REGULATIONS (R-16), SCHEME OF INSTRUCTION, EXAMINATION AND SYLLABI

for

B.TECH. FOUR YEAR DEGREE PROGRAM
(Applicable for the batches admitted from 2016-2017)

ELECTRONICS & COMMUNICATION ENGINEERING

R.V.R. & J.C. COLLEGE OF ENGINEERING

An Autonomous Institute
Accredited by NAAC with 'A' Grade
Approved by AICTE :: Affiliated to Acharya Nagarjuna University

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THE INSTITUTION

Established in 1985, Rayapati Venkata Ranga Rao & Jagarlamudi Chandramouli College of Engineering, Guntur is the 'Jewel in the Crown' of Nagarjuna Education Society, which took upon itself the responsibility of enriching the society through promotion of education, literature and culture. As it always happens, the genuine intentions of the promoters of the society received the support of the Almighty. Today eight educational institutions are functioning under the banner and patronage of Nagarjuna Education Society, with R.V.R. & J.C. College of Engineering, being the flag-ship of them, of course.

The Mission

An integrated development of manpower possessing technological and managerial knowledge and skills, values and ethics needed to make an honourable living and contribute to the socio-economic development and welfare of the society.

The Genesis and Growth

Like all great institutions, the College too had a humble beginning with just 180 intake and a barely adequate infrastructure in 1985, it is the determination and commitment of the Management that made the College one of the largest among Engineering Institutions in South India with excellent infrastructure, facilities and competent human resources. Today, it offers eight B.Tech., Degree Courses with an intake of 1080 plus 216 through lateral entry into the II Year for Diploma Holders. Further, the College offers MBA, MCA and M.Tech. in six specializations with an intake of 355. The total intake is 1435.

In 1998 it has become the youngest College to have been accredited and as on date all the seven eligible B.Tech. Degree Courses have been accredited in 2002, 2007 and again in 2012. It has became the first Engineering College in the state to have been accredited fourth time by N.B.A., New Delhi. Further in the Academic Audit and Grading done by Andhra Pradesh State Council of Higher Education, Govt. of A.P., the institute is rated as the SECOND best among Private Engineering Colleges of A.P. and FOURTH best amongst all Engineering Colleges of A.P. including University Engineering Colleges. It has also figured among the "Top-100" Engg. Colleges in independent surveys conducted in 2006 & 2007 by the popular magazine the "OUTLOOK". The College received Best Laboratory Award and First Prize for Best Performing Professional UG College in University Examination Results for the last FIVE consecutive years. The College is a typical example of meticulous planning, resource scheduling, human endeavour and institutional management.

COURSES OFFERED

1) Under-Graduate: B.Tech

i)	Civil Engineering (1985)	180
ii)	Mechanical Engineering (1985)	180
iii)	Electronics & Communication Engg. (1985)	180
iv)	Electrical & Electronics Engg. (1994)	180
v)	Computer Science & Engineering (1994)	180
vi)	Chemical Engineering (1996)	60
vii)	Information Technology (1998)	120

2) Post-Graduate:

i)	Management Sciences (MBA) (1995)	120
ii)	Computer Applications (MCA) (1995)	120
iii)	M.Tech in Computer Science & Engineering (2003)	25
vi)	M.Tech in Power Systems Engineering (2004)	18
v)	M.Tech. Structural Engineering (2004)	18
vi)	M.Tech. Communication Engineering and Signal Processing(2011)	18
vii)	M.Tech. in Machine Design (2013)	18
viii)	M.Tech. in Computer Science & Technology (2013)	18

The Campus

A built up area of 65,985 sq.m. on a 37.41 acres plot houses 61 Laboratories and 18 Computer Centres besides amenities like Canteen, Seminar Halls, Auditorium, Open Air Theatre, Gymnasium, e-classrooms and Conference Halls etc. to make life in the classroom and outside easy and comfortable. Continuous power supply is provided from 200 KVA, 250 KVA and 500 KVA modern Generator sets. Andhra Bank Branch is located in the campus. A fleet of 24 buses save the staff and students from the vagaries of public transport. The aesthetically designed structures, the hill slopes on the West, a well laid out campus dotted with roads, trees and gardens merge into a stunning landscape that inspires the minds to ''Think Better, Work Better''.

The Work Culture

The Management and Staff are a group of uncompromising people who stretch beyond reasonable limits to attain their objective - Excellence in everything they do. The people of RVR & JC have learnt that meeting of the minds and joining hands is the easier way to success. They do meet and interact frequently to set new starting lines than to celebrate the finishing lines reached.

The People

The College is possessive of its intellectual property through a 257 strong faculty with diversity in specialization and heterogeneity in abilities, have unity in their objective of enriching the students with up-to-date technical information, data and skills. The teachers adopt a very

professional attitude and commitment in imparting instruction, counseling and personality development in which the student has the final say. The emphasis is more on learning of the student than on teaching. All our teachers are rated 90% good by the students. The 165 administrative and supporting people provide the logistics to run academic and administrative operations, with silent efficiency.

Discipline

Insulating the students from the vulnerable influence due to the society's contemporary aberrations is our endeavor. The institution had become the choice of the parents for its track-record of campus discipline. The ambience and the exemplary orderliness of behavior of the staff induces a self-imposed discipline in the students. The temporary abnormalities if any, are disciplined, of course.

Computer Centres

The computer facilities are vast. About 1500 terminals with latest configuration are located in fourteen Central and Department Computer Centres, all air conditioned. Software necessary for effective training and instruction as well as for consultancy are in place. All the computers in the campus have been interconnected through campus-wide intranet using Fibre Optic cables and switches. The City Computer Centre is an off-time facility for students & staff. Examination & administrative services are Computerised. Currently, 16 MBPS Wireless Internet connectivity is provided by installing a Micro Tower.

Library

The four-storied library of 87,468 volumes of 25,910 titles, 3,267 CDs and educational films is the biggest learning resource in the campus. 257 National and International Journals provide up-to-date information on any topic the students and staff look for. Orderly stacking, computerized information and the seven qualified library staff facilitate easy location of any information needed. The Digital Library is providing internet facility to all the students with 17 systems. Comfortable seating arrangement and large reading spaces provide a serene atmosphere for spending long hours in the library. The City Centre too has a reference library that is open upto 10.00 p.m.

Hostels

Four storeyed Girls hostel with a 6,040 sq.m. accommodating 650 girl students with modern facilities available. Four storiedboys hostel with a 11,152 sq.m. accommodating 1400 students with modern facilities in the College campus.

The Students

From the day of induction, the staff do everything to naturalize the students to the culture of R.V.R. & J.C. College of Engineering i.e. singleminded pursuit of the objective. The part played by the students in making the College, into an ideal seat of learning is significant. The students of this College consistently produce the best of the results in the University.

Extra-curricular Activities

NCC, NSS Units are established in the College. Opportunities are a plenty for those with extracurricular talent. Numerous competitions are held forvarious levels of students, who have proved their superiority in various inter-collegiate competitions conducted by public organizations and other institutions. The students prove their leadership qualities and co-operative skills by organizing colorful functions at regular intervals.

Campus Recruitment

About 50 renowned industries / IT Organizations regularly visit the College to recruit the final years for employment. A training and placementDepartment monitors recruitment, short term training and personality development programmes. During the last four years the Campus recruitment steadily grew up.

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PROFILE OF THE ECE DEPARTMENT

The department of Electronics & Communication Engineering came into existence in 1985 immediately when the institute was founded. The mission of the department is to bring out competent Electronics &Communication Engineers. It strives for achieving excellence in imparting Technical, Social skills and attitudes for continuous learning and to mould young men and women capable of assuring leadership of the society for the betterment of the country. It offers currently 4- year B.Tech degree programme in Electronics & Communication Engineering with annual intake of 180 and 2-year M.Tech programme in Communication and Signal Processing with an intake of 18.

The department aims at training up youngman and women for careers in Engineering, synthesizing conventional and modern engineering thinking with a global outlook. The academic program that the Department offers focuses itself on an innovative design that blends creativity and analytical skills, system orientation and process oriented learning. The Department strives to deliver quality education and to keep pace with the changes, growth and advances in the area of Electronics & Communication Engineering with the help of the existing committed and competent Faculty, high quality infrastructure and a good learning environment. The department is Accredited Four times by National Board of Accreditation.

The objective of the department is to provide the students with a solid foundation in Mathematics, Basic sciences and Engineering Sciences and also to train the students in identifying, formulating, analyzing, and creating engineering solutions using appropriate current engineering techniques, designing skills and tools to develop novel products and solutions for the real life problems. The department imparts training to develop in the students teamwork, effective communication skills, multidisciplinary approach, professional and ethical attitude and an ability to relate engineering issues to broader social context. The department always focuses on providing the students with an academic environment aware of excellence, leadership and life-long learning needed for successful professional career.

Besides giving a thorough grounding in Basic sciences and Engineering subjects, the curriculum in Electronics and Communication engineering lays greater emphasis on deep understanding of fundamental principles and state of the art knowledge of Electronic Devices & Circuits, Computer Architecture & Microprocessors, VLSI & Embedded systems, Electromagnetic Field Theory, Analog and Digital Communications, Digital Signal Processing, Microwave & Broadband Communications, Image Processing, Optical Communication and so on.

The department is well equipped with all the infrastructural requirements to meet both academic and non-academic needs of the students. The Department set up laboratories in various areas of Electronics & Communication Engineering to cater to the ever changing practical training requirements of the students. They are also being upgraded and modernized from time to time such that the new gives place to the obsolete. The laboratories of the ECE department include Basic Electronics Laboratory, Digital Electronics Laboratory, Electronics

Engineering Laboratory, Communications Engineering Laboratory, Computer Simulation Laboratory, Microprocessor Laboratory, VLSI Laboratory, Microcontrollers Laboratory, Microwave and Advanced Communications laboratory, Computer center and Digital Systems laboratory and Electronics Workshop. The department is equipped with a department library that has wide collection of books, research papers, theses, project reports, national and international journals and so on.

The department has well experienced and dedicated faculty providing quality education to the students. The Faculty of the department are adequate in number drawn from among the very best in the profession. The faculty has well distributed teaching expertise in various specializations like Signal Processing, Communications, Digital Systems and VLSI Design and published number of books and number of researchpapers in national & international journals and conferences. The department has a good track record in bagging university ranks every year and completing many research projects, some of them funded by AICTE, UGC etc.

In order to disseminate knowledge, the department organizes seminars, a good number of National Level conferences, short-term courses, workshops and student MEETs. Further the department has ECE Association, IETE Student Forum that provide a platform for students to participate in various events like seminars, elocutions, debates, group discussions and so on which are essential for their all round development. The Department facilitates the students to acquire technical communication skills, in addition to soft inter-personal skills. The department curriculum has been designed to inculcate these traits through classroom teaching, experimental learning & discussions, invited lectures from promising industrial and scientific personalities. Besides the department arranges industrial visits from time to time to expose the students to practical situations.

The greatest asset of the department is its alumni. The alumni of the department hold top positions in the best of Indian and Multi nationalcompanies, both in India and abroad, such as MOTOROLA. INTEL, TEXAS, IBM, WIPRO, INFOSYS, ECIL, BHEL and so on.

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R.V.R. & J.C.COLLEGE OF ENGINEERING

VISION

Envisioning to be a 'Centre of Excellence' by synergizing quality education with professional and human values and to instil a broader sense of Social responsibility.

MISSION

An integrated development of manpower possessing technological and managerial knowledge and skills, values and ethics needed to make an honourable living and contribute to the socio-economic development and welfare of the society.

QUALITY POLICY

Establishment of quality assurance system with continuous evaluation and monitoring to impart the best education to create ambiance of excellence, recognizing the multicultural diversity and commitment to transform and assimilate the excellence in education and value system.

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

VISION

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To bring out competent Electronics & Communication Engineers. It strives for achieving excellence in imparting Technical, Social skills and attitudes for continuous learning and to mould young men and women capable of assuring leadership of the society for the betterment of the country.

QUALITY POLICY

Establishment of quality assurance system with continuous evaluation and monitoring to impart the best education to create ambiance of excellence, recognizing the multicultural diversity and commitment to transform and assimilate the excellence in education and value system.

GRADUATE ATTRIBUTES

The Graduate Attributes are the knowledge skills and attitudes which the students have at the time of graduation. These attributes are generic and are common to all engineering programs. These Graduate Attributes are identified by National Board of Accreditation.

1. **Engineering knowledge :** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis :** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions :** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems :** Use research-based knowledge and research methods 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 ofthe engineering practice.
9. **Individual and team work :** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication :** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance :** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and 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.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs) :

PEO1 To acquire knowledge in applied and basic engineering sciences for understanding engineering principles which are necessary to formulate and solve problems related to Electronics and Communication Engineering.

PEO2 To develop knowledge in experimentation and analysis of Electronics and Communication Engineering problems, to design and develop novel products / solutions for real life problems.

PEO3 To develop teamwork, effective communication skills, professional and ethical attitude and life-long learning needed for successful professional career.

PROGRAM OUTCOMES (POs) :

At the end of the program the Engineering Graduates will be able to :

1. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. 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. 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. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Apply ethical principles and commit to professional ethics and responsibilities and norms ofthe engineering practice.
9. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. 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.

Mapping of Program Outcomes(POs) with Program Educational Objectives (PEOs)

PEO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEO1	3	2	1	2	1	2	1	2	1	1	1	2
PEO2	2	3	3	3	2	2	2	2	3	2	2	3
PEO3	3	3	3	3	2	3	3	2	3	3	3	3

PROGRAM SPECIFIC OUTCOMES (PSOs):

At the end of the programme, a student will be able to :

1. Represent complex signals, test , measure, analyse , and provide all valid conclusions on the performance of signals and signal processing algorithms using the modern tools/equipment.
2. Model, simulate, design analog and digital components and systems to meet desired real world electronics and communication engineering applications.

Mapping of Program Specific Outcomes(PSOs) with Program Educational Objectives (PEOs)

PSO	PEO1	PEO2	PEO3
PSO1	3	2	-
PSO2	-	3	2

R.V.R. & J.C. COLLEGE OF ENGINEERING :: GUNTUR
(Autonomous)

CHOICE BASED CREDIT SYSTEM REGULATIONS (R-16) FOR
Four Year BACHELOR OF TECHNOLOGY (B.Tech.) Degree Program

(w.e.f. the batch of candidates admitted into First Year B.Tech. from the academic year 2016-2017).

1 MINIMUM QUALIFICATIONS FOR ADMISSION

A candidate seeking admission into I Year of B.Tech. Degree Program should have passed either Intermediate examination conducted by the Board of Intermediate Education, Andhra Pradesh with Mathematics, Physics, and Chemistry as optional subjects (or any equivalent examination recognized by the Acharya Nagarjuna University) or A candidate seeking admission into II Year of B.Tech. Degree Program should have passed either Diploma in Engineering in the relevant branch conducted by the State Board of Technical Education & Training of Andhra Pradesh (or equivalent Diploma recognized by Acharya Nagarjuna University).

The selection is based on the rank secured by the candidate at the EAMCET / ECET (FDH) examination conducted by A.P. State Council of Higher Education. The candidate shall also satisfy any other eligibility requirements stipulated by the University and / or the Government of Andhra Pradesh from time to time.

2 BRANCHES OF STUDY

The B.Tech. Course is offered in the following branches of study:

1. Chemical Engineering
2. Civil Engineering
3. Computer Science & Engineering
4. Electrical & Electronics Engineering
5. Electronics & Communication Engineering
6. Information Technology
7. Mechanical Engineering

3 DURATION OF THE COURSE AND MEDIUM OF INSTRUCTION

3.1 The duration of the course is Four academic years consisting of two semesters in each academic year. The medium of instruction and examination is English.

3.2 The duration of the course for the candidates (Diploma Holders) admitted under lateral entry into II Year B.Tech. is Three academic years consisting of two semesters in each academic year. The medium of instruction and the examination is English.

4 MINIMUM INSTRUCTION DAYS

Each semester shall consist of a minimum number of 90 days of instruction excluding the days allotted for tests, examinations and preparation holidays.

5 REGISTERING THE COURSES OFFERED

5.1 A candidate has to register and secure 189 credits out of which 54 credits from laboratory courses including project work.

5.2 A candidate has to register 12 courses in First, Second and Third Years of study and 10 courses in Fourth year of study.

5.3 A candidate can register for a minimum of 5 courses and maximum of 7 courses in each semester of II Year, III Year and IV Year I Semester of study.

5.4 National Cadet Corps (NCC) / National Service Organisation (NSO) / National Service Scheme (NSS) Requirements:

- All candidates admitted to the B.Tech. programme will have to take either NCC or NSO or NSS as an extra-curricular programme.
- The NCC / NSO / NSS programme will be held as announced by the respective Co-ordinator(s).
- Enrollment of NCC / NSO / NSS programme will be initiated from the date of commencement of class work for II Year I Semester.
- NCC / NSO / NSS certificate must be submitted on or before the last instruction day of III Year II Semester, otherwise his / her Semester End Examination results will not be declared.

5.5 MOOCS (Massive Open Online Courses) Requirements:

- Enrollment of MOOCS course will be initiated from the date of commencement of class work for III Year I Semester.
- MOOCS course completion certificate must be submitted on or before the last instruction day of IV Year I Semester, otherwise his / her Semester End Examination results will not be declared.
- List of organisations offering MOOCS course(s) will be announced by the respective Board of Studies at the time of commencement of class work for III Year I Semester.

5.6 Internship / Industrial Trainning / Certification Course :

- Enrollment of Internship / Industrial Trainning / Certification Course will be initiated from the end of II Year II Semester.
- Internship / Industrial Trainning / Certification Course completion certificate must be submitted on or before the last instruction day of IV Year I Semester, otherwise his / her Semester End Examination results will not be declared.

6 EVALUATION

The performance of the candidates in each semester shall be evaluated Course wise.

6.1 The distribution of marks between Sessional Examination (based on internal assessment) and Semester End Examination is as follows:

Nature of the Courses	Sessional Marks	Semester End Exam. Marks
Theory Courses / Design and / or Drawing / Practicals	40	60
Mini Project / Term paper	100	---
Project work	40	60 (Viva voce)

6.2 In each of the Semesters, there shall be two Mid Term examinations and two Assignment Tests in every theory course. The Sessional marks for the midterm examinations shall be awarded giving a weightage of 15 marks out of 18 marks (80% approx.) to that midterm examination in which the candidate scores more marks and the remaining 3 marks (20% approx.) for other midterm examination in which the candidate scores less marks. Similarly a weightage of 10 marks (80% approx.) out of 12 marks earmarked for assignment tests shall be given for the assignment in which the candidate scores more marks and remaining 2 marks (20% approx.) shall be given for the assignment test in which the candidate scores less marks.

A maximum of five marks are allotted for attendance in the respective theory courses in a graded manner as indicated in ***clause 8.2.*** The remaining 5 marks out of the 40 marks earmarked for the sessional marks are awarded (quiz / online examination) by the concerned teacher in the respective theory courses.

6.3 The evaluation for Laboratory class work consists of a weightage of 25 marks for day to day laboratory work including record work and 15 marks for internal laboratory examination including Viva-voce examination.

In case of Project work, the sessional marks shall be awarded based on the day-to-day progress, the performance in two Seminars and the Project Report submitted at the end of the semester. The allotment of sessional marks for Seminars and day-to-day work shall be 15 and 25 respectively.

NOTE : A candidate who is absent for any Assignment / Mid Term Exam, for any reason whatsoever, shall be deemed to have scored zero marks in that Test / Exam and no make-up test / Exam shall be conducted.

6.4 A candidate who could not secure a minimum of 50% aggregate sessional marks is not eligible to appear for the Semester End Examination and shall have to repeat that Semester.

7 LABORATORY / PRACTICAL COURSES

In any semester, a minimum of 10 experiments / exercises specified in the syllabus for laboratory course shall be completed by the candidate and get the record certified by the concerned Head of the Department, to be eligible to face the Semester End Examination in that Practical course.

8 ATTENDANCE REGULATIONS

8.1 Regular course of study means a minimum average attendance of 75% in all the courses computed by totalling the number of hours / periods of lectures, design and / or drawing, practical's and project work as the case may be, held in every course as the denominator and the total number of hours / periods actually attended by the candidate in all the courses, as the numerator.

8.2 A weightage in sessional marks up to a maximum of 5 marks out of 40 marks in each theory course shall be given for those candidates who put in a minimum of 75% attendance in the respective theory in a graded manner as indicated below:

Attendance of 75% and above but less than 80%	- 1 mark
Attendance of 80% and above but less than 85%	- 2 marks
Attendance of 85% and above but less than 90%	- 4 marks
Attendance of 90% and above	- 5 marks

8.3 Condonation of shortage in attendance may be recommended on genuine medical grounds, up to a maximum of 10% provided the candidate puts in at least 65% attendance as calculated in ***clause 8.1***, provided the Principal is satisfied with the genuineness of the reasons and the conduct of the candidate.

8.4 A candidate who could not satisfy the minimum attendance requirements in any semester as mentioned in ***clause 8.1***, is not eligible to appear for the Semester End Examinations and shall have to repeat the same Semester.

9 DETENTION

A candidate, who fails to satisfy either the minimum attendance requirements as stipulated in ***Clause-8***, or the requirement of minimum aggregate sessional marks as stipulated in ***Clause-6***, shall be detained. Such candidate shall have to repeat the same semester.

10 SEMESTER END EXAMINATION

10.1 For each theory course, there shall be a comprehensive Semester End Examination at the end of each Semester.

10.2 For each Practical course the Smester End Examination shall be conducted by one internal and one external examiner appointed by the Principal of the College, the duration being that approved in the detailed Schemes of Instruction & Examination.

10.3 Viva-voce Examination in Project Work shall be conducted by one internal examiner and one external examiner appointed by the Principal.

11 CONDITIONS FOR PASS

A candidate shall be declared to have passed in individual course if he / she secures a minimum of 35% marks in theory and 50% marks in Practical courses/drawing courses/Project Viva-voce in Semester End Examination and minimum of 40% marks in both Sessional & Semester End Examination put together.

12 AWARD OF CREDITS

12.1 Credits are awarded for each Theory / Practical Courses. Each theory course is awarded three credits and each practical course is awarded two credits. Project work is awarded Ten credits. The total number of credits for all Four years put together shall be 189.

12.2 AWARD OF GRADES

S.No.	Range of Marks	Grade	Grade Points
1	≥ 90	S	10.0
2	≥ 80 - < 90	A	9.0
3	≥ 70 - < 80	B	8.0
4	≥ 60 - < 70	C	7.0
5	≥ 50 - < 60	D	6.0
6	≥ 40 - < 50	E	5.0
7	< 40	F	0.0
8	The grade 'W' represents withdrawal / absent (subsequently changed into pass or E to S or F grade in the same semester)	W	0.0

12.3 A candidate securing 'F' grade in any course there by securing zero grade points has to reappear and secure at least 'E' grade in the subsequent examinations for that course.

12.4 A candidate who has earned 'F' grade in any course can repeat the course by re-registering it when the course is offered next time.

12.5 After each semester, Grade sheet will be issued which will contain the following details:

- The list of courses for each semester and corresponding credits and grades obtained
- The Semester Grade Point Average (SGPA) for each semester and
- The Cumulative Grade Point Average (CGPA) of all courses put together up to that semester.

SGPA is calculated based on the following formula: $$\frac{\sum [\text{ No. of Credits X Grade Points }]}{\sum \text{ No. of Credits}}$$

CGPA will be calculated in a similar manner, considering all the courses up to that semester.

12.6 A consolidated Grade Sheet shall be issued to the candidate, after completing all , indicating the CGPA of all the Four years put together.

12.7 Conversion of CGPA into equivalent Percentage.: Percentage of Marks = 9.25 x CGPA

13 CONDITIONS FOR PROMOTION

13.1 A candidate shall be eligible for promotion to next semester, if he/she satisfies the minimum requirements of attendance and sessional marks as stipulated in ***Clauses 6 and 8***.

13.2 A candidate shall be eligible for promotion to III Year, if he / she secures a minimum of 70% of the total number of credits of I Year by the time the classwork commences for III Year, in addition to satisfying the minimum requirements of attendance and sessional marks stipulated in ***Clauses 6 and 8*** in II Year II Semester.

13.3 A candidate shall be eligible for promotion to IV Year, if he / she secures a minimum of 70% of the total number of credits of I & II Years put together, by the time the classwork commences for IV Year, in addition to satisfying the minimum requirements of attendance and sessional marks stipulated in ***Clauses 6 and 8*** in III Year II Semester.

13.4 A candidate (Diploma Holder) admitted under lateral entry into II Year, shall be eligible for promotion to IV Year, if he/she secures a minimum of 70% of the total number of credits of II Year by the time the classwork commences for IV Year, in addition to satisfying the minimum requirements of attendance and sessional marks stipulated in ***Clauses 6 and 8*** in III Year II Semester.

14 ELIGIBILITY FOR AWARD OF B.TECH. DEGREE

The B.Tech. Degree shall be conferred on a candidate who has satisfied the following requirements:

14.1 The candidate must have satisfied the conditions for pass in all the courses of all the years as stipulated in ***Clauses 11***.

14.2 **Maximum Time Limit for completion of B.Tech Degree**

A candidate, who fails to fulfil all the academic requirements for the award of the degree within eight academic years from the year of admission, shall forfeit his/her seat in B.Tech. course.

14.3 A candidate (Diploma Holder) admitted under lateral entry into II B.Tech., who fails to fulfil all the academic requirements for the award of the degree within six academic years from the year of admission, shall forfeit his/her seat in B.Tech. course.

15 AWARD OF CLASS

A candidate who becomes eligible for the award of B.Tech. Degree as stipulated in ***Clause 12*** shall be placed in one of the following Classes.

S.No.	Class	CGPA
1	First Class With Distinction	8.0 or more
2	First Class	6.5 or more but less than 8.0
3	Second Class	5 or more but less than 6.5

16 IMPROVEMENT OF CLASS

A candidate, after becoming eligible for the award of the Degree, may improve the CGPA by appearing for the Semester End Examination in any of the theory course as and when conducted. But this provision shall be within a period of two academic years after becoming eligible for the award of the Degree. However, this facility cannot be availed by a candidate who has taken the Original Degree Certificate.

17 AWARD OF RANK

The rank shall be awarded based on the following:

17.1 Ranks shall be awarded in each branch of study for the top five percent of the candidates appearing for the Regular Semester End Examinations or the top ten candidates whichever is minimum.

17.2 Only such candidates who pass the Final year examination at the end of the fourth academic year after admission as regular final year candidate along with others in their batch and become eligible for the award of the degree shall be eligible for the award of rank. The Rank will be awarded only to those candidates who complete their degree within four academic years.

17.3 For the purpose of awarding rank in each branch, only such candidates who passed all courses in the first attempt only shall be considered.

18 SUPPLEMENTARY EXAMINATIONS

18.1 In addition to the Regular semester end examinations held at the end of each semester, supplementary examinations will also be conducted during the academic year. Such candidates taking the Regular / Supplementary examinations as supplementary candidates may have to take more than one examination per day.

18.2 Instant examination will be conducted immediately after the declaration of IV Year II Semester results for those candidates who cleared all courses except one course in IV Year II Semester.

19 TRANSITORY REGULATIONS

A Candidate, who is detained or discontinued in the semester, on readmission shall be required to do all the courses in the curriculum prescribed for such batch of candidates in which the candidates joins subsequently.

19.1 A candidate, studied under R-12 regulations of RVR & JCCE (Autonomous) curriculum, detained due to lack of academics/attendance at the end of the I Year II Semester or II Year I Semester, shall join in appropriate Semester of R-16 regulations. The candidate has to clear all the backlog subjects or equivalent subjects if any under R-16 curriculum by appearing the supplementary examinations, conducted by the college under R-16 curriculum. The class will be awarded based on the academic performance of the candidate as R-16 regulations.

19.2 A candidate, studied under R-12 regulations of RVR & JCCE (Autonomous) curriculum, detained due to lack of academics / attendance at the end of the II Year II Semester and also at the subsequent semesters will follow the same R-12 regulations/curriculum and he/she has to complete all the courses by appearing in the examination conducted by the college under R-12 curriculum. The class will be awarded based on the academic performance of the candidate as per R-12 regulations.

19.3 A candidate, transferred from other institutions / universities into I Year II Semester and also at the subsequent semesters of B.Tech., shall join at appropriate semester of R-16 curriculum. Such candidate shall study all the courses prescribed for that batch, in which, the candidate joins. The candidate has to clear the backlog courses, if any, in the semesters which he/she has studied in the earlier institutions / universities by appearing the supplementary examinations conducted by the college in R-16 circulum courses / equivalent courses. The equivalent courses will be decided by concerned Board of Studies.

20 CONDUCT AND DISCIPLINE

20.1 Candidates shall conduct themselves within and outside the premises of the institute in a manner befitting the candidates of our institution.

20.2 As per the order of Honourable Supreme Court of India, ragging in any form is considered as a criminal offence and is banned. Any form of ragging will be severely dealt with.

20.3 The following acts of omission and / or commission shall constitute gross violation of the code of conduct and are liable to invoke disciplinary measures with regard to ragging.

a Lack of courtesy and decorum, indecent behaviour anywhere within or outside the campus.

b Wilful damage of college / individual property

c Possession, consumption or distribution of alcoholic drinks or any kind of narcotics or hallucinogenic drugs.

d Mutilation or unauthorized possession of library books.

e Noisy and unseemly behaviour, disturbing studies of fellow candidates.

f Hacking of computer systems (such as entering into other person's areas without prior permission, manipulation and / or damage of computer hardware and software or any other cyber-crime etc.)

g Usage of camera / cell phone in the campus

h Plagiarism of any nature

i Any other acts of gross indiscipline as decided by the academic council from time to time.

20.4 Commensurate with the gravity of offense, the punishment may be reprimand, fine, expulsion from the institute / hostel, debar from examination, disallowing the use of certain facilities of the institute, rustication for a specified period or even outright expulsion from the institute or even handing over the case to appropriate law enforcement or the judiciary, as required by the circumstances.

20.5 For an offence committed in (i) a hostel (ii) a department or in a class room and (iii) elsewhere, the chief warden, the head of the department and the principal respectively, shall have the authority to reprimand or impose fine.

20.6 Cases of adoption of unfair means and / or any malpractice in an examination shall be reported to the principal for taking appropriate action.

20.7 All cases of serious offence, possibly requiring punishment other than reprimand, shall be reported to the academic council.

20.8 The institute level standing disciplinary action committee constituted by the academic council shall be the authority to investigate the details of the offence, and recommend disciplinary action based on the nature and extent of the offence committed.

20.9 The principal shall deal with any academic problem, which is not covered under these rules and regulations, in consultation with the programmes committee in an appropriate manner, and subsequently such actions shall be placed before the academic council for ratification. Any emergency modification of regulation, approved by the appropriate authority, shall be reported to the academic council for ratification.

20.10 ''Grievance and Redressal Committee'' (General) constituted by the Principal shall deal with all grievances pertaining to the academic / administrative / disciplinary matters.

21 MALPRACTICES

21.1 The Principal shall refer the cases of malpractices in internal assessment tests and semester-end examinations to a malpractice enquiry committee constituted by him / her for the purpose. Such committee shall follow the approved scales of punishment. The principal shall take necessary action, against the erring candidates basing on the recommendations of the committee.

21.2 Any action on the part of a candidate during an examination trying to get undue advantage or trying to help another, or drive the same through unfair means is punishable according to the provisions contained hereunder. The involvement of the staff, who are in-charge of conducting examinations, valuing examination papers and preparing / keeping records of documents relating to the examinations in such acts (inclusive of providing incorrect or misleading information) that infringe upon the course of natural justice to one and all concerned in the examination shall be viewed seriously and recommended for award of appropriate punishment after thorough enquiry.

22 AMENDMENTS TO REGULATIONS

The College may, from time to time, revise, amend, or change the Regulations, Schemes of Examinations, and / or Syllabus.

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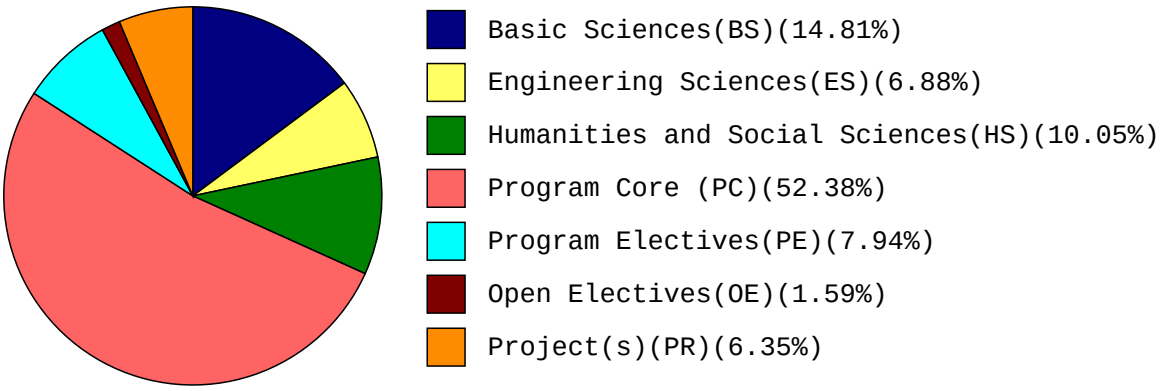
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

B.TECH ELECTRONICS & COMMUNICATION ENGINEERING

Pogram curriculum grouping based on course components

Course Component	Curriculum Content (% of total number of credits program)	Total number of contact hours	Total number of credits
Basic Sciences (BS)	14.81	38	28
Engineering Sciences (ES)	6.88	23	13
Humanities and Social Sciences (HS)	10.05	26	19
Program Core (PC)	52.38	150	99
Program Electives (PE)	7.94	20	15
Open Electives (OE)	1.59	4	3
Project(s) (PR)	6.35	9	12
Total number of Credits			189



B.TECH ELECTRONICS & COMMUNICATION ENGINEERING

(w.e.f. the batch of students admitted from the academic year 2016-2017)

I YEAR I SEMESTER COURSE STRUCTURE

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	Code
			L	T	P	SES	EXT		
1	EC/EE/ME-101	Differential Equations and Statistics	3	1	-	40	60	3	BS
2	EC/CE/ChE/CS/ EE/IT/ME-102	Engineering Physics	4	-	-	40	60	3	BS
3	EC/CE/CS/ EE/IT/ME-103	Applied Chemistry	4	-	-	40	60	3	BS
4	EC/CS/IT-104	Environmental Studies	4	-	-	40	60	3	HS
5	EC-105	Elements of Mechanical Engineering	4	1	-	40	60	3	ES
6	EC-106	Economics for Engineers	4	-	-	40	60	3	HS
7	EC-151	Physics lab	-	-	3	40	60	2	BS
8	EC-152	Engineering Graphics Lab	2	-	4	40	60	2	ES
9	EC-153	Communication Skills lab	-	-	3	40	60	2	HS
		TOTAL	25	2	10	360	540	24	

I YEAR II SEMESTER COURSE STRUCTURE

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	Code
			L	T	P	SES	EXT		
1	EC/EE/ME-107	Calculus and Numerical Methods	3	1	-	40	60	3	BS
2	EC/EE/CS/IT-108	Electronic and Electrical Engineering Materials	4	-	-	40	60	3	BS
3	EC/CE/EE/ CS/IT/ME-109	Chemistry of Engineering Materials	4	-	-	40	60	3	BS
4	EC/ChE/CS/IT-110	English for Communication	4	-	-	40	60	3	HS
5	EC/ChE-111	Problem Solving with C	4	1	-	40	60	3	ES
6	EC-112	Professional Ethics and Human Values	4	-	-	40	60	3	HS
7	EC-154	Chemistry lab	-	-	3	40	60	2	BS
8	EC-155	C Programming Lab	-	-	3	40	60	2	ES
9	EC-156	Electronics Engineering Workshop	-	-	3	40	60	2	PC
		TOTAL	23	2	9	360	540	24	

II YEAR I SEMESTER COURSE STRUCTURE

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	Code
			L	T	P	SES	EXT		
1	EC/EE-201	Transformation Techniques	3	1	-	40	60	3	BS
2	EC/EE-202	Electronic Devices and Circuits	4	-	-	40	60	3	PC
3	EC/EE-203	Digital Logic Design	4	1	-	40	60	3	PC
4	EC-204	Circuit Theory	4	1	-	40	60	3	PC
5	EC-205	Data Structures through C++	4	1	-	40	60	3	PC
6	EC-206	Signals and Systems	4	1	-	40	60	3	PC
7	EC-251	Electronic Devices Lab	-	-	3	40	60	2	PC
8	EC-252	Digital Logic Design Lab	-	-	3	40	60	2	PC
9	EC-253	Data Structures through C++ Lab	-	-	3	40	60	2	PC
		TOTAL	23	5	9	360	540	24	

The following Course can also be registered in this Semester in adition to the above or inplace of 206

EC-212 Electrical Engineering & Measurements

Enrollment of NCC / NSO / NSS programme will be initiated from the date of commencement of class work for II Year I Semester.

II YEAR II SEMESTER COURSE STRUCTURE

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	Code
			L	T	P	SES	EXT		
1	EC/EE-207	Complex and Numerical Analysis	3	1	-	40	60	3	BS
2	EC/EE-208	Electronic Circuit Analysis	4	1	-	40	60	3	PC
3	EC-209	Computer Organisation	4	-	-	40	60	3	PC
4	EC-210	Analog Communication	4	1	-	40	60	3	PC
5	EC-211	Electromagnetic Fields & Transmission Lines	4	1	-	40	60	3	PC
6	EC-212	Electrical Engineering & Measurements	4	-	-	40	60	3	ES
7	EC-254	Signals & Systems lab		-	3	40	60	2	PC
8	EC-255	Electronic Circuits Lab	-	-	3	40	60	2	PC
9	EC-256	Professional Communication Skills Lab	-	-	3	40	60	2	HS
		TOTAL	23	4	9	360	540	24	

The following Course can also be registered in this Semester in adition to the above or inplace of 212

EC-206 Signals and Systems

Enrollment of Internship / Industrial Trainning / Certification Course will be initiated from the end of II Year II Semester.

III YEAR I SEMESTER COURSE STRUCTURE

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	Code
			L	T	P	SES	EXT		
1	EC/EE-301	Pulse and Digital Circuits	4	-	-	40	60	3	PC
2	EC/EE-302	Microprocessors & Microcontrollers	4	1	-	40	60	3	PC
3	EC-303	Linear IC's and its Applications	4	1	-	40	60	3	PC
4	EC-304	Digital Communications	4	1	-	40	60	3	PC
5	EC-305	Control Engineering	4	-	-	40	60	3	PC
6	EC-306	Antennas and Wave Propagation	4	-	-	40	60	3	PC
7	EC-351	Microprocessors & Microcontrollers Lab	-	-	3	40	60	2	PC
8	EC-352	Analog Communication Lab	-	-	3	40	60	2	PC
9	EC-353	Circuit Simulation Lab	-	-	3	40	60	2	PC
		TOTAL	24	3	9	360	540	24	

Any one of the following Courses can also be registered in this Semester in adition to the above or inplace of 305 / 306

EC-311A	TV Engineering	EC-312A	Operating Systems
EC-311B	EMC / EMI	EC-312B	Neural Networks
EC-311C	Biomedical Instrumentation	EC-312C	Fuzzy Logic
EC-311D	Telecommunication Switching System	EC-312D	Spread Spectrum Communications

Enrollment of MOOCS course will be initiated from the date of commencement of class work for III Year I Semester.

