understand and describe the physical and medical principles used as a basis for biomedical instrumentation.
4. Understand the elements of risk for different instrumentation methods and basic electrical safety.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
B18EC 7034	CO1	3										1		1		
	CO2	3										1			3	2
	CO3	3	2									1				2
	CO4	3		2			2	2				1		1		2

Course Contents:

UNIT – 1: Fundamentals of Medical Instrumentation [11 hrs]

Sources of Biomedical Signal, Basic Medical Instrumentation System and their Performance Requirements.

Classification of transducers, performance characteristics of transducers, displacement, positioning and motion transducers, pressure transducers, transducers for body temperature measurement, photoelectric transducers, optical fiber sensor, biosensor and smart sensor.

UNIT – 2: Biosignal Acquisition: Electrodes and Amplifiers [10hrs]

Origin of Bioelectric signals, recording electrodes, Electrode Types – surface metal plate electrodes, Needle and wire electrodes, microelectrodes .

Basic Requirements of Biomedical Amplifiers, Differential Amplifiers, Carrier Amplifiers, Chopper Amplifiers.

UNIT – 3: Bio-Potential Recording [10hrs]

Electrocardiogram (ECG), Electroencephalogram (EEG), Electromyogram (EMG),

PCG(Phonocardiography), Vector cardiograph(VCG), lead systems and recording methods, typical waveforms and signal characteristics.

UNIT – 4: Patient Monitoring Systems and Safety Aspects of Medical Instrument [11 Hrs]

Heart rate measurement, Pulse rate measurement, Respiration rate measurement, Blood pressure measurement, Principle of defibrillator and pace mark, use of Microprocessors in patent monitoring. Gross current shock, Micro current shock, Special design from safety considerations, Safety standards.

Text Books:

1. R.S. Khandpur "Handbook of Biomedical Instrumentation", Tata McGraw Hill, 2nd Edition, 2003.
2. R.S. Khandpur, "Modern Electronics Equipment", Tata McGraw Hill, New Delhi
3. C. Raja Rao, Sujoy K. Guha "Principles of Medical Electronics and Biomedical Instrumentation", University Press.

Reference Books:

1. Tatsuo Togawa, Toshiyo Tamura and P. Ake Oberg "Biomedical Transducers and instruments" CRC Press, 1997.
2. Leslie Cromwell, Fred J Weibell and Erich A. Pfeiffer, "Biomedical Instrumentation and Measurement", Prentice-Hall India Pvt. Ltd.

SC-11

B18EC7041	SOC Design	L	T	P	C
Duration :14 Wks		3	0	0	3

Prerequisites:

Basics of system architecture, Principles of memory design and cache architecture.

Course Description:

Moore's law has created an era where most electronic systems contain chips that integrate various components such as microprocessor, DSPs, dedicated hardware processing engines, memories, and interfaces to I/O devices and off-chip storage. Most electronic systems today - cell phones, iPods, set-top boxes, digital TVs, automobiles contain at least one such "System-on-chip". Designing System-on-chips is a highly complex process. This course will present students with an insight into

the earlier stages of the System-on-chip design process. In addition to the conceptual foundations, this course will also involve analysis of chip basics, understanding various parameters for the selection of SOC processors and memory design.

Course Objectives:

The objectives of this course are to:

1. Provide a comprehensive introduction to the SOC technology and network on chip technologies.
2. Relate the different parameters needed to assess the tradeoffs in the chip basics.
3. Give an overview to SOC design, its challenges and design flow by giving an emphasis to processor selection.
4. Illustrate the memory design concepts in processors for system on chip and board based systems.

Course Outcomes:

On completion of this course the students will be able to:

1. Differentiate the system architecture and various components of System on Chip and to illustrate network on chip technologies.
2. Summarize the relevance and impact of chip basics- Cycle time, power, area tradeoff and various design aspects.
3. Illustrate the selection of processor core for SOC and analyze the system performance.
4. Analyze the system on chip and board based systems with respect to various memory designs techniques.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
B20 EC 7041	**CO1**	**2**	**2**	**2**	**1**									**2**	**1**	**2**
	CO2	**3**	**2**	**2**	**1**							**1**		**2**	**2**	**2**
	CO3	**2**	**3**	**3**	**2**			**1**		**2**		**2**	**1**	**2**	**3**	**3**
	CO4	**3**	**3**	**3**	**2**			**1**		**2**		**1**	**1**	**2**	**3**	**3**

Course Contents:

Unit-1: System Approach and Interconnect **[10 Hrs]**

System Architecture, Components of the System, Hardware and Software, An approach for SOC Design, System Architecture and Complexity.

Interconnect: Introduction, Interconnect architectures for SOC. Bus: Basic architecture. NOC standard buses, Analytic bus models, NOC with switch interconnects.

Unit-2: Chip Basics **[11 Hrs]**

Cycle Time, Die Area and Cost, Ideal and Practical Scaling, Power, Area–Time–Power Trade-Offs in Processor Design, Reliability, Configurability.

Unit-3: Processors **[10 Hrs]**

Processor Selection for SOC, Basic Concepts in Processor Architecture, Instruction Handling, and Buffers, Minimizing Pipeline Delays, Branches. Vector, Very Long Instruction Word (VLIW), and Superscalar with case studies.

Unit-4: Memory Design: **[11 Hrs]**

System-on-Chip and Board-Based Systems – Scratchpads and Cache Memory, Basic Notions, Cache Organization, Cache Data, Write Policies, Strategies for Line Replacement at Miss Time, Other Types of Cache, Split I- and D-Caches and the Effect of Code Density, Multilevel Caches, Virtual-to-Real Translation, SOC(On-Die) Memory Systems, Board-based (Off-Die) Memory Systems, Simple DRAM and the Memory Array, Models of Simple Processor–Memory Interaction.

Text book:

1. Michael J Flynn, Wayne Luk, "Computer System Design: System-on-Chip**,"** Wiley, First Edition, 2011.

Reference Books:

1. SudeepPasricha, Nikil Dutt, "On-Chip Communication Architectures: System on Chip Interconnect", Morgan Kaufman 2008.
2. Rao R.Tummala, Madhavan Swaminathan, "Introduction to system on package SOP-Miniaturization of the entire system", McGraw-Hill 2008.
3. Michael Keating, Pierre Bricaud, "Reuse Methodology Manual for System on Chip designs", Kluwer Edition, 2008.

B18EC7042	Grid Computing	L	T	P	C
Duration :14 Wks		3	0	0	3

Prerequisites:

Programming with C C++, JAVA, DBMS, OS

.

Course Description:

In this Course it is focused on grid computing in which each computer's resources are shared with every other computer in the system. Processing power, memory and data storage are all community resources that authorized users can tap into and leverage for specific tasks. The course describes Open Grid Services Architecture, a service-oriented architecture for a grid computing environment for business and scientific use. Globus grid software that addresses the most challenging problems in distributed resources sharing. The Globus Toolkit includes software services and libraries for distributed security, resource management, monitoring and discovery, and data management.

Course Objectives:

The objectives of this course are to:

1. Be providing with an overview of the basic concepts of Grid Computing.
2. Provide an understanding of the need for and evolution of Grids in the context of processor and data-intensive applications;
3. Become familiar with the fundamental components of Grid environments, such as authentication, authorization, resource access, and resource discovery.
4. Understand the software services and libraries for distributed security, resource management, monitoring and discovery, and data management

Course Outcomes:

On successful completion of this course, the student is expected to be able to:

1. Design and implement Grid computing applications using Globus or similar toolkits.
2. Justify the applicability, or non-applicability, of Grid technologies for a specific application.
3. Explain programming toolkits such as Parallel Virtual Machine and Message Passing.
4. Apply the Globus open source software for finding the solutions in Grid problems like resource management, monitoring and discovery, and data management.

Mapping of Course Outcomes with program Outcomes

Course Code	POS / COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P O 1 0	P O 1 1	P O 1 2	PSO 1	PSO 2	PSO 3
B18EC70 42	CO1		2			2		1	1		2		2			1
	CO2	1			1			2			2	1			2	
	CO3		2		3		2		1	2		1		2		
	CO4	2		2	1		1		2		2		1		3	

Course Contents:

Unit -1: Overview of Grid Computing **[11 Hrs]**

Early Grid Activities, Current Grid Activities, An Overview of Grid Business Areas, Grid Applications, Grid Infrastructure, Organizations Developing Grid Standards and Best Practice Guidelines, Organizations Developing Grid Computing Toolkits and the Framework, Organizations Building and Using Grid-Based Solutions to Solve Computing, Data and Network Requirements, Commercial Organizations Building and Using Grid-Based Solutions, The Grid Problem. Anatomy Computing

Unit -2: The OGSA Platform Components, OGSI **[10 Hrs]**

OGSA Architecture and Goals, Commercial Data Center (CDC), National Fusion Collaborator (NFS), Online Media and Entertainment, Native Platform Services and Transport Mechanisms, OGSA Hosting Environment, Core Networking Services Transport and Security, OGSA Infrastructure, OGSA Basic Services. Grid Services, A High-Level Introduction to OGSI (Open Grid Services Infrastructure).

Unit -3: OGSA Basic Services, Toolkit **[11 Hrs]**

Common Management Model (CMM), Service Domains, Policy Architecture, Security Architecture, Metering and Accounting, Common Distributed Logging, Distributed Data Access and Replication. GLOBUS GT3 Toolkit Architecture.

Unit -4: Globus GT3 Toolkit: High Level Services **[10 Hrs]**

Resource discovery and monitoring, information service, index service, resource information provider service, resource management service, data management services

Text Book:

1. Joshy Joseph and Craig Fellenstein, “Grid Computing,” Pearson/PHI PTR, 2003.

Reference Books:

2. Ahmar Abbas, “Grid Computing: A Practical Guide to Technology and Applications,” Charles River media, 2003.
2. J. Joseph, C. Fellenstein, “Grid Computing”, Pearson Education, 2004.
3. V. Silva, “Grid Computing for Developers”, Dreamtech Press, 2006.

B18EC7043	Multi Media Communication (MMC)	L	T	P	C
Duration :14 Wks		3	0	0	3

Prerequisites:

Signal representation, Quantization techniques, Coding theory, and OSI Reference model.

Course Description

The course introduces fundamental technologies for video communications and networking. The primary goal of the course is the development of necessary video-audio skills and understandings need to create effective digital media messages. It includes the introduction to the video system and Fourier analysis with effective representation and processing of video signals. Also, few more concepts covered include properties of the human visual system, motion estimation, basic video compression techniques, video communication standards, and video transport over the Internet and wireless networks.

Course Objectives:

The objectives of this course are to:

1. Provide an understanding of impact of multimedia techniques in the day to day life.
2. Provide an understanding of various representations of graphics, image & video.
3. Provide an understanding of the total processing, storing and communication of multimedia data.
4. Provide a comprehensive understanding of multimedia communication over wireless networks.

Course Outcomes:

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

1. Understand the different representations of graphics, image and video data types in multimedia.
2. Compare the various industry standard compression techniques for digital audio.
3. Understand the processing and storage techniques for video.
4. Determine impact of multimedia communication techniques in the wireless networks.

Mapping of Course Outcomes with program Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
B18EC 7043	CO1	3	2	1											2	1
	CO2	3	2	1	2									1	2	1
	CO3	3	2	1											2	1
	CO4	3	2	1											2	1

Course Contents:

Unit 1: Graphics, Image & Video Representation [11 Hrs]

Graphics/Image data types, Popular file formats, Color science – camera systems, XYZ to RGB Transform, Color models in images, Color models in video, Fundamental concepts in video

Unit 2: Digital Audio & Compression Algorithms [10 Hrs]

Digitization of sound, MIDI, Quantization & transmission of audio, Lossless compression: Basics of information theory, Run-Length Coding, Variable Length Coding – Shannon Fano Algorithm, Huffman

Coding, LZW, Arithmetic Coding, Lossy compression: Distortion measures, Rate-distortion theory, Quantization, Transform coding.

Unit 3: JPEG & MPEG **[11 Hrs]**

The JPEG Standard, Video compression based on motion compensation, Search for motion vectors, H.261, H.263, MPEG-1, MPEG-2, MPEG-4, MPEG-7, MPEG-21.

Unit 4: Multimedia Communication **[10 Hrs]**

Quality of multimedia data transmission, Multimedia over IP, Media- on- Demand (MOD), Multimedia over Wireless Network, C-Bird - A Case Study.

Text Book:

1. Ze-Nian Li, Mark S. Drew, "Fundamentals of Multimedia", Pearson Education, 2008.

Reference Book:

1. Ralf Steinmetz, KlaraNahrstedt, "Multimedia – Computing, Communications & Applications", Pearson Education, 2004,

B18EC7044	Reliability Engineering	L	T	P	C
Duration :14 Wks		3	0	0	3

Prerequisites:

Fundamentals of Analog and Digital Electronics, Fundamental Mathematics

Course Description:

In this course, the student shall learn the basic concepts of Reliability Engineering and apply them to constrain a design. Reliability Engineering is engineering that emphasizes dependability in the life cycle management of a product. The student shall be able to predict the ability of a product or system to perform its required functions without failure for a specified time period and when used under the specified conditions. Engineering and analysis techniques are used to improve the reliability or dependability of a product or system. Reliability engineering falls within the maintenance phase of the software development life cycle (SDLC). The overall aim of the SDLC is to make software and product more reliable.

Course Objectives:

The objectives of this course are to:

1. Introduce the subject of reliability engineering and familiarize the basic mathematics of reliability.
2. Predict the reliability of typical systems and familiarize the electronic systems with models.

3. Familiarize the concept of design for production, test and maintenance.
4. Introduce reliability of software, software errors and preventions, concepts of fault tolerance, software checking and testing and software reliability prediction.

Course Outcomes:

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

1. Understand principles of reliability engineering.
2. Predict and analyze the reliability of typical systems and Incorporate reliability in electronic systems.
3. Understand the concept of design for production, test and maintenance of systems
4. Familiarize and Understand the reliability of software , software errors, preventions and fault tolerance, software testing

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC7044	CO1	3	2	1	1	3							1	1	2	1
	CO2	1	3	2	3	3				1		1	1	1	2	2
	CO3	1	3	2	3	1				1	2	1	1	1	2	
	CO4	1	3	2	3	3				1	1	1	1	2	1	1

Course Contents:

Unit-1: Introduction to Reliability Engineering [11 Hrs]

What is Reliability Engineering? , Reasons for failure, Probabilistic Reliability, Repairable and Non-Repairable Items, The Pattern of Failures with Time (Non-Repairable Items), The Pattern of Failures with Time (Repairable Items).

Reliability Mathematics: Rules of probability, summary of continuous statistical distributions, discrete variations, statistical confidence, hypothesis testing.

Unit-2: Reliability prediction and modelling [10 Hrs]

Systems Reliability models, availability of repairable systems, modular design, block diagram analysis,

Unit-3: Electronic Systems Reliability [10 Hrs]

Reliability of Electronic Components ,Component Types and Failure Mechanisms, Reliability in Electronic System Design , Parameter Variation and Tolerances , Design for Production, Test and

Maintenance

Unit-4: Software Reliability **[11 Hrs]**

Introduction, Software in Engineering Systems ,Software Errors , Preventing Errors , Fault Tolerance , Software Checking , Software Testing ,Software Reliability Prediction and Measurement , Case study from industry.

Text Books:

1. Patrick D.T.O'Connor, "Practical Reliability Engineering", Wiley India, 5th edition, 2011.

Reference Books:

1. V.N.A. Naikan ,"Reliability Engineering and Life Testing", PHI Learning Private Limited, 2009.
2. Charles B. Ebeling, "An introduction to Reliability and Maintainability Engineering", Waveland Pr Inc, 2005.
3. Michael R. Lyu ,"Handbook of Software Reliability Engineering", IEEE Computer Society Press,McGraw Hill, 1996.

SC-12

B18EC8011	Low Power VLSI	L	T	P	C
Duration :14Wks		3	0	0	3

Prerequisites:

1. Concepts of low power VLSI design and scaling technologies involved.
2. Knowledge on simulation programming with integrated circuits and probabilistic power analysis.
3. Basics of design parameters of low power circuits and low power architecture.
4. Knowledge on clock distribution and architectural level methodologies.

Course Description:

This course deals with issues and models to design low-power VLSI circuits, fundamentals of power dissipation in microelectronic devices, will be able to estimate power dissipation due to switching, short circuit. The architectural, algorithm power estimation and optimization techniques will be discussed.

Course Objectives:

The objectives of this course are to:

1. Understand different sources of power dissipation in CMOS & MIS structure.
2. Understand the different types of low power adders and multipliers.
3. Focus on synthesis of different level low power transforms.
4. Understand the various energy recovery techniques used in low power design.

Course Outcomes:

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

1. Analyze different source of power dissipation and the factors involved in VLSI Circuits.
2. Explore the different techniques to design low power arithmetic circuits.
3. Illustrate the impact of various low powers transformation techniques
4. Optimize the power at architectural and algorithmic level.

Mapping of Course Outcomes with Program Outcomes:

Course Code	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC 8011	CO1	3	3		1	2				3	3	2				
	CO2	3	2	3	1	2				3	3	3		3		3
	CO3	3	3	1	2					3	2	3				
	CO4	3	3	2		1				2	1	3		3		

Course Contents:

Unit -1: Introduction [10 Hrs]

Need for low power VLSI chips, Sources of power dissipation on Digital Integrated circuits. Emerging Low power approaches, Physics of power dissipation in CMOS devices.

Device & Technology Impact on Low Power: Dynamic dissipation in CMOS, Transistor sizing & gate oxide thickness, Impact of technology Scaling, Technology & Device innovation.

Unit -2: Power estimation, Simulation Power analysis [11 Hrs]

SPICE circuit simulators, gate level logic simulation, capacitive power estimation, static state power, gate level capacitance estimation, architecture level analysis, data correlation analysis in DSP systems, Monte Carlo simulation.

Probabilistic power analysis: Random logic signals, probability & frequency, probabilistic power analysis techniques, signal entropy.

Unit 3: Low Power Design Circuit level **[11 Hrs]**

Logic level: Gate reorganization, signal gating, logic encoding, state machine encoding, pre-computation logic.

Low power Architecture & Systems: Power & performance management, switching activity reduction, parallel architecture with voltage reduction.

Unit 4: Low power Clock Distribution **[10 Hrs]**

Power dissipation in clock distribution, single driver Vs distributed buffers, Zero skew Vs tolerable skew, chip & package co design of clock network.

Algorithm & Architectural Level Methodologies: Introduction, design flow, Algorithmic level analysis & optimization, Architectural level estimation & synthesis.

Text Books:

1. Kaushik Roy, Sharat Prasad, "Low-Power CMOS VLSI Circuit Design" Wiley, 2000.
2. Gary K. Yeap, "Practical Low Power Digital VLSI Design", KAP, 2002.
3. Rabaey, Pedram, "Low Power Design Methodologies" Kluwer Academic, 1997.

B18EC8012	Parallel Processing	L	T	P	C
Duration :14 Wks		3	0	0	3

Prerequisites:

Computer Basics

Course Description.

In this course Parallel processing is taught which is a method in computing of running two or more processors (CPUs) to handle separate parts of an overall task. These multi-core set-ups are similar to having multiple, separate processors installed in the same computer. The course focus on memory technology and optimization technique by understanding the different types of parallelism, the course concentrates on reviewing the memory hierarchu and cache performance in parallel processors.

Course Objectives:

The objectives of this course are to:

1. Present design of parallel programs and how to evaluate their execution
2. Give knowledge of the characteristics, the benefits and the limitations of parallel systems and distributed infrastructures

3. Analyze the parallel programs in different operating system and build the programming model.
4. Encourage students to build experience with interdisciplinary teamwork.

Course Outcomes:

On completion of this course the student will be able to:

1. Analyze the requirements for programming parallel and critically evaluate the strengths and weaknesses of parallel programming models and how they can be used to facilitate the programming of concurrent systems.
2. Interpret the difference between the major classes of Instruction set architecture
3. Design and implement a SIMD and MIMD parallel processing solution for problems.
4. Understand the performances of processors and solve the optimization problems.

Mapping of Course Outcomes with program Outcomes

Course Code	POS / COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B20 EC 8012	**CO1**	**1**	**2**		**2**		**3**	**1**			**1**			**2**		
	CO2	**2**	**1**	**2**		**1**						**2**			**1**	
	CO3		**2**	**1**		**2**	**2**			**3**			**2**			**2**
	CO4		**1**		**2**		**1**		**2**	**1**		**2**			**2**	

Course Contents:

Unit -1: Introduction and Architecture [10Hrs]

Classes of computers; Defining computer architecture; Trends in Technology, power in Integrated Circuits and cost; Dependability; Measuring, reporting and summarizing Performance; Quantitative Principles of computer design

Unit -2: Memory Technology and Optimization [11Hrs]

Introduction to parallelism, shared memory model, distributed memory model, what is instruction level parallelism: concepts and challenges, basic compiler techniques for exposing ILP , Reducing Branch costs with prediction; Overcoming Data hazards

Unit -3: Thread Level Parallelism: Introduction [11Hrs]

Multiprocessor architecture: issues and approach, challenges of parallel processing, Symmetric shared-memory architectures; Performance of symmetric shared–memory multiprocessors; Distributed shared memory and directory-based coherence; Basics of synchronization; Models of Memory

Unit -4: Review of Memory Hierarchy **[10Hrs]**

Introduction: Cache performance, Cache Optimizations, Virtual memory, Advanced optimizations of Cache performance, Memory technology and optimizations, Protection: Virtual memory and virtual machines

Text Books:

1. John L. Hennessey and David A. Patterson, "Computer Architecture – A quantitative Approach", Morgan Kaufmann / Elsevier Publishers, 5th Edition, 2012.

Reference books:

1. Barry Wilkinson, Michael Allen, "Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers", Prentice Hall; 2nd edition ; ISBN: 0131405632
2. Kai Hwang ,"Advanced Computer Architecture Parallelism, Scalability , Programability", Tata Mc Grawhill, 2003.
3. David E. Culler, Jaswinder Pal Singh, Anoop Gupta:, Morgan Kaufman," Parallel Computer Architecture, A Hardware / Software Approach", –, 1999.

B18EC8013	Ad-Hoc Networks	L	T	P	C
Duration :14 Wks		3	0	0	3

Prerequisites:

Wireless Communication, Computer Communication Network.

Course Description:

This course is an advanced research-oriented course designed for graduate students with computer and wireless networks background. Through this course, students can learn the state of art of wireless ad hoc networks research, and enhance their potential to do research in this exciting area.

Course Objectives:

The objectives of this course are to:

1. Describe the issues and challenges of Wireless Ad hoc networks
2. Discuss the various concepts involved in designing the network layered protocols
3. Discuss the concepts involved in designing the transport layered protocols
4. Discuss the issues and challenges involved in providing QoS in Ad hoc wireless Networks.

Course Outcomes:

On successful completion of this course, the student should be able to:

1. Illustrate the characteristics of Adhoc Networks and MAC protocols
2. Explain the concepts of Adhoc networks and network layered protocols
3. Illustrate issues involved in designing transport layered protocols for Adhoc networks
4. Classify issues and challenges involved in providing QoS for Ad hoc wireless Networks

Mapping of Course Outcomes with program Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC8013	CO1	3	2	1											2	1
	CO2	3	2	1											2	1
	CO3	3	2	1		3								3	2	1
	CO4	3	2	1		3								3	2	1

Course Contents:

Unit-1: AD-HOC Networks & MAC Protocol [11 Hrs]

Introduction, Issues, Ad-hoc wireless internet, Issues in designing a MAC protocol for Ad hoc wireless Networks, Design goals of a MAC protocol for Ad hoc wireless Networks, Classification of MAC protocols. Contention - based MAC protocols with scheduling mechanism, MAC protocols that use directional antennas, Other MAC protocols.

Unit-2: Routing Protocols for AD HOC Wireless Networks [10 Hrs]

Introduction, Issues in designing a routing protocol for Ad hoc wireless Networks, Classification of routing protocols, Table drive routing protocol, On-demand routing protocol. Hybrid routing protocol

Unit- 3: Transport Layer Protocols for AD HOC Wireless [11 Hrs]

Introduction, Issues in designing a transport layer protocol for Ad hoc wireless Networks, Design goals of a transport layer protocol for Ad hoc wireless Networks.

Unit-4: Quality of Service In AD HOC Wireless Networks [10 Hrs]

Introduction, Issues and challenges in providing QoS in Ad hoc wireless Networks, Classification of QoS solutions.

Text Book:

1. C. Siva Ram Murthy & B. S. Manoj, “Ad hoc wireless Networks”, Pearson Education, 2nd Edition, 2005.

Reference Books:

1. Ozan K. Tonguz and Gianguigi Ferrari, “Ad hoc wireless Networks” , John Wiley, 2007
2. Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du: “Ad hoc Wireless Networking”, Kluwer Academic Publishers, 2004.

B18EC8014	Avionics	L	T	P	C
Duration 14 Weeks		3	0	0	3

Prerequisites:

Instrumentation systems, sensors, Mathematical modeling of System, Microwave signals, Radar systems, Modulation Techniques.

Course Description:

This course covers the different features of Display units, roles of Avionics. The curriculum for the programme is structured as per the requirements of the aviation industry. The field of activity of qualified personnel involves maintenance of various flying instruments in the realm of Avionics and Illustrate the Surveillance and Communications Systems in Avionics. Students are taught existing technology as well as advanced Multi-Functional Display Systems.

Course Objectives:

The objectives of this course are to:

1. Introduce the general topics of aircraft Electronics.
2. Summarize the advantages and disadvantages of various avionics system.
3. Understand the different avionics systems of aircraft like display system, navigation system.
4. Identify different aircraft cockpit fittings like display system.

Course Outcomes:

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

1. Describe the avionics environment.
2. Understand the importance of Aircraft Instruments.
3. Appraise the Navigation Systems and Flight Control in Avionics.
4. Illustrate the Surveillance and Communications Systems in Avionics.

Mapping of Course Outcomes with program Outcomes

Course Code	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC8014	CO1	1	1	1	2								2	1	1	2
	CO2	1	1	1	1								2	1`	1	2
	CO3	1	3	3	2								1	1	1	2
	CO4	1	2	2	2								1	1	1	2

Course Contents:

Unit -1: Introduction to Avionics & Display Systems [11 Hrs]

Importance and role of avionics, avionic environment, Regulatory and advisory agencies -Displays and man-machine interaction: Active Matrix Liquid Crystal Display (AMLCD),Head Down Display (HDD), Head Up Display (HUD),Helmet Mounted Display (HMD), OLEDS, Night Vision Goggles, LASERS, Integrated Standby Instrument System (ISIS), data fusion, intelligent displays management, Displays technology, control and data entry, instrument placements.

Unit -2: Aircraft Instruments [10 Hrs]

Inertial reference systems, attitude derivation. RMI, HSI, ADI Magnetic Heading Reference System (MHRS.); Outside world sensor systems: Radar systems - Radar Sensing - Radar Altimeter (RADALT), Doppler Radar, Weather Radar, RADOME.

Unit -3: Navigation Systems and Flight Control [11 Hrs]

Principles of navigation, Automatic Direction Finding, Very High Frequency Omni-Range (VOR), Distance Measuring Equipment (DME), landing aids (ILS & MLS), Inertial Navigation, GPS-global positioning system.Fly by Wire Flight control features and advantages.

Unit -4: Surveillance & Communication Systems [10 Hrs]

HF, VHF, UHF, Microwaves Signals and Noise, Modulation and demodulation, Antennas, propagation, data links, Telemetry, Transponders, Typical Systems in Aircrafts, ATC Electronic Warfare Basics.

Text Books:

1. Cary R.Spitzer, “Digital Avionics Handbook”, CRC Press LLC, 3nd Edition, 2006.
2. Collinson, R.P.G, “Introduction to avionics”, springer, 3rd Edition, 2011
3. Ian Moir, Allan G.Seabridge,” Military Avionics Systems”, John Wiley & Sons, Ltd,2009

Reference Books:

1. Ian Moir, Allan G.Seabridge, "Aircraft Systems" Mechanical, Electrical, Avionics Subsystems Integration, ohn Wiley & Sons, 3rdEdition, Ltd 2008
2. Cary R. Spitzer, "Digital Avionics Handbook", , CRC Press LLC, 2nd Edition ,2007.
3. Brain Kendal, "Manual of Avionics", the English Book House, New Delhi, 3rd Edition, 1993.
4. Collinson RPG, "Introduction to Avionics", Kluwer Academic Publishers, Chapman & Hall, 2nd Edition, 2003.
5. Mauhamed Abdulla, "Avionics made simple", Available at http://drmoe.org/research/avionics_made_simple, 2005

SC-13

B18EC8021	Digital Testing and Testablity	L	T	P	C
Duration :14Wks		3	0	0	3

Prerequisites:

Digital Electronic Circuits, HDL and Basic C Language.

Course Description:

Introduction to the basic concepts in digital systems testing. Advanced topics in fault modeling and simulation, test pattern generation, and design for testability.

Course Objectives:

The objectives of this course are to:

1. Describe the understanding of threshold logic and digital testing.
2. Demonstrate the understanding of minimization of FSM.techniques.
3. Provide an in-depth uunderstanding of the testing in sequential machines.
4. Conduct fault detection experiments.

Course Outcomes:

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

1. Identify the various ways of designing digital circuits.
2. Understand a combinational circuit and identify the faults.
3. Analyse the given finite state machines.
4. Design various fault detection experiments.

Mapping of Course Outcomes with Program Outcomes

Course Code	POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O 2	PS O3
BTEC15F 8230	CO1	1	3	3		3	3		1			2		3	2	1
	CO2	2	3	2	3	3	1						2	3	2	1
	CO3	2	3		3	3							1	3	2	1
	CO4	1	3	3	3	3	2					1		3	2	1

Course Contents:

UNIT-1: Threshold Logic, Reliable Design and Fault Diagnosis [11 Hrs]

Threshold Logic: Introductory Concepts, Synthesis of Threshold Networks.

Reliable Design and Fault Diagnosis: Hazards, Fault Detection in Combinational Circuits, Fault-Location Experiments, Boolean Differences, Fault Detection by Path Sensitizing, Detection of Multiple Faults, Failure-Tolerant Design, Quadded Logic.

Unit-2: Capabilities, Minimization, and Transformation of Sequential Machines [10 Hrs] The Finite-State Model- Further Definitions, Capabilities and Limitations of Finite – State Machines, State Equivalence and Machine Minimization, Simplification of Incompletely Specified Machines.

Unit-3: Structure of Sequential Machines [11 Hrs]

Introductory Example, State Assignments Using Partitions, The Lattice of closed Partitions, Reductions of the Output Dependency, Input Independence and Autonomous Clocks, Covers and Generation of closed Partitions by state splitting, Information Flow in Sequential Machines, Decompositions.

Unit-4: State—Identifications and Fault-Detection Experiments [10 Hrs]

Experiments, Homing Experiments, Distinguishing Experiments, Machine Identification, Fault-Detection Experiments.

Text book:

1. Zvi Kohavi, “Switching and Finite Automata Theory”, Tata McGraw Hill Edition, 2nd Edition. 1978.

B18EC8022	Pervasive and Ubiquitous Computing	L	T	P	C
Duration :14Wks		3	0	0	3

Prerequisites:

OSI Layer, TCP/IP, Protocols, IoT Layers

Course Description:

Pervasive and Ubiquitous Computing discusses the importance of modern communication systems and evolution of computing networking into various new domains. It highlights the recent trends in Internet of Things and its importance in everyday life.

Course Objectives:

Course objectives are to:

1. Provide a sound conceptual foundation in the area of Pervasive Computing aspects;
2. Provide a balanced treatment of the mechanisms and environments of ubiquitous Computing.
3. Give an insight into successful mobile and pervasive computing applications and Services.
4. Introduce to the architectures of Intelligent Systems.

Course Outcomes:

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

1. Summarise about the Smart Device, Environment and Interfaces (DEI) model of Ubiquitous Computing Systems.
2. Apply usability of alternative design of interactions for specific ubiquitous computing systems and HCI.
3. Design and implement simple context aware applications, using standard sensor technology.
4. Compare various Intelligent System.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC 8022	CO1	3	2				2	1					1	3	3	2
	CO2	3	2				2	1					1	3	3	2
	CO3	3	2				2	1					1	3	3	2
	CO4	3	2				2	1					1	3	3	2

Course Contents:

Unit-1: Ubiquitous Computing **[11 Hrs]**

Basics and Vision - Living in a Digital World, Modelling the Key Ubiquitous Computing Properties, Architectural Design for UbiCom Systems: Smart DEI Model; Applications and Requirements - Example Early UbiCom Research Projects

Unit-2: Human Computer Interaction **[10 Hrs]**

Introduction, User Interfaces and Interaction for Four Widely Used Devices, Hidden UI via Basic Smart Devices, Hidden UI Via Wearable and Implanted Devices, Human-Centred Design (HCD), User Models: Acquisition and Representation, iHCI Design

Unit-3: Tagging, Sensing and Controlling **[11 Hrs]**

Introduction, Tagging the Physical World, Sensors and Sensor Networks, Micro Actuation and Sensing: MEMS, Embedded Systems and Real-Time Systems, Control Systems (for Physical World Tasks), Robots.

Unit-4: Intelligent Systems (IS) **[10 Hrs]**

Introduction, Basic Concepts, IS Architectures; Ubiquitous Communication – Introduction, Audio Networks, Data Networks, Wireless Data Networks, Ubiquitous Networks, Service-Oriented Networks.

Text Books:

1. Stefan Poslad, "Ubiquitous Computing Smart Devices, Environments and Interactions", Wiley, 2009
2. Ed. John Krumm. Chapman, "Ubiquitous Computing Fundamentals" Hall/CRC 2009.

Reference Book:

1. Burkhardt, Henn, Hepper, Rintdorff, Schaeck. "Pervasive Computing", 2002, Addison Wesley.

B18EC8023	Network Security	L	T	P	C
Duration :14 Wks		3	0	0	3

Prerequisites

Basics of digital communication, computer communication

Course Discription

It is a concept-oriented course, which deals with principles and practice of cryptography and network security. The course enables student to become master in different encryption techniques such as

DES, AES, RSA etc. The student will have knowledge of attacks in distributed system and its counter measures. The student shall be able to explore the state of art technology such as hash functions, authentications, Key management, Key exchange, signature schemes, Transport layer security, web security, etc.

Course Objectives:

The objectives of this course are to:

1. Summarize classical encryption techniques.
2. Explain public key cryptography techniques.
3. Illustrate Hash function, MAC's and Digital signature.
4. Explain various key management technique and transport layer security

Course Outcomes

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

1. Illustrate different types of symmetrical encryption techniques.
2. Solve different types of public key cryptography.
3. Understand threats and security mechanisms of Hash function, MAC's and Digital signature.
4. Analyze the knowledge of key management and transport layer security.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC8023	CO1	3	3	2	2									1	2	1
	CO2	2	3	3	2									1	2	2
	CO3	2	2	3	3									1	2	3
	CO4	2	3	3	2									1	2	3

Course Contents:

Unit-1: Encryption Techniques & DES [11hrs]

Security attacks and security mechanisms.

Encryption Techniques: Symmetric cipher model, Substitution techniques, Transposition techniques, Rotor machines, Steganography.

Data Encryption Standard (DES): DES encryption and decryption, Strength of DES, Block Cipher design principles.

Unit-2: AES and Public-Key Cryptography [10hrs]

AES: Structure, transformation functions, key expansion.

Public-Key Cryptography: Principles of public key cryptosystems, RSA Algorithm, Diffie Hellman key exchange, Elgamal cryptographic system, Elliptic curve arithmetic.

Unit-3: Hash Functions, MACs and Digital Signature [11hrs]

Cryptographic Hash Functions: Two Simple Hash Functions, Hash function based on cipher block chaining, Message authentication requirements.

Message authentication functions: Requirements of MAC, Security of MACs, MAC based on hash functions: HMAC, Digital Signatures.

Unit-4: Key Management and Transport Layer Security [10hrs]

Key management: Symmetric key distribution using symmetric encryption, Symmetric key distribution using asymmetric encryption, distribution of public keys.

Transport-layer security**:** Web Security Considerations, Secure Sockets Layer, TLS, HTTPS.

Text Book:

1. William Stallings, "Cryptography and Network Security, Principles and Practice", Pearson/Prentice Hall ,6th edition, , 2011.

Reference Books:

1. Atul Kahate, "Cryptography and Network Security", Tata McGraw Hill ,2nd edition, , 2007.
2. Eric Maiwald, "Fundamentals of Network Security", McGraw-Hill,1st edition , 2003.

B18EC8024	RADAR and Navigational Aids	L	T	P	C
Duration :16 Wks		3	0	0	3

Prerequisites:

Analog & Digital Communication Basics

Course Description

This Course introduces the fundamental concepts of RADAR (RAdio Detection and Ranging) like MTI, Pulsed Radar, AMIT and Navigation aids. Introduces the students to different types of RADAR and Navigation systems like Navigational Systems, Aids to Approach and Landing, Doppler Navigation, Inertial Navigation, Satellite Navigation System and also make students learn modern radar and navigational techniques.

Course Objectives:

The course objectives are to:

1. Derive and discuss the Range equation and the nature of detection.
2. Apply Doppler principle to radars and hence detect moving targets, cluster, also to understand tracking radars
3. Understand principles of navigation, in addition to approach and landing aids as related to navigation

4. Introduce the different navigation system

Course Outcomes:

On completion of this course the student will be able to:

1. Discuss on the RADAR range equation parameters.
2. Explain the operation of MTI and Pulse Doppler RADAR.
3. Describe the Navigational methods.
4. Compare the different Navigational System.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	CO1	3	2	2							2		2	3	2	1
	CO2	2	2	2							2		2	3	2	1
	CO3	3	2	2							2		2	2	2	2
	CO4		3	2							2		2	2	2	2

Course Contents:

Unit1: Introduction to RADAR **[10 Hrs]**

Basic Radar –The simple form of the Radar Equation- Radar Block Diagram- Radar Frequencies – Applications of Radar – The Origins of Radar The Radar Equation Introduction- Detection of Signals in Noise- Receiver Noise and the Signal-to-Noise Ratio-Probability Density Functions- Probabilities of Detection and False Alarm Integration of Radar Pulses- Radar Cross Section of Targets- Radar cross Section Fluctuations- Transmitter Power-Pulse Repetition Frequency- Antenna Parameters System losses – Other Radar Equation Considerations

Unit 2 : MTI and Pulse Doppler RADAR: **[11 Hrs]**

Introduction to Doppler and MTI Radar- Delay –Line Cancellers- Staggered Pulse Repetition Frequencies –Doppler Filter Banks - Digital MTI Processing - Moving Target Detector - Limitations to MTI Performance - MTI from a Moving Platform (AMIT) - Pulse Doppler Radar – Other Doppler Radar Topics- Tracking with Radar –Monopulse Tracking –Conical Scan and Sequential Lobing - Limitations to Tracking Accuracy - Low-Angle Tracking - Tracking in Range - Other Tracking Radar Topics - Comparison of Trackers - Automatic Tracking with Surveillance Radars (ADT), Detection of Signals in Noise

Unit 3: Basics of Navigations: **[10 Hrs]**

Introduction - Four methods of Navigation.

Radio Direction Finding - The Loop Antenna - Loop Input Circuits - An Aural Null Direction Finder - The Goniometer - Errors in Direction Finding - Adcock Direction Finders - Direction Finding at Very High Frequencies - Automatic Direction Finders - The Commutated Aerial Direction Finder - Range and Accuracy of Direction Finders

Radio Ranges - The LF/MF Four course Radio Range - VHF Omni Directional Range (VOR) - VOR Receiving Equipment - Range and Accuracy of VOR - Recent Developments.

Unit 4: Navigational Systems **[11 Hrs]**

Aids to Approach and Landing, **Doppler Navigation, Inertial Navigation**, **Satellite Navigation System** - The Transit System - Navstar Global Positioning System (GPS).

Text Books:

1. Merrill I. Skolnik ," Introduction to Radar Systems", Tata McGraw-Hill,3rd Edition, 2003.
2. N.S.Nagaraja, “Elements of Electronic Navigation Systems”, Tata McGraw-Hill, 2nd Edition, ISBN: 9780074623015, 2000.

Reference Books:

1. Peyton Z. Peebles:, "Radar Principles", Johnwiley, 2004
2. J.C Toomay, “Principles of Radar", 2nd Edition –PHI, 2004

Open Elective

B18EC7051	Embedded Systems	L	T	P	C
Duration :14 Wks		4	0	0	4

Prerequisites:

Microcontroller, Operating Systems.

Course Description:

An embedded system is a computer *system* with a dedicated function within a larger mechanical or electrical *system*, often with real-time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts. Embedded systems control many devices in common use today.

Unit 1 gives an introduction to the basic elements of embedded system such as sensors, interfaces, firmware etc.

Unit 2 discusses about the various aspects of hardware software co design.

Unit 3 covers the complete aspects on real time embedded system design.

Unit 4 briefly covers the various topics on embedded integrated development environment.

Course Objectives:

Course objectives are to:

1. Give a brief idea about the embedded system components, memory, communication interfaces and other firmware components.
2. Understand the Quality attributes, hardware and Software co-design, Computational models in embedded systems, Unified Modelling languages etc.
3. Understand the firmware system development and firmware development languages.
4. Give a brief description of RTOS, Integrated Development Environment, Simulators and Emulators.
5. To understand the trends in embedded system development.

Course Outcomes:

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

1. Design a module of embedded system
2. Elaborate the quality attributes, hardware-software co-design in embedded systems.
3. Develop a firmware module.
4. Analyze the various tools in RTOS.

Mapping of Course Outcomes with program Outcomes

Course Code	POs / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC6041	CO1	3	2		1	3	1				2	1	2		1	1
	CO2	3	2	2	1	3									1	1
	CO3						1				2	1	2			
	CO4	3	2	2	1	3									1	1

Course Contents:

Unit-1: Typical Embedded System **[14 Hrs]**

Core of the Embedded System, Memory, Sensors and Actuators, Communication Interface, Embedded Firmware, Other System Components.

Unit-2: Characteristics and Quality Attributes of Embedded Systems [14 Hrs]

Hardware Software Co-Design and Program Modeling: Fundamental Issues in Hardware Software Co-Design, Computational Models in Embedded Design, Introduction to Unified Modeling Language **(Self Study/Case Study)**, Hardware Software Trade-offs

Embedded Firmware Design and Development: Embedded Firmware Design Approaches, Embedded Firmware Development Languages

Unit-3: Real-Time Operating System (RTOS) based Embedded System Design [14Hrs]

Operating System Basics, Types of OS, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Threads, Processes and Scheduling: Putting them altogether, Task Communication, Task Synchronization, Device Drivers, How to Choose an RTOS **(Self Study/Case Study)**.

Unit-4: The Embedded System Development Environment [14 Hrs]

The Integrated Development Environment (IDE) **(Self Study/Case Study)**, Types of Files Generated on Cross-compilation, Disassembler/Decompiler, Simulators, Emulators and Debugging, Target Hardware Debugging, Boundary Scan.

Trends in the Embedded Industry:**(Self Study/Case Study)**, Processor Trends in Embedded Systems, Embedded OS Trends, Development Language Trends, Open Standards, Frameworks and Alliances, Bottlenecks.

Text books:

1. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2009
2. James K Peckol , "Embedded Systems – A contemporary Design Tool", John Weily, 2008.

B18EC7052	Robotics and Automation	L	T	P	C
Duration: 14 Wks		4	0	0	4

Prerequisites:

Embedded System Design, Control systems, Programming skills

Course Description:

Robotics is the interdisciplinary branch of engineering and science that includes mechanical engineering, electrical engineering, computer science, and others. Robotics deals with the design, construction, operation, and use of robots as well as computer systems for their control, sensory feedback, and information processing. Automation and Robotics are two closely related

technologies. Automation as the technology that is concerned with the use of mechanical, electronic, and computer based systems in the operation and control of production. The course provides robot classification and anatomy, Robot kinematics, Trajectory Planning and control, Sensors and vision systems used in robots and Robot Programming.

Course Objectives:

Course objectives are to:

1. Classify Robots and anatomy.
2. Understand Robot kinematics
3. Determine Sensors and vision systems used in robots.
4. Write Robot Program.

Course Outcomes:

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

1. Summarize the basic applications and advantages of using robots in the industry
2. Do the robot motion analysis
3. Relate mathematical modeling and trajectory planning scheme in robots
4. Recognize the different types of sensors and cameras used in the field of robotics

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
B18EC 7052	CO1	3			3		3	1		2	2		2	3	3	2
	CO2	3			3		3	1					2	3	3	2
	CO3	3			3		3	1		2			2	3	3	2
	CO4	3			3		3	1		2	2		2	3	3	2

Course Contents:

Unit -1: Introduction to robotics [14 Hrs]

Definition, anatomy of robot, classification configurations, robot links and joints, robot specifications, resolution accuracy and repeatability, simple numerical problems, robot drive systems, hydraulic, pneumatic and electric drive systems, wrist and its motions, end effectors, types of end effectors, mechanical grippers, methods of constraining parts in grippers, types of gripper mechanisms, simple numerical problems, vacuum cups, magnetic grippers, adhesive grippers, hooks, scoops and other gripper devices, tool as end effectors, examples.

Unit -2: Robot motion analysis & Robot control [14 Hrs]

Direct kinematics and inverse kinematics, 3D homogeneous transformations, rotation, translation and displacement matrix, composite rotation matrix, rotation matrix about an arbitrary axis, links, joints and their parameters, Denavit-Hertenberg (D-H) representation, application of D-H matrices to different robot configurations.

Basic control systems and models, transfer function with examples, transfer function for spring-mass-damper system, transient response of a second order system, transfer function of a robot joint, different types of controllers, proportional (P) controller, integral (I) controller, derivative (D) controller, PID controller, simple numerical problems

Unit -3 Robot trajectory planning & Robot sensors [14 Hrs]

Trajectory planning, definition, steps in trajectory planning, joint space techniques, use of a p-degree polynomial as interpolation function, cubic polynomial trajectories, linear function with parabolic blends, joint space verses Cartesian space trajectory planning, simple numerical problems on joint space trajectory planning. Classification of robot sensors and their functions, touch sensor, tactile sensor, binary sensor, analog sensor, proximity sensor, range sensor, force and torque sensor.

Unit -4 Robot sensors and Machine Vision & Robot programming [14 Hrs]

Machine vision, functions of machine vision system, sensing and digitizing, imaging devices, analog to digital signal conversion, quantization and encoding, simple numerical problems, image storage, image processing and analysis, image data reduction, segmentation, feature extraction, object recognition, robotic machine vision applications, inspection, identification, visual servoing and navigation.

Introduction to robot programming, robot cell layout, work cell control and interlocks, manual programming, lead through and walkthrough programming, off-line programming, VAL programming language, example, AML and VAL-II robot programming languages, examples, Programming with graphics, example.

Text Books:

1. Mikell P. Groover, Mitchel Weiss, Roger N. Nagel, Nicholas G. Odrey, " Industrial Robotics,", McGraw-Hill Publications, International Edition, 2008.
2. James G. Keramas, " Robot Technology Fundamentals", Cengage Learning, International Edition 1999.

Reference Books:

1. Fu K. S., Gonzelez R. C., Lee C. S. G: Robotics, " Control, Sensing, Vision, Intelligence ", McGraw Hill Book Co., International edition, 2008.
2. Appu Kuttan K. K, " Robotics, International Publications", First Edition, 2007

3. R. K. Mittal, I. J. Nagrath, " Robotics and Control", Tata-McGraw-Hill Publications, 2007

B18EC7053	IOT & Cyber physical system	L	T	P	C
Duration:14 Wks		4	0	0	4

Prerequisites:

Embedded systems, Computer concept networking Course

Course Description:

IoT is the technology enabling the inter-connection of all types of devices through the internet to exchange data, optimize processes, monitor devices in order to generate benefits for the industry, the economy, and the end user. It is composed of network of sensors, actuators, and devices, forming new systems and services. Many protocols are used for faithful transmission data based on the applications. The Cyber Physical Systems (CPS) is an engineering discipline and specifies the integrations of and interaction between computation and physical processes. CPS integrates the dynamics of the physical processes with those of the communications, computation and networking, and analysis techniques for the integrated systems.

Course Objectives:

The objectives of this course are to:

1. Discuss the architecture of Internet of Things and connected world.
2. Contrast various hardware, communication and sensing technologies, cloud services to build IoT applications
3. Understand about modelling of cyber-physical systems
4. Describe the design of cyber physical system.

Course Outcomes:

On completion of this course the student will be able to:

1. Describe the IoT system architecture and system design.
2. Use protocols, cloud services and communication API's for developing Applications
3. Apply the core principles behind Cyber physical system
4. Discuss the abstraction in designing the cyber physical system

Mapping of Course Outcomes with Program Outcomes

Course Code	CO# / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
B18EC7010	CO1	3	2	3	2	3	2	2		1		1		3	2	3
	CO2	3		3		3								3	2	3
	CO3	3	2	3	2	3					2			3	3	3
	CO4	3	1				1							3	2	

Course Contents:

Unit -1: Introduction & Concepts of IoT [10]

IoT Definition & Characteristics of IoT, Physical Design of IoT: Thing in IoT, IoT Protocols, Logical Design of IoT: Function Block, Communication Models, Communication API, IoT Enabling Technologies: WSN, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded System, IoT Levels and Deployment Templates, Applications of IoT

Unit -2: IoT System Design [11]

IoT Design methodology, IoT Protocol – MQTT, CoAP, Introduction to Cloud storage Models: WAMP, Xively Cloud for IoT, Python Web Application Framework-Django, Designing a RESTful based Web API. Data Analytics for IoT – Apache Hadoop, Apache Oozie. Case studies illustrating IoT design – Home Automation, Cities, Environment, Agriculture

Unit -3: Introduction & Modelling of Cyber Physical System [10]

Definition & Example of CPS system, Design Process, Modelling Dynamic Behaviours – Continuous Dynamics: Newtonian Mechanics, Actor Model, Discrete Dynamics: Discrete Systems, Notion of State, Finite-State Machines, Extended State machines

Unit -4: Designing of Cyber Physical System [11]

Embedded architecture: Types of processors, Parallelism, Pipelining, Multicore Architectures, Multitasking: Process, Process Management, States of Process, Process Schedulers, Process Control Block, Interrupts, Threads & its types. Scheduling: Levels, Different of Types, Different process scheduling algorithms.

Textbooks:

1. Arshdeep Bagha and Vijay Madisetti Internet of Things: A Hands-on Approach

2. Edward A. Lee and Sanjit A. Seshia, "Introduction to Embedded Systems, A Cyber-Physical Systems Approach", Second Edition, MIT Press

Reference Books:

1. Pethuru Raj and Anupama C. Raman (CRC Press), The Internet of Things: Enabling Technologies, Platforms and Use Cases
2. Adrian McEwen, Hakim Cassimally, 'Designing the Internet of Things', Wiley, 2014.
3. OlivierHersent,DavidBoswarthick,OmarElloumi,'The Internet of Things: Key Applicationsand Protocols', Wiley, 2015.
4. Rajeev Alur, "Principles of Cyber-Physical Systems", MIT Press
5. Danda B. Rawat, Joel J.P.C. Rodrigues, Ivan Stojmenovic, "Cyber-Physical Systems: From Theory to Practice", CRC Press

REVA UNIVERSITY
Bengaluru, India

SCHOOL OF CIVIL ENGINEERING

HANDBOOK

M. Tech. in Computer Aided Structural Engineering

2018-20

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

Chancellor's Message

Education during recent years has witnessed a great transformation. Today's society, termed as "Knowledge Society" has brought about unprecedented economic and social growth. This has propelled universities across the world to devise new ways of tapping human potential for different competencies and building a vibrant society with a win-win situation for all.

REVA University has seen the light of the day to imbibe this character of paradigm shift in academic pursuits to contribute to the knowledge society. REVA works hard to bring in you an exciting and rewarding educational experience, to discover new interests and to develop your career prospects. You will benefit from a unique approach to student-centered learning through group work and individual study tackling real world challenges alongside experienced practitioners and researchers.

REVA has excellent learning facilities including custom built teaching facilities designed specifically to emulate working conditions, air-conditioned library opened for your studies from early morning till midnight and facilities for variety of sports and cultural activities.

Our faculties have introduced socially relevant and market driven engineering courses after studying the requirements of industries in detail and consulting entrepreneurs, experts in different areas of commerce and industry and other stake-holders. I am glad that the Choice Based Credit System (CBCS) and Continuous Assessment Grading Pattern (CAGP) being adopted will facilitate learning environment under continuous guidance and monitoring by the faculty and equip you with competent skills to opt for different job prospects across the global.

I hope that the present scheme of instructions, continuous periodic progress assessments, course curriculum of M. Tech in **Computer Aided Structural Engineering** and other information provided in this hand book will guide you to choose appropriate courses of study and move ahead in the right direction in your chosen area of study. I hope you will enjoy and experience the curriculum, the student-centered teaching and learning ambience in developing your personality to become successful professionals, entrepreneurs and proud citizens of the country.

I wish you every success in your career.

Dr. P. Shyama Raju

The Founder and Hon'ble Chancellor, REVA University

MESSAGE FROM THE VICE CHANCELLOR

Higher education across the globe is opening doors of its academic disciplines to the real world experiences. The disciplinary legitimacy is under critical review. Trans-border mobility and practice learning are being fore-grounded as guiding principles. Interactive learning, bridging disciplines and facilitating learners to gain different competencies through judicious management of time is viewed as one of the greatest and fascinating priorities and challenges today.

All the programs in REVA University are designed with a great care and after detailed market survey of present requirements and job opportunities. Experts in respective areas of study from primary institutions, industries, research organizations, business sectors and such others have been involved in designing the curriculum of each program.

The L: T: P structure of teaching and learning under Choice Based Credit System (CBCS) and Continuous Assessment Grading Pattern (CAGP) would certainly help our students learn and build competencies needed in this knowledge based society. It provides students an opportunity to choose subject(s) of interest in other areas of study and learn courses with students of different subjects. It facilitates cross cultural learning. It further facilitates students to move in fast track and earn additional certificates and diploma.

The well qualified, experienced, committed teachers in REVA University will involve students in integrative learning and application environment within and outside the university. They will certainly mould them with knowledge, skill and ethical values and empower them to face the competitive world with courage and confidence.

This handy document containing a brief information about ***M Tech in Computer Aided Structural Engineering***, scheme of instruction, course content, CBCS-CAGP regulations and its advantages and calendar of events for the year will serve as a guiding path to students to move forward in a right direction. It is for the students to be disciplined, committed and to work hard and make use of enormous resources and expert faculties to accomplish all round development of their personalities and succeed with flying colors not only in earning degree but also in their future career as leaders and proud citizens of mother India.

Dr. S.Y.Kulkarni
Vice-Chancellor, REVA University

MESSAGE FROM THE DIRECTOR

The M. Tech in Computer Aided and Structural Engineering is an innovative program based on recent advances in the Computer Aided analysis and design of structures mainly encountered in Civil Engineering practice. It provides an excellent grounding in the fundamentals of structural engineering subjects. It also provides a comprehensive coverage of the recent developments in structural engineering and of the use of computers in the analysis and design of structures.

The program comprises of courses providing knowledge in core areas of structural engineering, such as Computational Structural mechanics, Computer Aided design of RC structures, Computer Aided Design of concrete bridges, Computational Structural dynamics etc. These are known as Hard Core courses. There are number of courses providing knowledge in specialized areas of Computer Aided design of industrial structures, Advanced solid mechanics, Reliability Analysis of structures, Design of masonry structures, Special concrete and so on facilitating students to choose specialized areas of their interest. These are termed as Soft Core courses. Apart from a minor project in the third semester, the fourth semester is completely devoted to Dissertation work to enable students to work in concerned industries / institutions and get exposed to practical situations. The lab programs being part of the curriculum in each semester of the program will certainly provide students the experience and confidence to work in challenging environment in their future career.

The benefits of choosing M. Tech in Computer Aided and Structural Engineering are:

- Flexibility to choose various fields specializations for their study.
- Opportunity to work on live problems.
- Opportunity to work on latest technologies.
- Opportunity for designers & planner to plan & design live projects.

Students completing this program will have opportunities within the country as well as abroad to work and executive structural design projects of complex structures such as shells, folded plates, ribbed slabs, tall structures etc. They also have prospects of becoming entrepreneurs in structural consultancy. The field also has ample opportunities for advanced research as the students undergo preliminary research as a part of master's degree program.

I am sure the students choosing M Tech in Computer Aided and Structural Engineering in REVA University will enjoy the curriculum, teaching and learning environment, the vast infrastructure and the experienced teachers involvement and guidance. The cirruculum caters to and has relevance to local, regional, national, global developmental needs. We will strive to provide all needed comfort and congenial

environment for their studies. Maximum number of courses are integrated with cross cutting issues with relevant to professional ethics, Gender, human values, environment and Sustainability. I wish all students pleasant stay in REVA and grand success in their career. 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. Y. Ramalinga Reddy
Director
School of Civil Engineering

CONTENTS

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, Commerce, Education, Engineering, Environmental Science, 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 Degree College (Evening), 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 Engineering, Commerce, Management, Education, Arts 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 notch 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 M. Phil and 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 11,000 students study various courses across REVA's three campuses equipped with exemplary state-of-the-art infrastructure and conductive environment for the knowledge driven community.

ABOUT REVA UNIVERSITY

REVA University established under the Government of Karnataka Act 80 of the year 2012 and notified in the Karnataka Gazette dated 7th Feb, 2013, is located 14 kms away from the Bangalore International Airport on the way to Bangalore city. The university has a sprawling lush green campus spread over 42 acres of land equipped with state-of-the-art infrastructure and conductive environment for higher learning.

The REVA campus has well equipped laboratories, custom-built teaching facilities designed specifically to emulate working conditions, fully air-conditioned library and central computer centre. The well planned sports facility for variety of sports activities, facilities for cultural programs and friendly campus lifestyle add to the overall personality development of students. The campus also has residential facility for students, faculty and other staff.

Currently, REVA University offers 18 Post Graduate programs and 15 Graduate and P.G Diploma programs in Engineering and Technology, Science, Commerce and Management in addition to research degrees leading to PhD in different disciplines. The University aims to offer many more PG and UG programs in Science, Arts, Commerce, Engineering & Technology, Management Studies, Education, in the years to come.

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.

ABOUT SCHOOL OF CIVIL ENGINEERING

The School of Civil Engineering is headed by highly experienced Professor of Civil Engineering and is supported by well qualified faculty members. The school has the state-of-art class rooms and well equipped laboratories. It offers B.Tech in Civil Engineering and M. Tech in Computer Aided Structural Engineering and M Tech in Transportation Engineering & Management. 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 application oriented. The M. Tech in Computer Aided Structural Engineering program aims to prepare human resources to play a leading role in the competitive construction field and excel in their endeavors. The program focuses on research and design in the core and Computer Aided Structural Engineering. The M.Tech in Transportation Engineering & Management aims to supplement and create a sustainable world and to enhance the global quality of life by adopting enhanced techniques of design and application. This is reflected in various core subjects offered within the program. Currently Civil Engineering teaching was limited to planning, analysis, design and execution of different types of infrastructure like buildings, roads, bridges, dams and power plants. However, due to increase of technological sophistication and demand for higher living standards geared up by economic growth and concerns about environmental impact have changed the scope of Civil Engineering. The challenges of today's Civil Engineering infrastructure are much more complex and interdependencies between resources.

Even though there are a large number of institutions in the country which are producing Civil Engineers, there is acute shortage of quality Civil Engineers. The REVA University would like to offer Civil Engineering Programme to produce quality engineers who are effective and efficient in problem solving and providing economical and sustainable infrastructural solutions.

Vision

To produce young Engineers of caliber, who would be committed to their profession with ethics, will be able to contribute to Civil Engineering and allied fields in optimizing usage of resources globally making the world more eco-friendly to live in.

Mission

- *To make the Department centre of excellence for training the undergraduate students.*
- *To promote involvement of staff and students in research and advanced training.*

- *To develop good understanding skills in student communities about Civil Engineering, ethical practices, automation design and society need centric teaching and learning and imparting value addition skills.*

ACADEMIC OBJECTIVES

- To prepare graduates and post graduates in CIVIL ENGINEERING who will excel in their professional career and contribute with commitment and dedication to the progress of the society and the nation.
- To enhance the understanding of the engineering principles of Civil Engineering systems.
- Graduates will be prepared with a solid foundation in mathematics, sciences, and technical skills needed to analyze and design civil infrastructure systems.
- The professional careers of our graduates will be distinguished with a high degree of awareness of moral, ethical, legal and professional obligations to protect human health, human welfare, and the environment.
- A commitment to continue assessment in continuing education.
- Our graduates will become team leaders, and will successfully address open-ended problems applying critical thinking.
- To promote faculty, researchers and students to participate in national and international conferences, seminars, workshops etc. and present their research outputs. Also research output to publish in journals of repute, publish books in relevant fields and popular articles for the benefit of the society at large.
- To organize conferences, seminars, workshops, special lectures, summer schools, technical talks, faculty development programmes etc. on emerging areas.
- To establish incubation centre and center of excellence in thrust areas in collaboration with industries.
- To organize and promote co-curricular and extra-curricular activities that inculcate among students concerned to the society.

ADVISORY BOARD

Sl. No.	Name of Members
1	**Dr. A. Veeraraghavan,** Professor, Department of Civil Engineering, IIT Madras, Room No:#234, Building Sciences Block, IIT Madras, Chennai-600036 (o) 044-22574272 Fax:044-22570509 Email: av@iitm.ac.in
2	**Mr. Nagaraj Kulkarni,** Vice-President DivyaSree Developers (P) Ltd., DivyaSree Chambers, A Wing, #11, O'Shaughnessy Road, Shanthi Nagar, Bangalore 560 025. (M) 98452 11750 Email: nagaraj@divyasree.com
3	**Dr. V. Ramachandra** Zonal Head, Technical Services, Ultra Tech Cement Ltd., Industry House, 6th floor, #45, Race Course Road, Bangalore 560 001, (M)97432-47985 Email: Ramachandra.v@adityabirla.com
4	**Dr. Mattur C Narasimhan,** Professor, Department of Civil Engineering, NIT, Surathkal, Karnataka 575 025 (O) 0824-2474000Ext 3336 (R) 0824-2474336 (M) 94491-63427 Email: mattur.cn@gmail.com mattur@nitk.ac.in
5	**Dr. R.V. Ranganath.** Dean (Academic), Principal Professor & HOD, Department of Civil Engineering, BMS College of Engineering, Bull Temple Road, Bangalore-560 019 Currently Principal BMSIT, Yelahanka, Bangalore (M) 98450-86602 Email: rangarv@yahoo.com

Program Educational Objectives (PEO's)

The programme educational objectives of the Civil Engineering of REVA University is to prepare graduates

PEO-1	To have successful professional careers in industry, government, academia and military as innovative engineers.
PEO-2	To successfully solve engineering problems associated with the lifecycle of Civil Engineering system, in particular structural engineering by communicating effectively either leading a team or as a team member
PEO-3	To continue to learn and advance their careers through activities such as research and development, acquiring doctoral degree, participation in national level research programmes, teaching and research at university level etc.,
PEO-4	To be active members ready to serve the society locally and internationally, may take up entrepreneurship for the growth of economy and to generate employment; and adopt the philosophy of lifelong learning to be aligned with economic and technological development.

Program Outcomes (POs)

After successful completion of the programme, the graduates shall be able to

- PO1. **Demonstrate in-depth knowledge** of computer aided structural Engineering, including wider and global perspective, with an ability to discriminate, evaluate, analyze and synthesize existing and new knowledge, and integration of the same for enhancement of knowledge.
- PO2. **Analyze complex engineering problems critically**, apply independent judgment for synthesizing information to make intellectual and/or creative advances for conducting research in structural engineering , wider theoretical, practical and policy context.
- PO3. **Think laterally and originally, conceptualize and solve structural engineering problems**, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in computer aided structural Engineering

- PO4. **Extract information pertinent to unfamiliar problems** through literature survey and experiments, apply appropriate **research methodologies, techniques and tools, design**, conduct experiments, analyze and interpret data, demonstrate higher order skill and view things in a broader perspective, contribute individually/in group(s) to the development of scientific/technological knowledge in computer aided structural Engineering

- PO5. **Create, select, learn** and **apply** appropriate techniques, resources, and structural **engineering and IT tools**, including prediction and modeling, to complex engineering activities with an understanding of the limitations.

