ACHARYA NAGARJUNA UNIVERSITY

A State Government University, Accredited with "A" Grade by NAAC

Nagarjuna Nagar - 522 510, Guntur, Andhra Pradesh, India.

B.Tech. ELECTRONICS & COMMNUCATION ENGINEERING

SYLLABUS

2020 - 2021 onwards

Dr. Y.S.R. ANU COLLEGE OF ENGINEERING & TECHNOLOGY

PROGRAM CODE: ANUCETUG04


ACHARYA NAGARJUNA UNIVERSITY
సత్యం సర్వం ప్రతిష్ఠితమ్

ABOUT UNIVERSITY

ACHARYA NAGARJUNA UNIVERSITY (ANU)

- A Brief Profile

Acharya Nagarjuna University, a State University established in 1976, has been constantly striving towards achieving progress and expansion during its existence for over four decades, in terms of introducing new courses in the University Colleges, affiliated colleges and professional colleges. Spread over 300 acres of land on the National High Way (NH-16) between Vijayawada and Guntur of Andhra Pradesh, the University is one of the front ranking and fastest expanding Universities in the state of Andhra Pradesh. The University was inaugurated on 11th September, 1976 by the then President of India, Sri Fakruddin Ali Ahmed and celebrated its Silver Jubilee in 2001. The National Assessment and Accreditation Council (NAAC) awarded "A" grade to Acharya Nagarjuna University and also has achieved 108 International ranks, 39 National ranks UI Green Metrics rankings and many more It is named after Acharya Nagarjuna – one of the most brilliant preceptors and philosophers, whose depth of thought, clarity of perception and spiritual insight were such that even after centuries, he is a source of inspiration to a vast number of people in many countries. The University is fortunate to be situated on the very soil where he was born and lived, a soil made more sacred by the aspiration for light and a state of whole someness by generations of students. With campus student strength of over 5000, the University offers instruction for higher learning in 68 UG & PG programs and guidance for the award of M.Phil. and Ph.D. in 48 disciplines spread over six campus colleges and one PG campus at Ongole. It also offers 160 UG programs in 440 affiliated colleges in the regions of Guntur and Prakasam Districts. It has a Centre for Distance Education offering 87 UG & PG programs. Characterized by its heterogeneous students and faculty hailing from different parts of the state and the country, the University provides most hospitable environment for pursuing Higher Learning and Research. Its aim is to remain connected academically at the forefront of all higher educational institutions. The University provides an excellent infrastructure and on- Campus facilities such as University Library with over one lakh books & 350 journals; Computer Centre; University Scientific Instrumentation Centre; Central Research Laboratory with Ultra-modern Equipment; Well-equipped Departmental Laboratories; Career Guidance and Placement Cell; Health Centre; Sports Facilities with Indoor & Outdoor Stadiums and Multipurpose Gym; Sports Hostel; Separate hostels for Boys, Girls, Research Scholars and International Students; Pariksha Bhavan (Examinations Building); Computers to all faculty members; Wi-Fi connectivity to all Departments and Hostels; Canteen, Student Centre & Fast-food Centre; Faculty Club; Dr. H.H. Deichmann & Dr. S.John David Auditorium cum Seminar Hall; Post office; Telecom Centre; State Bank of India; Andhra Bank; Energy Park; Silver Jubilee Park; Fish ponds; internet center; xerox center; cooperative stores; Water harvesting structures.

VISION, MISSION & OBJECTIVES OF THE UNIVERSITY

ACHARYA NAGARJUNA UNIVERSITY

VISION

To generate sources of knowledge that dispels ignorance and establish truth through teaching, learning and research.

MISSION

To promote a bank of human talent in diversified faculties – Commerce & Management Studies, Education, Engineering & Technology, Humanities, Law, Natural Sciences, Pharmacy, Physical Education & Sports Sciences, Physical Sciences and Social Sciences that would become an investment for a prosperous society.