III YEAR II SEMESTER COURSE STRUCTURE

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	Code
			L	T	P	SES	EXT		
1	EC-307	HDL Programing	4	-	-	40	60	3	PC
2	EC-308	Advanced Microcontrollers	4	-	-	40	60	3	PC
3	EC-309	Computer Networks	4	-	-	40	60	3	PC
4	EC-310	Digital Signal Processing	4	1	-	40	60	3	PC
5	EC-311	ELECTIVE - I	4	-	-	40	60	3	PE
6	EC-312	ELECTIVE - II	4	-	-	40	60	3	PE
7	EC-354	Digital Communication Lab	-	-	3	40	60	2	PC
8	EC-355	Advanced Microcontrollers Lab	-	-	3	40	60	2	PC
9	EC-356	Pulse Circuits & ICs Lab	-	-	3	40	60	2	PC
		TOTAL	24	1	9	360	540	24	

Elective - I : Any one Course can be registered

EC-311A	TV Engineering
EC-311B	EMC / EMI
EC-311C	Biomedical Instrumentation
EC-311D	Telecommunication Switching System

Elective - II : Any one Course can be registered

EC-312A	Operating Systems
EC-312B	Neural Networks
EC-312C	Fuzzy Logic
EC-312D	Spread Spectrum Communications

Any one of the following Courses can also be registered in this Semester in adition to the above or inplace of 311 / 312

EC-305	Control Engineering	EC-306	Antennas and Wave Propagation

NCC / NSO / NSS certificate must be submitted on or before the last instruction day of III Year II Semester, otherwise his / her Semester End Examination results will not be declared.

IV YEAR I SEMESTER COURSE STRUCTURE

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category Code
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	
			L	T	P	SES	EXT		
1	EC-401	Microwave Engineering	4	1	-	40	60	3	PC
2	EC-402	VLSI Design	4	1	-	40	60	3	PC
3	EC-403	MOOCS (Open online Course)	-	-	-	-	-	-	OE
4	EC-404	ELECTIVE - III (Open Elective)	4	-	-	40	60	3	OE
5	EC-405	Industrial Management & Entrepreneurship	4	-	-	40	60	3	HS
6	EC-406	ELECTIVE - IV	4	-	-	40	60	3	PE
7	EC-451	Mini Project / Term Paper	-	-	3	100	-	2	PR
8	EC-452	HDL Programing Lab	-	-	3	40	60	2	PC
9	EC-453	Digital Signal Processing Lab	-	-	3	40	60	2	PC
		TOTAL	20	2	9	380	420	21	

Elective - III : Any one of the following Courses can be registered

CE-404A	Basic Surveying	CE-404B	Building Materials & Estimation
ChE-404A	Energy Engineering	ChE-404B	Bio-fuels
CS-404A	Java Programming	CS-404B	Database Management Systems
EE-404A	Non-conventional Energy Sources	EE-404B	Utilization of Electrical Energy
IT-404A	Software Engineering	IT-404B	Web Technologies
ME-404A	Robotics	ME-404B	Operations Research

Elective - IV : Any one of the following Courses can be registered

EC-406A	Digital Image Processing	EC-406B	Fundamentals of Global Positioning System
EC-406C	Advanced Digital Signal Processing	EC-406D	Smart Antennas

Any one of the following Courses can also be registered in this Semester in adition to the above or inplace of 405 / 406

EC-409A	Satellite Communication	EC-410A	Wireless Adhoc Networks
EC-409B	Embedded Systems	EC-410B	Real Time Operating System
EC-409C	DSP Processors	EC-410C	Speech Processing
EC-409D	RF System Design	EC-410D	Radar & Navigational Aids

MOOCS course completion certificate must be submitted on or before the last instruction day of IV Year I Semester, otherwise his / her Semester End Examination results will not be declared.

Internship / Industrial Trainning / Certification Course completion certificate must be submitted on or before the last instruction day of IV Year I Semester, otherwise his / her Semester End Examination results will not be declared.

IV YEAR II SEMESTER COURSE STRUCTURE

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category Code
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	
			L	T	P	SES	EXT		
1	EC-407	Mobile and Cellular Communications	4	-	-	40	60	3	PC
2	EC-408	Optical Communications	4	-	-	40	60	3	PC
3	EC-409	ELECTIVE - V	4	-	-	40	60	3	PE
4	EC-410	ELECTIVE - VI	4	-	-	40	60	3	PE
5	EC-454	Microwave & Optical Communication Lab	-	-	3	40	60	2	PC
6	EC-455	Project and Viva - Voce	-	-	6	40	60	10	PR
		TOTAL	16	0	9	240	360	24	

Elective - V : Any one Course can be registered

EC-409A	Satellite Communication
EC-409B	Embedded Systems
EC-409C	DSP Processors
EC-409D	RF System Design

Elective - VI : Any one Course can be registered

EC-410A	Wireless Adhoc Networks
EC-410B	Real Time Operating System
EC-410C	Speech Processing
EC-410D	Radar & Navigational Aids

Any one of the following Courses can also be registered in this Semester in adition to the above or inplace of 409 / 410

EC-405	Industrial Management & Entrepreneurship
EC-406A	Digital Image Processing
EC-406B	Fundamentals of Global Positioning System
EC-406C	Advanced Digital Signal Processing
EC-406D	Smart Antennas

EC/EE/ME-101 DIFFERENTIAL EQUATIONS AND STATISTICS

L	T	P	C
3	1	-	3

COURSE OBJECTIVES:

1. To provide knowledge on solving ordinary differential equations.
2. To To provide knowledge on applications of first order ordinary differential equations.
3. To provide knowledge on solving higher order ordinary differential equations.
4. Focused in partial differential equations.
5. To provide knowledge on curve fitting, correlation and regression lines.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Understand methods of solving first order differential equations.
2. Understand some physical applications of first order differential equations.
3. solve higher order differential equations.
4. solve partial differential equations.
5. understand the relation between two variables by Curve fitting.

UNIT I **(12)**

Differential Equations of First Order :

Definition - Formation of differential equation - Equations of first order and first degree : Linear equations, Bernoulli's equation.

Exact differential equations - Equations reducible to exact equations.

UNIT II **(12)**

Applications of differential equations of first order : Orthogonal trajectories, Newton's law of cooling, Growthand decay problems.

Higher order Linear Differential Equations : Definitions - Operator D - Rules for finding the complementary function.

UNIT III **(12)**

Inverse operator - Rules for finding Particular Integral - working procedure. Method of variation of parameters.

Equations reducible to linear equations with constant coefficients : Cauchy's and Legendre's Linear equations.

UNIT IV **(12)**

Partial Differential Equations :

Formation - Equations solvable by direct integration - Linear equations of first order- Lagrange's linear equation.

Linear Homogeneous partial differential equations of higher order with constant coefficients.

UNIT V **(12)**

Statistics : Method of least squares - Fitting of straight line and parabola.

Correlation, Co-efficient of correlation (direct method), Lines of regression.

LEARNING RESOURCES:

TEXT BOOK(s):

B.S.Grewal - Higher Engineering Mathematics, Khanna publishers, 40th edition, 2007.

REFERENCE BOOK(s):

Erwin Kreyszig - Advanced Engineering Mathematics, 8th edition, New Age International (P) Ltd., 2007.

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

EC/CE/ChE/CS/ EE/IT/ME-102	ENGINEERING PHYSICS	L	T	P	C
		4	-	-	3

COURSE OBJECTIVES:

1. To impart knowledge and understanding of basic principles of Ultrasound and its applications in imaging and industry
2. To understand about basic phenomena of light waves.
3. To understand about fundamentals of Laser, its types and applications. 3-D photography , principle and applications of optical fiber..
4. To understand Essential formulation of physics in the micro world.
5. To understand development of Electromagnetic wave equations.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand the concepts of Ultrasonic waves, production and applications in NDT.
2. understand the interference in thin films and its application, Concept of diffraction and grating, birefringence and production and detection of different polarized lights.
3. acquire Knowledge on basics of lasers, holography, fibers and their applications.
4. understand Schrodinger wave equation and its applications in 1-D with respect to the domain of quantum world.
5. describe the nature of electromagnetic radiation and matter in terms of the particles.

UNIT I **(12)**

Ultrasonics : properties, production of ultrasonics by magnetostriction, piezo electric oscillator methods, detection by acoustic grating method, General applications of ultrasonics in industry and medicine.

NDT: Normal beam pulse echo testing, Ultrasonic scanner (A & B modes).

UNIT II **(12)**

Physical Optics : Interference: Introduction, Stoke's principle (change of phase on reflection), interference in thin films due to reflected light (Cosine law), theory of air wedge (fringes produced by a wedge shaped thin film), theory of Newton's rings(reflected system).

Diffraction: Introduction, Fraunhofer diffraction due to a single slit (quantitative), theory of plane transmission diffraction grating.

Polarization: Introduction, double refraction, construction and working of a nicol prism, quarter wave plate, production and detection of circular and elliptical polarizations(qualitative).

UNIT III **(12)**

Lasers : characteristics, spontaneous and stimulated emissions, Einstein coefficients and Relation between them, population inversion, pumping, active system, gas (He-Ne) laser, Nd: YAG laser and semiconductor (GaAs) laser, applications of lasers.

Holography: basic principle, recording, reproduction and applications.

Fiber optics: Principle & structure of an optical fiber, numerical aperture, acceptance angle and acceptance cone, fractional index change, types of optical fibers, fiber optics in communication system and its advantages. Applications of optical fibers.

UNIT IV **(12)**

Principles of Quantum Mechanics : de Broglie's concept of matter waves, Davisson and Germer experiment, Heisenberg's uncertainty principle-experimental verification (electron diffraction - single slit)

Schrodinger equation and application : Time independent Schrodinger's wave equation, physical significance of the wave function, particle in a box (one dimensional), tunneling effect, expression for transition probability (Qualitative treatment).

UNIT V **(12)**

Electromagnetism : induced electric fields, displacement current and conduction current, Maxwell's equation - qualitative (differential & integral forms) - significance, velocity of electromagnetic wave equation in free space, Poynting Theorem, LC oscillations (quantitative).

LEARNING RESOURCES:

TEXT BOOK(s):

1. M.N.Avadhanulu & P.G. Kshirasagar - Engineering Physics, S.Chand & Co.Ltd.
2. V. Rajendran - Engineering Physics

REFERENCE BOOK(s):

1. Resnick & Halliday - Fundamentals of Physics, John Wiley sons.
2. SL Kakani & Shubhra kakani - Engineering Physics, 3rd Edition, CBS Publications Pvt. Ltd. Delhi.
3. B. K. Pandey & S. Chaturvedi - Engineering Physics, Cengage Learning India Pvt. Ltd., Delhi.
4. Hitendra K. Malik & A.K.Singh - Engineering Physics, TMH, New Delhi.
5. P.K.Palanisamy - Engineering Physics, Scitech Publications.

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

EC/CE/CS/ EE/IT/ME-103	APPLIED CHEMISTRY	L	T	P	C
		4	-	-	3

COURSE OBJECTIVES:

1. To know the softening methods and quality parameters of water used in industries.
2. To know the requirements and purification methods of drinking water.
3. To understand the construction and functioning of electrochemical energy systems.
4. To study the mechanisms, types, factors influencing corrosion and protection methods of corrosion.
5. To acquire knowledge on latest analytical techniques.

COURSE OUTCOMES:

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

1. acquire knowledge on quality and utility of water in industries.
2. gain knowledge on water treatment for drinking purpose.
3. understand functioning of electrochemical energy systems.
4. relate corrosion and environment and suggest methods to prevent corrosion.
5. analyse substances using techniques like Spectrophotometry, Colorimetry, Conductometry and Potentiometry.

UNIT I *Text Book - 1* **(12)**

Water technology: Types of Hardness - units and determination by EDTA method (simple problems), Water technology for industrial purpose: Boiler troubles- scales, sludges, caustic Embrittlement, boiler corrosion, priming and foaming - causes and prevention.

Internal conditioning - phosphate, calgon and carbonate treatment. External conditioning-lime soda process (simple problems), softening by ion exchange process. Desalination of brackish water by electro dialysis and reverse osmosis.

UNIT II *Text Book - 1* **(12)**

Water treatment for drinking purpose - WHO guidelines, sedimentation, coagulation, filtration (slow sand filter), various methods of chlorination, breakpoint chlorination.

Phase Rule: Statement and explanation of the terms involved, one component water system, condensed phase rule - construction of phase diagram by thermal analysis, simple eutectic system (Pb-Ag system only), applications eutectic compounds.

UNIT III *Text Book - 1* **(12)**

Electrochemistry: Electrode potential, electrochemical series and its significance, Nernst equation - derivation - related problems, Reference electrodes (SHE and Calomel electrode) Ion-selective electrode - glass electrode and measurement of pH.

Electrochemical Energy Systems: Types of electrochemical energy systems, electrochemistry of primary batteries (Lachlanche or dry cell), Secondary cells (Lead Acid cell, Ni-Cd cell), Lithium batteries (Li-MnO_2 Lithium organic electrolyte) and their advantages. Fuel cells (Oxygen-Hydrogen).

UNIT IV *Text Book - 1* **(12)**

Corrosion and its control: Introduction, dry corrosion, electrochemical theory of corrosion, Types of corrosion- differential aeration, galvanic (galvanic series) and Stress corrosion Factors affecting corrosion-design, pH, over voltage and temperature.

Protection methods: Cathodic protection, (Impressed current and sacrificial anode) corrosion inhibitors - types and mechanism of inhibition, metallic coatings - Galvanization, Tinning, Electroplating (Cu) and electro less plating (Ni)

UNIT V *Text Book - 1,2* **(12)**

Analytical Techniques: Spectroscopy- Beer-Lambert's law, UV-electronic transitions - chromophores - auxochromes - shifts, and IR- modes of vibrations, ex.H_2O, CO_2 Instrumentation of UV and IR.

Colorimetry - estimation of Iron, Conductometric (HCl vs NaOH) and potentiometric titrations (Fe(II) vs $K_2Cr_2O_7$).

LEARNING RESOURCES:

TEXT BOOK(s):

1. Engineering Chemistry, P.C. Jain and Monika Jain, 15th Edition, 2008, Dhanpat Rai Publishing Company, New Delhi.
2. A Text Book of Engineering Chemistry, Shashi Chawla, 3rd Edition, 2009, Dhanpat Rai and Co.(P) Ltd., New Delhi.

REFERENCE BOOK(s):

A Text Book of Engineering Chemistry, S.S. Dara and S.S. Umare, 12th Edition, 2010, S.Chand and Co.Ltd.

WEB RESOURCES:

1. http://www.powerstream.com/BatteryFAQ.html#lec
2. http://freevideolectures.com/Course/3029/Modern-Instrumental-Methods-of-Analysis
3. http://www.cdeep.iitb.ac.in/webpage_data/nptel/Core%20Science/Engineering%20Chemistry%201/

EC/CS/IT-104 **ENVIRONMENTAL STUDIES** **L T P C**
4 - - 3

COURSE OBJECTIVES:

1. To give a comprehensive insight into natural resources, ecosystems and bio diversity.
2. To create an awareness on various aspects of environmental pollution and effects.
3. To educate the ways and means to protect the environment from pollution.
4. To impart fundamental knowledge on human welfare and environmental acts.
5. To demonstrate the environmental problems like global warming, ozone layer depletion, acid rains.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. define and explain the basic issues concerning the ability of the human community to interact in a sustainable way with the environment.
2. describe and discuss the environmental implications of biologically important materials through the ecosystems.
3. describe and discuss the environmental pollution implications and watershed management.
4. discuss the benefits of sustaining each of the following resources - food, health, habitats, energy, water, air, soil and minerals.
5. understand the causes, effects and controlling measures of different types of environmental pollutions with some case studies.

UNIT I **(12)**

Introduction: Definition, Multidisciplinary nature, Scope and Importance of environmental studiesNatural Resources: Forest Resources: Use and over-exploitation, Deforestation, Effects of Mining and Big dams on forests and tribal people.

Water Resources: Use and over-utilization of surface and groundwater, floods and droughts, Water logging and salinity; Conflicts over water. **Energy resources:** Renewable and non-renewable Energy sources; Land as a resource, land degradation, Soil erosion & Desertification.

UNIT II **(12)**

Ecosystems: Definition, Structure and functions of Ecosystems, a general account of types of ecosystems with examples. Bio-geo chemical cycles (water, carbon, and nitrogen).

Biodiversity and its Conservation: Definition of Biodiversity, Values and threats to biodiversity and conservation of biodiversity. Bio-geographical classification of India, India as a mega-diversity nation, Hot-spots of biodiversity, IUCN classification of Biodiversity; Endemic, Exotic and Endangered species - Meaning with a few examples from India.

UNIT III **(12)**

Environmental Pollution: Causes, effects and control measures of Air pollution including Noise, Fresh Water pollution, Marine pollution, Thermal pollution, and nuclear pollution. Solid wastes - Types based on source (Ex. municipal, industrial, constructional and medical) and nature (degradable and non-degradable); Effects of improper dumping. Solid waste management - Objectives, practices.

Water shed and its management: Definition and importance; Water shed management methods including rain water harvestment.

UNIT IV **(12)**

Social Issues and Environment: Definition of sustainable development, key types and measures for sustainable development; salient features of Stockholm conference 1972, Earth summit, 1992; Human Population and environment, Green revolution, Resettlement and rehabilitation of people - problems and concerns.

Climate Changes: Green House Gases, Kyoto Protocol, Global warming (The story of Tuvalu); Ozone depletion and Acid rain; Environmental Impact Assessment.

UNIT V **(12)**

Environmental acts: Environmental Legislation; Wild life protection act, 1972; Water(Prevention and Control of pollution) act, 1974; Forest Conservation act, 1980; Air (Prevention and Control of pollution) act, 1981; Environmental protection act, 1986.

Case Studies: Chipko movement, Narmada Bachao Andolan, Silent Valley Project, Chernobyl Nuclear Disaster, Bhopal Tragedy, Ralegaon Siddhi, The story of Ganga.

Field work:

Visit to a local area to document environmental assets - river / forest / grassland / hill / mountain.

Study of local environment-common plants, insects, birds.

Study of simple ecosystems - pond,river, hill, slopes etc.

Visits to industries, water treatment plants, and effluent treatment plants.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Anubha Kaushik and C.P.Kaushik - Environmental Studies, 3rd Edition, New Age International Publishers, New Delhi., 2012.
2. R. Rajagopalan - Environmental studies from crisis to cure, 3rd Edition, Oxford University press, 2012.

REFERENCE BOOK(s):

1. T Benny Joseph - Environmental Studies, Tata McGraw-Hill Publishing Company Limited, 2006.
2. G. Tyler Miller Jr. - Environmental Science, 3rd edition, CENGAGE Learning, New Delhi, 2011.

WEB RESOURCES:

1. http://nptel.ac.in/120108004
2. http://nptel.ac.in/122102006

EC-105 **ELEMENTS OF MECHANICAL ENGINEERING** **L T P C**
4 1 - 3

COURSE OBJECTIVES:

1. To study various types of force systems. To teach students the basic principles of mechanics of rigid bodies and to analyze problems in a simple and logical manner, To teach students to draw free body diagrams and equilibrium methods in problem solving.
2. To understand the basic manufacturing process like casting, welding and their working process.
3. To impart the knowledge about different drive systems like belts, belt drives, gears and gear trains. To improve knowledge on basic conventional machining processes.
4. To understand the basic concepts of thermodynamics and working principles of 2 stroke and 4 stroke petrol and diesel engines.
5. To understand the working principles of different boilers and different mountings and accessories used for the safety operation of boilers and basics about refrigeration and air conditioning.

COURSE OUTCOMES:

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

1. understand different coplanar forces and determine the resultant forces. Simplify a system of forces and couples applied to a rigid body into a single resultant force and couple.
2. know about basic fabrication processes like welding, casting and their working.
3. know how the power is transmitted through belt and gear drives, estimate the tensions, power transmitted, length of the belt required etc.Know the various manufacturing process like foundry, welding, brazing , soldering, milling and drilling etc.,
4. know the basic concepts of thermodynamics, efficiencies and performance of 2-stroke and 4 stroke IC Engines
5. understand working principles of Babcock and Wilcox boilers, different mountings and accessories used in the boilers. They able to know basic working of refrigerator and air conditioning.

UNIT I *Text Book - 1* **(13)**

Forces : Types of forces, Concurrent Forces, Resolution of coplanar Forces, Equilibrium of Coplanar forces, free body diagrams, Method of Moments.

Non Concurrent Forces in a Plane : Couple, equilibrium of parallel forces in a plane, resultant and equilibrium of general case of forces in a plane, plane trusses-method of joints.

UNIT II *Text Book - 2* **(13)**

Casting : Steps involved in Casting, Applications metal casting, Pattern- Materials, Types of patterns, pattern allowances, casting defects.

Fabrication processes : Classification; Welding - Classification of welding; Electric arc welding - Principle of arc, Arc welding equipment, Electrodes, Manual metal arc welding, TIG welding (working principles)

Introduction to Machine Tools : Construction and working of Lathe.

UNIT III *Text Book - 3* **(13)**

Power Transmission Methods and Devices : Belts : Belts, expression for the ratios of tensions on the slack and tight side, power transmitted, V-belts, chain drives.

Gears : Types of gears, Spur, helical, Bevel gears, nomenclature of gears, Gear manufacturing methods, (Simple problems on spur gears) gear trains- introduction.

UNIT IV *Text Book - 4* **(13)**

Basic concept of thermodynamics : Introduction, States, Work, Heat, Temperature, Zeroth law, laws of thermodynamics, Classification of heat engines, Description and thermal efficiency of Carnot cycle, Otto cycle and Diesel cycle.

Internal Combustion Engines : Introduction, Classification Engine details, four-stroke/ two-stroke cycle Petrol/Diesel engines, Indicated power, Brake Power, Efficiencies. (Simple Problems)

UNIT V *Text Book - 4* **(13)**

Steam Boilers : Introduction, Classification, Cochran, Babcock and Wilcox boiler, functioning of different mountings and accessories.

Refrigeration & Airconditioning : Introduction to refrigeration and air-conditioning, Coefficient of performance,Simple refrigeration vapour compression cycle,Domestic Refrigerator, Summer and winter Air conditioning.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Engineering Mechanics - A.K. Tayal, Umesh Publications, 13th Edition, New Delhi.
2. Workshop Technology - Vol I and II - Hazaraj Chowdary
3. Elements of Mechanical Engineering, Mathur, and Mehta, Jain Brothers, Delhi (2005)
4. Treatise on Heat Engineering - V. P.Vasandhani & Kumar, Metropolitan Publishers

REFERENCE BOOK(s):

1. Applied Mechanics & Strength of Materials, R. S. Khurmi, 13thEdition, S. Chand & Co.(1977)
2. Basic Mechanical Engineering, T.J.Prabhu& Others, 1stEdition, ScitechPublishers(2010)

WEB RESOURCES:

http://nptel.ac.in/courses/

EC-106 **ECONOMICS FOR ENGINEERS** **L T P C**
4 - - 3

COURSE OBJECTIVES:

1. To provides the students with knowledge of basic economic problems and the relationship between engineering technology and economics.
2. To alerts the students to understand the demand determinats and the methods of demand forecasting of a product.
3. To give knowledge to the students about various costs for determining the manufacturing of a product.
4. To guide the students for accounting the depreciation and providing the funds for replacement of necessary and depreciated machinery and equipment.
5. To sensitize the students to the changing environment of banking scenario and to understand the functions of RBI.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand the decision making objective of a firm.
2. get knowledge about overall functions of Demand, Supply, Price, Income of the firms.
3. linkage various cost concepts and to understand how to maintain break even scenario for a business.
4. get knowledge about time value of money in and how to use Accounting concepts in the changing society.
5. know the overview of Liberalization, Privatization and Globalization and the impact of them on economy.

UNIT I *Text Book - 1,2* **(10)**

ENGINEERING ECONOMICS - AN OVERVIEW : Economics definition, Functions & Scope of Engineering economics, Basic economic problem, Relationship between Science, Engineering, Technology and Economics.

FIRMS OBJECTIVE: Theories of Maximization - Profit Maximization, Growth Maximization, Sales Revenue Maximization, Utility Maximization and Wealth Maximization.

UNIT II *Text Book - 2,3* **(8)**

THEORY OF DEMAND - AN OVERVIEW : Demand schedule, Nature and characteristics of demand, Law of demand, Limitaions to the law of demand, Elasticities of Demand: Price, Income and Cross elasticity, Demand Forecasting definition, factors determining demand forecasting, methods of demand forecasting.

UNIT III *Text Book - 4* **(12)**

COST CONCEPTS - AN OVERVIEW : Introduction, Types of costs: Fixed cost, Variable cost, Average cost, Marginal cost, Real cost, Opportunity cost, Accounting and Economic cost, Cost - Volume profit analysis, Break - Even analysis, Operating leverage.

UNIT IV *Text Book - 4* **(12)**

ACCOUNTING CONCEPTS - AN OVERVIEW : Accounting concepts, Double Entry system, Journal, Ledger, Trail balance, Final Accounts Book Keeping system, Depreciation - Definition, functions, methods of depreciation â€“ Straight line, Declining balancem Sum of years digits method and Problems.

UNIT V *Text Book - 3,5* **(8)**

INDIAN ECONOMY - AN OVERVIEW : Nature and characteristics of Indian economy, Banking - Meaning and functions of Commercial banks, Functions of RBI. Globalization, Privatization - Meaning , merits and de - merits, Elementary concepts like WTO, GATT, TRIPS, Monetary Policy and Fiscal Policy.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Riggs, Bedworth and Randhwa, Engineering Economics, McGrawhill Education India.
2. S.C.Sharma and T.R.Banga, Industrial Organisation and Engineering Economics, Khanna Publishers.
3. S.K.Misra and V.K.Puri, Economic Environment of Business, Himalaya Publishing House,2003.
4. K.Rajeswara Rao and G.Prasad, Accounting and Finance, Jai Bharat Publishers , 2014
5. Francis Cherunilam, Business Environment Text and Cases, Himalaya Publishing House, 2014

REFERENCE BOOK(s):

1. Singh A and Sadh A.N., Industrial Economics , Himalaya Publishing House , Bombay
2. H.L.Ahuja, Managerial Economics,S.Chand Publishing ,2007 Ediction
3. Datt & Sundharam, Indian Economy , S.Chand Publishing, 2014 Edition

WEB RESOURCES:

1. www.managementstudyguide.com : Describes about the amalgamation of economic theory with business practices.
2. www.tutorialspoint.com : Provides a platform to learn various courses disscussed in the syllabus.

EC-151	PHYSICS LAB	L	T	P	C
		-	-	3	2

COURSE OBJECTIVES:

1. To give background in experimental techniques and to reinforce instruction in physical principles.
2. To find measurement, data, error, or graphical analysis in addition to illustrating a physical principle.
3. To give skills that can transfer critical thinking into problem solving methods. How to identify what data is important, how to collect that data, and then draw conclusions from it.

COURSE OUTCOMES:

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

1. use CRO, signal generator, spectrometer for making measurements.
2. test the optical components using principles of interference & diffraction.
3. determine the selectivity parameter in electrical circuits.

List of Experiments:

1. Interference fringes - measurement of thickness of a foil using wedge method.
2. Newton's rings - measurement of radius of curvature of Plano - convex lens.
3. Lissajous' figures - calibration of an audio oscillator.
4. Photo cell - characteristic curves and determination of stopping potential.
5. Diffrraction grating - measurement of wavelengths.
6. Torsional pendulum - determination of Rigidity modulus of a wire.
7. Photo-Voltaic cell - determination of fill factor.
8. Series LCR resonance circuit - determination of Q factor.
9. Sonometer - determination of A.C. frequency.
10. Laser - determination of single slit diffraction.
11. B - H Curve - Variation of magnetic field along the axis of a circular current carrying coil.
12. Optical Fiber - Determination of Numerical Aperture and Acceptance Angle.

REFERENCE BOOK : Physics Lab Manual , R.V.R. & J.C. CE, Guntur

Note: A minimum of 10(Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

EC-152	ENGINEERING GRAPHICS LAB	L	T	P	C
	(To be taught & examined in First angle projection)	2	-	4	2

COURSE OBJECTIVES:

1. Comprehend general projection theory with emphasis on orthographic projection to represent three dimensional objects in two dimensional views.
2. To be able to plan and prepare neat orthographic drawings of points, Straight lines, Regular planes and solids
3. Draw and identify various types of section and Auxiliary views .
4. To enable the students the aspects of development of surfaces in sheet metal working
5. Introduce Auto CAD software for the creation of basic entities and usage of different tool bars.

COURSE OUTCOMES:

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

1. acquire basic skills in Technical graphic communication
2. visualize and communicate with 2D as well as three dimensional shapes.
3. understands the application of Industry standards and best practices applied in Engineering Graphics
4. apply the knowledge of development of surfaces in real life situations
5. draw simple 2D Engineering Drawings using Auto CAD.

List of Experiments:

Practice with mini Drafter on Drawing sheets:

General: Use of Drawing instruments, Lettering -Single stroke letters, Dimensioning- Representation of various type lines, Geometrical Constructions, Representative fraction.

Conic sections: general construction and special methods for ellipse, parabola and hyperbola.

Cycloidal curves: cycloid, epicycloid and hypocycloid; involute of circle , and Archemedian spiral.

Method of Projections: Principles of projection - First angle and third angle projection of points. Projection of straight lines. Traces of lines.

Projections of Planes: Projections of planes, projections on auxiliary planes.

Projections of Solids: Projections of Cubes, Prisms, Pyramids, Cylinders and Cones with varying positions.

Sections Of Solids: Sections of Cubes, Prisms, Pyramids, cylinders , and Cones. true shapes of sections. (Limited to the Section Planes perpendicular to one of the Principal Planes).

Development of Surfaces: Lateral development of cut sections of Cubes, Prisms, Pyramids, Cylinders and Cones.

Isometric Projections: Isometric Projection and conversion of Orthographic Projections into isometric views. (Treatment is limited to simple objects only).

Orthographic Projections: Conversion of pictorial views into Orthographic views. (Treatment is limited to simple castings).

Computer Aided Drafting (Using any standard package) (Demonstration only) :

Setting up a drawing: starting , main menu (New, Open, Save, Save As etc.), Opening screen, error correction on screen, units, co-ordinate system, limits, grid, snap, ortho

Tool bars: Draw tool bar, object snap tool bar, modify tool bar, dimension tool Bar

PRACTICE OF 2D DRAWINGS: Exercises of Orthographic views for simple solids using all commands in various tool bars.

LEARNING RESOURCES:

TEXT BOOK(s):

N.D. Bhatt & V.M. Panchal - Engineering Drawing, 50th Edition, Charotar publishing house , 2010.

REFERENCE BOOK(s):

1. Prof.K.L.Narayana & Prof. R.K.Kannaiah - Engineering Drawing, Scitech Publications, 2010.
2. James D. Bethune - Engineering Graphics with AutoCAD 2002, PHI, 2011.

EC-153 **COMMUNICATION SKILLS LAB** **L T P C**
- - 3 2

COURSE OBJECTIVES:

1. To acquaint the students with the standard English pronunciation, i.e., Received Pronunciation(RP), with the knowledge of stress and intonation.
2. To develop the art of effective reading and answer comprehension passages.
3. To enable the students use phrasal verbs and idiomatic expressions in an apt manner.
4. To equip with appropriate and spontaneous speech dynamics.
5. To develop production and process of language useful for social and professional life.

COURSE OUTCOMES:

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

1. know the IPA phonetics symbols, and their relation to pronunciation; recognize the difference among the native, regional and neutral accent of English.
2. employ different skills, inferring lexical and contextual meaning and attempt comprehension passages.
3. use confidently phrases and idioms for effective communication.
4. develop appropriate speech dynamics in professional situations.
5. focus on communication skills and social graces necessary for effective communication.

List of Exercises / Activities:

1. **Phonetics :**

   (i) Sounds, Symbols, Stress and Intonation.

   (ii) Pronunciation - Mother tongue influence - Indianisms etc.

2. **Reading Comprehension :**

   Strategies, Reading skills - Skimming and Scanning, Intensive and Extensive reading.

3. **Idioms & Phrases :** Idioms of variety.

4. **Interactive classroom activities.**

   Jam - (Guided & Free) - Extempore - Elocution - Telephonic Skills.

   Articulation and flow of oral presentation - voice modulation - content generation - Key Word Approach (KWA).

5. **Communication Skills**

   Greeting and Introducing; Making Requests; Agreeing and disagreeing; Asking for and giving permissions; Offering help; Art of small talk; making a short formal speech; Describing people, places, events & things.

REFERENCE BOOK(S) :

1. A Course in Listening & Speaking II, Foundation books by G.Raja Gopal,2012(For Exercises 1 & 4)
2. Books on GRE, IELTS & TOEFEL (For Exersises 2)
3. English Idioms by Jennifer Seidl W. Mc Mordie, OUP, V Edition , 2009 (For Exersise 3)
4. Interactive classroom activities. (10 titles -CUP) (Unit-IV) (For Exersise 4)
5. A course in English Communication - by Kiranmai Dutt, Rajeevan,C.L.N Prakash, 2013. (For Exersise 5)
6. Better English Pronunciation-J.D.O' Connor, Second Edition, 2009, Cambridge Semester Press, 2012. (For Exersise 1)

SOFTWARE :

1. Pronunciation power I & II
2. Author plus - Clarity.
3. Call Centre Communication - Clarity.

EC/EE/ME-107 CALCULUS AND NUMERICAL METHODS L T P C
3 1 - 3

COURSE OBJECTIVES:

1. Finding the Eigen values and Eigen vectors and inverse of a matrix and getting familiarity with diagonalization and quadratic forms.
2. To give basic knowledge on evaluation of double, triple integrals, area and volume.
3. To provide sufficient theoretical and analytical background of differentiation and integration of vector functions.
4. To provide basic knowledge of numerical methods including solving systems of linear equations.
5. To provide knowledge on numerical differentiation and integration.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand the basic linear algebraic concepts.
2. evaluate double, triple integrals and the area, volume by double & triple integrals respectively.
3. solve gradient, divergence, curl and integration of vector function problems.
4. solve system of equations.
5. evaluate derivatives and integrals using numerical techniques.

UNIT I (12)

Matrices : Characteristic equation - Eigen values and Eigen vectors of a real matrix - Properties of Eigen values (without proofs) - Cayley - Hamilton theorem (without proof). Reduction to diagonal form.

Reduction to diagonal form. Reduction of quadratic form to canonical form by orthogonal transformations, Nature of a quadratic form.

UNIT II (12)

Multiple Integrals : Double integration in Cartesian and polar coordinates - Change of order of integration - Area as a double integral.

Triple integration in Cartesian coordinates - Change of variables in double integrals from Cartesian to polar - Volume as a Triple Integral.

UNIT III (12)

Vector Calculus : Gradient, Directional derivatives, divergence, curl - Solenoidal and irrotational fields - Vector identities (without proof).

Line, surface and volume integrals - Green's theorem in the plane, Stoke's theorem and Gauss divergence theorem (without proofs).

UNIT IV (12)

Numerical Solution of Equations and Interpolation :

Newton - Raphson method - Gauss Seidel method. Forward and backward differences - Differences of a polynomial.

Interpolation - Newton-Gregory Forward and Backward Interpolation formulae (without proof), Lagrange's Interpolation formula (without proof) - Inverse interpolation.

UNIT V (12)

Numerical differentiation and Integration :

Newton's forward and backward differences formulae to compute first and second order derivatives.

Trapezoidal rule - Simpson's one third rule.

LEARNING RESOURCES:

TEXT BOOK(s):

B.S.Grewal - Higher Engineering Mathematics, Khanna publishers, 40th edition, 2007.

REFERENCE BOOK(s):

Erwin Kreyszig - Advanced Engineering Mathematics, 8th edition, New Age International (P) Ltd., 2007.

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

EC/EE/CS/IT-108	ELECTRONIC AND ELECTRICAL ENGINEERING MATERIALS	L	T	P	C
		4	-	-	3

COURSE OBJECTIVES:

1. To understand the concept of electron motion in a periodic potential and classification of solids through bands and intrinsic and extrinsic semiconductors and their carrier densities.
2. To understanding Energy level diagrams in in PN junction, its characteristic equation and the related optoelectronic devices.
3. To understand Basics of Dielectrics and magnetism, Classification of materials on Polarization and Magnetization and applications.
4. To understand Properties and applications of super conductors
5. To understand Nano materials and characterization with X-rays and electron probe techniques.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand the nature of formation of bands in solid and classifying the solids , Importance of Fermi level and law of mass action in semiconductors.
2. understand theory of P-N junction and the devices.
3. acquire knowledge on Importance of polarization and magnetization phenomena and their applications.
4. acquire knowledge on Relevance of superconductivity and its applications.
5. acquire knowledge on Nano material and their characterization principles.

UNIT I **(12)**

Electron theory of solids: Failures of Classical free electron theory and quantum free electron theory (qualitative), Bloch theorem (Qualitative), Kronig-Penney model (Qualitative treatment), effective mass of electron, energy band formation in solids, Classification of solids into metals, semiconductors and insulators.

Semiconductor Physics: Intrinsic & extrinsic semiconductors, density of states, derivation for intrinsic carrier concentration, Hall effect and its uses, direct & indirect band gap semiconductors, donor and acceptor energy levels, charge neutrality, law of mass action.

UNIT II **(12)**

Physics of Semiconductor materials: Drift and Diffusion current , Continuity equation Formation of P-N junction, energy level diagram and built in potential, Diode equation, I-V Characteristics of P-N junction diode, Photodiode, LED, LCD, solar cell (qualitative).

UNIT III **(12)**

Magnetic Materials: Introduction, origin of magnetic moment, Bohr Magneton, Langevin's theory of paramagnetism, hysteresis curve, soft and hard magnetic materials, Ferrites and their applications.

Dielectric Materials: Fundamental definitions: Electric dipole moment, polarization vector, polarizability, electric displacement, dielectric constant and electric susceptibility. Types of polarizations - Electric and ionic polarisations, internal fields in solids (Lorentz method), Clausius-Mossotti equation, Frequency dependence of polarization, loss tangent, and dielectric loss, Ferroelectrics and their applications.

UNIT IV **(12)**

Superconducting materials: Introduction, critical parameters (Tc, Hc, Ic), Meissner effect, types of superconductors, entropy, specific heat, energy gap, BCS Theory(in brief), Josephson effect, London equation and penetration depth, high temperature superconductors, applications of superconductors.

UNIT V **(12)**

Nanomaterials: Introduction to nano materials, surface to volume ratio, General properties of nano materials in brief, fabrication of nano materials (sol-gel and chemical vapour deposition methods), applications of nano materials.

Characterization techniques:SEM,AFM

LEARNING RESOURCES:

TEXT BOOK(s):

1. V. Rajendran - Engineering Physics
2. P.K.Palanisamy - Engineering Physics, Scitech Publications.

REFERENCE BOOK(s):

1. M. Vijaya and G. Rangarajan - Materials science, McGraw Hill Education, 2014.
2. S.O. Pillai - Solid State physics
3. R.K.Puri and V.K.Bubber - Solid state physics and Electronics,

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

EC/CE/EE/ CS/IT/ME-109	CHEMISTRY OF ENGINEERING MATERIALS	L	T	P	C
		4	-	-	3

COURSE OBJECTIVES:

1. To acquire knowledge on formation of polymers and conditions to act as conducting polymers.
2. To gain knowledge on the chemistry of some important plastics and rubbers commonly used.
3. To understand parameters related to efficiency of various fuels
4. To gain knowledge on the characteristics of refractories and lubricants.
5. To understand the requirements and chemistry of explosives and utility of liquid crystals

COURSE OUTCOMES:

After successful completion of the course, the students

1. know the formation of polymers and the utility of conducting polymers in electronics, electrical and other fields.
2. would be able to know usage of plastics and elastomers in day-to-day life and in fields like automobile, electronics, etc.
3. would acquire knowledge on composition, quality and uses of various fuels.
4. would be capable of selecting appropriate lubricant for a given system, and know the characteristics and utility of refractories.
5. acquire knowledge on the requirements, applications of liquid crystals and explosives.

UNIT I *Text Book-1 & 2* **(12)**

Polymers: Monomer functionality, degree of polymerization, Tacticity, classification of polymerization - addition, condensation and co-polymerization, mechanism of free radical polymerization.

Conducting polymers: Introduction, examples and applications, Polyacetylene - mechanism of conduction.

UNIT II *Text Book-1* **(12)**

Plastics - Thermoplastic and thermosetting resins, preparation, properties and uses of Bakelite, polyesters, Teflon and PVC. Compounding of plastics.