- PO6. Possess knowledge and understanding of group dynamics, recognize opportunities and contribute positively to **collaborative-multidisciplinary scientific research**, demonstrate a capacity for self-management and teamwork, decision-making based on open-mindedness, objectivity and rational analysis in order to achieve common goals and further the learning of themselves as well as others.

- PO7. Demonstrate knowledge and understanding of structural Engineering principles and apply the same to one's own work, as a **member and leader in a team**, manage projects efficiently in respective disciplines and multidisciplinary environments after consideration of economical and financial factors.

- PO8. **Communicate with the engineering community**, and with society at large, regarding complex Structural engineering activities confidently and effectively, such as, being able to comprehend and write effective reports and design documentation by adhering to appropriate standards, make effective presentations, and give and receive clear instructions.

- PO9: Recognize the need for, and have the preparation and ability to engage in **life-long learning** independently, with a high level of enthusiasm and commitment to improve knowledge and competence continuously.

- PO10. Acquire professional and intellectual integrity, professional **code of conduct**, **ethics of research** and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the community for sustainable development of society.

- PO11. Observe and examine critically the outcomes of one's actions and make corrective measures subsequently, and **learn from mistakes** without depending on external feedback **(SELF learning).**

Programme Specific Outcomes (PSO's)

1) Apply knowledge of Structural Engineering and management in real time.
2) Analyse a system, component or process in the knowledge areas of Structural Engineering in real time problems.
3) Design a system, component, or process in more than one areas of Structural Engineering.
4) Conduct investigations and address complex Structural Engineering problems; Utilize and develop innovative tools and techniques that are appropriate in discipline. Structural Engineering.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO1	P02	PO3	PO4	PO5	PO6	P7	PO8	PO9	PO 10	PO 11	PSO1	PSO2	PSO3	PSO4
M18SE1010	CO1	3	3	3	1	2		2	2	1		1	3	3	1	2
	CO2	3	3	3	1	2		2	1	1		1	3	3	1	2
	CO3	3	3	3	1	2		2	1	1		1	3	3	1	2
	CO4	3	3	3	1	2		2	1	1		1	3	3	1	2
M18SE1020	CO1	3	2	2		1		2	2	1	1	1	3	3	1	2
	CO2	3	2	2		1		2	2	1	1	1	3	3	1	2
	CO3	3	2	2		1		2	2	1	1	1	3	3	1	2
	CO4	3	2	2		1		2	2	1	1	1	3	3	1	2
M18SE1030	CO1	3	1	2		2		2	2	1		1	3	1	3	2
	CO2	3		2		2		2	2	1		1	3	1	3	2
	CO3	3		2		2		2	2	1		1	3	1	3	2
	CO4	3		2		2		2	2	1		1	3	1	3	2
M18SE1040	CO1	3	2	2		1			1		1	1	3	3	1	2
	CO2	3	2	2		1			1		1	1	3	3	1	2
	CO3	3	2	2		1			1		1	1	3	3	1	2
	CO4	3	2	2		1			1		1	1	3	3	1	2
M18SE1051	CO1	3	2	2		2			1	1		1	3	3	1	2
	CO2	3	2	2		2			1	1		1	3	3	1	2
	CO3	3	2	2		2			1	1		1	3	3	1	2
	CO4	3	2	2		2			1	1		1	3	3	1	2
M18SE1052	CO1	3	1	2		2		2	2	1		1	3	1	3	2
	CO2	3		2		2		2	2	1		1	3	1	3	2
	CO3	3		2		2		2	2	1		1	3	1	3	2
	CO4	3		2		2		2	2	1		1	3	1	3	2
M18SE1061	CO1	2	1		2	1	2	1	2		1	1	2	1	1	2
	CO2	2	1		2	1	2	1	2		1	1	2	1	1	2

	CO3	2			2	1	2	1	2		1	1	2	1	1	2
	CO4	2			2	1	2	1	2		1	1	2	1	1	2
M18SE1062	CO1	3	1	2		2		2	2	1		1	3	1	3	2
	CO2	3		2		2		2	2	1		1	3	1	3	2
	CO3	3		2		2		2	2	1		1	3	1	3	2
	CO4	3		2		2		2	2	1		1	3	1	3	2
M18SE1070	CO1	3	2		2	2	1		1			1	3	1	2	2
	CO2	3	2		2	2	1		1			1	3	1	2	2
	CO3	3	2		2	2	1		1			1	3	1	2	2
	CO4	3	2		2	2	1		1			1	3	1	2	2
M18SE2010	CO1	3	3	3	1	2		2	2	1		1	3	3	1	2
	CO2	3	3	3	1	2		2	1	1		1	3	3	1	2
	CO3	3	3	3	1	2		2	1	1		1	3	3	1	2
	CO4	3	3	3	1	2		2	1	1		1	3	3	1	2
M18SE2020	CO1	3	1	2		2		2	2	1		1	3	1	3	2
	CO2	3		2		2		2	2	1		1	3	1	3	2
	CO3	3		2		2		2	2	1		1	3	1	3	2
	CO4	3		2		2		2	2	1		1	3	1	3	2
M18SE2030	CO1	3	1	2		2		2	2	1		1	3	1	3	2
	CO2	3		2		2		2	2	1		1	3	1	3	2
	CO3	3		2		2		2	2	1		1	3	1	3	2
	CO4	3		2		2		2	2	1		1	3	1	3	2
M18SE2040	CO1	2	1		2	1	2	1	2		1	1	2	1	1	2
	CO2	2	1		2	1	2	1	2		1	1	2	1	1	2
	CO3	2			2	1	2	1	2		1	1	2	1	1	2
	CO4	2			2	1	2	1	2		1	1	2	1	1	2
M18SE2051	CO1	2	1	1			1		1				2	1		2
	CO2	2	2	2		1	1		1		1		2	1	2	2
	CO3	2	2	2		1	1		1		1		2	1	2	2
	CO4	2	2	2		1	1		1		1		2	1	2	2
M18SE2052	CO1	3	3	3	1	2		2	2	1		1	3	3	1	2
	CO2	3	3	3	1	2		2	1	1		1	3	3	1	2
	CO3	3	3	3	1	2		2	1	1		1	3	3	1	2
	CO4	3	3	3	1	2		2	1	1		1	3	3	1	2
M18SE2061	CO1	3	1	1		2	1	2	1				2	2		1
	CO2	3	2	2		2	1	2	1				2	2	2	1
	CO3	3	2	2		2	1	2	1				2	2	2	1
	CO4	3	2	2		2	1	2	1				2	2	2	1
M18SE2062	CO1	3	1	2		2		2	2	1		1	3	1	3	2
	CO2	3		2		2		2	2	1		1	3	1	3	2
	CO3	3		2		2		2	2	1		1	3	1	3	2
	CO4	3		2		2		2	2	1		1	3	1	3	2
M18SE2070	CO1	2	3	3	2	3	1		1	1		1	3	3	3	2

	CO2	**2**	**3**	**3**	**2**	**3**	**1**		**1**	**1**		**1**	**3**	**3**	**3**	**2**
	CO3	**2**	**3**	**3**	**2**	**3**	**1**		**1**	**1**		**1**	**3**	**3**	**3**	**2**
	CO4	**2**	**3**	**3**	**2**	**3**	**1**		**1**	**1**		**1**	**3**	**3**	**3**	**2**
M18SE3010	**CO1**	**3**	**2**		**2**	**2**	**1**		**1**			**1**	**3**	**1**	**3**	**2**
	CO2	**3**	**2**		**2**	**2**	**1**		**1**			**1**	**3**	**1**	**3**	**2**
	CO3	**3**	**2**		**2**	**2**	**1**		**1**			**1**	**3**	**1**	**3**	**2**
	CO4	**3**	**2**		**2**	**2**	**1**		**1**			**1**	**3**	**1**	**3**	**2**

Mapping of PEOS with Respect to POs

	PO1	P2	PO3	PO4	PO5	PO6	P7	PO8	PO9	PO 10	PO 11	PSO1	PSO2	PSO3
PEO1	√	√	√	√	√	√	√	√	√	√	√	√	√	√
PEO2	√	√	√	√	√	√	√	√	√	√	√	√	√	√
PEO3	√	√	√	√	√	√	√	√	√	√	√	√	√	√
PEO4	√	√	√	√	√	√	√	√	√	√	√	√	√	√

CBCS (CHOICE BASED CREDIT SYSTEM) AND CAGP (CONTINUOUS ASSESSMENT AND GRADING PATTERN) OF EDUCATION AND ITS ADVANTAGES

CBCS is a proven, advanced mode of learning in higher education. It facilitates students to have freedom in making their own choices for acquiring a Degree / Master's Degree program. It is more focused towards the student's choice in providing a wide range of Units available in a single campus across various disciplines offered by experts in the subjects. It leads to quality education with active teacher-student participation.

Studying under CBCS has following advantages:

- Students may undergo training in cross-disciplinary and multi-disciplinary subjects and acquire more focused and preferred knowledge.
- Students may get more skills from other subject(s) which are required for the career path in addition to their regular subject knowledge.
- Students may get ample opportunities to use the laboratories and gain practical exposure to the much needed Units available in other departments/schools for want of scientific inputs.
- Courses are conducted by subject experts identified on the basis of their experiences. Courses taught by such experts may provide in-depth information and clear understanding of the Units.

- Students may get an opportunity to study courses with other students of different programs and exchange their views and knowledge in a common class room.
- CBCS provides a cross-cultural learning environment.
- Students may benefit much from selecting the right options to successfully face the public service examinations like UPSC, KPSC, IES wherein the knowledge of additional subjects become mandatory for general or optional papers.
- Students are exposed to the culture of universal brotherhood during their campus life.
- Students are allowed to practice various methods of learning a subject.

Summary of REVA University Regulations for Choice Based Credit System (CBCS) and Continuous Assessment Grading Pattern (CAGP) for Post Graduate Degree Program

1.0 Teaching and Learning Process

The teaching and learning process under CBCS-CAGP of education in each course of study will have three components, namely-

(i) L= Lecture (ii) T= Tutorial (iii) 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 that equip students to acquire the much required skill component.

2.0. A course shall have either or all the three components. That means a course may have only lecture component, or only practical component or combination of any two or all the three components.

2.1. Various course of s**tudy** are labeled and defined as: (i) Core Course (CC) (ii) Hard Core Course (HC), (iii) Soft Core Course (SC), (iv) Foundation Core Course (FC) and (v) Open Elective Course (OE).

(i) **Core Course:** A course which should compulsorily be studied by a candidate as a core-requirement is termed as a Core course.

(ii) **Foundation Course (FC):**

The foundation Course is a core course which should be completed successfully as a part of graduate degree program irrespective of the branch of study.

(iii) **Hard Core Course (HC):**

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.

(iv) **Soft Core Course (SC):**

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.

(v) O**pen Elective Course:**

An elective course chosen generally from other discipline / subject, with an intention to seek exposure is called an O**pen Elective Course.**

2.2. Project Work:

Project work is a special course involving application of knowledge in solving / analyzing /exploring a real life situation / difficult problem.

2.3. Minor Project:

A project work up to **Six to Eight credits** is called **Minor Project** work. A Minor Project work may be a hard core or a Soft Core as decided by the BOS / concerned.

2.4. Major Project / Dissertation:

A project work of **EIGHT, TEN, TWELVE, SIXTEEN or TWENTY** credits is called **Major Project** work. The Major Project / Dissertation shall be Hard Core.

3.0. Minimum Credits to be earned:

3.1. A candidate has to earn 96 credits for successful completion of M Tech degree with a distribution of credits for different courses as prescribed by the university.

3.2. A candidate can enroll for a maximum of 26 credits per Semester. However he / she may not successfully earn a maximum of 26 credits per semester. This maximum of 26 credits does not include the credits of courses carried forward by a candidate.

3.3. Only such full time candidates who register for a minimum prescribed number of credits in each semester from I semester to IV semester and complete successfully 96 credits in 4 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.

4.0. Add- on Proficiency Certification:

In excess to the minimum of 96 credits for the M. Tech Degree program, a candidate can opt to complete a minimum of 4 extra credits either in the same discipline/subject or in different discipline / subject to acquire **Add on Proficiency Certification** in that particular discipline / subject along with the M .Tech degree.

4.1. Add on Proficiency Diploma:

In excess to the minimum of 96 credits for the M. Tech degree program, a candidate can opt to complete a minimum of 18 extra credits either in the same discipline/subject or in different discipline / subject to acquire Add on Proficiency Diploma in that particular discipline / subject along with the B. Tech degree. The A**dd - on Proficiency Certification / Diploma** so issued to the candidate contains the courses studied and grades earned.

5.0. Continuous Assessment, Earning of Credits and Award of Grades.

5.1. The assessment and evaluation process happen in a continuous mode. However, for reporting purpose, **a semester is divided into 3 components as C1, C2, and C3.**The performance of a candidate in a course will be assessed for a maximum of 100 marks as explained below.

(i) Component C1:

The first Component (C1), of assessment is for 25 marks. This will be based on test, assignment / seminar. During the first half of the semester (i.e. by 8th week), the first 50% of the syllabus (Unit 1&2) will be completed. This shall be consolidated during the first three days of 8th week of the semester. A review test based on C1 will be conducted and completed in the beginning of the 9th week. In case of courses where test cannot be conducted, the form of assessment will be decided by the concerned school and such formalities of assessment will be completed in the beginning of the 9th week. The academic sessions will continue for C2 immediately after completion of process of C1.

The finer split - up for the award of marks in C1 is as follows:

Assignment ……..…….. 05 marks for Unit 1&2

Seminar ……..……. 05 marks for Unit 1&2

Test (Mid-Term) ……..……..15 marks for Unit 1&2

Total ……..…… ……..25 marks

(ii) Component C2:

The second component (C2), of assessment is for 25 marks. This will be based on test, assignment /seminar. The continuous assessment and scores of second half of the semester (9th to 16th week) will be consolidated during 16th week of the semester. During the second half of the semester the remaining units in the course will be completed. A review test based on C2 will be conducted and completed during 16th week of the semester. In case of courses where test cannot be conducted, the form of assessment will be decided by the concerned school and such formalities of assessment will be completed during 16th week.

The 17th week will be for revision of syllabus and preparation for the semester - end examination.

The finer split - up for the award of marks in C2 is as follows:

Assignment ……..……... 05 marks for Unit 3 & 4

Seminar ……..……..……..05 marks for Unit 3 & 4

Review Test (Mid-Term) ……..…….15 marks for Unit 3 & 4

Total ……..……..25 marks

(iii) Component C3:

The end semester examination of 3 hours duration for each course shall be conducted during the 18th & 19th week. **This forms the third / final component of assessment (C3) and the maximum marks for the final component will be 50.**

5.2. Setting Questions Papers and Evaluation of Answer Scripts:

5.2.1. There shall be three sets of questions papers set for each course. Two sets of question papers shall be set by the internal and one set by external examiner for a course. The Chairperson of the BoE shall get the question papers set by internal and external examiners.

5.2.2. The Board of Examiners shall scrutinize and approve the question papers and scheme of valuation.

5.2.3. There shall be single valuation for all theory papers by internal examiners. In case, the number of internal examiners falls short, external examiners may be invited. The answer scripts evaluated both by internal and external examiners shall be moderated by the external examiner / moderator.

5.2.4. The examination for Practical work/ Field work/Project work will be conducted jointly by two examiners (internal and external). However, in case of non-availability of external examiner or vice versa, the Chairperson BoE at his discretion can invite internal / external examiners as the case may be, if required.

5.2.5. If a course is fully of (L=0): T: (P=0) type, then the examination for C3 Component will be as decided by the BOS concerned.

5.2.6. In case of a course with only practical component a practical examination will be conducted with two examiners (ref: 6.3.4 above) and each candidate will be assessed on the basis of: a) Knowledge of relevant processes, b) Skills and operations involved, and c) Results / Products including calculation and reporting.

5.2.7. The duration for semester-end practical examination shall be decided by the School / Council.

5.3. 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	(C1)	Periodic Progress and Progress Reports (25%)
Component – II	(C2)	Results of Work and Draft Report (25%)
Component– III	(C3)	Final Evaluation and Viva-Voce (50%). Evaluation of the report is for 30% and the Viva-Voce examination is for 20%.

5.4. The schedule of continuous assessment and examinations are summarized in the following Table below.

Component	Period	Syllabus	Weightage	Activity
C1	1st Week to 8th Week Last 3 days of 8th Week	First 50% (two units)	25%	Instructional process and Continuous Assessment
	1st Week to 8th Week Last 3 days of 8th Week	First 50% (two units)	25%	Consolidation of C1
C2	9th week to 16th week	Second 50% (remaining two units)	25%	Instructional process and Continuous Assessment
	Last 3 days of 16th week	Second 50% (remaining two units)		Consolidation of C2
C3	17th and 18th week			Revision and preparation for Semester end examination
	19th week to 20th week	Entire syllabus	50%	Conduct of semester end examination and Evaluation concurrently
	21st week			Notification of Final Grades
***Evaluation shall begin very first day after completion of the conduct of examination of the first course and both examination and evaluation shall continue concurrently. The examination results / final grades be announced latest by 21st week**				

Note: 1. Practical examination wherever applicable shall be conducted before conduct of C2 Examination. The calendar of practical examination shall be decided by the respective School.

2. Finally**, awarding the Grades** be announced latest by 5 days after completion of the examination.

6.0 Requirements to Pass a Course

6.1. 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 30% in C1 and C2 together, and 40% and above in aggregate of C1, C2 and C3 in a course is said to be successful.

6.2. **Eligibility to Appear for C3 (Semester - end) Examination and Provision to Drop the Course.**

Only those students who fulfill 75% attendance requirement and who secure minimum 30% marks

in C1 andC2 together in a course are eligible to appear for C3 examination in that course.

6.3. Those students who have 75% of attendance but have secured less than 30% marks in C1 and C2 together in a course are not eligible to appear for C3 examination in that course. They are treated as dropped the course and they will have to repeat that course whenever it is offered.

Teachers offering the courses will place the above details in the School Council meeting during the last week of the Semester, before the commencement of C3, and subsequently a notification pertaining to the above will be brought out by the Director of the School before commencement of C3 examination. A copy of this notification shall also be sent to the office of the Registrar & Registrar (Evaluation).

6.4. In case a candidate secures more than 30% in C1 and C2 together but less than 40% in aggregate of C1, C2 and C3 in a course is considered as unsuccessful and such a candidate may either opt to DROP that course or appear for C3 examination during the subsequent semesters / years within the stipulated period.

In such a case wherein he / she opts to appear for just C3 examination, then the marks secured in C1 and C2 shall get continued. Repeat C3 examination will be conducted in respective semesters.

6.5. In case a candidate opts to drop the course he / she has to re-register for the dropped course only in subsequent semesters whenever it is offered if it is Hard Core Course and he / she may choose alternative course if it is Soft Core Course or Open Elective course or Skill Development Course. **The details of any dropped course will not appear in the Grade Card.**

6.6. **Provision to Withdraw Course:**

A candidate can withdraw any course within ten days from the date of notification of final results. Whenever a candidate withdraws a course, he/she has to register for the same course in case it is hard core course, the same course or an alternate course if it is soft core/open elective. **A DROPPED course is automatically considered as a course withdrawn.**

7.0. Provision for Make- up Examination:

For those students who have secured less than 40% marks in C1, C2 and C3 (end semester examination) together; the university shall conduct a make-up C3 examination within three weeks after the end of each semester.

Such of those students who have secured more than 30% marks in C1 and C2 together and less than 40% marks in C1, C2, and C3 together in a course shall appear for make-up examination in that course. This make-up examination is only for C3examination.

A student who is absent to End Semester Examination (C3) due to medical emergencies or such other exigencies and fulfills the minimum attendance and performance requirements in C1 & C2 shall appear for make-up examination.

7.1 The candidate has to exercise his/her option immediately within 10 days from the date of notification of results. A MAKE-UP examination will be conducted within 25 days from the date of notification of results. If the candidate still remains unsuccessful after MAKE-UP examination he/she is said to have DROPPED that course

7.2 **Re-Registration and Re-Admission:**

A candidate's class attendance in aggregate of all courses in a semester is less than 75% or as stipulated by the University and is considered as dropped the semester and is not allowed to appear for end semester examination (C3) shall have to seek re-admission to that semester during subsequent semester / year within a stipulated period.

In case a candidate fails in more than 2 courses in odd and even semesters together in a given academic year, he / she may either drop all the courses and repeat the semester or reappear (C3 semester end examination) to such of those courses where in the candidate has failed during subsequent semester / year within a stipulated period.

7.3 In such a case where in a candidate drops all the courses in 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.

7.4 **Requirements to Pass the Semester and Provision to Carry Forward the Failed Subjects / Courses:**

7.4.1 A candidate who secures a minimum of 30% in C1 and C2 and 40% and above in aggregate of C1, C2 and C3 in all the courses with credits prescribed in a semester is said to have passed that semester.

7.5. Provision to Carry Forward the Failed Subjects / Courses:

A student who has failed in 4 courses in 1st and 2nd semesters together shall move to 3rd semester. And he / she shall appear for C3 examination of failed courses of the said semesters concurrently with 3rd semester end examinations (C3) and 4th semester end examinations (C3) of second year of study.

8.0 **Attendance Requirement:**

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

8.2. 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.

8.3. Any student with less than 75% of attendance in a course in aggregate during a semester shall not be permitted to appear to the end semester (C3) examination.

8.4. Teachers offering the courses will place the above details in the School / Department meeting during the last week of the semester, before the commencement of C3, and subsequently a notification pertaining to the above will be brought out by the Head of the School before the commencement of C3 examination. A copy of this notification shall also be sent to the office of the Registrar & Registrar (Evaluation).

8.5. **Absence during mid-semester examination**

In case a student has been absent from a mid-semester examination 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 Head of the School, for make-up examination. The Head of the School may consider such request depending on the merit of the case and after consultation with course instructor and class teacher, and permit such student to appear for make-up mid semester examination.

8.6. Absence during end semester examination:

In case a student is absent for end semester examination on medical grounds or such other exigencies, the student can submit request for make-up examination, with necessary supporting documents and certification from the concerned class teacher / authorized personnel to the concerned Director of the School. The Director of the School may consider such request depending on the merit of the case and after consultation with class teacher, course instructor and permit such student to appear for make-up mid semester examination

9. **Provisional Grade Card:**

The tentative / provisional Grade Card will be issued by the Registrar (Evaluation) at the end of every Semester indicating the courses completed successfully. The provisional grade card provides **Semester Grade Point Average** (SGPA).This statement will not contain the list of DROPPED courses.

9.1 **Challenge Valuation:**

A student who desires to apply for challenge valuation shall obtain a Xerox copy of the answer script 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 Registrar (Evaluation) within 15 days after the announcement of the results. This challenge valuation is only for C3 component.

The answer scripts for which challenge valuation is sought for shall be sent to another external examiner. The marks awarded will be the higher of the marks obtained in the challenge valuation and in maiden valuation.

9.2 Final Grade Card: Upon successful completion of the Post Graduate Degree a Final Grade card consisting of grades of all courses successfully completed by the candidate will be issued by the Registrar (Evaluation).

9.3 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	B
60-69	7	v*7	C
50-59	6	v*6	D
40-49	5	v*5	E
0-39	0	v*0	F

O - Outstanding; A-Excellent; B-Very Good; C-Good; D-Fair; E-Satisfactory; F - Fail;

Here, P is the percentage of marks (P=[(C1+C2)+M] 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.

9.4 **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, i.e

SGPA (Si) = ∑(Ci x Gi) / ∑Ci

Where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

Illustration for Computation of SGPA and CGPA
Illustration No. 1

Course	Credit	Grade letter	Grade Point	Credit Point (Credit x Grade)
Course 1	**4**	**A**	**9**	**4X9=36**
Course 2	**4**	**B**	**8**	**4X8=32**
Course 3	**4**	**C**	**7**	**4X7=28**
Course 4	**4**	**O**	**10**	**4X10=40**
Course 5	**4**	**D**	**6**	**4X6=24**
Course 6	**4**	**O**	**10**	**4X10=40**
	24			**200**

Thus, **SGPA = 200 ÷ 24 = 8.33**

Illustration No. 2

Course	Credit	Grade letter	Grade Point	Credit Point (Credit x Grade point)
Course 1	**5**	**A**	**9**	**5X9=45**
Course 2	**5**	**C**	**7**	**5X7=35**
Course 3	**5**	**A**	**9**	**5X9=45**
Course 4	**5**	**B**	**8**	**5X8=40**
Course 5	**4**	**O**	**10**	**4X10=40**
	24			**205**

Thus, **SGPA = 205 ÷ 24 = 8.54**

9.5 Cumulative Grade Point Average (CGPA):

Overall Cumulative Grade Point Average (CGPA) of a candidate after successful completion of the required number of credits (96) for two year post graduate degree in Computer Science & Engineering is calculated taking into account all the courses undergone by a student over all the semesters of a program, i. e

CGPA = ∑(Ci x Si) / ∑Ci

Where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

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

Illustration:

CGPA after Final Semester

Semester (ith)	No. of Credits (Ci)	SGPA (Si)	Credits x SGPA (Ci X Si)
1	24	8.33	24 x 8.33 = 199.92
2	24	8.54	24 x 8.54 =204.96
3	24	9.35	24x9.35=224.4
4	24	9.50	24x9.50=228.0
Cumulative	96		857.28

Thus, **CGPA** = $\frac{24x8.33+24x8.54+24x9.35+24x9.50}{96}$ = 8.93

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 8.93 x 10=89.30

9.6 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	Numerical Index	FGP Qualitative Index
> 4 CGPA < 5	**5**	SECOND CLASS
5 > = CGPA < 6	6	
6 >= CGPA < 7	7	FIRST CLASS
7 >= CGPA < 8	8	
8 >= CGPA < 9	9	DISTINCTION
9 >= CGPA 10	10	

Overall percentage=10*CGPA

10.0. Provision for Appeal

If a candidate is not satisfied with the evaluation of C1 and C2 components, he/she can approach the grievance cell with the written submission together with all facts, the assignments, test papers etc, which were evaluated. He/she can do so before the commencement of 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 taking disciplinary/corrective action on an evaluator if he/she is found guilty. The decision taken by the grievance cell is final.

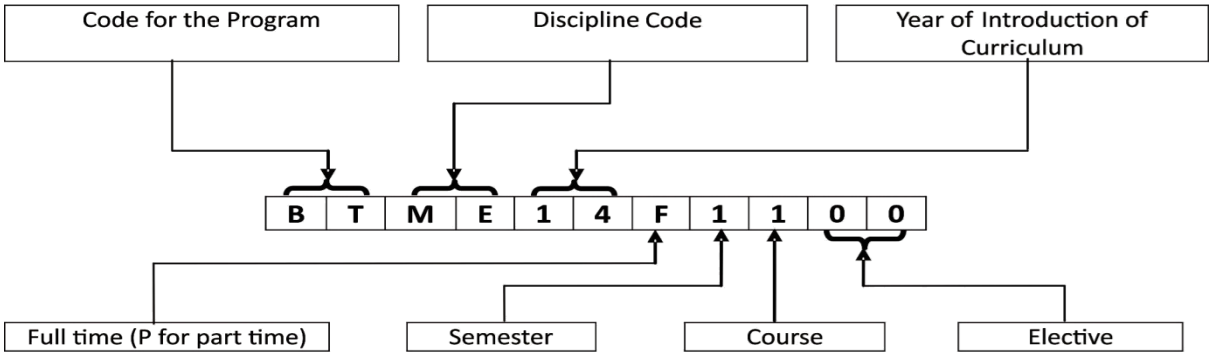
11.0. Grievance Cell

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

- The Registrar (Evaluation) - 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.

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

Course Numbering Scheme



List of Codes for Programs and Disciplines / Branch of Study

Program Code	Title of the Program	Discipline Code	Name of the Discipline / Branch of Study
BA	Bachelor of Arts	AE	Advanced Embedded Systems
BB	BBM (Bachelor of Business	AI	Advanced Information Technology
BC	B.Com (Bachelor of Commerce)	AP	Advanced Power Electronics
BR	B. Arch (Bachelor of Architecture)	CA	Computer Aided Structural Engineering
BS	B Sc, BS (Bachelor of Science)	CE	Civil Engineering
BT	B.Tech (Bachelor of Technology)	CH	Chemistry
BP	Bachelor of Computer Applications	CO	Commerce
BL	LLB (Bachelor of Law)	CS	Computer Science and Engineering /
MA	Master of Arts	DE	Data Engineering and Cloud
MB	MBA (Master of Business Administration)	EC	Electronics and Communication Engineering
MC	M.Com (Master of Commerce)	EN	English
MS	M.Sc / MS (Master of Science)	MD	Machine Design and Dynamics
MT	M Tech (Master of Technology)	ME	Mechanical Engineering
MC	Master of Computer Applications	EE	Electrical & Electronics Engineering

REVA UNIVERSITY
Bengaluru, India

Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Bengaluru-560064

SCHOOL OF CIVIL ENGINEERING
M. Tech in COMPUTER AIDED STRUCTURAL ENGINEERING
(2018-2020)
I SEMESTER

Sl. No	Course Code	Title of the Course	HC/SC/OE	Pre requisite	Credit Pattern & Credit Value				Contact Hours
					L	T	P	Total	
1	M18SE1010	Computational Structural Mechanics	HC	BE / B. TECH in Civil Engineering	3	1	-	4	5
2	M18SE1020	Computational Structural Dynamics	HC		3	1	-	4	5
3	M18SE1030	Advanced Design of RC Structures	HC		3	1	-	4	5
4	M18SE1040	Advanced Solid Mechanics	HC		3	1	-	4	5
5	M18SE1051	Advanced Structural Analysis	SC		3	1	-	4	5
	M18SE1052	Design of Bridges	SC		3	1	-	4	5
6	M18SE1061	Special Concretes	SC		3	1	-	4	5
	M18SE1062	Design of Tall Structures	SC		3	1	-	4	5
TOTAL								**24**	**30**
Practical									
7	M18SE1070	Structural Engineering Laboratory-I (Concrete Laboratory)	HC		0	0	4	4	3
TOTAL								**04**	**03**
TOTAL SEMESTER CREDITS								**28**	
TOTAL CUMULATIVE CREDITS								**28**	
TOTAL CONTACT HOURS								**33**	

REVA UNIVERSITY
Bengaluru, India

Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Bengaluru-560064

SCHOOL OF CIVIL ENGINEERING
M. Tech in COMPUTER AIDED STRUCTURAL ENGINEERING
(2018-2020)
II SEMESTER

Sl. No	Course Code	Title of the Course	HC/SC /OE	Pre requisite	Credit Pattern & Credit Value				Contact Hours
					L	T	P	Total	
1	M18SE2010	Finite Element Method of Analysis	HC	BE / B. TECH in Civil Engineering	3	1	-	4	5
2	M18SE2020	Advanced design of foundations	HC		3	1	-	4	5
3	M18SE2030	Advanced Design of Steel Structures	HC		3	1	-	4	5
4	M18SE2040	Structural Health Monitoring	HC		3	1	-	4	5
5	M18SE2051	Design of Earthquake Resistant Structures	SC		3	1	-	4	5
	M18SE2052	Stability Analysis of Structures	SC		3	1	-	4	5
6	M18SE2061	Reliability Analysis and Design of Structures	SC		3	1	-	4	5
	M18SE2062	Advanced Design of Prestressed concrete	SC		3	1	-	4	5
TOTAL								**24**	**30**
Practical									
7	M18SE2070	Structural Engineering Laboratory-II (Software Lab)	HC		0	0	4	4	3
TOTAL								**04**	**03**
TOTAL SEMESTER CREDITS								**28**	
TOTAL CUMULATIVE CREDITS								**56**	
TOTAL CONTACT HOURS								**33**	

REVA UNIVERSITY
Bengaluru, India

Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Bengaluru-560064

SCHOOL OF CIVIL ENGINEERING
M. Tech in COMPUTER AIDED STRUCTURAL ENGINEERING
(2018-2020)
III SEMESTER

Sl. No	Course Code	Title of the Course	Practical /Term Work / Sessions	Pre requisite	Credit Pattern & Credit Value				Contact Hours
					L	T	P	Total	
1	M18SE3010 / M18TE3010	Roads and Building Structures	OE	BE / B. TECH in Civil Engineering	4	0	0	4	4
2	M18SE3020	Internship with Report	Term Work and Viva - Voce		0	0	0	12	
3	M18SE3030	Project Phase-I	Report and Viva -Voce		0	0	0	04	
TOTAL								**20**	
TOTAL SEMESTER CREDITS								**20**	
TOTAL CUMULATIVE CREDITS								**76**	
TOTAL CONTACT HOURS								**-**	

REVA UNIVERSITY
Bengaluru, India

Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Bengaluru-560064

SCHOOL OF CIVIL ENGINEERING

M. Tech in COMPUTER AIDED STRUCTURAL ENGINEERING (2018-2020)

IV SEMESTER

Sl. No	Course Code	Title of the Course	Practical /Term Work / Sessions	Pre requisite	Credit Pattern & Credit Value				Contact Hours
					L	T	P	Total	
1	M18SE4010	Technical Seminar With Report	Term Work		0	0	0	4	
2	M18SE4020	Dissertation Phase-II	Thesis Submission and Viva-Voce		0	0	0	16	
TOTAL								**20**	
TOTAL SEMESTER CREDITS								**20**	
TOTAL CUMULATIVE CREDITS								**96**	
TOTAL CONTACT HOURS								**-**	

Note: 1) OPEN ELECTIVE Courses are offered for the students of other Schools. The students of the School of Civil Engineering have to **choose ONE Open Elective offered by other schools**.

2) Open elective Classes will be conducted on Saturdays only

Open Elective:M18SE3010/M18TE3010- Roads and Building Structures

FIRST SEMESTER

M18SE1010		L	T	P	C	Hrs.
Duration: 16weeks	COMPUTATIONAL STRUCTURAL MECHANICS	3	1	0	4	5
Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)					

Prerequisite: Structural Analysis I and II

Course Objectives: Student will be able to learn

1. To learn the concepts and principles of structural analysis and develop element stiffness and flexibility matrices.
2. To analyze framed structures subjected to direct and indirect loadings by flexibility and stiffness methods using force/displacement transformation matrices (element approach).
3. To learn the analysis of framed structures using standard structural analysis software
4. To learn an entire system analysis of structures

Course Outcome: After successful completion of this course the student will be able to:

1. Have learnt the concepts and principles of structural analysis and is able to compute element stiffness and flexibility matrices
2. Be able to analyze framed structures subjected to direct and indirect loadings by flexibility and stiffness methods using force/displacement transformation matrices (element approach)
3. Have learnt the analysis of framed structures using standard structural analysis software
4. Be able analyze every component of a structure

UNIT-I	12HOURS

Introduction: Classification of structures, Static and Kinematic indeterminacy, Equilibrium and compatibility conditions, Energy concepts, Principles of minimum potential energy and minimum complementary energy. Concepts of stiffness and flexibility, Coordinate systems, Relation between element and structure flexibility and stiffness matrices, Principle of contra-gradience, Development of element flexibility and element stiffness matrices for bar, beam, plane frame and truss elements.

UNIT-II	12 HOURS

Flexibility method: Consideration of redundants based on static indeterminacy, Basic determinate structures, Fixed end moments and equivalent joint loads, Development of force-transformation matrices and global flexibility matrices for continuous beams, rigid plane frames and plane trusses (not more than 6x6 structure flexibility matrix).

StiffnessMethod: Consideration of coordinates based on degrees of freedom, Fixed end moments and equivalent joint loads, Development of Displacement-transformation matrices and global stiffness matrices for continuous beams, rigid plane frames and plane trusses (not more than 6x6 structure stiffness matrix).

UNIT-III	12 HOURS

Analysis using Flexibility method by transformation approach: analysis of continuous beams, beams on elastic supports, beams with rotation of supports, Analysis of non-sway and sway rigid jointed plane frames using force-transformation matrix (not more than 3x3 structure flexibility matrix).

Analysis of plane trusses by flexibility method (not more than 3x3 structure flexibility matrix) using force-transformation matrix, considerations for lack of fit and thermal stresses.

UNIT-IV	12 HOURS

Analysis using Stiffness method by transformation approach: analysis of continuous beams, beams on

elastic supports, beams with rotation of supports, Analysis of non-sway and sway rigid jointed plane frames using displacement-transformation matrix (not more than 3x3 structure stiffness matrix).
Analysis of plane trusses by stiffness method (not more than 3x3 structure stiffness matrix) using displacement-transformation matrix, considerations for lack of fit and thermal stresses.

REFERENCE BOOKS:

1. S.Rajasekaran, "Computational Structural Mechanics", PHI, New Dehi 2001.
2. C.S.Reddy, "Basic Structural Analysis", TMH, New Delhi 2001.
3. W.Weaver and J.H.Gere, "Matrix Analysis of Framed Structures", Van Nastran, 1980.
4. A.K.Jain "Advanced Structural Analysis with Computer Application",Nemchand and Brothers, Roorkee, India.
5. M.F.Rubinstein "Matrix Computer Methods of Structural Analysis "Prentice - Hall.
6. Devdas Menon, "Advanced Structural Analysis", Narosa Publishers

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2	PSO3	PSO4
M18SE1010	CO1	3	3	3	1	2		2	2	1		1	3	3	1	2
	CO2	3	3	3	1	2		2	1	1		1	3	3	1	2
	CO3	3	3	3	1	2		2	1	1		1	3	3	1	2
	CO4	3	3	3	1	2		2	1	1		1	3	3	1	2

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

M18SE1020	COMPUTATIONAL STRUCTURAL DYNAMICS	L	T	P	C	Hrs.
Duration: 16weeks		3	1	0	4	5
Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)					

Prerequisite: Engineering Mechanics, Structural Analysis II

Course Objectives: Student will be able to learn

1. To learn the concepts and principles of structural mechanics
2. To frame mathematical models of SDOF and MDOF systems and analyse the corresponding free vibration response of damped and undamped systems
3. To frame mathematical models of SDOF and MDOF systems and analyze the corresponding forced vibration response of damped and undamped systems
4. To learn about principle of vibration-measuring instruments and evaluation of damping

Course Outcome: After successful completion of this course the student will be able to:

1. Has learnt the concepts and principles of structural mechanics
2. Is able to frame mathematical models of SDOF and MDOF systems and analyse the corresponding free vibration response of damped and undamped systems
3. Is able to frame mathematical models of SDOF and MDOF systems and analyse the corresponding forced vibration response of damped and undamped systems
4. Has learnt about principle of vibration-measuring instruments and evaluation of damping

UNIT-I	12 HOURS

Dynamical problems in Civil Engineering, Concepts of degrees of freedom and vibration, D'Alembert's principle, principle of virtual displacement and energy principles.

Free Vibration of Single-degree-of-freedom systems: Mathematical models of SDOF system, example problems, Free vibration response of damped and undamped systems, measurement of damping, Logarithmic decrement, half power bandwidth method.

UNIT-II	12 HOURS

Free Vibration of Multi-degree freedom systems: Mathematical models of MDOF systems, free vibration of undamped MDOF systems -Shear building concept, Natural frequency, importance of fundamental frequency, finding natural frequency for different structures, relation between frequency and time period and mode shapes – orthogonality conditions,

Free vibration of damped MDOF systems. damping properties, critical damping ratio, dynamic load factor, magnification factor, Rayleigh's and Cauchey's damping methods

UNIT-III	12 HOURS

Forced Vibration of SDOF Systems: Response damped and undamped systems to harmonic loading support motion, evaluation of damping, vibration isolation, transmissibility, response to periodic forces, rotation unbalance, reciprocatingunbalance.

Numerical methods applied to SDOF, Direct integration and Duhamel integral, principle of vibration-measuring instruments – seismometer and accelerometer.

UNIT-IV	12 HOURS

Forced Vibration of MDOF Systems:Equations of Motion and Response to forced excitations, Modal analysis

– free and forced vibration with and without damping.Stiffness matrix, mass matrix (lumped and consistent); equations of motion for the discretized beam in matrixform.

Dynamics of Continuous systems: Free longitudinal vibration of bars, flexural vibration of beams with different end conditions i.e simply supported, fixed at both ends , one end fixed other end free, both ends free, forced vibrations – response of beams under moving loads, concentrated load, chain of loads, wave propagation in solids

REFERENCE BOOKS:

1. Mario Paz, "**Structural dynamics–Theory and Computation**", CBS Publishers
2. R.W. Clough & J. Penzien, "**Dynamics of Structures**", McGraw Hill
3. Anil K. Chopra, "**Dynamics of Structures**", Prentice Hall of India
4. Timoshenko, S., "**Vibration Problems in Engineering**", VanNostrand Co.,
5. Mukhopadhyaya, "**Vibration and Structural Dynamics**", Oxford &IBH
6. William Thompson, "**Theory of Vibration with Applications**"
7. William Seto, "**Mechanical Vibrations**", McGraw Hill Pub., (Schaum Series)

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS O1	PS O2	PS O3	PS O4
M18SE1020	CO1	3	2	2		1		2	2	1	1	1	3	3	1	2
	CO2	3	2	2		1		2	2	1	1	1	3	3	1	2
	CO3	3	2	2		1		2	2	1	1	1	3	3	1	2
	CO4	3	2	2		1		2	2	1	1	1	3	3	1	2

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

M18SE1030		L	T	P	C	Hrs.

Duration: 16weeks	ADVANCED DESIGN OF RC STRUCTURES	3	1	0	4	5
Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)					

Prerequisite: Design of RCC Structural Elements

COURSE OBJECTIVES: Student will be able to learn

1. To design RC slabs by using yield line analysis
2. To design grid floors, continuous beams and flat slabs
3. To design chimneys, silos and bunkers
4. To learn the detailing of earthquake resistant structures and to design elevated water tanks

COURSE OUTCOME: After successful completion of this course the student will be able to:

1. Is able to design RC slabs by using yield line analysis
2. Is able to design grid floors, continuous beams and flat slabs
3. Is able to design chimneys, silos and bunkers
4. Has learnt about the detailing of earthquake resistant structures and is able to design elevated water tanks

UNIT-I	12 HOURS

Yield line theory for analysis of slabs: Characteristic Features of Yield Lines, Different yield line patterns, virtual work methods and Equilibrium of analysis.
Analysis of Rectangular and circular slabs: simply supported on all four edges and all edges fixed conditions

UNIT-II	12 HOURS

Design of grid floors or Coffered floors by approximate method, Design of continuous beams with redistribution of moments , Design of flat slabs

UNIT-III	12 HOURS

Design of Chimneys
Design of Silos, Design of Square or Rectangular Bunkers

UNIT-IV	12 HOURS

Art of detailing earthquake resistant structures, Expansion and contraction joints
Design of elevated water tanks by limit state method

REFERENCE BOOKS

- Lin, TY and Burns, N H. "**Reinforced Concrete Design**".
- Kong, KF and Evans, T H. "**Design of Prestressed Concrete Structures**
- Varghese, "P.C. **Advanced Reinforced Concrete Design**", Prentice-Hall of India, New Delhi, 2005.
- Punmia, B.C.Ashok Kumar Jain and Arun Kumar Jain, **"Comprehensive RCC Design"**
- Bhavikatti, "**Advanced design of R C Structures**."

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
M18SE1030	CO1	3	1	2		2		2	2	1		1	3	1	3	2
	CO2	3		2		2		2	2	1		1	3	1	3	2
	CO3	3		2		2		2	2	1		1	3	1	3	2
	CO4	3		2		2		2	2	1		1	3	1	3	2

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

M18SE1040	ADVANCED SOLID MECHANICS	L	T	P	C	Hrs.
Duration: 16weeks		3	1	0	4	5
Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)					

Prerequisite: Strength of Materials

COURSE OBJECTIVES: Student will be able to learn

1. To analyze stress and strain at a point
2. To learn the equilibrium and compatibility equations and boundary conditions.
3. To solve 2D problems of elasticity by Airy's stress function approach
4. To solve elementary 3D problems

COURSE OUTCOME: After successful completion of this course the student will be able to:

1. Is able to analyze stress and strain at a point
2. Has learnt the equilibrium and compatibility equations and boundary conditions.
3. Is able to solve 2D problems of elasticity by Airy's stress function approach
4. Is able to solve elementary 3D problems

UNIT-I — 12 HOURS

Introduction, Assumptions, Applications the state of stress at a point, Basic Equations of Elasticity, components of stresses at a point in Cartesian and polar co-ordinates. Equilibrium, compatibility equations and boundary conditions in 2-D and 3-D cases in Cartesian Coordinates, Principal stresses and stress Invariants, Hydrostatic and Deviatoric stress. Octahedral Stresses.

UNIT-II — 12 HOURS

Introduction, The state of strain at a point, Principal strains, Strain Invariants,Strain transformation, spherical and deviatoric strains, compatibility equations for strain, maximum shear strain, strain rosettes, Volumetric strain, Octahedral Strains.

UNIT-III — 12 HOURS

Plane stress and plane strain: Airy's stress function approach to 2-D problems of elasticity, simple problems of bending of beams,St. Venant's Theory.

Elementary problems of elasticity in three dimensions, stretching of a prismatic bar by its own weight, twist of circular shafts, torsion of non-circular sections, membrane analogy.

UNIT-IV — 12 HOURS

Theory of Plasticity
Stress – strain diagram in simple tension, perfectly elastic, Rigid – Perfectly plastic, Linear work – hardening, Elastic Perfectly plastic, Elastic Linear work hardening materials,
Failure theories, yield conditions, stress – space representation of yield criteria through Westergaard stress space, Tresca and Von-Mises criteria of yielding.

Fracture Mechanics
Introduction, Importance, Quasi brittle materials, Review of concrete behaviour in tension and compression, Linear Elastic Fracture Mechanics – Griffith and Irwin theories

REFERENCE BOOKS

- Timoshenko & Goodier, "**Theory of Elasticity**", McGraw Hill
- Srinath L.S., **Advanced Mechanics of Solids**, 10th print, Tata McGraw Hill Publishing company, New Delhi, 1994

- Sadhu Singh, "**Theory of Elasticity**", Khanna Publishers
- Verma P.D.S, "**Theory of Elasticity**", Vikas Publishing Pvt. Ltd
- Chenn W.P and Hendry D.J, "**Plasticity for Structural Engineers**", Springer Verlag
- Valliappan C, "**Continuum Mechanics Fundamentals**", Oxford IBH Publishing Co. Ltd.
- Sadhu Singh, "**Applied Stress Analysis**", Khanna Publishers
- Govindaraju L and Sitharam G, "Applied Elasticity", Interline Publishers
- XiLu, "Theory of Elasticity", John Wiley.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2	PSO3	PSO4
M18SE1040	CO1	3	2	2		1			1		1	1	3	3	1	2
	CO2	3	2	2		1			1		1	1	3	3	1	2
	CO3	3	2	2		1			1		1	1	3	3	1	2
	CO4	3	2	2		1			1		1	1	3	3	1	2

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

M18SE1051	ADVANCED STRUCTURAL ANLYSIS	L	T	P	C	Hrs.
Duration: 16weeks		3	1	0	4	5

Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)

Prerequisite: Strength of materials, Structural analysis

COURSE OBJECTIVES: Student will be able to learn

1. To analyze curved beams for circumferential and radial stresses
2. To analyze bending stresses in beams subjected to unsymmetrical bending and deflections of straight beams subjected to unsymmetrical bending
3. To study the shear centre in thin walled sections and tension coefficient method for the analysis of trusses
4. To understand the theoretical concept of beams on elastic foundations
5.

COURSE OUTCOME: After successful completion of this course the student will be able to:

1. Is able to analyze curved beams for circumferential and radial stresses
2. Is able to analyze bending stresses in beams subjected to unsymmetrical bending and deflections of straight beams subjected to unsymmetrical bending
3. Is able to understand the concept of the shear centre in thin walled sections and tension coefficient method for the analysis of trusses
4. Is able to understand the concept of the theoretical concept of beams on elastic foundations.

UNIT-I	12 HOURS

Curved Beams: Introduction, Circumferential stress in a curved beam, Radial stresses in curved beams, Correction for circumferential stresses in curved beams having I, T, or similar cross sections, Deflections of curved beams, Statically indeterminate curved beams, Closed ring subjected to concentrated load.

UNIT-II	12 HOURS

Non symmetrical Bending of Straight Beams: Definition of shear centre in bending, Symmetrical and nonsymmetrical bending, Bending stresses in beams subjected to unsymmetrical bending, Deflections of straight beams subjected to unsymmetrical bending, Sensitivity of deep I sections.

UNIT-III	12 HOURS

Shear Centre for Thin-Wall Beam Cross Sections: Approximation employed for shear in thin wall beam cross sections, Shear flow in thin-wall beam cross sections, Shear centre for a channel, I and angle sections. Method of Tension Co-Efficient: General principles, Analysis of three-dimensional trusses and frames

UNIT-IV	12 HOURS

Beams on Elastic Foundations: General theory, Infinite beam subjected to concentrated load, Boundary conditions, Infinite beam subjected to a distributed load segment, Semi-infinite beam subjected to loads at its end, Semi-infinite beam with concentrated load near its end, Short beams.

REFERENCE BOOKS

1. Boresi, A.P. and Sidebottom, O.M. (1985), Advanced Mechanics of Materials, Fourth Edition, John Wiley and Sons, New York.
2. Junnarkar, S.B. and Shah, H.J. (1996), Mechanics of Structures, Vol. III, Charotar Publications, Char House, Anand
1. Reference Books:
1. Gere, G.M. and Timoshenko, S.P. (2000), Advanced Mechanics of Materials, Second Edition, CBS Publishers, New Delhi.
2. Ugural, A.C. and Fenster, S.K. (1981), Advanced Strength of Material and Applied Elasticity, Arnold Publishers.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
M18SE1051	CO1	3	2	2		2			1	1		1	3	3	1	2
	CO2	3	2	2		2			1	1		1	3	3	1	2
	CO3	3	2	2		2			1	1		1	3	3	1	2
	CO4	3	2	2		2			1	1		1	3	3	1	2

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

M18SE1052	DESIGN OF BRIDGES	L	T	P	C	Hrs.
Duration: 16weeks		3	1	0	4	5
Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)					

Prerequisite: Design of RC Structural Elements, Design of Prestressed Concrete Structures

COURSE OBJECTIVES: Student will be able to learn

1. To learn about the historical developments, site selection for bridges
2. To learn about the design of box culvert and design of T beam slab
3. To learn about the different IRC loading cases and to design the slab culvert
4. To design T- beam bridge slab

COURSE OUTCOME:

After successful completion of this course the student will be able to:

1. Has learnt about the historical developments, site selection for bridges
2. Has learnt about the classification, components and forces acting on bridges
3. Has learnt about the different IRC loading cases and to design the slab culvert
4. Is able to design T- beam bridge slab

UNIT-I	12HOURS

Introduction: Historical Developments, Site Selection for Bridges, Classification of Bridges Forces on Bridges. Different Loading Cases IRC Class AA Tracked, Wheeled and Class A Loading, Abutments, Piers and Wing walls

Design of a slab culvert for Class AA tracked and Class A wheeled loading

UNIT-II	12HOURS

Box Culvert: Working outthe worst combination of loading, moment distribution, calculation of BM & SF, structural design of slab culvert with reinforcement details.

T Beam Bridge Slab Design: Proportioning of Components Analysis of interior Slab & Cantilever SlabUsing IRC Class AA Tracked, Wheeled Class A Loading, Structural Design of Slab, with Reinforcement Detail.

UNIT-III	12HOURS

T Beam Bridge Cross Girder Design: Analysis of Cross Girder for Dead Load & Live Load Using IRCClass AA Tracked, Wheeled Class A Loading A Loads, Structural Design of Beam, with Reinforcement Detail.

T Beam Bridge Main Girder Design: Analysis of Main Girder for Dead Load & Live Load Using IRCClass AA Tracked, Wheeled Class A Loading Using COURBON'S Method, Analysis of Main Girder Using HENDRY-JAEGER and MORICE-LITTLE Method for IRC Class AA Tracked vehicleonly, BM & SF for different loads, Structural Design of Main Girder With Reinforcement Details

UNIT-IV	12HOURS

PSC Bridges: Introduction to Pre and Post Tensioning, Proportioning of Components, analysis andstructural design of slab, analysis of main girder using COURBON's Method for IRC Class AA tracked vehicle, Calculation of pre-stressing force, cable profile and calculation of stresses, Design of End block and detailing of main girder.

Balanced Cantilever Bridge: Introduction and proportioning of components, Design of simply supportedportion and design of cantilever portion, design of articulation.

REFERENCE BOOKS

1. **"Essentials of Bridge Engineering**"- D Johnson Victor, Oxford & IBH Publishing Co New Delhi
2. **"Design of Bridges"-** N Krishna Raju, Oxford & IBH Publishing Co New Delhi

3. **"Principles and Practice of Bridge Engineering"-** S P Bindra Dhanpat Rai & Sons New Delhi
4. IRC 6 – 1966 "**Standard Specifications And Code Of Practice For Road Bridges"-** Section II Loads and Stresses, The Indian Road Congress New Delhi
5. IRC 21 – 1966 "**Standard Specifications And Code Of Practice For Road Bridges"-**Section III Cement Concrete (Plain and reinforced) The Indian Road Congress New Delhi
6. IS 456 – 2000 "**Indian Standard Plain and Reinforced Concrete Code of Practice"-** (Fourth Revision) BIS New Delhi
7. IS 1343 – "**Indian Standard Prestressed Concrete Code of Practice"-** BIS New Delhi
8. Raina V.K., "**Concrete Bridge Practice**"- Tata McGraw Hill
9. Bakht B & Jaeggar, "**Bridge Analysis Simplified**"- McGraw Hill
10. Ponnuswamy . S, "**Bridge Engineering**"- Tata McGraw Hill.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2	PSO 3	PSO 4
M18SE1052	CO1	3	1	2		2		2	2	1		1	3	1	3	2
	CO2	3		2		2		2	2	1		1	3	1	3	2
	CO3	3		2		2		2	2	1		1	3	1	3	2
	CO4	3		2		2		2	2	1		1	3	1	3	2

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

M18SE1061	SPECIAL CONCRETES	L	T	P	C	Hrs.
Duration: 16weeks		3	1	0	4	5
Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)					

Prerequisite: Concrete Technology

COURSE OBJECTIVES: Student will be able to learn

- To learn the different types of cement replacement materials and Light weight concrete
- To learn about High Density concrete and Ferro-cement
- To learn about fibre reinforced concrete and its properties
- To learn about High performance concrete and other types of concrete

COURSE OUTCOME:

After successful completion of this course the student will be able to:

- Has learnt the different types of cement replacement materials and Light weight concrete
- Has learnt about High Density concrete and Ferro-cement
- Has learnt about fibre reinforced concrete and its properties
- Has learnt about High performance concrete and other types of concrete.

UNIT-I **12HOURS**

Introduction to concrete as a construction material, significance of properties of concrete, Components of modern concrete and developments in the process and constituent materials: Role ofconstituents, Development in cements and cement replacement materials, pozzolona, fly ash, silica fume, rice husk ash, Aggregates classification and properties, artificial and recycled aggregates, chemical and mineral admixtures.

Mix proportioning of Concrete: Principles and methods of mix design, variables in proportioning, exposure conditions, and procedure of mix design as per relevant codal provisions and numerical examples of mix design of conventional concretes, Self-Compacting concrete and Geopolymer concrete

Microstructure of concrete, interfacial transition zone and its significance, application of nano materials, durability of concrete.

UNIT-II **12HOURS**

Light Weight concrete: Introduction, classification, properties, strength and durability, mix proportioningand problems.

High density concrete: Radiation shielding ability of concrete, materials for high density concrete, mixproportioning, properties in fresh and hardened state, placement methods.

Ferrocement: Ferrocement materials, mechanical properties, cracking of ferrocement, strength andbehaviour in tension, compression and flexure, Design of ferrocement in tension, ferrocement constructions, durability, and applications.

UNIT-III **12HOURS**

Fibre reinforced concrete: Fibre materials – types and properties, mix proportioning, distribution and orientation, interfacial bond,properties in fresh state.

Strength and behaviour in tension, compression and flexure of steel fibre reinforced concrete, mechanical properties, crack arrest and toughening mechanism, applications.

UNIT-IV **12HOURS**

High Performance concrete: constituents, mix proportioning, properties in fresh and hardened states,applications and limitations.

Ready Mixed Concrete – manufacture, transporting, placing and precautions, Self-Compacting Concrete, Self-Curing Concrete, Reactive powder concrete, Roller compacted concrete, Bacterial Concrete, Porous concrete.

REFERENCE BOOKS

1. Neville A.M, "Properties of Concrete" Pearson Education Asis, 2000
2. P. Kumar Mehta, Paul J.N.Monterio, CONCRETE, "Microstructure, Properties and Materials"-Tata McGraw Hill
3. A.R.Santhakumar, (2007) "Concrete Technology"-Oxford University Press, New Delhi, 2007.
4. Short A and Kinniburgh.W, "Light Weight Concrete"- Asia Publishing House, 1963
5. Aitcin P.C. "High performance concrete"-E and FN, Spon London 1998
6. Rixom.R. and Mailvaganam.N., "Chemical admixtures in concrete"- E and FN, Spon London 1999

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
M18SE1061	CO1	2	1		2	1	2	1	2		1	1	2	1	1	2
	CO2	2	1		2	1	2	1	2		1	1	2	1	1	2
	CO3	2			2	1	2	1	2		1	1	2	1	1	2
	CO4	2			2	1	2	1	2		1	1	2	1	1	2

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

M18SE1062	DESIGN OF TALL STRUCTURES	L	T	P	C	Hrs.
Duration: 16weeks		3	1	0	4	5

Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)

Prerequisite: Analysis and Design of RCC and Steel Structures

COURSE OBJECTIVES: Student will be able to learn

1. To introduce various systems of tall buildings.
2. To know about different types of loads, materials and design philosophy.
3. Various structural systems with their behaviour are introduced.
4. To impart knowledge about static, dynamic and stability analysis of various systems.

COURSE OUTCOME:

After successful completion of this course the student will be able to:

1. Develop various systems of tall buildings.
2. Understand different types of loads, materials for the design of tall structures.
3. Understand the behaviour of structural members.
4. Design stable structures.

UNIT-I	12HOURS

INTRODUCTION

Design Philosophy - History - Classification of buildings according to NBC – Wind load – Seismic load – Quasi static approach- combination of loading

UNIT-II	12HOURS

LOADS AND MATERIALS

Wind loading:static and dynamic approach, Analytical and wind tunnel experimentation method. Earthquake loading: Equivalent lateral force, modal analysis, combinations of loading, working stress design, Limit state design, Plastic design.

Materials – high performance concrete, fiber reinforced concrete, lightweight concrete, design mixes

UNIT-III	12HOURS

STRUCTURAL SYSTEMS

Behaviour of High Rise structures - Different system for load distribution in steel and concrete - Vertical and horizontal load resistant systems - Rigid frames - braced frames - infilled frames - shear walls - wall frames - tubular systems - outrigger braced systems - Mega systems.

UNIT-IV	12HOURS

ANALYSIS AND DESIGN

Analysis and Design principles of various horizontal load transfer systems - approximate methods - Modelling for accurate analysis - 3D analysis - Member forces - displacements. Analysis for various secondary effects - Creep, shrinkage and temperature. Stability Analysis - Overall buckling analysis of frames, wall frames, approximate methods, second order effects of gravity loading, P - effect and various methods of analysis - influence of foundation instability, out of plumb effects - Elastic Deformations. Dynamic Analysis - Principles of design of tall braced frames for earthquake and blast resistant design.

REFERENCE BOOKS

1. Schuller.W.G., "High Rise Building Structures", John Wiley & sons, 1977
2. Lynn.S. Beedle, "Advances in Tall Buildings", CBS Publishers and Distributors, New Delhi, 1996
3. LinT.Y. and Burry D.Stotes, " Structural Concepts and Systems for Architects and Engineers ", John Wiley, 1994.

4. Gupta.Y.P.,(Editor), “Proceedings of National Seminar on High Rise Structures - Design and Construction Practices for Middle Level Cities”, New Age International Limited, New Delhi,1995.
5. Lecture Notes on "Tall Buildings" - Short Term Course organized by Civil Engineering Department, SRM Engg college, Kattankulathur. June 2002
6. Smith .B.S. and Coull .A., "Tall Building Structure", 'Analysis and Design', John Wiley & Sons, Inc., 1991
7. Taranath .B.S., "Structural Analysis and Design of Tall Buildings", Mc Graw Hill Co. 1988

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS O1	PS O2	PS O3	PS O4
M18SE1062	CO1	3	1	2		2		2	2	1		1	3	1	3	2
	CO2	3		2		2		2	2	1		1	3	1	3	2
	CO3	3		2		2		2	2	1		1	3	1	3	2
	CO4	3		2		2		2	2	1		1	3	1	3	2

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

M18SE1070	STRUCTURAL ENGINEERING LABORATORY (CONCRETE LABORATORY)	L	T	P	C	Hrs.
Duration: 16weeks		0	0	4	4	3

Internal Assessment: 20 Marks	Semester End Examination: 30 Marks (Minimum 8 Marks)

Prerequisite: Concrete Technology, Chemical admixtures

COURSE OBJECTIVES: Student will be able to learn

1. To gain experience regarding the determination of properties of different building materials
2. To provide an opportunity to learn how to measure the parameters, which governs the quality of the materials
3. To impart knowledge of mix design of concrete
4. to gain experimental knowledge of testing specimens in loading frame

COURSE OUTCOME: After successful completion of this course the student will be able to:

1. Implement good quality construction techniques
2. Identify the quality of the materials used for construction
3. Identify the proportion of the mix design
4. Perform testing on loading frame

EXPERIMENTS TO BE CARRIED OUT

1. Determination of workability of concrete by Slump Cone Test
2. Determination of flow properties concrete and mortar by Flow Table Test
3. Determination of degree of workability of concrete by Compaction Factor Test
4. Determination of workability of concrete by Vee-Bee Consistometer
5. Determination of Compressive Strength of Cement Concrete
6. Determination of Flexure Test on Hardened Concrete
7. Determination aggregate properties by Shape Test (Elongation Index)
8. Determination of aggregate properties by Shape Test (Flakiness Index)
9. Impact Test on coarse aggregates
10. Water Absorption Test on Coarse Aggregate
11. Mix design of concrete: design for a particular strength and verify whether the desired strength is achieved at 28 days
12. Demonstration on Loading frame
13. Demonstration on Shake Table

REFERENCE BOOKS

1. "Laboratory Manual on Concrete Technology" Sood, Hemant, Mittal L N and Kulkarni P D, CBS Publishers, New Delhi, 2002.
2. Gambhir M L Concrete Manual Laboratory testing for quality control of concrete 4th edition Dhanpat Rai and Sons Delhi 1992
3. IS 10262-2012 Code for Mix design of concrete

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
M18SE1070	CO1	3	2		2	2	1		1			1	3	1	2	2
	CO2	3	2		2	2	1		1			1	3	1	2	2
	CO3	3	2		2	2	1		1			1	3	1	2	2
	CO4	3	2		2	2	1		1			1	3	1	2	2

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

SECOND SEMESTER

M18SE2010	FINITE ELEMENT ANALYSIS	L	T	P	C	Hrs.
Duration: 16weeks		3	1	0	4	5
Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)					

Prerequisite: Structural Analysis – II, Theory of Elasticity

COURSE OBJECTIVES: Student will be able to learn

- To learn about the basic concepts and principles of structural mechanics, FDM, RRM and GM.
- To learn about the basic analysis procedure, advantages and disadvantages of FEM.
- To learn about various types of finite elements used
- To derive the element stiffness matrices and load vectors for bar, beam, truss, plane frame, plane stress/strain elements.