OBJECTIVES

- To inspire and encourage all who would seek knowledge through higher education and research.
- To provide quality instruction and research for the advancement of science and technology.
- To promote teaching and research studies in disciplines of societal relevance.
- To bridge the gap between theory and practice of the principles of higher education.
- To develop human talent necessary for the industry.
- To open up avenues of higher education and research through non-formal means.
- To invite and implement collaborations with other institutes of higher learning on a continuous basis for mutual academic progress.
- To motivate and orient each academic department/center to strive for and to sustain advanced levels of teaching and research so that the university emerges as an ideal institute of higher learning.
- To focus specially on the studies involving rural economy, justifying its existence in the rural setting.

VISION

&

MISSION OF THE COLLEGE

ACHARYA NAGARJUNA UNIVERSITY

Dr. Y.S.R. ANU COLLEGE OF ENGINEERING & TECHNOLOGY

ABOUT ANUCET:

The ANU college of Engineering & Technology is established in the academic year 2009-2010 in the University campus under the able leader ship of the Vice-chancellor, Prof. Hara Gopal Reddy. The College offers UG and PG courses that include B.Tech. and M.Tech. The college commenced its operations with an annual intake of 60 into 5 branches of B.Tech. (Civil Engineering, Computer Science Engineering, Electronics & Communication Engineering, Electrical & Electronics Engineering & Mechanical Engineering) and 20 into 5 branches of M.Tech. The institution has been growing from strength to strength and got recognition in limited period.

VISION OF THE COLLEGE:

ANU College of Engineering & Technology is started with an aim of imparting technical values in the students, who can change the shape of global scenario in engineering arena.

MISSION OF THE COLLEGE:

- To educate students for careers of leadership, innovation in engineering and its related fields.
- To expand the base of engineering knowledge through original research and by developing technology to serve the needs of society.

OBJECTIVES:

- ★ To inspire and encourage all knowledge seekers of higher education and research.
- ★ To provide quality instruction and research for the advancement of science and technology.
- ★ To promote teaching and research studies in disciplines of societal relevance.
- ★ To bridge the gap between theory and practice.
- ★ To develop human talent necessary for the industry.

VISION & MISSION OF THE DEPARTMENT

ACHARYA NAGARJUNA UNIVERSITY

Dr. Y.S.R. ANU COLLEGE OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

B.Tech. ELECTRONICS & COMMUNICATION ENGINEERING

VISION OF THE DEPARTMENT:

To evolve into a globally recognized department in the frontier areas of Electronics & Communication Engineering (ECE) by producing innovative, creative and ethical Electronics & Communication Engineers with research focus to meet socio-economic needs.

MISSION OF THE DEPARTMENT:

- ★ M1-Imparting quality education with professional ethics to Electronics and Communication Engineering students to overcome challenges in professional career.
- ★ M2- Aimed to produce graduates having professional excellence.
- ★ M3- To carry out quality research having social & industrial relevance.
- ★ M4- To provide technical support to budding entrepreneurs and existing Industries.

ACHARYA NAGARJUNA UNIVERSITY

Dr. Y.S.R. ANU COLLEGE OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

B.Tech. ELECTRONICS & COMMUNICATION ENGINEERING

PROGRAM EDUCATIONAL OBJECTIVES (PEO's):

- PEO1: Practice engineering in a broad range of industrial, societal and real world applications.
- PEO2: Pursue advanced education, research and development, and other creative and innovative efforts in science, engineering, and technology, as well as other professional careers.
- PEO3: Conduct themselves in a responsible, professional, and ethical manner.
- PEO4: Participate as leaders in their fields of expertise and in activities that support service and economic development throughout the world.

PROGRAM OUTCOMES (PO's):

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	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.
PO3	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.
PO4	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.
PO5	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.
PO6	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.
PO7	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.

PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	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.
PO11	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.
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSO's):

PSO1	An ability to Understand the theoretical and mathematical concepts to analyze real time problems.
PSO2	An Ability to Design and Analyze systems based on the theoretical and Practical Knowledge

ACHARYA NAGARJUNA UNIVERSITY
FACULTY OF ENGINEERING
ACADEMIC REGULATIONS 2020 (R20) FOR B.TECH (REGULAR)
(APPLICABLE FOR THE STUDENTS ADMITTED DURING THEACADEMIC YEAR 2020-2021 AND ONWARDS)

1. ELIGIBILITY FOR ADMISSION:

Admission to the above program shall be made subject to the eligibility, qualification and specialization prescribed by the University for each program from time to time.