Rubber - Processing of latex, Drawbacks of natural rubber - Vulcanization, Chemistry of Synthetic rubbers- Buna-S and Buna-N, polyurethane rubber and silicone rubber, epoxy resin (adhesive)

UNIT III *Text Book-1* **(12)**

Fuels: Classification of fuels, calorific value - LCV and HCV-units and determination by Bomb calorimeter, Coal- Ranking, proximate and ultimate analysis, carbonization of coal-types (using Beehive oven), Metallurgical coke-properties and uses.

Petroleum based: Fractional distillation, cracking-fixed bed, reforming, octane number and cetane number of liquid fuels, composition and uses of petrol, diesel, CNG and LPG.

UNIT IV *Text Book-1 & 2* **(12)**

Refractories: Characteristics, classification, properties and their significance-refractoriness, strength of refractoriness under load, dimensional stability, thermal spalling, thermal expansion, thermal conductivity, porosity Common refractory bricks- silica, fire clay and carborundum.

Lubricants: Classification, functions, properties of lubricants - Viscosity, Viscosity index, Flash point, Fire point, Cloud point, Pour point, Oilyness. Solid lubricants - Graphite and Molybdenum sulphide, Additives, determination of viscosity by Red wood viscometer.

UNIT V *Text Book-1* **(12)**

Liquid crystals: Structure of liquid crystal forming compounds, Classification and applications.

Explosives: Characteristics, terms related to explosives, classification-primary, low and high explosives. Manufacture of gun powder, lead azide, nitroglycerine and RDX

LEARNING RESOURCES:

TEXT BOOK(s):

1. Engineering Chemistry, P.C. Jain and Monika Jain, 15th Edition, 2008, Dhanpat Rai Publishing Company, New Delhi.
2. A Text Book of Engineering Chemistry, Shashi Chawla, 3rd Edition, 2009, Dhanpat Rai and Co.(P) Ltd., New Delhi.

REFERENCE BOOK(s):

1. A Text Book of Engineering Chemistry, S.S. Dara and S.S. Umare, 12th Edition, 2010, S.Chand and Co.Ltd.
2. Principles of Polymer Science, P.Bahadur and N.V. Sastry, Narora Publishing House

WEB RESOURCES:

1. http://www.chem1.com/acad/webtext/states/polymers.html
2. http://www.nptel.ac.in/courses/104105039/
3. http://freevideolectures.com/Course/3070/Science-and-Technology-of-Polymers

EC/ChE/CS/IT-110 ENGLISH FOR COMMUNICATION L T P C
4 - - 3

COURSE OBJECTIVES:

1. To enable students improve their lexical and communicative competence.
2. To equip students with oral and written communication skills.
3. To understand and learn the correct usage and application of Grammar principles.
4. To get acquainted with the features of successful professional communication.
5. To enable students acquire various specific features of effective written communication.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. use vocabulary contextually.
2. compose effectively the various forms of professional communication.
3. apply grammar rules efficiently in spoken and written forms.
4. understand and overcome the barriers in communication.
5. develop professional writing.

UNIT I **(12)**

Lexis:

(a) i. Synonyms & Antonyms ii. Words often confused.

(b) i. One Word Substitutes ii. Analogies

UNIT II **(12)**

Written Communication:

(a) Note-taking & Note-making (b) Writing a Proposal (c) Memo Writing (d) Paragraph writing

UNIT III **(12)**

Exposure to basics of grammar with emphasis on

(a) Articles & Prepositions (b) Tenses (c) Voice (d) Speech

UNIT IV **(12)**

Communication:

Types: Oral & Written - Barriers to communication - Non-verbal Communication - Kinesics, Proxemics, Occulesics, Haptics

UNIT V **(12)**

Composition:

a) E-mail

b) Letter-writing: order, complaint, job application, invitation.

c) Precis writing

d) Biographical writing: i. APJ Abdul Kalam ii. Ratan Tata iii. Sudha Murthy iv. Mother Teresa

LEARNING RESOURCES:

TEXT BOOK(s):

1. Technical English - by Dr. M.Sambaiah, Wiley India Pvt. Ltd, New Delhi 2014.

2. Communication Skills by Sanjay Kumar & Pushpa Latha, Oxford University Press, 2015 [This text is prescribed for the topics: (1) One Word Substitutes(Unit-I), (2) Note-taking (Unit-II) and (3) Haptics (Unit-IV)].

REFERENCE BOOK(s):

1. Dictionary of Synonyms and Antonyms, Oxford & IBH, III Ed -, 2010
2. Objective English III Edition, Mc-Graw Hill Companies- by Hari Mohan Prasad, Uma Rani Sharma, 2007
3. Technical Communication - Principles & Practice. II Ed, by Meenakshi Raman & Sangeetha Sharma, 2015
4. Oxford Michael Swan- Practical English Usage - III Ed, New international Students Ed,OUP, 2007
5. Business Communication II Ed. Meenakshi Raman & Prakash Singh, OUP, 2012
6. A course in English Communication by Kiranmai Dutt, Rajeevan, C.L.N Prakash, 2013.
7. The Most Common Mistakes in English Usage - Thomas Elliott Berry, 2012.

EC/ChE-111	PROBLEM SOLVING WITH C	L	T	P	C
		4	1	-	3

COURSE OBJECTIVES:

1. To understand the basic problem solving process using algorithm, Flow Charts and pseudo-code development.
2. To understand the basic concepts of control structures in C.
3. To understand the concepts of arrays, functions and pointers in C and can effectively use pointers for Dynamic memory allocation.
4. To understand the concepts of structures, unions, files and command line arguments in C.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. develop algorithms and flow charts for simple problems.
2. use suitable control structures for developing code in C.
3. design modular programs using the concepts of functions and arrays.
4. design well-structured programs using the concepts of structures and pointers.
5. develop code for complex applications using file handling features.

UNIT I **(13)**

Introduction : Computer & it's Components, Hardware , Software, programming languages, Algorithm, Characteristics of algorithm, Flowchart, Symbols used in flowchart, history of C, structure of C program, C language features.

C Tokens: Character set, Identifiers, Keywords, constants, Data types, type qualifiers, Declaration and Initialization of variables.

Operators & Expressions: C operators and expressions, Type-conversion methods, Operators Precedence and Associativity, Input/ Output functions and other library functions.

Programming Exercises: C-Expressions for algebraic expressions, Evaluation of arithmetic and boolean expressions. Values of variables at the end of execution of a program fragment, Computation of values using scientific and engineering formulae.

UNIT II **(13)**

Control Statements : If-Else statement, Else-If statement, Switch statement and goto statement, Looping- While, Do-While and for statements, Break and continue statements.

Programming Exercises: Finding the largest of three given numbers, Computation of discount on different types of products with different ranges of discount, finding the type of triangle formed by the given sides, Computation of income-tax, Computation of Electricity bill, finding roots of a quadratic equation. Finding the factorial of a given number, test whether a given number is-prime, perfect, palindrome or not, Generation of prime and Fibonacci numbers.

UNIT III **(14)**

Arrays : One - dimensional, Two-dimensional numeric and character arrays.**Functions:** Function Definition, Function prototype, types of User Defined Functions, Function calling mechanisms, Built-in string handling and character handling functions, recursion, Storage Classes, mult-file compilation, Function with Arrays.

Programming Exercises: Computation of statistical parameters of a list of numbers, sorting and searching a given list of numbers, Operations on Matrices such as addition, multiplication, Transpose of a matrix. Finding whether a given string is palindrome or not, sorting of names, operations on strings

with and without using library functions, recursive functions to find the factorial value, Fibonacci series, GCD, swapping of two variables, calling the function by passing arrays.

UNIT IV **(13)**

Pointers : Pointer, Accessing a variable through pointer, pointer Arithmetic, pointer and Arrays, Dynamic memory allocation, pointer to pointer, Array of pointers.

Structures: Structures, Nested structures, Array of structures, Pointer to structures, passing structures to functions, self referential structure, Unions.

Programming Exercises: Sort and search the given list using functions and pointers, operations on arrays using functions and pointers. Operations on complex numbers, maintaining the books details by passing array of structures to functions, sorting the list of records.

UNIT V **(12)**

Files : Defining and opening a file, closing a file, input/output operations on files using file handling functions, random access to files. Command line arguments, C-preprocessor directives.

Programming Exercises: Create and display the contents of text file, copy the contents of one file into another, merging the contents of two files, writing, reading and updation of student records in a file, programs to display the contents of a file and copy the contents of one file into another using command line arguments.

LEARNING RESOURCES:

TEXT BOOK(s):

Byron Gottfried - Programming with C (Schaum's Outlines), Third Edition, Tata McGraw-Hill.

REFERENCE BOOK(s):

1. Stephen G. Kochan - Programming in C, Fourth Edition, Pearson
2. Herbert Sheildt - C Complete Reference, TMH, 2000.
3. K R Venugopal & Sudeep R Prasad - Programming with C, TMH., 1997
4. Brian W. Kernighan & Dennis M. Ritchie - The C programming Language, Second Edition, Prentice Hall

WEB RESOURCES:

1. http://cprogramminglanguage.net/
2. http://lectures-c.blogspot.com/
3. http://www.coronadoenterprises.com/tutorials/c/c_intro.htm
4. http://vfu.bg/en/e-Learning/Computer-Basics--computer_basics2.pdf

EC-112 PROFESSIONAL ETHICS AND HUMAN VALUES L T P C
4 - - 3

COURSE OBJECTIVES:

1. To provide essential complementarily between "VALUES" and "SKILLS" to ensure sustained happiness and prosperity.
2. To introduce Ethical concepts that are relevant to resolving Moral issues in Engineering and to impart reasoning and analytical skills needed to apply ethical concepts to Engineering decisions.
3. To facilitate the development of a Holistic perspective towards life, profession and happiness, based on a correct understanding of the Human reality.
4. To understand the need for lifelong learning and have the knowledge and skills that prepare them to identify the moral issues involved in engineering areas
5. To provide an understanding of the interface between Social, Technological and Natural environments.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. comprehend a specific set of behaviours and values the professional interpreter must know and must abide by, including confidentiality, honesty and integrity.
2. strive to achieve the highest quality, effectiveness and dignity in both the process and products of professional work
3. understand the moral requirements of engineering experiments, and have the ability to apply their knowledge to the solution of practical and useful problems;
4. understand Lack of communication, prejudice in not asking for clarification, fear of law and plain neglect will lead to the occurrence of many repetitions of past mistakes.
5. know and respect existing laws pertaining to professional work. The students can speak out against abuses in these areas affecting the public interest.

UNIT I (10)

Morals, Values and Ethics - Self-Confidence - Character - Valuing Time - Courage - Honesty - Caring - Sharing-Self respect - Respect for Others - Spirituality - Living Peacefully.Integrity- Commitment - Empathy - Work Ethics - Service Learning - Stress management - Civic Virtue - Co-operation.

UNIT II (10)

Scope and aims of Engineering Ethics - Senses of 'Engineering Ethics' - Variety of Moral Issues - Types of Inquiry - Engineering Ethics and Philosophy.

Moral Dilemmas - Moral Autonomy - Kohlberg's theory - Gilligan's theory - Criteria for a profession - Multiple Motives - Models of Professional Roles.

UNIT III (10)

Moral reasoning and Ethical Theories - Virtue Ethics - Utilitarianism-Duty ethics - Right ethics-Self interest, Customs and Religion - Uses of Ethical Theories-Testing of Ethical Theories.

Engineering as experimentation - Similarities to Standard Experiments - Contrasts with Standard Experiments - Engineers as Responsible Experimenters - A Balanced Outlook on Law - Problems with Law in engineering - The Challenger Case Study.

UNIT IV (10)

Safety and Risk - Assessment of safety and risk - Risk benefit analysis and reducing risk - Testing for safety The Three Mile Island and Chernobyl case studies and safe exit.

Collegiality and loyalty - Respect for authority - Collective bargaining - Confidentiality - Conflicts of interest - Occupational crime - Intellectual property rights (IPR) - Discrimination.

UNIT V **(10)**

Professional rights - Employee rights - Whistle blowing - discrimination - Multinational corporations - Environmental ethics - Computer ethics - Weapons development.

Engineers as managers - Consulting engineers - Engineers as expert witnesses and advisors - Moral leadership - codes of ethics - role and limitations of codes - Sample code of ethics like ASME, ASCE, IEEE, Institution of Engineers (IE), India Indian Institute of Materials Management, Institution of electronic and telecommunication engineers (IETE), India, etc.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Mkie Martin and Roland Schinzinger, Ethics in Engineering, McGraw - Hill, New Jersey, 2004 (Indian Reprint)
2. Govindarajan M, Natarajan S, Senthil Kumar V.S - Engineering Ethics, Prentice Hall of India, New Delhi, 2004.

REFERENCE BOOK(s):

1. Charles D. Fleddermann - Engineering Ethics, Pearson Education / Prentice Hall, New Jersey, 2004 (Indian Reprint).
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, Engineering Ethics - Concepts and Cases, Wadsworth Thompson Learning, United States, 2000 (Indian Reprint).

WEB RESOURCES:

1. http://nptel.ac.in/courses/109104068
2. http://nptel.ac.in/courses/109104030

EC-154	CHEMISTRY LAB	L	T	P	C
		-	-	3	2

COURSE OBJECTIVES:

1. To learn the concepts of equivalent weight, molecular weight, normality, molarity, weight percent, volume percent.
2. To prepare molar solutions of different compounds.
3. To know the methods of determining alkalinity, hardness and chloride ion content of water sample.
4. To know the methods to determining purity of washing soda, percentage of available chlorine in bleaching powder.
5. To learn the redox methods to determine Fe2+ ions present in solution.
6. To know principles and methods involved in using instruments like conductivity bridge, spectrophotometer, pH meter and potentiometer

COURSE OUTCOMES:

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

1. acquire knowledge on normality, molarity, molecular weight, equivalent weight, oxidizing agent, reducing agent.
2. prepare solutions with different concentrations.
3. analyze water for its hardness, alkalinity, chloride ion content, iron content.
4. understand the principles behind the development of instruments suitable for chemical analysis. Later he can use the knowledge in modifying instruments.

List of Experiments:

1. Determination of total alkalinity of water sample
   a. Standardization of HCl solution b. Determination of alkalinity of water
2. Determination of purity of washing soda
   a. Standardization of HCl solution b. Determination of percentage purity of washing soda
3. Estimation of Chlorides in water sample
   a. Standardization of $AgNO_3$ solution b. Estimation of Chlorides in water
4. Determination of Total Hardness of water sample
   a. Standardization of EDTA solution b. Determination of Total Hardness of water
5. Estimation of Mohr's salt - Permanganometry
   a. Standardization of $KMnO_4$ solution b. Estimation of Mohr's salt
6. Estimation of Mohr's salt - Dichrometry
   a. Standardization of $K_2Cr_2O_7$ solution b. Estimation of Mohr's salt
7. Determination of available chlorine in bleaching powder
   a. Standardization of Hypo b. Determination of available chlorine in bleaching powder
8. Estimation of Magnesium
   a. Standardization of EDTA solution b. Estimation of Magnesium
9. Conductometric titration of an acid vs base
10. Potentiometric titrations: Ferrous Salt vs Dichromate

Demonstration Experiments:

11. pH metric titrations of an acid vs base
12. Spectrophotometry: Estimation of Mn/Fe

Note: A minimum of 10(Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

EC-155 **C PROGRAMMING LAB** **L T P C**
- - 3 2

COURSE OBJECTIVES:

1. To understand the ANSI C/Turbo C compilers.
2. To develop various menu driven programs using conditional and control flow statements.
3. To develop programs using structures, unions and files.
4. To develop 'C' programs for various applications. .

COURSE OUTCOMES:

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

1. develop various menu driven programs like generation of electricity bill, evaluation of series etc.
2. write C programs using 1D, 2D and Multi Dimensional arrays.
3. write C programs to develop various applications using structures, unions and Files.
4. develop 'C' programs for various applications.

List of Experiments:

1. Write a program for electricity bill taking different categories of users, different slabs in each category. (Using nested if else statement or Switch statement.

Domestic level consumption as follows	
Consumption units	Rate of charges(Rs.)
0 - 200	0.50 per unit
201 - 400	100 plus 0.65 per unit
401 - 600	230 plus 0.80 per unit
601 and above	390 plus 1.00 per unit
Domestic level consumption as follows	
Consumption units	Rate of charges(Rs.)
0 - 100	0.50 per unit
101 - 200	50 plus 0.60 per unit
201 - 300	100 plus 0.70 per unit
301 and above	200 plus 1.00 per unit

2. Write a C program to evaluate the following (using loops):
   (i) $x - x^3 / 3! + x^5 / 5! - x^7 / 7! +$ ---------- up to n terms
   (ii) $1 + x + x^2 / 2! + x^3 / 3!$ + ---------- up to n terms
   (iii) $1 - x^2 / 2! + x^4 / 4! - x^6 / 6! +$ ---------- up to n terms
3. Write a menu driven program to test whether a given number is (using Loops):
   (i) Prime or not (ii) Perfect or not (iii) Armstrong or not (iv) Strong or not (v) Palindrome or not
4. Write a menu driven program to display statistical parameters (using one - dimensional array)
   (i) Mean (ii) Median (iii) Mode (iv) Standard deviation
5. Write a menu driven program to perform the following operations in a list (using 1-Dimen. array)
   (i) Insertion of an element (ii) Deletion of an element (iii) Remove duplicates from the list
   (iv) Print the list
6. Write a menu driven program with options (using two dimensional array)
   (i) To compute A+B (ii) To compute A x B
   (iii) To find transpose of matrix A, Where A and B are matrices.
7. Write C programs to perform the following using Strings
   (i) To test the given string is palindrome or not (ii) To sort strings in alphabetical order

8. Write a C programs using recursive functions
   (i) To find the Factorial value (ii) To generate Fibonacci series
   (iii) To find the GCD of two given numbers
9. Write a menu driven program with options (using dynamic memory allocation)
   (i) Linear search (ii) Binary search
10. Write a menu driven program with options (using Character array of pointers)
   (i) To insert a student name (ii) To delete a name (iii) To print list of names
   (iv) To sort names in alphabetical order
11. Write a program to perform the following operations on Complex numbers (using Structures & pointers):
   (i) Read a Complex number (ii) Addition, subtraction and multiplication of two complex numbers
   (iii) Display a Complex number
12. Write a C programs to perform the following operations on files
   (i) merging the contents of two files (ii) writing, reading and updation of student records in a file
   (iii) Copy the contents of one file into another using command line argument.

Note: A minimum of 10(Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

EC-156	ELECTRONICS ENGINEERING WORKSHOP	L	T	P	C
		-	-	3	2

COURSE OBJECTIVES:

1. To identify the active and passive electronic components.
2. To get hands-on assembling, testing, assembling, dismantling, fabrication and repairing systems experience by making use of the various tools and instruments

COURSE OUTCOMES:

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

1. identify the active and passive electronic components.
2. get hands-on assembling, testing, assembling, dismantling, fabrication and repairing systems by making use of the various tools and instruments

List of Experiments / Exercises :

1. Familiarization / Identification of electronic components with specification (Functionality, type, size, colour coding, package, symbol, cost etc. [Active, Passive, Electrical, Electronic, Electro-mechanical, Wires, Cables, Connectors, Fuses, Switches, Relays, Crystals, Displays, Fasteners, Heat sink etc.)
2. Drawing of electronic circuit diagrams using BIS / IEEE symbols and introduction to EDA tools, Interpret data sheets of discrete components and IC's, Estimation and costing.
3. Familiarization / Application of testing instruments and commonly used tools. [Multimeter, Function generator, Power supply, CRO etc.] [Soldering iron, De-soldering pump, Pliers, Cutters, Wire strippers, Screw drivers, Tweezers, Crimping tool, Hot air soldering and de- soldering station etc.]
4. Testing of electronic components [Resistor, Capacitor, Diode, Transistor, UJT and JFET using multimeter.]
5. Inter-connection methods and soldering practice. [Bread board, Wrapping, Crimping, Soldering - types - selection of materials and safety precautions, soldering practice in connectors and general purpose PCB, Crimping.]
6. Printed circuit boards (PCB) [Types, Single sided, Double sided, PTH, Processing methods, Design and fabrication of a single sided PCB for a simple circuit with manual etching (Ferric chloride) and drilling.]

Assembling of electronic circuit / system on general purpose PCB, test and show the functioning

7. Fixed voltage power supply with transformer, rectifier diode, capacitor filter, zener/IC regulator.
8. LED blinking circuit using a stable multi-vibrator with transistor BC 107.
9. Square wave generation using IC 555 timer in IC base.
10. Sine wave generation using IC 741 OP-AMP in IC base.

Familiarization of electronic systems

11. Setting up of a PA system with different microphones, loud speakers, mixer etc.
12. Assembling and dismantling of desktop computer / laptop / mobile phones.
13. Screen printing and PCB pattern transfer.

Note: A minimum of 10(Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

EC/EE-201 **TRANSFORMATION TECHNIQUES** **L T P C**
3 1 - 3

COURSE OBJECTIVES:

1. To provide knowledge on Fourier series.
2. To provide knowledge on Fourier integrals.
3. To provide knowledge on Fourier transforms.
4. To make the student to learn Laplace and inverse transforms of a function.
5. To solve differential equation using Laplace transforms.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. find Fourier series.
2. find Fourier integrals.
3. find Fourier transforms.
4. find Laplace and inverse transforms of a function.
5. find solution of differential equations using Laplace transforms.

UNIT I **(12)**

Fourier series :

Introduction-Euler's formulae-conditions for a Fourier expansion - Functions having points of discontinuity - Change of interval.

Even and odd functions, Half range series.

UNIT II **(12)**

Parseval's formula, Practical harmonic analysis.

Fourier Transforms : Introduction-Fourier integral theorem (without proof)-Fourier sine and cosine integrals-Complex form of Fourier integral.

UNIT III **(12)**

Fourier transform - Fourier Sine and Cosine transforms.

Properties of Fourier transform (without proofs) - Linear-Change of scale - Shifting Convolution theorem - Parseval's identity for Fourier transforms.

UNIT IV **(12)**

Laplace Transforms :

Introduction-Transforms of elementary functions - Properties of Laplace transforms - Transforms of derivatives and integrals - Multiplication by tn and division by t.

Laplace transform of periodic function. Evaluation of integrals by Laplace transforms.

UNIT V **(12)**

Inverse transforms - Convolution theorem (without proof).

Applications of Laplace transforms for solving linear ordinary differential equations up to second order with constant coefficients only.

LEARNING RESOURCES:

TEXT BOOK(s):

B.S.Grewal - Higher Engineering Mathematics, Khanna publishers, 40th edition, 2007.

REFERENCE BOOK(s):

Erwin Kreyszig - Advanced Engineering Mathematics, 8th edition, New Age International (P) Ltd., 2007.

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

EC/EE-202 **ELECTRONIC DEVICES AND CIRCUITS** **L T P C**
4 - - 3

COURSE OBJECTIVES:

1. To understand semiconductor basics like semiconductor material, its types, concepts of Drift current, diffusion current.
2. To understand the principle of operation and characteristics of Diode, Tunnel Diode and Rectifiers.
3. To understand the principle of operation and characteristics of BiPolar Junction Transistor.
4. To analyze the transistor biasing and thermal stabilization of transistor, operation and characteristics of JFET.
5. To understand the principle of operation and characteristics of MOSFET.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand semiconductor basics like semiconductor material, its types, concepts of Drift current, diffusion current.
2. understand the principle of operation and characteristics of Diode, Tunnel Diode and Rectifiers.
3. design various Equipment which are used in the construction and operation of electronic devices.
4. know about biasing and thermal stabilization of transistor. Understand the operation and characteristics of JFET.
5. understand the operation and characteristics of JFET.

UNIT I *Text Book-1* **(12)**

PN JUNCTION: Basic Structure of the PN Junction, Zero applied Bias, Reverse applied Bias, Non-Uniformly Doped Junctions, PN Junction Current, Generation-Recombination Currents, Junction Break Down, Zener diode as voltage regulator, Capacitances of The Diode. The Tunnel Diode.

UNIT II *Text Book-1* **(12)**

BIPOLAR TRANSISTOR: The Bipolar Transistor Action, Minority Carrier Distribution, Low-Frequency Common-Base Current Gain, Nonideal Effects. Equivalent Circuit Models - Hybrid-Pi Model, Frequency limitations.

UNIT III *Text Book-2* **(12)**

TRANSISTOR CHARACTERISTICS: Common Emitter, Common Base and Common Collector Characteristics, Photo Transistor.

TRANSISTOR BIASING: The Operating Point, Bias Stability, Biasing Techniques, Stabilization against variations in I_{CO}, V_{BE}, β, Thermal Runaway.

UNIT IV *Text Book-1* **(12)**

METAL-OXIDE-SEMICONDUCTOR FIELD-EFFECT TRANSISTOR: The Two Terminal MOS Structure, Capacitance-Voltage Characteristics, The Basic MOSFET Operation, Frequency limitations, Non-ideal Effects.

UNIT V *Text Book-1 , 2* **(12)**

JUNCTION FIELD-EFFECT TRANSISTOR: JFET Concepts, The Device Characteristics, Non-ideal Effects, Equivalent Circuit and Frequency limitations.

RECTIFIERS: Half wave Rectifier and Full wave Rectifier with Capacitor filter.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Donald A. Neamen - Semiconductor Physics and Devices, 3rd Edition, TMH, 2003.
2. Jacob Millman and Christos C. Halkias - Integrated Electronics, TMH, 1972.

REFERENCE BOOK(s):

Ben G Streetman and Sanjay Banerjee, Solid State Electronic Devices, 5th Edition,2000

WEB RESOURCES:

1. http://nptel.iitm.ac.in/courses/
2. http://www.deas.harvard.edu/courses/es154/

EC/EE-203	DIGITAL LOGIC DESIGN	L	T	P	C
		4	1	-	3

COURSE OBJECTIVES:

Students will be able to know

1. theorems and functions of Boolean algebra and behaviour of logic gates.
2. Boolean functions simplification using Karnaugh maps and Quine-McCluskey methods
3. combinational circuits design procedure and implementing them using PLDs
4. the behaviour and design of simple sequential circuits
5. the operation and design methodology for synchronous sequential circuits and Algorithmic State Machines

COURSE OUTCOMES:

After successful completion of the course, the students are able to understand

1. basic theorems in Boolean algebra and their relevance to digital logic design.
2. Boolean functions minimization methods of Karnaugh Maps and The Quine-McCluskey methods.
3. the operation and design procedure of combinational circuits.
4. the operation and design procedure of sequential circuits.
5. the operation and design methodology for synchronous sequential circuits and Algorithmic State Machines.

UNIT I **(13)**

Signed Numbers and Complements, Addition and Subtraction Using R's and (r-1)'s Complements, Codes.Boolean Algebra and Combinational Networks: Definition of A Boolean Algebra, Boolean Algebra Theorems, Boolean Theorems and Functions, Canonical Formulas, Manipulation of Boolean Formulas, Gates and Combinational Networks, Incomplete Boolean Functions and Don't Care Conditions, Additional Boolean Operations and Logic Gates.

UNIT II **(13)**

Karnagh Maps (upto five variables): Using Karnaugh Maps to Obtain Minimal Expressions for Complete Boolean Functions, Minimal Expressions of Incomplete Boolean Functions.

Quine-McCluskey Method: The Quine-McCluskey Method of Generating Prime Implicants and Prime Implicates, Prime Implicants / Prime Implicates Tables and Irredundant Expressions, Prime Implicants / Prime Implicates Table Reductions, Decimal Method for Obtaining Prime Implicants.

UNIT III **(13)**

Combinational Circuits: Binary Adders, Subtractors, Decimal Adders, Comparators, Decoders, Encoders, Multiplexers. PLDs, PROMs, PLAs, PALs.

UNIT IV **(13)**

Sequential Elements : Latches, Timing Considerations, Master-Slave Flip-Flops, Edge Triggered Flip-Flops, Characteristic Equations.

Sequential Circuits : Registers, Counters, Design of Synchronous Counters.

UNIT V **(13)**

Synchronous Sequential Networks: Structure and Operation of Clocked Synchronous Sequential Networks, Aynalysis of Synchronous Sequential Networks, Modeling Clocked Synchronous Sequential Network Behaviour.

Algorithmic State Machines: The Algorithmic State Machine, ASM Charts, Examples of Synchronous Sequential Network, Design using ASM Charts, State Assignments, ASM tables.

LEARNING RESOURCES:

TEXT BOOK(s):

Donald D. Givone - Digital Principles and Design, TMH, 2003.

REFERENCE BOOK(s):

1. Thomas L. Floyd - Digital Fundamentals, 10th Edition, Person Education, 2011
2. Brown-Vranesic - Fundamentals of Digital Logic with with Verilog Design, 3rd edition, TMH, 2013.

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

EC-204 **CIRCUIT THEORY** **L T P C**
4 1 - 3

COURSE OBJECTIVES:

1. To develop an understanding of the fundamental laws and elements of electrical circuits.
2. To learn the energy properties of electric elements and the techniques to measure voltage and current.
3. To develop the ability to apply circuit analysis to DC and AC circuits.
4. To understand transient and steady-state response of RLC circuits and to understand advanced mathematical methods such as Laplace transforms for solving circuit problems.
5. To provide an exposure to P-Spice.

COURSE OUTCOMES:

After successful completion of the course, the students are

1. able to understands basic electrical circuits properties.
2. capable to analyze electrical circuits.
3. able to understands transient and steady- state response of electrical circuits.
4. capable of finding circuit response using Laplace Transform.
5. able to simulate electrical circuits using P-Spice.

UNIT I **(13)**

INTRODUCTION OF CIRCUIT ELEMENTS: Basic definition of the unit of Charge, Voltage, Current, Power and Energy, Circuit concept, Active and Passive circuit elements; Ideal, Practical and dependent sources and their V-I characteristics, Source transformation, Voltage and Current division; V-I characteristics of Passive elements and their series / parallel combination; Star Delta transformation, Energy stored in Inductors and Capacitors Kirchhoff's Voltage law and Kirchhoff's Current law.

GRAPH THEORY: Introduction to Graph Theory, Tree, Branch, Link, Cutset and loop matrices, Relationship among various matrices and parameters.

UNIT II **(13)**

INTRODUCTION TO ALTERNATING CURRENTS AND VOLTAGES: Instantaneous, Peak, Average and RMS values of various waveforms; Crest factor, Form factor; Concept of phase and phase difference in sinusoidal waveforms; Phase relation in pure resistor, Inductor and capacitor; Impedance diagram, phasor diagram, series and parallel circuits, compound Circuits

METHODS OF ANALYSIS: Introduction, Nodal Analysis, Super Node Analysis, Mesh Analysis, Super Mesh Analysis for DC and AC Circuits.

UNIT III **(13)**

CIRCUIT THEOREMS: Superposition theorem, Thevenin's and Norton's theorems, Reciprocity, Compensation, Maximum power transfer theorems, Tellegan's and Millman's theorems, Application of theorems to DC circuits. Application of network theorems to AC circuits

POWER AND POWER FACTOR: Computation of active, reactive and complex powers, power factor

UNIT IV **(13)**

RESONANCE: Series resonance, Impedance and phase angle, voltages and currents, bandwidth and Q factor and its effect on bandwidth, magnification, parallel resonance, resonant frequency, variation of impedance with frequency, Q factor, magnification, reactance curves in parallel resonance.

TRANSIENTS ANALYSIS: Steady state and transient response, Source free, DC and Sinusoidal response of an R-L, R-C, R-L-C circuits.

UNIT V **(13)**

LAPLACE TRANSFORMS: Definition of the Laplace Transform. Properties of the Laplace Transform Inverse Laplace transforms, Initial and final value theorem, Transforms of typical signals, periodic functions, Application of Laplace transforms in circuit analysis.

PSPICE: Introduction to PSpice: D.C Analysis and control statements, dependent sources, DC Sweep, AC Analysis and control statements, Transient analysis.

LEARNING RESOURCES:

TEXT BOOK(s):

1. A Sudhakar and Shyam Mohan SP - Circuits and Networks: Analysis and Synthesis, 5th Edition, TMH, 2015.
2. Ch. Alexander and M.N.O Sadiku - Fundamentals of Electrical Circuit, 5th Edition, TMH, 2013.
3. William H. Hayt, Jack E. Kemmerly and Steven M. Durbin - Engineering Circuit Analysis, 8th Edition,TMH, 2012.

REFERENCE BOOK(s):

1. M.E.Vanvalkenburg - Network Analysis, 3rd Edition, PHI, 2003
2. Franklin F.Kuo - Network Analysis and Synthesis, 2nd Edition, JohnWiley & Sons, 2003.

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

EC-205 **DATA STRUCTURES THROUGH C++** **L T P C**
4 1 - 3

COURSE OBJECTIVES:

1. To understand Object Oriented Programing features of C++.
2. To understand the concepts encapsulation, inheritance, and polymorphism.
3. To understand the concepts inheritance, Runtime polymorphism and Templates.
4. To understand the concepts of Lists, Stacks and Queue ADT's.
5. To understand Binary trees and ADT's of BST and Various sorting techniques.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand C++ fundamentals and various function modifiers,create and manipulate classes and objects.
2. make use of the concept Inheritance and its types and efficiently develop reusable and extensible programs.
3. apply the concept of templates for generic programming.
4. write programs for various datastructures and their applications.
5. compare complexities of different sorting and searching techniques..

UNIT I *Text Book - 1* **(13)**

An Overview of C++ : The Origins of C++, What is Object Oriented Programming, some C++ fundamentals, Old-Style Vs Modern C++, Introducing C++ Classes, Function Overloading, Operator Overloading, Inheritance, Constructors and Destructors, The C++ Keywords, The General Form of a C++ Program.

Classes and Objects : Classes, Structures and Classes, Unions and Classes are Related, Friend Functions, Friend Classes, Inline Functions, Parameterized Constructors, Static Class Members, When Constructors and Destructors are Executed, Scope Resolution Operator, Nested Classes, Local Classes, Passing and Returning Objects, Object Assignment.

Arrays, Pointers, References and the Dynamic Allocation : Arrays of Objects, Pointers, References, Dynamic Allocation Operators, the Placement Forms of new and delete.

UNIT II *Text Book - 1* **(13)**

Function Overloading, Copy Constructors and Default Arguments : Function Overloading, Overloading Constructor Functions, Copy Constructors, Finding the Address of an Overloaded Function, Overload Anachronism, Default Arguments, Function Overloading and Ambiguity.

Operator Overloading : Creating Member Operator Function, Overloading Using a Friend Function, Overloading new delete, Overloading Special Operators & Comma Operator.

UNIT III *Text Book - 1* **(13)**

Inheritance : Base-Class Access Control, Inheritance and protected members, Inheriting Multiple Base Classes, Constructors, Destructors and Inheritance, Granting Access, Virtual Base Classes.

Virtual Functions & Polymorphism : Virtual Functions, The Virtual Attribute is inherited, Virtual Functions are Hierarchical, Pure Virtual Functions, Using Virtual Functions, Early Vs Late Binding.

Templates : Generic Functions, Applying Generic Functions, Generic Classes, Typename and export Keywords, Power of Templates.

UNIT IV *Text Book - 2* **(13)**

LINKED LISTS : Abstract Data Types, The List ADT, Linked Lists, Polynomial ADT, Doubly Linked Lists, Circular Linked lists.

THE STACK and QUEUE ADT : Stack Model, Implementation of Stacks, Applications: Conversion of infix expression to postfix Expression, postfix evaluation, Queue implementation.

UNIT V *Text Book - 2* **(13)**

TREES : Preliminaries, Binary Trees, Binary Tree Traversals, Binary Search Tree.

SORTING : Insertion sort, Merge sort, Quick sort, Heap sort.

LEARNING RESOURCES:

TEXT BOOK(s):

1. The Complete Reference - C++ by Herbert Schieldt, 4/e, Tata McGraw Hill
2. Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, 4/e , Pearson

REFERENCE BOOK(s):

1. Object Oriented Programming with C++, E. Balaguruswamy, 4/e, Tata McGraw Hill.
2. An Introduction to Data Structures with Applications, Trembley and Sorenson, 2/e,Tata McGraw Hill, 2001.

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

EC-206 **SIGNALS AND SYSTEMS** **L T P C**
4 1 - 3

COURSE OBJECTIVES:

1. To understand the characteristics of various signals & systems in time and frequency domain.
2. To understand about an LTI system and the concepts of convolution.
3. To understand correlation functions and different types of noise and their calculations.
4. To understand the concepts of random variables.
5. To understand the concepts of random process.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. analyze different signals & systems in time and frequency domain.
2. apply convolution functions to signals and find the response of LTI systems.
3. apply correlation functions and understand noise power spectral density and assess its effect.
4. apply the concepts of random variable to real time applications.
5. apply the concepts of random process to real time applications.

UNIT I **(16)**

SIGNAL ANALYSIS : Introduction to signals and systems, Classification of signals, Basic Operations on Signals, Elementary Signals, systems viewed as Interconnection of Operations, Properties of Systems. Approximation of a function by a set of mutually orthogonal functions, Evaluation of mean square error, Representation of a function by a closed or complete set of mutually Orthogonal functions, Orthogonality in complex functions, Trigonometric and Exponential Fourier series, Relationship between Trigonometric and Exponential Fourier series, Representation of a periodic function by the Fourier series over the entire interval, Convergence of Fourier series, Alternate form of Trigonometric series, Symmetry conditions, Complex Fourier spectrum.

UNIT II **(14)**

Representation of an arbitrary function over the entire interval: Fourier transform, Fourier transform of some useful functions, Singularity Functions, Fourier transform of periodic function, Some Properties of Fourier transforms, Energy Density spectrum.

Time Domain Representations for LTI systems: Convolution, Impulse response Representation for LTI systems, Properties of Impulse response representation for LTI systems, Impulse and Frequency response of LTI system, Conditions for Distrotionless Transmission, Ideal low pass filter, Frequency and Impulse response of ideal low pass filter, Paley-Wiener criterion, sampling theorem.

UNIT III **(13)**

Signal Comparison: Correlation and convolution, some properties of correlation functions, Correlation functions for Non finite energy signals.

NOISE: Shot Noise in Semiconductor Diode, Thermal Noise, Noise calculation, Multiple sources - Superposition of power spectra, Noise calculations in Passive circuits, Equivalent noise bandwidth, Noise-Figure of an amplifier, Power density and available power density, Effective noise temperature, Noise Figure in terms of available gain, Cascaded stages.

UNIT IV **(13)**

PROBABILITY & RANDOM VARIABLES: Probability Definition, Axioms of probability, Joint probability, Conditional probability, Total probability, Bayes' theorem, Independent events, Random variables, discrete and continuous, Probability Distribution Function, Probability Density Function, Guassian Random variable, Conditional distribution and density functions, Mean ,Variance and standard deviation of a random variable.

UNIT V **(13)**

RANDOM PROCESSES : Random process concept, stationary and independence, correlation functions, Gaussian random process, power density spectrum and its properties, relationship between power spectrum and autocorrelation function.

LEARNING RESOURCES:

TEXT BOOK(s):

1. B P Lathi, Signals, Systems and Communications, BSP, 2003
2. P.Z Peebles, Jr, Probability, random variables and random signal principles, TMH, 2002

REFERENCE BOOK(s):

1. Tarun Kumar and Rawat - SIGNALS AND SYSTEMS, Oxford Publications, 2010.
2. A.V Oppenheim, A. S. Wilsky and S. H. Nawab - Signals and Systems, 2nd Edition. PHI.,

WEB RESOURCES:

1. www.nptel.ac.in/courses/117104074
2. http:/walrandpc.eecs.berkeley.edu/126notes.pdf

EC-251	ELECTRONIC DEVICES LAB	L	T	P	C
		-	-	3	2

COURSE OBJECTIVES:

1. To observe the dc and ac waveforms on CRO
2. To plot the characteristics of basic electronic devices like p-n junction diode, zener diode, BJT characteristics in various configurations, JFET etc..
3. To design the basic biasing circuits for BJT and JFET
4. To design and verify the collector base bias circuit.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. obtain the characteristics of devices like p-n Junction diode, zener diode, BJT in CE, CB configurations, JFET.
2. calculate the parameters from the characteristics like static, dynamic and reverse resistances of p-n junction diode, h-parameters of BJT.
3. design a circuit to achieve the specified operating point.
4. measure the amplitude and frequency of given waveform using CRO.