COURSE OUTCOME: After successful completion of this course the student will be able to:

1. Has learnt about the basic concepts and principles of structural mechanics, FDM, RRM and GM.
2. Has learnt about the basic analysis procedure, advantages and disadvantages of FEM.
3. Has learnt about various types of finite elements used
4. Is able to derive the element stiffness matrices and load vectors for bar, beam, truss, plane frame, plane stress/strain elements.

UNIT-I — 12HOURS

Introduction, Historical background, Principles of virtual displacement and minimum potential energy, Approximate methods of analysis - concepts of Finite Difference Method, Rayleigh-Ritz method and Galerkin method, Principles involved in FEM, Basic analysis procedure of FEM for structural problems, Advantages and disadvantages of FEM, , Static and kinematic variables for various structural problems.

Finite elements for 1-D, 2-D and 3-D problems, Coordinate systems – member, structure and natural coordinates, Displacement functions for various structural problems – polynomial form of displacement function, Derivation of Shape functions for standard elements – Bar elements, Beam elements, Truss elements, Triangular elements, Rectangular elements, Quadrilateral elements –Higher order Elements, Choice of displacement function - C^0 , C^1 and C^2 Continuity functions, Lagrangian, Hermitian Polynomials, Serendipity and Lagrangian family of elements, Convergence requirements,Geometric invariance, Pascal's triangle, Patch test, Static condensation.

UNIT-II — 12HOURS

General expression for stiffness, Derivation of strain-displacement matrices and element stiffness matrices for Bar, Beam, Truss and Frame elements (planar), Linear static analysis of one-dimensional problems using Linear and Quadratic bar elements, Treatment of boundary conditions – Elimination approach and Penalty approach. Linear static analysis of indeterminate beams, continuous beams and beams on elastic supports using beam elements. Linear static analysis of pin jointed plane trusses, Considerations for lack of fit and thermal stresses.

Two dimensional problems, Derivation of properties for Constant Strain Triangle element (CST element), transformation of coordinate information using Jacobian, Application to plane stress, plane strain, axisymmetric problems using CST and quadrilateral elements.

UNIT-III — 12HOURS

Concept of Iso-parametric elements, sub and super parametric elements, Advantages of Iso-parametric elements, Convergence requirements for Iso-parametric elements, Concept of mapping in Iso-parametric

elements, Iso-parametric formulation of 4-noded quadrilateral element, Numerical Integration by Gauss quadrature rule –one-point rule, two-point rule, n-point rule, including numerical examples.

Dynamic considerations in FEM, Concept of consistent and lumped load vectors, Consistent and Lumped mass matrices in local and global coordinate systems – for bar, beam, frame and truss elements, Evaluation of Eigenvalues and Eigenvectors, Free vibration analysis, techniques of non-liner analysis.

UNIT-IV	**12HOURS**

Modeling considerations and Use of software – Mesh generation and refinement, Element selection, Material properties, Loads and reactions, Connections in structures, Boundary conditions, Symmetry and anti-symmetry, Stress concentrations, Sub-structuring, Methods of model generation, Common mistakes in modelling, analysis and design capabilities.

Organization of Computer Program for FEM – flowcharts, Classification and structure of finite element analysis software programs, Desired features of Pre and Post Processors, Commonly used commercial software packages, Use of Software to analyse Bar, Beam, Frame and Plane Stress/Strain problems.

REFERENCE BOOKS

- Finite element analysis Theory and Programming, C S Krishnamurthy, McGraw Hill
- Fundamental of finite Element Analysis, David V Hutton, McGraw Hill
- Introduction to Finite Element Method, Desai & Abel, CBS Publishers
- Bhatti, M.A., Fundamental Finite Element Analysis and Applications: with Mathematica and Matlab Computations, Wiley, 2005.
- Reddy, J. N., An Introduction to the Finite Element Method, 3rd Edition, McGraw-Hill Science/Engineering/Math,2005.
- Logan D. L., A First Course in the Finite Element Method, Thomson- Engineering, 3rd edition, 2001.
- The Finite Element Methods and its basics and fundamentals , Zienkiewicz & Taylor, Elsevier Publications

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
M18SE2010	CO1	3	3	3	1	2		2	2	1		1	3	3	1	2
	CO2	3	3	3	1	2		2	1	1		1	3	3	1	2
	CO3	3	3	3	1	2		2	1	1		1	3	3	1	2
	CO4	3	3	3	1	2		2	1	1		1	3	3	1	2

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

M18SE2020	ADVANCED DESIGN OF FOUNDATIONS	L	T	P	C	Hrs.
Duration: 16weeks		3	1	0	4	5

Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)

Prerequisite: Geotechnical Engineering

COURSE OBJECTIVES: Student will be able to learn

1. To learn method of estimating bearing capacity and design of shallow foundations
2. To learn design of pile foundations
3. To learn methods and design of well foundations
4. To learn soil structure interaction

COURSE OUTCOME:

After successful completion of this course the student will be able to:

1. has learnt method of estimating bearing capacity and design of shallow foundations
2. has learnt design of pile foundations
3. has learnt methods and design of well foundations
4. has learnt soil structure interaction

UNIT-I	12HOURS

Shallow Foundations : Methods for bearing capacity estimation, total and differential settlements of footing and raft, code provisions. Design of individual footings, strip footing, combined footing, rigid and flexible mat, buoyancy raft, basement raft, underpinning.

UNIT-II	12HOURS

Pile Foundations: Estimation load carrying capacity of single and pile group under various loading conditions. Pile load testing (static, dynamic methods and data interpretation), settlement of pile foundation, code provisions, design of single pile and pile groups, and pile caps.

UNIT-III	12HOURS

Well Foundations: Types, components, construction methods, design methods (Terzaghi, IS and IRC approaches), check for stability, base pressure, side pressure and deflection.

UNIT-IV	12HOURS

Soil-Foundation Interaction : Idealized soil, foundation and interface behavior. Elastic models of soil behavior; Elastic-plastic and time dependent behavior of soil. Beams and plates on elastic foundation; numerical analysis of beams and plates resting on elastic foundation.

REFERENCE BOOKS

1. A.P.S. Selvadurai, "Elastic Analysis of Soil-Foundation Interaction", Elsevier Scientific Publishing Company.
2. Braja M. Das, "Principles of Foundation Engineering", PWS Publishing Company.
3. Joseph Bowles, "Foundation Analysis and Design", McGraw-Hill Book Company.
4. V.N.S. Murthy, "Advanced Foundation Engineering", CBS Publishers and Distributors. A joint venture by IISc and IITs, funded by MH

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2	PSO3	PSO4
M18SE 2020	CO1	3	1	2		2		2	2	1		1	3	1	3	2
	CO2	3		2		2		2	2	1		1	3	1	3	2
	CO3	3		2		2		2	2	1		1	3	1	3	2
	CO4	3		2		2		2	2	1		1	3	1	3	2

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

M18SE2030	ADVANCED DESIGN OF STEEL STRUCTURES	L	T	P	C	Hrs.
Duration: 16weeks		3	1	0	4	5
Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)					

Prerequisite: Design of Steel structures

COURSE OBJECTIVES: Student will be able to learn

1. To familiarize with industrial structures such as gantry girder, crane girder
2. To understand the design concept of cooling towers, bunkers and silos
3. To familiarize with transmission towers
4. To familiarize the design of chimneys

COURSE OUTCOME: After successful completion of this course the student will be able to:

1. Design independently gantry girders, crane girders which are compulsorily used in manufacturing industries
2. Able to know the concept of analysis and design of power plants, containment structures such as cooling towers, bunkers and silos
3. Able to analyze and design transmission towers
4. Able to analyze and design chimneys

UNIT-I	**12HOURS**
PLANNING AND FUNCTIONAL REQUIREMENTS Classification of Industries and Industrial structures - planning for Layout Requirements regarding Lighting, Ventilation and Fire Safety - Protection against noise and vibration, Guidelines of Factories Act.	
UNIT-II	**12HOURS**
INDUSTRIAL BUILDINGS: Steel Gantry Girder, Crane Girders – Design of Corbels and Nibs	
UNIT-III	**12HOURS**
POWER PLANT STRUCTURES: Types of power plants – Containment structures - Cooling Towers - Bunkers and Silos - Pipe supporting structures	
UNIT-IV	**12HOURS**
TRANSMISSION LINE STRUCTURES AND CHIMNEYS: Analysis and design of transmission line towers - Sag and Tension calculations, testing of towers – Design of self supporting chimney, Design of Chimney bases.	
REFERENCE BOOKS	

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
M18SE2030	CO1	3	1	2		2		2	2	1		1	3	1	3	2
	CO2	3		2		2		2	2	1		1	3	1	3	2
	CO3	3		2		2		2	2	1		1	3	1	3	2
	CO4	3		2		2		2	2	1		1	3	1	3	2

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

1. Jurgen Axel Adam, Katharria Hausmann, Frank Juttner, Klauss Daniel, Industrial Buildings: A Design Manual, Birkhauser Publishers, 2004.
2. Manohar S.N, Tall Chimneys - Design and Construction, Tata McGraw Hill, 1985
3. Santhakumar A.R. and Murthy S.S., Transmission Line Structures, Tata McGraw Hill, 1992
4. Srinivasulu P and Vaidyanathan.C, Handbook of Machine Foundations, Tata McGraw Hill

M18SE2040		L	T	P	C	Hrs.
Duration: 16weeks	**STRUCTURAL HEALTH MONITORING**	3	1	0	4	5
Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)					

Prerequisite: Design of Reinforced Concrete Structures

COURSE OBJECTIVES: Student will be able to learn

- To learn the causes for deterioration of concrete and Non Destructive Tests
- To learn about effect of corrosion and prevention of concrete
- To learn detailed procedure of evaluating damaged structures
- To learn about maintenance of concrete structures

COURSE OUTCOME: After successful completion of this course the student will be able to:

1. Has learnt the causes for deterioration of concrete and Non Destructive Tests
2. Has learnt about effect of corrosion and prevention of concrete
3. Has learnt detailed procedure of evaluating damaged structures
4. Has learnt about maintenance of concrete structures

UNIT-I **12HOURS**

General: Introduction, Cause of deterioration of concrete structures, Diagnostic methods & analysis,preliminary investigations, experimental investigations using NDT, load testing, corrosion mapping, core drilling and other instrumental methods.

Quality assurance for concrete construction as built concrete properties strength, permeability, thermalproperties and cracking.

Influence on Serviceability and Durability: Effects due to climate, temperature, chemicals, wear anderosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking,

Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection.

UNIT-II **12HOURS**

Maintenance and Repair Strategies: Definitions: Maintenance, repair and rehabilitation, Facets of Maintenance, importance of Maintenance, Preventive measures on various aspects. Inspection,

Assessment procedure for evaluating a damaged structure causes of deterioration - testing techniques.

UNIT-III **12HOURS**

Materials for Repair: Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fibre reinforced concrete.

Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning.

UNIT-IV **12HOURS**

Introduction to Structural Health Monitoring (SHM) : Definition & motivation for SHM, SHM - a way for smart materials and structures, SHM and bio mimetic - analog between the nervous system of a man and a structure with SHM, SHM as a part of system management, Passive and Active SHM, NDE, SHM and NDECS, basic components of SHM, materials for sensor design.

Application of SHM in Civil Engineering: Introduction to capacitive methods, capacitive probe for cover concrete, SHM of a bridge, applications for external post- tensioned cables, monitoring historical buildings.

REFERENCES

1. Sidney, M. Johnson "Deterioration, Maintenance and Repair of Structures".
2. Denison Campbell, Allen & Harold Roper, "**Concrete Structures – Materials, Maintenance andRepair"-** Longman Scientific and Technical
3. R.T.Allen and S.C. Edwards, "**Repair of Concrete Structures**"-Blakie and Sons
4. Raiker R.N., "Learning for failure from Deficiencies in Design, Construction and Service"- R&D Center (SDCPL)
5. B.Vidiveli, "Rehabilitation of Concrete Structures", Standard Publishers.
6. B.L.Gupta and Amit Gupta, "Maintenance and Repair of Civil Structures", Standard Publishers.
7. Gahlot and Sharma, "Building Repair and Maintenance Management", CBS Publishers.
8. Daniel Balag eas, Claus-PeterFritzen and Alfredo Guemes Structural Health Monitoring, Published by ISTE Ltd., U.K., 2006.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
M18SE2040	CO1	2	1		2	1	2	1	2		1	1	2	1	1	2
	CO2	2	1		2	1	2	1	2		1	1	2	1	1	2
	CO3	2			2	1	2	1	2		1	1	2	1	1	2
	CO4	2			2	1	2	1	2		1	1	2	1	1	2

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

M18SE2051	DESIGN OF EARTHQUAKE RESISTANT STRUCTURES	L	T	P	C	Hrs.
Duration: 16weeks		3	1	0	4	5
Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)					

Prerequisite: Design of RCC

COURSE OBJECTIVES: Student will be able to learn

1. To familiarize with causes of earthquake and its history
2. To understand the principles of seismic design
3. To learn response spectrum method and time acceleration method
4. To learn Earthquake resistant design of masonry buildings

COURSE OUTCOME: After successful completion of this course the student will be able to:

1. To gain complete knowledge of history of seismicity
2. Use codal provisions for the analysis and design of structures to resist seismic forces
3. Is able to understand response spectrum method and time acceleration method
4. Is able to design earthquake resistant masonry buildings

UNIT-I	**12HOURS**

Elements of Earthquake Origin

Elements of Seismology - Earthquakes -Structure of the Earth -History of the Earth -Earthquake Mechanism - Propagation of Seismic Waves -Earthquake Phenomena -Earthquake Measurements -Definitions of magnitude, intensity, epicentre, Plate tectonics, seismographs, liquefaction, Types, effects and controlling factors seismic zoning map of India, Peak ground motion parameters.

UNIT-II	**12HOURS**

Principles of Seismic Design

Codal provision for design – IS 1893-2002 - aspects in planning and layout -Principles of design – choice of materials – ductility based design –Effect of Structural Irregularities on seismic performance of RC buildings- Vertical irregularity and plan configuration problems, Seismic resistant building architecture – lateral load resistant systems, building characteristics.

UNIT-III	**12HOURS**

Earthquake Resistant Design

Principles of Earthquake Resistant Design - Response spectrum theory. Time – Acceleration method Application of response spectrum theory to seismic design of structures.

Computation of seismic forces in multi-storied buildings – using procedures (Equivalent lateral force and dynamic analysis) as per IS-1893.Codal provision for detailing for earthquake resistance- IS 13920-1993 – shear wall design and detailing

UNIT-IV	**12HOURS**

Earthquake resistant design of masonry buildings

Elastic properties of structural masonry, lateral load analysis, Design of two storeyed masonry buildings.

REFERENCE BOOKS

1. Earthquake Resistant Design of Structures, Pankaj Agrawal, Manish Shrikhande, PHI Learning
2. Dynamics of Structures: Theory and Applications to Earthquake Engineering, AK Chopra, Prentice Hall
3. Dynamics of Structures, R.W. Clough and Joseph Penzien, McGraw-Hill Education

4. Structural Dynamics by Mario & Paz, Springer.
5. Earthquake Resistant Design by David J. Dowrick, Wiley India Pvt Ltd
6. Elements of Earthquake Engg by Jai Krishna, A.R. Chandrasekaran, Brijesh Chandra, South Asian Publishers.
7. IS 1893-2002 Indian Standard Criteria for Earthquake Resistant Design of Structures.
8. IS 4326-1993 2002 Indian Standard for Earthquake Resistant Design and Construction of Buildings.
9. IS 13920-1993 2002 Ductile detailing of Reinforced Concrete Structures subjected to Seismic Forces.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2	PSO 3	PSO 4
M18SE2051	CO1	2	1	1			1		1				2	1		2
	CO2	2	2	2		1	1		1		1		2	1	2	2
	CO3	2	2	2		1	1		1		1		2	1	2	2
	CO4	2	2	2		1	1		1		1		2	1	2	2

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

M18SE2052	STABILITY ANALYSIS OF STRUCTURES	L	T	P	C	Hrs.
Duration: 16weeks		3	1	0	4	5

Internal Assessment: 50 Marks | Semester End Examination: 50 Marks (Minimum 20 Marks)

Prerequisite: SOM, SA-I and SA-II

COURSE OBJECTIVES: Student will be able to learn

- To analyze beam columns subjected to different loadings and end conditions
- To determine buckling load and mode of frames and continuous beams
- To determine buckling load and mode of columns with different end conditions and loadings by different methods
- To perform buckling analysis of columns, pin-jointed frames and portal frames by FEM

COURSE OUTCOME: After successful completion of this course the student will be able to:

1. Is able to analyze beam columns subjected to different loadings and end conditions
2. Is able to determine buckling load and mode offrames and continuous beams
3. Is able to determine buckling load and mode of columns with different end conditions and loadings by different methods
4. Is able to perform buckling analysis of columns, pin-jointed frames and portal frames by FEM

UNIT-I — 12HOURS

Beam – column –Differential equation. Beam column subjected to (i) lateral concentrated load, (ii) severalconcentrated loads, (iii) continuous lateral load. Application of trigonometric series, Euler's formulation using fourth order differential equation for pined – pined, fixed – fixed, fixed – free and fixed – pinned column.

Buckling of frames and continuous beams. Elastic Energy method –Approximate calculation ofcritical loads for a cantilever. Exact critical load for hinged – hinged column using energy approach.

UNIT-II — 12HOURS

Buckling of bar on elastic foundation. Buckling of cantilever column under distributed loads. Determination of critical loads by successive approximation. Bars with varying cross section.
Effect of shear force on critical load. Column subjected to non – conservative follower and pulsating forces.

UNIT-III — 12HOURS

Stability analysis by finite element approach–deviation of shape function for a two nodded Bernoulli–Euler beam element (lateral and translation of) – element stiffness and element geometric stiffness matrices – assembled stiffness and geometric stiffness matrices for a discretized column with different boundary condition – calculation of critical loads for a discretized (two elements) column (both ends built in). Buckling of pin jointed frames (maximum of two active degree of freedom) – symmetrical single bay portal frame.

UNIT-IV — 12HOURS

Lateral buckling of beams–differential equation–pure bending–cantilever beam with tip load–simplysupported beam of I section subjected to central concentrated load. Expression for strain energy in plate bending with in plate forces (linear and non – linear). Buckling of simply supported rectangular plate–uniaxial load and biaxial load. Buckling of uniformly compressedrectangular plate simply supported along two opposite sides perpendicular to the direction of compression and having various edge condition along the other two sides.

REFERENCE BOOKS

- Stephen P.Timoshenko, James M Gere, "Theory of Elastic Stability"-2nd Edition, McGraw – Hill, New Delhi.

- Robert D Cook et.al, "Concepts and Applications of Finite Element Analysis"-3rd Edition, John Wiley and Sons, New York.
- S.Rajashekar, "Computations and Structural Mechanics"-Prentice – Hall, India.
- Ray W Clough and J Penzien, "Dynamics of Structures" – 2nd Edition, McGraw Hill, New Delhi
- H.Zeiglar, "Principles of Structural Stability"-Blaisdall Pu

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS O1	PS O2	PS O3	PS O4
M18SE2052	CO1	3	3	3	1	2		2	2	1		1	3	3	1	2
	CO2	3	3	3	1	2		2	1	1		1	3	3	1	2
	CO3	3	3	3	1	2		2	1	1		1	3	3	1	2
	CO4	3	3	3	1	2		2	1	1		1	3	3	1	2

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

M18SE2061	RELIABILITY ANALYSIS AND DESIGN OF STRUCTURES	L	T	P	C	Hrs.
Duration: 16weeks		3	1	0	4	5

Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)

Prerequisite: Basic Concepts of Probability and Statistics

COURSE OBJECTIVES: Student will be able to learn

- To learn basic concepts of probability and statistics
- To learn basic concepts of random phenomena
- To learn formulation of Mathematical Modeling using uncertainties
- To learn about simulation and particularly as a modeling tool

COURSE OUTCOME: After successful completion of this course the student will be able to:

1. learnt basic concepts of probability and statistics
2. learnt basic concepts of random phenomena
3. learnt formulation of Mathematical Modelling using uncertainties
4. learnt about simulation and particularly as a modelling tool

UNIT-I	12HOURS

Preliminary Data Analysis: Graphical representation- Histogram, frequency polygon, Measures of centraltendency- grouped and ungrouped data, measures of dispersion, measures of asymmetry.

Curve fitting and Correlation: Fitting a straight line, curve of the form $y = ab^x$ and parabola, Coefficientof correlation.

UNIT-II	12HOURS

Probability Concepts: Random events-Sample space and events, Venn diagram and event space, Measuresof probability-interpretation, probability axioms, addition rule, multiplication rule, conditional probability, probability tree diagram, statistical independence, total probability theorem and Baye's theorem.

Random variables: Probability mass function, probability density function, Mathematical expectation,Chebyshev's theorem.

UNIT-III	12HOURS

Probability distributions: Discrete distributions- Binomial and poison distributions, Continuousdistributions- Normal, Log normal distributions.

Reliability Analysis: Measures of reliability-factor of safety, safety margin, reliability index, performancefunction and limiting state. Reliability Methods-First Order Second Moment Method (FOSM), Point Estimate Method (PEM), and Advanced First Order Second Moment Method (Hasofer-Lind's method)

UNIT-IV	12HOURS

System reliability: Influence of correlation coefficient, redundant and non-redundant systems-series,parallel and combined systems, Uncertainty in reliability assessments- Confidence limits, Bayesian revision of reliability

Simulation Techniques: Monte Carlo simulation- Statistical experiments, sample size and accuracy,Generation of random numbers- random numbers with standard uniform distribution, continuous random variables, discrete random variables

REFERENCE BOOKS

- Ranganathan, R. (1999). "Structural Reliability Analysis and design"- Jaico publishing house, Mumbai, India.

- Ang, A. H. S., and Tang, W. H. (1984). "Probability concepts in engineering planning and design"- Volume –I, John Wiley and sons, Inc, New York.
- Ang, A. H. S., and Tang, W. H. (1984). "Probability concepts in engineering planning and design"- Volume –II, John Wiley and sons, Inc, New York.
- Milton, E. Harr (1987). "Reliability based design in civil engineering"- Mc Graw Hill book Co.
- Nathabdndu, T., Kottegoda, and Renzo Rosso (1998). Statistics, "Probability and reliability for Civiland Environmental Engineers"- Mc Graw Hill international edition, Singapore.
- Achintya Haldar, and Sankaran Mahadevan (2000). "Probability, Reliability and Statistical methodsin Engineering design"- John Wiley and Sons. Inc.
- Thoft-christensen, P., and Baker, M., J., (1982), "Structural reliability theory and its applications"- Springer-Verlag, Berlin, NewYork.
- Thoft-christensen, P., and Murotsu, Y. (1986). "Application of structural systems reliabilitytheory"- Springer-Verlag, Berlin, NewYork.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2	PSO3	PSO4
M18SE2061	CO1	3	1	1		2	1	2	1				2	2		1
	CO2	3	2	2		2	1	2	1				2	2	2	1
	CO3	3	2	2		2	1	2	1				2	2	2	1
	CO4	3	2	2		2	1	2	1				2	2	2	1

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

M18SE2062	ADVANCED DESIGN OF PRESTRESSED CONCRETE	L	T	P	C	Hrs.
Duration: 16weeks		3	1	0	4	5
Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)					

Prerequisite: Design of Prestressed Concrete Structures

COURSE OBJECTIVES: Student will be able to learn

- To impart the knowledge about behaviour, analysis and design of pre-stressed concrete members
- To develop an understanding of the design of continuous beams and simple portal frames.
- To study the design of anchorage zones, composite beams, analysis and design of continuous beam
- To study the shear and Torsion resistance of prestressed members

COURSE OUTCOME:

After successful completion of this course the student will be able to:

- develop skills in the analysis and design of pre-stressed concrete beams, columns and slabs
- design anchorage zones and composite pre-stressed concrete members.
- Understand the concepts and techniques of precast construction and Select or design precast elements
- Is able to understand the shear and Torsion resistance of prestressed members

UNIT-I	12HOURS

Anchorage zone stresses in post-tensioned members: Introduction, stress distribution in end block, investigations on Anchorage zone stresses, Magnel and Guyon's Methods, Comparative Analysis, Anchorage zone reinforcement.

Shear and torsion resistance: Shear and principal stresses, ultimate shear resistance, design of shear reinforcement, Torsion, Design of reinforcement for torsion.

UNIT-II	12HOURS

Tension members: Introduction, Ties, Pressure pipes – fabrication process, analysis, design and specifications. Cylindrical containers- construction techniques, analysis, design and specifications.

Compression members: Introduction, Columns, short columns, long columns, biaxially loaded columns, Design specifications.

Composite beams: Introduction, types of composite beams, analysis for stresses, differential shrinkage, serviceability limit state. Design for flexural and shear strength.

UNIT-III	12HOURS

Statically indeterminate structures: Introduction, Advantages of continuous members, effect of pre-stressing in indeterminate structures, methods of analysis for secondary moments, concordant cable profile, Guyon's theorem, Ultimate load analysis, Design of continuous beams and portal frames.

Slab and grid floors: Types of floor slabs, Design of one way, two way and flat slabs. Distribution of pre-stressing tendons, Analysis and design of grid floors.

UNIT-IV	12HOURS

Precast elements: Introduction, Prestressed concrete poles manufacturing techniques, shapes and cross sectional properties, design loads, design principles. Railway sleepers-classification and Manufacturing techniques, design loads, analysis and design principles. Prestressed concrete pavements, slab and wall panels.

REFERENCE BOOKS

- Design of Prestressed concrete structures - Lin T.Y. and H. Burns- John Wiley & Sons, 1982.
- Prestressed Concrete- N. Krishna Raju - Tata McGraw Hill, 3rd edition, 1995.
- Prestressed Concrete Structures- P. Dayaratnam - Oxford & IBH, 5th Edition, 1991.
- Prestressed Concrete- G.S. Pandit and S.P. Gupta – CBS Publishers, 1993.
- Prestressed concrete- N. Rajagopalan; Narosa Publishing House.2nd edition, 2005.
- Design of Prestressed Concrete- A. Nilson; John Willey & Sons.2nd edition, 1987.
- IS : 1343 : 1980.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS O1	PS O2	PS O3	PS O4
M18SE2062	CO1	3	1	2		2		2	2	1		1	3	1	3	2
	CO2	3		2		2		2	2	1		1	3	1	3	2
	CO3	3		2		2		2	2	1		1	3	1	3	2
	CO4	3		2		2		2	2	1		1	3	1	3	2

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

M18SE2070	STRUCTURAL ENGINEERING LABORATORY-II	L	T	P	C	Hrs.
Duration: 16weeks		0	0	4	4	3
Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)					

Prerequisite: Structural analysis and design

COURSE OBJECTIVES: Student will be able to learn

1. To impart STAAD PRO and ETABS software knowledge
2. To make them aware different tools in these two software
3. To analyze and design through STAAD PRO
4. To analyze and design through ETABS

COURSE OUTCOME: After successful completion of this course the student will be able to:

1. Gained sufficient knowledge of the software
2. Is able to analyze and design the structural components
3. Is able to design through STAAD PRO
4. Is able to design through ETABS

EXPERIMENTS TO BE CARRIED OUT

STAAD PRO

1. Overview of Structural Analysis and Design Calculating Shear Force and Bending Moment values for various supports and load types
2. Introduction- Co-ordinate Systems, Global Vs Local Model Generation, Creating Nodes & Members Select Menu
3. Model Editing Tools, Connect Beams Along, Stretch Selected Members, Intersect Selected Members, Merge Selected Members, Renumber, Split Beam, Break Beams at Selected Nodes Creating Models by using Structure Wizard, Mini Project
4. Support Specification- Member Property Specification, Member Offset, Material Specification, Group Specification Loading, Creating a Primary Load, Adding Self weight
5. Loading, Nodal Load, Member Load, Uniform Force and Moment, Concentrated Force and Moment - General Guidelines for Design, Concrete Design in STAAD.PRO, Column Design ,Beam Design

ETABS

1. Basics about the ETABS.
2. Introduction to various commands of ETABS and their applications in detail.
3. 2D model, analysis and design for Trusses, Beams and Frames
4. 3D model and analysis for Steel and RC Buildings.
5. Earthquake load application to RC and steel structures along with the design.
6. Members grouping
7. Design Grouping in Steel structures
8. Application of different building codes in the design of concrete and steel structures

REFERENCE BOOKS

1. Manual of STAAD PRO
2. Manual of ETABS

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2	PSO3	PSO4
M18SE2070	CO1	2	3	3	2	3	1		1	1		1	3	3	3	2
	CO2	2	3	3	2	3	1		1	1		1	3	3	3	2
	CO3	2	3	3	2	3	1		1	1		1	3	3	3	2
	CO4	2	3	3	2	3	1		1	1		1	3	3	3	2

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

M18SE3010	ROADS AND BUILDING STRUCTURES	L	T	P	C	Hrs.
Duration:16weeks		3	1	0	4	5
Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)					

COURSE OBJECTIVE: Student will be able to learn

1. About traffic characteristics and control over the vehicles.
2. The importance of highway geometric design and drainage systems.
3. Understand the building planning and Bye-Laws.
4. Different aspects of building construction.

COURSE OUTCOME: After successful completion of this course the student will be able to:

1: Describe about traffic characteristics and control over the vehicles.
2: Provide conceptual details of highway geometric design and drainage systems
3: Describe building planning and Bye-Laws.
4: Provide different aspects of building construction.

UNIT-I	12HOURS

Traffic Characteristics: Objectives and scope of traffic engineering. Components of road traffic: the vehicle, driver and road. Road user characteristics: human and vehicular characteristics.

Traffic Regulation and Control: Driver, vehicle, traffic flow and general regulations and control. Traffic Control Devices: traffic signs, markings, islands and signals.

UNIT-II	12HOURS

Elements of Highway Geometric Design: Design controls and criteria.Cross Section Elements: Pavement surface characteristics, width considerations for various components of cross section elements, right of way.

Highway Drainage: Objects and requirements of highway drainage. Surface drainage systems – analysis and design. Sub-surface drainage systems types and design.

UNIT-III	12HOURS

Building Planning: Introduction, Types of Buildings Based on Occupancy, Types of Residential Buildings, Basic Concepts of Building Elements, Methods of Construction, Cost-effective Building Techniques in Construction, Construction Management Techniques, Site Selection for Residential Buildings, Influence of Climate on Building Planning, Orientation of Building , Principles of Building Planning , Building bye-Laws , Planning of Residential Buildings, Building Services .

UNIT-IV	12HOURS

Building Construction: Foundations, Shallow and Deep Foundations, Stone Masonry, Brick Masonry,Partitions,Lintels, Stairs, Doors, Windows And Ventilators,Floors And Flooring , Roofs, Pointing And Plastering , Painting, Varnishing And Distempering, Etc. Acoustics, Fire Protection in Buildings.

REFERENCE

1. Khanna, S.K., Justo, C.E.G., and Veeraragavan, A., 'Highway Engineering', Nem Chand and Bros, Roorkee - 2014.
2. Kadiyali, L.R., `Traffic Engineering and Transport Planning', Khanna Publishers, Delhi – 2007.
3. Relevant IRC Publications.
4. "Building Drawing", Shah M.H and Kale C.M, Tata McGraw Hill Publishing co. Ltd., New Delhi.
5. "Building Construction", Gurucharan Singh, Standard Publishers &distributors, New Delhi.
6. National Building Code, BIS, New Delhi.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2	PSO3	PSO4
M18SE3010	CO1	3	2		2	2	1		1			1	3	1	3	2
	CO2	3	2		2	2	1		1			1	3	1	3	2
	CO3	3	2		2	2	1		1			1	3	1	3	2
	CO4	3	2		2	2	1		1			1	3	1	3	2

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

SCHOOL OF LEGAL STUDIES

HANDBOOK

for

BA LL.B (Hons) 2018

Approved by
RU/BoS/2018-19/19-05-2018
Batch: 2018-2023

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 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. 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. S. Y. Kulkarni

Vice-Chancellor, REVA University

PREFACE

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 needs. Maximum number of courses 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. M L Kalicharan

Director, School of Legal Studies

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 11,000 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 27th 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 center, 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 Censor 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, Nana 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 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.

The University has collaborations with Industries, universities abroad, research institutions, corporate training organizations, and Government agencies such as Florida International University, Okalahoma State University, Western Connecticut University, University of Alabama, Huntsville, Oracle India Ltd, Texas Instruments, Nokia University Relations, EMC^2, 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 Defense Dr. Sathish Reddy, Scientific Advisor, Ministry of Defense, 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, 6th 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, 6th 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 organises 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.

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 B.A., LL.B and B.B.A., LL.B programs and aims to offer many courses with specializations at bachelors and masters level. The curriculum of graduate degree program has been designed to bridge the gap between judiciary, industry and academia and hence they are practical oriented. The B.A., LL.B and B.B.A., LL.B programs aim to prepare human resources to play a leading role in the competitive Legal Studies excel in their endeavors. The programs also focus on specialized and allied fields like environmental law, cyber law, taxation law, banking and insurance law, international trade law, intellectual property law etc., to enable students to prepare themselves to face confidently the challenges of present and future dynamic society and become successful leaders in legal profession.

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.

Core Values

- Respect the rights, differences, and dignity of others;
- Maintain Honesty and integrity in all dealings;
- Strive continuously for pursuit of excellence;
- Encourage innovative and effective teaching and learning;
- Create disseminate, and apply knowledge for advancement of legal profession;
- Contribute to a just society;
- Promote improvement of the legal system;
- Build and maintain strong connections with the legal community;
- Encourage productive involvement with the University and the broader community.

ADVISORY BOARD

Sl. No	Name & Designation	e-mail and Contact Number
1	Prof. V.B. Coutinho, Former Vice-Chancellor, Gulbarga University	venitcoutinho@gmail.com 09311263035
2	Prof. T. Ramakrishna National Law School University, Bangalore	Ramakrishna@nls.ac.in ramipr@gmail.com 0886383353
3	Prof. Hanumantharayappa, Former Dean, School of Legal Studies, Mysore University	profrayappa@yahoo.co.in 09845032285
4	Prof. Basavaraj, Registrar & Dean of Faculty of Law, Mysore University, Mysore	cbr_1563@yahoo.co.in 09986390650
5	Prof. A.G. Asha, Principal, Seshadripuram College of Law, Bangalore	ag_asha@rediffmail.com 09886127414

Brief Summary of REVA University Regulations for Choice Based Credit System (CBCS) and Continuous Assessment Grading Pattern (CAGP) for FIVE Year Law Degree Programs

1. Teaching and Learning Process:

The five year B.A., LL.B and B.B.A LL.B programs comprise of various courses stipulated by the concerned Board of Studies. Each of the courses offered under both the programs will have three components associated with the teaching-learning process, namely:

(i) L= Lecture (ii) T= Tutorial (iii) 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 **s**tudies / case studies that equip students to acquire the much required skill component.

2. Courses of Study and Credits

2.1 The study of various subjects in Law degree programs are grouped under various courses. Each of these course carries credits which are based on the number of hours of teaching and learning.

2.1.1 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 or P amounts to 2 credits** over a period of one Semester of 16 weeks for teaching-learning process.

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

2.1.3 A course shall have either or all the three components. That means a course may have only lecture component, or only practical component or combination of any two or all the three components.

2.2. The total credits earned by a student at the end of the semester upon successfully completing the course are L + T + P. **The credit pattern of the course is indicated as L:**

T: P.

2.2.1. If a course is of 4 credits then the different credit distribution patterns in L: T: P format could be:

4 : 0 : 0, 1 : 2 : 1, 1 : 1 : 2, 1 : 0 : 3, 1 : 3 :0,

2 : 1 : 1, 2 : 2 : 0, 2 : 0 : 2, 3 : 1 : 0, 3 : 0:1, 0

: 2 : 2, 0 : 4 : 0, 0 : 0 : 4, 0 : 1 : 3, 0 :3: 1,

2.2.2 The concerned BOS will choose the convenient Credit Pattern for every course based on the requirement. However, generally, a course shall be of FOUR Credits and occasionally may be of TWO Credits

Different C**ourses of Study** are labeled and defined as follows:

a. Core Course:

A course which should compulsorily be studied by a candidate as a core-requirement is termed as a Core course. The CORE courses of Study are of THREE types, viz – (i) Foundation Course, (ii) Hard Core Course, and (iii) Soft Core Course.

b. Foundation Course (FC):

The foundation Course is a core course which should be completed successfully as a part of graduate degree program irrespective of the branch of study.

c. Hard Core Course (HC):

The **Hard Core Course** is a Core Course in the main branch of study and related branches of study, if any that the candidates have to complete compulsorily.

d. Soft Core Course (SC):

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.

e. O**pen Elective Course:**

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 O**pen Elective Course.**

f. Project Work / Dissertation:

Project Work / Dissertation is a special course involving application of knowledge in solving / analyzing /exploring a real life situation / difficult problem. A project work carrying **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 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.**

3. Duration of the programme and medium of instruction

3.1. The Duration of the programme shall be **FIVE academic years** comprising of **TEN semesters** and shall consist of 20 weeks duration including examination days.

3.2. A candidate who successfully completes 10 semesters and earns required number of credits shall be eligible for the award of B.A., LL.B / B.B.A., LL.B. A candidate can avail a maximum of 20 semesters – 10 years as per double duration norm, in one stretch to complete Law 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.

4. Eligibility for Admission

i. An applicant seeking admission to the B.A., LL.B. Degree Course shall have successfully completed Pre-University Course or Senior Secondary School course (10+2) or equivalent (such as 11+1, 'A' level in Senior School Leaving Certificate Course from a recognized

University in India or outside, or from a Senior Secondary Board or equivalent, constituted or recognized by the Union or by a State Government or from any equivalent institution from a foreign country recognized by the government of that country for the purpose of issue of quality certificate on successful completion of the course, securing in aggregate not less than 45% (in the case of SC/ST 40%, 43% for OBC) of the total marks.

ii. Provided that applicants who have obtained 10+2 higher education passed certificate or First Degree Certificate after prosecuting studies in distance or correspondence method shall also be considered as eligible for admission in the integrated Five years Course.

(Explanation: The applicants who have obtained 10+2 or graduation / post-graduation through open universities system directly without having any basic qualification for prosecuting such studies are not eligible for admission in the law courses).

4.1 Age on admission:

(a) Subject to the condition stipulated by a University on this behalf and the high degree of professional commitment required, the maximum age for seeking admission into a stream of integrated Bachelor of law degree program, is limited to **twenty years** in case of general category of applicants and to **twenty two** years in case of applicants from SC, ST and other Backward communities.

(*b*) Subject to the condition stipulated by a University, and the general social condition of the applicants seeking legal education belatedly, the maximum age for seeking admission into a stream of Three Year Bachelor Degree Course in Law, is limited to thirty years with right of the University to give concession of 5 further year for the applicant belonging to SC or ST or any other Backward Community.

4.2. Prohibition to register for two regular courses of study

No student shall be allowed to simultaneously register for a law degree program with any other graduate or postgraduate or certificate course run by REVA University or any other University

or an Institute for academic or professional learning excepting in the integrated degree program of the REVA University. Provided that any short period part time certificate course on language, computer science or computer application of an Institute or any course run by a Centre for Distance Learning of a University however, shall be accepted.

4.3. Students Intake

i. Students' intake and admission will be as approved by Bar Council of India and Govt. of Karnataka.

ii. No Student shall be allowed to simultaneously register for any other graduate or degree programme during the course of the B.A., LL.B./B.B.A, LL.B, Programme

4.4. Prohibition of Lateral Entry or Exit

i. There shall be no lateral entry or exit. However, migration from similar programme of other Universities to the 3rd, 5th, 7th and 9th semesters is permissible subject to passing of the required courses of study of earlier semesters.

5. Scheme of Instruction and Training

i. Hours of instruction per course per week shall be 4 + 1 hours conducted in day hours and the total number of class hours per week including tutorials, moot court exercises and seminars shall be 30 hours.

ii. Each registered student shall have completed a minimum of 20 weeks of internship during the entire period of legal studies (at least 4 weeks in each year) under NGO, Trial and Appellate Advocates, Judiciary, Legal Regulatory Authorities, Legislature and Parliament, other Legal Functionaries, Market Institutions, Law Firms, Companies and Local Self Government. As part of the internship programme the College may, at the expense of the students, arrange

for visits to the Supreme Court of India, Parliament House, Human Rights Commission, and Election Commission.

iii. The course teacher shall utilize at least 20% of the teaching hours for conducting seminars, debates, assignments & tests.

6. Moot court exercise and Internship:

(*a*) **Moot Court:** Every student is required to do at least three moot courts in a year. The moot court work will be on assigned problem and it will be evaluated for written submissions and for oral advocacy and as per the prescribed marks / credits by the University**.**

(*b*) **Observance of Trial in two cases, one Civil and one Criminal**:

Students are required to attend two trials in the course of the last two or three years of B.A.LL.B / B.B.A.LL.B studies. They will maintain a record and enter the various steps observed during their attendance on different days in the court assignment. This scheme will carry marks / credits prescribed by the University.

(*c*) **Interviewing techniques and Pre-trial preparations and Internship diary**:

Each student will observe two interviewing sessions of clients at the Lawyer's Office/Legal Aid Office and record the proceedings in a diary, which will carry prescribed marks / credits. Each student will further observe the preparation of documents and court papers by the Advocate and the procedure for the filing of the suit/petition. This will be recorded in the diary, which will carry prescribed marks / credits.

(*d*) The fourth component of this paper will be **Viva Voce examination** on all the above three aspects carrying prescribed marks.

6.1. Internship - Minimum Period:

i. Each registered student shall have completed minimum of 12 weeks internship for Three Year Course stream and 20 weeks in case of Five Year Course stream during the entire period of legal studies under NGO, Trial and Appellate Advocates, Judiciary, Legal Regulatory authorities, Legislatures and Parliament, Other Legal Functionaries, Market Institutions, Law Firms, Companies, Local Self Government and other such bodies as the University shall stipulate, where law is practiced either in action or in dispute resolution or in management.

ii. Provided that internship in any year cannot be for a continuous period of more than Four Weeks and all students shall at least gone through once in the entire academic period with Trial and Appellate Advocates.

iii. Each student shall keep Internship diary in such form as may be stipulated by the University concerned and the same shall be evaluated by the Guide in Internship and also a Core Faculty member of the staff each time. The total mark shall be assessed in the Final Semester of the course in the 4th Clinical course as stipulated under the Rules in Schedule II.

6.2. Formal Dress Code during Internship:

Students placed under internship or in moot court exercise shall have formal dress of legal professional in pupilage as follows:

a. (For all) White/Black trouser, white shirt, black tie, black coat, black shoe and black socks. When students have problems of getting the entire formal dress for any reason, they have to have a white trouser, full sleeve shirt to be tucked in and covered shoe.
b. (Optional for Girl students) Black printed saree, with white full sleeve blouse and covered black shoe or Lawyer's Suit with black covered shoe.
c. The Organization or Advocate under whom the internee is placed is required to follow suitable dress code.

7. Credit Distribution

7.1. A candidate has to earn 240 credits for successful completion of FIVE year Law degree with the distribution of credits for different courses prescribed by the Board of Studies in Legal Studies.

7.2. 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)** as defined by the BOS concerned.

7.3. **A candidate can enroll for a maximum of 32 credits and a minimum of 20 credits per Semester**. However he / she may not successfully earn a maximum of 32 credits per semester. This maximum of 32 credits does not include the credits of courses carried forward by a candidate.

7.4. Only such full time candidates who register for a minimum prescribed number of credits in each semester from I semester to X semester and complete successfully 240 credits in 10 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. Add-on Proficiency Certification and Diploma:

8.1. 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 240 credits for the Bachelor's Degree in Law.

8.2. Add on Proficiency Diploma:

To acquire **Add on Proficiency Diploma,** 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 240 credits for the Bachelor's Degree in Law.

8.3. The A**dd on Proficiency Certification / Diploma** so issued to the candidate contains the courses studied and grades earned.

9. Scheme of Assessment & Evaluation for Five Year Degree Program

9.1. The Scheme of Assessment and Evaluation will have two parts, namely;

ii. Internal Assessment (IA); and
iii. 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 UG non engineering programs and PG programs shall carry 50 marks each (i.e., 50 marks internal assessment; 50 marks semester end examination).

9. 3. The 50 marks of Internal Assessment (IA) shall comprise of:

Internal Test	= 30 marks
Assignments	= 10 marks
Seminars	= 10 marks

9.4. There shall be **three internal tests** conducted as per the schedule given below. T**he students have to attend all the three tests compulsorily.**

- 1st test for 15 marks at the end of 5th week of the beginning of the Semester;
- 2nd test for 15 marks at the end of the 10th week of the beginning of the Semester; and
- 3rd test for 15 marks at the end of the 15th week of the beginning of the Semester.

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

- For the 1st test syllabus shall be 1st unit and 1st half of Second Unit of the Course;
- For the 2nd test it shall be 2nd half of Second Unit and Third Unit of the Course;
- For the 3rd test the syllabus will be 4th Unit of the Course.

9.6. **Out of 3 tests, the highest marks scored in two tests are automatically considered while assessing the performance of the students**.

9.7. There shall be two Assignments and two Seminars each carrying 5 marks. Hence two assignments carry 10 marks (5+5 marks) and two seminars carry 10 marks (5+5 marks) as stated at Sl.No. 3 above.

9.8. The Semester End Examination for 50 marks shall be held during 19th and 20th week of the beginning of the semester and **the syllabus for the semester end examination shall be entire 4 units**.

9.9. The **duration of the internal test shall be 75 minutes and for semester end examination the duration shall be 3 hours.**

10. Evaluation of Clinical practice / Moot Court/ Internship

10.1. A Moot Court mock shall be assessed on the basis of:

a) Doctrinal Knowledge of relevant subject;

b) Advocacy Skills involved;

c) Decorum / Methodology.

10.2. In case of Moot Court / Clinical Practice / Internship course(s), the performance of a candidate shall be assessed for a maximum of 100 marks as explained below:

(a) Continuous assessment (IA) = 50 marks

(b) Semester end practical examination = 50 marks

10.3. The Moot Court / Clinical Practice shall be conducted throughout the Semester. The 50 marks meant for continuous assessment shall further be allocated as under:

i	Regular Participation in Moot Court / Clinical Practice throughout the semester	05 marks
ii	Written Submission/ Memorials	20 marks
iii	Oral Advocacy	20 Marks
Iv	Dress / Court Decorum	05 marks
	Total	**50 marks**

10.4. The 50 marks meant for Semester End Examination for Moot Court / Clinical Practices, shall be allocated as under:

i	Written Submission (Content + Structure)	20 marks
ii	Oral Advocacy Skills (Presentation + Decorum)	20 marks
iii	Dress Code	05 marks
iv	Response to Queries (Questions and Answers)	05 marks
	Total	**50 marks**

10.5 The Semester End Examination for Moot Court / Clinical Practices will be conducted jointly by internal and external examiners. However, if external examiner does not turn up, then both the examiners will be internal examiners.

10.6. In case a course is partly P type i.e, (L=3): (T=0) (P=1), then the examination for Semester End component will be as decided by the BoS concerned.

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

11. **Evaluation of Internship:**

Right from the initial stage of Internship, the candidate has to maintain the Dairy record the activities daily, obtain countersignature from the supervisor. After completion of the internship the candidate has to prepare a draft report of the internship work done based on

the records in his/her dairy under the guidance of the supervisor and submit the final report of the internship for final evaluation. The components of evaluation are as follows:

Component – I	IA	Daily Diary / Periodic Progress (25%)
Component – II	IA	Draft Report of Internship (25%)
Component– III	SEE	Final Evaluation of Internship report and Viva-Voce (50%). Evaluation of the report is for 30% and the viva-Voce examination is for 20%

11.1. Evaluation of Minor Project / Major Project / Dissertation / Internship:

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	IA	Daily Diary / Periodic Progress (25%)
Component – II	IA	Draft Report (25%)
Component– III	SEE	Final Evaluation and Viva-Voce (50%). Evaluation of the report is for 30% and the Viva-Voce examination is for 20%

11.2. The details of continuous assessment are summarized in the following table:

Summary of Continuous Assessment and Evaluation Schedule

Type of Assessment	Period	Syllabus	Marks	Activity
Allocation of Topics for Assignments / Seminars	Beginning of 5th Week	First Unit and Second Unit		Instructional process and Continuous Assessment

First Internal Test	Second Part of 6th Week	First Unit and 1st half of Second Unit	15	Consolidation of First Unit and 1st half of Second Unit
Submission of Assignments	8th Week	First Unit and Second Unit	5	Instructional process and Continuous Assessment
Seminars	9th Week	First Unit and Second Unit	5	Instructional process and Continuous Assessment
Second Internal Test	2nd Part of 13th Week	2nd half of Second Unit and Third Unit	15	Consolidation of 2nd half of Second Unit and Third Unit
Allocation of Topic for 2nd Assignment / Seminars	11th Week	Third Unit and Fourth Unit		Instructional process and Continuous Assessment
Submission of Assignments	13th Week	Third Unit and Fourth Unit	5	Instructional process and Continuous Assessment
Seminars	14th Week	Third Unit and Fourth Unit	5	Instructional process and Continuous Assessment
Third Internal Test	2nd Part of 16th Week	Fourth Unit	15	Consolidation of entire Fourth Unit
Semester End Practical Examination	17th & 18th Week	Entire syllabus	50	Conduct of Semester - end Practical Exams

Preparation for Semester–End Exam	17th & 18th Week	Entire Syllabus		Revision and preparation for semester–end exam
Semester End Theory Examination	19th and 20th Week	Entire Syllabus	50	Evaluation and Tabulation
	End of 21st Week			Notification of Final Grades

Note: 1. *Examination and Evaluation shall take place concurrently and Final Grades shall be announced latest by 5 days after completion of the examination.*

1. *Practical examination wherever applicable shall be conducted after 3rd 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 Registrar (Evaluation) who will notify the same immediately*

12. Provision for Appeal

If a candidate is not satisfied with the evaluation of Internal Assessment components, he/she can approach the Grievance Cell with the written submission together with all facts, the assignments, test papers etc, which were evaluated. He/she can do so before the commencement of 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 taking disciplinary/corrective action on an evaluator if he/she is found guilty. The decision taken by the Grievance Cell is final.

For every program there will be one Grievance Cell. The composition of the Grievance Cell is as follows:

- The Registrar (Evaluation) - 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.

13. Eligibility to Appear SEE (Semester - end) Examination

Only those students who fulfill a minimum of 75% attendance in aggregate of all the courses including practical courses / field visits etc., as part of the course(s), as provided in the succeeding sections, shall be eligible to appear for IA3 examination.

14. Requirements to Pass the Semester and to Carry Forward the Failed Subjects / Courses:

14.1. Requirements to Pass a Course

A candidate's performance from IA & SEE components will be in terms of scores, and the sum of all three 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 30% (15 marks) in SEE which is compulsory.

14.2 Provision to Carry Forward the Failed Subjects / Courses:

A student who has passed in at least one course in each of odd and even semesters but failed in remaining courses shall move to next semesters of succeeding years up to 6^{th} semester of the study. But, to move to VII semester of study, the student should have passed in all courses of I and II semesters. However, he / she may carry forward a maximum of 6 courses from III to VI semesters together. Such a student who carries forward the previous year's courses shall appear for Semester end examinations of failed courses of previous semesters concurrently with odd semester end examination and / or even semester end examinations of current year of study. Further, he / she shall have to clear all courses of both odd and even semesters of III and IV semesters to register for IX semester. However, he / she shall have to clear all courses of all semesters within the double duration, i. e., within ten years of admission of the first semester failing which the student has to re-register to the entire program.

Examples:-

a. Student "A" has passed in one Course in First Semester and one course in II Semester and has failed in all other Courses of I Semester and II Semester. He / she is eligible to seek admission for III Semester and appear for Semester End examination of all failed Courses of I Semester concurrently with III Semester End examination. Likewise, he / she is eligible to move to IV semester and appear for Semester End examination of all the failed Courses of II Semester concurrently with IV Semester End examination.

b. Student "B" studying in 2nd year of law program and has passed in one course in III Semester and one course in IV Semester and has failed in all other Courses of III Semester and IV Semesters. He / she is eligible to seek admission for V Semester and further move to VI semester. He / she may appear for Semester End examination of all failed Courses of I and III semesters concurrently with V Semester End examination and all failed Courses of II and IV Semesters concurrently with VI Semester End examination.

c. Student "C" who has completed 3 years of studies in law program and has passed in all the courses I and II Semester and has passed in 1 Course in each of III, IV, V and VI Semesters. He / she is eligible to seek admission for VII Semester and appear for Semester end examination of all failed Courses of III and V Semesters concurrently with VII Semester End examination. Likewise, he / she is also eligible to move to VIII semester and appear for Semester End examination of all failed Courses of IV and VI Semesters concurrently with VIII Semester End examination.

d. Student "D" has completed 3 years of studies in law program and has passed in all courses of I Semester but has failed in few courses in II semester. He / she has passed in few courses of III semester and few courses in IV semester and has also has passed in 1 Course in each of the V and VI Semesters. The student 'D' is not eligible to move to VII semester unless he / she reappears and pass in all courses of II semester, and hence, he / she is detained. However, he / she may appear for Semester End examination of all failed Courses of III and V semester examination concurrently in the coming years' odd Semester End examination and also appear for all failed courses of II, IV and IV Semesters concurrently in the coming years of even Semester End examination.

e. Student "E" who has completed 4 years of studies in law program and has passed in all the courses of I,II,III and IV Semesters. He / she has also passed in 1 Course in each of V, VI, VII and VIII Semesters. The student "E" is eligible to seek admission for IX Semester and move forward to X semester. He / She may appear for Semester End examination of all failed Courses of V and VII Semesters concurrently with IX Semester End examination and all failed Courses of VI and VIII Semesters concurrently with X Semester End examination. However, he / she has

to pass all the failed courses of V, VI, VII and VIII along with IX and X Semester courses to earn Law Degree (BA LLB / BBA LLB).

f. Student "F" has completed 4 years of studies in law program and has passed in all courses of I, II, IV and V Semesters but has failed in few courses in III semester, few courses in VI semester. He / she has also has passed in 1 Course in each of the VII and VIII Semesters. The student 'F' is not eligible to move to IX semester because he / she has not passed in III semester and hence he / she is detained. Therefore, student "F" has to appear for Semester End examination of all failed Courses of III semester and pass to become eligible to move to IX semester. However, the student "F" may appear for Semester End examination of all the failed courses of VII semesters in the coming years' odd semester End examination and also appear for all failed courses of VI and VIII Semesters concurrently in the coming years of even semesters' Semester End examination.

15. Re-Registration and Re-Admission:

a) 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.

b) 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.

16. **Attendance Requirement:**

(a) All students must attend every lecture, tutorial and practical classes.

(b) 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 semester end examination and such student shall seek re-admission as provided above.

(c) A candidate who has officially represented the University / College / State / Nation in Sports, NCC, NSS, Cultural Programme, Moot Court Competition, Legal Aid, Lok Adalat or involved in preparation of Public Interest Litigation, shall be exempted from attendance requirement to the extent of the days of such participation, which shall not exceed 15 days per semester.

(d) Teachers offering the courses will place the above details in the School Board meeting during the last week of the semester, before the commencement of Semester End examination, and

subsequently a notification pertaining to the above will be brought out by the Director of the School before the commencement of Semester End examination. A copy of this notification shall also be sent to the office of the Registrar & Registrar (Evaluation).

16.1 Absence during Internal Assessment Tests:

In case a student has been absent from a 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 Head of the School, for make-up examination. The Head 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 separate Internal Test for such candidate(s) well in advance before the Semester End Examination of that respective semester. Under no circumstances Internal Test(s) shall be held and Assignment(s) are considered after Semester End Examination.

17. Grade Card and Grade Point:

a. **Provisional Grade Card**: The tentative / provisional grade card will be issued by the Registrar (Evaluation) 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 B.A.L.L.B./B.B.AL.L.B. Degree, a Final Grade Card consisting of GRADES of all courses successfully completed by the candidate will be issued by the Registrar (Evaluation).

c. **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 > 90	9	v*9	A+
70 > 80	8	v*8	A
60 > 70	7	v*7	B+

55 > 60	6	v*6	B
50 > 55	5.5	V*5.5	C+
40 > 50	5	v*5	C
0-40	0	v*0	F
ABSENT			AB

O - Outstanding; A+-Excellent; A-Very Good; B+-Good; B – Above Average, C+ - Average; C-Satisfactory; F – Unsuccessful (Fail)

Here, P is the percentage of marks (P= [(IA)+M] 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.

18. Computation of SGPA and CGPA

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

a. **Computation of SGPA :**

Following is the procedure to compute the Semester Grade Point Average (SGPA):

SGPA (Si) = ∑(Ci x Gi) / ∑Ci where Ci is the number of credits of the course and Gi is the Grade Point scored by the student in the course.

Illustration 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	**3**	**B+**	**7**	**3X7=21**
Course 4	**3**	**O**	**10**	**3X10=30**
Course 5	**3**	**P**	**5**	**3X5=15**
Course 6	**3**	**B**	**6**	**3X6=18**
Course 7	**2**	**O**	**10**	**2X10=20**
Course 8	**2**	**A**	**8**	**2X8=16**
	24			**188**

Thus, **SGPA = 188 ÷ 24 = 7.83**

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**	**P**	**5**	**3X5=15**
Course 7	**2**	**B+**	**7**	**2X7=21**
Course 8	**2**	**O**	**10**	**2X10=20**
	24			**175**

Thus, **SGPA = 175 ÷ 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
	24			199

Thus**, SGPA = 199 ÷ 24 = 8.29**

b. Cumulative Grade Point Average (CGPA):

Overall Cumulative Grade Point Average (CGPA) of a candidate after successful completion of the required number of credits (240) for B.A.L.L.B./B.B.AL.L.B. Degree is calculated taking into account all the courses undergone by a student over all the semesters of a program, i.e. :

CGPA = ∑(Ci x Si) / ∑Ci

Where Si is the SGPA of the semester and Ci is the total number of credits in that semester.

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

Illustration:

CGPA after Final Semester

Semester (ith)	No. of Credits (Ci)	SGPA (Si)	Credits x SGPA (Ci X Si)
1	24	6.83	24 x 6.83 = 163.92
2	24	7.29	24 x 7.29 = 174.96
3	24	8.11	24 x 8.11 = 192.64
4	24	7.40	24 x 7.40 = 177.6
5	24	8.29	24 x 8.29 = 198.96

6	24	8.58	24 x 8.58 = 205.92
7	24	9.12	24 x 9.12 = 218.88
8	24	9.25	24 x 9.25 =222.00
9	24	9.35	24x9.35 = 224.40
10	24	9.50	24x9.50 = 228.00
Cumulative	240		2007.28

Thus, **CGPA** =

$$\frac{24x6.83+24x7.29+24x8.11+24x7.40+24x8.29+24x8.58+24x9.12+24x9.25\ 24x9.35\ 24x9.50}{240} = 8.36$$

c. 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 8.36 x 10 = 83.6

19. 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	First Class with 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	

> 4.5 CGPA <5	5	C	Pass	Satisfactory
<4 CGPA	0	F	Unsatisfactory	Unsuccessful

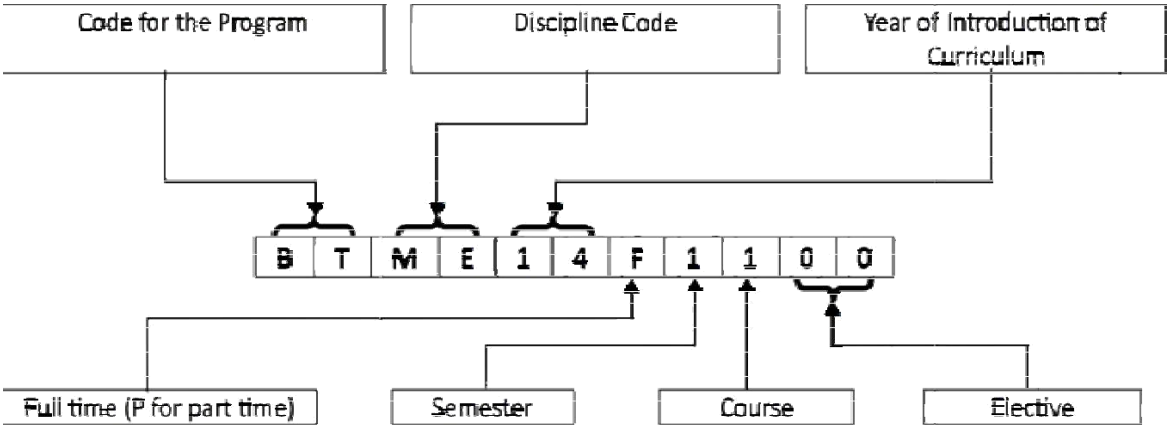
Overall percentage=10*CGPA

20. **Challenge Valuation**

a. A student who desires to apply for challenge valuation shall obtain a photo copy of the answer script 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 Registrar (Evaluation) within 10 days after the announcement of the results. This challenge valuation is only for marks secured in Semester End Examination.

21. The answer scripts 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.

Course Numbering Scheme



List of Code s for Programs and Disciplines / Branch of Study

Program Code	Title of the Program	Discipline Code	Name of the Discipline / Branch of Study
BA	Bachelor of Arts	AE	Advanced Embedded Systems
BB	BBM (Bachelor of Business	AI	Advanced Information Technology
BC	B.Com (Bachelor of	AP	Advanced Power Electronics
BR	B. Arch (Bachelor of Architecture)	CA	Computer Aided Structural Engineering
BS	B.Sc., BS (Bachelor of Science)	CE	Civil Engineering
BT	B.Tech (Bachelor of	CH	Chemistry

	Technology)		
BP	Bachelor of Computer Applications	CO	Commerce
BL	LL.B (Bachelor of Law)	CS	Computer Science and Engineering / Computer Science
MA	Master of Arts	DE	Data Engineering and Cloud Computing
MB	MBA (Master of Business Administration)	EC	Electronics and Communication Engineering
MC	M.Com (Master of Commerce)	EN	English
MS	M.Sc. / MS (Master of Science)	MD	Machine Design an d Dynamics
MT	M Tech (Master of Technology)	ME	Mechanical Engineering
MC	Master of Computer Applications	EE	Electrical & Electronics Engineering

B..A., LL.B (Honors) Program

Program Overview

The School of Legal Studies offers BA LL.B (Hons) Law Program which is a five year integrated graduate academic degree which integrates the Arts stream with that of Law, which is designed as per the BCI norms to equip students with a sound understanding of the foundations of legal knowledge and develop students' analytical and research skills, generic skills which they need in their future careers in Legal Profession. The program offers students the opportunity to study law from an extensive catalogue of related subjects and optional subjects, covering vast range of legal knowledge. The students of law are encouraged to learn on the complexity of legal practice and of the variety of ways of understanding role of law in contemporary society. The students are also provided with internship under NGOs, Trial and Appellate Advocates, Judiciary, Legal Regulatory Authorities, other Legal Functionaries, Law Firms, Companies, and Local Self Government. They are also facilitated with practical training through participation in Moot Court exercises, Legal Aid Clinic, and Lok Adalat. The completion of the program ensures that they will be able to walk into any courtroom and feel right at home.

The eligibility requirement for Law degree was that the applicant should already have a Bachelor's degree in any subject from a recognized institution (3 year LL.B). But now, universities offer 5 year integrated degree with the title of B.A., LL.B. (Honors), B.B.A, LL.B. (Honors) etc. as per the norms of BCI. India, today produces the largest number of legal professionals in the world. According to reports, about half a million law students pass out from various colleges in India. The Indian legal market is in a nascent stage in terms of growth. A law student with all desired skills, inherent interests has a wide range legal professional opportunities available these days. One way, lawyers are required in all walks of life.

The law graduates have ample career opportunities to serve/practice in Courts and Tribunals ranging from District Court to the High Court in different capacities. They also have an opportunity to prosper as successful lawyers at district, state and national levels. Legal professionals also have opportunities of being appointed by business firms, industrial sectors, insurance companies and several such sectors as legal knowledge in various sectors has become an essence.