Admission shall be made either on the basis of merit/rank obtained by the qualifying candidates in EAMCET/ECET or otherwise specified, whichever is relevant.

The duration of B.Tech. program is of four academic years divided into eight semesters comprising of two semesters in each academic year. A student is required to choose a branch of study at the time of admission. Students under lateral entry will be admitted straightaway into Third semester of B.Tech. course in the respective branch. No change of branch shall be allowed after the admissions are closed.

2. AWARD OF B.TECH. DEGREE:

A student will be declared eligible for the award of the B.Tech. degree if he/she fulfils the following academic regulations:

i) Regular entry students shall pursue a course of study for not less than four academic years and in not more than eight academic years.

ii) Students who fail to fulfill all the academic requirements for the award of the degree within eight academic years (for Regular Entry) / six academic years (for Lateral Entry) from the year of their admission, shall forfeit their seat in B.Tech. course and their admission is cancelled.

Completing the course of study shall mean not only satisfying the attendance requirements but also passing of all the subjects within the respective stipulated period.

3. BRANCHES OF STUDY:

The following Branches of study are offered at present for B. Tech. degree

S.No.	Branch
1	Civil Engineering
2	Electrical and Electronics Engineering
3	Mechanical Engineering
4	Electronics and Communication Engineering
5	Computer Science and Engineering

and any other branch as approved by the authorities of the University from time to time.

Each Branch will have a curriculum with a syllabus that shall consist of the following:

i) General Core Courses
   a) Basic Sciences
   b) Engineering Sciences
   c) Humanities and social sciences
ii) Program core courses in Engineering / Technology
iii) Elective courses of Engineering / Technology / Management Entrepreneurship / Business Communication and allied fields.
iv) Open Electives/CBCS
v) Mandatory learning courses
vi) Project work

4. CREDITS:

i) Academic Year: Two consecutive (one odd + one even) semesters constitute one academic year.
ii) Choice Based Credit System (CBCS): The CBCS provides choice for students to select from the prescribed courses (core, elective or minor or soft skill courses).
iii) Credit: A unit by which the course work is measured.

5. DISTRIBUTION AND WEIGHTAGE OF MARKS (INTERNAL & EXTERNAL):

i) The performance of a student in each semester shall be evaluated subject-wise with a maximum of 100 marks for theory and 100 marks for practical subject. In addition internship Project work shall be evaluated for 100 and 200 marks respectively.
ii) For both theory and lab subjects the distribution shall be 30 marks for Internal Evaluation and 70 marks for the External Evaluation.
iii) There shall be five units in each of the theory subjects.
iv) For theory subjects, there shall be two midterm examinations during the semester. Each midterm examination shall consist of assignment for 10 marks and sessional test for 20 marks with duration of 135 minutes respectively.

   First midterm examination shall be conducted for 50% coverage of syllabus and second midterm examination shall be conducted for remaining 50% of syllabus. Both the midterm exams are compulsory. Final midterm examination marks for a total of 30 marks shall be arrived at, by considering the 80% weightage (24 marks) to that midterm examination in which the student scores more marks and the remaining 20% (6 marks) for other midterm exam.

   *Note 1: The assignment test paper shall contain 6 questions of equal weightage and student is asked to answer any 2 questions randomly and shall be condensed for 10 marks, any fraction rounded off to the next higher mark.

*Note 2: The sessional examination shall contain 3 questions out of which first question is objective(6marks) and compulsory and remaining two questions(7 marks each) having internal choice and shall be considered for 20 marks, any fraction rounded off to the next higher mark.

v) For theory subjects, there will be 5 questions with following pattern in the End-Examination.

a) All Questions have to be answered compulsorily.

b) All five questions, EITHER/OR type shall be followed with 12 marks for each.

c) In each question as mentioned in (c), one, two or more bits can be set.

vi) Further, whenever any theory subject with two parts is offered (combined subject), for ex: Electrical & Mechanical Technology, then there shall be only two parts Part A, Part B in the question paper.