List of Experiments:

1. Study of C.R.O.
2. Characteristics of Silicon and Germanium diodes.
3. Characteristics of Zener diode.
4. Characteristics of Common Base configuration.
5. Characteristics of Common Emitter configuration.
6. Characteristics of Emitter follower circuit.
7. Characteristics of JFET.
8. Design and verification of collector to base bias circuit.
9. Design and verification of Self bias circuit using BJT.
10. Design and verification of Self bias circuit using MOSFET.
11. Characteristics of MOSFET.
12. Study of Full wave Rectifier without Filter.
13. Study of Full wave Rectifier with Filter.
14. Characteristics of source follower circuit.

Note: A minimum of 10(Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

EC-252	DIGITAL LOGIC DESIGN LAB	L	T	P	C
		-	-	3	2

COURSE OBJECTIVES:

1. To design Combinational logic circuits such as adders and subtractors.
2. To design comparators, decoders multiplexers and demultiplexers.
3. To design Sequential logic circuits such as flip-flops and shift registers.
4. To design synchronous and asynchronous counters.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. design Combinational logic circuits such as adders, subtractors, comparators, Code converters, decoders.
2. design Sequential logic circuits such as flip-flops, shift registers, synchronous and asynchronous counters.

List of Experiments:

1. Verification of logic gates using ICs.
2. Realization of Gates using Universal Building Block (NAND only).
3. Design of Combinational Logic Circuits like Half-adder, Full-adder, Half-Sub tractor and Full-Sub tractor.
4. Verification of 4-bit Magnitude Comparator.
5. Design of Decoders (BCD - Decimal decoder).
6. Applications of IC Parallel Adder (1's & 2's compliment addition).
7. Design of Code Converters (Binary to Gray).
8. Design of Multiplexers/De Multiplexers.
9. Verification of excitation Table of Flip-Flops using Gates.
10. Design of Shift register (To Verify Serial to parallel, parallel to Serial, Serial to Serial and parallel to parallel Converters) using Flip-Flops.
11. Design of Ring & Johnson Counters using Flip-Flops.
12. Conversion of Flip-Flops (JK-T, JK - D).
13. Design of Binary/Decade Counter.
14. Design of Asynchronous Counter, Mod Counter, Up Counter, Down Counter & Up/Down Counter.
15. Design of Synchronous Counter, Mod Counter, Up Counter, Down Counter & Up/Down Counter.

Note: A minimum of 10(Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

EC-253	DATA STRUCTURES THROUGH C++ LAB	L	T	P	C
		-	-	3	2

COURSE OBJECTIVES:

1. To understand Object Oriented Programing features of C++.
2. To understand the concepts of encapsulation and compile time polymorphism.
3. To understand the concepts of inheritance, Runtime polymorphism and Templates.
4. To understand the concepts of Lists, Stacks and Queue ADTâ€™s.
5. To understand Binary trees and ADT's of BST and Various sorting techniques.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. implement basic Object Oriented features of C++.
2. implement the concepts of encapsulation and compile time polymorphism.
3. implement the concepts of Inheritance, Runtime polymorphism and Templates.
4. implement Lists, Stacks and Queue ADTs.
5. implement BST ADT and different sorting algorithms.

List of Experiments:

1. Create a class HUGEINT by which we would be able to use much wider range of integers.Perform addition operation on two HUGEINTs.
2. Create a class TIME with appropriate data members to represent TIME. Construct a class implementation section to compare two TIMEs, to increment TIME by one second, to decrement TIME by one second and appropriate constructors to create TIME objects.
3. Write a class declaration for DATE and allow the operations to find nextday(), previousday(), leapyear(), compare() with appropriate constructors and destructors.
4. Create a user defined datatype STRING, allow possible operations by overloading (Relational operators,[], ( ), >, =).
5. Define RATIONAL class. Allow possible operations on RATIONALs by overloading operators(Arithmetic, Unary operators,>).
6. Program to implement (a) Single inheritance (b) Multiple inheritance (c) Hierarchical inheritance (d) Multipath inheritance.
7. Program to implement (a) runtime polymorphism (b) abstract base class concept.
8. Program to implement operations on single linked list.
9. Program to implement operations on doubly linked list.
10. Program to implement stack operations using arrays(with class templates) and linked lists.
11. Program to implement Queue operations using arrays and linked list.
12. Program to sort n elements using a) Merge Sort (with function templates). b)Quick Sort. c) Heap Sort.
13. Program to demonstrate BST ADT.

Note: A minimum of 10(Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

EC/EE-207	COMPLEX AND NUMERICAL ANALYSIS	L	T	P	C
		3	1	-	3

COURSE OBJECTIVES:

1. To provide knowledge on complex analysis.
2. To provide knowledge on complex integration.
3. To provide knowledge on singularities, poles and residues.
4. To provide knowledge on numerical solution of ordinary differential equations.
5. To provide knowledge on numerical solution of partial differential equations.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. apply Cauchy-Riemann equations and harmonic functions to problems of fluid mechanics, thermodynamics and electro-magnetic fields.
2. evaluate complex line integrals.
3. find singularities of complex functions and determine the values of integrals using residues.
4. find numerical solution of ordinary differential equations.
5. find numerical solution of partial differential equations.

UNIT I **(12)**

Complex Functions :

Introduction - Derivative of complex function - Analytic functions - The necessary and sufficient conditions for the analyticity of the function (without proof) - Cauchy-Riemann equations in polar form - Harmonic functions.

Milne-Thomson method, orthogonal system.

UNIT II **(12)**

Complex Integration : Complex integration - Line integrals

Cauchy's integral theorem, Cauchy's integral formulae.

UNIT III **(12)**

Series and Residues:

Taylor's and Laurent's expansions (without proofs).

Singularities - Poles and Residues - Cauchy's residue theorem (without proof).

UNIT IV **(12)**

Numerical Solutions of Ordinary Differential Equations (First order) :

Solution by Taylor's series - Picards method.

Euler's method - Runge-Kutta method of fourth order.

UNIT V **(12)**

Numerical Solutions of Partial Differential Equation :

Classification of Partial differential equations of the second order - Laplace-s equation.

Poisson's equation.

LEARNING RESOURCES:

TEXT BOOK(s):

B.S.Grewal - Higher Engineering Mathematics, Khanna publishers, 40th edition, 2007.

REFERENCE BOOK(s):

Erwin Kreyszig - Advanced Engineering Mathematics, 8th edition, New Age International (P) Ltd., 2007.

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

EC/EE-208 **ELECTRONIC CIRCUIT ANALYSIS** **L T P C**
4 1 - 3

COURSE OBJECTIVES:

1. To provide basic knowledge on analysis, design, and measurement of linear analog electronics.
2. To gain the knowledge in low frequency and high frequency Transistor amplifier analysis.
3. To acquire knowledge on feedback topologies
4. To know about various power amplifier circuits.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. analyze linear analog electronic circuits involving Bipolar Junction (BJT) and Field Effect (FET) transistors at both low and high frequencies.
2. analyze frequency response of transistor amplifier circuits.
3. understand four feedback topologies and their practical circuits.
4. analyze RC,LC and Crystal Oscillators.
5. analyze and design the Power amplifiers.

UNIT I *Text Book - 1* **(14)**

BJT AMPLIFIERS : Basic BJT Amplifiers, Analog Signals and Linear Amplifiers, The Bipolar Linear Amplifiers, Common-Emitter Amplifiers, Common-Collector Amplifier, Common-Base Amplifier, Multistage Amplifiers.

FET AMPLIFIERS : MOSFET DC Circuit Analysis, The MOSFET Amplifier, The Common Source Amplifier, The Common Drain Amplifier, The Common Gate Configuration, Single-Stage Integrated Circuit MOSFET Amplifiers, Multistage Amplifiers.

UNIT II *Text Book - 1* **(10)**

FREQUENCY RESPONSE : Amplifier Frequency Response, System Transfer Functions, Transistor Amplifiers with Circuit Capacitors, Bipolar Transistor Frequency Response, The FET Frequency Response, High Frequency Response of Transistor Circuits.

UNIT III *Text Book - 2* **(12)**

FEEDBACK : Classification of amplifiers, The feedback concept, the transfer gain with feedback, general characteristics of Negative Feedback, the Four Basic Feedback Topologies, voltage Series Feedback Amplifier, Current Series Feedback Amplifier, Current Shunt and Voltage Shunt Feedback Amplifiers.

UNIT IV *Text Book - 3* **(10)**

OSCILLATORS : Barkhausen Criterion for Sinusoidal Oscillators, RC Phase Shift Oscillator using FET and BJT, Wein Bridge, Hartley, Colpitt's Oscillators using BJT, Tuned Resonant Oscillator, Crystal Oscillators, Frequency and Amplitude Stability Criterion for Oscillators.

UNIT V *Text Book - 1* **(14)**

INTEGRATED CIRCUIT BIASING AND ACTIVE LOADS : Bipolar Transistor Current Sources, FET Current Sources, Circuits with Active Loads, Small Signal Analysis of Active Load Circuits.

OUTPUT STAGES AND POWER AMPLIFIERS : Power Amplifiers, Power Transistors, Classes of Amplifiers, Class-A Power Amplifiers, Class-AB Push-Pull Complementary Output Stages.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Donald A. Neamen, Electronic Circuits Analysis and Design, 3rd Edition,TMH,2007.
2. Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits, 5th Edition, Oxford University Press, 2004.
3. Jacob Millman and Christos C. Halkias, Integrated Electronics, TMH, 1972.

REFERENCE BOOK(s):

Paul R Gray, Gray J. Hurst, Stephen H. Lewis and Robert G. Meyer, Analysis and Design of Analog Integrated Circuits, 4th edition, John Wiley and Sons, 2001.

WEB RESOURCES:

1. http://nptel.ac.in/courses/117101106
2. http://nptel.ac.in/courses/117107094/22

EC-209 **COMPUTER ORGANISATION** **L T P C**
4 - - 3

COURSE OBJECTIVES:

1. To understand the basic organization of modern computer systems
2. To interpret how computer programs are organized, stored, and executed at the machine level.
3. To analyze an instruction-set architecture and propose a suitable data path and control unit implementation.
4. To understand the input/output mechanisms used to connect computers to their external environments.
5. To familiarize the design of high performance processors using single-cycle, multi-cycle and pipelined execution of instructions
6. To learn the concepts of memory hierarchy and do operations with various types of memories.

COURSE OUTCOMES:

After successful completion of the course, the students are

1. understand the basic structure and operation of a digital computer
2. understand in detail the operation of the arithmetic unit including the algorithms & implementation of fixed-point and floating-point arithmetic
3. understand the hierarchical memory system including cache memories and virtual memory.
4. understand the different ways of communicating with I/O devices and standard I/O Interfaces
5. understand the hardware multi threading and different approaches in hardware multi threading

UNIT I *Text Book - 1* **(10)**

Basic structure of computers : Computer types, Functional units, Basic operational concepts, Bus structures, Performance, multiprocessors and multi computers.

Instructions and Instruction sequencing: Numbers, Arithmetic operations and characters, Memory location and addresses, Memory operations, Instructions and instruction sequencing, addressing modes.

UNIT II *Text Book - 1* **(10)**

Arithmetic : Addition and subtraction of signed numbers, Design of fast adders, Multiplication of positive numbers, Signed operand multiplication, Fast multiplication, Integer division, Floating point numbers and operations.

UNIT III *Text Book - 1* **(15)**

Pipelining : Basic concepts, Data hazards, Instruction hazards, Influence of instruction sets, Data path and control considerations, Super scalar operation, Performance considerations.

Memory system : Basic concepts, Semi conductor RAM memories- Internal Organization of memory chips, Read only memories, Speed, size and cost, Cache memories, Performance considerations, Virtual memories.

UNIT IV *Text Book - 1* **(12)**

Input/Output organization : Accessing I/O devices, Interrupts- Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Exceptions,, Direct memory access, Buses Interface circuits, Standard I/O interfaces: PCI bus , SCSI bus, USB.

UNIT V *Text Book - 1,2* **(12)**

Basic processing : Some fundamental concepts, Execution of a complete instruction, multiple bus organization, Hard wired control, Micro programmed control.

Multiprocessors : Characteristics of Multiprocessors, Interconnection Structures : Time-shared Common bus, Multiport memory, Multistage Switching Network, Hypercube Interconnection, Interprocessor arbitration, Interprocessor Communication and Synchronization, Cache Coherence.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky - Computer Organization, 5th Edition, Tata McGraw Hill, 2002.
2. M.Moris Mano - Computer Systems Architecture, Third Edition, Pearson/PHI, 2007

REFERENCE BOOK(s):

William Stallings - Computer Organization & Architecture, 7th Edition, PHI, 2006.

WEB RESOURCES:

1. http://www.staroceans.org/kernel-and-driver/Computeranization%20And%20Embedded%20Systems,%20Hamacher,%20Vranesic,%20Zaky,%20Manjikian,%206Ed,%20Mgh,%202012.pdf
2. https://www.classle.net/large-content/hardwired-control-vs-microprogram
3. http://www.eecg.toronto.edu/~moshovos/ACA05/004-pipelining.pdf
4. http://publib.boulder.ibm.com/infocenter/iseries/v5r3/index.jsp?topic=%2Fapis%2FMIintro.htm

EC-210 **ANALOG COMMUNICATION** **L T P C**
4 1 - 3

COURSE OBJECTIVES:

1. To understand the various amplitude modulation and demodulation techniques & systems.
2. To understand the complex low pass representations, SSB and VSB modulations.
3. To understand the angle modulation and demodulation techniques.
4. To understand the functions of AM and FM transmitters and receivers.
5. To understand the effect of noise on the performance of AM and FM receivers and the principles of PAM, PWM, and PPM, TDM, and FDM techniques.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. independently determine the spectral components in a given signal and its bandwidth.
2. decide the type of modulation techniques required for a specific application.
3. decide the required modulation technique for a specific applications.
4. independently determine the Intermediate stages of Transmitter & Receiver blocks of RF Communication systems.
5. analyze the impact of noise on the performance of receiver.

UNIT I *Text Book - 1* **(12)**

AMPLITUDE MODULATION : Time domain description, Frequency domain description, Single tone modulation, Power Relations in AM Waves, Generation of AM wave, Square law modulator, Switching Modulator, Detection of AM waves, Square law detector, Envelope detector, DSB-SC Modulation, Time-domain and frequency domain descriptions of DSB-SC, Generation of DSB-SC: Balanced modulator, Ring modulator, Coherent detection of DSB-SC modulated waves, Costas loop, Quadrature-Carrier multiplexing.

UNIT II *Text Book - 1* **(14)**

SSB & VSB MODULATION : Band-pass transmission, Complex low-pass representation of Narrow-band signals, Concepts of pre-envelope, Complex envelope and Natural envelope, Equivalent low-pass transmission model, Single side band modulation: Frequency domain description, Generation of SSB-SC wave, Frequency-discrimination method, Phase discrimination method, Demodulation of SSB-SC waves, Vestigial side-band modulation, Frequency domain description, Generation of VSB modulated wave, Envelope detection of VSB wave plus carrier, comparison of modulation techniques.

UNIT III *Text Book - 1* **(12)**

ANGLE MODULATION : Introduction to Angle modulation, Relation between frequency Modulation and phase modulation, Single tone frequency modulation, Spectrum analysis of sinusoidal FM wave, Narrow Band FM and Wide Band FM, Transmission bandwidth of FM waves, Carson's Rule, Generation of FM waves, Indirect FM (Armstrong Method), Direct FM, Demodulation of FM waves, Balanced frequency discriminator - Zero-crossing detector.

UNIT IV *Text Book - 2* **(12)**

RADIO TRANSMITTERS & RECEIVERS : Frequency allocation for radio communication systems, Block diagrams and functions of radio transmitters for AM and FM systems ,TRF and super heterodyne receivers, RF, Mixer and IF stages, Choice of IF, Image frequency, Alignment and tracking of radio receivers, AGC, Tone and volume controls, Receiver characteristics and their measurements, FM receivers, Communication receivers.

UNIT V *Text Book - 1* **(13)**

DISCRETE MODULATION & NOISE IN ANALOG MODULATION : Practical aspects of sampling, Generation and Demodulation of PAM, PWM and PPM, TDM, FDM,AM Receiver model, Signal to noise ratios for coherent reception. DSB-SC receiver, SSC-SC receiver, Noise in AM receivers using envelope detection. AM threshold effect, FM receiver model, Noise in FM reception, Capture effect in FM, Threshold effect, FM threshold reduction, Pre-emphasis and De-emphasis in FM.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Simon Haykin - Introduction to Analog and Digital Communication Systems, 3rd Edition, John Wiley and Sons, 2001.
2. George Kennedy - Communication Systems, 3rd Edition, TMH Publishing.

REFERENCE BOOK(s):

1. Haykin Moher - Introduction to Analog and Digital Communications, 2nd Edition, Wiley,2014.
2. Sam Shanmugam - Analog and Digital Communication Systems, John Wiley, 1992.
3. B.P.Lathi - Communication Systems, BS Publications, 2006.

WEB RESOURCES:

1. http://web.engr.oregonstate.edu/~magana/ECE461-561/index.htm.
2. http://www.ensc.sfu.ca/~jiel/courses/327/index.html.

EC-211	ELECTROMAGNETIC FIELDS & TRANSMISSION LINES	L T P C 4 1 - 3

COURSE OBJECTIVES:

1. To calculate the electric field and electric potential due to various charge distributions using coulomb's law and guass's law.
2. To derive the boundary conditions for electrostatic case and to calculate capacitances of widely used configurations.
3. To know the basic laws describing the relationship between steady magnetic field and current.
4. To derive the maxwell's equations and apply these equations in free space to describe the electromagnetic waves.
5. To analyze and study the phenomenon of two wire transmission lines at low frequencies and high frequencies.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. find the electric field and electric potential due to various charge distributions.
2. find the boundary conditions and capacitances of various configurations .
3. find steady magnetic fields and magnetic potentials.
4. understand the Maxwell's equations and propagation of electromagnetic waves in freespace.
5. understand the basic transmission line parameters, such as reflection coefficient, standing wave ratio.

UNIT I *Text Book - 1* **(12)**

Electrostatics - I : The experimental law of coulomb, Electric field intensity, Field due to a continuous volume charge distribution, Field of a line charge, sheet of charge. Electric Flux Density, Guass's law, Applications of Gauss law, Divergence, Maxwell's First equation (Electrostatics), Energy expended in moving a point charge in an electric field, The line integral, Definition of potential and potential difference. The potential field of a point charge, system of charges, potential gradient, the dipole and Energy density in electrostatic field.

UNIT II *Text Book - 1* **(10)**

Electrostatics - II : Current and current density, continuity of current, conductor properties and boundary conditions. The nature of dielectric materials, boundary conditions for perfect dielectric materials. Capacitance. Several capacitance examples. Capacitance of a two wire line. Derivations of Poisson's and Laplace's equations, Examples of the solution of Laplace's equation.

UNIT III *Text Book - 1* **(13)**

The Steady Magnetic Field : Biot-Savart Law, Ampere's Circuital Law, Magnetic Flux and Magnetic Flux Density, The scalar and vector magnetic potentials.

Magnetic Forces and Materials : Force on a moving charge, Force on a differential current element, Force between differential current elements, Force and torque on a closed circuit, The nature of magnetic materials, Magnetization and Permeability. Magnetic boundary conditions. Potential energy and forces on magnetic materials.

UNIT IV *Text Book - 1,2* **(13)**

Time Varying Fields and Maxwell's Equations : Faraday's law, Displacement current, Maxwell's equations in point form, integral form.

Electromagnetic waves : Solution for free space conditions, Uniform plane wave propagation, Uniform Plane waves, Wave Equations for conducting medium, Sinusoidal Time variations. Conductors and dielectrics, Polarization, Direction Cosines, Reflection by Perfect conductor- normal incidence, Oblique Incidence, Reflection by Perfect Dielectric - Normal Incidence, Oblique Incidence, Poynting's theorem.

UNIT V *Text Book - 3* **(15)**

Transmission Lines : Line Parameters, The transmission line-general solution, Physical significance of the equations,The infiniteline,Wave length, Velocity of propagation, Waveform ditortion, The distortion less line, Reflection on a line not terminated in Zo, Constants for the line of zero dissipation, Standing waves, nodes, standing wave ratio, Input impedence of the dissipationless line, The input impedance of OC and SC lines, The eighth-wave line, The quarter wave line, Impedance matching, The halfwave line, Smith chart, Applications of smith chart: reflection coefficient, VSWR, input impedence.

LEARNING RESOURCES:

TEXT BOOK(s):

1. W H Hayt, J A Buck - Engineering Electromagnetics, 7th Edition TMH, 2006.
2. EC Jordan and KG Balmain - Electromagnetic Waves and Radiating Systems,PHI, 2003.
3. John D. Ryder - Networks, Lines and Fields, 2nd Edition, PHI, 1999.

REFERENCE BOOK(s):

1. G S N Raju, Electromagnetic Field Theory and transmission lines, 1st Edition, Pearson Education India, 2005.
2. Joseph A Edminister - Theory and Problems of Electromagnetics, 2nd Edition, Schaum's Outline Series, Mc-Graw Hill International, 1993
3. Mathew N O Sadiku - Elements of Electromagnetics, Oxford University Press, 2003.

WEB RESOURCES:

1. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/em/index.htm
2. http://www.mike-willis.com/Tutorial/PF2.htm

EC-212 ELECTRICAL ENGINEERING & MEASUREMENTS L T P C
4 - - 3

COURSE OBJECTIVES:

1. To understand how E.M.F & Torque is developed using Static and Time varying Electrical and Magnetic Felids.
2. To understand constructional, operational details of D.C machine, A.C machine, Transformer, Induction machine along with mathematical equations.
3. To understand about various analog instruments and bridges used in electrical measurements.
4. To understand the Cathode Ray Oscilloscope.
5. To understand about different Transducers.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. analyze the importance of Electric & Magnetic fields in DC machines.
2. know the selection of AC machines, Transformers, Induction Machines and their utilization in different applications.
3. know types of instruments and principle of operation of various analog and measure various parameters like resistance, inductance, and capacitance.
4. measure the various parameters usig Cathode Ray Oscilloscope.
5. know about various transducers and understand the applications of transducers.

UNIT I *Text Book - 1* **(12)**

D.C Generators : Introduction, Principle of operation of DC generator, EMF equation, types of generators, Applications, Simple problem on types of generators & EMF equation.

D.C Motors : Principle of operation of DC motor, Back EMF, Torque equation, types of DC motors, Applications, and simple problem on types of Motors & Torque equation.

UNIT II *Text Book - 1* **(12)**

1-Φ Transformers : Principle, operation, EMF Equation, Phasor diagram on no load and load, equivalent circuit. Simple problem on EMF Equations and equivalent circuit.

3-Φ Induction Motors : Construction, Types, Principle of operation of Induction Motors, Rotating magnetic field. Applications, Simple problems related to synchronous speed, slip, rotor speed.

1-Φ Induction motors : Construction, Principle of operation, Starting methods, double field revolving theory, comparison between 3-Φ and 1-Φ induction motors.

UNIT III *Text Book - 1* **(12)**

Measuring Instruments : Principles and operation of moving - coil and moving-iron instruments, Dynamo meter-type wattmeter.

DC & AC BRIDGES : Wheatstone, Kelvin, Guarded Wheatstone, Maxwell, Hay, Schering and Wein bridges, Wagner ground connection.

UNIT IV *Text Book - 1* **(10)**

Cathode Ray Oscilloscope : Introduction, Cathode ray oscilloscope, Storage and sampling oscilloscopes, Digital storage oscilloscope, Spectrum analyzer.

UNIT V *Text Book - 2* **(12)**

Transducers : Introduction, Classification of transducers, Analog transducers, Resistive transducers, Potentiometers, Strain gauges, Types of strain gauges, Resistance strain gauges, Semiconductor strain gauges, Resistance thermometers, Thermistors, Application of Thermistors, Thermo couple construction, Measurement of thermocouple output, Compensating circuits, Advantages and disadvantages of thermocouples, Variable inductance type transducer, Variation of self inductance, Variation of mutual inductance, Linear variable differential transformer, Capacitive transducers, Piezo-electric transducers.

LEARNING RESOURCES:

TEXT BOOK(s):

1. V.K.Mehta and Rohit Mehta - Principles of Electrical Machines, 2nd Edition, S. Chand Publications, 2002.
2. A.K.Shawney - Electrical & Electronic Measurement & Instruments, Dhanpat Rai & Co 17th edition 2000.

REFERENCE BOOK(s):

1. Nagsarkar, Sukhija - Basic Electrical Engineering, 2nd Edition, Oxford Publications.
2. H Cotton - Advanced Electrical Technology, AH Wheeler & Co., 1990

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

EC-254	SIGNALS & SYSTEMS LAB	L	T	P	C
		-	3	2	

COURSE OBJECTIVES:

1. To understand and analyze various signals.
2. To understand sampling theorem.
3. To design and analyze the responses of various filters..
4. To design and analyze random signals.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. design and analyze generation of unit step, impulse, ramp and sinusoidal sequences.
2. generate and analyze the discrete time sequence using sampling theorem.
3. design and implement various filters..
4. realize and analyze random signals.

List of Experiments:

1. Simulate the signals(step, impulse, ramp and sinusoidal).
2. Verify the properties (linearity and time invariance) of LTI systems.
3. Find the Fourier transform of a square pulse .Plot its amplitude and phase spectrum.
4. Find DFT and IDFT of a given DT signal.
5. Write a program to convolve two discrete time sequences. Plot all the sequences. Verify the result by analytical calculation.
6. Write a program to find the trigonometric Fourier series coefficients of a rectangular periodic signal. Reconstruct the signal by combining the Fourier series coefficients with appropriate weightings.
7. Write a program to find the trigonometric and exponential Fourier series coefficients of a periodic rectangular signal. Plot the discrete spectrum of the signal.
8. Generate a discrete time sequence by sampling a continuous time signal. Show that with sampling rates less than Nyquist rate, aliasing occurs while reconstructing the signal.
9. Write a program to find the magnitude and phase response of first order low pass and high pass filter. Plot the responses in logarithmic scale.
10. Write a program to find the response of a low pass filter and high pass filter, when a speech signal is passed through these filters.
11. Write a program to find the autocorrelation and cross correlation of sequences.
12. Compute and plot the frequency response of an LTI system using Laplace transform.
13. Generate a Gaussian distributed length 1000 random sequence. Compute the mean and variance of the random signal by a suitable method.
14. Write a program to generate a random sinusoidal signal and plot four possible realizations of the random signal.
15. Obtain and plot the power spectrum of the output process when a white random process is passed through a filter with specific impulse response .

Practice Book: Contemporary Communication Systems using MATLAB by John G.Proakis, M.Salehi, Cengage Learning Publisher.

Note: A minimum of 10(Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

EC-255	ELECTRONIC CIRCUITS LAB	L	T	P	C
		-	-	3	2

COURSE OBJECTIVES:

1. To obtain the frequency responses of amplifier configurations like CE (Common Emitter), CS (Common Source), a cascaded RC coupled amplifier
2. To Design RC phase shift oscillator, Colpitts oscillator
3. To design a class A power amplifier.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. find Band Width, input impedance and output impedances of CE (Common Emitter), CS (Common Source), and RC coupled amplifiers.
2. find the frequency response of voltage shunt amplifiers
3. design RC phase Shift oscillators, Class A power amplifier Colpitts oscillators Class B complementary symmetry power amplifier.

List of Experiments:

1. Frequency Response of Common Emitter Amplifier.
2. Frequency Response of Common Source Amplifier.
3. Measurement of Parameters of Emitter Follower : RI, AV, AI & RO.
4. Cascode Amplifier (CE-CB).
5. Darlington Pair amplifier.
6. Two Stage RC-Coupled Amplifier.
7. Voltage Shunt Feedback Amplifier.
8. Current Series Feedback Amplifier.
9. RC Phase Shift Oscillator.
10. Hartley Oscillator.
11. Colpitts Oscillator.
12. Wien bridge Oscillator.
13. Complementary Symmetry Class-B Push-pull Amplifier.
14. Class-A Power Amplifier.
15. Current mirror circuit.

Note: A minimum of 10(Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

EC-256	PROFESSIONAL COMMUNICATION SKILLS LAB	L	T	P	C
		-	-	3	2

COURSE OBJECTIVES:

The Professional Communication Skills Lab prepares students to

1. improve the dynamics of professional presentations.
2. develop the ability to compeer professional occasions.
3. enable to read news paper for their communicative competence.
4. equip with effective business correspondence.
5. develop in them communication and social graces necessary for functioning.
   * for employable ready skills * win in the job interviews * Build confidence to handle professional tasks.

COURSE OUTCOMES:

After successful completion of the course, the students will

1. develop effective communication and presentation skills.
2. learn corporate etiquette - organizing and managing professional events.
3. understand how reading enhances their communicative competency.
4. conduct effective correspondence and prepare reports which produce results.
5. develop all-round personalities with a mature outlook to function effectively in different circumstances.

List of Exercises / Activities:

1. **Presentation skills:**

   (a) Key presentation skills inspired by Steve Jobs - You Tube.

   (b) Personality & finishing skills training videos.

   How to make Effective Presentations, Methodology, Structure, using Technology and Conclusion.

2. **Speech writing:**

   (a) Welcoming guests on to the stage. (b) Proposing vote of thanks.

   Invite and thank people with professional etiquette.

3. **Reading skills:**

   (a) News paper reading (b) Reading and interpretation

   News paper reading - loud reading within the groups. Reporting the news with one another without the help of the news paper.

   (Besides this, motivate students to read News Paper every day without fail.)

4. **Writing Skills:**

   Report writing (a) Feasibility report (b) Project report

   (Writing an Abstract - Parts of a report - Title page - Declaration - Acknowledgements - Table of contents - Introduction - Conclusion - Citations - References - Appendices.)

5. **Career skills:**

   (a) Resume & Cover letter. (b) Interview - The purpose & preparation for an interview.

   Discover oneself - Self Introduction - Social background (family, home and town) - interests, Hobbies, likes & dislikes (persons, places, food, music, etc) - Strengths, Weaknesses, Skills, Qualities, Achievements - Opinions (love, life, marriage, politics, India, etc) what is life according to me? A creative narration with factual information is expected.

   Effective Resume writing: structure and presentation - planning and defining the career objective - strengths and skills set - format - cover letter.

   Facing Interviews : Interview Process - Understanding employer expectations - Pre-interview planning - Opening strategies - Answering strategies, Frequently Asked Questions (FAQs).

REFERENCE BOOK(S) :

1. Business Communication, II Ed, OUP, by Meenakshi Raman & Prakash Singh, 2012.
2. Technical Communication - English Skills For Engineers, II Ed, OUP by Meenakshi Raman & Sangeetha Sharma, 2011.(Unit-IV).
3. Technical Communication - Principles and Practice, II Ed, OUP by Meenakshi Raman & Sangeetha Sharma, 2015.(Unit-V)

SOFTWARE :

TOEFL Mastery, Rosetta Stone, TED Talks, Globarena, Clarity.

Web Resources :

www.esl-lab.com, www.eslgold.com

EC/EE-301 **PULSE AND DIGITAL CIRCUITS** **L T P C**
4 - - 3

COURSE OBJECTIVES:

1. To know the responses of first order RC low pass and high pass filters for standard inputs
2. To know the transfer characteristics of clipping circuits and the response of clamping circuits for sinusoidal and square wave signals.
3. To do the analysis and design of multivibrators using BJTs
4. To know the methods of generating voltage sweep waveforms
5. To know the concepts of TTL, ECL,NMOS and CMOS logic families

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand and analyze the responses of first order RC low pass and high pass filters for standard inputs.
2. understand the transfer characteristics of clipping circuits and the response of clamping circuits for sinusoidal and square wave signals.
3. understand the operation, analysis and design of multivibrators using BJTs
4. understand the operation of Miller and Bootstrap sweep circuits.
5. understand the operation of TTL, ECL,NMOS and CMOS logic families

UNIT I *Text Book - 1* **(12)**

LINEAR WAVE SHAPING : Responses of RC-high pass circuit and low pass circuits to sinusoidal, step, pulse, square, ramp and exponential inputs, Criteria for good differentiation and integration, uncompensated and compensated attenuators, RLC circuits and their response for step input, ringing circuit.

UNIT II *Text Book - 1* **(10)**

NON-LINEAR WAVE SHAPING : Clipping circuits with diodes, clipping at two independent levels, transfer characteristics of clippers, multi-diode circuits, transient and steady state response of a diode clamping circuit, clamping circuit theorem, practical clamping circuits, effect of diode characteristics on clamping voltage, transfer characteristics of clampers.

UNIT III *Text Book - 1* **(15)**

MULTIVIBRATORS (using BJTs) : Bistable Multivibrator: fixed bias transistor binary (only), commutating capacitors, unsymmetrical and symmetrical triggering of binary, schmitt trigger circuit.

UNIT IV *Text Book - 1* **(12)**

MULTIVIBRATORS (Contd..) collector coupled monostable and astable multivibrators - operation & design.

SWEEP CIRCUITS : Voltage sweep circuits, deviation from linearity expressed as errors, principles of miller and bootstrap sweep circuits, miller circuit, bootstrap circuit.

UNIT V *Text Book - 2* **(12)**

Digital Circuits : Fundamental concepts of digital circuits, cmos logic family, nmos logic family, TTL logic family, emitter coupled logic family

LEARNING RESOURCES:

TEXT BOOK(s):

1. J Millman and H Taub - Pulse Digital and Switching Circuits, TMH, 2003
2. Mark N Horemstein - Microelectronic Circuits and Devices, 2nd Edition, PHI, 1996

REFERENCE BOOK(s):

1. Mothiki S. Prakash Rao, Pulse Digital & Switching Waveforms, 2nd Edition, TMH.
2. Taub and Schilling, Digital Integrated Electronics, Mc-Graw Hill, 1977.

WEB RESOURCES:

1. http://nptel.ac.in/courses/117106086/
2. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-374-analysis-and-design-of-digital-integrated-circuits-fall-2003/

EC/EE-302 MICROPROCESSORS & MICROCONTROLLERS L T P C
4 1 - 3

COURSE OBJECTIVES:

1. To understand the architecture of 8086 family, addressing modes, Instruction description and assembler directives of 8086 microprocessor.
2. To develop the programming skills for applying them on various applications of 8086 microprocessor.
3. To understand 8086 systems connections and programmable parallel ports
4. To understand Analog interfacing with 8086 and learn different programmable peripheral devices.
5. Understand architecture of 8051microcontroller.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand architecture and programming model of 8086 microprocessor.
2. develop the assembly language programs for different problems using 8086.
3. understand 8086 system connections and Timings, Digital Interfacing.
4. understand Analog interfacing with 8086 and different programmable peripheral devices.
5. understand the architecture of 8051 microcontroller.

UNIT I *Text Book - 1* **(13)**

Introduction to microcomputers and microprocessors, The 8086 Microprocessors family-overview, 8086 internal architecture, Introduction to programming the 8086, 8086 Instruction Descriptions and Assembler Directives.

UNIT II *Text Book - 1* **(13)**

Program Development steps, writing programs for use with an assembler, assembly language program development tools, writing and using procedures, writing and using assembler macros, 8086 Interrupts and Interrupt responses.

UNIT III *Text Book - 1* **(13)**

8086 System Connections : 8086 Microprocessor pin diagram, minimum mode and maximum mode of 8086, 8086 bus activities during a read machine cycle, 8086 bus activities during a write machine cycle, addressing memory and ports in microcomputer systems.

Digital Interfacing : Programmable parallel ports and handshake Input/ Output: Methods of parallel data transfer, Implementing Handshake data transfer, 8255A Internal Block Diagram and System connections, 8255A operational modes and initialization, constructing and sending 8255A control words. Interface microprocessor to keyboards.

UNIT IV *Text Book - 1* **(15)**

Analog Interfacing : D/A converter operation and specifications, D/A Applications and Interfacing to Microcomputers, A/D converter specifications, A/D converter Types, and Interfacing Different types of A/D converters to Microcomputers.

Programmable peripheral devices : 8254, 8259, 8251, DMA data transfer, RS232 communication standard.

UNIT V *Text Book - 2* **(10)**

Introduction to microcontrollers, comparing microprocessors and microcontrollers, Architecture: Architecture of 8051, pin configuration of 8051microcontroller, Input/output pins, ports and external memory, counters and timers, serial data Input / Output and interrupts, Addressing modes of 8051 microcontroller.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Douglas V. Hall - Microprocessors and Interfacing, 2nd Edition, TMH,2006.
2. Kenneth J.Ayala - The 8051 Microcontroller Architecture, Programming and Applications, Second Edition, Penram International Publishers, 2005.

REFERENCE BOOK(s):

1. John Uffenbeck - The 80X86 Family, Design, Programming and Interfacing, 3rd Edition, Pearson Education, 2002.
2. Barry B.Bray - The intel microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium processors, architecture, programming, and interfacing, 6th Edition, PHI edition,2003.
3. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D.Mckinlay - The 8051 Microcontroller and Embedded Systems, Pearson Education,second edition 2006.

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

EC-303	LINEAR IC'S AND ITS APPLICATIONS	L	T	P	C
		4	1	-	3

COURSE OBJECTIVES:

1. To know the idealized and practical equivalent circuits of op amp.
2. To know design of filters using op amps and static op amp limitations.
3. To know the dynamic op amp limitations and stability of op amp circuits.
4. To know the operation of nonlinear circuits and signal generators using op amps.
5. To know the A-D and D-A conversion techniques.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. analyze circuits with op amp using resistive feedback
2. design filters using op amps and static limitations of op amp.
3. understand dynamic limitations of op amp and stabilizing the circuits with op amps.
4. Understand the behavior of non linear circuits and signal generators using op amps
5. understand A-D and D-A conversion techniques and the operation of nonlinear amplifiers

UNIT I **(13)**

Operational Amplifier Fundamentals: amplifier fundamentals, the operational amplifier, basic op amp configurations, ideal op amp circuit analysis, feedback in op amp circuits, op amp powering.

Circuits with Resistive Feedback: current to voltage converters, voltage to current converters, current amplifiers, difference amplifiers, instrumentation amplifiers.

UNIT II **(13)**

Active Filters: common frequency responses, the transfer function, first order active filters, standard second order responses, filter approximations cascade design direct design.

Static Op-Amp Limitations: simplified op amp circuit diagram, input bias and offset currents, input offset voltage, input offset error compensation, maximum ratings.

UNIT III **(13)**

Dynamic Op-Amp Limitations: open loop response, closed loop response, transient response, effect of finite gbp on integrator circuits, effect of finite gbp on filters.

Stability: the stability problem, stability in constant-gbp op amp circuits, internal frequency compensation, external frequency compensation.

UNIT IV **(13)**

Nonlinear Circuits: voltage comparators, comparator applications, schmitt trigger, precision rectifiers, peak detectors, sample and hold amplifiers

Signal Generators: sine wave generators, multivibrators, monolithic timers, triangular wave generators, saw tooth wave generators, monolithic waveform generators.

UNIT V **(13)**

D-A and A-D Converters: performance specifications, d-a conversion techniques, a-d conversion techniques.

Nonlinear Amplifiers and Phase Locked Loops: log/antilog amplifiers, analog multipliers, phase-locked loops

LEARNING RESOURCES:

TEXT BOOK(s):

Sergio Franco - Design with Operational Amplifiers and Analog Integrated Circuits, 3rd Edition, TMH, 2002

REFERENCE BOOK(s):

1. RamaKant A. Gayakwad - Op-Amps and Linear Integrated Circuits, 4th Edition, PHI, Pearson Education, 2003.
2. D.Roy and Choudhury - Shail B.Jain, Linear Integrated Circuits, 2nd Edition, New Age International, 2003.