In this context, an integrated Program in legal studies leading to B.B.A., LL.B., (Honors) degree of REVA UNIVERSITY is designed to create legal professionals to meet the human resources requirements of various sectors of Society.

The program offers students an opportunity to study law by choosing courses from a repository of related courses.

Program Educational Objectives (PEOs)

The aim of the program is to produce legal Professionals with advanced legal knowledge and to bring the critical, analytical, problem solving legal skills and Critical thinking and logical reasoning skills to meet higher level expectations of legal system, academics, and research establishments.

The Program Educational Objectives are to prepare the students to:

1. Be advocate to practice in different Courts and Tribunals in India.
2. Be part of Indian judicial system like magistrate, civil judge, presiding officers in different judicial forums.
3. To act as Legal Services Director in public, private and government organizations.
4. Pursue higher degrees to work in Colleges, Universities as professors.
5. Be independent tax consultant.
6. To be arbitrator and mediator ion the process of outside court settlement.
7. Can start his own Law Firm.
8. Work as member of Law Firm and can also head a wing of the law firm.
9. Adopt lifelong learning philosophy for continuous improvement.
10. To be a socially responsible citizen
11. Develop the knowledge to create legal awareness in society for attaining social and economic justice

PROGRAM OUTCOMES: -

After undergoing this program, a student will be able to: -

1. Explain and analyse the substantive and procedural laws.
2. Analyse legal document and resolve problems legally to achieve social and economic justice.
3. Understand the principles of law, its processes, procedures and relevant application in the legal world.
4. Demonstrate and provide adequate legal skills in different areas of legal profession.
5. Conduct legal research using analytical and critical thinking.
6. Develop a global perspective towards various legal issues.
7. Practice advocacy skills in different legal profession.
8. Develop the skill in Drafting of legal documents and Law reports.
9. Work as individual and team member in resolving issues in Legal Profession
10. Update the legal knowledge with the latest amendments.

PROGRAM SPECIFIC OUTCOMES:

1. Understand the structure, components and functioning of the various institutions of the Indian legal system and the role of law in day to day life.
2. Describe the general principles of law with the nature and sources of law, relation of law with human and institutional agencies responsible for the protection of human rights, liberty and balancing the interests of the individuals and society. .
3. Demonstrate the concepts of the legal provisions by addressing the ideological framework and analyse and apply for the benefit of the larger society

Mapping of Course Outcomes with programme Outcomes 2018-19 BA LLB

Course Code	POS/ COs	PO1	P02	PO3	PO4	PO5	PO6	P7	PO8	PO9	PO 10	PSO1	PSO2	PSO3
B18AL1010	CO1	3	1	3	1	1	1	2	2	1	2			
	CO2	2	2	3	2	1	2	1	1	1	2			
	CO3	3	1	3	1	1	1	1	1	1	2			
	CO4	3	2	3	3	3	2	3	2	1	3			
B18AL1020	CO1	1	2	3	1	2	2	1	1	2	2			
	CO2	1	2	3	1	1	2	3	2	2	1			
	CO3	2	2	2	3	2	2	1	2	1	2			
	CO4	2	3	2	3	3	2	2	1	3	3			
B18AL1030	CO1	2	2	3	3	3	3	3	2	3	3			
	CO2	3	3	3	3	2	3	2	3	2	2			
	CO3	3	2	3	2	3	2	2	2	2	3			
	CO4	3	3	2	3	2	3	3	2	2	2			
B18AL1040	CO1	1	1	1	1	2	3	1	1	1	1			
	CO2	1	1	3	1	1	2	1	1	2	1			
	CO3	2	2	1	1	1	2	1	1	2	2			
	CO4	2	1	2	2	2	2	1	2	2	2			
B18AL1050	CO1	2	2	3	2	1	2	3	2	3	2	3	3	3
	CO2	3	3	3	3	3	2	3	2	3	2	3	3	3
	CO3	3	2	3	2	2	3	2	2	2	2	3	3	3
	CO4	2	3	3	3	3	2	3	3	2	2	3	3	3
B18AL1060	CO1	2	2	3	1	2	2	2	2	2	1	3	3	3
	CO2	3	2	3	1	2	2	2	2	2	2	3	3	3
	CO3	2	1	3	1	2	2	1	1	3	2	3	3	3
	CO4	3	1	2	2	3	2	1	1	2	3	3	3	3
B18AL2010	CO1	3	1	3	1	1	1	2	2	1	2			

	CO2	2	2	3	2	1	2	1	1	1	2			
	CO3	3	1	3	1	1	1	1	1	1	2			
	CO4	3	2	3	3	3	2	3	2	1	3			
B18AL2020	CO1	2	3	2	1	2	3	1	1	2	2			
	CO2	1	2	3	1	1	2	3	1	2	1			
	CO3	2	2	2	1	2	3	1	2	3	2			
	CO4	3	3	1	3	3	2	1	3	2	1			
B18AL2030	CO1	3	3	2	3	3	3	2	2	2	2			
	CO2	3	2	3	3	3	3	3	3	3	2			
	CO3	3	3	3	2	2	3	3	3	3	3			
	CO4	2	3	3	3	3	2	3	3	3	3			
		3	3	3	3	3	3	3	3	3	3			
B18AL2040	CO1	3	2	1	1	1	2	2	2	3	2			
	CO2	3	3	1	3	1	2	2	3	2	1			
	CO3	2	2	2	3	3	2	2	3	1	1			
	CO4	3	3	2	2	3	3	3	2	1	1			
B18AL2050	CO1	3	2	3	2	2	3	2	3	3	3	3	3	3
	CO2	2	3	2	3	2	2	3	2	3	2	3	3	3
	CO3	3	2	2	2	2	2	3	2	2	3	3	3	3
	CO4	3	2	3	2	2	2	2	3	2	3	3	3	3
B18AL2060	CO1	3	2	3	2	2	3	2	3	3	3	3	3	3
	CO2	2	3	2	3	2	2	3	2	3	2	3	3	3
	CO3	3	2	2	2	2	2	3	2	2	3	3	3	3
	CO4	3	2	3	2	2	2	2	3	2	3	3	3	3
B18AL3010	CO1	2	2	1	2	2	1	2	1	3	3			
	CO2	2	3	2	3	2	1	1	2	3	2			
	CO3	3	2	1	2	2	2	3	2	1	3			
	CO4	3	2	3	3	1	2	2	3	1	1			

B18AL3020	CO1	2	3	3	3	3	2	3	2	3	2			
	CO2	3	3	3	3	2	3	2	3	3	3			
	CO3	3	3	3	3	3	3	3	3	3	3			
B18AL3030	CO1	3	3	3	3	3	3	2	2	3	3			
	CO2	3	3	2	2	2	3	3	3	2	2			
	CO3	3	2	2	2	2	3	3	2	3	1			
	CO4	2	3	2	3	3	3	2	2	2	3			
B18AL3040	CO1	3	3	2	3	3	2	2	3	2	3	2	3	3
	CO2	3	3	3	2	2	2	3	3	2	3	2	3	3
	CO3	3	3	2	2	2	2	1	2	3	2	2	2	3
	CO4	3	3	2	3	3	2	2	3	3	2	2	3	2
B18AL3050	CO1	3	2	3	2	2	3	2	3	3	3	3	3	3
	CO2	2	3	2	3	2	2	3	2	3	2	3	3	3
	CO3	3	2	2	2	2	2	3	2	2	3	3	3	3
	CO4	3	2	3	2	2	2	2	3	2	3	3	3	3
B18AL4010	CO1	2	2	2	1	2	3	1	3	2	1			
	CO2	1	1	3	1	1	2	3	1	2	1			
	CO3	2	2	2	1	2	3	1	2	2	2			
	CO4	3	2	1	2	3	2	2	3	2	3			
B18AL4020	CO1	3	2	2	2	2	2	2	2	2	2	3	3	3
	CO2	2	2	2	3	2	2	2	2	2	2	3	3	3
	CO3	2	2	2	3	3	2	2	2	2	2	3	3	3
	CO4	2	3	2	2	3	2	2	2	2	2	3	3	3
B18AL4030	CO1	1	1	1	1	2	3	1	1	1	1	3	3	3
	CO2	1	1	3	1	1	2	1	1	2	1	3	3	3
	CO3	2	2	1	1	1	2	1	1	2	2	3	3	3
	CO4	2	1	2	2	2	2	1	2	2	2	3	3	3
B18AL4040	CO1	2	3	1	2	1	1	2	1	2	1	3	3	3

	CO2	1	2	3	2	2	2	2	2	2	3	3	3	3
	CO3	3	2	3	1	1	1	1	2	3	1	3	3	3
	CO4	2	3	2	2	2	1	3	2	2	3	3	3	3
B18AL4050	CO1	3	2	2	3	2	2	3	3	2	3	3	3	3
	CO2	2	3	3	2	3	3	3	2	2	2	3	3	3
	CO3	2	2	3	2	2	2	2	2	2	3	3	3	3
	CO4	2	3	2	3	3	2	2	3	3	2	3	3	3
B18AL5010	CO1	1	2	2	1	2	3	1	1	2	2			
	CO2	1	1	3	1	1	2	3	1	2	1			
	CO3	2	2	2	1	2	3	1	2	2	2			
	CO4	3	3	1	3	3	2	2	3	2	1			
B18AL5020	CO1	3	1	3	1	1	1	2	2	1	2	3	3	3
	CO2	2	2	3	2	1	2	1	1	1	2	3	3	3
	CO3	3	1	3	1	1	1	1	1	1	2	3	3	3
	CO4	3	2	3	3	3	2	3	2	1	3	3	3	3
B18AL5030	CO1	3	2	2	1	2	2	1	1	2	3	3	3	3
	CO2	1	2	3	1	1	2	3	1	2	1	3	3	3
	CO3	2	2	2	1	2	2	1	2	1	2	3	3	3
	CO4	2	3	2	3	3	2	2	3	3	2	3	3	3
B18AL5040	CO1	2	1	1	1	2	1	1	1	1	1	3	3	3
	CO2	1	1	3	1	1	1	1	1	1	1	3	3	3
	CO3	1	1	2	1	1	1	1	1	1	1	3	3	3
	CO4	1	1	2	1	1	1	1	1	1	1	3	3	3
B18AL5050	CO1	3	2	2	2	1	1	1	1	2	2	3	3	3
	CO2	2	2	2	1	1	2	1	2	2	2	3	3	3
	CO3	3	3	2	2	2	2	2	2	3	3	3	3	3
	CO4	3	3	2	2	3	2	3	2	3	3	3	3	3
B18AL5060	CO1	2	1	1	1	1	1	1	1	1	1	3	3	3

	CO2	1	1	3	1	1	1	1	1	1	1	3	3	3
	CO3	1	1	2	1	1	1	1	1	1	1	3	3	3
	CO4	1	1	2	1	1	1	1	1	1	1	3	3	3
B18AL6010	CO1	1	2	3	1	2	2	1	1	2	2			
	CO2	1	2	3	1	1	2	3	2	2	1			
	CO3	2	2	2	3	2	2	1	2	1	2			
	CO4	2	3	2	3	3	2	2	1	3	3			
B18AL6020	CO1	3	1	3	1	1	1	1	1	1	1	3	3	3
	CO2	3	2	3	2	2	2	2	2	1	2	3	3	3
	CO3	3	2	3	1	2	1	1	1	1	1	3	3	3
	CO4	2	2	2	2	2	1	2	1	1	1	3	3	3
B18AL6030	CO1	3	2	2	2	2	2	2	3	3	1	3	3	3
	CO2	2	3	2	3	2	2	4	2	3	2	3	3	3
	CO3	3	2	3	2	2	2	3	2	2	3	3	3	3
	CO4	3	2	3	2	4	2	2	3	1	3	3	3	3
B18AL6040	CO1	3	1	3	2	2	1	3	2	2	2	3	3	3
	CO2	3	2	3	2	1	1	2	2	1	1	3	3	3
	CO3	3	2	3	1	2	2	1	1	1	2	3	3	3
	CO4	3	2	3	3	2	1	2	2	1	3	3	3	3
B18AL6050	CO1	2	2	2	2	2	2	2	3	3	2	2	2	2
	CO2	2	3	2	3	2	2	2	2	3	2	2	3	2
	CO3	3	2	1	2	2	2	3	2	2	3	2	2	2
	CO4	3	2	3	2	2	2	2	3	1	2	2	2	1
B18AL6060	CO1	3	3	2	3	2	3	2	3	3	3			
	CO2	2	3	2	3	2	2	3	2	3	3			
	CO3	3	2	1	3	3	2	3	2	2	3			
	CO4	3	2	3	3	2	3	2	3	2	2			
B18AL6071	CO1	3	1	3	1	1	1	2	2	1	2	3	3	3

	CO2	2	2	3	2	1	2	1	1	1	2	3	3	3
	CO3	3	1	3	1	1	1	1	1	1	2	3	3	3
	CO4	3	2	3	3	3	2	3	2	1	3	3	3	3
B18AL6072	CO1	1	1	2	1	2	1	2	2	1	3	3	3	3
	CO2	3	1	2	2	1	2	2	2	2	2	3	3	3
	CO3	2	2	2	1	3	3	2	2	2	3	3	3	3
	CO4	2	3	2	1	3	2	1	2	2	2	3	3	3
B18AL7010	CO1	1	2	1	2	2	1	2	1	3	1	3	3	3
	CO2	2	3	2	3	2	3	2	2	3	3	3	2	3
	CO3	3	2	2	2	3	2	3	2	1	3	2	3	3
	CO4	3	2	3	3	1	2	2	3	1	3	3	3	3
B18AL7020	CO1	1	2	1	2	2	1	2	1	3	1	3	3	3
	CO2	2	3	2	3	2	3	2	2	3	3	3	3	3
	CO3	3	2	2	2	3	2	3	2	1	3	3	3	3
	CO4	3	2	3	3	1	2	2	3	1	3	3	3	3
B18AL7030	CO1	2	2	2	2	2	2	2	4	3	2	2	2	2
	CO2	2	3	2	3	2	2	2	2	3	2	2	3	2
	CO3	3	2	1	2	2	2	3	2	2	3	2	2	2
	CO4	3	2	3	2	2	2	2	3	1	2	2	2	1
B18AL7040	CO1	3	2	2	2	2	2	2	3	3	1	3	3	3
	CO2	2	3	2	3	2	2	4	2	3	2	3	3	3
	CO3	3	2	3	2	2	2	3	2	2	3	3	3	3
	CO4	3	2	3	2	4	2	2	3	1	3	3	3	3
B18AL7061	CO1	3	1	3	1	1	1	2	2	1	2	3	3	3
	CO2	2	2	3	2	1	2	1	1	1	2	3	3	3
	CO3	3	1	3	1	1	1	1	1	1	2	3	3	3
	CO4	3	2	3	3	3	2	3	2	1	3	3	3	3
B18AL7062	CO1	1	3	1	2	1	1	2	1	2	1	3	3	3
	CO2	2	1	1	1	1	3	2	3	1	3	3	3	3

	CO3	3	2	2	2	2	1	3	3	1	2	3	3	3
B18AL7071	CO1	3	2	2	2	2	2	2	3	3	1	3	3	3
	CO2	2	3	2	3	2	2	4	2	3	2	3	3	3
	CO3	3	2	3	2	2	2	3	2	2	3	3	3	3
	CO4	3	2	3	2	4	2	2	3	1	3	3	3	3
B18AL7072	CO1	3	1	3	1	1	1	2	2	1	2	3	3	3
	CO2	2	2	3	2	1	2	1	1	1	2	3	3	3
	CO3	3	1	3	1	1	1	1	1	1	2	3	3	3
	CO4	3	2	3	3	3	2	3	2	1	3	3	3	3
B18AL8010	CO1	1	1	1	2	1	1	1	1	2	2	3	3	3
	CO2	2	1	1	1	3	3	1	3	2	2	3	3	3
	CO3	2	3	2	1	1	1	1	3	3	2	3	3	3
	CO4	2	2	3	2	2	3	3	3	2	1	3	3	3
B18AL8020	CO1	3	2	2	2	2	2	2	3	3	1	3	3	3
	CO2	2	3	2	3	2	2	4	2	3	2	3	3	3
	CO3	3	2	3	2	2	2	3	2	2	3	3	3	3
	CO4	3	2	3	2	4	2	2	3	1	3	3	3	3
B18AL8030	CO1	2	1	2	2	2	2	1	2	1	2			
	CO2	1	1	2	1	1	2	1	2	1	2			
	CO3	2	2	1	2	2	2	1	2	2	2			
	CO4	2	2	3	2	3	2	1	2	2	2			
B18AL8040	CO1	3	2	2	2	2	2	2	3	3	1	3	3	3
	CO2	2	3	2	3	2	2	4	2	3	2	3	3	3
	CO3	3	2	3	2	2	2	3	2	2	3	3	3	3
	CO4	3	2	3	2	4	2	2	3	1	3	3	3	3
B18AL8050	CO1	3	2	2	2	2	2	2	3	3	3			
	CO2	2	3	2	3	2	2	3	2	3	2			
	CO3	3	2	3	2	2	2	3	2	2	3			
	CO4	3	2	3	2	4	2	2	3	3	3			

B18AL8060	CO1	3	2	2	2	2	2	2	3	3	1	3	3	3
	CO2	2	3	2	3	2	2	4	2	3	2	3	3	3
	CO3	3	2	3	2	2	2	3	2	2	3	3	3	3
	CO4	3	2	3	2	4	2	2	3	1	3	3	3	3
B18AL8071	CO1	3	1	3	1	1	1	2	2	1	2	3	3	3
	CO2	2	2	3	2	1	2	1	1	1	2	3	3	3
	CO3	3	1	3	1	1	1	1	1	1	2	3	3	3
	CO4	3	2	3	3	3	2	3	2	1	3	3	3	3
B18AL8072	CO1	3	2	2	2	2	2	2	3	3	1	3	3	3
	CO2	2	3	2	3	2	2	4	2	3	2	3	3	3
	CO3	3	2	3	2	2	2	3	2	2	3	3	3	3
	CO4	3	2	3	2	4	2	2	3	1	3	3	3	3
B18AL9010	CO1	2	1	2	1	3	1	1	2	1	2			
	CO2	3	2	3	2	3	1	2	2	2	3			
	CO3	3	2	3	1	3	2	2	1	1	3			
	CO4	1	1	2	2	1	2	3	2	1	1			
B18AL9020	CO1	2	3	1	3	1	2	3	1	2	1	3	3	3
	CO2	3	3	1	2	3	1	2	3	2	1	3	3	3
	CO3	1	3	1	2	2	3	2	1	2	3	3	3	3
	CO4	1	3	1	2	2	3	2	1	3	1	3	3	3
B18AL9030	CO1	3	2	2	2	2	2	2	3	3	1	3	3	3
	CO2	2	3	2	3	2	2	4	2	3	2	3	3	3
	CO3	3	2	3	2	2	2	3	2	2	3	3	3	3
	CO4	3	2	3	2	4	2	2	3	1	3	3	3	3
B18AL9040	CO1	3	2	2	2	2	2	2	3	3	1	3	3	3
	CO2	2	3	2	3	2	2	4	2	3	2	3	3	3
	CO3	3	2	3	2	2	2	3	2	2	3	3	3	3
	CO4	3	2	3	2	4	2	2	3	1	3	3	3	3
B18AL9050	CO1	3	2	2	2	2	2	2	3	3	1	3	3	3

	CO2	2	3	2	3	2	2	4	2	3	2	3	3	3
	CO3	3	2	3	2	2	2	3	2	2	3	3	3	3
	CO4	3	2	3	2	3	2	2	3	1	3	3	3	3
B18AL9060	CO1	3	2	2	2	2	2	2	3	3	1	3	3	3
	CO2	2	3	2	3	2	2	4	2	3	2	3	3	3
	CO3	3	2	3	2	2	2	3	2	2	3	3	3	3
	CO4	3	2	3	2	4	2	2	3	1	3	3	3	3
B18AL9071	CO1	3	2	2	2	2	2	2	3	3	1	3	3	3
	CO2	2	3	2	3	2	2	4	2	3	2	3	3	3
	CO3	3	2	3	2	2	2	3	2	2	3	3	3	3
	CO4	3	2	3	2	4	2	2	3	1	3	3	3	3
B18AL9072	CO1	3	2	2	2	2	2	2	3	3	1	3	3	3
	CO2	2	3	2	3	2	2	4	2	3	2	3	3	3
	CO3	3	2	3	2	2	2	3	2	2	3	3	3	3
	CO4	3	2	3	2	4	2	2	3	1	3	3	3	3
B18AL9X20	CO1	1	2	1	2	2	1	2	1	3	1	3	3	3
	CO2	2	3	2	3	2	2	1	2	3	2	3	3	3
	CO3	3	2	1	2	2	2	3	2	2	3	3	3	3
	CO4	3	2	3	2	1	2	2	3	2	2	3	3	3

BA.LL.B (Hon's) PROGRAM
SCHEME OF INSTRUCTION

FIRST SEMESTER

COURSE CODE	COURSE TITLE	HC/ SC/ FC/ OE	CREDITS			TOTAL
			L	T	P	
B18AL1010	Law and Language-I	HC	3	1	0	4
B18AL1020	Political Theory	HC	3	1	0	4
B18AL1030	General Principles and Economics	HC	3	1	0	4
B18AL1040	Essentials of Sociology	FC	3	1	0	4
B18AL1050	Legal Methods and Legal Systems	HC	3	1	0	4
B18AL1060	Law of Torts, Consumer protection Act & Motor Vehicle Act	HC	3	1	0	4
B18AL1070	Moot Court	HC	0	0	2	2
TOTAL						**26**
SECOND SEMESTER						
B18AL2010	Law and Language-II	HC	3	1	0	4
B18AL2020	State and Political Obligations	HC	3	1	0	4
B18AL2030	Managerial Economics	HC	3	1	0	4
B18AL2040	Law and Social Issues in India	HC	3	1	0	4
B18AL2050	Jurisprudence	HC	3	1	0	4
B18AL2060	Law of Contract-I	HC	3	1	0	4
B18AL2070	Moot Court	HC	0	0	2	2
TOTAL						**26**
SUMMER INTERNSHIP: 4 WEEKS (to be evaluated in the III semester)						

THIRD SEMESTER

COURSE CODE	COURSE TITLE	HC/ SC/ FC/ OE	CREDITS			TOTAL
			L	T	P	
B18AL3010	International Relations	HC	3	1	0	4
B18AL3020	Money, Banking & Public finance	HC	3	1	0	4
B18AL3030	Exploration of Social Inequalities	HC	3	1	0	4
B18AL3040	Constitutional Law- I	HC	3	1	0	4
B18AL3050	Law of Contract-II	HC	3	1	0	4
B18AL3060	Sports, yoga, Music, Dance, Theater	HC	0	0	2	2
B18AL3070	Moot Court	SC	0	0	2	2
B18AL3080	Summer Internship (Evaluation)*	HC	0	0	2	2
TOTAL						**26**

*Marks allocation for the report submission of summer training undertaken at the end of **II Semester** with a corporate Lawyer or Law Firm.

FOURTH SEMESTER

COURSE CODE	COURSE TITLE	CREDITS				TOTAL
		HC/SC/ FC/OE	L	T	P	
B18AL4010	Public Policy and Public Administration	HC	3	1	0	4
B18AL4020	Law of Crimes (IPC 1860)	HC	3	1	0	4
B18AL4030	Public International Law	HC	3	1	0	4
B18AL4040	Constitutional Law- II	HC	3	1	0	4
B18AL4050	Administrative Law	HC	3	1	0	4
B18AL4060	MOOC, Swayam, EDX, CM Certificate	SC	0	0	2	2
B18AL4070	Moot Court	HC	0	0	2	2
B18AL4080	Soft Skills	SC	0	0	2	2
TOTAL						**26**
SUMMER INTERNSHIP: 4 WEEKS (to be evaluated in the V Semester)						

FIFTH SEMESTER

COURSE CODE	COURSE TITLE	CREDITS				TOTAL
		HC/ SC/	L	T	P	
B18AL5010	Political Science V (Anatomy of Political Institutions)	HC	3	1	0	4
B18AL5020	Family Law -I	HC	3	1	0	4
B18AL5040	Law of Evidence	HC	3	1	0	4
B18AL5050	Corporate Law	HC	3	1	0	4
B18AL5060	Labour Law -I	HC	3	1	0	4
B18AL5070	Transfer of Property	HC	3	1	0	4
B18AL5080	Soft Skill	SC	0	0	2	2
B18AL5090	Summer Internship (Evaluation)*	HC	0	0	2	2
TOTAL						**28**
*Marks allocation for the report submission of summer training undertaken at the end of **IV Semester** with a corporate Lawyer or Law Firm.						

SIXTH SEMESTER

COURSE CODE	COURSE TITLE	CREDITS				TOTAL
		HC/	L	T	P	
B18AL6010	Political Science VI Comparative Politics & Governance	HC	3	1	0	4
B18AL6020	Family Law- II	HC	3	1	0	4
B18AL6040	Criminal Procedure Code, Probation of Offenders Act & Juvenile Justice Act	HC	3	1	0	4
B18AL6050	Labour Law - II	HC	3	1	0	4
B18AL6060	Civil Procedure Code and Law of Limitation	HC	3	1	0	4
B18AL6070	Soft Skill	SC	0	0	2	2
Optional I (choose any one):						
B18AL6081	Criminology & Penology	SC	3	1	0	4
B18AL6082	Information Technology Law	SC	3	1	0	4
TOTAL						**26**
SUMMER INTERNSHIP: 4 WEEKS (to be evaluated in the VII semester)						

SEVENTH SEMESTER

COURSE CODE	COURSE TITLE	CREDITS				TOTAL
		HC/ SC/ FC/	L	T	P	
B18AL7010	Environmental Law	HC	3	1	0	4
B18AL7020	Intellectual Property Right	HC	3	1	0	4
B18AL7030	International Human Rights Law	HC	3	0	1	4
B18AL7040	Summer Internship (Evaluation)*	HC	0	0	2	2
B18AL7050	Open Elective	OE	3	0	1	4
Optional II Choose any ONE of the following						
B18AL7061	Law Relating to Mergers and Acquisition (Honours)	SC	3	0	1	4
B18AL7062	Indirect Taxation (Honours)					
Optional III Choose any ONE of the following						
B18AL7071	Banking and Insurance Law (Honours)	SC	3	0	1	4
B18AL7072	International Criminal Law (Honours)					
TOTAL						**26**
*Marks allocation for the report submission of summer training undertaken at the end of **VI semester** with a corporate Lawyer or Law Firm.						

*****OE = to be offered by School of Legal Studies

EIGHTH SEMESTER

Course Code	Course Title	HC/SC /FC/OE	Credits			
			L	T	P	Total
B18AL8010	Law of Taxation	HC	3	1	0	4
B18AL8020	International Humanitarian & Refugee Law	HC	3	1	0	4
B18AL8040	International Trade Law	HC	3	1	0	4
B18AL8040	International Air and Space Law	HC	3	1	0	4
B18AL8050	Trade in Service & Immigration Laws	HC	3	1	0	4
B18AL8060	MOOC, Swayam, EDX, CM Certificate	SC	0	0	2	2

Optional IV Choose any ONE of the following						
B18AL8071	Maritime Law	SC	3	1	0	4
B18AL8072	Media Law	SC	3	1	0	4
TOTAL						**26**
SUMMER INTERNSHIP: 4 WEEKS (to be evaluated in the IX semester)						

NINTH SEMESTER

Course Code	Course Title	HC/SC /FC/OE	Credits			
			L	T	P	Total
B18AL9010	Professional Ethics and Accountancy	HC	3	1	0	4
B18AL9020	Research Methodology	HC	3	1	0	4
B18AL9030	Moot Court & Internship	HC	3	1	0	4
B18AL9040	Drafting, Pleadings and conveyancing	HC	3	1	0	4
B18AL9050	Infrastructure Law	HC	3	1	0	4
B18AL9060	Summer Internship (Evaluation)*	HC	0	0	2	2
Optional V Choose any ONE of the following						
B18AL9071	Investment and Competition Law	SC	3	0	1	4
B18AL9072	Women and Law (Honours)					
TOTAL						**26**
Marks allocation for the report submission of summer training undertaken at the end of **VIII semester** with a corporate Lawyer or Law Firm.						

TENTH SEMESTER

Course Code	Course Title	HC/ SC /FC/ OE	Credits			
			L	T	P	Total
B18ALX010	Dissertation	HC	0	0	8	4
B18ALX020	Alternative Dispute Resolution	HC	3	1	0	4
TOTAL						**08**

Total 244 Credits

DETAILED SYLLABUS of BA LL.B (Hons.) 2018-2019

FIRST SEMESTER

Course Code	Course Title		L	T	P	Total
B18AL1010	**General English**	HC	3	1	0	4

Course Outline:
This is a 4 credit course for first semester consisting of 4 hours of teaching learning per week, inclusive of direct classroom teaching, practice in language lab and tutorials.

Course Objectives:

- To initiate the students to a sound knowledge of grammar.
- To develop the communicative skills of the students.
- To introduce the students to select works of literature in order to stir a literary interest in them which will give them an exposure to real-life scenarios.

Learning Outcomes:
After the completion of the course, the students will be able to:

- Build a strong base of grammatical knowledge to improve their communicative skills.
- Make use of their communicative skills to express themselves in personal and professional spaces.
- Demonstrate an understanding of select literary works and also extend their cognition to appreciate other literary works as well which mirror life.

Unit	Description	Evaluation Pattern	Topics	Teaching Hours
I	Functional English	**25 Marks** Fill in the blanks/ MCQs	1.Tenses 2.Conditional Sentences 3.Auxillaries(modals/primary) 4.Narratives 5.Active and Passive voice	14 Hours
II	Professional Communication Skills (Oral)	**25 Marks** Short Notes/ Descriptive Answers/ Comprehension Tasks	1.Introducing Yourself (Formal and Informal) 2.Public Speaking 3.Group Discussion 4. Interview Skills 5.Presentation Skills	14 Hours

III	Professional Communication Skills (Written)	**25 Marks** Short Notes/ Descriptive Answers	1.Paragraph Writing 2. Notice/Agenda/Minutes 3.Note Making 4.Summarising 5.Memorandum	14 Hours
IV	Literary Readings & Social Skills – I	**25 Marks** Short Notes/ Descriptive Answers	1.William Shakespeare: *The Merchant of Venice* (Act-IV, Court Scene) 2. Norman Mckinnel: *The Bishop's Candle Sticks* (Short Play) 3. M.K. Gandhi: *My Experiments with Truth* (Extract) 4. Rudyard Kipling: Justice (Poem) 5. William Cowper: Divine Justice Amiable (Poem)	14 Hours

References:

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.

Course Code	Course Title		L	T	P	Total
B18AL1020	**Political Theory**	HC	3	1	0	4

Objective:

This his course aims at introducing the philosophical ideas underlying constitution and other branches of law. Knowledge of these ideas will enable the students to understand the legal principles in a better way.

Learning Outcomes: On completion of this course you should be able to:

- Will deal with the contributions of Greek thinkers and the evolution of concepts like democracy and justice.
- Will deal will the impact of medieval thinkers and their contributions to political thought
- Will deal with the renaissance and modern political thinkers social contract theories that attempt to explain the origin of the state.
- Will deal with the prominent thinkers of liberal and conservative thought.
- Will deal with the writings of Hegel, Karl Marx and the revisionist thinkers.
- Will deal with contemporary political thought in India.

Unit – I: **Introduction and theories**

- What is Political Science - Definition, aims and scope
- Relationship between Political Science and Law
- Theories of State: Divine and Force theory, Organic theory, Idealist theory Individualist theory, Theory of social Contract.
- Indian Context Santiparva and Kautilaya's Saptang theory, Development of concept of Hindu State Islamic concept of State.

Unit – II: Liberalism and Totalitarianism

- Liberalism: meaning and features, Merits and demerits
- G.W. F. Hegel: Hegel's dialectic, atheism and liberal democracy
- Revisionists: Edward Bernstein and the social democrats
- Totalitarianism: meaning and features, Merits & demerits of Totalitarian state Fascism & Nazism

Unit – III: **Socialism and Marxism**

- Socialism- meaning and features, Schools of Socialism, Fabianism, Syndicalism,Guild socialism
- Marxism: Concept of Marxism, Historical and dialectical materialism Concept of class and class struggle, Merit and demerits of Marxism
- Karl Marx – The Hegelian influence, alienation, critique of the Modern State, ideology, forces and relations of production, influence of Marx today.

Unit – IV: **Political Thinkers – Contributions in brief**

- Western Political Thinkers- Plato, Aristotle, St. Augustine, St. Aquinas, J.S. Mills and T.H. Green
- Indian Political thinkers – Gopal Krishna Gokhale, M.N. Roy, LokamanyaTilak, Jaiprakash Narayan, Mahatma Gandhi and Pandit Nehru, Dr. B.R. Ambedkar

Text Books:

1. Eddy Asirvatham& K.K. Misra, Political Theory, S. Chand & Company Ltd., Delhi
2. A.C. Kapur, Principles of Political Science, S.Chand& Company Ltd., Delhi
3. Rawls, John. Political Liberalism. Expanded ed. New York; Chichester: Columbia University Press, 2005.
4. Weber, Max, and Stephen Kalberg. The Protestant Ethic and the Spirit of Capitalism. New York: Oxford University Press, 2011.
5. Pantham, Thomas, and Deutsch, Kenneth (eds.) Political Thought in Modern India, Safe Publications, New Delhi, 1986

References:

1. R.L. Gupta, Political Theory.
2. VishooBhagwan, Indian Political thinker.

Course Code	Course Title		L	T	P	Total
B18AL1030	**General Principles of Economics**	HC	3	1	0	4

Course Objectives:

The course is designed for the beginners with no formal background or little acquaintance with economics. The objective is to give the students with a clear understanding of the basic concepts, tools of analysis and terminologies used in economics, to facilitate their understanding of various legal phenomena. Emphasis will be on the use of graphs, diagrams and numerical tables/schedules for exposition. The teacher is expected to draw examples from the surrounding world to clarify the concepts.

Learning Outcomes: On completion of this course student should be able to:

- Understand economics terminology used in policy framework of any economy. Students will also understand how everyone can benefit when people trade with one another, and how to apply the theory of comparative advantage to everyday life and national policy.
- Understanding the psychology of individual economic agents like consumers and producers and their respective choices in the market.
- Able to analyze about different types of costs and its significance in production process. The discussion of types of revenues will help students to understand the determination of maximum profit for any firm.
- Understand the different kinds of market structure and the behavior of firms in determination of price and output. This Unit is a pre-requisite for the paper "Law and Economics" in advanced semester.
- To understand how the economy is run. It will also strengthen the understanding of the concept of equity in taxation and expenditure.
- Increase the overall awareness about the ways in which nations are compared. Students are made aware of the problems facing any economy and the government's policies and practical difficulties regarding the same.

UNIT – I: Introduction to Economics:

Definition, Basic concepts of economics and percepts- economic problems, economic rationality, optimality, demand and supply. History of Economic thoughts: Mercantilism, Classical economics, Keynesian economics.

UNIT – II DEMAND AND SUPPLY

Meaning of demand Law of Demand – Determinant of demand , Types of Elasticity of Demand - Price, Income and Cross elasticity, Demand Forecasting : Objectives and method of forecasting, Supply Analysis – Law of Supply – price elasticity of Supply, Market Equilibrium and disequilibrium, Consumer and producer surplus and market efficiency.

UNIT – III Market Analysis:

Perfect Competition, Meaning and types of market structure, Nature of Market – Features of Perfectly Competitive Market, Price-output determination in the short- run and long- Effects of Government Intervention on Price and Output in a Competitive Market, Monopoly-Monopolistic Competition, Oligopoly

UNIT – IV: Pricing decisions

Objectives of pricing, Factors underlying pricing, Methods of pricing, Applications of different pricing methods in different market structure.
National Income: real GDP, nominal GDP, per capita GDP. Economic policies: monetary and fiscal policy.

Text Books:

1. Robert Pindyck, Daniel Rubinfeld and Prem Mehta,: " Microeconomics"7th Edition, Pearson Education.
2. William Boyes and Michael Melvin: "Textbook of Economics"; 6th e, Biztantra publications.
3. Dominick Salvatore: "Managerial Economics", 7e, Oxford University Press.
4. . Robert S. Pindyck, Daniel L Rubinfeld: "Microeconomics" 6th Edition; Pearson Education
5. John Sloman & Mark Sutcliffe: "Economics for Business"; 3e, Pearson Education,
6. Gregory N Mankiw: "Economics – Principles and Applications"; Cengage Learning.

Books:

1. Dewett, K.K. Modern Economic Theory;
2. Seth. M.L. Money, Banking, International Trade and Public Finance

Course Code	Course Title		L	T	P	Total
B18AL1040	**Essentials of Sociology**	HC	3	1	0	4

Course Objectives:

The central object of this course is to expose the students to different theoretical perspectives and methodological foundations of Sociology through which they can understand and analyze the social context in which they live. The focus of the introductory paper is on helping students develop a 'sociological imagination'.

Learning Outcomes: On completion of this course student should be able to:

- Understand the nature of sociological discourse as a separate academic discipline and its practical dimensions.
- Understand the fundamental theories, ideological traditions, concepts and terminologies associated with the discipline of Sociology.
- Evaluate the intellectual understandings of classical and contemporary social issues and institutions like caste, gender, race etc.
- Articulate their own positions in a clear, coherent and logical manner concerning the theories and concepts covered in this course
- Cultivate the 'sociological imagination' to look at the contemporary social world critically.

Unit I: Intellectual Settings of Sociology as a Discipline

- General Framework of Sociology: An Introduction
- Scientific Claims of Sociology
- Sociological Imagination: C. Wright Mills
- Sociological Perspectives:
    - Functionalist Perspective
    - Conflict Perspective
    - Symbolic-interactionist Perspective
    - Feminist Perspective

Unit II: Conceptual Foundations of Sociology

- General Overview- Historical context of the development of Sociological theory
- Emile Durkheim: Social Facts and Forms of Solidarity; Division of Labour; Anomie
- Karl Marx: Historical Materialism and class struggle;
- Alienation, Society, Community, Institution and Association
- Groups: Primary and Secondary

Unit III: Culture, Socialization and Deviance

- General Overview
- Culture of Society
- Meaning, Nature and Component of Culture
- Cultural Universals
- Culture Identity, Culture Shock, Ethnocentrism
- Cultural Diversity and Cultural Relativism
- Socialization:
    A. Agencies of Socialization
    B. Re-socialization
    C. Socialization and Individual Freedom
- Social Deviance and Crime
    A. Norms, Sanctions and Deviance
    B. Anomie and Labeling Theory
    C. Theories of Delinquent subculture
    D. Society and Crime; Gender and Crime;
    E. White Collar Crime; Governmental Crime

Unit IV: Social Institutions

- General Overview
- Family and Kinship
- Meaning, Nature and Types of Family and Household
- Family and other social institutions: law, politics, religion and economy
- Dark sides of Family Life
- Marriage as a Social Institution
- Discourse on Education
- Social Structure, Economic Institutions and Poverty

BOOKS:

1. Andre Beteille, Sociology, New Delhi: Oxford University Press, 2003.
2. Tony Bilton et al., Introductory Sociology, New York: Palgrave, 2007
3. T.B. Bottomore, Sociology, Mumbai: Blackie & Son, 1986
4. Anthony Giddens, Sociology, Cambridge: Polity Press, 2008
5. M. Haralambos and R.M. Heald, Sociology: Themes and Perspectives, New Delhi: Oxford University Press, 2009.
6. John J. Macionis, Sociology, New Delhi: Pearson Education, 2009.
7. David M. Newman, Sociology, New Delhi: Pine Forge Press, 2008

Course Code	Course Title		L	T	P	Total
B18AL1050	**Legal Methods and Legal Systems**	HC	3	1	0	4

Course Objectives:
This course is specifically designed keeping in mind the requirements of students who have no prior training/understanding of law. It seeks to develop a range of appropriate legal skills for budding lawyers and introduce students to a range of intellectual perspectives, ideas and traditions that have influenced the development of legal traditions in various parts of the world. The course is a study in legal fundamentals, an introduction into the study of law and an overview of the nature, meaning of law and its methods. A component is dedicated to Legal Research, which seeks to inculcate research skills and an understanding of the various dimensions of its methodology.

Learning Outcomes: On completion of this course student should be able to:

- Understand the meaning of law and its implication in our daily lives. Appreciate the inter-relationship between law, ethics and morality.
- Understand what is meant by the 'Legal Framework' of a Nation. An understanding of the Indian Legal system and its Common Law roots lie at the heart of this module
- Understand that law is a confluence of many sources. Legislation, Custom and Precedent constitute the sources which define the modern understanding of what "Law" is
- Appreciate the meaning and importance of Legal Research, reasoning and writing. Understanding the distinction between Legal Research and other kinds of research.

Unit-I: Introduction to Law; Legal Methods and Legal Systems

- Meaning, nature and functions of Law
- Relationship of law and morality
- Questions of law and Questions of fact
- Classification of law: Civil and Criminal Law, Public and Private Law, Municipal and International Law, Substantive and Procedural law.
- Major legal systems of the world- Common Law Legal System, Equity, Civil Law Legal System, Religious legal systems.

Unit-II: Legal History

- Constitution as the Basic Law;
- Rule of Law; Separation of Powers; Delegated Legislation;
- Judicial system in India- Hierarchy of Courts in India, Jurisdiction of Courts (Territorial, Pecuniary, Subject Matter);
- Fora and Tribunals-Alternative Dispute Resolution Methods, Arbitration, Negotiation, Mediation and Conciliation, Lok-Adalats.

Unit III: Sources of Law:

- Meaning; Primary and Secondary sources;
- Custom; Precedent- Categories of precedents, dissenting and concurring opinion, overruling of judgments.
- Article 141 of the Constitution; *stare decisis, Ratio decidendi*- Tests to determine *ratio decidendi, obiter dictum;*
- Legislations, Juristic writings; Justice, Equity and Good Conscience, International law as a source of Municipal Law.
- Inter-relationship of the sources, relative significance with the help of leading case laws.

Unit IV: Legal Research Skills

- Understanding the meaning and importance of Legal Research and writing.
- Preparing a research design with all its components.

- Legal Reasoning- Inductive and Deductive Reasoning. Understanding Judicial decision making
- New Dimensions in Legal Research- Use of Online Databases and e-resources; Techniques of Legal Research; Legal writings and citations; Judicial Reasoning; Analogizing – the application of principles laid down in similar cases, static and dynamic analogy; Case Synthesis.
- Blue book Citation and footnoting

Books:

1. Indian Legal System, Joseph Minattur, Indian Law Institute
2. Legal Theory, Friedmann, Universal Law
3. Jurisprudence and Legal Theory, V.D.Mahajan, Eastern Book Company
4. Administrative Law, S.P.Sathe, Lexis Nexis
5. Introduction to Legal Method, Farrar & Dugdale , Sweet & Maxwell
6. Law in the changing Society ,Friedman, Universal Law
7. Crisis of Indian Legal System ,Baxi, Vikas
8. Idea of Law ,Lloyd, Butterworth
9. The Concept of Law, Hart, Clarendon Law Series
10. Introduction to Philosophy of Law , Pound, , Harvard
11. Rattan Singh, Legal Research Methodology, Lexis Nexis
12. Legal Research Methodology, Indian Law Institute

Course Code	Course Title		L	T	P	Total
B18AL1060	**Law of Torts, Consumer protection Act & Motor Vehicle Act**	HC	3	1	0	4

Course Objective:

This course is designed to study the principles of Tortious liability, the defences available in an action for torts, the capacity of parties to sue and be sued and matters connection there with. Further, this course is designed to study specific torts against the individual and property. With rapid industrialization, inadequacy of the law to protect the individual is exposed. An attempt shall be accorded to the individuals against mass torts and industrial torts. Keeping in the expensive character of judicial proceedings the students should reflect on the alternative forms, and also the remedies provided under the *Consumer Protection Act, 1986* and *Motor Vehicle Act.*

Learning Outcomes: On completion of this course student should be able to:

- familiarize with the basis of liability in tort and to distinguish it with the basis of contractual liability
- acquaint with different forms of tortious liability as well as different forms of tort
- understand the role of no fault liability, strict liability and absolute liability
- analyse the role played by statutes like the Motor Vehicles Act and the Consumer Protection Act in bringing in a new framework of protection to individuals from certain specific kinds of tort.

Unit I: Definition, Nature and Development of Tort.

- Definition, nature and history of the law of torts.
- Difference between Tort & Crime, Tort & Contract.
- Basis of the tortuous liability;
- Basic legal maxims for Determination of liability - *Ubi jus Ibi remedium, Injuria Sine Damnum and Damnum Sine Injuria.*

Unit II Liability for the Wrong Committed by Other Person

- Principle of Vicarious Liability and its basis.
- State's Liability: Doctrine of Sovereign Immunity in reference to the Crown Proceedings Act 1947, Federal Torts Claims Act 1946 and Article 300 of the Indian Constitution.
- Joint Tort Feasors, joint and several liabilities in payment of damages
- Negligence: Professional Negligence, psychiatric damage; economic loss.
- Proximate Cause and Intervening Cause.
- Contributory Negligence: Last Opportunity Rule, Res Ipsa Loquitur.
- Nuisance: History of Nuisance, Remedy for Nuisance, kinds of nuisance.
- General Defenses: *Volenti non fit injuria ,Vis Major (Act of God)* Inevitable Accident
- Remoteness of Damage: fixing of liability and damages, Directness test – *In re Polemis case,* The doctrine of reasonable foresight – *the Wagon Mound cases*

Unit III Statutory Tort I – Motor Vehicles Accident Protection

- Motor Vehicles Act,1988
    - Chapter-X Liability without Fault (Ss.140-144)
    - Chapter-XI Insurance of Motor Vehicles (Ss.145-164)
    - Chapter- XII Claims Tribunal (Ss. 165-173)

Unit IV Statutory Tort II – Consumer Protection Act

- The Concept, Objectives and Scope of CPA, Definitions: Consumer, The Consumer Protection Act and its applications.
- Services, -- Deficiency in services Meaning, Professional service, Medical services, Lawyering services, Public Utility Services ,Commercial Services; Unfair trade Practice -Misleading and False advertisement; Unsafe and Hazardous Products, Falsification of Trade Marks; Consumer safety; Services – Consumerism
- District Council, State Council National commission
- Product Liability – theories of causation, defectiveness and proximate reason.
- Tortuous misrepresentation and negligence.

Books

1. Winfield & Jolowicz: Tort, Sweet and Maxwell, London.
2. D.D. Basu,The Law Of Torts
3. B.M.Gandhi , Law of Tort, Lucknow.
4. Ratanlal and Dhirajlal, The Law of Tort, Universal, Delhi.
5. Salmond and Heuston –On the Law of Torts (2000) Universal, Delhi.
6. J.N Boriwala, Commentary on Consumer Protection Act , Delhi.
7. P.K Majumdar, The Law of Consumer Protection In India (1998), Orient Publishing Co., New Delhi.
8. Achutan Pillai: The Law of Torts, Eastern Book Co., Lucknow.
9. Ramaswamy Iyyer: The Law of Torts,
10. The Motor Vehicles Act, 1988

Course Code	Course Title		L	T	P	Total
B18AL1070	**Moot Court**	HC	0	0	2	2

SECOND SEMESTER

Course Code	Course Title		L	T	P	Total
B18AL2010	**Law and Language - II**	FC	3	1	0	4

Course Outline:
This is a 4 credit course for second semester consisting of 4 hours of teaching learning per week, inclusive of direct classroom teaching, practice in language lab and tutorials.

Course Objectives:

- To develop the vocabulary base of the students, a much essential component for professional as well as personal communication.
- To ensure a thorough development of the literary skills of the students which will enable them to appreciate social and cultural values.
- To develop the writing skills of the students to a professional level.

Learning Outcomes:
After the completion of the course, the students will be able to:

- Utilize their acquired or developed vocabulary in multiple situations that requires skillful communication.
- Develop a competent writing skill, which is extremely essential to excel in professional domains.
- Demonstrate an ability to understand and appreciate works of literature connected to ways of life.

Unit	**Description**	**Evaluation Pattern**	**Topics**	**Teaching Hours**
I	Language in Use	**25 Marks** Fill in the blanks/ MCQs	1. Vocabulary Building 2. Functional Words 3. Idioms & Phrasal Verbs 4. Homonyms & Homophones 5. Common Errors	14 Hours
II	Language and Communication	**25 Marks** Short Notes/ Descriptive Answers	1. Basics of Communication 2. Process and Importance of Communication 3.Verbal and Non Verbal Communication 4. Barriers to Communication 5. Strategies of Effective Communication	14 Hours
III	Advanced Writing Skills	**25 Marks**	1. Essays 2. Letter Writing	14 Hours

		Short Notes/ Descriptive Answers	3. Dialogues 4. Resume and Cover letters 5. Emails	
IV	Literary Readings & Social Skills – II	**25 Marks** Short Notes/ Descriptive Answers	1. John Galsworthy: *Justice* (Act-II) 2. Fritz Karinthy: *Refund* (Short Play) 3. Jack London: The Benefit of Doubt (Short Story) 4. Bertolt Brecht: On the Infanticide of Marie Farrar (Poem) 5. Eric Cockrell: Can't Get No Justice (Poem)	14 Hours

References:

- Bansal, R.K. and J.B. Harrison. *Spoken English*. Orient Blackswan, 2013.
- Raman, Meenakshi and Sangeeta Sharma. *Technical Communication*. Oxford University Press, 2015.
- Thorpe, Edgar and Showick Thorpe. *Objective English*. Pearson Education, 2013.
- Dixson, 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.
- Goodale, Malcolm. *Professional Presentation*. Cambridge University Press, 2013.

Course Code	Course Title		L	T	P	Total
B18AL2020	**State & Political Obligations (Political Science II)**	FC	3	1	0	4

Course Objectives:

The course explains the authority of the States to govern within their jurisdiction. Authority is generally understood as entailing a right to be obeyed correlative with a moral obligation incumbent on the subjects of authority to obey (provided that certain conditions obtain). The obligation to obey is said to be general (although capable of being defeated if the relevant conditions do not obtain). It is said to hold with regard to (almost) all directives, (almost) all subjects, on (almost) all occasions. This is the claim of political obligation.

Learning Outcomes: On completion of this course student should be able to:

- The student should be able to analyses of the issue of authority is a problem for political philosophy
- They should also be able to examine the direction in which the justification was traditionally sought and the reasons why this direction has been taken, the skeptical arguments against the traditional strategies, and the more recent attempts at meeting those arguments.

Unit – I: Introduction to Political obligation:

- Meaning, nature and scope of Political Obligation
- Evolution of the concept of political obligation
- Contemporary developments
- Political Obligation and right
- Political obligation and Duty.

Unit- II Theories of Political obligation:

- Voluntarism - Utilitarian theory
- Deontological theory
- Anarchist theory- Political obligation and consent
- Political obligation and Social contract (Hobbes, Locke & Rousseau)
- Types of Political obligation

Module - III Philosophical foundations of Political obligation:

- Moral or Ethical foundations of Political obligation
- Ancient Indian ideas and Institutions on Political obligation
- Dimensions of Political obligations in a modern State
- Political obligation and family - Political obligation and identity
- Membership and political obligation

Module- IV Legal and Political obligations:

- Nature and extent of the Authority in a State and Political Obligation
- History and Theory of Justice
- Constitution of India and the nature of Political obligation under the Constitution
- Dilution of Political obligation
- Impact of such dilution of Political obligation.
- Political Obligation and Revolution
- Role of State in balancing political obligations
- Role of international society in political obligation of a State

Books

1. John Horton, Political Obligation, MacMillan, London, 1992.
2. Margaret Gilbert, A Theory of Political obligation ; Membership, Commitment and the Bonds of Society, Clarendon Press, Oxford, London, 2006
3. D.D. Raphael and T. H. Green on Political Obligation, 2008

Course Code	Course Title		L	T	P	Total
B18AL2030	**Managerial Economics**	FC	3	1	0	4

Course Objectives:

Managerial economics is the study of how to direct scarce resources in the way that most efficiently achieve the goal. It is a broad discipline in that it describes the trade- off that consumers, workers, and firms face, and show how these trades-offs are best made. The idea

of making optimal trade-offs is an important theme in Managerial Economics. Though the subject is titled as Managerial Economics, some of the macroeconomics concepts also been introduced to provide students with a basic understanding of the behaviour of macro variables and policy frame work. Macroeconomics involves the study of aggregate factors such as income, employment and inflation, and functioning of an economy. Thus managerial economics provides useful insights into every facet of the business and non-business world in which we live-including household decision making

Learning Outcomes: On completion of this course student should be able to:

- Describe the nature of economics in dealing with the issue of scarcity. Perform supply and demand analysis to analyse the impact of economic events on markets.
- Analyse the behaviour of consumers in terms of the demand for products, evaluate the factors affecting firm behaviour, such as production and costs
- Analyse the conduct and performance of firms under different market structures
- Compute different measures of macroeconomic activity such as the national income accounts, inflation, and unemployment, and evaluate the shortcomings of traditional economic measures.
- Analyse the forces that affect the aggregate level of economic activity and the business cycle using AD-AS analysis, recognize how monetary and fiscal policy can be used to achieve policy goals

Unit I: Introduction:

Managerial Economics – Meaning, Definitions and scope. Importance of studying economics for business manager; Normative Vs Positive Analysis; Microeconomics Vs macroeconomics; Fundamental Problems of an Economy, Alternative Economic Systems; Goals of macroeconomic policies.

Unit II: Demand Analysis:

Meaning of demand, determinants of demand, Law of Demand, Deriving demand curve; Elasticity of Demand- Price elasticity. Income Elasticity and cross Elasticity. **Demand forecasting. Analysis of Market Structure:** Meaning and definition of Market, Types of Market; Perfect and imperfect competition; Features of perfect competition, monopoly, oligopoly and monopolistic competition – Price and output determination in each market environment in both Short Run and Long Run

Unit III: Supply Analysis:

Meaning of supply, determinants of supply, Law of Supply, Deriving supply curve; Elasticity of Supply; Market Equilibrium, Price Control: floor pricing and price ceiling. **Cost and Revenue Analysis:** Meaning; Concepts, Short-Run and Long-Run Cost Functions, Learning curve, Economies of Scale and revenue and profit determination. Areas and tools of cost control.

Unit IV: National Income and Inflation and Unemployment:

Concepts – Domestic v/s National, Gross v/s Net, Factor cost v/s Market price; Real v/s nominal GDP; personal income, per capita income, disposable income; Price indices and GDP deflator; Measuring National Income; Limitations of measurement; Usefulness of national income analysis. Meaning and types of inflation; Causes of inflation; Effects of inflation; Measures to control inflation. Unemployment: Meaning and types; Effects of unemployment; Measures to control unemployment.

Books

1. Karl E. Case and Ray C. Fair & Sharon Oster: "Principles of Economics" Ninth edition, Pearson
2. John Sloman & Mark Sutcliffe: "Economics for Business"; Pearson Education
3. R.Pindyck, D Rubinfeld and P Mehta,: " Microeconomics"7th Edition, Pearson Education.

4. N. G. Mankiw: “Economics – Principles and Applications”; Cengage Learning
5. Dominick Salvatore & Ravikesh Srivastava: “Managerial Economics”, Oxford Higher Education.
6. R. Dornbusch & S. Fisher, Macroeconomics, Tata Mc. Graw Hill.
7. William A MacEachern and A. Indira, “MacroECON”, Cengage Learning
8. Samuelson, P. A., and W. D. Nordhaus: “Economics” , Tata McGraw-Hill, India
9. Froyen: “Macroeconomics”, Pearson.
10. RT Kennedy: “Macroeconomic Theory”, Pearson Prentice Hall.
11. Shyamal Roy: “Macroeconomic Policy Environment”, Tata McGraw Hill.
12. M. Melvin and W. Boyes: Principles of Macroeconomics, Cengage Publication.

Course Code	Course Title		L	T	P	Total
B18AL2040	**Law and Social changes in India**	HC	3	1	0	4

Objective:

This paper will help the students to apply sociological theories to a myriad of contemporary justice problems. Use knowledge on sociological theories to analyse contemporary problems of Indian society, and critically reflect on media reports and cultural products concerning justice issues.

UNIT I – INTRODUCTION

- Law and disadvantaged group
- Issue of reservation to caste and women’s empowerment
- Law and social change
- Social perception of law in the global era
- Social role of judiciary and legal profession in Indian society.

UNIT II - Gender and Law

- The Social construction of Gender
- The status of women – Ancient age – Medieval India – Modern period – Problems Faced by women in modern India – the development and changing status of women.
- Domestic Violence Act, 2005
- Sexual Harassment of Women at workplace (Prevention, Prohibition & Redressal) Act 2013
- Dowry with special reference to Dowry Prohibition Act, 1961
- Women and property in India
- Impediments to legal reform: Patriarchy and Culture

UNIT III- Social problems related with children

- Child Marriage: Reasons and Consequences
- Prohibition of Child Marriage Act, 2006
- Juvenile Delinquency: Meaning, Factors, Juvenile Justice System
- Child Abuse: Child Labour (Prohibition & Regulation) Act, 1986.

UNIT IV- Crime and Deviance

- Relationship between Sociology and Criminology
- Crime and Deviance: Meaning and Difference
- Causes of Crime & Deviance, Labelling theory
- Crime, Deviance and Social Control

Books:

1. Jaya Sagade, 2005, Child Marriage in India, Oxford University Press, New Delhi.
2. K.L. Sharma, 2004, Social Inequality in India, Rawat Publications, Jaipur

3. Veena Das, 2004, Handbook of Indian Sociology, Oxford University Press, New Delhi.
4. Vandana Madan, The Village in India, Oxford University Press, New Delhi.
5. Jairam Kusal, Sociology of Social change, Dominant Publishers, New Delhi
6. Ghanshyam Shah, 2004, Caste and Democratic Politics in India, Permanent Black, New Delhi
7. Kushal Deb, 2002, Mapping Multiculturalism, Rawat Publications, Jaipur
8. Ram Ahuja, 2003, Indian Social System, Rawat Publications
9. Ranbir Singh, Ghanshyam Shah, Human Rights, Education, Law and Society, Nalsor University, The Print House
10. B. GopalKrishnan 2004- Rights of children Aavishkar Publishers, distributors, Jaipur, India
11. Kumari Ved, 2004, The Juvenile Justice System in India From Welfare to Rights, Oxford Univeristy Press, New Delhi
12. Seth, Mira, 2001, Women and Development, the Indian Experience, Sage Publications.

Course Code	Course Title		L	T	P	Total
B18AL2050	**Jurisprudence**	HC	4	1	0	4

Course Objective:
To develop an analytical approach to understand the nature of law, development of law and working of a legal system in different dimensions with reference to popular legal theorists.
Course Outcomes: The students will be able to:

- Comprehend knowledge of doctrines about law and justice, developed over the years, in various nations and historical situations.
- Understand the importance of legal concepts that is important so far as various legal courses are concerned.
- Relate various concepts that they learn in other courses in law to their jurisprudential meanings.
- Recognise sources of law that will foster legal research.
- Apply principles of liability with a comprehensive understanding of the concepts in environmental law and health care law.

Unit – I: Introduction

a. Nature, definition, meaning and scope of Jurisprudence
b. Link between Jurisprudence and other sciences
c. Law, Morality and Ethics – Hart-Fuller Debate – Hart and Patrick Devlin on Morality
d. Dharma – Meaning and scope in Indian Jurisprudence

Unit – II: Schools of Jurisprudence – I

a. Natural Law – Greek and Roman era – Medieval period - Classical era
b. German Transcendental Idealism – Emmanuel Kant
c. Analytical positivism – Utilitarianism - Pure Theory
d. Historical Jurisprudence – Anthropological approach - Evolutionary Theory

Unit – III: Schools of Jurisprudence – II

a. Sociological Jurisprudence
b. Concept of Dialects – Philosophy of Hegel – Economic Approach – Dialectical Materialism
c. Legal Realism – Philosophies of Cardozo and Holmes – American realism – Scandinavian realism

d. Revival of Natural Law – Rawls theory of Justice – Theory of Amartya Sen

Unit – IV: Concepts of Law

a. State – Nature and functions – Various kinds of Law - Administration of Justice
b. Sources of Law – Custom, Legislation, Precedent, Equity
c. Rights – Hohfeldian analysis of Rights and Duties – Obligation - Ownership – Possession – Liability - Immunity
d. Juristic personality – Corporations – Animals – Unborn –Dead persons – Idols and Mosque

Text books:

1. Amartya Sen, The Idea of Justice, Belknap Press; Reprint edition (2011)
2. Benjamin Cardozo, The Nature of Judicial Process, Wildside Press LLC, 2010
3. Edgar Bodenheimer, Jurisprudence, Harvard University Press, 1974
4. Fitzgerald, Salmond on Jurisprudence (1999), Tripathi, Bombay
5. Glanville Williams, Learning the Law, Thomson Reuters, 2010
6. HLA Hart, Law, Liberty and Morality, Stanford University Press, 1963
7. HLA Hart, The Concept of Law, Oxford University Press, 2012
8. John Rawls, A Theory of Justice, Harvard University Press, 2009
9. N.K. Jayakumar, Lectures in Jurisprudence, LexisNexis Butterworths, 2006
10. Paton, A Textbook of Jurisprudence, Clarendon Press, 1972
11. Patrick Devlin, The Enforcement of Morals, Liberty Fund, Incorporated, 2010
12. R.W.M. Dias, Jurisprudence (1994) Indian Reprint, Adithya Books, Delhi
13. V. D. Mahajan, Jurisprudence and Legal Theory (1996 re-print), Eastern Books, Lucknow
14. Prof. (Mrs.) Nomita Aggarwal , Jurisprudence (Legal Theory)

Course Code	Course Title		L	T	P	Total
B18AL2060	**Law Contract-I**	HC	3	1	0	4

Objective:

A contract is essential for any business transaction, ensuring that both parties to the contract abide by the commonly established terms and conditions. They are the main means by which, transactions are made and legal obligations voluntarily incurred. Law of contract will be taught in two papers for the course. While semester I will deal with the general principles of contract law, the second paper in the next semester will focus on certain forms of specific contracts.

Learning Outcomes - The students should be able to:

- Enumerate the basic principles of contract law, including the sources of contract law, its theoretical underpinnings, and the influences of common law and statutory law in its development.
- Analyses the principles particularly of contract formation and validity, enforcement of promises and liability.
- Analyses the defenses to formation, distinctions between breach and performance, contract remedies, and third party interests in contracts.
- Acquaint with principles of analysis with regards to a particular issue, and utilization of law of contract including the Indian Contract Act, 1872.

Unit I: Introduction

- Nature and functions of a contract.
- Justification for and the limits of contract law.

- Freedom of contract and its exceptions
- Modern trends in contract law.
- Offer – kinds of offer, distinction between invitation to treat, revocation and termination.
- Acceptance – modes of acceptance, communication of acceptance, revocation.
- Intention to create legal relations
- Consideration – definition and kinds of consideration, exceptions to the requirement of consideration.
- Free consent – doctrine of *consensus ad idem*

Unit II: Competency to contract

- Minor's agreement – status, agreement for the benefit and to the detriment of a minor, fraud by minor and estoppel, restitution as a remedy.
- Unsoundness of mind – meaning and exceptions
- Insolvency
- Coercion – definition, essential elements, duress and coercion distinguished.
- Undue Influence – definition, essential elements, parties between whom it can exist, who is to prove.
- Misrepresentation – definition, essential elements, fraud distinguished.
- Fraud – definition, essential elements, when silence amounting to fraud.

Unit III: Void Agreements

- Mistake – definition, mistake of fact and law and their consequential effects upon the validity of the agreement.
- Legality of objects – lawful objects and considerations, immoral agreements, agreements opposed to public policy
- Agreements expressly declared to be void – agreements in restraint of: marriage, trade and legal proceedings;
- Uncertain agreements
- Wagering agreements
- Contingent contracts – nature, when contingent contract becomes void.
- Quasi contracts – meaning and nature, theory of unjust enrichment, situations where law implies contractual relationship.
- Government as a contracting party – formation, and constitutional requirements as provided under Art. 299 of the Constitution of India
- Standard form contracts – nature and advantages, principles of protection against the possibility of exploitation, judicial approach to such contracts

Unit IV: Discharge of liability under a contract

- By performance- conditions of valid tender of performance, reciprocal promises
- By death, Inheritance, part performance,
- By breach - time as essence of contract, anticipatory breach and actual breach, constructive breach.
- By frustration of contract - Impossibility of performance, specific grounds of frustration, *force majeure.*
- By period of limitation.
- By agreement- rescission and alteration - their effect- remission and waiver of performance - extension of time- accord and satisfaction.
- Meaning, kinds of breach, remedies for breach.
- Damages – meaning, measure of damages, remoteness of damages

- Specific Performance of contract – which contracts may be specifically enforced, which may not, persons against whom it can be enforced.
- Injunction

Books

1. Avtar Singh, Contract & Specific Relief, 11th Ed., Eastern Book Company, 2013.
2. Anson's Law of Contract, Beatson, Burrows and Cartwright (Eds), 29th Ed., Oxford University Press, 2010.
3. Moitra's Law of Contract and Specific Relief, 6th Ed., Universal Law Publishing Co., 2012.
4. Chitty on Contracts, Volume I & II, 29th Ed., Sweet & Maxwell, 2004.
5. Cheshire, Fifoot & Furmston's Law of Contract, 16th Ed., Michael Furmston (Ed), Oxford University Press, 2012.

Course Code	Course Title		L	T	P	Total
B18AL2070	**Moot Court**	HC	0	0	2	2

THIRD SEMESTER

Course Code	Course Title		L	T	P	Total
B18AL3010	**International Relations**	HC	3	1	0	4

Course Objective:

This module facilitates you to understand the approaches to the study of Comparative Politics in vogue in an informed and efficient manner. The module helps you to acquire the knowledge that is vital in understanding the concepts of International Politics and approaches to foreign policy

Learning Outcomes: On completion of this unit you should be able to:

- To develop conceptual knowledge of the anatomy of Global Politics and concepts.
- To evaluate the foreign policy determinants of the countries across the globe.

Unit –I: Introduction

Traditional approaches; political economy, political sociology or political system approaches; Nature of political process in the Third World. Evolution, the contemporary trends in the advanced industrial countries and the Third World.

Unit –II: Power and Politics

Power, national interest, balance of power, national security, collective security and peace-Theories of International politics, Marxist, Realist, Decision-making and Game Theory. Domestic compulsions, geopolitics, geo-economics and global order. Origin and contemporary relevance of the Cold War, nature of the post-cold war global order.

Unit –III: International Politics and Intentional Organization

Cuban Missile Crisis; Vietnam War, Oil Crisis, Afghan Civil War, Gulf War, Collapse of the Soviet Union, Yugoslav Crisis, War on terrorism, Bin-Laden. Fall of dictatorship in Syria, Libia, Egypt and Iraq and global political equations. Organs of UNO and their powers, General Assembly, Security Council, International Court of Justice; ILO, UNICEF, WHO, UNESCO, ASEAN, APEC, EU, SAARC, NAFTA.

Unit –IV: Contemporary Global Concerns:

Democracy, Human Rights, Ecology, Gender Justice, Global commons, Communication Non Aligned Movement, Indo- China, Indo- Russia and Indo- Pak relations, India and other countries. India's relation with Africa and Latin America. India and South East Asia; ASEAN. India and the major powers: USA, EU, China, Japan and Russia. India and the UN System:

India's role in UN Peace Keeping and global disarmament. India and the emerging international economic order; multilateral agencies-WTO, IMF, IBRD, ADB. India and the question of nuclear weapons: NPT and CTBT

Books

1. Palmer & Perkins, Intentional Relations
2. Robert H. Jackson, Introduction to International Relations: Theories and Approaches
3. Joshua S. Goldstein , International Relations (5th Edition)
4. John Baylis, The Globalization of World Politics: An Introduction to International Relations

Course Code	Course Title		L	T	P	Total
B18AL3020	**Money, Banking and Public Finance**	HC	3	1	0	4

Course Objective:

This course is an introduction to the behavioral science of economics which focuses on interest rates, the concept of money, exchange rates, and monetary policy. Topics covered include banking structures and function, the Federal Reserve, determinants of the money supply, fiscal policy and monetary policy, and international economies.

Learning Outcomes - The students should be able to:

- Comprehend the need, definition, functions and economic significance of financial institutions and markets
- Understand the interdependence between financial markets and interest rates comprehend the behavioral analysis of interest rates: risk, liquidity and term structure identify the role played by the Central Bank and instruments of credit control.
- Grasp the conduct of monetary policy and its effect on interest rate, credit availability, prices and inflation rate

Unit –I: Introduction

An Overview of the Financial System Saving and Investment Money, Inflation and Interest Banking and Non-Banking Financial Intermediaries, Financial Markets and Instruments Money market and Capital Markets Financial Instruments: REPO, TBs, Equities, Bonds, Derivatives, etc. Characteristics of Financial Instruments: Liquidity, Maturity, Safety and Yield

Unit –II: Financial Markets

Principles of Financial Markets and Interest Rates Understanding Interest Rates Risk and Term Structure of Interest Rates Interdependence of Markets and Interest Rates Rational Expectations and Efficient Markets

Unit –III: Banking

Economics of Banking (Depository) Institutions Banking Institutions: Revenues, Costs and Profits, Basic Issues and Performance of Depository Institutions Asymmetric Information and Banking Regulation. Central Banking, Monetary Policy and Regulation the RBI as a Central Bank: Structure, Functions and Working Reforms, The Current Regulatory Structure

Unit –III: Monetary theory

Essentials of Monetary Theory the Classical and Keynesian Theories of Money, Prices and Output Rational Expectations and Modern Theories of Money and Income. Conduct of Monetary Policy and Interlinkages Objectives and Targets of Monetary Policy Lags and Intermediate Targets Rules Vs. Discretion in Monetary Policy Interlinkages.

Books

1. L M Bhole and Jitendra Mahakud, Financial Institutions and Markets, TataMcGraw-Hill, 2009.
2. F S Mishkin, The Economics of Money, Banking, and Financial Markets, Prentice Hall, 2007.
3. S B Gupta, Monetary Economics, S Chand Limited, 1988.
4. Economic Survey, Ministry of Finance, Government of India.

Course Code	Course Title		L	T	P	Total
B18AL3030	**Exploration in Social Inequalities**	HC	3	1	0	4

Course Objective:

This course aims to examine social inequality and stratification more closely. The aim is to look at the distribution of key social resources to groups and individuals, as well as theoretical explanations of how unequal patterns of distribution are produced, maintained, and challenged. You will also be exposed to classical and contemporary theories of inequality and stratification, particularly in areas structured along lines of caste, class, race and gender, data on the extent of social inequality and stratification in India and abroad. In addition, interlocking systems of privilege are scrutinized so we can theorize how they maintain and reproduce inequality. This class will provide you with a foundation for understanding social inequality in its multiple and intersectional forms. This is a writing intensive course and to promote the learning of course material, writing assignments will be assigned throughout the semester.

Learning Outcomes - The students should be able to:

- Comprehend the theoretical distinctions between social differentiation, inequality and stratification
- Understand the different axis of inequality- class, caste, race and gender
- Understand 'intersection', and how inequality needs to be understood inter-sectional
- Gain a better understanding of how our own experiences are both the products and producers of larger stratification systems.
- Develop the ability to apply theoretical understanding of social

Unit I: Framework of Social Inequality & Stratification

- General Overview: Social differentiation, Inequality and Stratification
- Basis of Social Stratification
- Social Resources and Inequality: Meaning, Nature, Origin and Measures of Inequality
- Forms of Social Stratification: Sex and Gender; Race and Ethnicity; Caste and Class
- Individual and Social Mobility:
  - Status Attainment
  - Social Reproduction
  - Intersecting inequalities

Unit II: Gender Inequality

- General Overview: Sex, Gender and Biology
- Gender Socialization and Gender Stereotypes
- Patriarchy and Production
- A: Gender Inequality at Home
- B: Gender Inequality in Public
- Ideology of Sexism: "Biology as Destiny"
- Domestic Violence, Sexual Harassment and Rape
- Gender, Power and Resistance

Unit III: Class Inequality

- General Overview: Class Inequality, Social Class: Development of Social Class; Criteria of Class distinction; Functions of social class
- Class Consciousness and Class Conflict
- Class and Social Mobility
- Class and Culture
- Classical Perspectives on Class: Marxian Analysis; Max Weber's Analysis; Contemporary Debates on Class

Unit IV: Caste Inequalities and Racial Inequality

- General Overview: Caste Inequalities
- Caste System: Meaning, Nature and Origin
- Caste and Religion
- Caste Inequality and Discrimination
- Caste Stereotypes
- 'Dominant Caste' and 'Sanskritization'
- Contemporary Significance of Caste and Caste System
- General Overview: Racial Inequality
- Race: Meaning, Nature and Origin
- Race and Privilege
- Ethnicity and Race
- Race, Racism and Social Inequality
- Racial Stereotypes, IQ controversy
- Caste and Race: A Comparison

Books

1. Oomen T.K(eds.),Classes, Citizenship and Inequality- Emerging Perspectives, Pearson Education India, 2010
2. Gupta Dipankar(ed.), Social Stratification, Oxford India Paperbacks, New Delhi, 1991
3. Sharma K.L, Social Stratification in India-issues and themes, Sage Publications, 1992
4. Levine Rhonda, Social Class and Stratification, Rowman & Littlefield Publishers, Inc., 1998
5. Dill and Zambrana(ed.), Emerging Intersections: Race, Class, and Gender in Theory, Policy, and Practice, Rutgers, 2009
6. Charles E. Hurst, Social Inequality: Forms, Causes, and Consequences,6th ed. Pearson, 2007
7. Allan G. Johnson, Privilege, Power, & Difference,2nd ed., McGraw-Hill, 2004.
8. Yadav Neelima, Gender, Caste and Class in India, Pragun Publication, 2006
9. Babu and Khare(eds.), Caste in Life-Expriencing Inequalities, Pearson, 2010
10. Kamla Bhasin, Understanding Gender, New Delhi: Kali for Women, 2000

Course Code	Course Title		L	T	P	Total
B18AL3040	**Constitutional Law-I**	HC	3	1	0	4

Course Objective:

This course will endeavor to help budding attorneys understand the meaning and nature of Constitutional law and governance in India. The philosophy of Constitutionalism and its impact on people's lives through the implementation of Fundamental Rights will be the intellectual focus of the course. Academic attention will be given to Constitutionalism, Fundamental Right and Directives Principles. Students are expected to analyze the importance of protection of Human Rights given effect through various judicial interpretations of the Supreme Court.

Learning Outcomes - The students should be able to:

- Explain the meaning and history of Constitutional law and its implication in the life of a nation. Appreciate the inter-relationship between rights and duties and the significance of a written instrument guaranteeing basic rights.
- Understand the meaning and significance of the preamble to the Constitution. Citizenship and the various legal aspects surrounding citizenship in light of international legal principles.
- Understand the nature, meaning and the controversies surrounding the principle of "equality". The various interpretation of equality with specific emphasis on Indian Supreme Court judgments on equality.
- Appreciate the enforcement mechanisms ingrained in the Constitution for the enforcement of fundamental rights. Articles 32 and 226 and the various writs and the role they have played in the enforcement of fundamental rights.
- Analyses of doctrinal foundations of a 'welfare state'. The cohesion between fundamental right and directive principles is of critical significance.

Unit 1: Introduction to Constitutional law; Preamble and Citizenship

- Meaning and Nature of Constitutional Law
- Historical origins of Constitutional Law- Role of the Constituent Assembly and Objectives Resolution
- Constitutionalism-Meaning and Nature
- Preamble- Meaning and Significance
- Citizenship- Basic Principles, Rules of Citizenship, Acquisition and termination of Citizenship

Unit 1I: Gateway to Fundamental Rights: Concept of State and the meaning of Law

- Concept of State and Fundamental Rights. Meaning and Definition of Law
- Doctrine of Equality and the finer dimensions of equality
- Reservation debate and the abolition of equality; abolition of titles
- The domain of freedoms: Reasonable restrictions as a limitation on the right to freedoms.
- Self-Incrimination-Double jeopardy-ex post facto law
- Right to Life and Due Process versus Procedure established by Law.
- Other aspects of life and liberty- Protection of Offenders, Protection against forced labour.
- Freedom of Religion.
- New Generation Rights: The "Rights Revolution" in India in the context of Article 21- The Right to Bodily Sovereignty
- Right to a corruption free government
- Right to Inter-Generational Equity
- Right to Cultural Heritage

Unit II: Right to Constitutional Remedies:

Writs- Meaning, Nature and maintainability of Writ Petitions

- Habeous Corpus
- Mandamus
- Certiorari
- Quo Warranto
- Prohibition
- Difference between Articles 32 and 226
- PIL's and the Locus Standii liberalization debate

Unit IV: Directive Principles of State Policy:

- Directive Principles- Nature and Meaning
- Fundamental Rights and Directive Principles: The interaction and the Supremacy debate
- Various Directive Principles enshrined in the Indian Constitution
- Enforceability of Directive Principles of State Policy
- Fundamental Duties of Citizens.

Reference Books:

1. V.N. Shukla, Constitution of India, Eastern Book Company
2. M.P. Jain , Constitutional Law, Lexis Nexis Wadhwa publication
3. Mamta Rao, Constitutional Law, Eastern Book Company

Other books you may want to consider are:

4. H.M.Seervai , Constitutional Law of India, Universal Publication

Course Code	Course Title		L	T	P	Total
B18AL3050	**Law of Contract -II**	HC	3	1	0	4

Course Objectives:

The object of the course is primarily aimed at a building up of knowledge which must lead to an effective understanding of the specific contracts stated in the Indian Contract Act, The Indian Partnership Act, the Sale of Goods Act and other forms of special contracts. The course on specific contracts is closely related to the basic course on the law of contracts, which has been taught during the first semester. The general principles, which are the foundations of any contract, are consequently already known, which should normally aid the assimilation of the subject matter.

Learning Outcomes - At the end of the course the student is expected:

- to be familiar with some of the specific contracts enshrined in the Indian Contract Act, 1872;
- to be acquainted with different forms of business associations such as Agency and Partnership and to build an understanding of the rights and duties of the parties in agency and partnership agreements;
- to understand the dynamics in sale of goods in India as governed by the Sale of Goods Act, 1930; and
- to understand the use of negotiable instruments in everyday commerce

Unit I: Contracts of Indemnity and Guarantee

- Contract of Indemnity – Nature and definition;
- Rights of indemnity holder;
- Commencement of liability;
- Contract of Guarantee – Nature and definition;
- Essential features of guarantee;
- Extent of surety's liability, discharge of surety;
- Rights of the surety.

Unit II: Contracts of Bailment and Pledge

- Bailment – Nature and definition;
- Essential features;
- Rights and duties of bailor and bailee;

- Pledge – Nature and definition;
- Rights of pawnor and pawnee.
- Agency – Definition and kinds of agency;
- Essentials of agency;
- Modes of creation of agency;
- Duties and rights of agents;
- Authority of agent – express, implied, and ostensible authority,
- Liabilities- liability of principal & agent;
- Termination of agency.

Unit III: Contracts for Sale of Goods

- The Sale of Goods Act 1930 – purpose of the Act;
- Sale, Agreement to sell;
- Difference between sale and agreement to sell;
- Caveat Emptor, Caveat Venditor, Nemo dat quod non habet;
- Condition and warranties;
- Passing of property, rules relating to passing off property;
- Rights of the unpaid seller.

Unit IV: Negotiable Instruments

- Negotiable Instruments – Definition, Nature and Types.
- Characteristics, Rights and Obligations of Parties.
- Rules of honour and dishonor on presentment.
- Endorsements, accommodation and notices.
- Criminal Liability for non-payment of cheque.

Books

1. Avtar Singh, Contract & Specific Relief, 11th Ed., Eastern Book Company, 2013.
2. Anson's Law of Contract, Beatson, Burrows and Cartwright (Eds), 29th Ed., Oxford University Press, 2010.
3. Moitra's Law of Contract and Specific Relief, 6th Ed., Universal Law Publishing Co., 2012.
4. Chitty on Contracts, Volume 1 & II, 29th Ed., Sweet & Maxwell, 2004.
5. Pollock & Mulla, The Indian Partnership Act, GC Bharuka (Ed), 7th Ed., Lexis Nexis Butterworths Wadhwa Nagpur, 2011.
6. Pollock & Mulla, The Sale of Goods Act, Satish J Shah (Ed), 8th Ed., Lexis Nexis Butterworths Wadhwa Nagpur, 2011.
7. Khergamvala on the Negotiable Instruments Act, BM Prasad & Manish Mohan (Eds), 21st Ed., Lexis Nexis Butterworths Wadhwa Nagpur, 2013.
8. Avtar Singh, Negotiable Instruments, 4th Ed., Eastern Book Company, 2005.

Course Code	Course Title		L	T	P	Total
B18AL3060	**Sports/Yoga/Music/Dance/Theater**	SC	0	0	2	2

Course Code	Course Title		L	T	P	Total
B18AL3070	**Moot Court**	HC	0	0	2	2

Course Code	Course Title		L	T	P	Total
B18AL3080	**Summer Internship**	HC			2	2

Fourth Semester

Course Code	Course Title		L	T	P	Total
B18AL4010	**Public Policy and Public Administration**	HC	3	1	0	4

Course objective:
To make the student understand the importance of public administration from its crucial role in the governing of a society. All the great human events in history were probably achieved by what we today would call public administration. Organization and administrative practices in collective or public settings are as old as civilization. The field of public policy has assumed considerable importance in response to the increasing complexity of the government activity. The advancements of technology, changes in the social organization structures, rapid growth of urbanization added to the complexities. The study of Public Policy aspires to provide an in-depth understanding of the ills prevailing in the society and aids to identify the solutions for them.

Learning Outcomes - The students should be able to:

- Analyze the transformations in public administration with emphasis on current initiatives and emerging challenges in the field.
- Analyze public administration in a fast changing environment of globalized phenomenon.
- Enumerate the important mechanism for moving a social system from the past to the future and helps to cope with the future.
- Elucidate basic areas of public policy on the largest gamut of its canvas.

Unit I: Introduction

- Meaning, Nature, Scope and importance of Public Administration
- State and Evolution of Public Administration and present status
- Politics & Administration Dichotomy-Woodrow Wilson and F.J. Goodnow
- Globalization and Public Administration
- Nature, Scope and Importance of Public Policy
- Evolution of Public Policy and Policy Sciences
- Public Policy and Public Administration

Unit II: Approaches

- Classical Approach
- Human Relations and Behavioural Approach
- Ecological Approach

Public Policy Analysis

- The Process Approach
- The Logical Positivist Approach
- The Phenomenological Approach
- The Participatory Approach and Normative Approach

Unit III: Principles of Public Administration

- Division of Work and Coordination, hierarchy, Unity of Command and Span of Control
- Delegation, Centralization and Decentralization
- Line and Staff and Administrative Planning
- Leadership and Supervision
- Communication and Public Relations.
- Theories and Models of Policy Making
- Perspectives & Institutions of Policy Making Process
- Concept and Techniques of Policy Implementation
- Concept of Policy Evaluation
- Constraints of Public Policy Evaluation

Unit IV: Emerging Trends

- Public Accountability and Social Accountability
- New Public Administration: Minnowbrook I, II& III
- New Public Management
- Public Administration in Transition
- Global Policy Process
- Transnational Actors: Impact on Public Policy Making
- Impact of Globalization on Policy Making

Books

1. Avasthi & Maheshwari (2012), Public Administration, Lakshminarayan Agarwal, Agra
2. Anderson J.E., (2006) Public Policy-Making: An Introduction, Boston, Houghton
3. Henry, Nicholas (2006), Public Administration and Public Affairs, Prentice Hall of India, New Delhi.
4. Donald Menzel and Harvey White (eds) (2011). The State of Public Administration: Issues, Challenges and Opportunities, New York, M. E. Sharpe.
5. Journals: Indian Journal of Public Administration New Delhi -1
6. M. Lakshmi Kanth- Indian Politics

Course Code	Course Title		L	T	P	Total
B18AL4020	**Law of Crimes (IPC 1860)**	HC	3	1	0	4

Course Objectives:

Crime and Punishment has been the one of the most important task of rule of law of the State. This course is designed with a prime object to familiarize students with the principles of criminal liability and other concepts of substantive criminal law. Crime is a phenomenon studied by several disciplines from several perspectives and methodologies. The lawyer must have an acquaintance with such knowledge in order to make criminal justice serve the goals of social defense. Subsequently, a study of the basic concepts of Criminal Law is undertaken, followed by a study of specific offences under the Indian Penal Code.

Learning Outcomes - The students should be able to:

- Examine the historical background to the codification of Indian Penal law and its implication on the criminal justice administration.
- Analyze the principles of criminal liability and other concepts of substantive criminal law.
- Comprehend key cases, legal terms, clauses, chronologies in Criminal Law.

- Articulate informed opinion over important, controversial issues in Criminal Law.

Unit I: General Introduction

- Historical development of Penal Law
- Nature, definition and essentials of Crime.
- Criminal Law and Morality.
- Mens Rea, Actus Reus and Criminal Liability
- Meaning, origin and development of Mens rea, Intention, Motive, Knowledge, Recklessness and Negligence.
- Mens Rea and Socio-Welfare offences, Socio-Economic offences
- Basis of liability: Joint liability, Vicarious liability, Strict liability, Absolute liability Under IPC 1860

Unit II: Elements of Criminal Liability

- Common intention
- Unlawful assembly
- Abetment: Instigation, aiding and conspiracy
- Criminal conspiracy
- Guilty intention - mere intention not punishable
- Preparation,
- Attempt: Attempt when punishable - specific provisions of IPC
- Commission of an offence.
- Mistake of fact, not mistake of law
- Accident, Act done in good faith for the benefit of victim
- Right of private defence (Sec 76-106)
- Death: Social relevance of capital punishment
- Alternatives to capital punishment
- Imprisonment - for life, with hard labor, simple imprisonment
- Forfeiture of property, Fine, Discretion in awarding punishment.

Unit III: Specific offences against the Human Body

- Culpable homicide
- Murder
- Causing death by negligence
- Abetment of suicide
- Attempt to commit the above three offences
- Causing miscarriage, exposure by children.
- Hurt (Simple & Grievous)
- Wrongful restraint & Wrongful confinement
- Criminal force & assault
- Kidnapping, Abduction, Slavery & forced labours
- Unnatural offence
- Dowry death
- Cruelty against women by husband or relatives
- Outraging modesty of women
- Insulting the privacy of women
- Rape- Custodial & Marital

Unit IV: Offences against Property & New kinds of Crimes

- Theft
- Extortion

- Robbery and Dacoity
- Criminal Misappropriation of Property & Criminal Breach of Trust
- Terrorism
- Pollution
- Food Adulteration

Reference Books:

- Ratanlal & Dhirajlal , *The Indian Penal Code,* Wadhwa & Company (2011)
- K.D.Gaur, *Criminal Law Cases and Materials*, Lexis Nexis
- Prof. S.N. Misra, *Indian Penal Code*, Central Law Publications(2013)
- Smith & Hogan's, *Criminal Law,* Oxford University Press
- Glanville Williams, *Criminal Law*, Universal Law Publications

Recommended Reports:

- Justice V.S. Malimath Committee report on reforms of Criminal Justice System
- The Wolfenden Report on Homosexual offences and Prostitution
- Justice J.S. Verma Committee report on amendments to Criminal Law

Course Code	Course Title		L	T	P	Total
B18AL4030	**Public International Law**	HC	3	1	0	4

Course Objective:

To acquaint the students with the basics of Public International Law and practice and the "general" part of international law, i.e. questions of law making, sovereignty, jurisdiction, responsibility, enforcement, the settlement of disputes, and specific topics such as the use of force.

Learning Outcomes: On completion of this unit you should be able to:

- Through all components, clear demonstration of the ability to present coherently and also achieve clarity in oral and written exercises will be assessed.
- Students should have a good understanding of the legal structures underpinning international relations.
- Understand the basic doctrines and concepts of public international law
- Critically discuss the limits and potentials of international law as a
- technique of public policy
- Analyze contemporary issues from the perspective of international law

Unit – I: Introduction

Nature and basis of International Law, definition of International Law, Subjects of International Law, Relationship between Municipal Law and International Law, Sources of International Law (Treaties custom, general principles, recognized by civilized Nation, ICJ decisions).

Unit –II: Subjects of International law

Essentials of statehood, not fully sovereign states and other entities, right and duties of states, modes of acquisition and loss of state territory, state responsibility. Recognition and State succession: Concept of recognition, theories, kinds (De facto, De jure recognition) and consequences of recognition, recognition, Basis of jurisdiction, Sovereign immunity, diplomatic privileges and immunities.

Unit-III: **Recognition and Law of the Sea**

Making of Treaty, Reservations to treaty, Pacta sunt servanda, modes of termination of treaty, UN and other treaty-based organizations, Law of international organizations, Law of the Sea: Territorial Sea, Contiguous Zone, Exclusive Economic Zone, Continental Shelf & High Sea.

Unit – IV: International Organizations

The Basic modification, post charter in the position: Nationality, extradition, Asylum, UNO & Human Rights, UDHR, Covenant on Civil Political Rights, 1966, Covenant on Economic Social and Cultural Rights, 1966, ICJ.

Text books:

1. Starke – Introduction to International Law
2. Oppenheim - International Law
3. Brownlie – Principles of International Law
4. S.K. Kapoor- Public International Law

References:

1. Shaw - International Law

Course Code	Course Title		L	T	P	Total
B18AL4040	**Constitutional Law-II**	HC	3	1	0	4

Course Objectives:

This course is specifically designed keeping in mind the requirements of students who need to be trained rigorously in the essentials of Constitutional Law. It seeks to develop a range of appropriate legal skills for budding lawyers and introduce students to a range of intellectual perspectives, ideas and traditions that have influenced the development of Constitutionalism in India. The course is a study in the fundamentals of Constitutionalism, the branches of government, Constitutional Institutions and their interrelationships and the importance of judicial interpretations in unravelling the dynamics of institutional interrelationship in our country.

Learning Outcomes - The students should be able to:

- Analyze and research relevant issues in Constitutional law.
- Enumerate Constitutionalism so as to enable them to learn the operations of state institutions, constitutional functionaries and other key areas of Constitutional law.
- Acquired the skills to appreciate complex issues in the realm of Constitutional law and introducing them to the method of comparative scholarship in Constitutional law to the extent necessary for undergraduate students.

Unit I: Nature of Federalism in India & Forms of Government

- Essential character of Indian Federalism.
- Indian Federalism distinguished from US Federalism.
- Federalism as part of the basic structure.
- Centre-State relations in the Indian Constitutional framework.
- Parliamentary versus Presidential form of government.
- Indian Parliamentary model versus US Presidential model.

Unit II: Executive, Legislature & Judiciary

- Powers and Functions of the President in India.
- Relationship of the President with the Prime Minister and the Council of Ministers.
- Power and Functions of the Prime Minister and the Council of Ministers.
- Role of the Governor.
- Power and Functions of Chief Ministers and Council of Ministers

- Parliament and State Legislatures-Bicameral Character and constitution, Composition of the House of States and House of the People, Duration, Qualification and disqualification of members, Conduct of Business, Office of Profit, Power, Privileges and Immunities of Parliament and its Members, role of the Speaker/Chairman.
- Local Self-governing institutions.
- Nature of Indian Judicial System with its distinctive feature, Supreme Court of India and its various powers, Appointment of Supreme Court Judges.
- Appointment of High Court Judges and conditions of office, Various Powers, Establishment of Common High
- Court, Constitution of Bench, Transfer of a judge. Control over subordinate judiciary.

Unit III: Financial, emergency powers

- Power of Taxation, Allocation of Taxing Power, Central, State Taxes and Concurrent Taxes, Fees, Restrictions on the power to Tax, Tax Sharing, Grants in Aid, Finance Commission, Borrowing Power.
- Proclamation, effect, grounds, failure of constitutional breakdown.

Unit IV: Amending powers and Constitutional Institutions

- Comparison of the constitutional position with the position in the US. Basic structure philosophy.
- Election Commission, Union Public Service Commission, SC/ST Commission, Comptroller and Auditor General and the judicial trends in interpretation of constitutional principles for ensuring institutional autonomy.

Reference Books:

1. H.M.Seervai , *Constitutional Law of India*, 4th Edition, Universal Publication (2013) ISBN- 9788175344037
2. D.D. Basu, *Introduction to the Constitution of India*, 21st Edition, Wadhwa (2013) ISBN- 9788180389184
3. M.P. Jain , *Indian Constitutional Law*, 7th Edition, Lexis Nexis Wadhwa publication (2014) ISBN-9789351430643.

Course Code	Course Title		L	T	P	Total
B18AL4050	**Administrative Law**	HC	3	1	0	4

Course Objectives:

This course is specifically designed keeping in mind the requirements of students who need to be trained rigorously in the essentials of Administrative Law. It seeks to develop a range of appropriate legal skills for budding lawyers and introduce students to a range of intellectual perspectives, ideas and traditions that have influenced the development of Administrative lawyering in India. The course is a study in the fundamentals of Administrative law, the principles that constitute the core of the subject, legislative and judicial functions of administration, judicial discretion among others, and the importance of judicial interpretations in unravelling the dynamics of administrative governance in our country. Contemporary debates surrounding administrative governance like Lokpal (Ombudsman) will be discussed in detail.

Learning Outcomes: On completion of this unit you should be able to:

- Student appreciate the nature and scope of the discipline. Fundamental debates in the subject like the interrelationship between the rule of law and administrative law, administrative law in the age of privatisation etc. which lie at the heart of its theoretical

foundation will be discussed in detail.

- Appreciate the idea that administration is not a stand-alone function but encompasses legislative dimensions.
- Understand the need for Administrative tribunals. Contrasting the institution with full-fledged law courts.
- Appreciate the institutionalised limitations on the exercise of administrative power.
- Understand the concept of civil and criminal liability of administrators in the exercise of their functions

Unit I: Evolution and Scope of Administrative Law

- Meaning and nature of Administrative law.
- Scope of the discipline.
- Rule of Law and its complex interrelationship with Administrative law.
- Relationship between Constitutional law and administrative law.
- The role of administrative role in the age of privatisation.
- Classification and function of administration
- Necessity for vesting administration with legislative functions.
- Constitutional issues in administrative law making
- Comparative position with USA, UK
- Control of legislative functions

Unit II: Judicial functions of Administration

- Need for devolution of adjudicatory authority on administration.
- Administrative Tribunals– Constitution, powers, procedures, rules of evidence.
- Principles of Natural Justice – Rule against bias, Audi Alteram Partem Exceptions to the principle of Natural Justice

Unit III: Administrative Discretion and Judicial Control of Administrative Action

- Need for conferring discretion on administrative authorities and its relationship with rule of law.
- Court as the final authority to determine the legality of administrative action.
- Constitutional imperatives and exercise of discretion.
- Grounds of judicial review: Abuse of discretion, Failure to exercise discretion, Exhaustion of Administrative remedies.
- Locus standi, Laches, Res judicata
- Doctrine of legitimate expectations, Doctrine of Proportionality, Public Accountability

Unit IV: Methods of judicial review & Ombudsman

- Statutory appeals,
- Writs – Habeas Corpus, Mandamus, Certiorari, Prohibition and Quo warranto,
- Declaratory judgements and injunctions,
- Civil Suits for Compensation
- Concept of personal liability for Administrators
- Forms of liability: Civil liability, Criminal liability
- Meaning of Ombudsman
- Need for Ombudsman
- Lokayukta and Lokpal

Reference Books:

- M.P.Jain & S.N.Jain, Principles of Administrative Law
- I.P. Massey, Administrative Law
- Wade, Administrative Law
- C.K. Takwani, Lectures on Administrative Law

- S.P. Sathe, Administrative Law
-

Course Code	**Course Title**		L	T	P	Total
B18AL4060	**MOOC/Swayam/EDX/CM Certification**	SC	0	0	2	2

Course Code	**Course Title**		**L**	**T**	**P**	**Total**
B18AL4070	**Moot Court**	HC			2	2

Course Code	**Course Title**		**L**	**T**	**P**	**Total**
B18AL4080	**Soft Skill**	SC	0	0	2	2

Fifth Semester

Course Code	**Course Title**		**L**	**T**	**P**	**Total**
B18AL5010	**Anatomy of Political Institutions (Political Science V)**	HC	3	1	0	4

Course Objectives:

This course facilitates you to understand the approaches to the study of Political Institutions in an informed and efficient manner. The module helps you to acquire the knowledge that is vital in understanding the working of Political Institutions in a State. To help you in understanding the principles in the study of Comparative Politics. To help you in interpreting the dynamics of challenges in Political Institutions.

Learning Outcomes: On completion of this unit you should be able to:

- To develop conceptual knowledge of Political Institutions in a country.
- To understand the studies related to Indian Administration.

Unit I: Structure of State Government:

- Governor
- Chief Minister and Council of Ministers
- Secretariat and Directorates
- Inclusive Growth,- Structures for Inclusive Growth
- Welfare responsibilities of State Government

Unit II: Organizing the state

- Constitutions-UK, USA, China, Switzerland and India.
- Unitary State, Federations and Confederations
- Non-democratic systems

Unit III: Government Structures

- Legislature- Political executive Composition and powers, Norms of representation Legislative supremacy
- Judiciary: Judicial review, judicial interpretations of FRs and DPSPs and basic structure doctrine, judicial activism.
- Bureaucracy

- Military and Police
- Accountability: Legislative and Executive Control
- Lokpal and Lokayukt
- Right to Information

Unit IV: Local Government & Urban Government

- Constitutional provisions before 1992-73
- 74th amendments Panchayat Raj system
- Municipalities- Municipal Corporation

Books

1. R. A. W. Rhodes, Sarah A. Binder, Bert A. Rockman, The Oxford Handbook of Political Institutions
2. Austin Granville,1972, The Indian Constitution: Cornerstone of a Nation, New Delhi, OUP
3. Austin Granville, 1999, Working a Democratic Constitution: The Indian Experience, New Delhi, OUP
4. Almond G. and B. Powell, 1988, Comparative Politics Today: A World view, Chicago, Foresman

Course Code	Course Title		L	T	P	Total
B18AL5020	**Family Law –I**	HC	3	1	0	4

Course Objectives:

This course is intended to familiarize students with the Hindu Law and its philosophy as extant in India. Emphasis will be both on the origin and development of Hindu law. It attempts to examine the legal principles and the legalese, in connection with, Hindu marriage and Divorce, Inheritance and Succession to property, Guardianship, Maintenance and Adoption

Learning Outcomes: On completion of this unit you should be able to:

- To analyse the uncodified and codified aspects of Hindu Law.
- To summarize the Hindu law relating to marriage, divorce, adoption, guardianship, joint family property, maintenance. To conceptually analyse the meaning of a 'Hindu'.
- To examine the traditional and modern sources of Hindu law and its contribution in the development of respective legislations.
- To understand the concept of Joint family property, Karta and coparcenary. To examine the partition related aspects of assets and liabilities of a Hindu joint family.
- To analyse the rules relating to Hindu Marriage, adoption, property and crucial judicial decisions through case studies.

Unit I: Introduction

- Nature of evolution of family
- Sphere of Personal Law
- Persons governed by Hindu Law
- Ancient source of law - the Vedas, Dharmashastras and contribution to law, the Srutis, the Smritis and customs.
- Modern Sources of Law - Precedents, Legislature, Justice, equality and good conscience.
- Origin of schools of Hindu Law: Mitakshara and Dayabhaga School of law

- Differences between Mitakshara and Dayabhaga School of law, sub schools of Mitakshara
- Effect of migration.
- The Hindu Joint family and role of Karta.
- Joint family property, coparcenary system, devolution of property as per ancient law.

Unit II: Law on Marriage

- Marriage as an institution – As defined in various religious forms and types, Marriage as a religious part of civil life
- Various forms and requirements of a valid marriage
- Issues on a religious marriage form and law under Special Marriage Act
- Unisex marriage and question on living together and its legal validity
- Restitution of conjugal rights, Judicial separation, Nullity of marriages - Void, voidable and valid marriage
- Divorce, Divorce by mutual consent, jurisdiction and procedure.
- In camera proceedings, maintenance during pendency of the suit, maintenance after the dissolution of marriage and conditions, maintenance under Cr.P.C.– Permanent alimony

Unit III: Succession, Adoptions and Maintenance Under Hindu Law

- Application of the Act - Definitions, Act do not apply to certain properties, Devolution of interest in coparcenary property
- General rules of succession in the case of males, order of succession among class I heir, class II heirs, agnates and cognates
- Property of a Hindu female to be her absolute property, general rules of succession in the case of Hindu females, order of succession in the case of Hindu females
- Special provisions respecting persons governed by Marumakkattayam and Aliyasantana laws, full blood, half blood and uterine blood, disqualification to inherit, escheat and testamentary succession
- Application of the Act - Definitions, Pre-requisites for valid adoption, Capacity of a male Hindu to take in adoption, capacity of a female Hindu to take in adoption, persons capable of giving in adoptions, persons who may be adopted, conditions for valid adoptions
- Effects of adoption, right of adoptive parents to dispose of their properties, valid adoption not to be cancelled
- Maintenance of wife, widowed mother, widowed daughter-in-law, children and aged parents, dependents, Quantum of maintenance, debts to have priority.

Unit IV: Law on Hindu Minority and Guardianship

- Guardian under the Guardian and Wards Act, Eligibility for appointment
- Procedure of application – who can apply, what are powers, what matters court would consider for appointment of a guardian, cessation of authority , general and special liability of a guardian,
- Natural guardian and his/her power, Incapacity of minor to act as guardian of property, De facto guardian not to deal with minor's property
- Structure of Family court, procedure to be adopted, jurisdiction

Books:

- Hindu Law by Mulla
- Other books you may refer:

- Modern Hindu Law by Paras Diwan
- Modern Hindu Law by G.C.V. Subba Rao
- Modern Hindu Law by U.P.D. Kesari

Course Code	Course Title		L	T	P	Total
B18AL5030	**Law of Evidence**	HC	3	1	0	4

Course Objectives:

The law of Evidence has its own significance amongst Procedural Laws. The knowledge of law of Evidence is indispensable for a lawyer. The course is designed to acquaint the students with the rules of evidence in relation to relevancy of facts and proof. In addition they are introduced to law relating to production of evidence. The course teacher shall familiarize the students with appreciation of evidence and use innovative techniques like simulation exercises wherever necessary.

UNIT- I: Introduction

Distinction between substantive and procedural law- Conceptions of evidence in classical Hindu and Islamic Jurisprudence- Evidence in customary law systems (Non-state law)- Introduction to the British 'Principles of Evidence'- Legislations dealing with evidence (other than Indian Evidence Act) with special reference to CPC, Cr.P.C., Bankers Book Evidence Act, Commercial Document Evidence Act, Fiscal and revenue Laws- Salient features of the Indian Evidence Act, 1861, Applicability of the Indian Evidence Act. Central Conceptions in Law of Evidence – Facts - Facts in issue and relevant facts- Evidence- Circumstantial and direct evidence- Presumptions, proved, disproved, not proved- Witness- Appreciation of evidence.

Relevancy of Facts- Facts connected with facts in issue Doctrine of Res gestae; Sections 6, 7, 8 and 9 of Evidence Act- Evidence of Common Intention-Section10, Relevancy or otherwise irrelevant facts- Facts to prove right or custom (Section13)-Facts concerning state of mind/state of body or bodily feelings (Sections 14 and 15) - Relevancy and admissibility of admissions, privileged admissions- evidentiary value of admissions (Sections 17 to 23).

Unit II: Relevancy and admissibility of confessions:

Admissibility of information received from an accused person in custody- Confession of co-accused (Sections 24 to 30) – Admitted facts need not be proved (Section 58); Dying declaration- Justification for relevance- Judicial standards for appreciation of evidentiary value-Section 32 (1) with reference to English Law -Other statements by persons who cannot be called as witnesses- (Sections 32(2) to (8), 33)- Statement under special, circumstances (Sections 34 to 39); Relevance of judgments- General principles – Fraud and collusion (Sections 40 to Sec. 44); Expert testimony: General principles (Sections 45-50) - Who is an expert- Types of expert evidence – Problems of judicial defence to expert testimony.

Character evidence- Meaning – Evidence in Civil Criminal cases; (Sections 52-55)- Oral and documentary Evidence -Introduction on Proof of facts- General principles concerning oral; Evidence (Sections 59-60)- General principles concerning documentary; Evidence (Sections 61-90)- General principles regarding exclusion by evidence (Sections 91-100).

Unit III: Burden of Proof:

The general conception of onus probandi (Section 101)- General and special exception to onus probandi (Sections102-106)- The justification of presumption and burden of proof (Sections 107 to 114) with special reference to presumption to legitimacy of child and presumption as to dowry death- Doctrine of judicial notice and presumptions. Estoppel: Scope of Estoppel - Introduction as to its rationale (Section 115)- Estoppel distinguished from Res judicata -

Waiver and Presumption- Kinds of Estoppel- Equitable and Promissory Estoppel- Tenancy Estoppel (Section 116).

Unit-IV: Witness, Examination and Cross Examination:

Competence to testify (Sections 118 to 120)-Privileged communications (Sections 121 to 128)- General principles of examination and cross examination (Sections 135 to 166)- Leading questions (Sections 141- 145)- Approver's testimony (Section 133)- Hostile witnesses (Section 154)- Compulsion to answer questions (Sections 147, 153)- Questions of corroboration(Sections 156-157)- Improper admission of evidence.

Books

- Ratanlal and Dhirajlal - Law of Evidence.
- Reference Books:
- Best - Law of Evidence.
- Sarkar - Law of Evidence.
- M. Rama Jois - Legal and Constitutional History of India.
- Batuklal - Law of Evidence.

Course Code	Course Title		L	T	P	Total
B18AL5040	**Corporate Law**	HC	3	1	0	4

Course Objective

- To encourage the development of students' skills in legal reasoning and analysis through study of statutes, case law and regulatory practice relating to Company Law.
- To introduce students to the economic function of the company as a legal structure for business, to its advantages and disadvantages compared to other structures available such as the partnership and the limited liability partnership, and in particular to the company's limited liability.
- To explain the legal nature and significance of limited liability and the price which those using a company as a business structure are required to pay for it.
- To provide students with knowledge and appreciation of the major core topics in Company Law including the legal nature of the company as a business structure, the legal implications of separate corporate personality including limited liability, the validity of contracts made with companies, the role of the board of directors and their legal duties as directors and the legal protection of shareholders.
- To facilitate an appreciation of the legal basis of the control exercised by a company's board of directors over a company's management and affairs, the legal limitations and constraints on this control and the effectiveness of these limitations and constraints in practice.
- To facilitate an appreciation of the legal nature of the relationships between a company and its management on the one hand and the various groups with an interest in the affairs of the company (or 'stakeholders') on the other, these stakeholders including the company's shareholders, creditors and employees.
- To provide students with an awareness of current policy trends and developments in Company Law.

Learning Outcomes: On completion of this unit you should be able to:

- Analyze the relevant statutory materials, case law and regulatory practice relating to the major topics in Company Law
- Understand the economic function of the company as a legal structure for business, the legal nature and significance of the limited liability of a company, the price paid for limited

liability, the legal nature of the role of the board of directors of a company and of the legal relationships between a company's management and its various stakeholders.

- Familiar with the current policy trends and developments in Company Law and of the likely impact of these trends and developments on the major topics in Company Law.

Unit I: Introduction to Corporate Law

Evolution of law relating to corporate law in UK, USA and in India – Corporate personality – Registration and Incorporation of a company – Kinds of Companies - Promoters.

Unit II: Management of Corporate Affairs

Management and control of companies - Shares – Shareholders – Share capital - Board of Directors - Responsibilities and Duties of Directors – CSR - Majority rule and minority rights - Protection of minority shareholders – Oppression and Mismanagement - Remedies in case of mismanagement - Accounts and audit - Divisible profits - Appointment of statutory auditors - Powers and duties.

Unit III: Corporate Reconstruction, Merger and Amalgamation

Strategic Planning and formulation towards Corporate reconstruction – Compromises and arrangements with members and creditors – Role of Tribunal - Introduction and meaning of amalgamation and merger - Reasons and objectives of merger - Categories of merger - Sick industrial Companies - Important provisions of Sick Industrial Companies (Special Provisions) Act, 1985 - Revival of sick companies – Amalgamation in public interest – Defunct companies- Appointment of Administrator.

Unit IV: Winding up

Introduction and meaning - Kinds of winding up - Winding up through court - Grounds for winding up by the Court - Rights of filing petition for winding up before the court - Provisions and procedures - Voluntary winding up and winding up under the supervision of Court - Kinds of voluntary winding up - Provisions and procedure - Consequences of winding up - Appointment of liquidators, powers and duties of liquidators - Process of winding up - Offences and penalties for defaults - Officers in defaults; - Recovery of damages - Compounding of offences.

Course Code	Course Title		L	T	P	Total
B18AL5050	**Labour Law - 1**	HC	3	1	0	4

Objective: In this course, the students are to be acquainted with the Industrial relations framework in our country. Further, the importance of the maintenance of Industrial peace and efforts to reduce the incidence of Strikes and Lockout and Industrial Strike are to be emphasized. The main theme underlying the course is to critically examine the provisions in the Trade Unions Act, 1926; the machineries contemplated under the provisions of the Industrial Disputes Act for the prevention and settlement of Industrial Disputes, Industrial Employment (Standing Orders) Act, 1946 and Disciplinary Enquiry for Misconduct are to be studied with a view to acquaint misconduct and the procedure to be followed before imposing punishment for misconduct alleged and established. Further, the students are to be acquainted with Social Security Frame-work prevailing in our Country. It is necessary to know the concept of social security, its importance and also constitutional basis for the same in India. The importance of ensuring the health, safety and welfare of the workmen and social assistance and social Insurance Schemes under various legislations are to be emphasized. The provisions in the Workmen's Compensation Act, 1923, the machinery provided for protecting the interests of workers. Further, the objectives underlying the Factories Act,1948, E.S.I. Act, 1948, the employees provident fund Act,1952 are to be studied with a view to acquaint the students with various rights and benefits available to the workmen under the legislations.

Learning Outcomes: On completion of this unit you should be able to:

- Take stock of the jurisprudential facets of labour policy and underscores the need for industrial peace and the role played by the judiciary, especially in India.
- Examine the all important aspect of resolution of industrial disputes from different angles as a means of ensuring industrial harmony.
- Analyse aspect of standing orders and the pragmatic requirements of domestic inquiry of workmen for misconduct.
- Gather the growth of trade unions, collective bargaining process as an important tool of workers and the rights and immunities of trade unionists.
- Underscores the judicial interpretation of doctrine of the notional extension of employment with respect to the liability of an employer to pay compensation under prescribed circumstances.

Unit- I Industrial Disputes Act:

Introduction to Law of Industrial Disputes Act, 1947: Historical Aspects-Master and slave relationship-Industrial revolution-Laissez-faire state-Impact of Constitution on Labour provision; Definition and law relating to Appropriate Government- Award and settlement-Industry-Industrial Dispute- Workman. Strikes and Lock-out

Unit II: Industrial Disputes Act, 1947:

Lay-off –Retrenchment-Closure - Unfair Labour Practices and Role of Government; Authorities under the Act (Chapter II) to be read with chapters II B, III and IV Adjudication and Arbitration; Restrictions on the right of the employer-Chapter IIA-Notice of change, section 11-A and sections 33,33A; Recovery of money due from an employer. Industrial Employment (Standing Orders) Act, 1946 and Disciplinary Enquiry

Unit III: Trade Unions Act, 1926:

Salient features of the enactment and important definitions, Registration of Unions, Amalgamation of Unions, Cancellation and Registration of Trade, Unions, Funds of the Union, Immunity enjoyed by the Union. The Employees State Insurance Act, 1948: Corporation, Standing Committee and Medical Benefit Council; Contributions; Benefits; Adjudication of disputes and Claims; Penalties.

Unit IV: Labour Welfare Legislations:

The Employees Provident Fund Act, 1952: Employees Provident Fund Scheme and Authorities; Miscellaneous. The Maternity Benefit Act, 1961- Its object and its scope. The Minimum Wages Act, 1948- Fixation of minimum rates of wages - working hours and determination of wages and claims The Factories Act- its essential features, Safety, Health and Welfare measures.

Books

- S. N Mishra - Labour Laws
- S. C Srivastava - Social Security and Labour Laws.
- Reference Books:
- Malhotra O. P - Industrial Disputes Act Vol. I and II.
- Madhavan Pillai - Labour and Industrial Laws.
- Srivastava K. D - Commentaries on Industrial Disputes Act, 1947.
- V. V Giri - Labour problems in Indian Industry.

Course Code	Course Title		L	T	P	Total
B18AL5060	**Transfer of Property**	HC	3	1	0	4

Courser Objective:

This course is intended to familiarize students with the concepts and incidents of diverse transfers of immovable property. Emphasis will be on the substantive law relating to different transfers. It attempts to make an exposure into the intricacies of law involved in transfer of immovable property in contradistinction to movables.

Learning Outcomes: On completion of this unit you should be able to:

- To analyse the concept of 'property' and 'transfer'. To study the objectives of Transfer of Property Act, 1882 from a historical perspective.
- To appreciate the application and relevance of doctrines of 'election' and 'lis pendens' in property related matters.
- Analyses the underlying legal principles in respect of different kinds of mortgages and charge of properties.
- To understand the rights and liabilities accruing to transferor and transferee in case of sale, gift and exchange and how these transactions are effected.
- To make a comparative study in the concept of trust with debt, contract, bailment, agency and ownership.
- To examine the rights and liabilities of trustee and beneficiary.

Unit 1: General Principles of Transfer of Property

- General principles of Transfer of Property by Act of parties' inter-vivos.
- Concept and meaning of immovable property; Transferable Immovable Property; Persons Competent to transfer; Operation of Transfer.
- Conditions restraining alienation and restrictions repugnant to the interest created.
- Rule against perpetuity and exceptions; Direction for accumulation; Vested and Contingent interest.

Unit II: General Principles of Transfer of Property

- Doctrine of election; Transfer by ostensible and co-owner; Apportionment; Priority of rights; Rent paid to holder under defective title; Improvements made by bonafide holder.
- Doctrine of Lis pendens; fraudulent transfer and part-performance.

Unit III: Immovable Property

- Mortgages of Immovable property: Definition; Kinds of mortgages and their features.
- Rights and liabilities of mortgagor and mortgagee; Priority of securities; Marshalling and contribution, Charge.
- Sale of immovable property; Rights and liabilities of seller and buyer before and after completion of sale; Difference between sale and contract for sale.
- Creation of lease; rights and liabilities of lessor and lessee; Determination and holding over.
- Exchange: Definition and mode; Actionable Claims
- Scope & Meaning of Gifts; Mode of transfer; Universal gifts; onerous gifts.

Unit IV: Law of Trusts with Fiduciary Relations

- Concept of Trust and its comparison with other transfers such as Debt, Ownership, Bailment, Agency and Contract.
- Kinds of Trusts; Creation of Trust; Appointment of Trustees; Duties and Liabilities of Trustees.
- Rights and Powers of Trustees; Disabilities of Trustee; Rights and Liabilities of the Beneficiary; Vacating the office of trustee and Extinction of Trusts.

Books:

1. Mulla, Transfer of Property Act 1882, 11th edition, 2012, LexisNexis.
2. G.C.V. Subba Rao, Law of Transfer of Property (Easement, Trust and Wills), 5th edition, 2007, Vol I & II.
3. M.P. Tondon, Indian Trust Act 1882, 22nd edition, 2014, Allahabad Law Agency.
4. Goyle's, A Commentary on the Transfer of Property Act, 2001, Eastern Law House.
5. S.N. Shukla, Transfer of Property Act, 28th edition, 2011, Allahabad Law Agency.
6. R.K. Sinha, Transfer of Property Act, 12th edition, 2011, Allahabad Central Law Agency.
7. G.P. Tripathi, Transfer of Property Act, 7th edition, 2011, Allahabad Central Law Publications.

Course Code	Course Title		L	T	P	Total
B18AL5070	**Soft Skills**	HC	0	0	2	2

Course Code	Course Title		L	T	P	Total
B18AL5080	**Summer Internship (Evaluation)**	HC	0	0	2	2

Sixth Semester

Course Code	Course Title		L	T	P	Total
B18AL6010	**Political Science VI Comparative Political Governance**	HC	3	1	0	4

Courser Objective:

This module facilitates you to understand the approaches to the study of Comparative Politics in an informed and efficient manner. The module helps you to acquire the knowledge that is vital in understanding the concepts of Comparative Politics and the studies related to it.

Learning Outcomes: On completion of this unit you should be able to:

- To develop conceptual knowledge of Comparative Politics
- To evaluate the challenges of diversities.
- Development and understanding of concepts and applying them to day to day as evidenced from case studies and research articles.

Unit I: Approaches to the Study of Comparative Politics

- System Theories, Culture Theories, Class Theories, Developmental Theories
- Sovereignty, Authority, and Power
- Citizens, Society and the State
- Public Policy

Unit II: Organizing the state

- Nation States-UK, USA, China, France, Germany and India.
- Economic, Political powers
- Federalism-Devolution of power, Regionalism, Casteism and Communalism

Unit III: Electoral Systems:

- First past the post,
- proportional representation,
- mixed systems
- Development and Underdevelopment Developmentalism: The debate of Impact of Liberalization and Globalization

Unit IV: Comparing Regimes:

- Authoritarian and Democratic
- Classifications of political systems:
    - Parliamentary and Presidential: UK and USA
    - Federal and Unitary: Canada and China
- Comparative Study of: Party Systems Pressure Groups Social Associations

Books

1. Bara, J & Pennington, M. (eds.). (2009) Comparative Politics. New Delhi: Sage.
2. Caramani, D. (ed.). (2008) Comparative Politics. Oxford: Oxford University Press.
3. Chilcote, Ronald, Theories of Comparative Politics: The Search for a Paradigm Reconsidered, Boulder, Westview Press, 1994
4. Hardtm, Michael and Antonio Negri, Empire, Cambridge, Harvard University Press, 2000.
5. Manor, James edited, Rethinking Third World Politics, London, Longman, 1991
6. O'Neil Patrick, 2004, Essentials of Comparative Politics, New York, W.W. Norton and Co

Course Code	Course Title		L	T	P	Total
B18AL6020	**Family Law-II**	HC	3	1	0	4

Courser Objective:

The Course is an overview of Islamic law covering its religious historical and contemporary dimensions. The addresses first the religious and historical foundations of Islamic law before going on to address its application in contemporary jurisdictions. The course aims to give students a basis from which the richness and complexity of Islamic law may be explored further. The module concentrates on various aspects of Islamic law including family law, gifts, wakfs and some other areas of law, succession and Indian Divorce Act and Special Marriage Act

Learning Outcomes: Students completing this Course are expected to have knowledge and understanding of the foundations and principles of Islamic law. In particular they should be able to:

- Describe the origins and sources of Islamic law;
- Describe the history of Islamic law and appreciate its role in the contemporary world
- Explain the main features of the administration of Islamic justice including: the role and function of Islamic courts, role of judges, evidence and proof;
- Compare and contrast the operation of Islamic law in relation to matters concerning crime, contract, tort, family and succession

Unit I: Introduction to Mahomedan Law

- Who are Mohamedans
- Conversion to mahomedanism
- Mahomedian sects and sub-sects
- The Koan, Hadis, Ijmaa Qiyas

- Interpretation of the Koran
- Precepts of Prophet
- Ancient texts
- General rules of interpretation of Hanafi Law

Unit II: Marriage, Divorce and Maintenance

- Definition of Marriage
- Capacity for Marriage
- Essentials of Marriage
- Kinds of Marriage
- Iddat period
- Marriage between Sunni and Shia Law
- Presumption of Marriage
- Muta marriage
- Marriage of Minors
- Repudiation under the Dissolution of Muslim Marriage Act, 1939
- Divorce by Husband
- Judicial divorce at suit of wife
- Effects of Divorce
    - Maintenance of Wives
    - Suits of restitution of Conjugal rights
- Dower**:** Definition Kinds of Dower Suit for dower and limitation
- Widow's right to retain possession of husband's estate in lieu of dower

Unit III: Succession and Administration

- Administration of the estate of a deceased Mahomedan – general rules
- Vesting of estate in executor and administrator
- Devolution of inheritance
- Extent of liability of heirs for debts
- Distribution of estate
- Hanafi Law of Inheritance
- Shia Law of Inheritance
- Wills: Persons capable of making wills, Limit of testamentary power
- Conditions necessary for its validity
- Death-bed acknowledgment of debt
- Persons capable of making gifts
- Gift to unborn person
- Extent of donor's power
- Gift of Actionable Claim & incorporeal property
- Gift of equity or redemption
- Relinquishment by donor of ownership and dominion
- Essentials of Gift
- Contingent gift
- Revocation of gift & Kinds of gift.
- Wakfs: Definition, Subject of Wakf Object of Wakf, Law relating to private wakfs before the Mussalamn Wakf Validating Act, 1913
- Guardianship of person and property of Minor

Unit IV: Indian Succession Act, Indian Divorce Act & Special Marriage Act

- Preliminary, Jurisdiction, Dissolution of Marriage, Nullity of Marriage, Judicial separation, Restitution of Conjugal Rights, Alimony, Settlements, Re-marriage.

- Domicile (Ss 4-19), Consanguinity (Ss 23-28)
- Intestate Succession (Ss 29-56)
- Testamentary Succession (Ss 57-191)
- Probate, Letters of Administration of assests of deceased
- Succession of Certificate (Ss 370-390)
- Indian Divorce Act
- Special Marriage Act 1954

Books

1. Mulla Principles of Mahomedan Law
2. Mohammedan Law by Aqil Ahmad
3. Muslim Law in Modern India by Dr. Paras Diwan
4. Muslim Law by Dr. R.K.Sinha
5. Outlines of Mohammedan Law by A.A. Fyzee.
6. Indian Succession Act by Parruck
7. Indian Succession Act by Basu
8. Indian Succession Act by Paras Diwan
9. Indian Divorce Act by Manchand
10. Marriage and Divorce by Kumud Desay

Course Code	Course Title		L	T	P	Total
B18AL6030	**Criminal Procedure Code, Probation of Offenders Act & Juvenile Justice (Care And Protection Of Children) Act.**	HC	3	1	0	4

Courser Objective:

To familiarize the students with the crucial aspects relating to investigation and trial of offences (like initiation of criminal cases, powers and duties of police during investigation of offences, stages of criminal trial, functions, duties, and powers of criminal courts) To sensitize the students about critical issues in administration of criminal justice (like protection of human rights of accused, victims, principles of fair trial)

Learning Outcomes:

- At the end of the course, the students will be able to: l. Identify the stages in investigation and procedure of trial in criminal cases
- Explain the powers, functions, and duties of police and criminal courts
- Critically analyze the recent amendments in the Cr PC
- Employ and promote adoption of humane and just practices in administration of criminal justice

Unit I:

- Concept and types of criminal justice system,
- Nature and scope of Criminal Procedure-
- Preliminary Considerations: Classification of offences, hierarchy of Criminal Courts,
- Functionaries under the Code -the Organisation of the Police, FIR, Prosecutor and Defence Counsel- Cognizable and non-cognizable offences.

- Arrest: definition and types of arrest- Rights of arrested persons under Cr.P.C. and Article 22 (2) of the Constitution of India –
- Search and Seizure- Charge-charge, maintenance of public order and tranquility- F.I.R and Investigation, charge sheet
- Warrant and Summons.

Unit II:

- Trials: Various kinds of trials, concept of fair trials, hearing the accused, Judgement, Trial procedure in Criminal Cases- Plea bargaining procedure,
- General Provisions as to Inquiries and Trials, Provisions relating as to accused person of unsound mind, Provisions relating to judgement, Submission of Death Sentence for confirmation.
- Appeal – kinds of Appeal, when appeal is not permissible, Appeal in non-appealable cases, Powers of the Appellate Court.
- Reference, Revision and Transfer of cases: functions and significance- Execution, Suspension, Remission and Commutation of sentences.
- Bail: bailable and non- bailable offences and related provisions, Anticipatory Bail and Miscellaneous- inherent powers of High Court, Victims Compensation.

Unit III: Probation of Offenders

- Concept of Probation system-Origin and Development in India
- Admonition under the P.O. Act
- Release of offenders on Probation
- Release of young offenders
- Removal of Disqualification in attached to probation
- Appeal & Revision
- Removal of disqualification attached to conviction

Unit IV: Juvenile Justice (Care and Protection of Children) Act, 2015

- Power, composition, functions and procedure to be followed by the Juvenile Justice Board.
- Order that may or may not be passed regarding or against juvenile
- Offences against Children
- Institutions under J. J. Act
    - Observation Home
    - Special Home
    - Children Home
    - Shelter Home

Books

1. Ratanlal & Dhirajlal: The Code of Criminal Procedure, 20th Edition, 2011. Published by Lexis Nexis Butterworths Wadhwa Nagpur. ISBN: 9788180387081
2. R V Kelkar's - Lectures on Criminal Procedure, 4th Edition, Reprinted 2011. By: Dr K N Chandrasekharan Pillai. ISBN: 9789350281147.
3. Batuk Lal's Commentary on The Code of Criminal Procedure, 1973 with Special Chapter on "Plea Bargaining", 5th Edition, 2010 (2 Volumes), Orient Publishing Company. ISBN: 8187197056
4. Sarkar : The Code of Criminal Procedure, 10th Edition, 2012 (2 Volumes), Lexis Nexis Butterworths Wadhwa Nagpur. ISBN: 9878180387272
5. Woodroffe's Code of Criminal Procedure, 3rd Edition 2010 (2 Volumes), Law Publishers (India) Pvt. Ltd. ISBN : 8171110606.

Course Code	Course Title		L	T	P	Total
B18AL6040	**Civil Procedure Code and Law of Limitation**	HC	3	1	0	4

Corse Objective:

Civil Procedure Code is a subject of daily use by the courts and lawyers and a student cannot afford to have scant knowledge of civil procedure when he goes out to practice as a lawyer. True that it is through experience one gets expert knowledge of civil procedure. However, it is necessary to have good grounding in the subject before one enters the profession. While the substantive law determines the rights of parties, procedural law sets down the norms for enforcement. Whenever civil rights of persons are affected by action, judicial decisions will supply the omissions in the law. The course also includes law of limitation.

Learning Outcomes: On completion of this unit you should be able to:

- Make reasoned choices in relation to the court where the suit is to be filed, the essential forms and procedure for institution of suit, the documents in support and against etc.
- Interpret the statute of limitation that fixes a period within which a case has to be filed.
- Master the rules of pleading and trial.

UNIT – I

Introduction; Distinction between procedural law and substantive law- History of the code, extent and its application, definition; Suits: Jurisdiction of the civil courts- Kinds of jurisdiction-Bar on suits- Suits of civil nature (Sec.9); Doctrine of Res sub judice and Res judicata (Sec. 10, 11 and 12); Foreign Judgment (Sec.13, 14); Place of Suits (Ss. 15 to 20); Transfer of Cases (Ss. 22 to 25). Institution of suits and summons: (Sec. 26, 0.4 and Sec. 27, 28, 31 and O.5); Interest and Costs (Sec. 34, 35, 35A, B); Pleading: Fundamental rules of pleadings- Plaint and Written Statement- Return and rejection of plaint- Defences- Set off- Counter claim; Parties to the suit (O. 1): Joinder, misjoinder and non-joinder of parties- Misjoinder of causes of action- Multifariousness.

UNIT – II

Appearance and examination of parties (O.9, O.18) - Discovery, inspection and production of documents (O.11 & O.13) - First hearing and framing of issues (O.10 and O.14) - Admission and affidavit (O.12 and O.19) - Adjournment (O.17) - Death, marriage-Insolvency of the parties (O.22) - Withdrawal and compromise of suits (O.23) - Judgment and Decree (O.20); Execution (Sec.30 to 74, O.21): General principal of execution- Power of executing court- Transfer of decrees for execution- Mode of execution- a) Arrest and detention, b) Attachment, c) Sale.