WEB RESOURCES:

1. http://nptel.ac.in/courses/117108038/
2. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-01sc-introduction-to-electrical-engineering-and-computer-science-i-spring-2011/unit-3-circuits/op-amps/

EC-304	DIGITAL COMMUNICATIONS	L	T	P	C
		4	1	-	3

COURSE OBJECTIVES:

1. To understand the different types of digital modulation techniques.
2. To study the base band pulse transmission through the communication channel.
3. To understand the digital pass band transmission and the different binary modulation techniques.
4. To study about information theory and to analyze the different coding principles.
5. To understand the different error control coding techniques.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand different Digital modulation techniques.
2. understand the base band pulse transmission.
3. analyze various methods of digital modulation and demodulation.
4. analyze different source coding techniques and their efficiency.
5. generate Coding sequences for different error correcting codes.

UNIT I **(15)**

PULSE MODULATION : Introduction, Sampling process, Quantization Process, Quantization Noise, Pulse Code Modulation: Encoding, Regeneration, Decoding,Noise considerations in PCM, Virtues and limitations of PCM, Delta Modulation, Differential Pulse Code Modulation (DPCM).

UNIT II **(13)**

BASE BAND PULSE TRANSMISSION : Matched filter, Properties, Intersymbol interference, Nyquist's criterion for distortionless baseband binary transmission, Ideal Nyquist channel, Correlative level coding, Duobinary signaling, Modified Duobinary signaling, General form of correlative level coding.

UNIT III **(13)**

PASSBAND DATA TRANSMISSION : Signal space analysis: Introduction, Pass band transmission model, Geometric interpretation of signals, Gram Schmidt Orthogonalization procedure, Coherent detection of signals in noise, Correlation receiver, Probability of error, Coherent BPSK, QPSK, BFSK, Detection of signals with unknown phase, Non Coherent BFSK, DPSK .

UNIT IV **(12)**

INFORMATION THEORY : Uncertainty, Information, Entropy, Properties of Entropy, Source Coding Theorem, Shannon Fano Coding, Huffman Coding, Discrete memoryless channels, Mutual information, Properties, Channel capacity, Channel coding theorem, Differential entropy and mutual information for continuous ensembles, Information capacity theorem.

UNIT V **(12)**

ERROR CONTROL CODING : Introduction, Binary Symmetric Channel, Linear Block Codes: Syndrome, Properties, Syndrome decoding, Hamming Codes, Cyclic Codes, Convolution Codes.

LEARNING RESOURCES:

TEXT BOOK(s):

Simon Haykin - Communication Systems, 4th Edition, John Wiley & Sons., 2011

REFERENCE BOOK(s):

1. Sam Shanmugam - Digital and Analog Communication Systems, John Wiley, 1979.
2. Taub and Schilling - Principles of Communication Systems, 2nd Edition, TMH, 1986.
3. John Proakis - Digital Communications, TMH,3rd Edition,1995.

WEB RESOURCES:

1. http://nptel.ac.in/courses/117105077
2. http://www.ece.utah.edu/~npatwari/ece5520/lectureAll.pdf

EC-305	CONTROL ENGINEERING	L	T	P	C
		4	-	-	3

COURSE OBJECTIVES:

1. To the mathematical modeling of control systems using transfer function and impulse response functions
2. To know the transient and steady state responses of first and second order systems
3. To know the fundamentals of root locus technique
4. To plot Bode diagrams and polar plots
5. To represent control systems in state space

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand the use of transfer function and impulse response functions to find the response of control systems.
2. understand the transient and steady state responses of first and second order systems with the help of time domain specifications.
3. understand role of the root locus plotting techniques in the analysis of control systems
4. understand the concepts required to plot bode diagrams and polar plots to do the stability analysis of control systems
5. understand the advantage of representing control systems in state space

UNIT I **(12)**

Introduction to Control Systems : Introduction, Examples of Control systems, Closed Loop Control vs Open Loop Control, Mathematical modeling of Dynamic systems, Mathematical models transfer function and Impulse Response function, Automatic Control Systems, Block Diagram Reduction Techniques Signal Flow graphs.

UNIT II **(12)**

Transient and Steady-State Response Analyses : Introduction, First-Order Systems, Second-Order Systems, Higher Order systems (upto third order) Steady-State Errors in Unity Feed back Control Systems.

UNIT III **(12)**

Routh Hurwitz Stability Criterion, Root-Locus Analysis : Introduction, Root-Locus Plots, Summary of General Rules for Constructing Root Loci.

Lead Compensation, Lag Compensation, Lag-Lead Compensation

UNIT IV **(12)**

Frequency-Response Analysis : Introduction, Bode Diagrams, Polar Plots, Log-Magnitude vs Phase Plots, Nyquist Stability Criterion, Stability Analysis.

UNIT V **(12)**

Analysis of Control Systems in State Space : Modeling in State Space, State Representation of Dynamic Systems, State Space representations of Transfer Function systems, Solving the Time Invariant State Equation(upto second order systems), Controlability, Observability.

LEARNING RESOURCES:

TEXT BOOK(s):

Katsuhiko Ogata, Modern Control Engineering, 4th Edition, PHI, 2002.

REFERENCE BOOK(s):

1. J.Nagrath and M.Gopal, Control Systems Engineering, NewAge Publishers, 2009
2. A.K.Jairath,Problems and Solutions of Control Systems with Essential Theory,2012
3. B C KUO, Automatic Control Systems,7th Edition, PHI, 2004.
4. Norman Nise, Control Systems Engineering, 6th Edition, John Wiley, 2011.

WEB RESOURCES:

1. http://nptel.ac.in/courses/108101037/
2. http://ocw.mit.edu/courses/aeronautics-and-astronautics/16-30-feedback-control-systems-fall-2010/

EC-306 **ANTENNAS AND WAVE PROPAGATION** **L T P C**
4 - - 3

COURSE OBJECTIVES:

1. To develop understanding of various types of antenna radiation mechanism.
2. To provide the knowledge of basic understanding of antenna operation through the application of Maxwell's equations.
3. To provide the basic knowledge to calculate array factor of array antennas.
4. To introduce the students various types of antennas and their performance Characteristics.
5. To develop the students' ability to apply modern mathematical techniques to the solutions of antenna problems.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand the radiation of electromagnetic waves by antennas.
2. understand the antenna operation through the solution of antenna design and analysis problems.
3. analyze basic antennas to determine their performance characteristics.
4. interpret the antenna performance characteristics and understand their importance in antenna engineering design.
5. understand of the Radio wave propagation

UNIT I *Text Book - 1* **(10)**

RADIATION : Radiation Mechanism, Potential functions-heuristic approach, Maxwell's equation approach, Potential functions for sinusoidal oscillations.

Alternating current element, Power radiated by current element, Application to short antennas, Assumed current distribution, Radiation from quarter wave Monopole / half wave dipole.

UNIT II *Text Book - 2* **(10)**

ANTENNA FUNDAMENTALS : Isotropic, Directional, Omni-directional patterns, Principle patterns, Field regions, Radiation density, Radiation intensity, Directive gain, Power gain, Half power Beam width.

Antenna polarization, Power loss factor, Radiation efficiency, Effective aperture of antenna, Relation between maximum effective aperture and directivity, Friss transmission equation.

UNIT III *Text Book - 2* **(10)**

ARRAY ANTENNAS : Two element array, N-element uniform linear array, Side lobe level and beam width of broadside array, Beam width of end fire array, Principle of multiplication of patterns. Binomial array, Basic principle of Dolph-Tschebyscheff array. Circular array and phased array. Effect of earth on vertical patterns.

UNIT IV *Text Book - 1,3* **(13)**

CHARACTERISTICS OF TYPICAL ANTENNAS : Traveling wave antennas, V and Rhombic antennas, Folded Dipole, Loop antenna, Yagi Uda array, Helical antenna, Log periodic antenna, Pyramidal and conical Horn antenna.

Corner reflector antenna, Parabolic reflector antennas - Paraboloid and parabolic cylinder, Cassegrain system of reflectors, Lens Antenna, Basic principles of micro strip antennas.

UNIT V *Text Book - 1* **(12)**

RADIO WAVE PROPAGATION : Ground wave Propagation, Earth constants, Space-wave Propagation, Effect of curvature of an Ideal Earth, Variations of Field strength with height in space-wave Propagation, Atmospheric effects in space-wave Propagation, Radio-Horizon, Duct Propagation.

Tropospheric Scatter Propagation, Ionospheric Propagation, Gyro frequency, Refraction and reflection of Sky Waves by the Ionosphere, Critical Frequency, Skip Distance, Maximum Usable Frequency.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Edward C Jordan and Keith G Balmain - Electromagnetic Waves and Radiating Systems, 2nd Edition, PHI, 2003.
2. Constantine A Balanis - Antenna Theory : Analysis and Design, Harper and Row Publishers, 2002.
3. G.S.N.Raju - Antennas and Wave Propagation, 1st Edition, Pearson Publication, Singapore.

REFERENCE BOOK(s):

1. J.D.Kraus and Ronald J Marhefka - Antennas For all Applications, TMH, 2003
2. F.E. Terman - Electronic and Radio Engineering, Mc Graw Hill, 1985.

WEB RESOURCES:

http://nptel.ac.in/courses/117107035/

EC-351	MICROPROCESSORS & MICROCONTROLLERS LAB	L	T	P	C
		-	-	3	2

COURSE OBJECTIVES:

1. To develop the microprocessor based programs for various problems.
2. To understand interfacing the microprocessor with external world.
3. To develop the microcontroller based programs for various applications.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. develop programs for various problems. using 8086 microprocessor.
2. understand interfacing 8086 microprocessor to external world.
3. develop programs for various applications using 8051 microcontroller.

List of Experiments:

Experiments Based on ALP (8086):

1. Programs on Arithmetic and Logical Instructions.
2. Programs on Data Transfer Instructions.
3. Programs on Branch Instructions.
4. Programs on Subroutines.
5. Sorting of an Array.
6. Programs on string instructions.
7. Programs on Interrupts.

Experiments Based on Interfacing with 8086 and Experiments Based on Microcontroller (8051):

8. DAC Interface-Waveform generations.
9. Stepper Motor Control.
10. Keyboard Interface / LCD Interface.
11. Programs on Data Transfer Instructions using 8051 Microcontroller.
12. Programs on Arithmetic using 8051 Microcontroller.
13. Programs on Logical and bitmanipulation Instructions using 8051 Microcontroller.
14. Applications with Microcontroller 8051.

Note: A minimum of 10(Ten) experiments, choosing 5 (Five) from each part, have to be Performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

EC-352	ANALOG COMMUNICATION LAB	L	T	P	C
		-	-	3	2

COURSE OBJECTIVES:

1. To understand analyze various analog modulation and demodulation methods.
2. To understand analyze various pulse modulation techniques.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. design and analyze the modulation and demodulation for different analog techniques like AM, FM, PM.
2. conduct and verify the frequency responses of pre-emphasis and de-emphasis circuits.

List of Experiments:

Experiments Based on ALP (8086):

1. Amplitude Modulation and Demodulation.
2. DSB SC Modulation and Demodulation.
3. SSB SC Modulation and Demodulation.
4. Frequency Modulation and Demodulation.
5. Pre Emphasis - De Emphasis Circuits.
6. Verification of Sampling Theorem.
7. PAM Generation and Reconstruction.
8. PWM and PPM Generation and Reconstruction.
9. Synchronous Detector.
10. Mixer Circuit.
11. Spectrum Analyzer and Analysis of AM and FM signals.
12. Frequency Division Multiplexing and De-Multiplexing.
13. Frequency Synthesizer.
14. AGC Characteristics Synchronous Detector.
15. Squelch Circuit.

Note: A minimum of 10(Ten) experiments have to be Performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

EC-353	CIRCUIT SIMULATION LAB	L	T	P	C
		-	-	3	2

COURSE OBJECTIVES:

1. To build circuit construction skills using circuit simulation software tool.
2. To simulate rectifiers and amplifier circuits.
3. To simulate LC oscillators, RC oscillator and analog modulation techniques.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. write a netlist from the given circuit, simulate it and observe the transient & frequency response plots.
2. verify characteristics of rectifiers circuits.
3. obtain frequency response of various amplifiers.
4. simulate LC oscillators, RC oscillator and analog modulation techniques.

List of Experiments:

1. Simulate step response of a RL, RC, and RLC circuits.
2. Design and verify the operating point for a self bias circuit.
3. Determine ripple factor and efficiency of a half wave rectifier and full wave rectifier.
4. Obtain the frequency response of a CS amplifier.
5. Obtain the frequency response of enhancement MOSFET amplifier with series-shunt feedback amplifier.
6. Obtain the frequency response of a single stage and two stage CE amplifier and compare the bandwidths.
7. Design and simulate Class A power Amplifier.
8. Simulate Hartley/ Colpitts Oscillator using BJT.
9. Verify the characteristics of Clippers and Clampers.
10. Simulate a differentiator and integrator using OPAMP.
11. Simulate a low pass and high pass filter using OPAMP.
12. Simulate a RC phase shift Oscillator using OPAMP.
13. Simulate a wein bridge Oscillator using OPAMP.
14. Simulate an Amplitude Modulator and Demodulator.
15. Simulate a Frequency Modulator and Demodulator.

Note: A minimum of 10(Ten) experiments have to be Performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

EC-307 **HDL PROGRAMING** **L T P C**
4 - - 3

COURSE OBJECTIVES:

1. To know the basic language features of Verilog HDL and the role of HDL in digital logic design.
2. To know the behavioural modeling of combinational and simple sequential circuits.
3. To know the behavioral modeling of algorithmic state machines.
4. To know the synthesis of combinational and sequential descriptions.
5. To know the architectural features of programmable logic devices.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand HDL design flow and its relevance to digital circuits design
2. describe combinational and sequential circuits using behavioral modeling
3. describe algorithmic state machines using behavioral modeling
4. do the synthesis of combinational and sequential descriptions
5. understand the advantages of programmable logic devices and their description in Verilog.

UNIT I *Text Book - 1,2* **(12)**

Introduction to Logic Design with Verilog : Structural models of combination logic, logic simulation, design verification, test methodology, propagation delay, truth table models of combinational and sequential logic with verilog modules, ports, gate types, gate delays, dataflow modelling, continuous assignments delays, expressions, operators, operands, operator types

UNIT II *Text Book - 1* **(12)**

Logic Design With Behavioral Models of Combinational And Sequential Logic : Behavioral modeling, data types for behavioral modeling, behavioral models of combinational logic, propagation delay and continuous assignments, lathes and level sensitive circuits in verilog, cyclic behavioural models of flip flops and latches, cyclic behavior and edge detection, a comparison of styles for behavioral modeling.

UNIT III *Text Book - 1* **(10)**

Behavioral models of multiplexers, encoders and decoders data flow model of a lfsr machines with multicycle operations, algorthmic state machine charts for behavioral modeling, asmd charts, behavioral models of counters, shift registers and register files, switch debounce, metastability, synchronizers for asynchronous signals.

UNIT IV *Text Book - 1* **(10)**

Introduction to synthesis : synthesis of combinational logic, synthesis of sequential logic with latches, synthesis of three state devices and bus interfaces, synthesis of sequential logic with flip flops, synthesis of explicit state machines registered logic.

UNIT V *Text Book - 1* **(10)**

Programmable logic devices, storage devices, programmable logic array programmable array logic, programmability of PLDs CPLDs.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Michael D Ciletti - Advanced Digital Design with the VERILOG HDL, 2ND Edition, PHI, 2009.
2. Samir Palnitkar - Verilog HDL, 2nd edition, Pearson Education, 2003.

REFERENCE BOOK(s):

1. Stephen Brown and Zvonko Vranesic - Fundamentals of Digital Logic with Verilog, 2nd Edition, TMH, 2008.
2. Z Navabi - Verilog Digital System Design, 2nd Edition, McGraw Hill, 2005.

WEB RESOURCES:

1. http://nptel.ac.in/video.php?subjectId=106105083
2. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-884-complex-digital-systems-spring-2005/lecture-notes/

EC-308 **ADVANCED MICROCONTROLLERS** **L T P C**
4 - - 3

COURSE OBJECTIVES:

1. To learn the concept of Embedded system and have Knowledge on instruction-set of advanced microcontrollers.
2. To provide experience to integrate hardware and software for microcontroller systems applications.
3. To learn about Analog interfacing and data acquisition.
4. To learn different serial communication Interfaces.
5. Understanding Embedded Networking concepts based upon connected MCUs.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand the programming model and Instruction set of advanced microcontrollers
2. write the programs for microcontroller based systems.
3. undestand Analog interfacing and data acquisition.
4. undestand different communication protocols and Interfacing with external devices.
5. understand Embedded networking and Internet of Things.

UNIT I **(11)**

Introduction to Embedded systems : Embedded system overview and applications, features and architecture considerations - ROM, RAM, timers, data and address bus, Memory and I/O interfacing concepts, memory mapped I/O. CISC Vs RISC design philosophy, Von-Neumann Vs Harvard architecture, instruction set, instruction formats, and various addressing modes of 32-bit. Fixed point and floating point arithmetic operations.

Introduction ARM architecture and Cortex - M series, Introduction to the Tiva family viz. TM4C123x & TM4C129x and its targeted applications, Tiva block diagram, address space, on-chip peripherals (analog and digital) Register sets, Addressing modes and instruction set basics.

UNIT II **(11)**

Microcontroller Fundamentals for Basic Programming : I/O pin multiplexing, pull up/down registers, GPIO control, Memory Mapped Peripherals, programming System registers, Watchdog Timer, need of low power for embedded systems, System Clocks and control, Hibernation Module on Tiva, Active vs Standby current consumption. Introduction to Interrupts, Interrupt vector table, interrupt programming. Case Study: Tiva based embedded system application bringing up the salient features of GPIO, Watchdog timer, etc.

UNIT III **(11)**

Timers, PWM and Mixed Signals Processing : Timer, Basic Timer, Real Time Clock (RTC), Timing generation and measurements, Analog interfacing and data acquisition: ADC, Analog Comparators, DMA, Motion Control Peripherals: PWM Module & Quadrature Encoder Interface (QEI).Case Study: Tiva based embedded system application using ADC & PWM.

UNIT IV **(11)**

Communication protocols and Interfacing with external devices : Synchronous / Asynchronous interfaces (like UART, SPI, I2C, USB), serial communication basics, baud rate concepts, Interfacing digital and analog external device, I2C protocol, SPI protocol & UART protocol. Implementing and programming I2C, SPI & UART interface using Tiva. CAN & USB interfaces on Tiva platform. Case Study: Tiva based embedded system application using the interface protocols for communication with external devices "Sensor Hub BoosterPack".

UNIT V **(11)**

Embedded networking and Internet of Things : Embedded Networking fundamentals, Ethernet, TCP/IP introduction, IoT overview and architecture, Overview of wireless sensor networks and design examples. Various wireless protocols and its applications: NFC, ZigBee, Bluetooth, Bluetooth Low Energy, Wi-Fi.

Adding Wi-Fi capability to the Microcontroller, Embedded Wi-Fi, User APIs for Wireless and Networking applications Building IoT applications using CC3100 user API: connecting sensor devices using Tivaware sensor library.

Case Study: Tiva based Embedded Networking Application: "Smart Plug with Remote Disconnect and Wi-Fi Connectivity".

LEARNING RESOURCES:

TEXT BOOK(s):

Jonathan W Valvano - Embedded Systems: Real-Time Interfacing to Arm(r) Cortex -M Microcontrollers : Volume 2

REFERENCE BOOK(s):

1. Joseph Yiu - The Definitive Guide to the ARM Cortex-M3, Second Edition, Newnes
2. Steve Furber - ARM system on chip architecture, Addison Wesley, 2000.
3. ARM Architecture Reference Manual, 2nd edition, Addison Wesley

WEB RESOURCES:

1. http://www.ti.com/lit/ug/spmu290/spmu290.pdf
2. http://www.ti.com/lit/ug/tidu531/tidu531.pdf

EC-309 **COMPUTER NETWORKS** **L T P C**
4 - - 3

COURSE OBJECTIVES:

1. To understand the concepts of OSI model and protocol architecture
2. To understand the detailed inner workings of TCP/IP protocol suite
3. To understand data link layer design issues and MAC sub layer protocols
4. To understand Network layer design issues, various routing algorithms and congestion control algorithms
5. To understand transport layer protocols and application layer.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. gain knowledge of layered architecture TCP/IP and OSI model used for computer communication
2. understand the operation of Data Link Layer protocols and architecture of various networks like ETHERNET, WLAN, Broadband Wireless and Bluetooth
3. implement various routing algorithms like distance vector routing, flooding and shortest path in network Layer
4. understand the working of Internet Protocol and IP address classes
5. understand the working of TCP,UDP and the services of application layer like WWW,DNS and E-mail

UNIT I *Text Book - 1* **(12)**

Uses of Computer networks, Network Hardware, Network Software, Reference Models (OSI and TCP/IP only). **PHYSICAL LAYER :** Introduction to Guided Transmission Media, Wireless Transmission.

UNIT II *Text Book - 1,2* **(12)**

DATA LINK LAYER : Data Link Layer design issues, Elementary Data link Protocols, Sliding window protocols. **MEDIUM ACCESS CONTROL SUBLAYER :** The channel Allocation problem, Multiple Access Protocols, Ethernet, Wireless LANs, Bluetooth, Broadband Wireless, Data Link Layer Switching

UNIT III *Text Book - 2* **(12)**

NETWORK LAYER : Network layer Design Issues, Routing Algorithms - (The Optimality Principle, Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Routing for Mobile Hosts).

UNIT IV *Text Book - 1* **(12)**

Congestion Control Algorithms, Quality of Service -(Requirements, Techniques for Achieving Good Quality of Service. Internetworking, The Network layer in the internet-(The IP Protocol, IP Address, Internet Control Protocols, OSPF, BGP).

UNIT V *Text Book - 1,2* **(12)**

TRANSPORT LAYER : Elements of Transport Protocols, TCP, UDP, RTP APPLICATION LAYER: DNS, Electronic Mail, The World Wide Web (Architectural Overview only) Multimedia.

LEARNING RESOURCES:

TEXT BOOK(s):

1. A.S Tanenbaum - Computer Networks, 4th Edition, PHI, 2003.
2. Behrouz A. Foruzan - Data communication and Networking, 4th edition, TMH, 2004.

REFERENCE BOOK(s):

1. James F.Kurose,Keith W.Ross - Computer Networking A Top Down Approach, 3rd Edition, Pearson education.
2. Larry L.Peterson and Bruce S.Davie - Computer Networks A Systems Approach, 4th Edition, Morgan Kaufmann Publishers,2007

WEB RESOURCES:

http://nptel.ac.in/courses/106105081/1

EC-310 **DIGITAL SIGNAL PROCESSING** **L T P C**
4 1 - 3

COURSE OBJECTIVES:

1. To provide fundamental knowledge of digital signal processing techniques and applications.
2. To learn Z transforms.
3. To learn Discrete Fourier transforms and Fast Fourier transform techniques.
4. To understand various design techniques and realization methods of IIR filters.
5. To understand various design techniques and realization methods of FIR filters.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. analyze discrete times signals in the time domain and frequency domain.
2. analyze the Z-transform and their significance
3. analyze DFT and FFT transform domain techniques and their significance.
4. design and realize IIR Butter worth and Chebyshev filters using by linear transformation and impulse and invariance transformation methods.
5. design and realize FIR filters by using rectangular, hamming, hanning, Bartlett triangular windowing techniques.

UNIT I **(13)**

DISCRETE - TIME SIGNALS AND SYSTEMS : Discrete - Time Signals - Sequences, Linear Shift - Invariant Systems, Stability and Casuality, Linearity, Linear constant - Coefficient Difference Equations, Frequency Domain Representation of Discrete - Time Signals and Systems.

UNIT II **(13)**

Z-TRANSFORMS : Z-transforms, Region of convergence, Z-transform theorems and properties, Parseval's relation, Relation between Z-transform and Fourier transform of a sequence, Inverse Z transform using Cauchy's integration theorem, Partial fraction method, Long division method, Solution of differential equations using one sided Z-transform, Frequency response of a stable system.

UNIT III **(13)**

DFT AND FFT : Discrete Fourier Series, Properties of DFS, Discrete Fourier Transform, Properties of DFT, Linear convolution using DFT.

Efficient Computation of the DFT : Computations for evaluating DFT, Decimation in time FFT algorithms, Decimation in frequency FFT algorithm, Computation of inverse DFT.

UNIT IV **(13)**

IIR FILTER DESIGN TECHNIQUES : Introduction, Properties of IIR filters, Design of Digital Butterworth and Chebyshev filters using bilinear transformation, Impulse invariance transformation methods. Design of digital filters using frequency transformation method.

UNIT V **(13)**

FIR FILTER DESIGN TECHNIQUES : Introduction to characteristics of linear phase FIR filters, Frequency response, Designing FIR filters using windowing methods: Rectangular window, Hanning window, Hamming window, Generalized Hamming window, Bartlett triangular window, Comparison of IIR and FIR filters.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Alan V Oppenheim and Ronald W Schafer - Digital Signal Processing, PearsonEducation/PHI, 2004.
2. John G.Proakisand Dimitris G.Manolakis - Digital Signal Processing Principles, Algorithms and Applications, 2007.
3. P Ramesh Babu - Digital Signal Processing, 5th edition, scitech, 2014.

REFERENCE BOOK(s):

1. Tarun Kumar Rawat - Digital Signal Processing, Oxford University Press,2015.
2. Johnny R. Johnson - Introduction to Digital Signal Processing, PHI, 2001.
3. Andreas Antoniou - Digital Signal Processing,TMH, 2006.
4. Lonnie C Ludeman - Fundamentals of Digital Signal Processing, John Wiley & Sons, 2003.
5. S K Mitra - Digital Signal Processing: A Computer Based Approach, 4th Edition, TMH, 2011.

WEB RESOURCES:

1. http://nptel.iitm.ac.in/courses/117102060/
2. http://www.ece.cmu.edu/~ee791/
3. http://www.ee.umanitoba.ca/~moussavi/dsp815/LectureNotes/index.html
4. http://cobweb.ecn.purdue.edu/~ipollak/ee438/FALL04/notes/notes.html

EC-311A	TV ENGINEERING (ELECTIVE - I)	L T P C 4 - - 3

COURSE OBJECTIVES:

1. To study the analysis and synthesis of TVPictures, Composite Video Signal, Receiver Picture Tubes and-Television Camera Tubes
2. To study the principles of Monochrome Television Transmitter and Receiver systems.
3. To study the advanced topics in Television systems.
4. To study the various Color Television systems with a greater emphasis on PAL

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand the fundamentals of television
2. know the detailed functionality of monochrome TV transmitters and receivers
3. know the types of camaratubes and essentials of colour television
4. know the colour TV display tubes and colour TV systems.
5. understand various advanced colour TV technologys.

UNIT I *Text Book - 1* **(10)**

FUNDAMENTALS OF TELEVISION : TV transmitter and receivers, synchronization, Basic factors of TV system: aspect ratio, image continuity, interlaced scanning, flicker, picture resolution, Composite video signal, Horizontal and vertical sync details, no of scanning lines, scanning sequence details.

Monochromatic Picture tube, Electrostatic focusing, Beam deflection, picture tube characteristics and specifications, monochrome TV camera.

UNIT II *Text Book - 1,2* **(12)**

MONOCHROME TV TRANSMITTER : TV transmitter - picture signal transmission, sound signal transmission, vestigial side band transmission, TV signal propagation â€“ Interference - TV transmission Antennas.

MONOCHROME TV RECEIVER : RF tuner, IF subsystem, video amplifier, sound section, sync separation and processing, deflection circuits, scanning circuits.

UNIT III *Text Book - 1,2* **(10)**

CAMERA TUBES : Basic Principles, Types: Image Orthicon, Vidicon, Plumbicon, Block diagram of broad cast TV transmitter, Block diagram of broadcast TV receiver.

Essentials of Colour Television : Compatibility â€“ colour perception- Three colour theory- luminance, hue and saturation-colour television cameras- values of luminance and colour difference signals-formation of chrominance signal.

UNIT IV *Text Book - 1,2* **(12)**

Colour TV display tubes : delta gun, precision in-line and Trinitron colour picture tubes, purity and convergence, purity and static and dynamic convergence adjustments, automatic degaussing circuit, grey scale tracking.

Colour television systems : NTSC colour TV system, limitations of NTSC system, PAL colour TV system, merits and demerits of the PAL system - SECAM colour TV system, merits and demerits of SECAM system.

UNIT V *Text Book - 1* **(10)**

Advanced Colour TV Systems - Cable TV : cable signal sources, cable signal processing, cable signal distribution - digital television - DTH, threedimensional (3D) TV.

Extended Definition television (EDTV), HDTV, LCD Television : LCD technology, LCD matrix types & operation, **Plasma Television :** conduction of charge, signal processingin plasma TV receivers.

LEARNING RESOURCES:

TEXT BOOK(s):

1. R.R. Gulati-Modern Television Practice - Principles, Technology and Service - New Age International Publication, 2009.
2. R.R. Gulati-Monochrome and Colour TV - New Age International Publication, 2002.

REFERENCE BOOK(s):

1. S. P.Bali - Colour Television Theory and Practice - TMH, 1994.
2. A.M. Dhake - Television and Video Engineering - 2nd Edition - 16th Reprint-2006

WEB RESOURCES:

1. http://nptel.iitm.ac.in/
2. http://jwfiles.net/files/6/f0bsb8og8vy3yq/Tv-Lectures_JWFILES.pdf
3. http://jwfiles.net/fiu1pa6wkw84/Tv-L...FILES.pdf.html

EC-311B	EMC / EMI	L	T	P	C
	(ELECTIVE - I)	4	-	-	3

COURSE OBJECTIVES:

1. To provide information on various types EMI sources.
2. To study EMI on various test sites.
3. To study about various equipment to measure EMIâ€•.
4. To study various types techniques for suppressing noise.
5. To study different standards of EMC designs.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. â€œknow about the history of EMI and their sources.
2. learn about various types of Noise sources
3. know about various methods for suppression of EMI.
4. know about shielding Effectiveness and its determination.
5. know about the design of simple circuits for EMC

UNIT I *Text Book - 1* **(10)**

Introduction, Natural and Nuclear sources of EMI / EMC : Electromagnetic environment, History, Concepts, Practical experiences and concerns, frequency spectrum conservations. An overview of EMI / EMC, Natural and Nuclear sources of EMI.

UNIT II *Text Book - 1* **(12)**

EMI from apparatus, circuits and open area test sites : Electromagnetic emissions, noise from relays and switches, non-linearities in circuits, passive intermodulation, cross talk in transmission lines, transients in power supply lines, electromagnetic interference (EMI). Open area test sites and measurements.

UNIT III *Text Book - 1,2* **(10)**

Radiated and conducted interference measurements and ESD : Anechoic chamber, TEM cell, GH TEM Cell, characterization of conduction currents/ voltages, conducted EM noise on power lines, conducted EMI from equipment, Immunity to conducted EMI detectors and measurements. ESD, Electrical fast transients / bursts, electrical surges.

UNIT IV *Text Book - 1* **(12)**

Grounding, shielding, bonding and EMI filters : Principles and types of grounding, shielding and bonding, characterization of filters, power lines filter design.

UNIT V *Text Book - 1,2* **(10)**

Cables, connectors, components and EMC standards : EMI suppression cables, EMC connectors, EMC gaskets, Isolation transformers, optoisolators, National / International EMC standards.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Dr. V.P.Kodali - Engineering Electromagnetic Compatibility by IEEE Publication, Printed in India by S.Chand & Co. Ltd., New Delhi, 2000.
2. Electromagnetic Interference and Compatibility IMPACT series, IIT - Delhi, Modules 1-9.

REFERENCE BOOK(s):

C.R. Pal - Introduction to Electromagnetic Compatibility, John Wiley, 1992.

WEB RESOURCES:

1. www.measurement-testing.com/EMC-electromagnetic-compatibility
2. www.thefreedictionary.com/Electromagnetic+interference
3. wikipedia.org/wiki/Conducted_Electromagnetic_Interference

EC-311C	BIOMEDICAL INSTRUMENTATION (ELECTIVE - I)	L	T	P	C
		4	-	-	3

COURSE OBJECTIVES:

1. To Bio-signals and their characteristics, biological parameters and relationship between them.
2. To understand the principles involved in acquiring different bio-signals.
3. To represent these principles in form of mathematical equations.
4. understand or become aware of different Therapeutic equipment.
5. understand Modern medical imaging systems.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand about Bio-signals and their characteristics, biological parameters and relationship between them.
2. understand about the principles involved in acquiring different bio-signals.
3. understand about Anatomy of the nervous system-neuronal communication
4. understand or become aware of different Therapeutic equipment.
5. understand about Modern medical imaging systems-Radiography.

UNIT I **(10)**

Bio-signals and their characteristics, organization of cell, Nernst equation of membrane, Resting and Action potentials. Bio-amplifiers, characteristics of medical instruments, problems encountered with measurements from living systems.Bio-potential electrodes - Body surface recording electrodes, Internal electrodes, micro electrodes. Bio-chemical transducers - reference electrode, the pH electrodes, Blood gas electrodes.

UNIT II **(10)**

Heart and cardiovascular system Heart electrical acvitity, blood pressure and heart sounds.Cardiovascular measurements electro cardiography â€“ electroeardiogram, ECG Amplifier, Electrodes and leads, ECG recorder principles. Types of ECG recorders. Principles of blood pressure and blood flow measurement.

UNIT III **(10)**

Anatomy of the nervous system-neuronal communication, electro encepherogram (EEG), EEG Measurements EEG electrode-placement system, interpretation of EEG, EEG system Block diagram, pre-amplifiers and amplifiers.Anatomy of vision, electrophysiology of the Eye (ERG) Spatial properties of ERG, the electrooculogram (EOG), Ophthalmoscopes, Tonometer for eye pressure measurement.

UNIT IV **(10)**

Therapeutic equipment, Pacemaker, Defibrillator, Shortwave diathermy. Hemodialysis machine. Respiratory Instrumentation - Mechanism of respiration, Spirometry, Pneumotachograph, Ventilators.

UNIT V **(10)**

Modern medical imaging systems-Radiography, computed Radiography, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Nuclear Medicine, Single Photon Emission Computed Tomography (SPECT), Positron Emission Tomography (PET), Ultrasonography.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Leslie Cromwell - Biomedical Instrumentation and Measurements, 2nd Edition, PHI, 2006.
2. John G Webster - Medical Instrumentation - Application and Design, John Wiley and Sons,3rd Edition.

REFERENCE BOOK(s):

Joseph Carr and Brown - Introduction to Biomedical equipment technology.

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/102104043

EC-311D	TELECOMMUNICATION SWITCHING SYSTEM (ELECTIVE - I)	L	T	P	C
		4	-	-	3

COURSE OBJECTIVES:

1. To understand the Switching systems and Networks
2. To understand the Signal path in time and space between two terminals
3. To understand the Signaling systems in Telephone Data Networks
4. To understand the Protocols and Data Communication Networks
5. To understand the ISDN Protocols of Network Convergence

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. to evaluate the Time and Space parameters of a switched signal
2. to evaluate the Digital Signal path in Time and Space in Traffic load Systems
3. to understand the concept of Data link Protocols in Networks
4. to Know the concept of Multiplexing Techniques
5. to evaluate the inherent facilities within the system to test some of the ISDN and digital switch functions.

UNIT I *Text Book - 1* **(10)**

TELECOMMUNICATION SWITCHING SYSTEMS : Evolution of Telecommuni-cations Simple Telephone Communication Basics of Switching System Electronic Space Division Switching Stored Program Control Centralized SPC Distributed SPC Software Architecture Two Stage Networks Three Stage Networks Time Division Switching Basic Time Division Time Switching Combination Switching Three Stage Combination Switching.

UNIT II *Text Book - 1* **(10)**

TELEPHONE NETWORKS : Subscriber Loop Systems Switching Hierarchy and Routing Transmission Plan Signaling Techniques In-channel Signaling Common Channel Signaling Network Traffic Load and Parameters Grade Of Service and Blocking Probability.

UNIT III *Text Book - 2* **(10)**

FUNDAMENTAL CONCEPTS OF DATA COMMUNICATIONS : Data Communi-cations Codes Bar Codes Character Synchronization Data Communications Hardware Data Communications Circuits Line Control Unit Serial Interfaces.

DATA-LINK PROTOCOLS AND DATA COMMUNICATIONS NETWORKS : Introduction Data Link Protocol Functions Character- and Bit- Oriented Data Link Protocols Asynchronous Data-Link Protocols Synchronous Data-Link Protocols Synchronous Data-Link Control High-Level Data-Link Control Public Switched Data Networks Asynchronous Transfer Mode.

UNIT IV *Text Book - 2* **(10)**

DIGITAL T-CARRIERS AND MULTIPLEXING : Time-Division Multiplexing T1 Digital Carrier North American Digital Hierarchy Digital Carrier Line Coding T Carrier Systems European Digital Carrier System Digital Carrier Frame Synchronization Bit Versus Word Interleaving Statistical Time Division Multiplexing Frequency Division Multiplexing FDM Hierarchy Composite Baseband Signal Formation of a Master Group.

UNIT V *Text Book - 3* **(10)**

ISDN : What Is ISDN? ISDN Components ISDN Channel Types Basic and Primary Rate Interfaces ISDN Protocols ISDN Features Services and Applications Other ISDN Initiatives

DIALUP AND HOME NETWORKING : What Is Dialup Networking? Analog Modem Concepts DSL Service Cable Modems Home Networking Concepts and Issues. **NETWORK CONVERGENCE :** What Is Network Convergence? Networking Issues and Convergence Effects of Network Convergence on Business Convergence At Home.

LEARNING RESOURCES:

TEXT BOOK(s):

1. T Viswanathan - Telecommunication Switching Systems and Networks, PHI, 2004.
2. Wayne Tomasi - Advanced Electronic Communications Systems, 6th Edition, Pearson, 2004.
3. Machael A. Gallo and William M. Hancock - Computer Communications and Networking Tecnologies, 1st Edition,Cengage Learning, 2002.

REFERENCE BOOK(s):

1. J E Flood - Telecommunications Switching, Traffic and Networks, Person, 1999
2. Ray Horak - Communication Systems and Networks, 3rd Edition, Wiley, 2002

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

EC-312A	OPERATING SYSTEMS (ELECTIVE - II)	L	T	P	C
		4	-	-	3

COURSE OBJECTIVES:

1. To understand the underlying principles, techniques and approaches which constitute a coherent body of knowledge in Operating Systems.
2. To understand the inherent functionality and processing of program execution.
3. To understand how the various elements that underlie operating system interact and provides services for execution of application software.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand the structures of an operating system and design issues associated with operating systems.
2. understand various process management concepts, scheduling and multithreading concepts.
3. understand the concept of synchronization and deadlocks.
4. understand the memory management including virtual memory.
5. understand issues related to file system interface and implementation and disk management.

UNIT I **(13)**

Introduction : Operating System Structure, Operating system operations, process management, memory management, storage management, protection and security, distributed systems, special purpose systems, computing environments.

System structure : Operating System Services, user operating system interface, system calls, types of system calls, system programs, operating system design and implementation, operating system structure, virtual machine, operating system generation, system boot.

UNIT II **(13)**

Process Concept : Process concept, process scheduling, operations on processes, inter process communication, examples of IPC systems, communication in client server systems.

Multithreaded Programming : Overview, multithreading models, thread libraries, threading issues, operating system examples, Process Scheduling: Basic Concepts, Scheduling Criteria Scheduling Algorithms, Thread scheduling, multiple processor scheduling.

UNIT III **(13)**

Synchronization : Background, The critical section problem, Peterson's solution, Synchronization Hardware, Semaphores, Classic Problem of synchronization, monitors, synchronization examples, Atomic Transaction Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock detection, Recovery from Deadlock.

UNIT IV **(13)**

Memory Management strategies : Background, Swapping, Contiguous Memory allocation, Paging, Structure of the page table, segmentation, Virtual Memory Management: Background, Demand Paging, Copy on Write page replacement, Allocation of Frames, Thrashing.