UNIT – III

Suits in particular cases; Suits by or against Governments (Sec. 79 to 82, O.27); Suits by aliens and by or against foreign rulers, ambassadors (Sec. 85 to 87); Suits relating to public matters (Sec. 91 to 93); Suits by or against firms (O.30); Suits by or against minors and unsound persons (O.32); Suits by indigent persons (O.33); Inter-pleader suits (Sec.88, O.35); Interim Orders; Commissions (Sec.75, O.26); Arrest before judgment and attachments before judgment (O.38); Temporary injunctions (O.39); Appointment of receivers (O.40); Appeals (Ss. 90 to 109, O.41, 42, 43, 45); Reference- Review and Revision (Ss. 113, 114, 115, O.46, O.46); Caveat (Sec. 144.A)- Inherent powers of the court (Ss. 148, 149, 151).

Unit IV Law of Limitation

The concept - the law assists the vigilant and not those who sleep over the rights. Object-Distinction with latches, acquiescence, prescription. Extension and suspension of limitation Sufficient cause for not filing the proceedings, Illness, Mistaken legal advice Mistaken view of law, Poverty, minority and Purdah, Imprisonment Defective vakalatnama, Legal liabilities, Foreign rule of limitation: contract entered into under a foreign law, Acknowledgement - essential requisites Continuing tort and continuing breach of contract.

Books

1. Mulla, Code of Civil Procedure (1999), Universal, Delhi.
2. C.K. Thacker, Code of Civil Procedure (2000), Universal, Delhi.
3. M. R. Mallick(ed.), B. B. Mitra on Limitation Act (1998), Eastern, Lucknow
4. Majumdar. P.K and Kataria. R. P., Commentary on the Code of Civil Procedure, 1908 (1998),
5. Universal, Delhi.
6. Saha. A. N., The Code of Civil Procedure (2000), Universal, Delhi.
7. Sarkar's Law of Civil Procedure, Vols.(2000) Universal, Delhi. Universal's Code of Civil Procedure, (2000).

Course Code	Course Title		L	T	P	Total
B18AL6050	**Labour Law II**	HC	3	1	0	4

Course Objective: The Labour laws in our country impose certain responsibilities on the employer and the government so as to provide support to the working class. The best form of support that can be offered to the workmen, by both the employer and the government, is providing financial support in situations of need like accident, retirement, death, etc. In India such social security and other welfare measures have been statutorily recognized and are being implemented. In the present course the students are required to do an extensive study on some social security and other economic and welfare legislations.

Learning Outcomes: On completion of this unit you should be able to:

- Underscores the judicial interpretation of doctrine of the notional extension of employment with respect to the liability of an employer to pay compensation under prescribed circumstances.
- Analyse the social security for women workers with reference to maternity benefit and the winds of change envisaged therein.
- Explain the rationale behind and the need for minimum wage, and the study of the relevant statutory provisions.
- Underscores the concept of payment of wages and the legal regime for it while. The necessity and provisions for provident fund and miscellaneous matters are also discussed.

UNIT- I – Labour Welfare:

- Philosophy of Labour Welfare; Historical Development of Labour welfare legislation; Health, Safety and welfare measures under Factories Act, 1948;
- Welfare of women and child labour: Protective provisions under Equal Remuneration Act & Maternity Benefit Act.
- **Law relating to wages and bonus:** Theories of wages: marginal productivity, subsistence, wage fund, supply and demand, residual claimant, standard of living Concepts of wages (minimum wage, fair wage, living wage, need-based minimum wage); Constitutional provisions; components of wages:
- Minimum Wages Act, 1948: Objectives and constitutional validity of the Act; procedure for fixation and revision of minimum rates of wages – exemptions and exceptions; Payment

of Wages Act, 1936: Regulation of payment of wages; Authorized Deductions, 2.3 Payment of Bonus Act; Bonus - Its historical background, present position and exemptions ; Payment of Bonus (Amendment) Act, 2007.

UNIT II: Social security against employment injury and other contingencies:

- Concept and development of social security measures; Employers liability to pay compensation for employment injury; Legal protection: Workmen's Compensation Act, 1923 – Concept of 'accident arising out of' and 'in the course of the employment'; Doctrine of notional extension and doctrine of added peril; Total and partial disablement; Quantum and method of distribution of compensation.

UNIT III: Contract Labour:

- Problems of contract labour; Process of contractualisation of labour; The Contract Labour (Regulation and Abolition) Act, 1970 - Its object and its essential features.
- Legal protection: Contract Labour (Regulation and Abolition) Act, 1970; Controversy regarding Abolition of contract labour and their absoption; Land mark cases: Air India Statutory Corpn. V. United Labour Union, (1997) & SAIL case (2002); proposed amendment and its impact on the contract labour.
- **Unorganized Sector:** Problem of Definition and Identification; Unionization problems Historical backdrop of proposed bills on social security for unorganized sector (2004, 2005 & 2007); Unorganized Sector Workers' Social Security Act, 2008.
- **Protection of Weaker Sections of Labour:** Problems of bonded labour, bidi workers, domestic workers, construction workers inter-state migrant workmen; Legal protection: Bonded Labour System (Abolition) Act, 1976; Inter State Migrant Workmen (Regulation of Employment and Conditions of Service) Act, 1979

UNIT IV: Law relating to retirement benefits:

- Employees Provident Fund and Miscellaneous Provisions Act, 1952; Family Pension Scheme 1971 and Employees' Pension Scheme 1995;
- The changing rules regarding Employees Provident Fund and Pension Schemes;
- Payment of Gratuity Act, 1972 – Concept of gratuity; Eligibility for payment of gratuity; Determination of gratuity; Forfeiture of gratuity.

Acts

1. Workmen's Compensation Act, 1923
2. Maternity Benefit Act, 1961
3. Payment of Wages Act, 1936
4. Minimum Wages Act, 1948
5. Payment of Gratuity Act, 1972
6. Employees State Insurance Act, 1948.

Books

1. K.D.Srivastava, Commentaries on Minimum Wages Act, 1995, Eastern Book Co.
2. K.D.Srivastava, Commentaries on Payment of Wages Act, 1998, Eastern Book Co.
3. S.B.Rao, Law and Practice on Minimum Wages, 1999

Course Code	Course Title		L	T	P	Total
B18AL6060	**Soft Skills**	HC	0	0	2	2

Course Code	Course Title		L	T	P	Total

B18AL6071	**Criminology and Penology**	SC	3	1	0	4

Corse Objective:

Criminology is the scientific analysis of criminal behavior, of criminalization processes and of the processes of social control. Criminology is also an applied discipline. As such, it studies interventions that help resolve conflicts and problems in society. This course offers a specialist understanding of criminal policies including theories of punishment, their supposed philosophical and sociological justifications and the problem of exercise of discretion in sentencing.

Learning Outcomes: On completion of this unit you should be able to:

- Recognize, define, and understand core issues in criminology.
- Additionally, students are expected to gain a working knowledge of the key elements of the content(s) identify and to develop critical thinking in these areas.

Unit- I: The study of Criminology & Theories of Causation of Crime I

- its nature and elements of crime;
- criminal law and criminal behavior;
- Delinquency and Crime; purpose of criminal law.
- pre-classical school;
- the classical school,
- the neo-classical school,
- the positive school and
- the cartographic school.

Unit II : Theories of Causation of Crime II

- the socialist school;
- the typological/bio-typological school;
- the psychiatric and sociological school;
- the multiple-factor approach towards crime.

Unit III: Methods of studying Crime

- Statistical Application in Criminological Research; Sources of Crime Statistics in India and Crime Trends.
- Research Questions and Hypotheses; Research Design; Sampling, Data Collection, Data Analysis, Interpretation and Report Writing;

Unit IV:

- Notion of punishment in law;
- Difference between crime prevention and control;
- Theories of punishments.
- Kinds of punishment; Sentencing policies and processes;
- The riddle of capital punishment.

Books

1. Richard R. Korn, Lloyd W. McCorkle, *Criminology and Penology* 1-356 (Holt, Rinehart and Winston, New York, 1961).
2. E.H. Sutherland, D.R. Cressey, *Criminology,* (J.B. Lippincott Co., Philadelphia, 1978).
3. Roscoe Pound, *Criminal Justice in America* (Dacapo, New York).
4. Hans Toch (ed.), *Legal and Criminal Psychology,* (Holt, Rinehart and Winston Inc, New York, 1961).

5. Mabel A. Elliott, *Crime in Modern Society* (Harper and Brothers, New York, 1952).
6. B. R. Sharma, S*cientific Criminal Investigation*, (Universal Law Publication, Delhi, 2006).

Course Code	Course Title		L	T	P	Total
B18AL6072	**Information Technology Law**	SC	3	1	0	4

Course Objective: The course aims at appreciating one of the important emerging areas of law and the nitty-gritty involved in it. This introduces the students to the underlying philosophy of the subject and its relation to other areas focusing on human rights.

Learning Outcomes: On completion of this unit you should be able to:

- Provide legal advice on ICT related matters across jurisdictions and work anywhere in the world.
- They should be able to perform interdisciplinary and comprehensive regulatory, analytical, and expert work in the field of IT Law.
- Having all necessary skills to face the challenges posed by the extraterritoriality, novelty, and complexity of its problems.

Unit-I: Concept of Information Technology and Cyber Space- Interface of Technology and Law -Jurisdiction in Cyber Space and Jurisdiction in traditional sense - Internet Jurisdiction - Indian Context of Jurisdiction - Enforcement agencies -International position of Internet Jurisdiction - Cases in Cyber Jurisdiction

Unit-II: Information Technology Act, 2000- Aims and Objects — Overview of the Act – Jurisdiction –Electronic Governance – Legal Recognition of Electronic Records and Electronic Evidence -Digital Signature Certificates - Securing Electronic records and secure digital signatures - Duties of Subscribers - Role of Certifying Authorities -Regulators under the Act - The Cyber Regulations Appellate Tribunal - Internet Service Providers and their Liability– Powers of Police under the Act – Impact of the Act on other Laws .

Unit-III:E-Commerce - UNCITRAL Model - Legal aspects of E-Commerce - Digital Signatures - Technical and Legal issues - E-Commerce, Trends and Prospects - E-taxation, E-banking, online publishing and online credit card payment - Employment Contracts - Contractor Agreements, Sales, Re-Seller and Distributor Agreements, Non-Disclosure Agreements- Shrink Wrap Contract ,Source Code, Escrow Agreements etc. Cyber Law and IPRs-Understanding Copy Right in Information Technology -Software - Copyrights vs Patents debate - Authorship and Assignment Issues - Copyright in Internet - Multimedia and Copyright issues - Software Piracy –Patents - Understanding Patents - European Position on Computer related Patents - Legal position of U.S. on Computer related Patents - Indian Position on Computer related Patents –Trademarks -Trademarks in Internet - Domain name registration - Domain Name Disputes & WIPO

Unit-IV: Cyber Crimes - Meaning of Cyber Crimes –Different Kinds of Cybercrimes – Cybercrimes under IPC, Cr.P.C and Indian Evidence Law - Cybercrimes under the Information Technology Act, 2000 - Cybercrimes under International Law – Hacking Child Pornography, Cyber Stalking, Denial of service Attack, Virus Dissemination, Software Piracy, Internet Relay Chat (IRC) Crime, Credit Card Fraud, Net Extortion, Phishing etc - Cyber Terrorism - Violation of Privacy on Internet - Data Protection and Privacy- Databases in Information Technology -Protection of databases - Position in USA,EU and India

Suggested Readings:

1. Kamlesh N. & Murali D.Tiwari(Ed), IT and Indian Legal System, Macmillan India Ltd, New Delhi

2. K.L.James, The Internet: A User's Guide (2003), Prentice Hall of India, New Delhi
3. Chris Reed, Internet Law-Text and Materials, 2nd Edition, 2005, Universal Law Publishing Co., New Delhi
4. Vakul Sharma, Hand book of Cyber Laws, Macmillan India Ltd, New Delhi
5. S.V.Joga Rao, Computer Contract & IT Laws (in 2 Volumes), 2005 Prolific Law Publications, New Delhi
6. T.Ramappa, Legal Issues in Electronic Commerce, Macmillan India Ltd, New Delhi
7. Indian Law Institute, Legal Dimensions of Cyber Space, New Delhi
8. Farouq Ahmed, Cyber Law in India
9. S.V.Joga Rao, Law of Cyber Crimes and Information Technology Law, 200 Wadhwa & Co, Nagpu

SEVENTH SEMESTER

Course Code	Course Title		L	T	P	Total
B18AL7010	**Environmental Law**	HC	3	1	0	4

Course Objective: The Environmental law programme, in contrast to other law curricula, has certain characteristics which make it unique and is one of the best instruments for breaking the ice of colonial legal education. Its uniqueness lies in the fact that the problems it raises do not relate merely to specific individuals but about such matters as national development, industrial policy, policies concerning natural resources, injustice to communities, inter-generational equity and prevention of pollution. All these issues relate to problematic about construction of a just, humane and healthy society. Secondly, environmental law necessarily demands an inter-disciplinary approach. Thirdly, uniqueness of the subject is borne out by the new epistemological outlook which ecology-related knowledge has brought about in recent times. The development of ecological knowledge has necessitated an overall change not only in managerial studies but also in socio-legal explorations. This approach to the growing dimensions of environmental law is essential.

Learning Outcomes: On completion of this unit you should be able to:

- Understand the concepts of environment and pollution, and impresses upon them the need to protect the environment.
- Analysis historical perspectives of the environmental law and to elaborate the constitutional perspective of the environmental law.
- Get a comprehensive idea of Water and Air Pollution Acts and deals with the Environment Protection Act, Forest and wildlife, bio-diversity.
- Differentiate between the international environment protections regimes.

Unit-I: CONCEPT OF ENVIRONMENT AND POLLUTION

The Idea of Environment: Ancient and Medieval Writings, Traditions, Natural and Biological Sciences – Perspectives: Modern concept, Conflicting dimensions, recent issues -Environment and sustainable development - National and International Perspectives - Population and Development.

Unit-II: Environmental Policy and Law

Environmental Policy : Pre & Post Independence Period; From Stockholm to Johannesburg Declaration (Rio) and Role of Government - Five year Plans - Forest Policy - Conservation strategy - Water Policy; Conservation of Natural Resources and its Management; Constitution and Environment: Right to Environment - Constitutional provisions on Environment and its

Protection - Role of Judiciary on Environmental issues - Evolving of new Principles - Polluter pays principle - Precautionary principle - Public trust doctrine.

Unit-III: International Law and Environmental Protection

International conventions in the development of Environmental Laws and its Policy - From Stockholm to recent conventions (Special Emphasis on Major conventions & Protocols) - Control on Marine, Pollution; Common Law aspects of Environmental Protection; Remedies under other Laws (I.P.C., Cr.P.C, C.P.C.) - Riparian rights and prior-appropriation. Prevention and Control of Pollution: Pollution of Water, Sources, Legal Control, The Water Act, 1974 - Pollution of Air, Modalities of control, The Air Act, 1981 – Noise Pollution and its control, Noise Pollution control order - Disposal of Waste, laws on waste, disposal and its control - Trans-boundary Pollution hazards & Regulation;.

Unit-IV: Indian Legal Order:

Bio-diversity and Legal regulation - Utilization of flora and fauna - Experimentation on animals - Legal and Ethical issues – Genetic Engineering - Wildlife Protection Act, 1972 - Forest Conservation Act, 1980 – Prevention of Cruelty against animals - Problems in Legal regulation of medicinal plants - The plant varieties Act - Wetland Conservation, Environment Protection Act, 1986 including, Environment Protection Rules, Coastal Zone Regulation, ECO-Mark, Environment Impact Assessment, Environmental Audit, Public Participation in Environmental decision making, Environment information, public hearing, Regulation on Bio-Medical Waste.

Books

- Armin Rosencranz - Environmental Law and Its Policy in India.
- P. Leelakrishnan - Environmental Law in India /Cases.
- Lal's commentaries on Water and Air Pollution laws along with Environment (Protection) Act and Rules, 1986.
    - **Reference Books:**
- Simon Ball Stuart Bell - Environmental Law.
- Sanjay Upadhyay and Videh Upadhyay - Handbook on Environmental Laws.
- S. Shantha Kumar- Introduction to Environmental Law.
- Relevant Bare Acts/Notifications.

Course Code	Course Title		L	T	P	Total
B18AL7020	**Intellectual Property Rights**	HC	3	1	0	4

Course Objective: To conceptually analyze the fundamental aspects of intellectual property rights (IPR) and their role in the modern world. To examine the dynamic legal regime of IPR in the contemporary relations among nations along with contestation of these rights both at international and transnational level. To examine adoption of national legislation on IPR and establishment of government structures to administer such legislation.

Learning Outcomes: On completion of this unit you should be able to:

- Analyse the rationale behind protecting intellectual property. To examine major international instruments concerning the IPRs and their evolution.
- Study the legal regime for registration and enforcement of trademarks. To understand the concept of unfair competition as IPR.
  Examine the national and international response for protection of geographical indications and plant varieties.
- Analyse the concept of copyright in contradistinction to other IPRs.
- To understand the rights associated with designs and integrated circuits and the defences available in cases of right infringement.
- To understand the concepts of 'patentable' inventions, 'novelty', 'non-obviousness'

and ‘industrial applicability’. To examine the legal regime for patents, procedures for obtaining patents and remedies for patent infringement.

- To understand protection mechanism for Microorganisms and examine other emerging and grey areas of IPR.

Unit I: General Overview of Intellectual Property

- Introduction- History of IPR Protection Theories of IP.
- Rationale behind IP System, Philosophical Aspects of Intellectual Property Laws, Political economy of Intellectual Property.
- Patents, Geographical Indication, Biodiversity, biotechnology, farmers and breeders rights, trade secrets and technology transfer.
- Trademark, Copyrights, Industrial Designs Layout Design of Integrated Circuits.
- Information Technology and IPR, Biotechnology and IPR, IPR litigation and IPR transaction.
- Introduction to the leading international instruments concerning intellectual property rights.
- The Berne Convention, Universal Copyright Convention, the Paris Union.
- TRIPS the World Intellectual Property Rights Organisation (WIPO) and the UNESCO.
- Rationale for Intellectual Property Protection of Microorganisms.
- Moral Issues in Patenting Biotechnological inventions.
- Protection of IPR in Internet.
- Other emerging and grey areas of IPR.

Unit II: Copy Rights and Trademarks

- Historical evolution of the law relating to copyright.
- Copyright in literary, dramatic and musical works.
- Copyright in sound records, cinematograph films and Copyright in computer programme.
- Ownership & Assignment of copyright.
- Author's special rights.
- Notion of infringement and Criteria of infringement.
- Infringement of copyright by films of literary and dramatic works, Importation and infringement.
- Fair use doctrine.
- Aspects of copyright justice.
- Remedies, especially, the possibility of Anton pillar injunctive relief in India.
- Recent Landmark Foreign and Indian cases
- The rationale of protection of trademarks as an aspect of commercial and of Consumer rights.
- Unfair Competition, Passing off, Standards of proof in passing off action.
- Definition, concept of trademarks and Registration.
- Distinction between trademark and property mark.
- The doctrine of honest concurrent user.
- The doctrine of deceptive similarity.
- Protection of well-known marks.
- Remedies

Unit III: Geographical Indications and Plant Varieties

- Protection of Geographical Indications.
- Objectives, Justification, International Position.
- Multilateral Treaties, National Level, Indian Position.
- Plant Varieties Protection-Objectives, Justification.
- International Position, Plant Varieties Protection in India

Unit IV: Patent & designs

- Concept of patent, Historical view of the patents law in India.
- Patentable inventions with special reference to biotechnology products entailing
- Process of obtaining a patent: application, examination, opposition and sealing of
- Patents: general introduction.
- Procedure for filing patents. Patent co-operation treaty.
- Some grounds for opposition.
- The problem of limited locus standi to oppose, specifically in relation to inventions having potential of ecological and mass disasters.
- Wrongfully obtaining the invention.
- Prior publication or anticipation.
- Obviousness and the lack of inventive step, insufficient description.
- Rights and obligations of a patentee, Patents as chose in action.
- Duration of patents: law and policy considerations, Use and exercise rights.
- Right to secrecy, the notion of "abuse" of patent rights.
- Compulsory licenses, Special Categories.
- Employee Invention: Law and Policy Consideration.
- International Patents, Transfer of Technology, Know-How and problems of self-reliant development.
- Infringement, Criteria of infringement, Onus of Proof.
- Modes of Infringement: the Doctrine of Colourable Variation.
- Defences in suits of infringement.
- Injunctions and related remedies.
- Designs-Objectives, Rights, Assignments, Infringements.
- Defences for Design Infringement

Books:

1. Jayashree Watal, *Intellectual property rights in the WTO and developing countries*, Oxford University Press, 2001.
2. Robert Merges, Peter Menell, and Mark Lemley, *Intellectual Property in the New Technological Age*, Fifth Edition 2010.
3. Cormish W.R., *Cases and Materials on Intellectual Property*, 5th Edition (2006), Sweet & Maxwell London.
4. S.K Verma and Raman Mittal, *Intellectual Property Rights a Global Vision*, ILI 2004.
5. Gopalakrishnan N.S, *Intellectual Property Law*, 2008.
6. Timothy, Joshua & Edwin, *Properties of Law*, Oxford University Press, 2006.
7. Singh Raghbir, *Law Relating to Intellectual Property*, 2nd Edition, 2008, Vol., I, II, III, Universal Publishing
8. .Lionel Bentley & Brad Sherman, *Intellectual Property Law*, 3rd Edition, 2009, Oxford University Press.

Other books you may refer:

1. Daniel Gerwais Edi, Intellectual Property Trade and Development (Strategies to optimize Economic Development in a Trips-Plus Era), Oxford University Press, 2007.
2. Philippe Cullet, Intellectual Property Protection and Sustainable Development, Butterworth's, 2005.
3. Christopher Arup & William Van Caen gem, Intellectual Property Policy Reform, PEFC, Edward Elgar UK & USA, 2009.

Course Code	Course Title		L	T	P	Total
B18AL7030	**International Human Rights Law**	HC	3	1	0	4

Objective

The understanding of human rights is the foundation for the development of a good citizen and a responsible legal professional. The main objective of this course is to provide an insight into the meaning and significance of various human rights in the contemporary era and the mechanisms developed at the international and national level for protection and promotion of such rights. This course attempts to increase the knowledge of law students with respect to human rights; to focus their attention on the underlying values of human rights and to explore various international and national legal frameworks which embody human rights and promote them in practice.

Learning Outcomes On completion of the course the students will be able to:

- Compare the international human rights law system and regional human rights law systems;
- Evaluate the various mechanisms and procedures for human rights law enforcement;
- Critically assess specific areas of international human rights law with reference to relevant legal instruments and contemporary cases;
- Draft a legal document in the form of a submission, reasoned opinion, declaration or resolution concerning a specific area of human rights.
- Acquire basic competency in legal writing and research

Unit I: Introduction International Human Rights Law

Meaning and Concept of Human Rights, Theoretical Foundation of Human Rights-Natural Law and Natural Rights-History and Development of Human Rights: Ancient –Medieval-17th & 18th Century – 19th & 20th Century –Modern Developments-Generations of Human Rights - Civil and Political Rights-Economic, Social and Cultural Rights-Solidarity Rights- United Nations and Human Rights-UN Charter United Nations Commission on Human Rights (Human Rights Council) Sub-commission on Prevention of Discrimination and Protection of Minorities-Commission on Status of Women-UN Centre for Human Rights & UN Commissioner for Human Rights-Office of UN High Commissioner for Human Rights-UN High Commissioner for Refugees-Role of UN in Protection and Promotion of Human Rights

Unit II: International Human Rights Instruments

International Bill of Human Rights Universal Declaration of Human Rights, 1948 – Influence –Legal Significance-International Covenant on Civil and Political Rights, 1966-First Optional Protocol-Second Optional Protocol to ICCPR-International Covenant on Economic, Social and Cultural Rights, 1966-Optional Protocols to ICESCR, Regional System for Protection of Human Rights-The European Convention on Human Rights, 1950-The American Convention on Human Rights, 1969- African Charter on Human and Peoples Rights,1981-Arab Charter, 2004-Asian Human Rights Charter, 1998

Unit III: Implementation of Human Rights

UN Commission on Human Rights (Human Rights Council) The Human Rights Committee (CCPR) under ICCPR-The Committee on Economic, Social and Cultural Rights (CESCR)

under ICESCR-Treaty Bodies and Other Bodies- Human Rights of Vulnerable Groups-Women-Children-Minorities-Disabled person.

Unit IV: Human Rights in India

Rights under Indian Constitution-Application of International Human Rights Law in India-Role of Indian Judiciary-The Protection of Human Rights Act, 1993-Establishment, Powers and Functions of NHRC - Role of NHRC- Contemporary Challenges to Human Rights-Science and Technology-Terrorism

Books

1. Bajwa, G.S. and D.K. Bajwa, Human Rights in India: Implementation and Violations, D.K. Publishers, New Delhi (1996).
2. Basu, D.D., Human Rights in Constitutional Law, Prentice Hall, New Delhi (1994).
3. Sehgal, B.P.Singh, ed., Human Rights in India: Problems and Perspectives, Deep and Deep Publications, New Delhi (1999).
4. S.K.Avesti and R.P.Kataria, Law Relating to Human Rights, Orient Publications, New Delhi (2000).
5. SK Kapoor, Human Rights under International and Indian Law, Central Law Agency, Allahabad, (1999)
6. Symmonides, J., Human Right: International Protection, Monitoring and Enforcement, Rawat publications, New Delhi (2005)
7. Mamata Rao, Law Relating to Woman and Children, Eastern Book Co., Lucknow (2008)
8. G B Reddy, Woman and the Law, Gogia Law Agency, Hyderabad (2001).

SC Tripathi, Law Relating to Woman and Children, Central Law Publishers, Allahabad, (2001).

Course Code	Course Title		L	T	P	Total
B18AL7040	**Summer Internship**	HC			2	2

Course Code	Course Title		L	T	P	Total
B18AL7050	**Open Elective**	OE	3	0	1	4

Optional II

Course Code	Course Title		L	T	P	Total
B18AL7061	**Law Relating to Mergers & Acquisitions**	SC	3	1	0	4

Course Objective: The process of globalization and liberalization have brought a considerable awareness towards improving the competitive process in developing economies such as India. Until recently most of the developing countries operated without a structured competition policy, and have justified the intervention by the state over economic activities. India owing to its WTO obligations enacted Competition Act, 2002. The course seeks provide fundamentals of market economy and extensive knowledge of application of competition policy in India.

Learning Outcomes: On completion of this unit you should be able to:

- Explain the meaning, nature, object of law of M&A and also clarify the distinction between various businesses terms associated with M&A.

- Understand the Indian statues having bearing on M&A. It will also cover the statutory basis of different routes in M&A and the role of Regulatory agencies.
- Understand the implications in sale of undertaking with the help of decided cases, and be able analyse the procedural and substantive law applications of Mergers. Concept of arrangement and the need to obtain the consent of Creditors and members is discussed in detail in this unit.
- Understand the reasons for special treatment to banking companies, distinguish between the law and procedure of banking companies and the other companies and the law and procedure of share acquisition of companies under the Companies Act, 2013. It also enable them to know the distinction between the share acquisition in Companies Act and under the SEBI takeover Regulations.
- Analyze the practical knowledge on takeover regulations in India. It focus on the requirement of voluntary and compulsory disclosures during share acquisition and at the time of acquisition of voting rights and aims to provide the restrictions imposed by Competition Act, 2002 in approving certain mergers exceeding turn over and assets.

Unit I: Introduction to the Law of M&A

Concepts in M&A- Categories of M&A- Causes and Consequences of M&A. Provisions of the Companies Act, SEBI Act, Competition Act and other statutes- Routes of M&A- Regulatory authorities of M&A. Concepts and issues – Sale of an `undertaking' (slump sale) - Business transfer agreement of a `going concern'--Matters to be considered -Conveyance of immoveable property -Transfer of contracts, debts, licenses, intellectual property rights - Transfer of employees -Effect on mortgages and charges.

Unit II: Mergers & Arrangements Under 230-234

Procedure for effecting mergers / Demergers- Drafting of schemes of arrangements and other documentation- The role of the Court / Tribunal in sanctioning the scheme / implementation of the scheme -Modification of the scheme – who can and how? Rights of dissenting shareholders / creditors -Power of the Court to make incidental orders-Merger under Section 237- Law and procedure of merger of banking companies under the Banking Regulation Act, 1949 -The role of RBI in the merger of Banking companies -Comparison with merger procedure under Ss 230 – 237.

Unit III: Share Acquisitions under 235- 236

Who can invoke the provision? Squeezing out the minority – when and how-Requirements for invoking the provision – procedural and substantive law aspects – The price – procedure for transfer of the shares of the dissenting minority-Remedies available to the dissenting shareholders-Scope of judicial review. History of Takeover Regulations in India-Takeover Regulation, 1997 –Definitions – Compared with 2011. Threshold limits – Non-Compete fee – Directors Duties in Takeovers- Due Diligence- UK Takeover code.

Unit IV: Competition Law Issues in Mergers & Acquisitions

Existing position–Monopolies and Restrictive Trade Practices Act, 1969– no provisions for merger control- Comparative analysis of merger control / anti-trust laws in other jurisdictions. US, European Union- Competition Act, 2002- pre-notification of M & A Transactions to competition commission beyond certain threshold limits.

Books

1. Whish, Richard. Competition Law. London: Oxford University Press, 2009.
2. Furse, Mark. Competition Law of the EC and UK. London: Oxford University Press, 2008.
3. Rijn, Alphen aan den. The Reform of EC Competition Law: New Challenges, Austin.
4. Chao, Yang-Ching. International and Comparative Competition Law and Policies India. Kluwer Law International, 2008.

5. Rodriguez, A. E. The Limits of Competition Policy: The Shortcomings of Antitrust in Developing and Reforming Economies. Aspen Pub, 2010.
6. Dugar, S. M. Guide to Competition Law: Containing Commentary on Competition Act, MRTP Act and Consumer Protection Act. LexisNexis-Butterworths Wadhwa Nagpur, 2010.
7. Smith, Martin. Competition Law: Enforcement and Procedure. London: Oxford University Press, 2001.
8. Competition Law-Emerging Trends. Hyderabad: ICFAI University.
9. Competition Law and Cartels. Hyderabad: ICFAI University.

Course Code	Course Title		L	T	P	Total
B18AL7062	**Indirect Taxation**	HC	3	1	0	4

Course objective: This course provides an overview of the basic structure of indirect taxes and covers key concepts in the field. The study of the course the students will be able to analyze indirect taxes, more specifically, the Value Added Tax (VAT) and GST.

Upon completion of the course students will be able:

- To describe the transaction types which are related to Indirect Taxation
- To analyses the Constitutional dimension of indirect taxation
- Analyze the advantages and disadvantages of VAT and GST

Unit I: Introduction

Introduction about Indirect Tax-Constitutional Validity of Indirect Tax Laws-Indirect Tax Structure in India-The Central Sales Tax Act, 1956-Definitions of certain terms relating to CST-Definitions of Sales and its Essentials- Relevant Provisions of Sales of Goods Act, 1930-Taxability of a sale - Transactions which are sale under the CST Act - Transactions which are not sale under the CST Act - Restrictions on Imposition of Tax on Sales by State - Principles of Sales Tax - Principles of State Sales Tax Laws - Liability to Central Sales Tax - Declared goods and their taxation - Offences and Penalties.

Unit II: Value Added Tax (VAT)

Basic Concept of VAT-Objectives of VAT-Advantages of VAT-Distinction between CST & VAT - Appointment, Jurisdiction and Power of the Authority-

Unit III: Concept of Service Tax:

Background - Basic Concepts of Service Tax - Reason for Imposition of Service Tax - Constitutional Validity of Service Tax e. Administrative Structure of Service Tax f. Charge of Service Tax g. Taxability of Services and Negative List of Services 7.

Unit IV: Goods and Services Tax (GST)

Salient Features-Objective-Advantages and disadvantages- SGST and CGST- VAT and GST: A Comparison.

Books:

- S. S. Gupta, Demands Penalties & Appeals Under Service Tax/ Excise & Customs Laws, Taxman ¬ V S Datey, Elements of Indirect Taxes, Taxman Allied Services Pvt. Ltd. Books in India.
- Indirect taxes made easy----Prof N.S. Govindan (C.Sitaraman publication) 2007.
- Indirect taxes, Viswanathan Nagarajan (Asia Law House)19th edition.
- Indirect Taxation-V.Balachandra, Sultan Chand & Sons, New Dehli.

Course Code	Course Title		L	T	P	Total
B18AL7071	**Banking and Insurance Law**	HC	3	1	0	4

Course Objective: The Banking and Insurance sectors are undergoing rapid transformation in this era of privatization. Any one specializing in the area of corporate and commercial law must have the special knowledge of law relating to Banking and Insurance. Hence, this course is designed to sensitize students about emerging trends in this area of law.

Learning Outcomes: On completion of this unit you should be able to:

- Understand the fundamental concepts of banking and banking law **a**nd provisions of Banking Regulation Act and different types of banking institutions in India.
- Understand the different forms of borrowing and their legal aspects of banking operations.
- Analyse the securing bank loans with guarantee with collateral security and e-banking
- Identify the concept of insurance and its evolution and emerging trends.
- Understand the general principles of the law of insurance.
- Analyse and understand different kind of insurance like the Life insurance, marine insurance fire insurance.
- Understand the working of insurance regulatory authorities and registration requirements of insurance companies.

Unit I: Nature and Development of Banking. Evolution of Banking in the west and the east including India. Different kinds of Banks and multifunctional Banks. Need for Social Control over banks in India.

Unit II: Nationalization of Banks, Government control over banks through priority lending, credit policy and the like. New generation Banks. Role of RBI in regulation of commercial banks. Bank rate policy etc. Banker and Customer relations. Types of customer accounts. Bankers lien. Bankers duty towards customers. Internet banking and A.T.M. Consumer protection and Banking Service. Banking Regulation Act, 1949

Unit III: Nature and Purpose of Insurance. Insurance Contracts Legal Control over insurance business. Insurance Regulatory Authority of India. Basic Principles underlying Marine, life, fire and motor vehicle insurance. Insurable interest underlying these and the risks covered.

Unit IV: Insurance Regulatory and Development Authority, Tariff Advisory committee, Insurance, Association of India, Councils and Committees, Ombudsmen, Insurance intermediaries– insurance agents, surveyors, loss assessors, third party administrators, Amendments to the Insurance Act, scope of FDI in Insurance.

Books:

- M. Hopgood: Pagets Law of Banking, (London: Butterworth)
- Tannon's Banking Law and practice, Lexis Nexis
- M. Srnivasan: Insurance Law (Eastern Law House)
- Banerjee: Law of Insurance, Asia Law House
- K. Subramanya, Banking Reforms in India.
- Bird's Modem: Insurance Law (Sweet & Maxwell)

Course Code	Course Title		L	T	P	Total
B18AL7072	**International Criminal Law**	HC	3	1	0	4

Course Objectives:

1. To provide basic knowledge concerning international criminal courts and tribunals.
2. To provide basic knowledge concerning principles of individual responsibility in international criminal law.

3. To provide basic knowledge concerning international crimes.
4. To provide basic knowledge with regard to the most important case-law of international criminal courts and tribunals.

Learning Outcomes: After completion of the Course students will be able to

- Analyze the evolution of International Criminal Justice.
- Gain the knowledge concerning the principles of criminal liability in international criminal jurisdiction
- Distinguish the crimes in municipal law and international crimes.

Unit I: Introduction

-notion of international criminal law and the sources of international criminal law- International Military Tribunals: Nuremberg and Tokyo-Principles and objectives of international-criminal law-International Criminal Tribunals ad hoc.

Unit II: International Crimes:

Genocide- International Criminal Court- International Crimes II: crimes against humanity-Other examples of international criminal justice-International Crimes III: war crimes-Principles of criminal liability in international criminal law-International Crimes IV: crime of aggression and other international crimes-Circumstances excluding criminal liability.

Unit III: Victims of international crimes – notion and the respective rights-International criminal procedure -State cooperation with international criminal courts and tribunals-International criminal procedure II-Alternatives to international criminal justice.

Unit IV: Punishment and Cases

Penalties and sentencing- Future of international criminal justice- Final test- Leading Cases

Books:

1. R. Cryer, H. Friman, D. Robinson, E. Wilmshurst, An Introduction to International Criminal Law and Procedure, Cambridge University Press 2010, second ed.
2. M.C. Bassiouni, Introduction to International Criminal Law, Transnational Publishers 2003.
3. A.Cassese, International Criminal Law, Oxford University Press 2008, wyd. 2.
4. A.Cassese, P. Gaeta, J.R.W.D. Jones (red.), The Rome Statute of the International Criminal Court: A Commentary, Oxford University Press 2002.
5. W.A. Schabas, The UN International Criminal Tribunals. The former Yugoslavia, Rwanda and Sierra Leone, Cambridge University Press 2006.
6. C. Romano, A. Nollkaemper, J. Kleffner (red.), Internationalized Criminal Courts and Tribunals: Sierra Leone, East Timor, Kosovo and Cambodia, Oxford University Press 2004.

EIGHTH SEMESTER

Course Code	Course Title		L	T	P	Total
B18AL8010	**Law of Taxation**	HC	3	1	0	4

Course Objective: The subject is divided into two parts .i.e. Direct and Indirect taxes. This subject gives an overview of Income tax, Wealth tax, Value added tax, Service tax and Central sales tax. It is devised to help students understand the significant aspects of Taxation.

Learning Outcomes: On completion of this unit you should be able to:

- Firmly ensconced in the historical and constitutional footings of taxation.
- Firmly rooted in the conceptual tone of taxation.
- Appreciate the computation of income in its proper perspective.
- In a position to appreciate the ways and means of determining tax liability and the

incidental concepts.

- Get requisite knowledge about wealth tax and the incidental concepts.
- Would get the requisite knowledge about Service Tax with all its incidents.
- Cogent information and knowledge about the relevance, desirability and procedural aspects of GST.

UNIT I: Historical background of taxation in India, Canons of a good taxing system, Characteristics of tax, Reasons for taxation, Kinds of taxation, Types of Taxes, Merits and Demerits of Direct and Indirect taxes, Constitutional Provisions relating to taxation.

UNIT II: Basic concepts /Definitions – Assessee , Persons, Previous year, Assessment year, Distinction between capital and revenue receipts, Income, Basis of charge and scope of total income, Incomes which do not form part of the total income, Residential status and incidence of tax, Agricultural income and taxability.

- **Unit III:** Overview of Wealth tax Act,1957, Concept of Net wealth, Assessee , Valuation date, Incidence of wealth tax, Assets, deemed assets and assets exempt from tax; valuation of assets, computation of net wealth, return of wealth and provisions concerning assessment, Liability to assessment in special cases, Wealth tax Authorities
- Unit IV: Legislative background, concept of VAT, GST, Advantages and Disadvantages, Difference between VAT and GST, Constitutional provisions, Computation and procedural aspects including registration under GST; filing of returns, rates of tax, assessment, returns, revisions, appeals , authorities and their powers

Books

1. Dr. Girish Ahuja and Dr. Ravi Gupta, Systematic Approach to Taxation, Bharat 32nd Edition,2014-2015
2. Dr. Yogendra Bangar and Dr. Vandana Bangar, Indirect Tax Laws,Bangar,2012
3. Dr. vinod Singhania and Dr. Kapil Singhania, Direct taxes law and Practice, Taxmann 43rd Edition
4. Rohini Aggarwal , Service Tax Law And Practice, Eastern Book Company,2009
5. J.K.Mittal, Law, Practice and Service of Service tax Law ,Lexis Nexis25th Eddition,2013
6. Sampath Iyengar, Law of Income tax ,Bharat Law House,2008
7. P.L.Subramanian ,Central Sales Tax Law and Practice, Snow White,2008
8. V.S.Datey, Indirect Taxes Law and Practice, 23rd Edition, Taxmann.

Course Code	Course Title		L	T	P	Total
B18AL8020	**International Humanitarian and Refugee Law**	HC	3	1	0	4

Objective:

The aims of the subject are to introduce to international humanitarian law and to international refugee law, to examine the protection of refugees under both sets of laws, to survey the sources of IHL and IRL, to outline the substantive law within each domain and to introduce their respective attendant international institutional frameworks.

Learning Outcomes: On completion of this course you should be able to:

- Examine the sources of law of IHL and IRL the relationship of IHL and IRL with domestic law
- Define the concept of refugee and Distinguish between refugees and internally displaced persons
- Distinguish between combatants and civilians in IHL and Identify the substantive rules applicable to combatants and civilians.
- Describe the functions of the International Committee of the Red Cross and Identify and discuss contemporary challenges to the protection of IRL

- Analyze how refugees are protected under both IHL and IRL Identify the substantive rules applicable to combatants and civilians and describe the functions of the UN High Commissioner for Refugees and Identify and discuss contemporary challenges to the protection of IRL

Unit I: Introduction to "War Law":

Jus in bello and *Jus ad bellum*; Treaties and Customary International Law; Hague Peace Conferences; Geneva Conventions and Protocols; International Humanitarian Law; Fundamental Principles; IHL in Domestic Law - Protection of sick, wounded and shipwrecked not taking part in hostilities; prisoners of war; other detained persons; civilians and civilian objects; refugees and internally displaced persons.

Unit II: Conduct of Hostilities

Regulation and limits to methods and means of warfare used by parties to an armed conflict.; Balance between legitimate military action and the humanitarian objective of reducing human suffering, particularly among civilians. Choice of weapons and prohibits or restricts the employment of certain weapons. The ICRC plays a leading role in the promotion and development of law regulating the use of certain weapons

Unit III: Contemporary Challenges to IHL:

Occupation of territory, Privatization of War, Security Detention, Terrorism Fourth Geneva convention; Protocols I and II to the Geneva Conventions; Rome Statute of ICC; Convention and Protocol Relating to the Status of Refugees (1951& 1967); Convention governing the specific aspects of refugee problems in Africa 1974 and Guiding Principles on Internal Displacement

Unit IV: Refugee Law

Refugees Defined and Described; Determination of Refugee Status: Analysis and Application; Loss and Denial of Refugee Status and its Benefits - Non-Refoulement in the 1951 Convention; Protection under Human Rights and General International Law; The Concept of Asylum - International Protection; Protection and Solutions; Treaty; Standards and their Implementation in National Law - IHL and Refugee Law; Human Rights Law; Terrorism; Migration; Gender-based Violence; Humanitarian Action, etc.

Books:

- Guy S. Goodwin-Gill and Jane McAdam, *The Refugee in International Law*(OUP, 22 March 2007)
- Jean-Marie Henckaerts, Louise Doswald-Beck,*Customary International Humanitarian Law: Rules* (ICRC & Cambridge U. Press, 2005)

Reference Books/suggested Readings

- Dieter Fleck, *The Handbook of International Humanitarian Law* (Oxford U. Press, 2010)
- Gary D. Solis, *The Law of Armed Conflict: International Humanitarian Law In War* (Cambridge U. Press, 2010)
- James Simeon, *Critical Issues in International Refugee Law: Strategies Toward Interpretive Harmony* (Cambridge U. Press, 2010).
- Robin Ramcharan, 'The African Refugee Crisis: Contemporary Challenges to the Protection of Refugees and Displaced Persons in Africa' (2000) 8 *African Yearbook of International Law* 119

Course Code	Course Title		L	T	P	Total

B18AL8030	**International Trade Law**	HC	3	1	0	4

Objective: To introduce the students to the rise of the international economy, the formation of international regulatory regimes governing the world economy, the specific norms and rules within each regime, the rules and procedures of each organization and the relationship between the various organizations.

Learning Outcomes: On completion of this course you should be able to:

- Focus on international trade theories, meaning and relationship of imports and exports.
- Analyze the shift to understanding of multilateral, regional and bilateral treaties.

Unit I: Introduction to international trade law

Principal documents in international sales- bill of lading, commercial invoice and insurance policy, carriage of goods by sea, Bill of Lading- as a receipt and as a document of title, Electronic bill of lading. The Carriage of Goods by Sea Act, 1992, The Hamburg Rules, FOB, FAS, CIF, Ex-ship Contracts, Sale Contracts based on carriage by land, CIM and CMR conventions FOR and FOT contracts, Sale contracts based on carriage by air, Warsaw Conventions of 1929 and 1955 and the Montreal Convention 1999.

Unit II: International Trade Law and the WTO

The origins of WTO, Mandate and Membership of WTO, Institutional Structure of WTO, Decision making in WTO, Origins of the WTO Dispute Settlement System, Institutions of dispute settlement, Dispute Settlement procedures, Challenges and proposals for reforms

Unit III: Rules on Market Access and Unfair Trade under WTO

Tariff and non-tariff barriers to trade in goods, Barriers to trade in services , Dumping and anti-dumping measures, Subsidies and countervailing measures, Overview of the principle of non-discrimination, *De Facto v De Jure* discrimination, National treatment under GATT and GATS 'Most Favoured Nation' status under GATT and GATS

Unit IV: GATT exceptions

General exceptions under GATT 1994, Security exceptions, Economic emergency exceptions Regional integration exceptions, Economic development exceptions, Balance of payments exceptions

Books

1. Bernardette Griffin, *Day and Griffin: The Law of International Trade,* 3rd edition, Oxford University Press, 2004
2. LS Sealy and RJA Hooley, *Commercial Law, Text, Cases and Materials*, 4th edition, Oxford University Press, 2008
3. Andreas F. Lowenfeld, *International Economic Law* , 2nd edition, Oxford University Press, New Delhi, 2008
4. Asif H. Qureshi and Andreas R. Ziegler, *International Economic Law*, 2nd edition, Sweet & Maxwell, London, 2007
5. Simon Lester & Bryan Mercurio with Arwell Davies & Kara Leitner, *World Trade Law, Text, Materials & Commentary*¸ Hart Publishing, 2008
6. Peter Van Den Bossche, *The Law and Policy of the World Trade Organization, Text, Cases and Materials,* Cambridge University Press, 2005.

Course Code	**Course Title**		L	T	P	Total
B18AL8040	**International Air and Space Law**	HC	3	1	0	4

Course Objective:

This subject introduces students to the field of air and space law. The exploitation of air and space has begun relatively recently in the history of humanity. From the first airplane to the present, technological advances have enabled the exponential increase in the uses of air and space. As such use is relatively new so is the body of international rules that have emerged within the realm of public international law. This course traces the evolution of the air and pace regulatory regime, its linkages with public international law and the various components of the regime.

Learning Outcomes: At the end of the course the students will be equipped to:

- Outline the sources and rules of international air law
- Outline the sources and rules of the *lex specialis* of outer space which emanates from international agreements and principles of public international law.
- Demonstrate an understanding of the major conventions, laws, legal rules and sources of information for the aviation sector.
- Effectively research and provide advice on aviation, aerospace or space law issues.

Unit-I: Space Law:

Historical Background-Definition and demarcation of outer space-Space technology –Benefits-Shift from air law to space law-Development of the space law-UN contributions-UN General Assembly Resolutions-Space treaties-Principles-A midway approach

Unit-II: Fundamental Principles:

Province of all Mankind-National non-appropriation-Freedom of exploration, use and scientific investigation-Common Heritage of Mankind-Jurisdiction and control-Co-operation-between the states-Astronauts -Envoys of Mankind

Unit-III: Liability and Registration

Launching state and Registering state Liability and responsibility regime under the Outer Space Treaty-Absolute liability and fault liability-COSMOS 954 -A case study-State liability / responsibility for private space activities-Registration and identification Question of state sovereignty and claim of property rights-Human habitation on the moon and other celestial bodies-Protection of the space environment-Demilitarization of the outer space-International Space Station-Inventions in outer space

Unit IV: National Space Legislation:

Need for national space legislation-Commerce oriented approach - US & Australian models-Other approaches-Russian & UK models-Indian position

Books:

- Bin Cheng, Studies in International Space Law, Oxford: Clarendon Press, 1997.
- Sandeepa Bhat B.(ed.), Outer Space Law: From Theory to Practice, Hyderabad: Icfai University Press, 2009.
- Sandeepa Bhat B. (ed), Space Law in the Era of Commercialization, Lucknow: Eastern Book Company, 2010.
- I.H.Ph. Diederiks-Verschoor, An Introduction to Space Law, Second revised edition, Kluwer Law International.
- Sa‟id Mosteshar (ed), Research and Inventions in Outer Space -Liability and Intellectual Property Rights, London: Martinus Nijhoff, 1995

Course Code	Course Title		L	T	P	Total
B18AL8050	**Trade in Service and Immigration laws**	HC	3	1	0	4

Course Objective: The course will review the constitutional basis for regulating immigration into India, and, to some extent, the constitutional rights of non-citizens in the country; the

history of Indian immigration law and policy; the contours of the immigration bureaucracy, including the roles played by various agencies in immigration decisions; the admission of nonimmigrants (i.e., temporary visitors) and immigrants into the India; the deportation and exclusion of nonimmigrants and immigrants; refugee and asylum law; administrative and judicial review; undocumented immigration; immigration and national security; and citizenship and naturalization.

Unit-I: Introduction:
Meaning & Definition of Citizenship-Fundamental Right To Movement-Constitutional Provisions Regarding Citizenship-The Citizenship Act, 1955-The Citizenship Rules, 2009 and The Citizenship (Amendment) Rules, 2015

Unit –II Immigration
Meaning of Immigration-History of Immigration Law-The Passport (Entry into India) Act, 1920-The Passport (Entry into India) Rules, 1920

Unit III: Indian Legal Frame Work
The Registration of Foreigners Act, 1939
The Registration of Foreigners Rules, 1992
The Emigration Act, 1983

Unit IV:
The Foreigners Act, 1946
The Passports Act, 1967
The Immigration (Carriers Liability) Act, 2000
The Immigration (Carriers' Liability) Rules, 2007

Judgments:

- Sarbananda Sonowal v. Union of India, 2005 (5) SCC665
- Akmal Ahmad v. State of Delhi, 1999 (3) SCC 337
- R. Louis De Raedt&Ors.v. Union of India And Ors., AIR 1991 SC 1886
- Maneka Gandhi v. Union of India, AIR 1978 SC 597

Books:

1. Mazhar Hussain, The Law Relating To Foreigners, Passport and Citizenship in India
2. Seth, Citizenship and Foreigner Act
3. Anil Malhotra (2009), India, Nris and Law, Eastern Book Publishers, New Delhi
4. M.P. Jain, Indian Constitutional Law
5. D. D. Basu, Shorter Constitution of India
6. V.N. Shukla, Constitution of India.

Reference

- Foreigners Division Ministry of Home Affairs Government of India http://mha1.nic.in/foreigDiv/ForeigHome.html

Course Code	Course Title		L	T	P	Total
B18AL8060	**MOOC, Swayam, EDX, CM Certificate**	HC			2	2

Course Code	Course Title		L	T	P	Total

B18AL8071	**Maritime Law**	SC	3	1	0	4

Course Objective:

Currently 90% of international trade is carried on by sea and the annual rate of growth of sea-borne trade for the next decade is estimated at approximately 4.3, with already Asia having the largest percentage share of the world tonnage of sea-borne goods and developing countries having a share of 49.3% of total sea-borne exports.

With the sea emerging as the most important channel of world commerce, law students, especially trade law students are required to possess a fair knowledge of the law governing maritime shipping. To that end this introductory course is structured.

Learning Outcomes On completion of the course the students will be able to:

- Understand and analyses the concepts of Customs and International Conventions Civil & Criminal, Attachment of ships, concept of Maritime Property, Geographical Limits of Salvage & Eligibility of a Salvor, Relationship between Salvor & Salvee, Salvage Awards, Remedies including Security for the Claim
- Understand International Sales of Goods, Carriage of Goods by Sea, Contracts of Carriage,

Unit I: Introduction

Customs and International Conventions, Resolutions of I.O. including IMO, UNEP and decisions of ICJ, ITLOS and National courts, International Waters, baselines and Maritime Boundaries, Territorial sea and contiguous zones, Right of Innocent Passage and costal state jurisdiction, EEZ, Continental shelf and resources jurisdiction, International Fisheries. Port state Jurisdiction: Civil & Criminal, Attachment of ships: arrest of ships, Access of foreign ships to ports, Ships in distress, Quarantine regulations

Unit II: Carriage of goods by sea

International Sales of Goods, Carriage of Goods by Sea, Contracts of Carriage, The Voyage Charter party, The Bill of Lading, Sea Waybills, Implied Contracts on Loading, Ship owners' Bill, Agency, Assignment, Non-Contractual Obligations- **The Hague & The Hague-Visby Rules-**Mandatory Application & Voluntary Incorporation, Contracting Out & Third Party Reliance on the Rules, The Carrier's Duties Under Article 3,The Carrier's Defenses under Article 4, Shipper's Liability, The Package Limitation, Containerization- Lay time & Demurrage.

Unit III: Collisions and Salvage

Vicarious Liability & Standard of Care, Causation & Apportionment of Liability, Damages & Statutory Liability, Jurisdiction- Concept of Maritime Property, Geographical Limits of Salvage & Eligibility of a Salvor, Relationship between Salvor & Salvee, Salvage Awards, Remedies including Security for the Claim.

Unit IV: General Average, Jurisdiction & Applicable Law

Extraordinary Sacrifices, Extraordinary Expenses, Voluntariness & Time of Peril, Common Safety & Fault, Assessing Contributory Values & Losses- Jurisdiction under Brussels Convention & Domestic Sources, Forum Non-convenience, Contractual Law & Tort Law, Arrest & Mareva Injunction, Other Interlocutory Reliefs.

Text Books and Reference Books:

1. 1952 Convention Relating to the Arrest of Sea Going Ships.
2. 1999 Convention Relating to the Arrest of Sea Going Ships.
3. 1957 Limitation Convention (Convention Relating to the Limitation of Owners of Seagoing Ships).
4. 1976 Limitation Convention (Convention on Limitation of Liability for Maritime Claims).

5. 1996 Protocols to the Limitation Convention (Convention on the Limitation of Liability for Maritime Claims)
6. William Tetley, "The Burden and Order of Proof in Marine Cargo Claims [.pdf]" (2004)
7. William Tetley, "Jurisdiction Clauses and Forum Non Conveniens in the Carriage of Goods by Sea [.pdf]" (publisbed in *Jurisdiction and Forum Selection in International Maritime Law. Essays in Honor of Robert Force* (Martin Davies, ed.), Kluwer Law International, The Hague, 2005, Chapter 6 at pp. 183-263).
8. William Tetley, "Mixed Jurisdictions, Language, Legislatures and Courts" (2003) 78 Tul. L. Rev. 175-218.
9. R.R. Churchill and A.V. Lowe, "The Law of the Sea", 3rd edn., Manchester, 1999

Course Code	**Course Title**		L	T	P	Total
B18AL8072	**Media Law**	SC	3	1	0	4

Course Objective:

Mass communication from the days of printing press has played a very important role in the formation of public opinion. Advancement in science and technology has changed the scope and dimensions of mass communication. ICT has created digital era for us. While there are definite benefits from these technologies, the experience shows that these technologies can be abused to harm the interests of the society. The course aims to provide basic understating of the evolution and existence of various facets of media and the legal regime in place to regulate its content and matters incidental to it.

Learning Outcomes: At the end of the course the students will be equipped to

- Appreciate the philosophical justification for the protection of free speech right.
- understand the fundamental aspects of protection of reputation
- To analyze the legal nitty-gritty of media and how their activities can result in a breach of privacy in its various hues.
- Understand the requisite conceptual as well as statutory provisions pertaining to media, ethics and adjudication.

Unit I: Freedom of speech as a human right

- Philosophical justification for the protection of Free speech right – Constitutional guarantee for Free Press – reasonable restrictions on Free speech.
- Media Freedom – boundaries of a free press - Mass media –press, films, radio, television – ownership patterns – legal issues; Freedom of Information v Free Speech- Origins of broadcasting – regulation of press and broadcasting – censorship of broadcasting media and press – leading cases – Evolution of television as a visual media
- Impact of films as visual media – censorship of films – judicial view on film censorship – standards of censorship, Role of media in law making process.

Unit II: **Protection of reputation**

- Defamation – overview – general framework for defamation law- role of malice – IPC provisions – remedies and damages
- Decent speech – indecent speech – hate speech – racial speech – obscenity on mass media – regulation and control
- Libel in press –regulation and control – Slander through Broadcasting audio-video defamation
- Internet as a platform of free speech – regulation of content on Internet self-regulation v Government regulation, Libel and slander in cyberspace – cross border libel/slander – jurisdictional problems – Gutnick v John Doe

Unit III: **Media and privacy**

- Obscenity and pornography – historical background - Hicklin Test – contemporary standards in Miller v California - Child pornography
- Blasphemy – historical overview- censorship of stage productions – violence - legal regulation of blasphemy
- Privacy – historical development of private and confidential information – media practices and human rights – photo journalism in public places – child right to privacy
- Information privacy and reputation - personal data protection – abuse of personal information – market ing of personal information- internet privacy
- Press and Public access to the judicial processes , records, places and meetings – Right to information Act

Unit IV: Media, ethics and adjudication

- Copyright issues in mass media – protection for copyrighted work – plagiarism – pirated music - remedies for infringement
- Media and Courts - Report of legal proceedings – trail by media – sensitive court reporting and human rights contempt of court – procedure and punishment
- Corporate and commercial speech – development of commercial speech doctrine – commercial speech for professionals and corporations – Art.19(1)(a) protection for unsolicited mail advertising – regulation of commercial speech
- Ethical dilemmas, issues and concerns in mass communication – foundation of ethics- different aspects of journalism's ethical issues- Reporters priviliges and protection of media sources
- Extra- judicial regulation of media content – press complaints and editors' code of practice –Broadcasting standards commission – codes for advertisement standards – Film censorship board – ICANN

Books

1. D.D. Basu *Law of the Press,* Wadhwa Nagpur, 2002
2. D.D.Basu, *Commentary on the Constitution of India,* Wandhwa Nagpur, Vol. 2, 8th edn., 2007
3. K.N.Harikumar (edt.), *Courts, Legislatures, Media Freedom,* National Book Trust, 1st edn., 2006
4. Karnika Seth, *Computers, Internet & New Technology Laws,* LexisNexis Butterworths, 2012
5. M. Neelamalar, *Media Law and Ethics,* New Delhi, 2010
6. Madhavi Goradia Divan, *Facets of Media Law,* Eastern Book Co., 2000
7. Manita Singh, *Law of Journalism and Mass Communication,* Centrum Press, New Delhi,1st edn. 2010
8. Mukul Sahay, *Media Law and Ethics,* Wisdom Press, Delhi, 2011
9. P.K. Ravindranath, *Press Law and Ethics of Journalism,* Anmol Publications New Delhi, 2011

NINTH SEMESTER

Course Code	**Course Title**		L	T	P	Total
B18AL9010	**Professional Ethics and Accountancy**	HC	3	1	0	4

Course Objective:

Ethics are an integral part of every profession. Every profession has certain peculiar codes of conduct and well defined norms. Advocacy being a profession of immense social relevance, and its significant role in the justice delivery system makes it a unique profession in itself and therefore it is highly desired that this profession be carried on ethically. This Paper aims at appreciating the avowed duties of advocates as well as the Bar-Bench relation. Designed to be taught with the assistance of practitioners, it will impart the students their role and responsibilities as professionals.

Learning Outcomes: At the end of the course the students will be equipped to

- Understand the historical evolution of the legal profession as well as the various codes of conduct and ethical norms for the advocates.
- Understand the contempt law in India and the classifications of contempt, the punishments and remedies etc.
- Analyse case studies by the students and case presentations in the class.
- General principles of accounting.

Unit I: Professional Conduct and Advocacy Bar Council Code of Ethics

Development of Legal Profession in India; Legal Profession and its responsibilities; Equipment of a lawyer; Admission, Enrolment & Rights of Advocate; Bar Councils; Ethics of Legal profession; Qualities of good Advocate; Seven Lamps of Advocacy-Abbot Parry; Professional or other Misconduct; Disciplinary proceedings.

Unit II: Advocate Act

Conduct and Etiquette, Conflict between interest and duty, Duty to court, Duty to Client, Duty to opponent, Duty to Colleagues, Duty towards Society and obligation to render legal aid-Bench-Bar Relationship -Reciprocity as partners in administration of Justice-Professional Misconduct- Rights and Privileges of Advocates

Unit III: Contempt Law and Practice

Contempt law in India and the classifications of contempt, the punishments and remedies etc. Introduction to Contempt of Court; Meaning and kinds of contempt of court; Origin, Development, object and Constitutional validity of contempt law; Basis and extent of contempt jurisdiction; contempt by lawyers, judges, State and Corporate Bodies; Contempt proceedings-nature and main features; Defences open to contemner; Nature and extent of punishment and remedies against the order of punishment.

Unit IV: Professional Accounting

Professional Accounting; Nature and Functions; important Branches of Accountancy; Accounting and Law; Need of accountancy for lawyers. To acquaint students with general principles of accounting. Professional Accounting; Nature and Functions; important Branches of Accountancy; Accounting and Law; Need of accountancy for lawyers

Acts

1. The Indian Advocate Act, 1961
2. Contempt of Court Act, 1971
3. The Advocates Welfare Fund Act, 2001

Rule

The Bar Council of India Rules, 1961

Books

1. Holland Avrom Shree, Advocacy, 1994 Universal, Delhi
2. Keith Evam,The Golden Rules of Advocacy, 1994, Universal, Delhi
3. Sandeep Bhalla, Advocates Act & Professional Misconduct, Nasik Law House
4. JPS Sirohi, Professional Ethics, Lawyer's Accountability, Bench-Bar Relationship, ALA
5. Mr. Krishna Murthy Iyer's Book on Advocacy

6. The Bar Council Code of Ethics selected opinions of the Disciplinary Committees of Bar Councils
7. Lamps of Advocacy –Judge Edward Abbot Parry

Course Code	Course Title		L	T	P	Total
B18AL9020	**Research Methodology**	HC	3	1	0	4

Course Objective: The main objective of this course is to acquaint the student of law with the scientific method of social science research. This course is expected to provide the knowledge of the technique of selection, collection and interpretation of primary and secondary data in socio-legal research. Emphasis would be laid on practical training in conducting research in this course

Learning Outcomes: At the end of the course the students will be equipped to:

- Get an idea of technique of selection, collection and interpretation of primary and secondary data in socio-legal research.
- Understand the Kinds of Research - Concepts and constructs- relationship between theory and fact
- Classification and Tabulation of Data

Unit I: Basics of Legal Research

Meaning, objectives of legal research-Characteristics of scientific method – applicability of scientific method-Kinds of Research - **c**oncepts and constructs- relationship between theory and fact - Stages of Research Process

Unit II: Research Problem, Hypothesis, Research Design, Sampling

Research Problem – Definition, Determination, Sources of Data - Hypothesis – Meaning and definitions, Characteristics, Research Questions and Hypothesis - Research Design – Meaning and essentials of Research Design, Forms of Research Design, and major steps **-:** Testing of Hypothesis**-:** Sampling techniques – definition, basic assumptions, classifications

Unit III: Research Methods and Tools

Social and legal survey - **Case** method - Jurimetrics - Questionnaire Schedule - Observation and interview

Unit IV: Tabulation, Analysis, Interpretation, and Reporting

Classification and Tabulation of Data - Analysis and interpretation of Data - Use of Statistical methods and computers in legal research - Reporting and Methods of Citations **-:** Ethics in research

Text Books:

1. Whitney, F.L, The elements of Research.
2. Goode. William J and Hatt. Faul, H, Methods in Social Research.
3. I.L.I, Legal Research and Methodology.
4. Amy E Sloan, Basic Method Research – Tools and Materials
5. Pauline V.Young, Scientific Social Survey and Research.
6. Morris L.Cohan, Legal Research in Nutshell
7. Harvard Law Review Associaltion, Uniform System of Citations.

Course Code	Course Title		L	T	P	Total

B18AL9030	**Moot Court & Internship**	HC	3	1	0	4

This paper has three components of 30 marks each and a viva for 10 marks.

Course Objective: The course is designed to hone advocacy skills in the students. Moot courts are simulation exercises geared up to endow students with facility in preparation of written submission and planning, organizing and marshalling arguments in the given time so as to convince the presiding officer.

Learning Outcomes: The students should familiarize them self's with the various stages of trial in civil and criminal cases. They should be exposed to real core experiences. Further they should imbibe the skills of client interviewing. This component may be planned to be part of the internship. Each student shall undergo and internship for minimum 20 weeks during the entire course. However the internship shall not be for a period of more than 4 weeks continuously in an academic year.

UNIT- I: Moot Court

- Moot Court (30 Marks). Every student may be required to do at least three moot courts in a year with 10 marks for each. The moot court work will be on assigned problem and it will be evaluated for 5 marks for written submissions and 5 marks for oral advocacy.
- The students shall make written submission on behalf of the party for whom he makes oral advocacy as assigned by the course teacher.
- The written submission for the 3 Moot courts shall be neatly written on one side of the bond size papers and bound together with the certificate signed by the course teacher and the Director.
- The cover shall indicate the name of the examination and subject.

Unit II: Observance of Trial

- Observance of Trial in two cases, one Civil and one Criminal (30 marks).
- Students may be required to attend two trials in the course of the last two or three years of LL.B. studies.
- They will maintain a record and enter the various steps observed during their attendance on different days in the court assignment.
- This scheme will carry 30 marks.

UNIT III: Client Interviewing (30 Marks)

- Interviewing techniques and Pre-trial preparations and Internship diary
- Each student will observe two interviewing sessions of clients at the Lawyer's Office/Legal Aid Office and record the proceedings in a diary, which will carry 15 marks.
- Each student will further observe the preparation of documents and court papers by the Advocate and the procedure for the filing of the suit/petition. This will be recorded in the diary, which will carry 15 marks.
- The dairy shall be neatly written on one side of the bond size papers and bound together with the certificate signed by the course teacher and the Director.

UNIT IV:

- The fourth component of this paper will be Viva Voce examination on all the above three aspects. This will carry 10 marks.

Course Code	**Course Title**		L	T	P	Total
B18AL9040	**Drafting Pleadings and Conveyancing**	HC	3	1	0	4

Course Objective:

One of the practicals, this Paper aims at giving the students an opportunity to peep into the

working of law by referring to various practical aspects of civil and criminal laws. It also emphasizes on the conveyancing aspects and imparts the students the requisites of various deeds that go to make the theoretical law complete.

Learning Outcomes: At the end of the course the students will be equipped to:

- Understand and disseminate the fundamental principles of drafting which are very crucial with regard to the propriety of the cases to be filed.
- Understand the particular application of the said rules with respect to pleadings in civil matters.
- Understand the drafting with reference to criminal matters.
- Understanding the principles of conveyancing with reference to different deeds.
- Drafting skills of scrutiny of reports.
- Imparts the basic rules of Judgment Writing.

Unit I: Introduction

The General principles of Drafting, Pleading and Conveyancing and their relevant substantive rules shall be taught.

Unit: II: Writing exercises on Drafting and Pleading (Civil & Criminal)

- Plaint
- Written Statement
- Affidavit
- Caveat / Injunction Application / Preliminary issue application / Court Commission / Amendment Application
- Execution Petition
- Appeal / Revision (Civil)
- Petition under Article 226 / Article 32 of Constitution of India
- Application u/s Motor Vehicle Act- M.A.C.P.
- Divorce Petition – H.M.P.
- Pursis / Adjournment Exemption / Application
- PIL Petition
- Complaint
- Bail Application – Regular Bail u/s 439/Anticipatory Bail application u/s 438.
- Appeal / Revision (Criminal)
- Criminal Miscellaneous Petition-Maintenance Application u/s 125 of Cr. P.C.

Unit: III: Writing Exercises on Conveyancing [Deeds / Parts of Deed]

- Sale Deed
- Mortgage deed
- Lease deed
- Gift deed
- Power of Attorney
- Promissory Note
- Will & Codicil
- Trust deed
- Agreement to Sell deed
- Partnership deed
- Guarantee Bond
- Leave & License deed
- Adoption deed
- Partition Deed
- Deed of declaration

Unit IV: Viva Voce exam

The Viva Voce exam is 10 marks will be assessed by the concerned Faculty and Director of School of Legal Studies REVA University or his nominee and one external examiner appointed by the University. The examiner has to see overall performance of exercises written by the student.

Text Books and Reference Books:

1. Sengupta, Ajit K. *Maumdar'sLaw Relating to Notices*. Kolkata: Eastern Law House Pvt. Ltd., 2005.
2. Mogha G. C. *Mogha's Law of Pleadindgs in India with Precedents*. 17th ed. Lucknow: Eastern Book Company, 2006 (2009).
3. Shrivastava J. M. *Mogha's Indian Conveyancer*. 14th ed. Lucknow: Eastern Book Company, 2009.
4. Bindra, M. S. *Bindra's Pleading & Practice* Vol. 1 & 2. New Delhi: Universal Law Publishing, 2010.
5. Parimeswaran, S. *Law of Affidavit*. New Delhi: Universal Law Publishing, 2003.
6. Rathwade, Rajaram S. *Legal Drafting*, Pune: Hind Law House, 2010.

Course Code	**Course Title**		L	T	P	Total
B18AL9050	**Infrastructure Laws**	HC	3	1	0	4

Course Objective:

To make the student under the importance of Infrastructure like roads, airports and other utilities. For the progress of any nation both economic and social infrastructure development plays a vital role. The core infrastructural sectors India are namely Roads and Highways, Railways, Ports, Civil Aviation, Energy and Telecommunication. There are respective ministries governing these areas of infrastructure to ensure development of world class standards. Each area of infrastructure is regulated by certain laws. The Committee on Infrastructure was constituted on 31st August, 2004 under the Chairmanship of the Prime Minister of India with the objectives of initiating policies that would ensure time-bound creation of world class infrastructure delivering services matching international standards, developing structures that maximize the role of public-private partnerships and monitoring progress of key infrastructure projects to ensure that established targets are realized.

Learning Outcomes: At the end of the course the students will be equipped to:

- Understand the important central enactment regulating infrastructure in India.
- Analyze the importance of these laws in development of infrastructure in India.

Unit I:

Introduction- infrastructure law and constitutional rights- Infrastructure sector contribution to overall development of the Indian economy- Infrastructure Investments in India-infrastructure and environment in India.

Unit II:

- Road Transport Corporation Act in 1950
- National Highways Authority of India Act, 1988'
- Control of National Highways (Land and Traffic) Act 2002
- The Railway Act 1989

Unit III:

- The Indian Ports Act, 1908
- Civil aviation in India
- The Energy Conservation Act, 2001

- The Electricity Act, 2003

Unit IV:

- Petroleum and Natural Gas Regulatory Board Act, 2006
- The Atomic Energy Act, 1962
- Land acquisitions in India
- Infrastructural Committee.

Acts:

- Petroleum and Natural Gas Regulatory Board Act, 2006
- The Atomic Energy Act, 1962
- Road Transport Corporation Act in 1950
- National Highways Authority of India Act, 1988'
- Control of National Highways (Land and Traffic) Act 2002
- The Railway Act 1989
- The Indian Ports Act, 1908
- Civil aviation in India
- The Energy Conservation Act, 2001
- The Electricity Act, 2003
- http://www.lexuniverse.com/infrastructure-laws/india/index.html

Course Code	Course Title		L	T	P	Total
B18AL9060	**Summer Internship**	HC			2	2

Course Code	Course Title		L	T	P	Total
B18AL9071	**Investment and Competition Laws**	SC	3	1	0	4

Course Objective:

Domestic as well as foreign investment is the driving force of Indian economy. This course aims to provide an overview on central topics of Indian investment law, and investigate the approach of legal frameworks and regulating authorities of investments in India. It endeavours to make an optimum mix of basic concepts relating to investments and legal provisions. It also focuses on the current state of investor protection in India. The second part of this course highlights the process of globalization and liberalization which have brought a considerable awareness towards improving the competitive process in developing economies such as India. Until recently most of the developing countries operated without a structured competition policy, and have justified the intervention by the state over economic activities. India owing to its WTO obligations enacted Competition Act, 2002. The course seeks provide fundamentals of market economy and extensive knowledge of application of competition policy in India.

Learning Outcomes On completion of the course the students will be able to:

- Provide knowledge on investment as economic activity and deal with basic concepts such as securities and various modes of making investment in India.
- Analyse the working knowledge about various investment done and made by banking sector in India and the legal framework relating to it.
- Analyse the overall view of international investment regime, various principles applicable to international investment.
- Overview about the different aspects of competition law.
- Clear understanding about the different fundamental issues of competition law.

Unit – I: Investment Law

Historical background of the securities and --Investment laws. Concept of 'Securities' under The Securities Contracts (Regulations) Act 1956. -Legal nature of securities and types of securities: Corporate security, bank security and Government securities including securities issued by Government, semi government & RBI and other collective investment funds, Depositories Act 1996- Depository receipts, derivatives -Securities issued by Banks- Bank notes: is it the exclusive privilege of the Central Bank in the issue-Changing functions of banks from direct lending and borrowing to modern System.

Unit-II: Legal regulatory framework

SEBI Act 1992- FEMA Regulations on Foreign Investment --Protection standards for the placement of foreign investment projects-Enforcement of Bilateral Investment Treaties Standards of protection in --Bilateral Investment. Procedural Rules for International Investment Arbitration. ICSID, UNCITRAL, ICC, LCIA and SCC rules. How they interact and have an effect on the applicable law of an international investment dispute.

Unit III: Competition Law

Concept of market, Open market- Regulated market, Market functions of role of competition law Nature & Scope of competition law and policy-Evolution & Growth of competition law-Theoretical foundations of competition law-Competition Act, 2002- overview, definitions and ideas of agreement, dominant position, combination and effects of anti- competitive activities-Treatment of anti- competitive agreements under India, USA, EU, UK, Australia Unit IV: Abuse of Dominant Position- Combinations- Competition Commission of India- IPR and Competition Law- WTO and it's impacts on Competition Laws with reference to UNCTAD-International enforcement and judicial assistance-Applicability of competition law into agricultural sector-Dumping-State aid-Recession

Text Books:

1. Competition law –Avtar Singh
2. Competition Law –S. C. Tripathi
3. Competition and Investment Laws In India –Singhal Law Publications
4. Versha Vahini- Indian Competition Law Whish, Richard. Competition Law. London: Oxford University Press, 2009.
5. Furse, Mark. Competition Law of the EC and UK. London: Oxford University Press, 2008.
6. Rijn, Alphen aan den. The Reform of EC Competition Law: New Challenges, Austin.

Statutes:

1. Competition Act 2002
2. Security Contract (Regulation) Act 1956
3. SEBI Act 1992
4. Depositories Act 1996
5. Foreign Trade (Development & Regulation) Act 1992,
6. Foreign Exchange Management Act, 1999

Reference:

- Taxman's Student's Guide to Economic Laws
- Principles of International Investment law –Rudolf Dolzer Christoph Schreuer

Course Code	**Course Title**		L	T	P	Total
B18AL9072	**Women and Law**	SC	3	1	0	4

Course Objectives: India is a country with diverse cultures. Irrespective of this fact, the plight of women has remained the same for all cultures and communities in India. Women, not only

because of their being a weaker sex, but also due to the country's cultural drawbacks, have suffered subjugation and exploitation since ages and at all levels. Spread of education and technology has not been able to resolve women's issues; instead, the nature of issues relating to women, have further complicated and crimes aggravated.

Learning Outcome: The course aims at making students learn about the laws relating to women, how women are being empowered through the instrument of law, and what are the lacunae which are to be discussed and dealt with.

Unit-I: Women In Colonial India

Position of Indian Women in British India – Social Reforms during the 19th century India for the upliftment of women.

Unit-II: Women's Right: Access To Justice

Introduction, Criminal Law – Crime Against Women – Domestic Violence – Dowry Related Harassment and Dowry Deaths – Molestation – Sexual Abuse and Rape – Loopholes in Practice – Law Enforcement Agency.

Unit-III: Special Laws on Welfare of Women

Sexual Harassment at Work Places – Rape and Indecent Representation – The Indecent Representation of Women (Prohibition) Act, 1986 - Immoral Trafficking – The Immoral Traffic (Prevention) Act, 1956 - Acts Enacted for Women Development and Empowerment - Role of Rape Crisis Centers.

Unit-IV: Women's Rights and Property Rights

Violence against Women – Domestic Violence - The Protection of Women from Domestic Violence Act, 2005 - The Dowry Prohibition Act, 1961. Introduction – Faces of Poverty – Land as Productive Resources – Locating Identities – Women's Claims to Land – Right to Property - Case Studies.

Books:

1. Nair, Janaki. Women and Law in Colonial India: A Social History, Kali for Women in collaboration with NLSIU Bangalore, 1996.
2. Verma, Jagmohan Singh. Gender Justice in India, Spellbound Publications Pvt Limited, 1999.
3. Mill, John Stuart. The Subjection of Women, Hayes Barton Press, 1997.
4. Rao, Nitya. Good Women do not Inherit Land Social, Science Press and Orient Blackswan 2008.
5. International Solidarity Network. Knowing Our Rights, An imprint of Kali for Women 2006.
6. Kaushik, P.D. Women Rights, Bookwell Publication 2007.
7. Goel, Aruna. Violence Protective Measures for Women Development and Empowerment, Deep and Deep Publications Pvt 2004.
8. Chawla, Monica. Gender Justice, Deep and Deep Publications Pvt Ltd.2006.
9. Mishra, Preeti. Domestic Violence against Women, Deep and Deep Publications Pvt 2007.

Tenth Semester

Course Code	Course Title		L	T	P	Total
B18ALX010	**Dissertation**	HC	3	1	0	4

Course Objective: This course is designed to test the research prowess of the students and

their analytical skills. 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.

Learning Outcome: While taking the Paper to its logical end viz., submission of the thesis, the students will be cajoled to make an introspection about their research prowess and the acquisition of the analytical skills which the profession of law assiduously demands.

Evaluation Pattern:

The Dean/Directors will propose a panel of examiners to the Controller of Examination for evaluation of the dissertation and for conducting the viva. The examiners approved by the university will evaluate dissertation in consultation with the supervisor followed by a viva to be conducted by a Board consisting of:

- The External Examiner;
- Dean/Director of the Institute;
- Supervisor of the candidate;
- One faculty member of the institute.

Course Code	Course Title		L	T	P	Total
B18ALX020	**Alternative Dispute Resolution**	HC	3	1	0	4

Course Objective: The main objectives of the Course are to understand the strengths and weakness of various dispute resolution methods. The course aims to explain primary dispute resolution processes and functions and develop techniques and skill to make effective use of ADR methods. Also it is designed to compare and contrast various legal implications of each method and train students to be effective Arbitrators, Conciliators and Mediators.

Learning Outcomes: At the end of the course the students will be equipped to:
Students would acquire the conceptual as well as the necessary practical approach to the art of Negotiation.
Enables the students to learn the about Mediation and Conciliation skills.
Students would get the required knowledge about the legal regime on Arbitration.

Unit – I: Introduction

Alternative Dispute Resolution (ADR): Concept and Need of Legal Aid: Concept, Dimensions and Practice-Constitutional Provisions-Legal Services Authority Act, 1987-Legal Literacy Mission

Unit – II: Negotiation Skills

Importance of Negotiation as a method of Conflict Resolution, Negotiation Skills and Behaviour, Rule of law; Ethics and Policies, Simulation Exercises.

Unit – III: Mediation and Conciliation

Meaning of Mediation, Advantages, Characteristics, Appointment of Mediator, fixation of fee, restrictions on mediation, Mediation models- Med-Arb, Arb-Med, Role of Mediators, and Simulation Exercises. Conciliation-Meaning, conciliation as a mode of settlement of disputes, distinction between negotiation, mediation and conciliation, advantages, Appointment of conciliators, commencement of conciliation proceedings, submission of statements, communication between conciliator and the parties, Role of a conciliator, settlement agreement- status and effect. Termination of conciliation proceedings; costs and deposits, Simulation Exercises.

Unit- IV: Arbitration

Introduction to Arbitration– meaning, scope, concept, terminology, history of Arbitration, types of Arbitration, Arbitration agreement, seat of arbitration, Arbitral Proceedings, statement of claim and defense, Arbitral Tribunal - Composition, eligibility and qualifications of

arbitrators. Termination or a mandate of arbitral Tribunal's and of arbitrators, appointment of arbitrators and filling up of vacancies, powers and functions of Arbitral Tribunal's, Arbitral award-recourse and enforcement, rules of procedure, Online Dispute Resolution, Simulation Exercises.

Books:

1. International Dispute Settlement – J.G. Merrills
2. Alternative Dispute Resolution- Mark V.B. Partridge
3. Law of Arbitration and Conciliation Including other ADRs- S.K. Chawla

Acts:

1. Legal Services Authority Act, 1987

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:

a. Willingness to learn
b. Self motivation
c. Team work
d. Communication skills and application of these skills to real scenarios
e. Requirement of gathering, design and analysis, development and testing skills
e. Analytical and Technical skills
f. Computer skills
g. Internet searching skills
h. Information consolidation and presentation skills
i. Role play
j. 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 Commerce is efficient leaders of repute, who can deal the real time problems with 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, leadership, and strategic management 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 University has recognized skill development and industry relationship as its very important activities. Therefore, the University-Industry Interaction and Skill Development Centre headed by a Senior Professor & Director has been established 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 various skill/certification programs identified are as follows:

- Big-data and Cloud Computing, Internet of Things (IOT), ORACLE, MYSQL, Advanced Java and Internals of LINUX/UNIX
- Red-hat certified programs on LINUX,
- Management related programs like SAP,ERP and Business Analytics
- Open Source software/hardware, Software Testing
- Advanced networking based CISCO / Microsoft technology.
- Web designing, System administration
- IBM certified programs.

The University has 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.

FACULTY PROFILE

DR. KALICHARAN M. L

Director, School of Legal Studies

Dr. Kalicharan M. L. Associate Professor and Director, School of Legal Studies, holds an LLM degree in Constitutional Law and holds Ph.D. on international law topic from University of Mysore. He holds an M.B.A. degree from KSOU, Mysore, M.F.T. from Pondicherry University, and M.A. (Human Rights) from the University of Madras. He has 9 years of academic and one year of practicing experience and also held administrative positions in colleges and universities. He has published around 23 articles in national and international journals. He is the External member of BOS of Department of studies in Law, University of Mysore and also been a BOE member for SIBM, Bangalore. His area of interest: Constitution, international, Procedural laws including Drafting Pleading and Conveyancing.

MS. NEHA MISHRA

Assistant Professor

Prof. Neha Mishra (Associate Professor) is the Head, School of Legal Studies. She holds LL.M. from National Law School of India University specializing in Human Rights Law and is currently pursuing her Ph.D. from the same institution. She completed her Master's in Arts from Hindu College, Delhi University. She has worked as an Attorney and has a total industry experience of 6 years and a teaching experience of 2 years. She has presented her papers globally and authored articles and research papers for international journals. She also has been a part of various national and international conferences, seminars and workshops. Her area of interest includes International Human Rights Law, the Study of Exclusion and Constitutional law.

MR. G. RAGHAVENDRA

Assistant Professor

G.Raghavendra, is Assistant Professor. Prior to joining School of Legal Studies, REVA University, he worked as Attorney for Guru Associates and J.Sagar Associates, holds Master degree in Mass Communication, LL.M. degree in Business Law from Kumvempu University, LL. B. degree from Bangalore University. He has 10 years of corporate and 6 years of teaching experience. He teaches Indian Constitution and Professional Ethics and Legal and Constitutional History. He has also coordinated and actively participated in various training programmes. He has also received appreciation certificate for effective teaching in Indian Constitution and Journalism. He has to credit for publication a research paper in a reputed journal. His areas of interests include Intellectual Property Rights Corporate Law, Banking and Insurance Law.

MR.SANDEEP M N

Assistant Professor

Sandeep M.N., Assistant Professor, School of Legal Studies, has completed B.A.LL.B. (Hons.) from National University of Advanced Legal Studies, Cochin in 2007 and LLM in Criminal Law and Constitutional Law from School of Legal Studies, CUSAT in 2009 and International Human Rights Law from University of Exeter, UK in 2011. He has a number of publications to his credit and has presented papers in various conferences and seminars. He was named the International Student Employee of the year 2011 by the National Association of Student Employee Services, UK.

MS. JAYASHREE.N

Assistant Professor

Is a law graduate with Master degree in Labour and Industrial Relations and Administrative Law Has also pursued M.B.A., in HR from Sikkim Manipal University and had been working as a lecturer at SESHADRIPURAM FIRST GRADE COLLEGE, Yelahanka New Town, Bangalore, for five years. Has also taught students of M.B.A AND ICWA in Seshadripuram College. Jaishree.N, has attended various workshops and seminars at various institutions. She had been practicing law for a period of one year. She has also presented many papers at National and International level. Has worked as Asst. Professor at PRESIDENCY UNIVERSITY, SCHOOL OF LAW, Itagalpura, and is currently working with REVA University, School of Legal Studies as Asst.Prof.

MR. B GOPALAIAH

Assistant Professor

Mr. B GOPALAIAH, is an Assistant professor, School of Commerce, REVA University. Did his M.Com from Bangalore University. Prior to joining REVA University he served as Professor at various educational institutions and conducted Tutorials for professional courses like ICAI, ICWAI and ICSI for more than 20 years. He has worked as Senior Accountant in the Mysore Lamps, Bangalore. His areas of interest are Financial Accounting, Cost Accounting and Taxation.

Email ID – gopalaiahbg@REVA.edu.in

MR. MAHANTAPPA MACHA

Assistant Professor

Prof. Mahantappa Macha, Assistant professor, School of Legal Studies, at REVA University holds B.ED and M.A (Political Science) degree from Bangalore University. He has 3 years of teaching experience. His areas of teaching include: Indian Constitution, western political theory, Indian political theory, comparative politics, political thought, Indian foreign policy and international foreign policy. He has attended and presented papers in various International Conferences, National Seminars and State Seminars. Email ID: mahantappamacha@REVA.edu.in

MR.BHADRAVATHI NAGARAJA RAHUL

Assistant Professor

Completed M.A (Applied Sociology)from Christ University and M.Phil. (Sociology)from Madurai Kamaraj University. Presently pursuing PhD in Sociology from Madurai Kamaraj University on the topic of A Study on Folk Gods and Goddesses of Madurai District, Tamil Nadu & Mandya, Karnataka- a Sociological Perspective. His major areas of Specialization are Tribal Community and Development, Folk Religion and Women Studies. Presented five National level Paper Presentations and three International level Paper Presentations and attended several workshops and Seminars. With 3years of Research experience particularly in Qualitative Research. Currently working as Assistant Professor, at School of Legal Studies, REVA University, Bangalore, handling Sociology for B.A.LLB. And working as a National Service Scheme Program Officer in REVA University. Email. ID: rahul.bn@REVA.edu.in

MS. DEVI K S

Assistant Professor

Ms.DEVI KS, Assistant Professor of Political Science, School of Legal Studies, a University Rank Holder in her Graduation BA and MA. She completed her M.Phil. in International Relations and qualified SLET in Political Science. She has 2-3 years of teaching experience in various institutions. She has attended and presented papers in various national and international seminars on various topics. Her areas of interest include International Relations, Human Rights and Women Empowerment. Currently she is an Assistant Professor in the School of Legal Studies, REVA University, Bangalore.
EmailId-devi.ks@REVA.edu.in.

MR. SHARANAPPA

Office Assistant

Mr. SHARANAPPA Office Assistant, School of Legal Studies REVA University. He has completed his Graduation, Bachelor's Degree (B.Ed.) and working as Administrative Assistant with 2 years of experience flawless preparation of presentations, preparing facility reports and maintaining the utmost confidentiality and expertise in Microsoft Excel. Email Id-sharanappa@REVA.edu.in.

DO'S AND DON'TS

DO'S

1. Maintain discipline and respect the rules and regulations of the university
2. Be regular and punctual to classes
3. Study regularly and submit assignments on time
4. Be respectful to your Teaches/friends and hostel staff/management.
5. Read the notice board (both at your college and the hostel) regularly.
6. Utilize your Personal Computer for educational purpose only.
7. Follow the code of conduct.
8. Visit Health Center on the campus whenever you are unwell.
9. Be security conscious and take care of your valuables especially Cash, Mobile Phones, Laptop and other valuables.
10. Carry your valuables along with you whenever you proceed on leave/vacation.
11. Use electric appliances, lights and water optimally.
12. Keep the campus clean and hygienic.
13. Use decent dressing.

DON'TS

1. Ragging inside / outside the campus.
2. Possession of Fire arms and daggers etc.
3. Use of Alcohols, Toxic drugs, sheesha, gutkha and hashish/heroin etc.
4. Use of Crackers, explosives and ammunition etc.
5. Smoking and keeping any kind of such items.
6. Misusing college & hostel premises/facilities for activities other than studies.
7. Playing loud music in the room which may disturb studies of colleagues / neighbours.
8. Making noise and raising slogans.
9. Keeping electrical appliances, other than authorized ones.
10. Involvement in politics, ethnic, sectarian and other undesirable activities.
11. Proxy in any manner.
12. Use of mobiles in the academic areas.

Note: 1. Rules are revised / reviewed as and when required.
2. Healthy suggestions are welcome for betterment of Institution

REVA UNIVERSITY
Bengaluru, India

(School of Applied Sciences)
M.Sc. Biochemistry
HANDBOOK
2017

Rukmini Knowledge Park
Kattigenahalli, Yelahanka, Bengaluru – 560064
Phone No: +91-080-46966966, Fax: 080-28478539
www.reva.edu.in

REVA UNIVERSITY

School of Biochemistry

M.Sc. Biochemistry
Hand Book

2017

Rukmini Knowledge Park
Kattigenahalli, Yelahanka, Bangalore-560 064, INDIA
www.reva.edu.in
Phone No: +91-080-46966966, Fax: 080-28478539

Rukmini Educational Charitable Trust

A Unit of DivyaSree

MESSAGE FROM THE HON'BLE CHANCELLOR

Dr. P. Shyama Raju
Chancellor
REVA University

Education during recent years has witnessed a great transformation. Today's society, termed as "Knowledge Society" has brought about unprecedented economic and social growth. This has propelled universities across the world to devise new ways of tapping human potential for different competencies and building a vibrant society with a win-win situation for all.

REVA University has seen the light of the day to imbibe this character of paradigmshift in academic pursuits to contribute to the knowledge society. REVA works hard to bring in you an exciting and rewarding educational experience, to discover new interests that will develop your career prospects. You will benefit from a unique approach to student-entered learning through group work and individual study tackling real world challenges alongside experienced practitioners and researchers.

REVA has excellent learning facilities including custom built teaching facilities designed specifically to emulate working conditions, air-conditioned library opened for your studies from early morning till midnight and facilities for variety of sports and cultural activities.

Our faculties have introduced socially relevant and market driven commerce courses after studying the market situation in detail and consulting entrepreneurs, experts in different areas of commerce and industry and other stake-holders. I am glad that the Choice Based Credit System (CBCS) and Continuous Assessment Grading Pattern (CAGP) being adopted will facilitate learning environment under continuous guidance and monitoring by the faculty and equip you with competent skills apt for different job prospects across the globe.

I hope that the present scheme of instructions, continuous periodic progress assessments, course curriculum of MSc Biochemistry program and other information provided in this hand book will guide you to choose appropriate courses of study and move ahead in the right direction in your chosen area of study. I hope you will enjoy and experience the curriculum, the student-centred teaching and learning ambience in developing your personality to become successful professionals, entrepreneurs and proud citizens of the country. I wish you every success in your career.

MESSAGE FROM THE VICE-CHANCELLOR

Higher education across the globe is opening doors of its academic disciplines to the realworld experiences. The disciplinary legitimacy is under critical review. Trans-border mobility and practice learning are being fore-grounded as guiding principles. Interactive learning, bridging disciplines and facilitating learners to gain different competencies through judicious management of time is viewed as one of the greatestand fascinating priorities and challenges today.

All the programs in REVA University are designed with a great care keeping in view of present requirements and job opportunities. Experts in respective areas of study from primary institutions, industries, research organizations, business sectors and such others have been involved in designing the curriculum of each program.

The L: T: P structure of teaching and learning under Choice Based Credit System (CBCS) and Continuous Assessment Grading Pattern (CAGP) would certainly help our students learn and build competencies needed in this knowledge based society.It provides students an opportunity to choose subject(s) of interest in other areas of study and learn courses with students of different subjects and also facilitates cross cultural learning. It further facilitates students to move in fast track and earn additional certificates and diploma.

The well qualified, experienced, committed teachers in REVA University will involve students in integrative learning and application environment within and outside the University. They will certainly mould them with knowledge, skill and ethical values and empower them to face the competitive world with courage and confidence.

This handy document containing brief information about MSc Biochemistry, scheme of instructions, course content, CBCS-CAGP regulations, its advantages and calendar of events for the year will serve as a guiding path to students to move forward in a right direction. It is for the students to be disciplined, committed, to work hard, make use of enormous resources and take guidance from expert facultiesto accomplish all round development of their personalities and succeed with flying colours not only in earning degree but also in their future career as leaders and proud citizens of Mother India.

Dr. S Y Kulkarni
Vice-Chancellor

MESSAGE FROM THE DIRECTOR - FACULTY OF SCIENCE

The curriculum of an Institution of higher learning is a living entity. It evolves with time, reflects the ever hanging needs of the society and keeps pace with the growingtalent of the students and the faculty. The curriculum of the M.Sc. Biochemistry program of REVA University is no exception.

An experience of a decade in preparing graduates and postgraduates in engineering, architecture, law, commerce and science for a wide variety of industries & research organizations has led to creation of the new curriculum. I sincerely believe that it will meet the aspirations of all stake holders – students, faculty and the employers of REVA University

The curriculum has been designed in such a way that the teacher enjoys freedom to expand it in any direction he feels appropriate and incorporates the latest knowledgeand stimulates the creative minds of the students. There is also provision for new experiments with new contents and new techniques. This is going to lead to new teaching – learning paradigm with experiential, experimental & industry relevant approaches. The present curriculum is contemporary because it is culmination of efforts of large number of faculty members, experts from industries and research level organizations. An effort of benchmarking this curriculum with curriculum of other institutions of repute like NITs and IITs has been done.

I am very sure that all students of REVA University enjoy this curriculum and take fullest advantage to expose themselves to fundamentals and applications. Also, imbibe all attributes that are required to term them as Global Engineers. The innovativeness and creativity being introduced should be explored fully by our students.

The flexibility in the curriculum permits staff and students to incorporate changes in terms of addition of new courses and deletion of irrelevant courses keeping the rapid advances in the technology into consideration.

The curriculum caters to and has relevance to local, regional, national, global developmental needs. Maximum number of courses are integrated with cross cutting issues with relevant to professional ethics, gender, human values, environment and sustainability.

I also record my personal gratitude to Chancellor, Vice-Chancellor and members of Academic Council who have lent every bit of their wisdom to make this curriculum truly superior.

Dr. N. Ramesh,
Director, Faculty of Science

PREFACE

M.Sc Biochemistry conceived by REVA University is an intensive intellectually challenging programme expect to acquire many transposable skills, allows studentsto gain research and industrial experience in contemporary Biochemistry. The curriculum covers Core courses with good number of electives in the final year. The electives include the area of General/Applied Biochemistry, Food Technology and Computational Biology. Short term training, Internships, Student Projects in Biochemistry, Clinical Research, SAS, Clinical Diagnostics provide opportunity for the students to choose their area of interest and eligibility criteria.

The students may also choose fast track learning and acquire additional Proficiency Certificate or Diploma in addition to the curriculum. Interactions with Industries, Diagnostic Laboratories, and Research Institutes are made through Industrial visits, Internships, Training programs and MOUs.

Collaborations with Research Institutes / Industries

- FRLHT-The Trans disciplinary University
- CIMAP- CSIR Laboratory
- CIFT & other Central Institutes
- Himalaya Drug Company
- Clinical Research Institutes

Such collaborations will help a student to compete in employment and research to recognize them as Research Scholars, Scientists in reputed Chemical, Biological, Healthcare, Pharmaceutical, Agriculture, Petrochemicals, Cosmetics, Food Industries, Clinical data management and Diagnostic Laboratories.

Prof.Jayashree S

Head, School of Biochemistry

CONTENTS

RUKMINI EDUCATIONAL CHARITABLE TRUST

It was the dream of late Smt. Rukmini Shyama Raju to impart quality 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. The 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, Law, 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 Degree College (Evening), REVA Independent PU College at Kattigenahalli, Ganganagar and Sanjaynagar and 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 thisnation to excel in the areas of Engineering, Commerce, Management, Architecture, Law,Education, Arts 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 M. Phil and Ph.D degrees. REVA has well qualified experienced teaching faculty of whom majority are doctorates. The faculty is supported by committed administrative and technical staff. Over 10,000 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 established under the Government of Karnataka Act 80 of the year 2012 and notified in the Karnataka Gazette dated 7th Feb, 2013, is located 14 kms away from the Bangalore International Airport on the way to Bangalore city. The university has a sprawling lush green campus spread over 41 acres of land equipped with state-of-the-art infrastructure and conducive environment for higher learning.

The REVA campus has well equipped laboratories, custom-built teaching facilities designed specifically to emulate working conditions, fully air-conditioned library and central computer centre kept open from morning 8.00 AM till mid-night for the students and the faculty. The well planned sports facility for variety of sports activities, facilities for cultural programs and friendly campus lifestyle add to the overall personality development of students. The campus also has residential facility for students, faculty and staff.

Currently, REVA University offers 23 Post Graduate programs and 17 Graduate programs in Engineering and Technology, Science, Commerce & Management and Humanities in addition to research degrees leading to Ph.D in different disciplines. The University aims to offer many more PG and UG programs in Science, Arts, Commerce, Engineering & Technology, Management Studies, Education and Humanities in the years to come.

The programs being offered by REVA University are well planned and designed after detailed study in 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 respective job environment has been given while designing the curricula. The Choice Based Credit System and Continuous Assessment Grading 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 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. REVAUniversity has also initiated many supportive measures such as bridge courses, specialcoaching, 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, businessfirms and other institutions seeking their help in imparting quality education through practice, internship and also assisting students' placements.

SCHOOL OF BIOCHEMISTRY

- The School of Biochemistry offers graduate, post graduate and PhD programs.
- The course trains students to acquire knowledge and skills in the field of General, Industrial and Clinical Biochemistry applicable to Industry, Research and Development laboratories

Vision

To impart contemporary knowledge in various socially relevant disciplines to students and transforming them to become global citizens by nurturing intellect, creativity, character and professionalism.

Mission

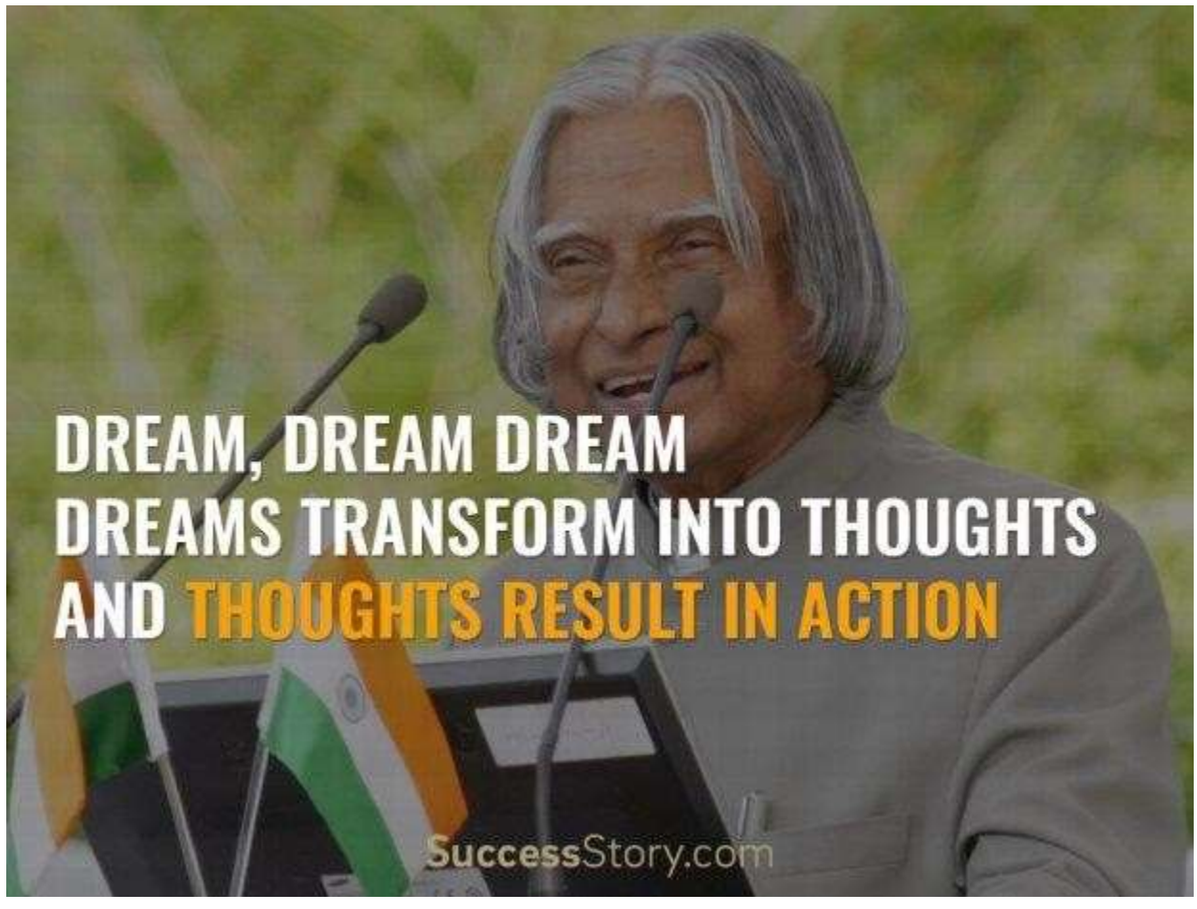
To achieve excellence through pedagogy, support interface between industry and academy through research in order to help students achieve creative and professional outlook to make them global citizens.

Objectives:

- Impart need based, practical education and global competence in contemporary biological sciences in accordance with the vision of REVA University.
- Provide an advanced understanding of the core principles of Biochemistry and their experimental basis.
- Enable students to acquire specialised knowledge and understanding of selected aspects by means of series of lectures.
- Foster growth, innovation, research and to promote entrepreneurship.
- Publish research papers in peer reviewed journals.

VALUE SYSTEM

- Excellence in all our academic and research endeavours
- Dedication and service to our stakeholders
- Leadership through innovation
- Accountability and transparency
- Creating conducive academic environment with service motto
- Integrity and intellectual honesty
- Ethical and moral behaviour
- Freedom of thought and expression
- Adaptability to the change
- Team-work



External Advisory Board

Sl. No.	Members
1	Dr. U.V Babu, Head- Phytochemistry, Research and Development, Himalaya Drug Company, Yeshwantpur, Bangalore.
2	Dr. Subramanya, Department of Life Sciences, Foundations for Revitalisation of Local Health Traditions (FRLHT), Yelahanka, Bangalore
3	Dr.Sudha Devaraj Director, Aristogene Biosciences PVT. Ltd. Rajaji Nagar Industrial Estate,Bangalore.
4	Dr. V.R. Devaraj, Professor, Department of Biochemistry,Bangalore University
5	Dr. Renuka Srihari, Professor, Department of Biochemistry, MLACW, Bangalore

CBCS (CHOICE BASED CREDIT SYSTEM) AND CAGP (CONTINUOUS ASSESSMENT AND GRADING PATTERN) OF EDUCATION AND ITS ADVANTAGES

CBCS is a proven, advanced mode of learning in higher education. It facilitates students to have freedom in making their own choices for acquiring a Masters Degree program. It is more focused towards the student's choice in providing a wide range of modules available in a single campus across various disciplines offered by experts in the subjects. It leads to quality education with active teacher-student participation.

Studying under CBCS has following advantages:

- Students may undergo training in cross-disciplinary and multi-disciplinary subjects and acquire more focused and preferred knowledge.
- Students are allowed to practice various methods of learning a subject.
- Students may get more skills from other subject(s) which are required for the career path in addition to their regular subject knowledge.
- Students may get ample opportunities to use the laboratories and gain practical exposure to the much needed modules available in other departments/schools for want of scientific inputs.
- Courses are conducted by subject experts identified on the basis of their experiences. Courses taught by such experts may provide in-depth information and clear understanding of the modules.
- Students may get an opportunity to study courses with other students of different programs and exchange their views and knowledge in a common class room.
- CBCS provides a cross-cultural learning environment.
- Students may benefit much from selecting the right options to successfully placed in the industries having production / Research and Development divisions. Also to compete in public service examinations like CSIR-UGC JRF/NET, GATE, UPSC and other Central Institute recruitment services wherein the knowledge of additional subjects become mandatory for general or optional papers.

Summary of REVA University Regulations for Choice Based Credit System (CBCS) and Continuous Assessment Grading Pattern (CAGP) for Two Years Post Graduate Program

1.0 Teaching and Learning Process

The teaching and learning process under CBCS-CAGP of education in each course of study will have three components, namely-

(i) L= Lecture (ii) T= Tutorial (iii) P= Practical 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 that equip students to acquire the much required skill component.

2.0 Course of Study and Credits:

The Program is grouped under various courses. Each of these courses carries credits which are based on the number of hours of teaching and learning. In terms of credits every one-hour session of L amounts to 1 credit per Semester and a minimum of 2 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.

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

A course shall have only lecture, lecture and tutorial or practical component or combination of any two or all the three components.

The total credit earned by a student at the end of the semester upon successfully completing the course are L + T + P. **The credit pattern of the course is indicated as L:T:P.**

2.1. Various course of study are labelled and defined as: (i) Core Course (CC) (ii) Hard Core Course(HC)(iii)Soft Core Course(SC) (iv) Open Elective Course (OE).

(i) **Core Course (CC):** A course which should compulsorily be studied by a candidate as a core-requirement is termed as a Core course.

(ii) **Hard Core Course (HC):** 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.

(iii) **Soft Core Course (SC):** 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.

(iv) O**pen Elective Course (OE):**

An elective course chosen generally from other discipline / subject, with an intention to seek exposure is called an O**pen Elective Course.**

2.2. Project Work: Project work is a special course involving application of knowledge in solving / analyzing /exploring a real-life situation / difficult problem.

School of biochemistry, REVA University is associated with several central govt research organizations namely CIMAP, FRLHT, CIFT, CFTRI, and other research organizations like

Himalaya Drugs, Clinical research institutes [Clini India], SKANDA Labs, Clinical Diagnostics Labs, [ELIBT Laboratories, CHANRe Diagnostics] for students projects.

2.3. Minor Project:

A minor project work along with practical sessions as a hard core.

2.4. Major Project / Dissertation:

The Major Project / Dissertation shall be Hard Core.

The Project work and presentation commence soon after the completion of the second semester end examination. This project work is preliminary and will continue during fourth semester. A project work of Four and Fourteen credits together with eighteen is called Major Project work.

3.0. Total Credits to be earned:

3.1. A candidate has totally 96 credits for entire MSc Biochemistry program with a distribution of credits are tabulated in the next section for different courses as prescribed by the university as illustrated in scheme of instruction.

3.2. The credit system vary for different courses and a candidate can enrol for a maximum ranges of 22 to 25 per Semester.

3.3. Only such full time candidates who register for a minimum prescribed number of credits in each semester from I to IV semester and complete successfully 96 credits in 4 successive semesters shall be considered for declaration of Ranks, Medals, Prizes and are eligible to apply for Student Fellowship, Scholarship, Free-ship, and such otherrewards / advantages which could be applicable for all full time students and for hostel facilities.

4.0. Add on Proficiency Diploma and Add on Proficiency Certification:

4.1. Add on Proficiency Diploma: In excess to the minimum of 96 credits prescribed a candidate can opt to complete a minimum of 18 extra credits to acquire add on proficiency diploma in a particular discipline / subject in his / her subject of study or in other subjects / discipline along with the masters' degree.

4.2. Add on Proficiency Certification: To acquire add on proficiency certification a candidate can opt to earn a minimum of 4 extra credits either in the field of Biochemistry or in different discipline(s) / subject(s) in addition to a minimum of 96 prescribed credits for the Masters degree program.

5. Scheme of Assessment & Evaluation for P G Degree Programs of two years duration

5.1. The Scheme of Assessment and Evaluation will have two components, namely;

i. Internal Assessment (IA); and ii. Semester End Examination (SEE)

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

5.3. The 50 marks of Internal Assessment (IA) shall comprise of:

Internal Test (2) = 30 marks

Assignments (2) = 10 marks

Seminars (2) = 10 marks

5.4. There shall be three internal tests conducted as per the schedule given below. The students have to attend all the three tests compulsorily.

- 1st test for 15 marks at the end of 5th week of the beginning of the Semester;
- 2nd test for 15 marks at the end of the 10th week of the beginning of the Semester; and
- 3rd test for 15 marks at the end of the 15th week of the beginning of the Semester

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

- For the 1st test syllabus shall be 1st unit and 1st half of Second Unit of the Course;
- For the 2nd test it shall be 2nd half of Second Unit and Third Unit of the Course;
- For the 3rd test the syllabus will be 4th Unit of the Course.

5.6. Out of 3 tests, the highest marks scored in two tests / average are automatically considered while assessing the performance of the students along with the attendance for the complete semester.

5.7. There shall be two Assignments and two Seminars each carrying 5 marks each. Hence two assignments carry 10 marks (5+5 marks) and two seminars carry 10 marks (5+5 marks) as stated above.

5.8. The duration of the internal test shall be 75 minutes and for semester end examination the duration shall be 3 hours.

5.9. The Semester End Examination (SEE) for 50 marks shall be held during 19th and 20th week of the beginning of the semester and the syllabus for the semester end examination shall be entire 4 units.

5.10. There shall be double evaluation, viz, first valuation by the internal teachers who have taught the subject and second evaluation shall be the external examiner.

5.11. The average of the two evaluations (internal examiner & external examiner) shall be the marks to be considered for declaration of results. However the difference between the marks awarded by the external and internal examiners shall not be more than 20%.

In such cases where there is a difference of more than 20%, there shall be third valuation by the external examiner who has not valued the script, in which case the average of the marks awarded by the third valuer and nearest marks of the marks awarded by the first two examiners (internal and external) shall be considered for declaration of results.

5.12. Summary of Internal Assessment and Evaluation Schedule is provided in the table given below:

Summary of Continuous Assessment and Evaluation Schedule

Type of Assessment	**Period**	**Syllabus**	**Marks**	**Activity**
Allocation of Topics for Assignments / Seminars / Model making	Beginning of 5th Week	First Unit and Second Unit		Instructional process and Continuous Assessment
First Internal Test	Second Part of 6th Week	First Unit and 1st half of Second Unit	15	Consolidation of First Unit and 1st half of Second Unit
Submission of Assignments	8th Week	First Unit and Second Unit	5	Instructional process and Continuous Assessment
Seminars	9th Week	First Unit and Second Unit	5	Instructional process and Continuous Assessment
Second Internal Test	2nd Part of 13th Week	2nd half of Second Unit and Third Unit	15	Consolidation of 2nd half of Second Unit and Third Unit
Allocation of Topic for 2nd Assignment / Seminars	11th Week	Third Unit and Fourth Unit		Instructional process and Continuous Assessment
Submission of Assignments	13th Week	Third Unit and Fourth Unit	5	Instructional process and Continuous Assessment
Seminars	14th Week	Third Unit and Fourth Unit	5	Instructional process and Continuous Assessment
Third Internal Test	2nd Part of 16th Week	Fourth Unit	15	Consolidation of Entire Fourth Unit

Semester End Practical Examination	17th & 18th Week	Entire Syllabus	50	Conduct of Semester- end Practical Exams
Preparation	17th & 18th	Entire		Revision and
for Semester– End Exam	Week	Syllabus		preparation for semester–end exam
Semester End Theory Examination	19th and 20th Week	Entire Syllabus	50	Evaluation and Tabulation
	End of 21st Week			Notification of Final Grades

Note:

1. *As per the model making is concerned, the School shall decide about the Marks and the Number of Model Designs and as well the schedule of allocation and presentation of model design(s). If the model design carries 5 marks, there shall be two model designs; and in case of 10 marks, there shall be one model design. However, the decision of the School should be announced in the beginning of the Semester for students to avoid ambiguity and confusion.

2. Examination and Evaluation shall take place concurrently and Final Grades shall be announced latest by 5 day after completion of the examination.

3. Practical examination wherever applicable shall be conducted after 3rd 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 Registrar (Evaluation) who will notify the same immediately.

6. Assessment of Performance in Practical's

6.1. 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 with error calculation.

6.2. The 50 marks meant for continuous assessment 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
	Total	**50 marks**

6.3. The 50 marks meant for Semester End Practical Examination, shall be allocated as under:

I	Conduction of semester end practical examination	30 marks
II	Write up about the experiment / practical conducted	10 marks
III	Viva Voce	10 marks
	Total	**50 marks**

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

7. 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:

I	Periodic Progress and Progress Reports (25%)
II	Results of Work and Draft Report (25%)
III	Final Evaluation and Viva-Voce (50%). Evaluation of the report is for 30% and the Viva-Voce examination is for 20%.

8. Provision for Appeal

If a candidate is not satisfied with the evaluation of Internal Assessment components, he/she can approach the grievance cell with the written submission together with all facts, the assignments, test papers etc, which were evaluated. He/she can do so before

the commencement of 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 taking disciplinary/corrective action on an evaluator if he/she is found guilty. The decision taken by the grievance cellis final.

Grievance Cell:

For every program there will be one grievance cell. The composition of the grievance cell is as follows. The Registrar (Evaluation) - 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.

9. 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, as provided in the succeeding sections, shall be eligible to appear for Semester End examination.

10. Requirements to Pass the Semester and to Carry Forward the Failed Subjects / Courses:

10.1. 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 30% (15 marks) in Semester End Examination (SEE) which is compulsory.

10.2. Provision to carry forward the failed subjects / courses:

The student who has failed in 4 courses in odd and even semesters together shall move to next semester of immediate succeeding year of study. And he / she shall appear for SEE of failed courses of previous semesters concurrently with even end SEE of current year of study. However, he / she shall have to clear all courses of both odd and even semesters of preceding year to register for next succeeding semester. Students of final semester program can appear for make up examinations.

11.0. Re-Registration and Re-Admission:

11.1. In case a candidate fails in more than 4 courses in odd and even semesters together in a given academic year has to seek re-admission to those semesters during subsequent year within a stipulated period.

11.2. 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 not allowed to appear for end semester examination (SEE) and he / she shall have to seek re-admissionto that semester during subsequent year within a stipulated period.

11.3. In such case a candidate drops all the courses in semester due to personal reasons he / she readmission to such dropped semester.

12.0. Attendance Requirement: a) All students must attend every lecture, tutorial and practical classes. b) 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 attended. c) Any student with less than 75% of attendance in a course in aggregate during a semester shall not be permitted to appear to the SEE. d) Teachers offering the courses will place the above details in the School / Department meeting during the last week of the semester, before the commencement of SEE, and subsequently a notification pertaining to the above will be brought out by the Head of the School before the commencement of SEE. A copy of this notification shall also be sent to the office of the Registrar & Registrar (Evaluation).

12.1. Absence during Internal test: In case a student has been absent from a 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 Head of the School, for conducting a separate internal test. The Head 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 internaltests shall be held / assignments are accepted after Semester end examination.

12.2. Absence during end semester examination:

In case a student is absent for end semester examination on medical grounds or such other exigencies, the student can submit request for make-up examination, with necessary supporting documents and certification from the concerned class teacher / authorized personnel to the concerned Director of the School. The Director of the School may consider such request depending on the merit of the case and after consultation

with class teacher, course instructor and permit such student to appear for make-up mid semester examination

13.0. Provisional Grade Card: The tentative / provisional grade card shall be issued by the Registrar (Evaluation) at the end of every semester indicating the courses completed successfully. The provisional grade card provides 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,
i. e SGPA (Si) = $\sum$(Ci x Gi) / $\sum$Ci Where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

13.1. Final Grade Card: Upon successful completion of MSc in Biotechnology Degree a Final Grade card consisting of Grades of all courses successfully completed by the candidate will be issued by the Registrar (Evaluation).

13.2. 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	B
60-69	7	v*7	C
50-59	6	v*6	D
40-49	5	V*5	E
0-39	0	v*0	F

O - Outstanding; A-Excellent; B-Very Good; C-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.

13.3. Cumulative Grade Point Average (CGPA):

Overall Cumulative Grade Point Average (CGPA) of a candidate after successful completion of the required number of credits (96) for MSc BT degree is calculated taking into account all the courses undergone by a student over all semesters of a program, i.e: CGPA = $\sum$(Ci x Si) / $\sum$Ci

Where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

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

13.4. 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, i.e 24

SGPA (Si) = ∑(Ci x Gi) / ∑Ci

Where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

Illustration for Computation of SGPA and CGPA

Illustration No. 1

Course	Credit	Grade letter	Grade Point	Credit Point (Credit x Grade)
Course 1	4	A	9	4X9=36
Course 2	4	B	8	4X8=32
Course 3	3	C	7	3X7=21
Course 4	3	O	10	3X10=30
Course 5	3	E	5	3X5=15
Course 6	3	D	6	3X6=18
Course 7	2	O	10	2X10=20
Course 8	2	B	8	2X8=16
	24			188

Thus, SGPA = 188 ÷ 24 = 7.83

Illustration No. 2

Course	Credit	Grade letter	Grade Point	Credit Point (Credit x Grade point)
Course 1	4	B	8	4X8=32

Course 2	4	C	7	4X7=28
Course 3	3	A	9	3X9=27
Course 4	3	C	7	3X7=21
Course 5	3	D	6	3X6=18
Course 6	3	E	5	3X5=15
Course 7	2	C	7	2X7=21
Course 8	2	O	10	2X10=20
	24			175

Thus, SGPA = 175 ÷ 24 = 7.29

Illustration No.3

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade point)
Course 1	4	D	10	4 x 10 = 40
Course 2	4	A	9	4 x 9 = 36
Course 3	3	C	7	3 x 7 = 21
Course 4	3	D	6	3 x 6 = 18
Course 5	3	A	9	3 x 9 = 27
Course 6	3	C	7	3 x 7 = 21
Course 7	2	A	9	2 x 9 = 18
Course 8	2	A	9	2 x 9 = 18
	25			199

Thus**, SGPA = 199 ÷ 25 = 8.29**

9.5. Cumulative Grade Point Average (CGPA):

Overall Cumulative Grade Point Average (CGPA) of a candidate after successful completion of the required number of credits (144) for MSc Biochemistry program is calculated taking into account all the courses undergone by a student over all the semesters of a program, i. e

CGPA = ∑(Ci x Si) / ∑Ci

Where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

Illustration:

CGPA after Final Semester

Semester (ith)	No. of Credits (Ci)	SGPA (Si)	Credits x SGPA (Ci X Si)
1	24	6.83	24 x 6.83 = 163.92
2	24	7.29	24 x 7.29 = 174.96

3	24	8.29	24 x 8.29 = 198.96
4	24	8.55	24 x 8.55 = 205.20
Cumulative	96		743.04

Thus, CGPA = $\frac{24x6.83+24x7.29+24x8.29+24x8.55}{96}$ = 7.74

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 7.67 x 10 = 76.7

14. 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	**Numerical Index**	**FGP**
		Qualitative Index
> 4 CGPA < 5	**5**	SECOND CLASS
5 > = CGPA < 6	6	
6 >= CGPA < 7	7	FIRST CLASS
7 >= CGPA < 8	8	
8 >= CGPA < 9	9	DISTINCTION
9 >= CGPA 10	10	

Overall percentage=10*CGPA

15. Challenge Valuation

A student who desires to apply for challenge valuation shall obtain a photo copy of the answer script 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 Registrar (Evaluation) within 07days after the announcement of the results. This challenge valuation is only for SEE.

The answer scripts for which challenge valuation 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.

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

M Sc in BIOCHEMISTRY (2017-18 batch)

Eligibility: Bachelors Degree of three years with Biochemistry,Chemistry or any Life Science subject as one of the cognate / major / optional subjects with 45% (40% in

case of candidates belonging to SC/ST) of marks in aggregate from any recognized

University / Institution or any other qualification recognized as equivalent thereto.

Table

Course Structure and Credit Distribution across Semesters

* Hard-Core Course- includes practical lessons

**Soft-Core Course- does not include practical lessons

+Open Elective

M Sc (Biochemistry) Program Overview

Biochemistry explores the chemical processes within and related to living organisms. The subject focuses on processes happening at a molecular level. It focuses on what's happening inside our cells by studying components like proteins, lipids and organelles. It also looks at how cells communicate with each other, for example during growth or fighting illness. Biochemists need to understand how the structure of a molecule relates to its function, allowing them to predict how molecules will interact.

By using chemical knowledge and techniques, biochemists can understand and solve biological problems

Biochemistry covers a range of scientific disciplines, including genetics, microbiology, forensics, plant science and medicine. Because of its breadth, biochemistry is very important and advances in this field of science over the past 100 years have been staggering. It's a very exciting time to be part of this fascinating area of study.

Biochemists find opportunities in Hospitals, Universities, Agriculture, Food institutes/organisations, Cosmetics, Forensic crime research, Drug discovery and development, and many other sectors.

In India, the hospital, pharmaceutical, food processing and agricultural sectors are all growing at a significant rate and development of biotech industries is being given prime importance by the Government of India to make it $100 billion industry by 2025, creating greater opportunities for Biochemists.

In this context, University Programme in Biochemistry at postgraduate level in India remains relevant for the creation of trained human resources.

M. Sc. (Biochemistry) at REVA UNIVERSITY has been designed to meet the human resources needs of existing and futuristic biotech industries and biotech research organizations involved in pharmaceuticals, food processing, agriculture, biomedical devices development; academic institutions and hospitals. The programme is designed to produce graduates with higher order critical, analytical, problem solving and research skills; ability to think rigorously and independently to meet higher level expectations of biotech industries, research organizations, hospitals and academic institutions. The programme in addition to core courses covers a number of specialized electives in the areas of Bioinformatics, Food Technology, Pharmacovigilance and SAS, Clinical Biochemistry and Diagnostics, and Plant & Industrial Biochemistry. The short term training in industries / R & D institutions, Internships, Student Projects in Biochemistry, Clinical Research, SAS and Clinical Diagnostics provide opportunity for the students to choose and acquire in-depth knowledge and skills in their area of interest.

Programme Educational Objectives (PEOs)

PEO-1	Become a professional biochemist with strong ethics and communication skill
PEO-2	Pursue carrier in reputed industry and diagnostic laboratories
PEO-3	Explore idea in research and consultancy services to develop new process and product

Programme Outcomes (POs)

PO-1: Science knowledge: Apply the knowledge of different fundamentals of life sciences including healthcare considering public health and safety, and the cultural, societal, and environmental concerns.

PO-2: Problem analysis: Identify, design and analyse problems related to the various domains of Biochemistry such as Clinical Biochemistry, Agricultural Biochemistry, Genetic Engineering, Molecular Biology, Food biochemistry and enzymatic diagnosis.

PO-3: 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-4: Modern tool usage: Identify, select the methodology, and apply appropriate techniques, resources, and modern technology for product/process development which in turn benefit the society.

PO-5 Environment and sustainability: Understand and implement environmental-friendly approaches in Biochemistry to support sustainable development.

PO-6: **Ethics:** Apply ethical principles and commit to professional ethics, responsibilities and norms in life sciences.

PO-7: **Individual and team work**: Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.

PO-8: Communication: Communicate effectively with the science 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-9: Project management and finance: Prove knowledge and understanding of Biochemistry and management principles and apply these to research work, as a member and leader in a team. Manage projects in interdisciplinary field.

PO-10: Life-long learning: Recognize the need for, and have the preparation as well as abilityto engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSO)

After successful completion of the programme, the graduates shall be able to

PSO-1: Work as scientist or biochemist experts in industries and research organizations in ateam with further training.

PSO-2: Develop strong ethics and communication as consultant with lifelong learningattitude.

PSO-3: Use higher order critical, analytical skill to solve a new problem.

REVA UNIVERSITY
M.Sc. BIOCHEMISTRY

Scheme of Teaching, Examination and Credits

FIRST SEMESTER MSc Biochemistry

Scheme & Syllabus-2017

Course code **I Semester**	**Title of the paper**	**Type of paper**	**Periods / Weeks**	**Duration of Exam Hours**	**IA**	**EA**	**Maximum Marks**	**Credit**
MSBC16F1100	Fundamentals of chemistry and Toxicology	H Core	4	3	50	50	100	4
MSBC16F1200	General Physiology	H Core	4	3	50	50	100	4
MSBC16F13 00	Bioenergetics and Intermediary Metabolism	H Core	4	3	50	50	100	4
MSBC16F1400	Analytical Techniques	H Core	4	3	50	50	100	4
MSBC16F1500	Biomolecules	S Core	2	1 1/2	25	25	50	2
MSBC16F1600	Laboratory Course I and Short term Training	Practical	12	6	20(practical) 30(project)	50	100	6
	Total Marks and Credits						500	20

Second Semester

Sl. No	**Code**	**Title**	**HC/ SC/ FC**	**Credit Pattern**			**Credits**
				L	**T**	**P**	

1	MS17BC301	Molecular Biology	HC	3	1	0	4
2	MS17BC302	Nutritional Biochemistry	HC	3	1	0	4
3	MS17BC303	Research Methodology & Statistics	HC	3	1	0	4
4	MS17BC304	Biochemistry in daily life *	OE	2	1	0	4
5	MS17BC305	Laboratory cum Training - V (Advanced Molecular Techniques)	HC	2	0	4	4
6	MS17BC306	Project work and presentation **	HC		0	4	4
Total Credits				**13**	**4**	8	**24**

Third Semester

Sl. No	Code	Title	HC/ SC/ FC	Credit Pattern			Credits
				L	T	P	
1	MS17BC201	Enzymology	HC	3	1	0	4
2	MS17BC202	Biotechnology	HC	3	1	0	4
3	MS17BC203	Immunology	HC	3	1	0	4
4	MS17BC204	Biochemical genetics	HC	2	1	0	3
5	MS17BC215	Bioinformatics	SC	2	0	0	2
6	MS17BC225	Food Technology	SC				
7	MS17BC206	Laboratory cum Training – III (Protein chemistry and Immunology)	HC	0	0	4	4
	MS17BC207	Laboratory cum Training - IV(Molecular Biology and Bioinformatics)	HC	0	0	4	4
Total Credits				**13**	**4**	8	**25**

*OE = Open Elective course “Biochemistry in daily life” is offered for students belonging to other schools. The students of M Sc Biochemistry have to choose Open Elective offered by other schools.
** The Project work and presentation commence soon after the completion of the second semester end examination. This project work is preliminary and will continue during fourth semester.

Fourth Semester

Sl. No	Code	Title	HC/ SC/ FC	Credit Pattern			Credits
				L	T	P	
1	MS17BC411	Pharmacovigilance and SAS	SC	3	1	0	4

2	MS17BC421	Clinical Biochemistry and Diagnostics	SC				
3	MS17BC431	Plant and Industrial Biochemistry	SC				
4	MS17BC402	Laboratory cum Training - VI (Genetic Engineering)	HC	0	0	4	4
5	MS17BC403	Project work-dissertation (continued from III Semester)	Project report	-	-	14	14
Total Credits							**22**
Total Credits of all Semesters							**96**

Project Guidelines

1. Students should develop a project individually.

2. They should implement their project in the university/Government or Private laboratory after approval of the Head of School.

3. The project should be subject based. The students have to collect data outside practical hours.

4. Internal marks can be awarded by the guide by evaluating the performance of The students during the course of project work.