UNIT V **(10)**

File System : File Concept-Access Methods-Directory and disk structure-file system mounting- File Sharing, Protection. Implementing File Systems: File System Structure-File System, Implementation, Directory Implementation, Allocation methods-free space management, Efficiency and performance, recovery, **Secondary Storage Structure :** Overview of Mass-Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, Disk Management, Swap Space Management, RAID structure.

LEARNING RESOURCES:

TEXT BOOK(s):

Silberschatz and Galvin - Operating System Concepts, 7th Edition, John Wiley & Sons (Asia) Pvt. Ltd.

REFERENCE BOOK(s):

1. William Stallings - Operating Systems-Internals and Design Principles, 5th Edition, Pearson
2. Charles Crowley - Operating Systems: A Design-Oriented Approach, TMH 1998

WEB RESOURCES:

1. http://nptel.iitm.ac.in/courses/
2. http://www.mike-willis.com/Tutorial/PF2.htm

EC-312B	NEURAL NETWORKS (ELECTIVE - II)	L	T	P	C
		4	-	-	3

COURSE OBJECTIVES:

1. To gain knowledge about the fundamentals of artificial neural networks.
2. To gain knowledge about single layer networks such as perceptron with supervised learning method.
3. To learn about the Backpropagation which is mostly used supervised learning algorithm for multilayer networks.
4. To learn about unsupervised learning networks which are used to discover special features and patterns from available data without using external help.
5. To learn how to apply the Artificial Neural Networks for real world problems.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand the fundamentals such as neural networks, learning laws and their applications.
2. understand how to train the neural networks to solve linear separability with perceptions and also to understand support vector classification.
3. understand how to train Back propagation algorithm and setting the parameter values.
4. understand about the clustering process using neural networks such as counter propagation networks and Adaptive Resonance Theory.
5. apply the principles of Artificial Neural Networks in the fields of image processing, pattern recognition.

UNIT I *Text Book - 1,2* **(11)**

Introduction : History of Neural Networks, Structure and function of biological and artificial neuron, models of a neuron, Neural network architectures, Neural learning, Learning laws Applications of neural networks to solve tasks such as clustering and pattern association, Evaluation of Networks.

UNIT II *Text Book - 1* **(11)**

Supervised learning-I : Single layer networks: Supervised and unsupervised learning, Perceptrons, Linear separability, Perceptron training algorithm, Gaurenty of success, Modifications, Support vector classification.

UNIT III *Text Book - 1* **(12)**

Supervised learning-II : Multi layer networks: Multi level discrimination, Preliminaries, Backpropagation algorithm, Classification using Backpropagation, setting the parameter values,Radial basis functions, Support vector machines, Probabilistic neural network, Polynomial networks

UNIT IV *Text Book - 1* **(11)**

Unsupervised learning : Winner - Take - all networks, Learning vector quantizers, Counter propagation networks, Adaptive Resonance Theory, Topologically organized networks, Distance based learning, Principal component analysis networks.

UNIT V *Text Book - 1,2* **(10)**

Associative Memories : Non iterative procedures for association, Hopfield networks, Boltzmann Machines, Hetero-associators, Applications of Neural Networks: Optimization, Travelling salesperson, Applications in Pattern recognition and image processing.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Kishan Mehrotra, Chelkuri K. Mohan, Sanjav Ranka - Elements of Artificial Neural Networks, Penram International, 2001.
2. B. Yegnanarayana - Artificial Neural Networks, PHI, New Delhi, 1999.

REFERENCE BOOK(s):

1. J.M. Zurada - Introduction to Artificial Neural Systems, Jaico Publications, India,1994.
2. Rajasekharan and Pai - Neural Netwroks, Fuzzy Logic and Genetic algorithms: synthesis and applications, PHI Publication, 2003.

WEB RESOURCES:

http://nptel.ac.in/syllabus/syllabus.php?subjectId=117105084

EC-312C	FUZZY LOGIC (ELECTIVE - II)	L T P C 4 - - 3

COURSE OBJECTIVES:

1. To develop the fundamental concepts such as fuzzy sets, operations and fuzzy relations.
2. To lean about the fuzzification of scalar variables and the defuzzification of membership functions.
3. To learn three different inference methods to design fuzzy rule based system.
4. To develop fuzzy decision making by introducing some concepts and also Bayesian decision methods
5. To learn different fuzzy classification methods.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand the basic ideas of fuzzy sets, operations and properties of fuzzy sets and also about fuzzy relations.
2. understand the basic features of membership functions, fuzzification process and defuzzification process.
3. design fuzzy rule based system.
4. know about combining fuzzy set theory with probability to handle random and non-random uncertainty, and the decision making process.
5. gain the knowledge about fuzzy C-Means clustering.

UNIT I *Text Book - 1,2* **(12)**

Classical sets : Operations and properties of classical sets, Mapping of classical sets to the functions. Fuzzy sets - Membership functions, Fuzzy set operations, Properties of fuzzy sets. **Classical and Fuzzy relations :** Cartesian product, crisp relations-cardinality, operations and properties of crisp relations. Fuzzy relations-cardinality, operations, properties of fuzzy relations, fuzzy Cartesian product and composition, Fuzzy tolerance and equivalence relations, value assignments and other format of the composition operation.

UNIT II *Text Book - 1* **(10)**

Fuzzification and Defuzzification : Features of the membership functions, various forms, fuzzification, defuzzification to crisp sets, λ- cuts for fuzzy relations, Defuzzification to scalars. Fuzzy logic and approximate reasoning, Other forms of the implication operation.

UNIT III *Text Book - 1* **(10)**

Fuzzy Systems : Natural language, Linguistic hedges, Fuzzy (Rule based) System, Aggregation of fuzzy rules, Graphical techniques of inference,Membership value assignments: Intuition, Inference, rank ordering, Fuzzy Associative memories.

UNIT IV *Text Book - 1* **(11)**

Fuzzy decision making : Fuzzy synthetic evaluation, Fuzzy ordering, Preference and consensus, Multi objective decision making, Fuzzy Bayesian, Decision method, Decision making under Fuzzy states and fuzzy actions.

UNIT V *Text Book - 1,2* **(11)**

Fuzzy Classification : Classification by equivalence relations-crisp relations, Fuzzy relations, Cluster analysis, Cluster validity, C-Means clustering, Hard C-Means clustering, Fuzzy C-Means algorithm, Classification metric, Hardening the Fuzzy C-Partition.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Timothy J.Ross - Fuzzy logic with engineering applications, 3rd edition, Wiley,2010.
2. George J.KlirBo Yuan - Fuzzy sets and Fuzzy logic theory and Applications, PHI, New Delhi,1995.

REFERENCE BOOK(s):

S.Rajasekaran, G.A.Vijayalakshmi - Neural Networks and Fuzzy logic and Genetic Algorithms, Synthesis and Applications, PHI, New Delhi,2003.

WEB RESOURCES:

http://www.nptel.ac.in/syllabus/syllabus.php?subjectId=111106048

EC-312D **SPREAD SPECTRUM COMMUNICATIONS** **L T P C**
(ELECTIVE - II) **4 - - 3**

COURSE OBJECTIVES:

1. To know the fundamental concepts of spread spectrum.
2. To know the tracking and synchronization methods of wideband signals.
3. To know the principles and detection methods of code division multiple aceess.
4. To find the performance of spread spectrum systems in jamming environment.
5. To know the fundamental concepts of software defined radio.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand the various methods of spreading the spectrum and generation of codes.
2. understand the working of loops to track codes and synchronization techniques.
3. understand the CDMA principles and various schemes for multi-user detection.
4. calculate the performance of spread spectrum systems in jamming environment with forward error correction.
5. understand the principles and architecture of software defined radio.

UNIT I *Text Book - 1* **(10)**

Introduction to spread spectrum system : Fundamental concepts of spread spectrum systems, Pseudo noise sequences, direct sequence spread spectrum, frequency hop spread spectrum, Hybrid direct sequence frequency hop spread spectrum, code division multiple access

Binary shift register sequences for spread spectrum systems : Introduction, Definitions, Mathematical back ground and sequence generator fundamentals, maximal length sequences, Gold codes.

UNIT II *Text Book - 1* **(10)**

Code tracking Loops : Introduction, Optimum tracking of wideband signals, Base band delay-lock tracking loop, Tau-dither non-coherent tracking loop, Double dither non-coherent tracking loop.

Initial synchronization of the receiver spreading code : Introduction, Problem definition and the optimum synchronizer, serial search synchronization techniques, synchronization using matched filter, synchronization by estimated the received spreading code.

UNIT III *Text Book - 2* **(10)**

Cellular code division multiple access CDMA Principles : Introduction, Wide band mobile channel, The cellular CDMA System, Single user receiver in a multi user channel, CDMA System capacity.

Multi-User detection in CDMA Cellular radio : Optimal multi-user detection, linear suboptimal detectors, Interference combat detection schemes, Interference Cancellation techniques.

UNIT IV *Text Book - 1* **(10)**

Performance of spread spectrum systems in jamming environments : Spread Spectrum Communication system model, Performance of spread spectrum systems without coding,

Performance of spread spectrum systems with forward error correction : Elementary block coding concepts, Optimum decoding rule, Calculation of error probability. Elementary convolution coding concepts, viterbi algorithm, Decoding and bit-error rate.

UNIT V *Text Book - 3* **(10)**

Software Defined Radio : Introduction to SDR: SDR concepts and history, Characteristics and Benefits of SDR, SDR Forum, Design principles of Soft ware Radio, Ideal SDR architecture, SDR Based End-to-End Communication.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Introduction to spread spectrum communication - Rodger Eziemer, Roger L. Peterson and David E Borth - Pearson, 1st Edition,1995
2. Introduction to CDMA wireless Communications - Mosa Ali Abu, Rgheff, Elsevier Publications, 2008.
3. A Modern Approach to Radio Engineering - Software Radio - Jeffrey H. Reed, Prentice Hall PTR, May 2002

REFERENCE BOOK(s):

1. Modern Communication and Spread Spectrum - George R. Cooper, Clare D. Mc Gillem, McGraw Hill, 1986.
2. CDMA; Principles of Spread Spectrum Communication - Andrew J. Viterbi, Pearson Education, 1st Edition, 1995.
3. Wireless Digital Communications - Kamilo Feher, PHI, 2009.
4. WCDMA Design Handbook -Andrew Richardson, Cambridge University Press, 2005.
5. Software Defined Radio, Architectures, Systems and Functions - Dillinger, Madani, Alonistioti(Eds.), Wiley, 2003.

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

EC-354	DIGITAL COMMUNICATION LAB	L	T	P	C
		-	-	3	2

COURSE OBJECTIVES:

1. To verify PCM and calculate analog to digital conversion error.
2. To verify Frequency Shift Keying and Phase Shift Keying functionality in time domain, companding scheme.
3. To design, analyze and test linear block, cyclic and convolution encoders and decoders

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. conduct and Analyze the responses of various digital modulation and demodulation methods like PCM, DPSK,ASK, PSK , FSK, QPSK, DPSK
2. experience real time behavior of different digital modulation schemes and technically visualize spectra of different digital modulation schemes

List of Experiments:

1. Generation and Detection of PCM.
2. Generation and Detection of DPCM.
3. Generation and Detection of ASK
4. Generation and Detection of FSK.
5. Generation and Detection of PSK.
6. Generation and Detection of QPSK.
7. Generation and Detection of DPSK.
8. Delta Modulation and Demodulation.
9. Continuously Variable Slope Detector (CVSD).
10. Principles of A/D Converter D/A Converter.
11. Analog Signal Sampling & Reconstruction.
12. Study of Compander.
13. Linear Block code Encoder & decoder
14. Binary Cyclic code Encoder & decoder
15. Convolution code Encoder & decoder

Note: A minimum of 10(Ten) experiments have to be Performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

EC-355	ADVANCED MICROCONTROLLERS LAB	L	T	P	C
		-	-	3	2

COURSE OBJECTIVES:

1. To make the students familiar with the programming of 32 bit Microcontrollers and its architcture features.
2. To make them understand to interface the external embedded world for data acquisition etc.

COURSE OUTCOMES:

After successful completion of the course, the students are

1. capable of programming Microcontrollers based Embedded Systems.
2. capable of performing interfacing to building Microcontrollers based Embedded Systems

List of Experiments:

1. Interfacing and programming GPIO ports in C using Tiva (blinking LEDs , push buttons).
2. Interrupt programming examples through GPIOs.
3. Use Hibernation mode and wake on RTC interrupt.
4. PWM generation using PWM Module on Tiva.
5. Interfacing potentiometer with Tiva GPIO.
6. PWM based Speed Control of Motor controlled by potentiometer connected to Tiva GPIO.
7. Connect the Tiva to terminal on PC and echo back the data using UART.
8. Interfacing an accelerometer with Tiva using I2C.
9. Experiment on USB (Sending data back and forth across a bulk transfer-mode USB connection.)
10. Using IQmath Library for implementing Low pass FIR filter.
11. Review of User APIs for TI CC3100 & Initialization and Setting of IP addresses.
12. A basic Wi-Fi application - Communication between two Tiva based sensor nodes using TIVA sensor library in TivaWare.
13. Setting up the CC3100 as a HTTP server.

Note: A minimum of 10(Ten) experiments have to be Performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

EC-356	PULSE CIRCUITS & ICS LAB	L	T	P	C
		-	-	3	2

COURSE OBJECTIVES:

1. To design and obtain the responses of linear and nonlinear wave shaping circuits for standard inputs.
2. To design and analyze of multivibrators using BJT's.
3. To design a high voltage and a low voltage regulator using IC 723.
4. To design a PLL using IC 566 and a VCO using IC 565.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. design linear and non-linear wave shaping circuits verify their responses with theoretical values.
2. verify waveforms of monostable and astable multivibrator circuits.
3. verify outputs from low and high voltage regulators.
4. verify the behaviours of VCO and PLL.

List of Experiments:

1. Linear Wave-Shaping.
2. Non-linear Wave-Shaping.
3. Design and Verification of Astable Multivibrator.
4. Design and Verification of Monostable Multivibrator.
5. Design and Verification of Schmitt Trigger (using discrete components and IC741).
6. Measurement of Op-amp Parameters.
7. Applications of Op-amp (Adder, Subtractor, Integrator, Differentiator).
8. Instrumentation Amplifier using Op-Amp.
9. Waveform Generation using Op-amp (Square, Triangular).
10. Design of Active Filters (LPF & HPF- First Order).
11. Application of 555 Timer (Astable, Monostable).
12. PLL using 565.
13. Design of IC Regulator using 723.
14. Design of VCO using 566.
15. D-A Converter (R-2R Ladder).

Note: A minimum of 10(Ten) experiments have to be Performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

EC-401 **MICROWAVE ENGINEERING** **L T P C**
4 1 - 3

COURSE OBJECTIVES:

1. To analyze and study rectangular and circular wave guides using field theory.
2. To understand the theoretical principles underlying microwave devices and networks.
3. To design microwave components such as power dividers, hybrid junctions, Directional Couplers, microwave filters, Microwave Wave-guides and Components, Ferrite Devices.
4. To study about Microwave Solid-State Microwave Devices and Microwave Tubes.
5. To Study about Microwave Measurement Techniques.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understood the propagation characteristics of EM waves in various wave guide structures.
2. use S-parameter terminology to describe circuits and Design microwave transmission lines.
3. describe and analyze different impedance matching techniques and Design impedance matching networks for specific application.
4. use microwave components such as isolators, couplers, circulators and Know principles of Microwave devices.
5. know principles of Microwave tubes and microwave devices and about different Microwave Measurement techniques.

UNIT I *Text Book - 1* **(18)**

RECTANGULAR WAVE GUIDES : Wave equations in Rectangular Coordinates, TE modes in Rectangular Waveguides, TM modes in rectangular Waveguides, Power Transmission in Rectangular Wave guides, and Power Losses in Rectangular Wave guides.

CIRCULAR WAVE GUIDES : Wave equations in Cylindrical Coordinates, TE modes in Circular Waveguides, TM modes in Circular Waveguides, TEM modes in Circular Waveguides, Power Transmission in Circular Wave guides or Coaxial Lines, Power Losses in Circular Wave guides (Qualitative treatment only), Coaxial Lines.

UNIT II *Text Book - 2* **(14)**

INTRODUCTION : Microwave Spectrum and Bands, Applications of microwaves. **MICROWAVE COMPONENTS :** Microwave Cavities - Rectangular and Circular cavity Resonators, Microwave Hybrid Circuits - Waveguide Tees E-plane or Series tee, H-plane or shunt Tee, Magic Tees(Hybrid Tees), Applications of magic Tee, Hybrid Rings (Rat-Race Circuits) Hybrid Rings, Waveguide Corners, Bends and Twists, Directional Couplers, Two-Hole Directional Couplers, S Matrix of a Directional Coupler, Circulators and Isolators.

UNIT III *Text Book - 2* **(8)**

MICROWAVE SOLID-STATE DEVICES - Transferred Electron Devices : GUNN-EFFECT Diodes, RWH Theory, Two-Valley Modes of operations, Avalanche Transit Time Devices: Read diode, IMPATT diode, TRAPATT diode, BARITT diodes, Pin diodes, Varactor diode.

UNIT IV *Text Book - 2* **(15)**

MICROWAVE LINEAR BEAM TUBES (O TYPE) : Limitations of Conventional tubes at Microwave frequencies, Klystron: Velocity modulation process, bunching process, output power and beam loading, **Multicavity Klystron amplifiers :** Beam current density, output current and output power of two cavity Klystron, Reflex Klystron: Velocity modulation, Power output and efficiency. Helix Traveling Wave tube: Slow Wave structures, Amplification process, and Conventional current.

UNIT V *Text Book - 2* **(10)**

MICROWAVE CROSS FIELD TUBES (M TYPE) : Magnetron Oscillators : Cylindrical Magnetron, CFA and BWO.

MICROWAVE MEASUREMENTS : Components of Microwave Bench, Detection of Microwaves, Microwave power measurement, Impedance measurements, VSWR measurement, Frequency measurement.

LEARNING RESOURCES:

TEXT BOOK(s):

1. E C Jordan and K G Balmain - Electromagnetic Waves and Radiating Systems, 2nd Edition, PHI, 2003.
2. ML Sisodia and V.L.Gupta - Microwave Engineering, 1st Edition, New Age International, 2005.

REFERENCE BOOK(s):

1. Samuel Y Liao - Microwave Devices and Circuits, 3rd Edition, Pearson Education, 2003.
2. M.L.Sisodia and GS Raghuvamshi - Microwave Circuits and Passive Devices, Wiley Eastern, 1987.

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

EC-402	VLSI DESIGN	L	T	P	C
		4	1	-	3

COURSE OBJECTIVES:

1. To understand the basic CMOS circuit process and its theory.
2. To understand the CMOS processing technologies and typical geometric design rules.
3. To understand the depth of various alternatives available CMOS circuit design.
4. To understand the combinational logic design with CMOS technology.
5. To understand the various memories and floor planning in CMOS technology.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. know the fabrication process of CMOS.
2. know about design rules which are helpful in CMOS processing technologies.
3. gain knowledge on different CMOS logic circuits.
4. design combinational circuits using CMOS technology.
5. understand the floor planning and routing.

UNIT I **(13)**

Fabrication of CMOS Integrated Circuits : Overview of Silicon Processing, Material Growth and Deposition, Lithography, The CMOS Process Flow, Design Rules.

Logic Design with MOSFETs : Ideal Switches and Boolean Operations, MOSFET as Switches, Basic Logic Gates in CMOS, Complex Logic Gates in CMOS, Transmission Gate Circuits, Physical Structure of CMOS ICs: Integrated Circuit Layers, MOSFETs, CMOS Layers, Designing FET arrays.

UNIT II **(13)**

Elements of CMOS Integrated Circuits : Basic Concepts, Layout of Basic Structures, Cell Concepts, FET Sizing and the Unit Transistor, Physical Design of Logic Gates.

Electronic Analysis of CMOS Logic Gates : DC Characteristics of CMOS Inverter, Inverter Switching Characteristics, Power Dissipation, DC characteristics: NAND and NOR gates, NAND and NOR Transient Response, Transmission Gates and Pass Transistors.

UNIT III **(13)**

Designing High-Speed CMOS Logic Networks : Gate Delays, Driving Large Capacitive Loads, Logical Effort, BiCMOS Drivers.

Advanced Techniques in CMOS Logic Circuits : Mirror Circuits, Pseudo-nMOS, Tri-State Circuits, Clocked CMOS, Dynamic CMOS Logic Circuits, DualRail Logic Networks.

UNIT IV **(13)**

General VLSI System Components : Multiplexers, Binary Decoders, Equality Detectors and Comparators, Parity Encoder, Latches, D-flip flop, Registers.

Arithmetic Circuits in CMOS VLSI : Ripple Carry Adders, Carry Look-Ahead Adders, Multipliers.

UNIT V **(13)**

Memories and Programmable Logic : The Static RAM, SRAM arrays, Dynamic RAMs, ROM Arrays, and Logic Arrays.

System Level Physical Design : Large Scale Physical Design, Interconnect Delay Modeling, Crosstalk, Interconnect Scaling, Floor Planning and Routing.

LEARNING RESOURCES:

TEXT BOOK(s):

John P.Uyemura - Introduction to VLSI Circuits and Systems, 1st Edition. Wiley, 2009

REFERENCE BOOK(s):

1. Neil H.E. Weste & Kamran Eshraghian - Principles of CMOS VLSI Design, A system perspective, 2nd Edition, Pearson Education, 2002.
2. Wayne Wolf - Modern VLSI Design: IP Based Design, 4th Edition, Pearson Education, 2009.

WEB RESOURCES:

1. http://nptel.iitm.ac.in/courses/
2. http://nptel.ac.in/courses/117101058/
3. http://www.ee.ncu.edu.tw/~jfli/vlsi1/
4. http://cc.ee.ntu.edu.tw/~ywchang/Courses/PD/EDA_Chapter1.pdf

EC-403	MOOCS (OPEN ONLINE COURSE)	L	T	P	C
		-	-	-	-

MOOCS (Massive Open Online Courses) Requirements:

- Enrollment of MOOCS course will be initiated from the date of commencement of class work for III Year I Semester.
- List of organisations offering MOOCS course(s) will be announced by the respective Board of Studies at the time of commencement of class work for III Year I Semester.
- MOOCS course completion certificate must be submitted on or before the last instruction day of IV Year I Semester, otherwise his / her Semester End Examination results will not be declared.

EC-404	ELECTIVE - III (OPEN ELECTIVE)	L T P C - - - -

COURSE OFFERED BY ALL BRANCHES OF ENGINEERING

(To be selected other than home branch offered courses)
(CSE / IT Students has to be selected courses offered by other than those branches)

CE-404A	Basic Surveying
CE-404B	Building Materials & Estimation
ChE-404A	Energy Engineering
ChE-404B	Bio-fuels
CS-404A	Java Programming
CS-404B	Database Management Systems
EE-404A	Applied Electronics
EE-404B	Basic Communication
EC-404A	Non-conventional Energy Sources
EC-404B	Utilization of Electrical Energy
IT-404A	Software Engineering
IT-404B	Web Technologies
ME-404A	Robotics
ME-404B	Operations Research

CE-404A	BASIC SURVEYING (OPEN ELECTIVE)	L T P C 4 - - 3

COURSE OBJECTIVES:

1. To study about the various surveying instruments.
2. To study the basics of chain survey in linear measurements.
3. To determine the relative positions of the existing features on the ground.
4. To obtain basic knowledge on Total Station.
5. To acquaint with procedures of leveling by dump level & auto level.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. know about the various surveying instruments.
2. determine the relative positions of a point on the existing ground by conducting the survey.
3. use all basic surveying instruments.
4. operate Total Station instrument.
5. take the levels of existing ground and to determine the reduced levels.

UNIT I *Text Book - 1* **(12)**

Surveying & Measurements : Definitions, Classification, Principles of Surveying, Basic measurements in surveying, Instruments used for different measurements, Units of measurement (linear & Angular), Plan and map, Scales used for Maps and plans, Phases of survey work and Duties of a surveyor. Procedures for distance measurement - Ranging, Chaining/taping a line.

UNIT II *Text Book - 1* **(12)**

Chain Surveying : Principle of Chain surveying, Basic definitions, Well-Conditioned & Ill-Conditioned triangles, Selection of stations and survey lines, Procedure of Field Work in Chain Surveying, Off-sets, Booking the survey (Field Book), Conventional Symbols, Problems encountered in chaining, Obstacles in chain Surveying.

UNIT III *Text Book - 1* **(12)**

Compass Surveying : Angles and Bearings, Instruments used to measure angles and bearings, Designation of Bearings, Fore and Back Bearings, Calculation of Included Angles from Bearings and Bearings from Included Angles, Prismatic & Surveyor's Compass, Magnetic Dip & Declination, Local Attraction and Corrections.

UNIT IV *Text Book - 1,2* **(12)**

Theodolite Surveying : Types of Theodolites, Vernier Theodolite - Essential Parts, Basic definitions, Temporary adjustments, Field operations - Measurement of horizontal angles (Repetition & Reiteration), vertical angles.

Total Station : Introduction; components of Total Station; Types of Prisms and targets used in total station; various advantages of Total Stations.

UNIT V *Text Book - 1* **(12)**

Simple Leveling : Basic definitions, Curvature and Refraction, Different methods of leveling, Levels - Dumpy level, Tilting level, Auto level, Leveling staff, Level field book, Booking and reducing levels, Classification of direct differential leveling methods - Fly leveling, Check leveling, Profile leveling and Cross sectioning, Reciprocal leveling and Precise leveling, Sources of errors & Difficulties in leveling.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Surveying Vol. I & II by Dr. K. R. Arora,11th Edition, Standard Book House,2012.
2. Surveying Vol. I & II by S K Duggal, 4th Edition, McGraw Hill Education (India) Private Limited, 2013.

REFERENCE BOOK(s):

1. Surveying Vol. I&II by B.C. Punmia, Laxmi Publications,2005.
2. Surveying and Levelling by N.N Basak, McGraw Hill Education (India) Private Limited,2014.
3. Plane Surveying by AM Chandra, 2nd Edition, New Age International (P) Ltd.,2006.

WEB RESOURCES:

1. http://nptel.iitm.ac.in/courses/105104101/
2. http://nptel.iitm.ac.in/courses/105107121/
3. http://nptel.iitm.ac.in/courses/105107122/

CE-404B	BUILDING MATERIALS & ESTIMATION (OPEN ELECTIVE)	L	T	P	C
		4	-	-	3

COURSE OBJECTIVES:

1. To teach the basics involved in selection of good quality building materials for construction
2. To give knowledge about various building elements and their specifications
3. Presents the basics of planning strategies, building bye laws and acoustics of building
4. preparing tender notice and various approvals needed for a project
5. Valuation of building and rent fixation

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. familiar with various building materials
2. know about various building elements and their specifications
3. familiar with types of masonry works and bonds used in construction
4. understand building plan and have knowledge about building rules, bye-laws and building elements
5. know about Valuation of building and rent fixation.

UNIT I *Text Book - 1* **(12)**

Clay bricks : Brick clay, Preparation of bricks, Types of bricks, Dimensions of bricks, Weight of bricks, Storing of bricks, Brick substitutes, Classification of bricks, Tests for bricks.

Timber : Classification of trees, Structure of wood, seasoning and con-version of timber, Market forms of timber, Defects of timber, Treatment of timber, Classification of timber.

Glass : Manufacture and Classification, Treatment of glass, Uses of glass, testing for quality, Characteristics and Performance of glass, Glass fibre.

Plastics : Classification of plastics, Properties of plastics, Fabrication of plastic articles, some plastics in common use, Reinforced plastics.

UNIT II *Text Book - 2* **(12)**

Cement : General, Manufacture of Portland cement by dry process, Approximate oxide composition limits of OPC, Bogue's compounds, Hydration of cement, heat of hydration, structure of hydrated cement.

Types of Cements : Ordinary Portland cement, low alkali cement, Rapid hardening cement, Sulphate resisting cement, Portland blast furnace slag cement, Portland pozzolana cement, air entraining cement, white cement, hydro phobic cement, oil well cement, low heat Portland cement.

UNIT III *Text Book - 1* **(12)**

Building Rules and Bye-Laws : Zoning regulations, Regulations regarding layouts or sub-divisions, Building regulations, Rules for special type of buildings, Calculation of plinth, floor and carpet area, Floor space index.

Building Elements : Conventional signs, Guidelines for staircase planning, Guidelines for selecting doors and windows, Terms used in the construction of door and window, Specifications for the drawing of door and window.

UNIT IV *Text Book - 3* **(12)**

Analysis of Rates : Task or out - turn work, Labour and materials required for different works, Rates of materials and labour, Preparing analysis of rates for the following items of work: i) Concrete ii) RCC Works iii) Brick work in foundation and super structure iv) Plastering v) CC flooring vi) White washing.

PWD Accounts and Procedure of Works : Organization of Engineering department, Work charged establishment, Contract, Tender, Tender notice, Tender Schedule, Earnest money, Security money, Measurement book, Administrative approval, Technical sanction, Plinth area, Floor Area, Carpet area, Approximate Estimate, Plinth area estimate, Revised Estimate, Supplementary estimate.

UNIT V *Text Book - 1* **(12)**

Valuation : Cost, Price & value, Methods of valuation, Out goings, Depreciation, Methods for Estimating cost depreciation, Valuation of building.

Miscellaneous Topics : Gross income, Net income, Scrap value, Salvage value, Obsolescence, Annuity, Capitalized value, Years purchase, Life of structures, Sinking fund, Standard rent, Process of fixing standard rent, Mortgage.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Estimating & Costing in Civil Engineering by B.N. Dutta; UBS Publishers & Distributors, 2010.
2. Building Materials by P.C. Vergese, 1st Edition, PHI, 2009.

REFERENCE BOOK(s):

1. Engineering Materials by Rangawala, Charotar Publications, Fortieth Edition: 2013
2. Building construction by BC Punmia et al., 10th Edition,Laxmi Publications, 2008.
3. Building planning, designing and scheduling by Gurucharan Singh,Standard book House, 2006.

WEB RESOURCES:

1. http://nptel.iitm.ac.in/courses.php
2. http://freevideolectures.com/Course/86/Building-Materials-and-Construction
3. http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv053-Page1.htm
4. http://bookmoving.com/register.php?ref=Building%20materials%20rangwala

ChE-404A	ENERGY ENGINEERING (OPEN ELECTIVE)	L T P C 4 - - 3

COURSE OBJECTIVES:

1. To provide the knowledge about formation, classification, ranking, analysis, testing, carbonization, gasification and liquefaction of coal, manufacture of cock.
2. To provide the knowledge about design, occurrence, composition, classification, exploration and production of petroleum, refining, testing and analysis of petroleum products.
3. To provide knowledge about the non -conventional energy resources sun and wind.
4. To provide knowledge about the non -conventional energy resources like ocean thermal, geothermal energy, biomass and fuel cells.
5. To provide knowledge about the energy storage and related problems in the world and its solutions.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand the importance of environment and conservation of natural resources.
2. succeed in the competitive exams of energy industry.
3. utilize the non-conventional energies in place of conventional energies and its manufacture.
4. utilize the non- conventional energies in place of conventional energies and its manufacture.
5. maintain the sustainability in the environment.

UNIT I **(12)**

Conventional energy resources, the present scenario, scope for future development.

Coal : Origin, occurrence and reserves, classification, ranking, analysis and testing, coal carbonization, manufacture of coke, coal gasification, coal liquefaction.

UNIT II **(12)**

Petroleum : Origin, occurrence and reserves, composition, classification, characteristics, explorationand production-.

Petroleum Refining : petroleum products, testing and analysis of petroleum products, Refinery processes- Distillation, cracking, reforming and alkylation, polymerization& isomerization .

UNIT III **(12)**

Non-conventional energy sources - Solar energy : Solar energy, solar radiation, solar collectors-flat plate, concentrating (focusing and non-focusing)collectors , principles of heating and cooling, photo voltaic cells.

Wind energy : Basic principles, basic components, classification of WECS, types of wind machines (horizontal, vertical axis machines) Wind energy conversion systems- horizontal and vertical systems. Applications.

UNIT IV **(12)**

Non-conventional energy sources - Ocean thermal energy : Introduction, OTEC (Closed and open OTEC cycles), applications. Geothermal energy - introduction, sources, hydrothermal resources (Liquid and vapor dominated systems), applications.

Bio-mass energy - Introduction, conversion techniques, classification and Types of biogas plants, Hydrogen energy - Introduction,hydrogen production,storage and applications. Fuel cells-introduction, classification, types, advantages and applications.

UNIT V **(12)**

Energy storage : introduction, storage systems. Mechanical energy storage - pumped hydroelectric, compressed air, fly wheel storage. Electrical storage - lead acid battery. Chemical storage- via hydrogen, ammonia, chemical reactions.Thermal energy storage - latent, sensible heat storage. Solar pond

Energy Conservation : Conservation methods in process industries, Theoretical analysis, practical limitations, equipment for energy saving / recovery - recuperators, regenerators, pipes and pumps.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Non-conventional energy resources by G. D. Rai, Khanna Publishers(2004).
2. Engineering chemistry by Jain & Jain 15 th edition.

REFERENCE BOOK(s):

1. Conventional Energy technology by S.B.Pandy, Tata McGraw Hill (1987)
2. Elements of Fuels ,furnaces and refractories O.P.Gupta , Khanna publishers(2000)

ChE-404B	BIO-FUELS	L	T	P	C
	(OPEN ELECTIVE)	4	-	-	3

COURSE OBJECTIVES:

1. To provide the knowledge about properties, composition, features of bio fuels and uses of biomass and their environmental impacts.
2. To provide the students a substantial knowledge of bio fuel production technologies.
3. To provide knowledge about the process of biogas production and methods of production of biodiesel and comparison of the standards to the conventional diesel.
4. To provide knowledge about the production of lipids, bio hydrogen from different bacteria and algae.
5. To provide knowledge about the fuel cell technology

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. describe the functional principle of biofuel technologies in small and large scale.
2. describe the main steps and components in bioethanol, biodiesel and biogas production.
3. Participate actively in teamwork and work with case related problem solving.
4. work with professional problem solving in an industrial environment.
5. work in other fields of engineering.

UNIT I **(12)**

Types of biomass (e.g. wood waste, forestry residues, agricultural residues, perennial annual crops, organic municipal solid waste). Composition of lignocellulose (lignin, hemi cellulose, cellulose); energy crops; chemical pretreatment; enzymatic pretreatment; degradation of cellulose; trichodermacellulases; bacterial cellulases; and comparison with degradation of high starch crops.

Sources of energy, introduction of biofuels, availability of bio mass, composition of biomass, terrestrial biomass, aquatic biomass.Physical and chemical properties of biomass. Useful and undesirable features of biofuels.

UNIT II **(12)**

Biogas : The substrate, the digester, the microorganisms, the process of bio gas production, factors affecting bio gas yields, advantages, disadvantages.

Bioethanol : Bioethanol vs. Petrol, production of bio ethanol, ethanol recovery. Bio butanol.Properties and standards of bioethanol. Lignocellulosic biomass composition and characterizations.

UNIT III **(12)**

Sources and processing of biodiesel (fatty acid methyl ester); nature of lipids, especially fatty acids and triglycerides. Sources and characteristics of lipids for use as biodiesel feedstock; and conversion of feedstock into biodiesel (transesterification). Use of vegetable oil (SVO) and waste vegetable oil (WVO).

Engineering, economics and environmental issues of biodiesel; major policies and regulations pertaining to the production, distribution, and use of biodiesel. Comparison of bio diesel with conventional diesel. Standards of bio diesel, current technologies and challenges.

UNIT IV **(12)**

Hydrogen Production - Direct electrolysis of water, thermal decomposition of water, biological and biochemical methods of hydrogen production - Storage of Hydrogen - Gaseous, Cryogenic and Metal hydride.

Bio hydrogen : Production of bio hydrogen from anaerobic bacteria, photosynthetic algae, photosynthetic - hydrogenase system. Pyrolysis, bio-oil upgradation.

UNIT V **(12)**

Fuel cells : Enzymatic fuel cells, microbial fuel cells. Fuel Cell â€“ Principle of working, construction and applications.

Fuels for Fuel Cells : Hydrogen, Hydrocarbon fuels, effect of impurities such as CO, S and others.

LEARNING RESOURCES:

TEXT BOOK(s):

Robert C. Brown - Biorenewable Resources: Engineering, New Products from Agriculture, Wiley - Blackwell Publishing, 2003

REFERENCE BOOK(s):

1. Samir K. Khanal-Anaerobic Biotechnology for Bioenergy Production: Principles and Applications, Wiley - Blackwell Publishing 2008
2. Martin Kaltschmitt, Hermann Hofbauer - Biomass Conversion and Biorefinery, Springer Publishing, 2008.

CS-404A	JAVA PROGRAMMING (OPEN ELECTIVE)	L T P C 4 - - 3

COURSE OBJECTIVES:

1. To understand the basic concepts and fundamentals of platform independent object oriented language.
2. To demonstrate skills in writing programs using exception handling techniques and multithreading.
3. To understand streams and efficient user interface design techniques.
4. To know about various Telecommunication Systems.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. use the syntax and semantics of java programming language and basic concepts of OOP.
2. develop reusable programs using the concepts of inheritance, polymorphism, interfaces and packages.
3. apply the concepts of Multithreading and Exception handling to develop efficient and error free codes.
4. demonstrate how the java program communicates with the console and disk files using the concept of streams.
5. design event driven GUI and web related applications which mimic the real word scenarios.

UNIT I **(12)**

Introduction : The History and Evolution of Java, an Overview of Java.

Data Types, Variables, and Arrays : The primitive types, variables, type conversion and casting, Automatic Type Promotion in Expressions, Arrays, Operators, Control statements.

Introducing Classes : Class fundamentals, Declaring the objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this keyword, Garbage Collection, the finalize() Method.

A Closer Look at Methods and Classes : Overloading Methods, Using objects as Parameters, Returning Objects, Introducing Access control, Understanding static and final keywords, Nested and Inner Classes.

UNIT II **(12)**

Inheritance : Inheritance Basics, Using super, Creating multilevel Hierarchy, When Constructors are executed, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, using final with Inheritance.

Packages and Interfaces : Packages, Access Protection, Importing Packages, Interfaces, Default Interface Methods, Use static Methods in an Interface.

UNIT III **(12)**

String Handling : String class, StringBuffer class.

Exception Handling : Fundamentals, Exception types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses.

Multithreaded Programming : The Java Threaded Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Using isAlive() and join(), Thread Priorities, Synchronization, Inter Thread Communication.

UNIT IV **(12)**

I/O Basics : Streams, Byte streams, Character streams, Reading Console Input, Writing Console Output, Reading and Writing Files.

The Applet Class : Applet Basics, Applet Architecture, An Applet Skeleton, Simple Applet Display Methods, Requesting Repainting, The HTML APPLET Tag, Passing Parameters to Applets.

UNIT V **(12)**

Event Handling : Two Event Handling Mechanisms, The Delegation Event Model, Event Classes, The KeyEvent Class, Sources of Events, Event Listener Interfaces, Using The Delegation Event Model, Adapter Classes.

Introducing the AWT : Working with Windows, Graphics and Text, Using AWT Controls, Layout Managers and Menus.

LEARNING RESOURCES:

TEXT BOOK(s):

Java The Complete Reference 9th Edition, Herbert Schildt, Mc Graw Hill Education (India) Private Limited, New Delhi.

REFERENCE BOOK(s):

1. Java How to Program, Sixth Edition, H.M.Dietel and P.J.Dietel, Pearson Education/PHI.
2. Introduction to Java programming, By Y.Daniel Liang,Pearson Publication.

CS-404B	DATABASE MANAGEMENT SYSTEMS (OPEN ELECTIVE)	L T P C 4 - - 3

COURSE OBJECTIVES:

1. To understand the fundamental concepts, historical perspectives, current trends, structures, operations and functions of different components of Databases.
2. To understand the types of integrity constraints in a relational database system and the concepts of SQL to create and access the database.
3. To understand basic concepts of ER model and database design using normalization process.
4. To understand concurrency, Recovery techniques.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand basic concepts and use of various database systems.
2. enforce integrity constraints to maintain validity & accuracy.
3. write relational expressions for the queries.
4. design and develop a database using normalization theory.
5. use different concurrency control and Recovery techniques.

UNIT I **(12)**

Databases and Database Users : Introduction - An Example - Characteristics of the Database Approach - Actors on the Scene - Workers behind the Scene - Advantages of Using the DBMS Approach.

Database System Concepts and Architecture : Data Models, Schemas, and Instances - Three-Schema Architecture and Data Independence - Database Languages and Interfaces - The Database System Environment - Centralized and Client/Server Architectures for DBMSs

UNIT II **(12)**

Data Modeling Using the Entity-Relationship (ER) Model : Using High- Level Conceptual Data Models for Database Design - An Example Database Application - Entity Types, Entity Sets, Attributes, and Keys - Relationship Types, Relationship Sets, Roles, and Structural Constraints - Weak Entity Types.

The Relational Data Model and Relational Database Constraints : Relational Model Concepts - Relational Model Constraints and Relational Database Schemas - Update Operations, Transactions, and Dealing with Constraint Violations.

UNIT III **(12)**

SQL-99 : Schema Definition, Constraints, Queries, and Views : SQL Data Definition and Data Types - Specifying Constraints in SQL - Schema Change Statements in SQL - Basic Queries in SQL â€“ More Complex SQL Queries - INSERT, DELETE, and UPDATE Statements in SQL - Views (Virtual Tables) in SQL.

UNIT IV **(12)**

Functional Dependencies and Normalization for Relational Databases : Informal Design Guidelines for Relation Schemas - Functional Dependencies - Normal Forms Based on Primary Keys - General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form.

Introduction to Transaction Processing Concepts and Theory :

Introduction to Transaction Processing - Transaction and System Concepts - Desirable Properties of Transactions - Characterizing Schedules Based on Recoverability -Characterizing Schedules Based on serializability.

UNIT V **(12)**

Concurrency Control Techniques : Two-Phase Locking Techniques for Concurrency Control - Concurrency Control Based on Timestamp Ordering.

Database Recovery Techniques : Recovery Concepts - Recovery Techniques Based on Deferred Update - Recovery Techniques Based on Immediate Update - Shadow Paging.

LEARNING RESOURCES:

TEXT BOOK(s):

Fundamentals of Database Systems, Ramez Elmasri and SHamKanth B.Navate Pearson Education, 5th edition.

REFERENCE BOOK(s):

1. Introduction to Database Systems, C.J.Date Pearson Education.
2. Data Base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGrawHill, 3rdEdition.
3. Data base System Concepts, Abraham Silberschatz, Henry.F.Korth, McGraw hill, 5th edition.

EC-404A	APPLIED ELECTRONICS (OPEN ELECTIVE)	L T P C 4 - - 3

COURSE OBJECTIVES:

1. To understand about various modern electronic systems.
2. To provide clear explanation of the operation of all the important electronic devices and systems available.
3. To know about modern audio and video systems.
4. To know about various Telecommunication Systems.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand the working, types and applications of microphones and loudspeakers.
2. understand the features of commercial, theatre sound recording and colour TV standards
3. understand the working of various electronic systems, telecommunication and switching systems.
4. understand the working of various applications like digital clocks, fiber optics, microprocessor and mobile radio systems.
5. understand consumer electronic equipment and systems like washing machines.

UNIT I *Text Book - 1* **(12)**

Microphones : Characteristics of microphones, Types: Carbon microphones, moving coil microphones, ribbon microphones, electret microphones and wireless microphones. **Headphones :** Headphones and Headsets, Types of headphones. **Loud Speakers :** Ideal loudspeaker, Types: Crystal loudspeaker, electrostatic loudspeaker, permanent magnet loudspeaker, **High frequency loudspeakers:** Horn type tweeters, Equalizers and Mixers.

UNIT II *Text Book - 1,2* **(10)**

Commercial Sound : Recording, manual synthesizer, programmed synthesizer, public address systems, speaker matching systems, PA-system characteristics, Theatre Sound System. **Color TV standards and Systems :** Primary and secondary colors, Luminance signal, Chrominance signal, color TV camera tube, color TV picture tube, NTSC system PAL system SECAM system.

UNIT III *Text Book - 1,2* **(10)**

Audio systems, Video Systems, Remote Controls, Modulation Techniques, Carrier Systems, Telecommunication Systems: telephone receivers and handsets, signaling-CCITT NO7, modes of operation, **Switching Systems :** principle,Read relay and cross bar switching, PBX switching, stored program control.

UNIT IV *Text Book - 1,2* **(10)**

Fiber Optics, Data Services, digital clocks, microprocessor, microcontroller, Mobile radio systems: wireless local loop (WLL), role of WLL, radio paging service, digital cellular block diagram, establishing a call, Fascimile (FAX).

UNIT V *Text Book - 2* **(10)**

IN-CAR Computers : Electronic ignition, electronic ignition lock system, ABS, Electronically controlled suspension (ECS), instrument pannel display, air-bag system. Washing machines: Electronic controller for washing machine, washing machine hardware, washing cycle, software and hardware development, refrigeration systems.

LEARNING RESOURCES:

TEXT BOOK(s):

S.P.Bali - Consumer Electronics-Pearson Education, ISBN: 9788131717592, first impression-2008.

REFERENCE BOOK(s):

1. Philip Herbert Hoff -Consumer Electronics for Engineers -Cambridge University Press, 1998, ISBN-10: 0521582075
2. Ronald K.Jurgen -Digital Consumer Electronics Handbook -(Editor) by McGraw Hill Professional Publishing, 1997. ISBN-10: 0070341435

WEB RESOURCES:

1. http://nptel.iitm.ac.in/courses/
2. http://www.newagepublishers.com/samplechapter/000969.pdf
3. http://www.bits-pilani.ac.in:12354/qp1-9-10/EEE_C414_851_C_2009_1.pdf

EC-404B	BASIC COMMUNICATION (OPEN ELECTIVE)	L T P C 4 - - 3

COURSE OBJECTIVES:

1. To understand an overview of communication systems.
2. To understand the modulation technique, need of modulation,Amplitude modulation.
3. To understand fundamentals of digital communications.
4. To understand broadband communication systems and Television fundamentals.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand transmission of analog signals using amplitude modulation.
2. understand the transmission of digital signals through PCM, PAM, PPM and DELTA Modulation techniques
3. know about various Broad band communication systems.
4. know about the monochrome and colourTelevision fundamentals.
5. know about Optical communication systems.

UNIT I *Text Book - 1* **(10)**

Communications : Communications systems, Information, Transmitter, Channel, noise, Receiver, Modulation, Description, Need for modulation, Bandwidth Requirements.

Amplitude Modulation : Amplitude Modulation Theory, Frequency spectrum of the AM wave, Representation of AM, Power relations in the AM wave, Generation of AM, Basic requirements, comparison of levels, Grid modulated class C amplifier, Plat modulated class C amplifier, Modulated transistor amplifiers.

UNIT II *Text Book - 2* **(12)**

Digital Communications : Digital Technology, Digital fundamentals, sampling theorem, aliasing effect, pulse amplitude modulation (PAM), synchronization in PAM systems, pulse time modulation, spectra of PDM and PPM systems, Elements of pulse code modulation (PCM), sampling and quantization, encoding, regeneration, decoding, DPCM, delta modulation.

UNIT III *Text Book - 1* **(10)**

Broadband Communications Systems : Multiplexing,Frequency division multiplex, Time â€“ division multiplex, **Short and Medium Haul Systems :** Co-axial Cables, Fiber optic links, Microwave links, **Long Haul Systems :** Satellite Communications, Elements of Long-Distance Telephony, Routing codes and signaling systems, Telephone exchanges (switches) and routing.

UNIT IV *Text Book - 3* **(10)**

Television Fundamentals : TV transmitter and receivers, synchronization, image continuity, interlaced scanning, flicker, picture resolution, horizontal and vertical sync details, number of scanning lines, scanning sequence details.

Essentials of colour television : colour perception, three colour theory, luminance, hue, saturation, colour difference signals.

UNIT V *Text Book - 1* **(10)**

OPTICAL COMMUNICATIONS History and development, nature of light:reflection, refraction, dispersion, diffraction, absorption, scattering, Optical fiber losses, fiber cables, types of fibers.

LEARNING RESOURCES:

TEXT BOOK(s):

1. George Kennedy-Electronic Communication Systems -Tata McGraw-Hill Publishing , 5th Edition,2011
2. Simon HykinS, Communication Systems, 2nd Edition-reprint 2010
3. R.R. Gulati - Modern Television Practice - Principles, Technology and Service- New Age International Publication, 2009.

REFERENCE BOOK(s):

1. Simon HykinS - Introduction to Analog and Digital Communication, 2007
2. John M Senior - Optical Fiber Communications - An imprint of Pearson Education, 3rd Edition, 2009

WEB RESOURCES:

1. http://nptel.iitm.ac.in/courses/
2. http://web.engr.oregonstate.edu/~magana/ECE461-561/index.htm
3. http://www.ensc.sfu.ca/~jiel/courses/327/index.html
4. http://www.ece.utah.edu/~npatwari/ece5520/lectureAll.pdf

EE-404A	NON-CONVENTIONAL ENERGY SOURCES (OPEN ELECTIVE)	L	T	P	C
		4	-	-	3

COURSE OBJECTIVES:

1. To know the depletion rate of conventional energy resources and importance of renewable energy resources.
2. To know the importance of Energy Storage Devices.
3. To know alternate viable energy sources to meet the energy requirements.
4. To discuss about solar energy, wind energy, tidal energy and geothermal energy as alternate resources.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. know the national scene of energy production, utilization, consumption and energy storage systems.
2. understand about the basics of solar energy, collectors & generation of electricity from solar energy &photovoltaic's.
3. understand the assessment of wind energy potential, wind turbines and wind generators.
4. know about ocean energy, temperature differences & principles, extraction of energy from waves.
5. understand about geothermal, types & how biogas is produced & digester for power generation.

UNIT I *Text Book - 1,2* **(12)**

Principle of Renewable Energy : Comparison of renewable and conventional energy sources - Ultimate energy sources - natural energy currents on earth - primary supply to end use - Spaghetti & Pie diagrams - energy planning - energy efficiency and management.

Energy Storage Systems : Pumped Hydro - Compressed air storage-Energy storage by fly wheels-Electrical battery storage - Thermal sensible energy storage - Latent heat energy storage.

UNIT II *Text Book - 2* **(12)**

Solar Energy : Extra terrestrial solar radiation - terrestrial solar radiation - solar thermal conversion-solar thermal central receiver systems, Solar pond, Distributed systems.

Photovoltaic's : Photovoltaic energy conversion - solar cell - Construction - conversion efficiency & output-VI characteristics.

UNIT III *Text Book - 2* **(12)**

Wind energy : Planetary and local winds - vertical axis and horizontal axis wind mills.

Principles of wind power : maximum power - actual power - wind turbine operation - electrical generator.

UNIT IV *Text Book - 1,2* **(12)**

Energy from Oceans : Ocean temperature differences - principles of OTEC plant operations.

Wave energy : devices for energy extraction - tides - simple single pool tidal system, two pool tidal system.

UNIT V *Text Book - 1* **(12)**

Geothermal Energy : Origin and types: Hydrothermal, Geo-pressurized & Petro thermal.

Bio fuels : Classification - direct combustion for heat and electricity generator - anaerobic digestion for biogas - biogas digester - power generation.

LEARNING RESOURCES:

TEXT BOOK(s):

1. JohnTwidell & Toney Weir - Renewable Energy Sources, E&F.N. Spon
2. EL-Wakil - Power Plant Technology, McGraw-Hill Publications.

REFERENCE BOOK(s):

1. G.D.Rai - Non-Conventional Energy Sources, Khanna Publishers.
2. Abbasi & Abbasi - Renewable Energy Sources, Their impact on global warming and pollution, PHI.

WEB RESOURCES:

1. http://www.tn.gov.in/spc/tenthplan/CH_11_2.PDF
2. http://bieap.gov.in/Nonconventionalenergysources
3. http://www.em-ea.org/Guide%20Books/book4/4.12App%20of%20Non%20conventional

EE-404B	UTILIZATION OF ELECTRICAL ENERGY (OPEN ELECTIVE)	L	T	P	C
		4	-	-	3

COURSE OBJECTIVES:

1. To know about the different types of lamps & lighting schemes.
2. To know about the different types electric heating methods.
3. To know the design heating elements such as furnaces and ovens.
4. To know to utilize the electrical energy for production of heat and welding process.
5. To provide specific knowledge on Principles and characteristics of storage batteries.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. get overall idea for the different types of lamps & lighting schemes.
2. know about the different types electric heating methods.
3. know the designing of heat elements such as furnaces and ovens.
4. know how to utilize the electrical energy for production of heat and welding process.
5. gain knowledge on principles and characteristics of storage batteries.

UNIT I *Text Book - 1* **(12)**

Illumination : Introduction- terms used in illumination-laws of illumination - Square law methods of calculation.

Gas discharge lamps - Fluorescent lamps - Arc lamps - Filament lamps - Comparison between filament and fluorescent lamps.

UNIT II *Text Book - 1* **(12)**

Lighting schemes & Introduction to Electric heating : Factory lighting - flood lighting and street lighting-design of lighting schemes-introduction to Compact Fluorescent Lamps.

Introduction-Modes of heat transfer - Stefan's law - Classification of electric heating methods

UNIT III *Text Book - 1* **(12)**

Electric Heating element Design and types of furnaces : Design of heating element - Construction and working of different types of induction furnaces -resistance furnace - arc furnaces.

Dielectric heating, Dipole formation, generation of dielectric heat and applications.

UNIT IV *Text Book - 1* **(12)**

Welding : Introduction- Types of welding - resistance and arc welding -Characteristics of Carbon and metallic arc welding - comparison, welding equipment.

Requirements of good weld, comparisons of A.C and D.C weld (Excluding electronic controls)

UNIT V *Text Book - 2* **(12)**

Storage batteries : Types of cells. Lead acid cell, Nickel Iron cell, Chemical changes during charging and discharging. Applications - rating - classification-dry cell and wet cells.

Methods of charging & common troubles : Charging and discharging of lead acid cells, methods of charging lead acid batteries - over discharging common troubles with lead acid batteries and remedies - Nickel cadmium batteries.

LEARNING RESOURCES:

TEXT BOOK(s):

1. J.B. Gupta - Utilization Electric Power and Electric Traction, Katson books publishers, Tenth Edition, 2012.
2. Utilization, generation & conservation of electrical energy by Sunil S Rao, Khanna publishers, Sixth Edition, 2005.

REFERENCE BOOK(s):

1. Partab H - Art and Science of Utilization of Electrical Energy, Dhanpat Rai and Sons, New Delhi, Second Edition, 2009.
2. R.K.Rajput - Utilization of Electric Power, Laxmi publications Private Limited, Second Edition, 2013.
3. G.C.Garg - Utilization of Electric Power and Traction, Kanna publishers, Ninth Edition, 2014.

WEB RESOURCES:

1. http://nptel.iitm.ac.in/video.php?subjectId=108105060
2. http://web.mit.edu/lien hard/www/ahttv201.pdf
3. http://www.comp-as.com/pdf/Article03.pdf
4. www.srmuniv.ac.in/downloads/welding.doc

IT-404A	SOFTWARE ENGINEERING (OPEN ELECTIVE)	L T P C 4 - - 3

COURSE OBJECTIVES:

1. To understand Basic concepts on Software Engineering methods and practices.
2. To understand Software Process Models and Software Development Life Cycle.
3. To understand requirements analysis and design of software development.
4. To know Software Development life cycle for Web app.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. identify, formulate, and solve Software Engineering problems.
2. elicit, analyze and specify software requirements for various stakeholders.
3. familiar with Design, development, deployment and maintenance of a software project.
4. familiar with Architecture design and User Interface design
5. apply software engineering paradigms to web apps.

UNIT I *Text Book - 1* **(12)**

INTRODUCTION TO SOFTWARE ENGINEERING : The Evolving Role of Software, Software, The Changing Nature of Software, Legacy Software, Software Myths.

A GENERIC VIEW OF PROCESS : Software Engineering - A Layered Technology, A Process Framework, The CMMI, Personal and Team Process Models.

UNIT II *Text Book - 1,2* **(12)**

PROCESS MODELS : The Waterfall Model, Incremental Process Models, Evolutionary, Agile Process Model.

SOFTWARE ENGINEERING PRACTICE : Software Engineering Practice, Communication Practices, Planning Practices, Modeling Practices, Construction Practice, Deployment.

UNIT III *Text Book - 1,2* **(12)**

REQUIREMENTS ENGINEERING : A Bridge To Design and Construction, Requirements Engineering Tasks, Initiating the Requirements Engineering Process, Eliciting Requirements, Developing Use-cases, Building the Analysis Model, Negotiating Requirements, Validating Requirements.

DESIGN ENGINEERING : Design within the Context of Software Engineering, Design Process and Design Quality, Design Concepts, The Design Model.

UNIT IV *Text Book - 1,2* **(12)**

CREATING AN ARCHITECTURAL DESIGN : Software Architecture, Data Design, Architectural Styles and Patterns, Architectural Design. PERFORMING USER INTERFACE DESIGN: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation.

UNIT V *Text Book - 2* **(12)**

INITIATING A WEBAPP PROJECT : Formulating Web-Based systems, Planning for Web Engineering projects

ANALYSIS FOR WEBAPPS : Requirements Analysis for WebApps, Analysis Model for WebApps, The Content Model, The Interaction Model.

LEARNING RESOURCES:

TEXT BOOK(s):

Roger S.Pressman, 'Software Engineering- A Practitioner's Approach', 6th Edition, McGraw- Hill International, 2009.

REFERENCE BOOK(s):

1. Ian Sommerville, 'Software Engineering', 6th Edition, Pearson Education, 2014.
2. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, 'Fundamentals of Software Engineering', 2nd Edition, PHI,2002.
3. RajibMall, 'Fundamentals of Software Engineering', 3rd Edition, PHI, 2013.

IT-404B	WEB TECHNOLOGIES (OPEN ELECTIVE)	L T P C 4 - - 3

COURSE OBJECTIVES:

1. To understand basic technologies to develop web documents.
2. To understand design web pages with css and apply scripting to web documents.
3. To understand design dynamic web pages with javascript.
4. To understand concepts of php and database access.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. apply technologies to develop web documents.
2. design web pages with css and apply scripting to web documents.
3. create dynamic web pages with javascript.
4. create valid and well-formed xml documents.
5. write server side scripts with php and database access.

UNIT I **(12)**

Fundamentals : A Brief introduction to the Internet, The World Wide Web, Web Browsers, Web Servers, Uniform Resource Locators, Multipurpose Internet Mail Extensions, The HTTP.

Introduction to XHTML : Origins and evolution of HTML, and XHTML, Basic Syntax, Standard XHTML, Document structures, Basic Text markup, images, hypertext links, lists, tables, forms, frames, syntactic differences between HTML & XHTML.

UNIT II **(12)**

Cascading Style Sheets (CSS) : introduction, levels of style sheets, style specification formats, selector forms, property value forms, font properties, list properties, color, alignment text, The Box model, Background images, the span and div tags.

The Basics of JavaScript : Overview of JavaScript, Object orientation and JavaScript, General Syntactic characteristics, primitives, operations and expressions, Screen output and keyboard input, control statements.

UNIT III **(12)**

JavaScript : Object creation and modification, Arrays, Functions, An Example, Constructors, Pattern matching using regular expressions, Errors in scripts.

JavaScript and HTML Documents : The JavaScript Execution Environment, The Document Object Model, Element accessing in JavaScript, Events and Event Handling, Handling Events from Body elements, Handling events from Button elements, Handling Events from Text boxes and password elements, The DOM 2 Event model, The Navigator object.

UNIT IV **(12)**

Dynamic Documents with JavaScript : Introduction, Element Passing, Moving Elements, Element Visibility, Changing colors and Fonts, Dynamic Content, Stacking Elements, Locating the mouse cursor, Reacting to mouse click, slow movement of elements, dragging and dropping elements.

Introduction to XML : Introduction, The syntax of XML, XML document structure, Document Type Definition, Namespaces, XML Schemas, Displaying Raw XML documents, displaying XML documents with CSS, XSLT Style sheets.

UNIT V **(12)**

Introduction To PHP : Origins and uses of PHP, Overview of PHP, General Syntactic Characteristics, primitives, Operations and Expressions, Output, Control Statements, Arrays, Functions, Pattern Matching, Form Handling.

Database Access through the web : Relational Databases, An Introduction to the Structured Query Language, The MYSQL Database System, Database Access with PHP and MYSQL.

LEARNING RESOURCES:

TEXT BOOK(s):

Robert W. Sebesta, Programming the World Wide Web, 4/e Pearson Education.

REFERENCE BOOK(s):

1. Harvey M. Deitel and Paul J. Deitel, Internet & World Wide Web How to Program, 5/e, Pearson Education.
2. Jeffrey C. Jackson Web Technologies - A Computer Science Perspective, Pearson Education, 1st Edition.
3. Jason Cranford Teague, Visual Quick Start Guide CSS, DHTML & AJAX, Pearson Education, 4th Edition.

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

ME-404A	ROBOTICS (OPEN ELECTIVE)	L T P C 4 - - 3

COURSE OBJECTIVES:

1. To provide an introduction to Robotics and Automation including robot classification, design and selection, analysis and applications in industry.
2. To provide information on various types of end effectors, their design, interfacing and selection.
3. To provide the details of operations for a variety of sensory devices that are used on robot , the meaning of sensing, classification of sensor, that measure position, velocity & acceleration of robot joint.
4. To familiarize the basic concepts of transformations performed by robot.
5. To perform kinematics and to gain knowledge on programming of robots.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand basic components of robotics, classification of robots and their applications.
2. know on types of robot grippers, their usage and design considerations.
3. understand about various types of sensory devices their working and applications.
4. apply basic transformations related to the movement of manipulator.
5. design a robot mechanism to meet kinematics requirements and to write simple programs.

UNIT I *Text Book - 1* **(12)**

Basics of Robot : Introduction to Robotics, major component of a robot, robotic like devices, classification of robots - Classification by coordinate system and by control method, Specifications of robots, fixed versus flexible automation.

Applications of robot : Economic analysis, Robot applications in Material Handling, Processing and assembly.

UNIT II *Text Book - 1* **(12)**

Robot End Effectors : Introduction, end effectors, interfacing, types of end effectors, grippers and tools.

Selection : Selection and Design Considerations of End effectors, Remote Centre Compliance device.

UNIT III *Text Book - 1* **(12)**

Robotic Sensory Devices : Position Sensors : Objective, Non-optical position sensors - potentiometers, synchros, inductocyn, optical position sensors - opto interrupters, optical encoders (absolute & incremental).

Proximity Sensors : Contact type, non-contact type - inductive, capacitive proximity sensors, optical proximity sensor, and scanning laser proximity sensor.

UNIT IV *Text Book - 1* **(12)**

Touch and Slip Sensors : Proximity rod & photo detector tactile sensor, slip sensors - Forced oscillation slip sensor, interrupted type slip sensors.

Transformations : Objectives, homogenous coordinates, basic transformation operations, fixed angle representation, Euler angle representation.

UNIT V *Text Book - 2* **(12)**

Forward Kinematics : Forward solution - Denavit Hartenberg procedure. Simple problems involving 2 and 3 DOF manipulators, SCARA manipulator.

Robot Programming : Robot programming Languages - VAL Programming - Motion Commands, Sensor Commands, End effecter commands, and Simple programs.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Robotic Engineering by Richard D.Klafter, Prentice-Hall of India Pvt Ltd, 2010.
2. Robotics and Control, R.K. Mittal and I.J. Nagarath, TMH, 2005.

REFERENCE BOOK(s):

1. Introduction to Robotics: Mechanics And Control, John J.Craig 3rd Edition, Pearson, 2008.
2. Robotics: Control, Sensing, Vision, and Intelligence, K. S. Fu, R. C. Gonzales, and C. S. G. Lee, Tata McGraw-Hill, NY, 2008.
3. Introduction to Robotics: Analysis, Systems, Applications, Saeed B. Niku, Prentice Hall, NJ, 2010.

WEB RESOURCES:

1. http://nptel.iitm.ac.in/courses.php?branch=Mechanical
2. http://academicearth.org/courses/introduction-to-roboticsVideo references:-

ME-404B	OPERATIONS RESEARCH (OPEN ELECTIVE)	L T P C 4 - - 3

COURSE OBJECTIVES:

1. To understand the methodology of OR problem solving and formulate linear programming problem.
2. To develop formulation skills in transportation models and finding solutions
3. To understand the basics in the field of game theory and assignment problems
4. To know how project management techniques help in planning and scheduling a project
5. To know the basics of dynamic programming and simulation.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. recognize the importance and value of Operations Research and linear programming in solving practical problems in industry
2. Interpret the transportation models' solutions and infer solutions to the real-world problems.
3. recognize and solve game theory and assignment problems.
4. gain knowledge of drawing project networks for quantitative analysis of projects
5. know when simulation and dynamic programming can be applied in real world problems.

UNIT I **(12)**

Linear Programming : Definition and Scope of Operations Research, Mathematical formulation of the problem, graphical method, Simplex method, artificial basis technique, dual Simplex method. Degeneracy, alternative optima, unbounded solution, infeasible solution.

UNIT II **(12)**

Transportation Problem : Introduction to the problem, LP formulation of a transportation problem. Basic feasible solution by north-west corner method, Vogel's approximation method, least cost method. Finding optimal solution by MODI method, degeneracy, unbalanced transportation problem and Maximization in transportation model.

UNIT III **(12)**

Assignment Problem : One to one assignment problem, optimal solutions, unbalanced assignment matrix, travelling sales man problem, maximization in A.P.

Theory of Games : Introduction, rectangular two person zero sum games, solution of rectangular games in terms of mixed strategies, solution of 2x2 games without saddle point, concept of dominance to reduce the given matrix, Graphical method for 2xn and nx2 games.

UNIT IV **(12)**

Project Planning through Networks : Introduction, Basic steps in PERT/CPM techniques, Network diagram representation, Rules of drawing network diagram, Fulkerson's rule, Time estimates and Critical path in network analysis, floats, Project evaluation and review technique, Application areas of PERT/CPM techniques.

UNIT V **(12)**

Dynamic Programming : Introduction, Characteristics of D.P. model, the recursive equation approach, Computational Procedure in dynamic Programming, solution of an L.P. by D.P.

Simulation : Introduction, Monte-Carlo Simulation, Application to Inventory Control, Application to Queuing Problems.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Operations Research - S.D.Sharma, Kedar nath Ram nath & Co, 2008.
2. Operations Research - Theory and Applications, J.K Sharma, Macmillan Publications India Ltd, 2013

REFERENCE BOOK(s):

1. Operations Research - H.A.Taha, Pearson, 7th Edition, June 2002.
2. Introduction to Operations Research - Hiller and Liberman, MGH, 7th Edition, 2002.

WEB RESOURCES:

1. http://www2.informs.org/Resources/
2. http://www.mit.edu/~orc/
3. http://www.ieor.columbia.edu/
4. http://www.universalteacherpublications.com/univ/ebooks/or/Ch1/origin.htm

EC-405 INDUSTRIAL MANAGEMENT & ENTREPRENEURSHIP L T P C
4 - - 3

COURSE OBJECTIVES:

1. To provides the students with a foundation of knowledge in management of organizations.
2. To provides a business organization which produces a very good quality products but it must satisfy the needs, wants and desires of the consumer.
3. To alerts the students to understand the time value of money for evaluation of several project alternatives.
4. To give knowledge to the students for avoiding any delays in production processes due to non availability of material by effectively managing the function of materials management.
5. To sensitize the students to the changing environment and its implication for managing the human resources to achieve the corporate excellence in a changing environment.
6. To give an idea to the students to get the infornmation about the different set of organizations and to develop themselves as successful entrepreneurs.
7. To give an idea about which form of business organization is suitable for todayâ€™s business environment and their impact towards society.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand the customer perception, making him to buy the products and retaining the customer in a business.
2. get knowledge about time value of money in the changing society and to get awareness about the calculation of several assets for tax purpose.
3. linkage corporate vision, mission, strategies, and policies to human resource management to acquire competitive advantage and to frame strategies to develop talent and to retaining talent.
4. become aware of the inference of organization structure and performance of people working in organizations and to develop themselves as individual entrepreneurs for the society.
5. get awareness of managing the projects in various organizations by using different techniques.

UNIT I *Text Book - 1* **(10)**

GENERAL MANAGEMENT : Management Concept, Managerial Roles,Managerial Skills, Brief treatment of managerial functions,Scientific Principles of Management, Administrative Principles of Management.

MARKETING MANAGEMENT : Functions of Marketing, Marketing Mix, Product life cycle, Channels of distribution, Marketing Segmentation, Advertising & Sales promotion, Market Research.

UNIT II *Text Book - 1,2* **(12)**

FINANCIAL MANAGEMENT : Objectives of Financial Management, Concept of interest, compound interest, equivalent cash flow diagram.

ECONOMIC EVALUATION OF ALTERNATIVES : Basic methods, the annual equivalent method, present worth method, future worth method.

MATERIAL MANAGEMENT : Functiions of Materials Management, Material Requirement Planning, Purchasing, Objectives of Purchasing, Source Selection, Procurement Methods, Vendor Rating, Inventory Management - EOQ, EPQ, ABC Analysis, FSN Analysis,VED Analysis.

UNIT III *Text Book - 1* **(10)**

HUMAN RESOURCE MANAGEMENT : Functions of Human Resource Management - Job Analysis, Human Resources Planning, Brief treatment of Recruitment, Selection, Placement, Induction & Orientation, Training and Development, Performance Appraisal, Job Evaluation, Career Planning and Development, Stress Management, Compensation.

Directing : Motivation and Leadership, Theories of motivation and styles of Leadership.

UNIT IV *Text Book - 3,4* **(10)**

ENTREPRENEURSHIP DEVELOPMENT : Introduction, Entrereprenuerial Characteristics,Functions of an Entrepreneur,Factors affecting Entrepreneurship, Profiles of Successful Entreprenuers, Women Entrepreneurship concept, Strategies for the development of Women Entreprenuers

Forms of business organisation : Salient features of sole proprietorship. Partnership, Joint Stock Company, Private limited and public limited companies.

UNIT V *Text Book - 5* **(8)**

PROJECT MANAGEMENT : Project Definition, Project life cycle, Roles & responsibilities of a Project Manager, Problems in Managing a Project, Project Planning & Controlling techniques : Basics of PERT & CPM, Problems

LEARNING RESOURCES:

TEXT BOOK(s):

1. KK Ahuja, Industrial Management, Vol. I & II, Dhanpat Rai, 1978.
2. E.Paul Degarmo, John R Chanda, William G Sullivan, Engineering Economy, Mac Millan Publishing Co, 1979.
3. Poornima M Charantimath, Entreprenurship Development Small business environment ,Pearson Education Publishers , 2006 Edition.
4. Shivganesh Bhargav, Entrepreneurial Management, Sage Publications, 2008.
5. Prasanna Chandra , Projects, Tata McGrawhill Education,2013 Edition,

REFERENCE BOOK(s):

1. Philip Kotler, Marketing Management, 11th Edition, Pearson Education, 2004.
2. P. Gopalakrishnan, Hand Book of Materials Management, PHI, 1999.
3. Gary Dessler, Human Resource Management,11th Edition, 2008.
4. Heinz Weirich and Harold Koontz, Management, 10th Edition, TMH, 2004.

WEB RESOURCES:

1. www.managementstudyguide.com : Describes the Concepts of Management & Its Operational Functions.
2. www.1000ventures.com : Describes about Management Gurus, Business Gurus.
3. www.citehr.com : Describes the Human Resource Management Topics.

EC-406A	DIGITAL IMAGE PROCESSING (ELECTIVE - IV)	L T P C 4 - - 3

COURSE OBJECTIVES:

1. To understand the use of digital image fundamental steps and the role human Visual system plays in perception of gray image data and various application of image processing in industry, medicine.
2. To understand different methods for smoothening and sharpening of digital images as part of enhancement in spatial and frequency domain methods.
3. To understand various image Restoration techniques and color image processing.
4. To understand different types of lossless and lossy compression techniques and their applications, and Morphological image processing concepts.
5. To understand different types of filters and algorithms used for segmentation, Understand the different representation techniques, boundary and regional descriptors which are used for image analysis.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand image formation and the role of human visual system of various applications of image processing in industry, medicine and defense.
2. learn the image processing algorithms and techniques for image enhancement in spatial and frequency domain.
3. understand various image restoration techniques and color image processing.
4. understand the image compression techniques and Morphological image processing.
5. learn various types of algorithms used for segmentation, recognition, representation and description.

UNIT I **(10)**

INTRODUCTION : Origin of Digital Image Processing, Fields that uses Digital Image Processing, Fundamental steps in Digital Image Processing, Components of an Image Processing System.

DIGITAL IMAGE FUNDAMENTLS : Elements of Visual perception, Image sampling and Quantization, Basic relationships between Pixels, Linear and Non-linear operations.

UNIT II **(10)**

IMAGE ENHANCEMENT IN SPATIAL DOMAIN : Some basic Grey level transformations, histogram processing, enhancement using Arithmetic/Logic operations, Smoothing Spatial Filters, Sharpening Spatial Filters.

IMAGE ENHANCEMENT IN FREQUENCY DOMAIN : Introduction to Fourier Transform and the Frequency Domain, Smoothing Frequency Domain Filters, Sharpening Frequency Domain Filters.

UNIT III **(10)**

IMAGE RESTORATION : Noise models, Restoration in the presence of Noise, only Spatial Filtering, Periodic Noise reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations, Inverse Filtering, Wiener Filtering.

COLOR IMAGE PROCESSING : Color model, Pseudo Color image processing, color transformation, Smoothing and shaping, color segmentation

UNIT IV **(10)**

IMAGE COMPRESSION : Fundamentals - Image Compression models - Error Free Compression, Lossy Compression.

MORPHOLOGICAL IMAGE PROCESSING : Preliminaries, Erosion and Dilation, Opening and Closing, Morphological Algorithms- Boundary Extraction, Hole Filling, Extraction of Connected Components, Convex Hull, Thinning, Thickening.

UNIT V **(10)**

IMAGE SEGMENTATION : Detection of discontinuities, Thresholding, Edge based Segmentation and Region based Segmentation.

IMAGE REPRESENTATION AND DESCRIPTION : Representation schemes, Boundary Descriptors, Regional Descriptors.

LEARNING RESOURCES:

TEXT BOOK(s):

R C Gonzalez and Richard E Woods - Digital Image Processing, Pearson Education, Third Edition, 2015

REFERENCE BOOK(s):

A K Jain - Digital Image Processing, PHI, 1989

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

EC-406B FUNDAMENTALS OF GLOBAL POSITIONING SYSTEM L T P C
(ELECTIVE - IV) 4 - - 3

COURSE OBJECTIVES:

1. To know the evolution of of global positioning system .
2. To know the principles of global positioning system.
3. To know various global navigational satellite systems such as GPS, GALILEO, GLONASS.
4. To know various GPS segments and signal structure.
5. To understand different coordinate systems in GPS.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand history of GPS and new trends in the GPS.
2. calculate GPS satellite orbit positions and velocities.
3. define the fundamental working principle of GPS and outline its development.
4. describe global satellite navigation systems, satellite orbital characteristics, and satellite signal structure.
5. define coordinates systems likely to be encountered by GPS users and calculate and discuss GPS coordinates.

UNIT I (10)

Introduction to Global Navigation Satellite Systems(GNSSs) : The History of GPS, The Evolution of GPS, Development of NAVSTAR GPS, Block I, Block II satellites, Block IIA, Block IIR and Block II R-M satellites.

UNIT II (10)

GPS working principle, Trilateration, Determination of where the satellites are, Determination of how far the satellites are, Determining the receiver position in 2D or X-Y Plane, Determining the receiver position in 3D or X-Y-Z Plane.

UNIT III (10)

Other Global Navigation Satellite Systems : GLONASS, GALILEO, Comparion of 3 GNSS (GPS, GALILEO, GLONASS) interms of constellation and services provided.

UNIT IV (10)

GPS Satellite constellation and Signals : GPS system segments, Space segment, Control segment, User segment, GPS Signals, Pseudorandom noise (PRN) code, C/A code , P code Navigation data, Signal structure of GPS.

UNIT V (10)

Coordinate Systems : Geoid, Ellipsoid, Coordinate Systems, Geodetic and Geo centric coordinate systems, ECEF coordinates, Datums, world geodetic 1984 (WGS 84), Conversion between Cartesian and geodetic coordinate frame.

LEARNING RESOURCES:

TEXT BOOK(s):

G S RAO, Global Navigation Satellite Systems, McGraw-Hill Publications, New Delhi, 2010.

REFERENCE BOOK(s):

1. Scott Gleason and Demoz Gebre-Egziabher, GNSS Applications and Methods, Artech House, 2009.
2. James Ba - Yen Tsui, Fundamentals of GPS receivers - A software approach, John Wiley & Sons (2001).

WEB RESOURCES:

http://ocw.mit.edu/courses/earth-atmospheric-and-planetary-sciences/12-540-principles-of-the-global-positioning-system-spring-2012/index.htm

EC-406C	ADVANCED DIGITAL SIGNAL PROCESSING (ELECTIVE - IV)	L	T	P	C
		4	-	-	3

COURSE OBJECTIVES:

1. To understand multirate structures, sampling rate converters.
2. To understand multirate filter banks such as two channel QMF banks.
3. To understand different non-parametric techniques for power spectral estimation.
4. To understand various desing techniques and realisation methods of digital filters.
5. To understand different parametric techniques for power spectral estimation.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. design multistage decimator and interpolator.
2. design multirate filter banks.
3. estimate power spectrum using non-parametric techniques.
4. realise digital filters using lattice structures.
5. estimate power spectrum using parametric techniques.

UNIT I **(10)**

Multi Rate Signal Processing : Introduction, Decimation by a factor D, Interpolation by a factor I, Sampling rate conversion by a rational factor I/D, Multistage Implementation of Sampling Rate Conversion, Filter design & Implementation for sampling rate conversion.

UNIT II **(10)**

Applications of Multi Rate Signal Processing : Design of Phase Shifters, Interfacing of Digital Systems with Different Sampling Rates, Implementation of Narrow Band Low Pass Filters, Implementation of Digital Filter Banks, Sub-band Coding of Speech Signals, Quadrature Mirror Filters, Trans-multiplexers, Over Sampling A/D and D/A Conversion.

UNIT III **(10)**

Non-Parametric Methods of Power Spectral Estimation : Estimation of spectra from finite duration observation of signals, Non-parametric Methods: Bartlett, Welch & Blackman - Tukey methods, Comparison of all Non-Parametric methods

UNIT IV **(10)**

Implementation of Digital Filters : Introduction to filter structures (IIR & FIR), Frequency sampling structures of FIR, Lattice structures, Forward prediction error, Backward prediction error, Reflection coefficients for lattice realization, Implementation of lattice structures for IIR filters, Advantages of lattice structures.

UNIT V **(10)**

Parametric Methods of Power Spectrum Estimation : Autocorrelation & Its Properties, Relation between auto correlation & model parameters, AR Models - Yule-Walker & Burg Methods, MA & ARMA models for power spectrum estimation, Finite word length effect in IIR digital Filters - Finite word-length effects in FFT algorithms.

LEARNING RESOURCES:

TEXT BOOK(s):

1. J.G.Proakis & D. G. Manolakis - Digital Signal Processing: Principles, Algorithms & Applications, 4th Ed., Pearson Education Publication.

2. Alan V Oppenheim & R. W Schaffer - Discrete Time Signal Processing, PHI.
3. Emmanuel C. Ifeacher, Barrie. W. Jervis - DSP - A Practical Approach, 2 Ed., Pearson Education.