6.In viva-voce the questions must be directed only on the project work to access The involvement and understanding of the problem by the students.

7. The project carries 200 marks is distributed as follows:

Demonstration and Presentation	130 Marks
Viva-voce	50 Marks
Project Report	20 Marks

Training and Placement

A degree with real life skills will open doors to the world of opportunities. But Employers are looking for much more than just a degree.

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

The 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 Counselling, Training and Placement (CCTP) Centre headed by well experienced dynamic Trainer, Counsellor and Placement Officer supported by an efficient team does handle all aspects of Internships and Placement for the students of REVA University. The prime objective of the CCTP Centre 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 CCTP Centre 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, CCTP Centre 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 University has signed MOU's with Multi-National Companies,

research institutions and universities abroad to facilitate greater opportunities of employability and as well students' exchange programs for higher learning.

The need of the hour is efficient leaders of repute, who can deal the real time problems with a pinch of innovation. This kept in focus, the training and Placement cell 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, leadership, strategic management and communication skills to every student of REVA University are given with utmost care. The process involves continuous training and monitoring the students to develop their interpersonal skills that will fetch them a job of repute and to choose a proper career path.

FACULTY PROFILE - SCHOOL OF BIOCHEMISTRY

MRS. JAYASHREE.S

Professor and Head School of Biochemistry, REVA University

Specialization: General Biochemistry

Dr.V.VEERA RAGHAVAN

Professor, School of Biochemistry, REVA University

Specialization: Clinical Biochemistry

MR.CHARAN RAJ T P

Assistant Professor, School of Biochemistry, REVA University

Specialization: Organic Chemistry

MRS.JAYASRI.P

Assistant Professor, School of Biochemistry, REVA University

Specialization: Analytical techniques

MRS.DEEPA.H N

Assistant Professor, School of Biochemistry, REVA University

Specialization: Enzymology

MS.MEGHANA. M.V

Assistant Professor, School of Biochemistry, REVA University

Specialization: General Physiology

MS.SMITHA.A R

Lab Instructor, School of Biochemistry, REVA University

FIRST SEMESTER CALENDAR 2017-18 (REVA)

Time Table for First Semester **W.E.F**

	8.30-9.30	9.30-10.30	TEA BREAK	10.45-11.45	11.45-12.45	LUNCH BREAK	1.30-2.30	2.30-.30	3.30-4.30
Mon									
Tue									
Wed									
Thu									
Fri									
Sat									

DO'S AND DON'TS

DO'S

1. Maintain discipline and respect the rules and regulations of the university.
2. Be regular and punctual to classes.
3. Study regularly and submit assignments on time.
4. Be respectful to you Teachers/friends and hostel staff / management.
5. Read the notice board (both at your college and the hostel) regularly.
6. Utilize your Personal Computer for educational purpose only.
7. Follow the code of conduct.
8. Visit Health Centre on the campus whenever you are unwell.
9. Be security conscious and take care of your valuables especially Cash, Mobile Phones, Laptop and other valuables.
10. Carry your valuables along with you whenever you proceed on leave/vacation.
11. Use electric appliances, lights and water optimally.
12. Keep the campus clean and hygienic.
13. Use decent dressing.

DONT'S

1. Ragging inside/outside the campus.
2. Use of Alcohols, Toxic drugs, sheesha, gutka and hashish/heroin etc.
3. Use of Crackers, explosives and ammunition etc.
4. Smoking and keeping any kind of such items.
5. Misusing college & hostel premises/facilities for activities other than studies.
6. Playing loud music in the room which may disturb studies of colleagues/neighbours.
7. Making noise and raising slogans.
8. Keeping electrical appliances, other than authorised ones.
9. Involvement in politics, ethnic, sectarian and other undesirable activities.
10. Use of mobiles in academic areas.

I SEMESTERPAPER-I

MS17BC101: Organic, Biophysical, Biochemical and Environmental Toxicology

52hrs

Unit-1

ORGANIC CHEMISTRY

Electronic theory of valency. Electronic displacements in a molecule: Inductive effect, Electronic effect, resonance. The hydrogen bond, hydrophobic interactions. Atomic and molecular orbitals. Shapes of biomolecules, hybridization and tetracovalency of carbon.

Types of organic reactions: Substitution, addition, elimination, rearrangement, condensation and polymerization.

Free radicals in biological system: Oxygen as free radical in the auto oxidation of fats. Antioxidants (free radicals inhibitors in the cell such as vitamin A, vitamin E,vitamin C,Se etc)

Mechanism of substitution in benzene ring: ortho, para and Meta directing groups. The concept of resonance with reference to benzene derivatives. Direct influence of substituents- Electronic interpretation. **13hrs**

Unit-2

Stereochemistry: Structural isomerism, stereoisomerism, geometrical isomerism. Opticalisomerism,opticalactivity,mesocompounds,specificrotation,chirality,chiralcentre enantiomers,diastereoisomeres,confirmation and configuration, boat and chair forms, axialandequatorialbonds,anomersandmutarotation,glycoside,epimers,glucopyranose, fructopyranose, periodic acid oxidation of sugars.

Heterocyclic systems occurring in living systems: Numbering of the ring and properties of pyran, furan, thiazole, indole, pyridine, pyrimidine quinine,purine and pteridine. **13hrs**

Unit-3

Biophysical chemistry

T**hermodynamics studies in chemistry and biochemistry:** Definition and application of the first and second law of thermodynamics in understanding energies in living cells, chemical potential, equilibrium constant. Phosphate group transfer potentials.

Biological solvents: Water properties, dipole moments, ionic product of water

Acids, Bases and Buffers: pH scale, acids-bases, Henderson-Hasselbalch equation, buffers, ionization behavior of amino acids and proteins, titration curve, buffer solutions and action.

Microbiology: Physical,environmental and nutritional requirements for growth(growth curve).continuos culture of bacteria and synchronous growth of bacteria.Preparationof culture media, staining techniques and isolation of pure cultures. starter cultures for dairy industry. Fermented products. (food and dairy)
11hrs

Unit-4

BIOCHEMICAL AND ENVIRONMENTAL TOXICOLOGY **15hrs**

Definition and scope of toxicology: Eco-toxicology and its environmental significance. Toxic effects: Basic for general classification & nature. Dose - Response relationship: Synergism and Antagonism, Determination of ED50 & LD50. Acute and Chronic exposures. Factors influencing Toxicity. Pharmacodynamics & Chemodynamics.OECD guidelines.

Principles & procedures of testing for acute toxic effects: Regulatory guidelines, Mammalian systems affected & the clinical signs of Systemic Toxicity. Factors affecting acute Toxicity studies.

Xenobiotic metabolism: Absorption & distribution. Phase I reactions. Oxidation, Reduction, Hydrolysis and Hydration. Phase II reactions/Conjugation: Methylation, Glutathione and amino acid conjugations.

Biochemical basis of toxicity: Mechanisms of Toxcity: Disturbance of Excitable membrane functions. Altered calcium Homeostasis. Covalent binding to cellular macromolecules & Genotoxicity. Tissue specificity of Toxicity.

Pesticidetoxicity: Insecticides: Organochlorines, Anticholinesterases. Organophosphates and Carbamates. Fungicides.Herbicides. Environmental consequences of pesticide toxicity. Biopesticides.

Food toxicity: Common food adultrants, detection of adultrants, sources and effects of food toxicants. Toxicology of food additives i.e preservatives, colourants taste enhancers

Metal toxicity: Toxicology of Arsenic, mercury, lead and cadmium, sources and permissible limits of metals in organs, antidotes.

PAPER-II

MS17BC102: GENERAL PHYSIOLOGY

52hrs

Unit-1:

Muscular System: Ultra structure of smooth, skeletal and cardiac muscle fibers. Contractile and other proteins of muscle. Energy metabolism in muscle; Phosphagens, neuro-muscular junctions, excitation of striated muscles. Organization of

sarcolemma, transverse-tubular system and sarcoplasmic reticulum, mechanism of muscle contraction. Regulation of contraction in striated and smooth muscle. Calmodulin and its regulatory role, muscular dystrophies.

Resting potentials and action potentials of excitable cells, contraction of skeletal,cardiac and smooth muscles

Cardiovascular system: Anatomy and physiology of blood vessels, structure of heart, cardiac cycle, heart sounds, ECG, blood pressure and haemorrhage. **13hrs**

Unit-2

Nervous system: Types and structure of neuron. Neurotransmitters and receptors, mechanism of synaptic transmission. Briefly about membrane potential, resting potential and action potential. Briefly about EEG and epilepsy. Outline and function of CNS and PNS.Neuromuscular junctions. **7hrs**

Biochemistry of cancer – carcinogenesis, characteristics of cancer cell, agentspromoting carcinogenesis. **2hrs**

Respiratory system: Anatomy of lungs, mechanism and regulation of respiration, transport of gases O_2 and CO_2 respiratory, mechanism of acid and base balance with briefly the disorders of respiratory system. **4hrs**

Unit-3:

Blood and Body fluids: Composition and functions of blood. Erythrocytes including Hb, leukocytes and thromobocytes plasma proteins in health and diseases. Blood coagulation – mechanism and regulation. Fibrinolysis,anticoagulants,transfers of blood gases – oxygen and carbon dioxide. Hydrogen ion homeostasis- Factors regulating blood pH – buffers. Composition and functions of lymph and CSFAcid-base balance, metabolic and respiratory acidosis and alkalosis. **7hrs**

Digestive system:– Secretions, functions and regulation of saliva, gastric, pancreatic, intestinal and bile juice.

Digestion and absorption of carbohydrates, lipids, proteins, nucleic acids, minerals and vitamins. **6hrs**

Unit-4

Renal physiology and Excretion: Structure and functional unit of kidney, mechanism of urine formation (Glomerular filtration, Tubular reabsorption and Tubular secretion), concentration of urine, tubular function test, kidney hormones, regulation of acid-base balance, electrolyte and water balance. Renal failure, nephrosisand nephrites **7hrs**

Endocrine system: Chemistry of hormones and hormonal activity**.** Site of synthesis , secretion,functions and Circulation in blood of hypothalamus, pituitary, thyroid, adrenal cortex, parathyroid and pancreas, local hormones and their biological significance.Degradation and peripheral transformation.Receptors and the mechanismof hormone action.Disorders of endocrine system. **6hrs**

PAPER-III

MS17BC103: BIOENERGETICS AND INTERMEDIARY METABOLISM

52hrs

Unit-1

Bioenergetics: Energy transformation, Laws of thermodynamics, Biological oxidations, oxygenases, hydroxylases, dehydrogenases and energy transducing membranes. Gibbs energy, free energy changes and redox potentials, phosphate potential,chemo-osmotic theory.Proton circuit and electrochemical gradient, ionophores. Uniport, antiport and symport mechanisms, shuttle systems.

The mitochondrial respiratory chain, order and organization of carriers, proton gradient, iron sulphur proteins, cytochromes and their characterization. The Q cycle; P/O ratio. Reversed electron transfer, respiratory controls and oxidative phosporylation, uncouplers and inhibitors of energy transfer. Fractionation and reconstitution of respiratory chain complexes.
ATP – synthetase complex., partial reduction of oxygen, superoxides.
12hrs
Unit-2
Intermediary metabolism: Approaches for studying metabolism. Introduction to metabolism.

Carbohydrates: Glycolysis, citric acid cycles, its function in energy generation and biosynthesis of energy rich bonds, pentose phosphate pathway and its regulation. Alternate pathways (glyoxalic and uronic acid pathways)of carbohydrate metabolism. 38

Gluconeogensis. Interconversions of sugars. Biosynthesis of glycogen, starch and oligosaccharides.
Regulation of blood glucose homeostasis. Hormonal regulation of carbohydrate metabolism.

12hrs

Unit-3: Lipids

Fatty acid biosynthesis: Acetyl CoA carboxylase, Fatty acid synthase, desaturase and elongase. Fatty acid oxidation: α, β, ω oxidation and lipoxidation. Lipid Biosynthesis: Biosynthesis of triacyglycerols, phosphoglycerides and sphingolipids, Biosynthetic pathways for terpenes, steroids and prostaglandins. Ketone bodies: Formation and utilization. Metabolism of circulating lipids: chylomicrons, LDL, HDL and VLDL. Free fatty acids. Lipid levels in pathological conditions.

Amino Acid Metabolism : Overall nitrogen metabolism,digestion of dietary proteins,transaminationreaction(ALT,AST),mechanism of action of aminotransferases.Urea cycle and its regulation.Metabolism of ammonia and its disorders.Biosynthesis and degradation of essential and non essential amino acids and their regulation.Synthesis and degradation of catecholamines.In-born errors of amino acid metabolism.

17hrs

Unit-4
Nucleic Acid Metabolism: Biosynthesis of purines and pyrimidines. Degradation of purines and pyrimidines. Regulation of purine and pyrimidines biosynthesis. Structure and regulation of ribonucleotide reductase.Biosynthesis of ribonucleotides, deoxy ribonucleotides and polynucleotides. Inhibitors of nucleic acid biosynthesis.Salvage pathways.Disorders of nucleic acid metabolism.

11hrs

PAPER-IV

MS17BC104: ANALYTICAL TECHNIQUES

52 hrs

Unit-1

Centrifugation: Basic principles of centrifugation.Factors affecting sedimentation, Sedimentation Coefficient, Instrumentation and applications of Desktop, High speed and Ultra centrifuges; Preparative and Analytical centrifugation; Density gradiant and differential centrifugation and Isopycnic Centrifugation,

Extraction methods for preparation of samples: Preparation of extracts for biochemical investigations, physicochemical properties of metabolites and drugs

extracts from biological materials. Physico-chemical properties of solvents, solubility and missibility, ionic bonds, and salting out. Partition, ionization, buffering and their effect on extraction. Choice of solvent for solvent extraction, mixed solvents, solid phase extraction.

13hrs

Unit-2

Chromatography: Introduction, partition coefficient, phase systems- liquid and solid phases. Principle, instrumentation and applications of paper and thin layer chromatography.column chromatography-Ion exchange, Affinity and gel permeation Chromatography, HPLC.

Gas chromatography: Principle and design of instrument. Factors affecting GC, .Types of detectors (flame ionization , thermionic , electron capture , mass spectrometer).G.L.C; principle and application. **13 hrs**

Unit-3

Electrophoresis: Basic principles of electrophoresis and factors effecting electrophoretic mobility, Agarose gel electrophoresis of nucleic acids, capillary and pulse field,capillary electrophoresis.SDS PAGE.

Electro blotting: Western, southern, northern equipments and application. GIMSA assay.

Microscopic techniques: Types of microscopy(light, Phase Contrast ,florescence,dark field.Electron Microscopy- Working principle and applications of TEM and SEM, advantages.Immune gold , cryo-electron and Trans focal microscopy.

13hrs

Unit-4

Spectroscopic techniques: Electromagnetic spectrum, transition in spectroscopy. Principle, design and application of UV-Visible , fluorescence,

IR ,Raman IR , Atomic Absorption Spectroscopy,Flame photometer.

Principle, instrumentation and applications of X-RAY crystallography,NMR,ESR,

Mass Spectroscopy: Principle, overview of MS experiment, ionization modes: MALDI, equipments in MS analysis (Identification of metabolites). Interfacing MS with other methods; MS/MS, LC/MS, GC/MS.

13 hrs

PAPER-V MS17BC105:BIOMOLECULES

26Hrs

Unit 1: Carbohydrates and lipids

Carbohydrates: Structure, Classification and function of carbohydrates. Structure characteristics and biological importance of aminosugars , glycosides, bacterial polysaccharides, glycoproteins, blood group antigens and Lectins

Lipids Structure, Classification ,Characteristics and biological importance of lipids. Behavior of amphipathic lipids in water, formation of micelles and lioposomes. Prostaglandins.Bio membranes, membrane composition and fluid mosaic model.

13Hrs

Unit 2: PROTEINS AND NUCLEIC ACIDS

Proteins: Structure, Classification and properties of amino acids and proteins. Structural organization of proteins- Keratin, silk fibroin, collagen , myoglobin, haemoglobin, Integral membrane proteins,,concanavalin-A and Rossmann fold, ribonuclease, glyceraldehyde-3-phosphate dehydrogenase, lysozyme, chymotrypsin ,Triose phosphate isomerase . **13hrs**

MS17BC106 : Laboratory cum Training- I (BioPhysical chemistry and Clinical Biochemistry)

1. Preparation of buffers; Acetate, phosphate and tris buffer.
2. Chromatographic techniques (Paper,TLC,Column)
3. Qualitative Tests for bio constituents in biological sample.
4. Estimation of cholesterol, urea and glucose in biological sample.
5. Estimation of Serum bilirubin by Diazo method.
6. Estimation of Hemoglobin.
7. Analysis of water: estimation of calcium and magnesium by EDTA method.

MS17BC107 : Laboratory cum Training- II (Enzymology and Microbiology)

1. Assay of salivary amylases,
2. Assay of Alkaline phosphatases
3. Assay of SGOT, SGPT and LDH.

4. Microscopic examination and chemical analyses of blood, urine and stools.
5. Isolation of air microflora Colony characteristics and Counting, pure culture techniques
6. Biochemical tests for microbial culture,testing water quality by microbial Method.
7. Bacterial growth curve.

II SEMESTERPAPER-I
MS17BC201:ENZYMOLOGY

Unit-1 52hrs

Introduction to Enzymes: Nomenclature and classification of enzymes. Mechanism of enzyme actions. Monomeric and oligomeric enzymes and multi- enzyme complexes with examples viz. Pyruvate dehydrogenase and fatty acid synthetase. Isoenzymes

The investigation of active site structure: The identification of binding sites and catalytic sites–trapping the E-S complex, use of substrate analogs, enzyme modification by treatment with proteolytic enzymes, photo – oxidation and chemical modification of amino acid side chains. The 3-D structural features of active sites.

13hrs

Unit-2

Factors affecting enzyme activity: pH, temperature, substrate concentration, enzyme concentration.

Enzyme catalysis: Chemical nature of enzyme catalysis-General acid-base catalysis, electrostatic catalysis, covalent catalysis, intramolecular catalysis and enzyme catalysis.

Mechanisms of action of the following enzymes-lysozyme, ribonuclease, serineproteases and Triose phosphate isomerases.

Co-enzymes and cofactors: Water soluble vitamins and structure and function of their coenzymes.Metallo enzymes.

13 hrs

Unit-3

Enzyme kinetics: Kinetics of single substrate enzyme catalysed reactions; Michaelis Menton equation; determination of Vmax and Km values; Line-Steady State Kinetics, Eadie-Hofste plot; Kinetics of multi substrate enzymecatalysed reaction- reorder, order and Ping-Pong mechanism. Use of initial velocity, inhibition and exchange studies to differentiate between multi substrate reaction mechanisms.

Enzyme inhibition: Types-reversible, irreversible, competitive, non-competitive, mixed inhibition, partial inhibition, substrate inhibition and allosteric inhibition; irreversible inhibition.

14 hrs

Unit-4

Enzyme regulation: General mechanisms of enzyme regulation: Feed Back Inhibition and Enzyme repression control of enzymic activity by products and substrates; Allosteric enzymes, Sigmoidal kinetics and their physiological significance.

Fundamentals of enzyme assay – enzyme units, coupled kinetic assay. Criteria of purity of enzymes.

Industrial uses of enzymes: Amylases, cellulose degrading enzymes, proteolytic enzymes in meat and leather industry, detergents and cheese production; immobilisation of enzymes and their applications; introduction to biosensors.

12hrs

PAPER-II

MS17BC202: BIOTECHNOLOGY 52hrs

Unit-1

Recombinant DNA Technology

Introduction to recombinant DNA technology, importance of recombinant DNA technology, construction and screening of genomic and cDNA libraries, chemical synthesis of oligonucleotides, cloning vectors (λ -phage, plasmid, M-13 phage, cosmid shuttle, BAC and YAC vectors), properties of restriction endonucleases and their mode of action. **10 hrs**

Unit-2 Sequenicng

Sequencing OF DNA by Sanger's method, Principle and technique of pyrosequencing, Protein sequencing by Edman degradation method, site directed mutagenesis, RFLP,RAPD, PCR, DNA finger printing, Phage display , Yeast-two-hybrid (Y2H), Three hybrid assay**.** **10 hrs**

Unit-3

Gene transfer to plants: Plant tissue cell culture, hormones in plant tissue culture media, callus culture, Acclimatization of micro propagated plant. *Agrobacterium* mediated transformation, Ti plasmid, mechanism of T-DNA transfer, Function of T-DNA genes, Ti-plasmid derivatives as plant vectors (disarmed T-DNA), cointegrate and binary vectors, selectable markersfor plants, Direct DNA transfer to plants: protoplast transformation, particle bombardment, chloroplast transformation, electroporation. **11hrs**

Animal tissue culture: Cell culture media, monolayer and suspension culture, Gene transformation: Transfection, electroporation and liposome mediated transfer. *In vitro* fertilization and embryo transfer. Introduction to Transgenic animals, ethical issues regarding genetically modified organisms. **9hrs**

Unit-4

Fermentation technology

Primary and secondary metabolites in biotechnology, continuous and batch type culture techniques, principle types of fermentors, general design of fermentor, fermentation processes-brewing, manufacture of penicillin, production of single cell proteins, production strategies for other antibiotics and other organic compounds.

12 hrs

PAPER-III MS17BC203: IMMUNOLOGY

Unit-1

Introduction to Immune System

Memory, specificity, diversity, innate and acquired immunity, self vs non-self discrimination. Structure and functions of primary and secondary Iymphoid organs.

Cells Involved in Immune Responses

Structure and functions of Lymphocytes,Granulocytes,Macrophages,Dendritic cellsand mast cells

Nature of Antigen and Antibody

Antigen vs Immunogen, Haptens ,Structure and functions of immunoglobulins ,Isotypic, allotypic and idiotypipc variations.Clonal selection theory – concept of antigen specific receptor.

13 hrs

Unit-2

Humoral and Cell Mediated Immune Responses

Complement activation and its biological consequences, Antigen processing and presentation Cytokines and costimulatory molecules: Role in immune responses.T and B cell interactions.

Major Histocompatibility Complex (MHC) Genes and Products

Polymorphism of MHC genes, Role of MHC antigens in immune responses,MHC antigens in transplantation.

13hrs

Unit-3

Immunological Techniques.

Production of polyclonal and monoclonal antibodies: Principles, techniques and applications. Agglutination and precipitation techniques, Radio immunoassay, ELISA, Immunofluorescence assays: Fluorescence activated cell sorter (FACS) technique.

Hypersensitivity

Immune – tolerance, Immunosuppression, Hypersensitivity (Type I, II, III and IV).

13hrs

Unit-4

Immune Responses in Diseases

Immune responses to infectious diseases: viral, bacterial and protozoal, Cancer and immune system, Immunodeficiency disorders, Autoimmunity.

Immunization

Active immunization (immunoprophylaxis), Passive immunization (immunotherapy), Role of vaccines in the prevention of diseases**.** **13 hrs**

PAPER-IV

MS17BC204: BIOCHEMICAL GENETICS

Unit I

Introduction: Nature of genetic material. Chromosomes and genes. Mutation: types of mutation, mutagens, mechanism of mutation **3 hrs**

Classical Genetics: Review of classical genetics; work on Pisum sativum, Drosophila Melanogaster, Neurospora Crassa etc. inheritance (sex-linked and others). Population genetics, extranuclear inheritance. Sex determination, Morgan's discovery of sex linked inheritance of sex linked genes, X;linked traits in humans. Identification of sex chromo;somes, XX,XY, mechanism of sex determination. **10 hrs**

Unit II

Quantitative Genetics: Human quantitative traits, discontinuous traits and continuous traits,Breeding analysis, genetics basis of quantitative variation, Multiple factor hypothesis and analysis of polygenes. Genotype-Environment Interaction and models for their measurement, estimation of Heritability Index.

13 hrs

Unit III

Human Genetics: Biochemical events occurring during mitosis and meiosis. Structure of chromatin; nucleosomes and higher orders of organization. Chromosome banding, Chromosome mapping based on recombination frequency data. Transposons. Overview of human genome project, mapping of human genes; techniques used, assignment of important genes. Transposition in human chromosomes. Chromosomal abnormalities. **13 hrs**

Unit IV

Bacterial Genetics: Bacterial chromosomes, plasmids; fertility, resistance, colicinogenic and others. Recombination in bacteria**.** **5 hrs**

Viral Genetics: Life cycles of bacteriophages, lytic cycle; replication of T-phages. Lysogeny and its regulation. Transduction; specialized, generalized and abortive. Fine structure analysis of T-phages; Benzers work, concept of cistrons**.** **8 hrs**

PAPER-V MS17BC215:BIOINFORMATICS

Unit-1

Computer basics, Introduction, Scope of Bioinformatics and Biological data bases

- MS windows basics, UNIX basics.
- PC X Windows (NCD PCXWARE).
- File management.
- E-Mail (PINE, EUDORA, NETSCAPE MAIL).
- File transfer (ftp, WSftp).

Operating systems: System and application software, evolution of operating systems, layered structure of operating system, CUI and GUIs, DOS internet & external commands, Batch files.

Office applications: MS-office including MS-Word, MS-Excel, and MS-Powerpoint.
Data bases: Databases structure Organization and management of data bases, Data mining. Retrieval tools of biological data. Biological information resources, Nucleic acid and protein data bases.
13 hrs

Unit 2

Sequence Alignment and prediction of structure of protein
Database similarity searches: BLAST and FASTA**,** Sequence Alignment. Methods of local and global alignment. Dynamic programming, scoring matix, PAM, BLOSUM, Pairwise and multiple sequence alignment. Phylogenetic tree construction and software, Methods of prediction

of structure of protein and structure prediction softwares, Drug designing : Chemo-informatics in Biology.

13 hrs

PAPER – VI

MS17BC225: FOOD TECHNOLOGY **26hrs**

Unit 1

Introduction and Constituents of foods.

Food: source, functions of food – food groups – basic five food groups, usage of the food guide – food in relation to health – objectives of cooking.

Water: Purification processes – Ion exchangers, reverse osmosis, activated charcoal treatment. Use of chlorination, ozone, and UV light disinfection. Specification of drinking water. Water borne diseases – microbiological examination. Sources and detection.

Milk: Composition and effectiveness as a diet. Fat content in milk, whole and skimmed. Effect of cooking and heat processing of milk – pasteurization. Preservation of milk. Deep freeze preservation, dairy products – cheese, butter, ghee and kova. Spray drying technique – milk powder, infant food preparation. Lactose intolerance. Milk substitutes – vegetable milk. Toned milk.

Effect of cooking on the nutritive value of carbohydrate, protein, fat, vitamins and minerals food products. Emulsions and emulsifiers, rancidity of fats – chemistry of fat and oil processing , Fortification with vitamins and minerals. Effect of cooking on different methods of cooking of vegetables, fruits – dehydrated fruits, canned fruit, canned fruit juices. Estimation of thiamine,riboflavin (fluorimetry) and metals in tea dust. **13hrs**

UNIT 2:

FOOD ADDITIVES,ADULTERATION AND HYGIENE

Enzymes in food processing. Enzymic browning – mode of action and prevention of enzymic and non-enzymic browning. Artificial sweetening agents. rancidity of fats ; storage of fats. Fortification with vitamins and minerals.

Food Additives: Food additives: Artificial sweeteners – saccharin, cyclomate, asparatame –food flavours – esters, aldehydes and heterocyclic compounds. Antioxidants. Food colours – changes in cooking..Restricted use. Spurious colours. Emulsifying agents, preservatives – leavening agents.Baking powder –Yeast. Taste enhancers – MSG-vinegar Modern food: Mushroom cultivation and types, . Production of bread, bun and biscuits. Raw materials, methods and machinery required.Functions and uses of food additives.

Beverages: Composition of soft drinks. Preservation of tetrapack. Nitrogen preservation and packing of fruit juices.

Food Adulterants: Common adulterants in different foods – milk and milk products, vegetable oils, fats, spices , cereals and pulses. Prevention of food adulteration

Food preservation and processing : Food deterioration, methods of preservation and processing. Quality control: Specifications and standards: PFA, FPO, FDA, drug license, WHO standards, ISI ,AGMARK. **13hrs**

PAPER – VII

MS17BC206: LABORATORY COURSE– III (PROTEIN CHEMISTRY AND IMMUNOLOGY)

1. Isolation, separation and identification of protein/enzyme using thin layer chromatography.
2. Purification of an enzyme using column chromatography(ion-exchange columns/gel filtration/ affinity chromatography).
3. Estimation of protein by Lowry's method.
4. Estimation of tyrosine by Millon's method.
5. Molecular weight determination and kinetic studies on purified enzymes.
6. Demonstration of Ag-Ab interaction: Radial immuno-diffusion and ODD.
7. Demonstration of direct agglutination reaction using human blood group antigens.
8. Bacterial agglutination (WIDAL)
9. Antibody titration – ELISA; Direct, Indirect ELISA.
10. Rocket electrophoresis.
11. Protein synthesis in a cell free protein synthesizing system from animal and plant source.(industrial visit)

PAPER – VIII

MS17BC207: LABORATORY COURSE– IV (MOLECULAR BIOLOGYAND BIOINFORMATICS)

1. Isolation of DNA from cauliflower, sheep liver and bacterial source.
2. Isolation, separation, identification and Determination of molecular weight of Proteins by SDS-PAGE.
3. Writing a BASIC computer program to plot graphs of enzyme kinetic data by a variety of linear transforms and the Michaelis- Menten hyperbolic plot.
4. Prediction of structure of a biomolecule by using various softwares.(Rasmol, PDB,Identification of ligands/substrate through docking, chemsketch etc,…)
5. Subcellular fractionation of organelles from liver cells and identification by the use of marker enzymes.(industrial visit)
6. Separation of Protein in HPLC.

III SEMESTERPAPER-I

MS17BC301: MOLECULAR BIOLOGY 52 hrs

Unit -1

INTRODUCTION: Principle of DNA sequencing**,** automated sequencing, extending the sequence, shot gun sequencing.Interpretation of DNA sequences.Role of counterions, deep and narrow grooves, single stranded DNA, A, B and Z DNA etc. Chirality of the helix, syn/antiparallel complementary stands.

Physical properties of RNA: Classes of RNA, rRNA, tRNA, mRNA, HnRNA etc.

12hrs

Unit -2

DNA Replication: Replication origin and replication fork, mapping origin ofReplication by autoradiography and electrophoresis, semi-conservative and semi-discontinuous replication; DNA Polymerases, Semi-discontinuous synthesis,Replication apparatus of phage.Properties and functions of DNA polymerase-I,Korenberg enzyme,Subunit composition of polymerase –III holoenzyme,telomerase, topoisomerase and gyrase.

Genetic code;Properties of genetic code,coding properties of mRNA,Coding properties of tRNA, triplet binding assay, Khorana and Neirenberg experiments, base pairing between codon and ani-codon, Wobble base pairing., deviation from universal genetic code.

14hrs

Unit-3

Transcription in prokaryotes: RNA synthesis and processing (transcription factors and machinery, formation of initiation complex, transcription activator and repressor, RNA polymerases, capping, elongation, and termination, RNA processing, RNA editing, splicing, and polyadenylation, structure and function of different types of RNA, RNA transport). Protein synthesis and processing (Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, and translational proof-reading, translational inhibitors, Post- translational modification ofproteins).
15hrs

Unit -4

DNA Repair : Damaging agents and damagerecognition, direct repair, Miss-matchrepair assay for mismatch repair, Base excision repair(BER), Nucleotide excision repair(NER) systems; components and mechanism of repair, errorprone repair, SOS and Rec-A.
Satellite DNA: C-value paradox, possible functions of satellite DNA, Mechanical strength, gene library, suppressor mutation, centromeric DNA, split genes
Chromatin: Histone and non-histone proteins . Nucleosomes, role of H1.

11hrs

PAPER - II

MS17BC302: NUTRITIONAL BIOCHEMISTRY 52 hrs

Unit-1

Introduction of Nutrition: Energy concept of foods- Definition and characteristicfeature of balanced diet, proximate analysis of foods for carbohydrates, proteins, fats, fibre material.Determination of calorific value of foods, like carbohydrates, fats and proteins. Biochemical importance of R.Q. BMR, measurement of BMR, direct and indirect method, factors affecting BMR.

Biological Oxygen Demand: Definition and importance. Energy requirement for different physical activities. Standard Dynamic Action (SDA) of food. Recommended Daily Allowance (RDA) – Definition & for various food and physical activities. **15hrs**

Unit-2
Carbohydrates: carbohydrate reserves of the human body,nutritional importance of carbohydrates.

Proteins: Protein reserves of human body. Nitrogen balance studies and factors influencing nitrogen balance. Essential amino acids for man and concept of protein

quality.Protein energy malnutrition: Marasmus, Kwashiorkor, causative factors, symptoms, treatment & prevention

Lipids: Major classes of dietary lipids. Properties and composition of plasma lipo-proteins. Dietary needs of lipids. Essential fatty acids and their physiologicalfunctions.

13hrs

Unit-3

Nutritional importance of vitamins: Classification, sources, daily requirement and functions. Hypervitaminosis of fat soluble vitamins

Nutritional importance of Minerals: Definition, classification, sources, daily requirement and deficiency, symptoms. The process of digestion, absorption, functions, toxicity interaction with other nutrients. **13hrs**

Unit-4

Biochemical aspects of oxidative stress and antioxidants. Free radicals- formation and biological importance in human system. Natural antioxidants, role of free radicals and antioxidants in health & diseases.

Starvation :. Protein metabolism in prolonged fasting. Protein sparing treatmentsduring fasting. Basic concept of high protein, low caloric weight reduction diets.

Obesity : Definition and classification. Genetic and enviromental factors leading to obesity. Obesity related related diseases and management of obesity. **11 hrs**

PAPER - III

MS17BC303: RESEARCH METHODOLOGY AND STATISTICS

52hrs

Unit-1

Methodology of scientific research.The nature of scientific methods.Quantitative biochemical measurements: Analytical considerations and experimental errors, nature of experimental errors- random and systemic errors. Identification of systemic errors, SOPs. Performance of analytical methods, precision, accuracy, detection limit, analytical range, specificity, sensitivity, and robustness. **13 hrs**

Unit-2 and 3

Quantitative biochemical measurements: Analytical considerations and experimental errors,nature of experimental errors- random and systemic errors. Identification of systemic errors, SOPs. Performance of analytical methods, precision, accuracy, detection limit, analytical range,specificity, sensitivity, and robustness.

Gaussian distribution (normal) of data, quantification ofprecision by standard deviation, coefficient of variation and variance, (data to be provided forcalculation of each parameter). Assessment of accuracy; Population statistics- confidence limitsand confidence intervals, student's t-test, standard error of mean, examples for calculation. Qtests,examples and applications, Null hypothesis, use of t-test tovalidate analytical methodsunpaired,paired, one-sample, two-sample tests with examples. Calibration methods; Least meansquare method of fitting straight line to data with example. Correlation and regression analyses.ANOVA, one way and two-way ANOVA.
Principles and practice of statistical methods in biological research, Basic statistics: samples and populations ,measures of average, measures of dispersion, standarderror, confidence limits; Probability distribution: normal, binomial and Poisson distribution; correlation and regression, test of statistical significance, and analysis of variance, Distribution of student's -t, chi-square (X2), F-test, latest software, introduction of software, exercise on biochemical problems **26 hrs**

Unit-4

Collection and review of research literature, sources of literature and their evaluation. Designing research methodologies. General strategies for preparation of research proposals. Data representation in technical reports, posters, presentation in scientific conferences and workshops. Preparation of manuscripts for publication in national and international journals. Yardsticks employed in evaluation of manuscripts for publications. **13hrs**

MS17BC304: BIOCHEMISTRY IN DAILY LIFE (For Other streams)

PAPER-V

MS17BC305: LABORATORY COURSE-III

1. Preparation of plasmid DNA from bacterial source.
2. Digestion by endonucleases and separation of DNA restriction fragment on agarose gel electrophoresis.
3. Ligation of DNA.
4. Isolation, quantification and characterization of total RNA from plant and microbial source.
5. DNA and RNA techniques using nitrocellulose - Southern and Northern Blotting.
6. Electroblotting of DNA restriction fragments.
7. Sequencing of DNA and RNA on polycrylamide gels.(Industrial Visit)
8. Rapid amplification of polymorphic DNA(RAPD).

9. Amplification of desirable gene by PCR
10. Real Time– Polymerase Chain Reaction RT-PCR. (Industrial Visit)
11. Preparation of competent cells.

MS17BC306- Project work-Dissertation

SEMESTER IV

Open Elective ICombination-1

MS17BC411: Pharmacovigilance

(Four hours per week, 4 credits)

Unit-1 (13hrs)

Drug Development Process

Drug discovery,Permulation and formulation,ICH-GCP Guidelines, ICMR Guidelines,USFDA guidelines, Indian Regulatory Authority Frame Work-CDSCO Regulations, DCGI,Data to be submitted along with the application to conduct clinical trials/import/manufacture of new drugs for marketing in the country, Data requiredto be submitted by an applicant for grant of permission to import and manufacture a new drug already approved in the country. Structure,Contents and Format for clinical study reports.

Unit-2 (13hrs)

Pharmacoepidemiology

Definitions: epidemiology, Disease distribution, disease determination, disease frequency, Aims of epidemiology, Difference between epidemiology and clinical medicines, Epidemiological approach, Measurements in epidemiology, (rates, ratios, and proportions) Measurement of mortality: international death certificate, limitations and use of mortality data, mortality rates and ratios, crude death rates, specific death rates, case fatality ratio, proportional mortality ratio, survival rate, standardize rates, direct standardization, indirect standardization, Measurement of morbidity: Incidence,

Prevalence, uses of prevalence, relationship between incidence and prevalence.

Unit-3 (13hrs)

Clinical Trial Management

Definition: Clinical Research, Different phases, study designs in research, glossary, Different parties involved in Clinical research, Regulatory Authorities, IRB/IEC, Sponsor, CRO, SMO, Investigator, Patients, Clinical Research History, Food, Drug & Cosmetic Act, Nuremberg Code, Declaration of Helsinki, ICH, Thalidomide Disaster

Different Regulatory Bodies- an overview, FDA, DCGI, MHRA, MHLW, TGA, IRB/IEC, Schedule Y, IND & NDA Application, Regulatory requirements & Forms, Clinical Trials process & monitoring,Roles of different parties, Clinical Trialprocess and design, Informed Consent Process, TMF (Trial Master File), Investigator Boucher, Essential Documents

Unit-4 (13hrs)

Clinical Data Management

CDM Overview, CRF Design – Theory & Practical Design of the pCRF (Paper CRF) &eCRF (electronic CRF), Data Entry & DE Guidelines, Discrepancy Management, Data Validation, CDISC (SDTM), Query Management, QA, QC in CDM, Audits & Inspections (Indian DCGI & USFDA), SAE Reconciliation, Data Management Systems and Tools, Medical Coding and Medical Dictionaries – MedRA& WHODD, Documentation and Document Management System, Data Archival, Software's in CDM, CDM

MSBC16F4200: SAS Technique 52 hrs

Unit-1 (13hrs)

Pharmacovigilance

Introduction, Scope, definition and Aims of Pharmacovigilance.Adverse drug reactions – Classification, mechanism, predisposing factors and casualty assessment. Role ofclinical pharmacist in Reporting, evaluation, monitoring, prevention and management of ADR Adverse drug reaction.Signal detection, PSUR (Periodic safety update report),Safetyspecification,and Risk management.Eporting and monitoring Drug induced diseases.

Unit-2 (13hrs)

Introduction and use of SAS

Environment of SAS, Library structure in SAS, Data steps and Procstep,manipulating the data-Converting the numeric data to character and vice versa.Using logical operators and where conditions, Merging of the datasets, Writing the data into multiple datasets.Debugging errors in the program.Writing the procedure- Tabulate, Univariate, Means, Median, Mode, Report, Sort, Mixed, Transpose etc. Creating the html reports.Importing the data to SAS and exporting the data from SAS.Overview of SAS macros.

Unit-3 (13hrs)

Regulatory Affairs

Basic Fundamentals of Regulatory Affairs, Introduction to Regulatory Bodies, Introduction to Quality Standards for Regulatory Compliance, Common Technical Documents - CTD (API & Formulation), Introduction to eCTD, ASEAN Common Technical Dossier (ACTD), Marketing Authorization Procedures in USA, Marketing Authorization Procedures/ Channels in Europe, Marketing Authorization Procedures in India, Marketing Authorization Procedures in ROW markets, Maintenance and Annual updates for Marketing authorizations, Reference on Further reading & Dissertation

Unit-4 (13hrs)

Medical & Scientific writing

What is Medical Writing, Scope of Medical Writing, Medical Writing in Clinical trials, Medical Writing and Scientific Writing, Fundamentals of Medical Writing, Regulatory Medical Writing, The Writing Process, Good Writing Skills:Introduction to basic rules, Elements of style

Good Clinical Practice guidelines, The Clinical Study Report

Introduction to publication writing, Regulations and Industry Standards, Writing Effective Documents, Writing standard operating procedures policies, procedures, instructions and methods, Writing quality manuals and plans

Open Elective IICombination-2

MS17BC421:Clinical Diagnostics

52hrs

Unit-1
Human Physiology

Rhythmical excitation of heart, basic theory of circulatory function, blood flow and resistance, function of arterial and venous systems

Microcirculation and lymphatic system, control of blood flow, regulation of arterial pressure, cardiac output.

Spinal cord and motor functions, role of brain stems in controlling motor functions, functions of cerebellum, functions of cortical areas, the limbic system and cerebrospinal fluid system.

Medico -informatics

Introduction to Medical Network Design & Development Emergence of Medical Informatics as a Discipline; Library facilities & Logistics ; Online Resources ; Grading and Class Policies, Medical data acquisition and database systems: PC based multichannel data acquisition system; storage, analysis and retrieval techniques.

Basics of sequence analysis-

Dot matrix method, Needleman–Wunsch Algorithm and Smith-Waterman algorithm, Alignments using BLAST and FASTA, Multiple Sequence Alignment (CLUSTAL-X and CLUSTAL-W), Application of multiple sequence alignment. **13hrs**

Unit-2

Analysis tools: Analysis by TreeView, Genedoc and Lasergene. Protein Structure Prediction in Bioinformatics- Ab initio based methods, Homology based methods, prediction with neural networks, secondary structure prediction (helical membrane proteins, beta-barrel membrane proteins). Protein structure comparison of intermolecular and intramolecular methods Phylogenetics- construction by distance based methods, character based methods.

Visual programming concepts

Visual Basic environment, tools and controls; Dynamic data exchange; VB based Medical information System. Basic concepts of Multimedia; Design of Multimedia information systems; Components of virtual reality; Virtual reality applications in medicine. Medical Informatics and its levels; Design and development of educational packages on medical sciences; Integrated design concepts; Interactive multimedia,Virtual and digital libraries, Internet and its applications.

Hospital Information System its design and functional characteristics; Pattern Recognition, Neural Network and Fuzzy Logic in Medicine. Autonomous, Decision-

Support & "Expert" System: History of Artificial Intelligence in Medicine; Expert Systems in Medicine; Clinical Software Overview Risks of Decision-Support Systems,Computational Statistics in medical biology. **13hrs**

MS17BC421: CLINICAL BIOCHEMISTRY **52 hrs**

UNIT - 1

Concepts of accuracy, reproducibility, reliability and other factors in quality control: Specimen collection and processing, collection of blood- venepuncture, arterial puncture and anticoagulants. Collection and analysis of normal and abnormal urine samples, preservation, clinical significance of sugars, ketone bodies, proteins & bilirubin. Theories of CSF collection, composition and analysis.

Disorders of carbohydrate metabolism: Blood sugar levels, hyper and hypoglycemia, regulation of blood glucose level. Diabetes mellitus- types, causes and symptoms. GTT, HbAIC, GSD, HMP Shunt, fructosuria & fructose intolerance.

Disorders of lipid metabolism: Lipid levels in various conditions, lipoproteins,clinical inter-relationship of lipids.

Diagnostic tests for apolipoproteins, HDL-C, LDL-C, and triglycerides levels in healthy& diseases conditions. Hypercholestremia, fatty liver and myocardial infarction.

Disorders of protein metabolism: Non-protein nitrogenous constituents in blood- urea, uric acid & creatinine. Plasma protein abnormalities, multiple myeloma, proteinuria, haemoglobinopathies, PKU, AKU, homocystinuria, albinism & Bence Jones proteins. **13hrs**

UNIT - 2

Disorders of nucleic acid metabolism: Disorders of purine metabolism- Gout- causes & symptoms, xanthinuria, orotic acidic uria & L-N syndrome.

Disorders of mineral metabolism: Hypercalcemia, hypocalcemia, hypophosphatemia& hyperphosphatemia.

Disorders of vitamins & trace elements: Hypervitaminosm- causes & symptoms, trace elements deficiency disorders.

Evaluation of organ function test: Assessment and clinical manifestation of renal, pancreatic, gastric and intestinal functions.

Disorders of heme metabolism: Jaundice- types, causes & symptoms. Clinical importance of diagnostic enzymes- SGOT, SGPT, creatine kinase, aldolase, LDH, CPK, troponin 'C'

Renal and gastric functional test: Acute and chronic renal failure, urinary tract, observation and analysis of urinary calculi, LFT, pancreatic and gastric function test.

13hrs

Open Elective IIICombination-3

MS17BC431: PLANT BIOCHEMISTRY

52hrs

Unit-1

Structure and functions of plant cell (including cell wall, plasmodesmata, meristematic cells, vacuoles, secretary systems and root quiescent zone), Isolation of cell organelles, absorption, adsorption and transport of water and ions in plants. Evapotranspiration.

Biological nitrogen fixation and ammonia assimilation.Nitrate and sulphate reduction and their incorporation into amino acids.Translocation of inorganic and organic substances.Metabolism of sucrose and starch. Important routes (pathways) of biosynthesis- phenyl propanoid pathway; Mevalonate pathway; Acetate-mevalonate pathway

Photosynthesis – structure of organelles involved in photosynthesis in plants and bacteria. Proton gradients and electron transfer in chloroplasts of plants and in purple bacteria – differences from mitochondria. Light receptors – chlorophyll, light harvesting complexes, bacteriorhodopsin, rhodopsin as ion pump.
Photosystems I and II, their location, mechanism of quantum capture and energytransfer between photosystems – ferridoxin, plastocyanin, plastoquinone, carotenoids.The Hill reaction, photophosphorylation and reduction of CO_2.C_3, C_4 and CAMmetabolism, light and dark reaction. Light activation of enzymes, regulation ofphotosynthesis. Photorespiration.

13hrs

Unit-2

Special features of secondary plant metabolism, formation of phenolic acids, tannins, lignins, lignans, pigments, terpenes, terpenoids, plant phenolics, alkaloids and surface waxes – their biosynthesis and function, cell wall components.

Plant hormones – Growth regulating substances and their mode of action. Molecular effects of auxin in regulation of cell extension and of gibberllic, abscisic acids and cytokinins in the regulation of seed dormancy, germination, growth and development and embryogenesis. Biochemistry of seed development and fruit ripening. Defence system in plants. Tissue culture and transgenic plants.

Plant responses to biotic and abiotic stresses:Introduction; Plant pathogens and diseases; plantdefense systems-hypersensitive response; systemic acquired resistance; induced systemic resistance; Plant abiotic stress responses-Salt stress, drought and heavy metal stress responses; osmotic adjustment and significance of osmotic agents such as proline, sugar alcohols andquaternary ammonium compounds; An overview ofoxidative stress and oxidative damage. Antioxidant enzymes and stress tolerance. Plant biotic stress response – pathogen and insects.

13hrs

MS17BC431: INDUSTRIAL BIOCHEMISTRY

52hrs

Unit-1

Nanobiotechnology: Types of nanoparticles, DNA based nanostructures, nanosized carriers for drug delivery. Role of nanoparticles in drug delivery. Nanobiotechnology in gene therapy, tissue engineering andtransplantation.

Pharmaceutical biochemistry and vaccine development

Development of new drug/molecules and elucidation of their mechanisms of actions; formulations; pharmacokinetics and pharmacodynamics; factors affecting drug efficacy drug resistance; traditional medicines; biotransformation; large scale production of humanized monoclonal antibodies; vaccine development.

Food biochemistry

Introduction to different categories of food; constituents of food products and their functional properties; introduction to food processing;food spoilage; intrinsic and extrinsic factors affecting the quality and life of food material; food storage and preservation techniques; food poisoning; molasses and alcohol production.Industrial production of proteases; carbohydrases; lipases and their applications, vaccine production by rDNA technology; downstream processing.

13 hrs

Unit -2

Fermentation technology- surface, submerged and continuous culture techniques. Design and operation of fermentors, Agitation and Aeration, selection and growth of microorganisms in controlled environments, medium development. Strategies for improvement and maintenance of the industrial strains, Bioreactors.

Production of fermented milks, cheese, alcoholic beverages, breads by yeast. Fermentation production of Antibiotics- pencillin, streptomycin, Organic acid, citric acid, lactic acid, Enzymes –amylase, proteases, Amino acid-glutamic acid, lysine and Vitamins- B12 and vitamin C .

Microbial transformation

Types, techniques and commercial applications. Bioleaching and biosorption, Biodegradation and Bioremediation, Biomass and Bioenergy, Biopolymers and Biosurfactants. Enzyme electrodes and biosensors. Sewage water treatment – primary, secondary and tertiary treatments. Bio-control agents- Insecticidal toxins of Bacillus thuringenesis.

Bioethics and Biosafety, biosafety guideline and regulations, animals in research, Legal and socio-economic impacts of Biotechnology, Ethical, legal and social implications (ELSI) of HGP.Ethics in clinical trials. Intellectual property rights and protections for biological inventions. Patent and process involved in patenting.

13hrs

MS17BC402: Laboratory cum Training- VI(Genetic Engineering)

1. Digestion of endonucleases and separation of DNA restriction fragment on agarose gel electrophoresis.
2. Ligation of DNA
3. Blotting Techniques:Southern and Northern
4. DNA amplification by PCR.
5. Random Amplification of polymorphic DNA.
6. Plant tissue culture independent method of transformation.
7. Sequencing of DNA and RNA on polyacrylamide gels.

MS17BC403: Project work-dissertation (continued from III Semester)

SUGGESTED READINGS FOR M.Sc.BIOCHEMISTRY
I SEMESTER

MS17BC101: ORGANIC, BIOPHYSICAL CHEMISTRY, BIOCHEMICAL AND ENVIRONMENTAL TOXICOLOGY

1. Stereo chemistry of organic compounds (1994) by E L Eliel & SHW Awley. Inter Science Pub.30. Wiley and sons.Inc.
2. Organic Chemistry (6th ed. 2000) by R T Morrison & R N Boyd. Prentice Hall of India. New Delhi.
3. Organic Chemistry Vol.1 Fundamental Principles (6th Ed. 2003) by IL Finar, ELBS
4. Organic Chemistry, 11th edition 2014, by T W Graham Solomons, Craig B Fryhle and Scott A Synder.
5. Organic chemistry by Stanley H. Pine (4th Edition, 1987) Tata Mc-Graw hill.
6. Vol.2 Stereo Chemistry and the Chemistry of Natural Products. (5th ed. 1985) by I L Finar, ELBS.
7. Lehninger's Principles of Biochemistry (2nd Ed 2000) D L Nelson and M M Cox, Macmillan Worth pub. Inc NY.
8. Physical Biochemistry by Kansal Edward Van Holde (1971) Prentice Hall Inc. New Jersey.
9. Physical biochemistry 2nd nd (1982) by David Friedfelder, W H Freeman and Co. NY.

10. General and Applied Toxicology 1995 by Marrs and Turner. Macmillan Press Ltd.
11. Basic Envionmental Toxicology (1994) by Lorris G. Corkerhem and Barbara S S Shane CRP Press Inc.
12. Introduction to Food Technology by Talayurki Shibamato & Leonard F Bzeldanes.
13. Molecular Biotechnology 2nd ed 1994 by Barnard R Glick & J J Pasternak.

MS17BC102:GENERAL PHYSIOLOGY

1. Molecular Biology of the Cells (3rd edn 1994) by Alberts et al., Garland Publications inc NY and London.
2. Cell Biology (1993) by E S Sedava, Jones and Barlett Publishers Boston, London.
3. Cell and Molecular Biology (8th ed. 2001) by E D P de Robertis & E M F de Robertis (Jr) Lippincott Williams &Wilkins, Philadelphia.
4. Principles of Cell Biology (1988) by Klein Smith and M.Kish. Harper-Cellins Pub. Inc. New Delhi.
5. Text book of Medical Physiology (10th ed. 2001) by A C Guyton & **J** E Hall. Harcourt Asia.

MS17BC103: BIOENERGETICS AND INTERMEDIARY METABOLISM

1. Lehninger's principles of Biochemistry (2nd edn. 2000) by D L Nelson and M M Cox, Macmilian, Worth Pub Inc.
2. Biochemistry (4th edn. 1992) by Lubert Stryer WH Freeman & Co., NY.
3. Harper's Biochemistry (25th ed.) by R K Murray and others. Appleton and lange, Stanford.

MS17BC104: ANANLYTICAL TECHNIQUES

1. Instrumental methods of analysis H.H.Wilard,L.L.Merritt, J A Dean.
2. Instrumental Methods of Chemical analysis.
3. Analytical Chemistry G.D. Chritiain. Wiley
4. Introduction of instrumental analysis. R.P.Braun
5. Biophysical chemistry by Upadhyay and Upadhyay .
6. Principles and Techniques of Practical Biochemistry byKeith Wilson, John Walker, 5th Edition, 2000. Cambridge Univ.Press
7. Organic Spectroscopy by Willium Kemp,3rd edition 2008.
8. Essentials of Nuclear Chemistry- H.J.Arnikar
9. A text book of quantitative Inorganic analysis A I Vogel.
10. Pharmacopoeia of India , British Pharmacopoeia
11. Standard methods of Chemical analysis A Series of Volumes Edited F.J.Welcher R.G. Krieger publ-Company.
12. Principles of Instrumental Analysis Fifth edition Skoog, Holler, Niemay

13.Principles and techniques of practical Biochemistry. K.Wilson and J. Walker. 4thEdn. Cambridge University press (2012).

II SEMESTER

MS17BC201:ENZYMOLOGY

1. The chemical kinetics of enzyme action by K J Laidler and P S Bunting, Oxford University Press. London.
2. Enzymes by M Dixon, E C Webb, CJR Thorne and K F Tipton, Longmans, London.
3. Enzyme structure and mechanism (1977) by Alan Fersht, Reading, USA.
4. Enzymatic reaction mechanism (1979) by Cheristopher Walsh, freeman Pub., San Francisco.
5. Immobilized enzymes (1978) by Ichiro Chibata, Haisted Press Book.
6. Enzyme structure and function by S Blackburn (1976) marcel Dekker, Inc., NY.

MS17BC202: BIOTECHNOLOGY

1. Biochemistry (2nd ed 1995) by Donald Voet and Judith Voet.
2.Molecular Biology of the gene (IV ed 1987) J Watson NH Hopkin JW Roberts J P Stertz A M Weiner, FreemanPub., San Francisco.
3.Genes VII Benjamin Lewin (2000) Oxford Univ Press. London.

MS17BC203:TECHNICAL WRITING, COMPUTERS AND BIOINFORMATICS

1. Discovering Genomics, Proteomics and Bioinformatics, Campbell A M & Heyer L J, 2nd Edn. Benjamin Cummings, (2007).
2. Protein Bioinformatics; M. Michael Gromiha, Academic Press (1983).
3. Principle and Practice of Bioanalysis; Richard F. Venn (Ed.) Taylor and Francis (2000).
4. Attwood, T. and P.S. David. 2006. Introduction to Bioinformatics. Pearson Education Ltd.,New York.
5. Baxevanis, A.D., and Ouellette, B.F.F. (eds) 2006. Bioinformatics A Practical Guide to Analysis of Genes and Proteins. 3rd Edition, John Wiley and Sons, New York.
6. Attwood T.K. and Higgs, P.G. 2005. Bioinformatics and molecular evolution. Blackwell Publishers, London.
7. Lesk, A.M. 2002. Introduction to Bioinformatics. Oxford University Press

MS17BC204:IMMUNOLOGY

1. Immunology (4th edn. 1998) by Ivan Roitt, J Brostoff and David Mole (4th edn) Mosby Times Mirror Int. Pub.Ltd.
2. Essential Immunlogy (9th ed. 1997) by Ivan Roitt Blackwell Science Ltd.
3. Immunology (1992) by Janis Kuby W H Freeman and Co. Ltd. USA.

4. Immunology (2nd edn. 991) by Edwards S Golub, Sinauer Associate, Sunderland.

MS17BC225:FOOD TECHNOLOGY

5. Swaminathan M. Advanced Text Book on Food and Nutrition , volume I and II Printing and Publishing CO., Ltd., Bangalore. 1993.
6. Swaminathan M. Text Book on Food chemistry, Printing and Publishing CO., Ltd., Bangalore. 1993.
7. Norman N. Potter , Food science, CBS publishers and distributors, New Delhi. 1994.
8. Lillian Hoagoland Meyer, Food Chemistry, CBS publishers and distributors, New Delhi. 1994.
9. Owen R Fennema, Food Chemistry, Marcel Decker Inc., New York. 1996.
10. Srilakshmi B., Food Science, New age International Pvt. Ltd. Publishers, III ed. 2003.
11. Siva Sankar B., Food Processing and Preservation. Prentice – Hall of India Pvt. Ltd., New Delhi. 2002.
12. Ramakrishnan S., Prasannam K.G and Rajan R –Principles. Text book of medical biochemistry. Orient Longman Ltd. III ed. 2001.
13. Shakuntala Manay N. and ShadaksharaswamyM. FOODS: Facts and Principles. New age International Pvt. Ltd. Publishers

III SEMESTER

MS17BC301: MOLECULAR BIOLOGY

1. Molecular cloninig:a laboratory manual (Vol.1,2&3) 1989) by T.Maniatis, E.F.Fritsch, J. Sambrook. Cold SpringHarbor Laboratory Publications.
2. RNA Isolation and Analysis by P.Jones, J.Qiu, D.Rickwood (1st ed.1994) Bios Scientific Publishers.
3. Gene and Probes: A practical Approach Series (1995) by B D Hames and S J Higgins. Oxford universityPress.
4. Gel Electrophoresis of nuclei Acids: A practical Approach (1990) by D.Rickwood and B.D.Hames. OxfordUniversity Press.

MS17BC302:NUTRITION BIOCHEMISTRY

1. Nutrition: An integrated approach (3rd edn. 1984) R L Pike and M L Brown, Wiley & Sons Inc., NY.
2. Text Book of Biochemistry and Human Biology G P Talwar, Prentice Hall.
3. Mechanism and Theory is food chemistry (1996) DWS Wong, CBS, New Delhi.
4. Text Book of Human Nutrition (1996) M S Bamji N Pralhad Rao and V Reddy, Oxford & IBH Publishers.
5. Nutritional Biochemistry and Metabolism Linten.
6. Principles of Food Science-l (Food chemistry) Fennemona D R.
7. Human Nutrition and Dietetics (8th Ed. 1982) by Davidson and Passmore ELBS.

8. Modern Nutrition in Health and Diseases (7th ed. 1988) by Maurice E Skills and V R Young K M VargheseCo. Bombay.

MS17BC303:RESEARCH METHODOLOGY AND BIOSTATISTICS

1. Biostatistics : A foundation for analysis in the health. (7th ed. 1999) by W W Daniel John Wiley and Sons Inc.,New York.
2. Choosing and Using Statistics; A Biologist Guide, Clavin Dythan, Blackwell Scientific(1999).

IV SEMESTER

MS17BC411:PHARMACOVIGILANCE AND SAS TECHNIQUE

1. Basic and Clinical Pharmacology, Prentice hall, International, Katzung, B.G.
2. Clinical Pharmacology, Scientific book agency, Laurence, DR and Bennet PN.
3. Clinical pharmacokinetics, Pub. Springer Verlab, Dr. D.R Krishna, V. Klotz
4. Remington Pharmaceutical Sciences, Lippincott, Williams and Wilkins
5. Drug interaction, Kven Stockley. Hamsten
6. Drug interaction, Basic Bussiness Publ, Bombay, J.K. Mehra
7. Clinical pharmacology and drug therapy Grahame smith and Aronson,
8. Text Book of Therapeutics Drug and Disease Management Hardbound. Richard A Helms,
9. Clinical Pharmacy and therapeutics Herfindal E T and Hirschman JL, Williams and Wilkins

MS17BC421:CLINICAL DIAGNOSTICS & CLINICAL BIOCHEMISTRY

1. R. D. Lele, "Computer in Medicine", Tata McGraw-Hill, New Delhi, 1997.
2. Tay Vaughan, "Multimedia making it work', Tata McGraw-Hill, New Delhi, 1997.
3. Davis Chapman, "Teach Yourself Visual Basic 6 in 21 days", New Delhi, 1997.
4. Harold Sackman, "Biomedical Information Technology', Academic Press, New York, 1997.
5. Tietz Fundamentals of Clinical Chemistry – (5th edn.) C A Burtis, E R Ashwood (eds.) Saunders WB Co.
6. Notes on Clinical Chemistry – Whitby L G, A F Smith, G J Beckett, S M Walker, Blackewll science Inc.
7. Practical Clinical Biochemistry methods and later ,3rd edition,2003,2006 by Ranjna Chawla.

8. Practical Clinical Biochemistry,4th edition,2005,by Harold Valley.
9. Practical Biochemistry-Principles and Techniques,5th edition by Keith Wilson and John Walker(2000).
10. Introductiory Practical Biochemistry-3rd edition,2005 by S.K.Sawtrey,Randhir Singh.
11. Biochemical Methods- 3rd edition,2008,by S.Sadasivan and A.Manickam.
12. Experimental Biochemistry,3rd edition,2003, by Robert Switzer and Liam Garrity.
13. Text Book of Biochemistry and Human Biology,3rd edition,2006 by G.P.Talwar and L.M.Srinivastava.

MS17BC431: PLANT BIOCHEMISTRY& INDUSTRIAL BIOCHEMISTRY

1. Handbook of photosynthesis (ed) mohammad pe sarakle, marcel Dekkar, Inc.NY. Basel. Hong Kong 1997.
2. Introduction to plant biochemistry (1983) T W Goodwin and E I mercer.Pergaman press, Oxford, NY< Toronto,Sydney, Paris, Frankfurt.
3. Seed: physiology of development and germination (2nd ed. 1994) **J** D Bewleyand M Black Plenum Press.
4. Biochemistry of energy utilization in plants D T Dennis Blackie, Glasgow andLondon 1987.
5. Industrial Microbiology by Prescott, 4th ed. CBS Publishers.
6. Biotechnology by Crueger, PANI Publishers.
7. Principles of Fermentation Technology by Stanbury .
8. Industrial Microbiology by A.H.Pate
9. Plant Biochemistry by P M Dey and **J** B Harborne. Harcourt Asia PTE Ltd.,Singapore.

Career Development and Placement

Having a degree will open doors to the world of opportunities for you. But Employers arelooking 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 s kills
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 throughvariety of training programs and such other activities that induce the said skills among all students.

A full-fledged Career Counselling and Placement division, namely Career Development Centre (CDC) headed by well experienced senior Professor and Dean and supported by dynamic trainers, counsellors and placement officers and other efficient supportive teamdoes 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 ina 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 Commerce is efficient leaders of repute, who can dealthe real time problems with a flavour of innovation. This kept in focus, the CDC has designed the training process, which will commence from second semester along with thecurriculum. Special coaching in personality development, career building, English proficiency, reasoning, puzzles, leadership, and strategic management and communication skills to every student of REVA University is given with utmost care. Theprocess 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 University has recognized skill development and industry relationship as its very important activities. Therefore, the University-Industry Interaction and Skill Development Centre headed by a Senior Professor & Director has been established to facilitate skill related training to REVA students and other unemployed students around REVA campus. The centre 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 leasttwo 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 signed MOU's with research organizations and universities abroad to facilitate greater opportunities of employability for conducting certification programs.