REFERENCE BOOK(s):

1. Tarun Kumar Rawat - Digital Signal Processing, Oxfod University Press, 2015.
2. Multi Rate Systems and Filter Banks - P.P.Vaidyanathan - Pearson Education.
3. Digital Signal Processing - S.Salivahanan, A.Vallavaraj, C.Gnanapriya, 2000,TMH

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

EC-406D	SMART ANTENNAS (ELECTIVE - IV)	L T P C 4 - - 3

COURSE OBJECTIVES:

1. To provide the basic knowledge of smart antennas and their radiation characteristics.
2. To introduce the students various types of wire and aperture antennas.
3. To provide the knowledge of broad band antennas and their applications.
4. To develop the students understanding of various Microstrip antenna for smart antenna applications

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand the various antenna parameters.
2. demonstrate basic understanding of smart antennas for broad frequency range.
3. demonstrate basic understanding of wire and aperture antennas.
4. analyze the broadband antennas for different applications.
5. interpret the different microstrip antennas for smart antenna applications.

UNIT I *Text Book - 1* **(10)**

Physical concept of radiation, Radiation pattern, near- and far-field regions, reciprocity, directivity and gain, effective aperture, input impedance, efficiency.

Polarization, Friis transmission equation, radiation integrals and auxiliary potential functions.

UNIT II *Text Book - 2* **(10)**

Introduction to Smart Antennas : Need for smart antennas, standards for smart antennas, types of smart antennas, features and benefits ,architecture, advantages and disadvantages of smart antennas, introduction to orthogonal signals, signal propagation: multipath and co-channel Interference.

Concept and benefits of smart antennas, fixed weight beam forming basics. Adaptive beam forming. Switched beam systems, spatial division multiple access.

UNIT III *Text Book - 1* **(10)**

Radiation from Wires and aperture antennas : Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobile communication, small circular loop.

Huygens' Principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts.

UNIT IV *Text Book - 1* **(10)**

Microstrip Antennas : Basic characteristics of microstrip antennas, feeding methods, methods of analysis.

Design of rectangular and circular patch antennas and their field expressions.

UNIT V *Text Book - 3* **(10)**

Broadband Antennas : Broadband concept,Biconical antenna, radiated fields and input impedance, Log-periodic antennas, Planer and wire surfaces, Dipole array and feed networks, frequency independent antennas, equiangular spiral antennas, Planner spiral, and conical spiral.

LEARNING RESOURCES:

TEXT BOOK(s):

1. C.A.Balanis - Antenna Theory and Design, 3rd Ed., John Wiley & Sons., 2005.
2. F.B.Gross - Smart Antennas for Wireless Communications, McGraw-Hill., 2005.
3. J.D.Kraus and Ronald J Marhefka - Antennas For all Applications, TMH, 2003

REFERENCE BOOK(s):

1. R. E. Collin - Antennas and Radio Wave Propagation, McGraw-Hill., 1985.
2. R. S. Elliot - Antenna Theory and Design, Revised edition, Wiley-IEEE Press., 2003.

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/117107035

EC-451	MINI PROJECT / TERM PAPER	L	T	P	C
		-	-	3	2

COURSE OBJECTIVES:

1. To Work with others and on one's own to pursue a goal.
2. To apply Engineering knowledge.
3. To Gain project management skill.
4. To Develop skill at conveying activities and achievements.
5. To Decide and agree with peers what work moves all toward a goal.
6. To Sustain diverse acts with partners to complete a good project.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. work with others and on one's own to pursue a goal.
2. apply Engineering knowledge and Gain project management skill.
3. develop skill at conveying activities and achievements.
4. decide and agree with peers to carryout work towards a goal.
5. sustain diverse acts with partners to complete a good project.

At the end of the Semester, the student must submit a report on the work they have pursued throught the Semester.

EC-452	HDL PROGRAMING LAB	L	T	P	C
		-	-	3	2

COURSE OBJECTIVES:

1. To understand the design process of Logic gates / Multiplexers / ALU
2. To understand the design process of Flip flops, Synchronous & Asynchronous Counters
3. To understand the design process of State machines

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. analyse Logic Gates, multiplexers / ALU behaviour.
2. analyse Flip flops, Synchronous & Asynchronous Counters behaviour.
3. analyse Mealy & Moore state machines behaviour.

List of Experiments:

Verilog Modeling and Synthesis of the following Experiments

1. Write a Verilog code for the design of Logic Gates.
2. Write a Verilog code for Combinational Circuits
3. Write a Verilog code for JK, D, T, and SR flip-flops with preset and clear inputs.
4. Write a Verilog code for Parity Generator and Magnitude Comparator.
5. Write a Verilog code for Carry skip Adder.
6. Write a Verilog code for 8-bit Array Multiplication/ Booth Multiplication.
7. Design of 4-bit Binary, BCD counters (synchronous/ asynchronous reset) using Verilog.
8. Design of an N- bit shift register of Serial in Serial out, Serial in parallel out, Parallel in Serial out and Parallel in Parallel out using Verilog.
9. Write a Verilog Code for 3-bit Arbitrary Counter to generate 0,1,2,3,6,5,7 and repeats.
10. Design Mealy and Moore Sequence Detector using Verilog to detect Sequence.Example: 11101 (with and without overlap) any sequence can be specified.
11. Write a Verilog code for an ALU to Perform - ADD, SUB, AND, OR, 1's compliment, 2's Compliment, Multiplication and Division.
12. Write a Verilog code for Traffic Light Controller.
13. Write a Verilog code for Seven Segment Display Interface.
14. Construct an 8-bit dedicated control unit to generate and add the numbers from n down to 1, where 'n' is an 8-bit user input number using Verilog.
15. Construct an 8-bit general data path to generate and add the numbers from n down to 1, where 'n' is an 8-bit user input number using Verilog.

Note: A minimum of 10(Ten) experiments have to be Performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

EC-453	DIGITAL SIGNAL PROCESSING LAB	L	T	P	C
		-	-	3	2

COURSE OBJECTIVES:

1. To study and simulate ASK, FSK and PSK.
2. To understand DIT & DFT algorithms.
3. To understand the design process of IIR & FIR filters.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. analyze different modulation techniques.
2. analyze the principles of DIT & DIF algorithms.
3. analyze the design process of IIR & FIR filter.

List of Experiments:

The following programs shall be implemented in software

1. Simulation of ASK and FSK.
2. Simulation of PSK.
3. Implementation of FFT of a given sequence.
4. Simulation of M-ary PSK
5. To find DFT / IDFT of 16 sample sequence using DIT algorithm.
6. To find DFT / IDFT of 16 sample sequence using DIF algorithm.
7. Determination of Power spectrum of a signal(s).
8. Implementation of LP FIR filter for a given sequence.
9. Implementation of HP FIR filter for a given sequence
10. Implementation of LP IIR filter for a given sequence.
11. Implementation of HP FIR filter for a given sequence
12. Design of IIR butterworth filter using impulse invariant method.
13. Implementation of I/D sampling rate converters.

Note: A minimum of 10(Ten) experiments have to be Performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

EC-407 **MOBILE AND CELLULAR COMMUNICATIONS** **L T P C**
4 - - 3

COURSE OBJECTIVES:

1. To know the evolution of Mobile communication and cell concept to improve capacity of the system.
2. To know the fading mechanism and types of fading and effect of fading on Mobile communication.
3. To know the role of equalization in Mobile communication and to study different types of Equalizers and Diversity techniques.
4. To know the types of channel coding techniques, data transmission modes and services of GSM.
5. To know the types of channel coding techniques, data transmission modes and services of CDMA.

COURSE OUTCOMES:

After successful completion of the course, the students are are able to

1. understand cellular concepts like frequency reuse, hand-off and Interference.
2. apply knowledge of reflection, diffraction and scattering to calculate link budget using path loss models.
3. understand the importance of Equalization and different diversity techniques.
4. know fundamentals of GSM. viz., channels, coding techniques, data transmission, services.
5. know fundamentals of CDMA. viz., channels, coding techniques, data transmission, services.

UNIT I *Text Book - 1* **(10)**

INTRODUCTION TO MOBILE COMMUNICATION : Evolution of Mobile Radio Communication, Examples of Wireless Communication Systems. Paging system, Cordless telephones systems, Cellular telephone Systems, Cellular concept: Frequency reuse, Channel Assignment strategies, Hand off strategies. Interference and System capacity, Improving coverage and capacity in cellular systems.

UNIT II *Text Book - 1* **(12)**

MOBILE RADIO PROPAGATION:

Large Scale Fading : Free space propagation model, Three basic propagation mechanisms, Reflection, Ground Reflection(Two-Ray)Model, Diffraction, Scattering, Practical link budget using path loss models.

Small Scale Fading : Multipath Propagation, Types of small scale fading, Parameters of Mobile Multipath channels, Fading effects due to multipath time delay Spread and Doppler spread.

UNIT III *Text Book - 2* **(10)**

Equalization : Fundamentals of Equalizers, Linear equalizers, Non-linear equalizers, Decision feedback equalizers, MLSE.

Diversity Techniques : Space diversity: MRC, EGC Selection diversity, Polarization diversity, Frequency diversity, Time diversity.

UNIT IV *Text Book - 2* **(10)**

Global System For Mobile (GSM) : Historical overview, System overview, The air interface, Logical and physical channels, Synchronization, Coding, Equalizer, Circuit-switched data transmission, Establishing a connection and handover, Services and billing.

UNIT V *Text Book - 2* **(10)**

CDMA : Historical overview, System overview, Air interface, Coding, Spreading and Modulation, Logical and Physical channels, Handover.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Theodore S. Rappaport - Wireless Communications Principles and Practice, 2nd Edition, Pearson Education, 2003.
2. Andreas F.MOlisch - Wireless Communications,J ohn Wiley, 2nd Edition, 2006.

REFERENCE BOOK(s):

1. Kamilo Feher - Wireless Digital Communications, PHI, 2003
2. W.C.Y. Lee - Mobile Cellular Communications, 2nd Edition, MC Graw Hill, 1995.
3. Yi-Bing Lin - Wireless and Mobile Network Architectures, 2nd Edition, Wiley, 2008.

WEB RESOURCES:

http://nptel.ac.in/courses/

EC-408 **OPTICAL COMMUNICATIONS** **L T P C**
4 - - 3

COURSE OBJECTIVES:

1. To provide an overview of optical technologies.
2. To understanding of the design, implementation, operation and maintenance issues associated with optical network solutions.
3. To gain the knowledge on existing and future optical network technologies.
4. To acquire knowledge on Complex problems related with optical fiber links design.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. design optical link
2. analyze concepts of types of fibers
3. design optical link
4. demonstrate loss measurements.
5. analyze the concepts of optical Networks.

UNIT I *Text Book - 1,2* **(10)**

INTRODUCTION : Historical development, Elements of an Optical Fiber transmission link, Advantages of Optical Fibers, Applications of Optical Fiber, Ray Theory Transmission, Total internal reflection, Acceptance angle, Critical angle, Numerical Aperture.

FIBER TYPES : Step Index, Graded Index, Modes of Propagation, single mode and multimode fibers, Fiber materials.

UNIT II *Text Book - 1,2* **(10)**

TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS : Attenuation, absorption, scattering and bending losses in fibers, Intermodal and intramodal Dispersions.

FIBER OPTIC COMPONENTS : Splicing, Connectors, Connection losses, Fiber Optic couplers, Fiber Optic Switches.

UNIT III *Text Book - 1,2* **(15)**

OPTICAL SOURCES : General characteristics, Principles of Light Emission. Light Emitting Diodes types- Planar, Dome, Surface emitting, Edge emitting Super luminescent LED's, Lens coupling to fiber, LED Characteristics - Optical output power & efficiency, output spectrum, modulation bandwidth, reliability.

LASER : Working of DH injection laser, DFB laser and Threshold condition for lasing, Principles of photo detection. PIN Photodiode, Avalanche Photodiode and their characteristics.

UNIT IV *Text Book - 1* **(10)**

OPTICAL FIBER SYSTEMS : Optical Transmitter Circuits - source limitations, LED drive circuits. Optical Receiver operation-Digital system transmission, error sources, receiver configuration, Preamplifier types, Digital receiver performance-probability of error, Quantum limit.

SYSTEM CONSIDERATIONS : Link power budget, rise time budget, direct intensity modulation, Advanced Multiplexing Strategies - OTDM, WDM.

UNIT V *Text Book - 1* **(10)**

OPTICAL FIBER SYSTEMS : Optical Transmitter Circuits - source limitations, LED drive circuits. Optical Receiver operation-Digital system transmission, error sources, receiver configuration, Preamplifier types, Digital receiver performance-probability of error, Quantum limit.

SYSTEM CONSIDERATIONS : Link power budget, rise time budget, direct intensity modulation, Advanced Multiplexing Strategies - OTDM, WDM.

LEARNING RESOURCES:

TEXT BOOK(s):

1. John M Senior - Optical Fiber Communications: Principles and Practice, 2nd Edition, PHI, 2002.
2. JC Palais - Fiber Optic Communications, 2nd Edition, PHI, 2001

REFERENCE BOOK(s):

Gerd Keiser, Optical Fiber Communications, 4th Edition, McGraw-Hill, 2007

WEB RESOURCES:

1. http://nptel.iitm.ac.in/courses/
2. www.photonics.cusat.edu/links_optical_communications.html
3. groups.csail.mit.edu/Miller.On-Chip-Optical-Communications.ppt

EC-409A **SATELLITE COMMUNICATION** **L T P C**
(ELECTIVE - V) **4 - - 3**

COURSE OBJECTIVES:

1. To know the orbital aspects of satellite communication.
2. To know about the satellite subsystems and multiple access techniques used in satellite communication.
3. To design satellite links and earth stations.
4. To know the Low earth orbit and non-geo stationary satellite systems.
5. To know about the Global positioning system.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand the orbital aspects on satellite communications.
2. understand the functioning of attitude and orbit control system, Telemetry, tracking, command and monitoring, Power Systems, Communication Subsystems, Satellite antennas and TDMA, FDMA and CDMA techniques.
3. perform link budget calculations and understand earth station technology.
4. understand the Low earth orbit and non-geo stationary satellite systems.
5. understand the Satellite Navigation and Global positioning system.

UNIT I *Text Book - 1* **(12)**

INTRODUCTION AND ORBITAL ASPECTS OF SATELLITE COMMUNICATIONS : A brief history of satellite communications, Orbital mechanics, Keplers laws of planetary motion, Locating the satellite in the orbit, Locating the Satellite with respect to the earth, Orbital elements, Look angle determination, Orbital perturbations, launches and launch vehicles, Orbital effects in communication System performance.

UNIT II *Text Book - 1,2* **(12)**

SATELLITE SUB SYSTEMS : Introduction, attitude and orbit control system, Telemetry, tracking, command and monitoring, Power Systems, Communication Subsystems, Satellite antennas.

MULTIPLE ACCESS TECHNIQUES : Introduction, FDMA Systems, TDMA Systems, Beam switching and satellite switched TDMA, Spread spectrum techniques (CDMA), Comparison of multiple access techniques.

UNIT III *Text Book - 1,2* **(12)**

SATELLITE LINK DESIGN : Introduction, Basic transmission theory, System noise temperature and G / T ratio. Design of uplink and down link models, Design of satellite links for specified C / N ratio.

EARTH STATIONS : Introduction, Transmitters, Receivers, Antennas, Tracking systems, Terrestrial interface, Primary power, test methods.

UNIT IV *Text Book - 1* **(10)**

LOW EARTH ORBIT AND NON-GEO STATIONARY SATELLITE SYSTEMS : Introduction, Orbit consideration, coverage and frequency considerations, Delay and Throughput considerations, System considerations, Operational NGSO constellation Designs

UNIT V *Text Book - 1* **(10)**

SATELLITE NAVIGATION & THE GLOBAL POSITIONING SYSTEM : Introduction, Radio and Satellite Navigation, GPS Position Location principles, GPS Receivers and codes, Satellite signal acquisition, GPS Navigation Message, GPS signal levels, GPS receiver operation, GPS C/A code accuracy, Differential GPS.

LEARNING RESOURCES:

TEXT BOOK(s):

1. T Pratt and W Bostiain - Satellite Communications, 2nd Edition, John Wiley, 2003.
2. Wilbur L. Pritchard, Henri G.Suyderhoud and Robert A Nelson - Satellite Communication Systems Engineering, 2nd Edition, Pearson Publications, 2003.

REFERENCE BOOK(s):

1. Dennis Roddy, Satellite communications, McGraw Hill, 4 th Edition,2009.
2. DC Agarwal, Satellite Communications, Khanna Publishers, 2003 Robert M Gagliard, Satellite Communications.

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

EC-409B	EMBEDDED SYSTEMS	L	T	P	C
	(ELECTIVE - V)	4	-	-	3

COURSE OBJECTIVES:

1. To understand the concept of an embedded system, to get the clarity of various design metrics for a system, understand the concept of improving productivity by presenting a unified view of software & hardware.
2. To understand general purpose processors and standard single purpose processors.
3. To grasp the advanced techniques for programming embedded systems including state machine models & concurrent process models.
4. To learn the details of task scheduling algorithms. Understand the commonalties and differences of the operating systems available off the shelf and to grasp the knowledge regarding various abstraction levels (syntheses) to be involved in the designing of an embedded system.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand embedded systems and their design challenges and custom single purpose processors common in embedded systems.
2. understand standard single purpose processors and general purpose processors used in digital design techniques amenable to synthesis.
3. understand memory and interfacing concepts.
4. understand and design the advanced state machine computation models which are used when describing complex embedded system behavior.
5. understand the Real time scheduling algorithms, various design technologies used for building embedded systems and hardware software co design and synthesis.

UNIT I *Text Book - 1* **(12)**

Introduction to embedded systems overview, design challenge, processor technology, IC technology, design technology, tradeoffs. Custom single-Purpose processors: Hardware, Introduction: Combinational Logic, Sequential Logic, Custom Single-Purpose Processor Design, RT-Level Custom Single-Purpose Processor Design, Optimizing the Custom Single-purpose processors.

UNIT II *Text Book - 1* **(12)**

General purpose processors : Software, Introduction, Basic Architecture, Operation, programmer's View. Development Environment, Application-Specific Instruction-Set Processors (ASIPs), Selecting a Microprocessor, General-Purpose Processor Design, Standard Single-Purpose Processors: Peripherals, Introduction: Timers, Counters and Watchdog Timers, UART, Pulse Width Modulators, LCD Controllers, Keypad Controllers, Steeper Motor Controllers, Analog-to-Digital Converters, Real-Time Clocks.

UNIT III *Text Book - 1* **(12)**

Memory : Introduction, Memory Write Ability and Storage Permanence, Common memory types, Composing Memory, Memory Hierarchy and Cache, Advanced RAM. **Interfacing:** Introduction, Communication Basics, Microprocessor Interfacing: Input / Output Addressing port and bus based I/O, Arbitration, Multilevel Bus Architectures, Advanced Communication Principles, Serial Protocols, Parallel Protocols, Wireless Protocols.

UNIT IV *Text Book - 1* **(10)**

State machine and concurrent process models : Introduction, models vs. languages, Text versus Graphics, An Introductory Example, FSM, FSMD, using state machines, HCFSM and the state charts language PSM,The role of an appropriate Model and Language concurrent process model, concurrent processes, communication and synchronization among processes, Implementation, data flow model and real time systems.

UNIT V *Text Book - 1,2* **(10)**

Embedded system and RTOS concepts : priority inversion problem, priority inheritance protocol, embedded OS and real time OS, RT Linux, and Handheld OS. Design technology: Introduction, automation, synthesis, Verification: Hardware / Software Co-Simulation, Reuse: Intellectual Property Cores. Design Process Models.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Frank Vahid, Tony D Givargis - Embedded system design - A unified HW/ SW Introduction, John Wily & sons 2002.
2. KVKK Prasad - Embedded and real time systems, Dreemtech Press, 2005.

REFERENCE BOOK(s):

1. Raj Kamal, Embedded system architecture, programming and design, TMH edition.
2. Jonathan W Valvano, Embedded Microcomputer Systems, Brooks/cole, Thompson Learning.
3. David E. Simon, An Embedded Software Primer, Pearson edition

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

EC-409C	DSP PROCESSORS (ELECTIVE - V)	L	T	P	C
		4	-	-	3

COURSE OBJECTIVES:

1. To introduce features and applications of DSP processors.
2. To introduce architecture of TMS320C6x and addressing modes of processors.
3. To introduce the instruction description and assembler directives of processors.
4. To introduce the programming of DSP processors.
5. To demonstrate the usefulness of the adaptive filters and learn techniques of code optimization.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand DSP processor and its features and applications and to understand data representation in DSP Processors.
2. understand DSP processor addressing modes, registers.
3. understand DSP processor instructions.
4. understand programming concept of DSP Processors.
5. understand different adaptive filters and code optimization techniques.

UNIT I *Text Book - 1* **(12)**

Digital signal processing and DSP systems, comparison between general purpose processors and DSP processors, examples of DSP processors, motivation for the specialized processors, Data representations and arithmetic: Fixed-point numbers and arithmetic, Floating point arithmetic, Fixed - point verses Floating - point format, Finite - word length effects.

UNIT II *Text Book - 2* **(11)**

Key features of TMS320C6713 processor, TMS320C6x Architecture, Functional Units, Fetch and Execute Packets, Pipelining, Registers, Addressing modes of 6713: Linear and Circular Addressing.

UNIT III *Text Book - 2* **(12)**

Instruction Set of the C6x Processor : Assembly Code Format, Types of Instructions, Assembler Directives, Timers, Interrupts, Interrupt Control Registers, Interrupt Acknowledgment.

UNIT IV *Text Book - 2* **(10)**

Multichannel Buffered Serial Ports, Direct memory access, Memory considerations, Code improvement, Constraints, Programming TMS32OC6713 processor for linear and circular convolution.

UNIT V *Text Book - 2* **(10)**

Adaptive Filters : Introduction, Adaptive Structures, Adaptive Linear Combiner, Performance Function Searching for the Minimum,Code Optimization: Introduction to optimization, Optimization Steps, Procedure for Code Optimization, Software Pipelining for Code Optimization, and Execution Cycles for Different Optimization Schemes.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Kuo, Woon Seng Gan - Digital Signal Processors: Architectures, Implementations, and Applications, Pearson education,2005.
2. DSK Rulph Chassaing - Digital Signal Processing and Applications with the C6713 and C6416, A. JOHN WILEY & SONS, INC., Publication,2005.

REFERENCE BOOK(s):

1. Phil Lapsly, Jeff Bier, Amit Sheham - DSP processor fundamentals and architectures and features, S Chand & Co. New Delhi,2000.
2. John G Ackenhhusin - Realtime signal processing, Printice Hall of India, 1999.

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

EC-409D	RF SYSTEM DESIGN	L	T	P	C
	(ELECTIVE - V)	4	-	-	3

COURSE OBJECTIVES:

1. To know the physics of CMOS devices and the origin of noises in RF systems.
2. To know the concepts of high frequency and low noise amplifier amplifier design
3. To know the concepts of stability and power amplifier fundamentals
4. To know the role of PLLs and frequency synthesizers in RF system design
5. To know the role of mixers and oscillators in RF system design

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand the role of CMOS devices physics and noise sources in the design of RF systems
2. understand the design intricacies of high frequency and low noise amplifiers
3. determine the stability using gain and phase margins and root locus techniques, and linearising techniques for power amplifiers
4. underastand the working of PLLs and frequency synthesizers
5. understand the principles of designing oscillators and mixers in RF systems

UNIT I **(10)**

Introduction to mosfet physics, noise, thermal, shot, flicker, popcorn noise, two port noise theory, noise figure, thd, ip2, ip3, sensitivity, sfdr, phase noise, specification distribution over a communication link, homodyne receiver, heterodyne receiver, image reject, low if receiver architectures, direct up conversion transmitter, two step up conversion transmitter.

UNIT II **(10)**

Impedance matching and amplifiers, s-parameters with smith chart, passive ic components, impedance matching networks, common gate, common source amplifiers, oc time constants in bandwidth estimation and enhancement, high frequency amplifier design, power match and noise match, single ended and differential LNAs, terminated with resistors and source degeneration LNAs.

UNIT III **(10)**

Feedback systems and power amplifiers, stability of feedback systems, gain and phase margin, root-locus techniques, time and frequency domain considerations, compensation, general model class A, AB, B, C, D, E and F amplifiers, power amplifier linearization techniques, efficiency boosting techniques, ACPR metric, design considerations.

UNIT IV **(10)**

Mixers and oscillators, mixer characteristics, non-linear based mixers, quadratic mixers, multiplier based mixers, single balanced and double balanced mixers, sub sampling mixers, oscillators, describing functions, colpitts oscillators, resonators, tuned oscillators, negative resistance oscillators, phase noise.

UNIT V **(10)**

PLL and frequency synthesizers, linearised model, noise properties, phase detectors, loop filters and charge pumps, integer-N frequency synthesizers, direct digital frequency synthesizers.

LEARNING RESOURCES:

TEXT BOOK(s):

Thomas Lee, The Design of Radio Frequency CMOS Integrated Circuits, 2nd Edition, Cambridge University Press, 2004.

REFERENCE BOOK(s):

1. Matthew M.Radmanesh - Radio frequency and Microwave Electronics illustrated, 1st Edition, Pearson Education, Delhi, 2000.
2. Reinhold Ludwig and Gene Bogdanov - RF Circuit Design Theory and Applications, 2nd Edition, Pearson Education, 2009.
3. Joseph Carr - Secrets of RF circuit design, 3rd Edition, TMH, 2001.

WEB RESOURCES:

1. http://nptel.ac.in/courses/117102012/
2. www.rf-mw.org
3. www.rfcafe.com

EC-410A	WIRELESS ADHOC NETWORKS (ELECTIVE - VI)	L T P C 4 - - 3

COURSE OBJECTIVES:

1. To understand the architecture of Wireless Ad Hoc Networks
2. To distinguish between proactive and reactive routing in an Ad hoc networks
3. To understand issues and challenges in Providing QoS in Ad Hoc Wireless Networks
4. To know the importance of Wireless Sensor Networks

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. analyze MAC protocols for Ad Hoc Wireless Networks
2. analyze Routing protocols for Ad Hoc Wireless Networks
3. understand the need for Energy Management in Ad Hoc Wireless Networks
4. understand the issues and challenges in Wireless Network security
5. understand the issues of routing in WSN

UNIT I *Text Book - 1* **(10)**

Wireless AdHoc Networks : Introduction, Properties, applications, limitations, Issues in Ad Hoc Wireless Networks, Ad Hoc Wireless Internet. **MAC Protocols :** Introduction, Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols, Contention - Based Protocols, Contention - Based Protocols with reservation Mechanisms, Contention - Based MAC Protocols with Scheduling Mechanisms

UNIT II *Text Book - 1* **(10)**

Routing Protocols : Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Proactive/ Table-Driven Routing Protocols, Reactive/ On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols, Power - Aware Routing Protocols. **Transport Layer :** 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, Classification of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks, Other Transport Layer Protocol for Ad Hoc Wireless Networks.

UNIT III *Text Book - 1* **(10)**

Quality of Service : Introduction, Issues and Challenges in Providing QoS in Ad Hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions, and QoS Frameworks for Ad Hoc Wireless Networks. **Energy Management :** Introduction, Need for Energy Management in Ad Hoc Wireless Networks, Classification of Ad Hoc Wireless Networks. Battery Management Schemes, Transmission Power Management Schemes, System Power Management Schemes.

UNIT IV *Text Book - 1,2* **(10)**

Security Protocols : Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Networks. **Wireless Sensor Networks :** Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering, Location Discovery, Quality of a Sensor Network, Evolving Standards, Other Issues.

UNIT V *Text Book - 1* **(10)**

WSN routing, localization & QOS : Issues in WSN routing - OLSR, AODV. Localization - Indoor and Sensor Network, Localization. QoS in WSN.

LEARNING RESOURCES:

TEXT BOOK(s):

1. C. Siva Ram Murthy and B.S.Manoj - AdHoc Wireless Networks: Architectures and Protocols, 2004, PHI.
2. Jagannathan Sarangapani - Wireless Ad-hoc and Sensor Networks: Protocols, Performance and Control, CRC Press.

REFERENCE BOOK(s):

1. C. S. Raghavendra, Krishna M. Sivalingam - Wireless Sensor Networks, Springer, 2004.
2. C.K. Toh - Ad-Hoc Mobile Wireless Networks: Protocols & Systems, First ed. Pearson Education.

WEB RESOURCES:

http://nptel.ac.in/courses/

EC-410B	REAL TIME OPERATING SYSTEM (ELECTIVE - VI)	L T P C 4 - - 3

COURSE OBJECTIVES:

1. To explain the concept of a real-time system and why these systems are usually implemented as concurrent processes
2. To describe a design process for real-time systems.
3. To explain the role of a real-time operating systems.
4. To introduce generic process architectures for monitoring and control and data acquisition systems

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. present the mathematical model of the system and to develop real time algorithm for task scheduling.
2. understand capabilities Handling Resource Sharing and dependencies among Real-time Tasks
3. generate a high-level analysis for Scheduling Real-time tasks in multiprocessor and distributed systems
4. understand the working of real time operating systems and real time database.
5. understand the fault tolerance techniques, evaluation of reliability.

UNIT I *Text Book - 1* **(12)**

REAL-TIME SYSTEMS Introduction : What is real time, Applications of Real-Time systems, A basic model of Real-time system, Characteristics of Real-time system, Safety and Reliability, Types of Real-time tasks, timing constraints, Modeling timing constraints Some important concepts, Types of Real-time tasks and their characteristics, Task scheduling, Clock-Driven scheduling, Hybrid schedulers, Event-Driven scheduling, Earliest Deadline First (EDF) scheduling.

UNIT II *Text Book - 1* **(12)**

Rate monotonic algorithm (RMA) : Some issues associated with RMA. Issues in using RMA practical situations. Handling Resource Sharing and dependencies among Real-time Tasks: Resource sharing among real-time tasks. Priority inversion. Priority Inheritance Protocol (PIP), Highest Locker Protocol (HLP). Priority Ceiling Protocol (PCP).Different types of priority inversions under PCP. Important features of PCP. Some issues in using a resource sharing protocol. Handling task dependencies.

UNIT III *Text Book - 1* **(12)**

Scheduling Real-time tasks in multiprocessor and distributed systems : Multiprocessor task allocation, Dynamic allocation of tasks. Fault tolerant scheduling of tasks. Clock in distributed Real-time systems, Centralized clock synchronization Commercial Real-time operating systems: Time services, Features of a Real-time operating system, Unix as a Real-time operating system, Unix-based Real-time operating systems, Windows as a Real-time operating system, POSIX-RT, A survey of contemporary Real-time operating systems. Benchmarking real-time systems.

UNIT IV *Text Book - 2* **(10)**

Real-time Databases : Example applications of Real-time databases. Review of basic database concepts, Real-time databases, Characteristics of temporal data. Concurrency control in real-time databases. Commercial real-time databases. Real-time Communication: Basic concepts, Examples of applications, Real-time communication in a LAN and Real-time communication over packet switched networks.

UNIT V *Text Book - 2* **(10)**

Fault tolerance techniques : Introduction: Faults, Errors and Failures, Fault types, Detection and Containment, Redundancy, Integrated Failure Handling. Reliability evaluation: Introduction, Parameters, Reliability Models for Hardware, Software Error Models.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Rajib Mall - Real-time System Theory and Practice, Pearson Publication, 2008.
2. Krishna C. M. & Kang Shin G., Real Time Systems, Mc Graw Hil, 1997

REFERENCE BOOK(s):

1. Jane W. S. Liu, Real-Time Systems, Pearson Education, 2000.
2. Stuart Bennett, Real time computer control, phI 1997.

WEB RESOURCES:

http://nptel.ac.in/courses/

EC-410C	SPEECH PROCESSING (ELECTIVE - VI)	L T P C 4 - - 3

COURSE OBJECTIVES:

1. To acquire the fundamentals of the digital signal processing that allows them to assimilate the concepts related to the speech processing.
2. To introduce the fundamentals of speech signal processing.
3. To present basic principles of speech analysis.
4. To give an overview of speech processing applications including speech enhancement, speech recognition and speaker recognition.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand the mechanism of human speech production and digital models of speech signals.
2. apply standard digital signal processing tools to analyze speech signals in terms of their Time and frequency domain representations.
3. understand Linear Predictive analysis of speech signal and different pitch period estimation methods.
4. understand the Homomorphic processing of speech signal and applications of speech processing, including speech enhancement.
5. understand the applications of speech processing including speaker recognition and speech recognition.

UNIT I *Text Book - 1* **(11)**

Introduction : Introduction, Fundamentals of Digital Speech Processing, The Mechanism of speech production, Acoustic phonetics: vowels, diphthongs, semivowels, nasals, fricatives, stops and affricates, Applications of Speech Signal Processing, Digital Models for Speech Signals: Vocal Tract, Radiation, Excitation, The complete Model.

UNIT II *Text Book - 2* **(11)**

Speech Analysis : Short-Time Speech Analysis : Windowing , Spectra of Windows , Time-Domain Parameters: signal analysis in Time Domain, Short-Time average magnitude, Short-Time Average zero-crossing rate (ZCR) and Short-Time auto correlation function Short-Time Average Magnitude Difference Function, Frequency Domain (Spectral) Parameters : Short-Time Fourier Transform Analysis, Spectral Displays, Formant Estimation and Tracking.

UNIT III *Text Book - 1* **(10)**

Linear predictive coding (LPC) of Speech : Introduction, Basic principles of Linear predictive Analysis, Solution of the LPC Equation: Cholesky Decomposition Solution for covariance method, Durbin's Recursive Solution for the Autocorrelation Equations, Frequency domain interpretation of mean squared prediction error, Applications of LPC parameters: pitch detection using LPC parameters and Formant analysis using LPC parameters. Pitch Period Estimation using Parallel Processing Approach ,Pitch Period Estimation using Autocorrelation Function.

UNIT IV *Text Book - 1,2* **(10)**

Homomorphic Speech processing : Homomorphic Speech processing: Introduction, Homomorphic systems for Convolution, The complex cepstrum of speech, The Homomorphic Vocoder.

Speech enhancement : Introduction, Background, Nature of interfering sounds, speech enhancement techniques: spectral subtraction, Multi-Microphone Adaptive Noise Cancellation.

UNIT V *Text Book - 1* **(10)**

Speech Recognition : Basic pattern recognition approaches, Preprocessing, Parametric Representation, speech recognition systems: Isolated Digit Recognition system and continuous Digit Recognition system.

Speaker Recognition : Verification vs recognition, Speaker Recognition Systems: speaker verification system and speaker identification system.

LEARNING RESOURCES:

TEXT BOOK(s):

1. L.R. Rabiner and R.W. Schafer - Digital Processing of Speech Signals, Pearson, 2009.
2. Douglas O' Shaughnessy - Speech Communications: Human & Machine, Second Edition, Oxford University Press, 2004.

REFERENCE BOOK(s):

1. Thomas F. Quatieri - Discrete Time Speech signal Processing principles and practice, Third Edition, Pearson Education, 2009.
2. Dr.Shaila D.Apte - Speech and Audio Processing, First Edition, WILEY Precise Textbook, 2015.

EC-410D	RADAR & NAVIGATIONAL AIDS (ELECTIVE - VI)	L	T	P	C
		4	-	-	3

COURSE OBJECTIVES:

1. To understand the basic principles of radar communication .
2. Identification and detection of fixed and moving targets using different types of radars.
3. Identification and detection of fixed and moving targets using different types of radars.
4. To understand the concepts of navigational aids and electronic warfare systems.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. know about types of radars and their working, applications at different frequencies.
2. know about types of radars and their working, applications at different frequencies and used for landing of aircraft.
3. know about the super heterodyne receiver, types of duplexers and protectors to be used in radar communication system.
4. understand various electronic warfare technicians like ECM, ECCM and stealth applications are to be known to the students.
5. know about the navigational methods VOR, DVOR etc. and Hyperbolic navigational techniques like LORAN, OMEGA and DECCA systems.

UNIT I *Text Book - 1* **(10)**

Introduction to Radar concepts : Block Diagram of Pulse Radar, simple form of Radar equation, Detection of signals in noise, Receiver noise and signal to noise ratio, integration of Radar pulses, RCS of simple targets, RCS of multiple targets, PRF and Range Ambiguities, Doppler Effect, Limitations of CW Radar, FMCW Radar, Altimeter.

UNIT II *Text Book - 1,2* **(10)**

MTI Radar : MTI Radar, Clutter Attenuation, MTI improvement factor, Delay line cancellers, Frequency response of single delay line cancellers, N-pulse delay line canceller, Non recursive and Recursive filters, Staggered PRF, Doppler filter banks.

UNIT III *Text Book - 1,2* **(12)**

SUPER HETERODYNE RECEIVER : Receiver, types of Duplexers and receiver protectors, types of Displays, wall construction of Radomes.

TRACKING : Types of Tracking Radar Systems, Sequential lobing, conical scan and mono pulse tracking (amplitude comparison and phase comparison).

UNIT IV *Text Book - 1,2* **(10)**

ELECTRONIC WARFARE : Objectives an definitions, Noise jamming, Types of Electronic counter measures and Electronic counter to counter measures, Stealth applications.

UNIT V *Text Book - 2* **(13)**

ELEMENTARY IDEAS OF NAVIGATION AIDS : VOR, DME, DVOR, TACAN, ILS and MLS, GPS, Automatic Direction finder.

HYPERBOLIC NAVIGATIONAL AIDS : LORAN, DECA, OMEGA.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Merrill I Skolnik - Introduction to Radar Systems, 3rd Edition, TMH, 2003.
2. Dr AK Sen and Dr AB Bhattacharya - Radar Systems and Radio Aids to Navigation, 6th Edition, Khanna Publishers, 2009.

REFERENCE BOOK(s):

Peyton Z Peebles Jr, Radar Principles - John Wiley Inc., 2nd Edition, Prentice-Hall of India, 2004.

WEB RESOURCES:

1. http://nptel.iitm.ac.in/courses/
2. http://nptel.iitm.ac.in/courses.php?branch=Ece 2.
3. http://www.radartutorial.eu/07.waves/wa04.en.html

EC-454	MICROWAVE & OPTICAL COMMUNICATION LAB	L	T	P	C
		-	-	3	2

COURSE OBJECTIVES:

1. To understand the concepts of transmission of microwaves using microwave bench system
2. To understand the concepts of communication using fiber optics.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. understand the concepts of transmission of microwaves.
2. understand the concepts of fiber optic communication.

List of Experiments:

Experiments Related to Microwave Engineering

1. Characteristics of Reflex Klystron
2. Verification of the Expression $1/\lambda_o^2 = 1/\lambda_g^2 + 1/\lambda_c^2$
3. Measurement of VSWR using Microwave Bench
4. Measurement of Unknown Impedance Using Microwave Bench
5. Measurement of Directivity of a given directional coupler
6. Measurement of Gain of an Antenna.
7. Measurement of Dielectric Constant of a Given Material

Experiments Related to Optical Communication

8. Characteristics of Light Sources
9. Characteristics of Light Detectors
10. Measurement of Coupling and Bending Losses of a Fiber
11. Analog Link Set up using a Fiber
12. Digital Link Set up using a Fiber
13. Set up of Time Division Multiplexing using Fiber Optics
14. Study of Cellular Communication.

Note: A minimum of 10(Ten) experiments have to be Performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

EC-455	PROJECT AND VIVA - VOCE	L	T	P	C
		-	-	6	10

COURSE OBJECTIVES:

1. To Work with others and on one's own to pursue a goal.
2. To apply Engineering knowledge.
3. To Gain project management skill.
4. To Develop skill at conveying activities and achievements.
5. To Decide and agree with peers what work moves all toward a goal.
6. To Sustain diverse acts with partners to complete a good project.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. work with others and on one's own to pursue a goal.
2. apply Engineering knowledge and Gain project management skill.
3. develop skill at conveying activities and achievements.
4. decide and agree with peers to carryout work towards a goal.
5. sustain diverse acts with partners to complete a good project.