First question objective can be equally divided into two parts.

Part – A: shall contain two questions, EITHER/OR type shall be followed with 12 marks for each.

Part – B: shall also contain two questions, EITHER/OR type shall be followed with 12 marks for each.

vii) Model Question paper for each theory course shall be prepared by the teacher within 15 days from the commencement of the semester and the same shall be forwarded to the Controller of Examinations through the Chairman, BOS concerned.

viii) For practical subjects there shall be a continuous evaluation during the semester for 30 internal marks and 70 end examination marks. Day-to-day work in the laboratory shall be evaluated for 15 marks by the concerned laboratory teacher based on the report of experiments/jobs (10 marks for the record submitted and 5 marks for day to day work). The end examination for 15 marks (10 marks for experiment and 5 marks for viva-voce) shall be conducted by the laboratory teacher and another examiner from the same department.

*Note: Day to day performance shall be recorded in student record (each experiment carries 15 marks, at least ten experiments should be done and average marks must be taken at the end of semester).

ix) For the subject having design and / or drawing, such as Engineering Drawing, Machine Drawing and Estimation, the distribution shall be 30 marks for internal evaluation and 70 marks for end examination. The Internal evaluation will be 20 marks for day-to-day work in the class that shall be evaluated by the concerned subject teacher based on the reports/submissions prepared in the class. Further, there shall be two midterm exams in a Semester for a duration of 2 hrs. Each evenly distributed over the syllabi for 20 marks and the average marks of both the mid examinations shall be considered as internal test marks. The sum of day-to-day evaluation and the internal test marks will be the final internal marks for the subject.

x) Out of a total of 150 marks for the project work, 50 marks shall be for Internal Evaluation and 100 marks for the End Semester Examination (Viva-voce). The viva-voce shall be conducted by a committee consisting of Head of the Department, Project Supervisor and an External Examiner nominated by the principal from the panel of 3 members proposed by Head of the Department. The project work shall start in IV-year II semester. The evaluation of project work shall be conducted at the end of the IV-year II semester. The Internal Evaluation shall be made on the basis of weekly progress (a minimum of 12 weeks and 3 marks for each week progress) and at least two seminars (one at the beginning of IV B.Tech. II semester (30 marks) and the other before submission of project work (20 marks) given by each student on the topic of his project.

xi) The laboratory records and internal test papers shall be preserved for minimum of 2 years in the respective departments and shall be produced to the Committees of the college as and when the same are asked for.

xii) A student shall be permitted to pursue up to a maximum of ONE elective courses under MOOCs during the Program. The courses must be of minimum 12 weeks in duration. Attendance will not be monitored for MOOC courses. Student has to pursue and acquire a certificate for a MOOC course only from the organizations/agencies approved by the BoS in order to earn the 2 credits. The Head of the department shall notify the list of such courses at the beginning of the semester.

6. ATTENDANCE REQUIREMENTS:

i) A student shall be eligible to appear for end examinations if he/she acquires a minimum of 75% of attendance in aggregate of all the subjects in a semester.

ii) Shortage of Attendance below 65% in aggregate shall in NO case be condoned.

iii) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.

iv) Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.

v) A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester, as applicable. They may seek readmission for that semester when offered next.

vi) A stipulated fee shall be payable towards condonation of shortage of attendance to the college.

7. MINIMUM ACADEMIC REQUIREMENTS (FOR REGULAR ENTRY STUDENTS):

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.6

i) A student who could not secure a minimum of 50% aggregate from midterm examination marks is not eligible to appear for the semester end examination and shall have to repeat that semester.

ii) A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, design, drawing subject or project if he secures not less than 40% of marks in the end examination and a minimum of 50% of marks in the sum total of the internal evaluation and end examination taken together. In the internship & project he/she should secure 40%. For practical examination if he secures not less than 50% of marks in the semester end examination.

iii) A student shall be promoted from I to II year only if he/she fulfils the academic requirements of attendance and internal marks as stipulated in clause 6 and 7 irrespective of back log subjects in I/IV B.Tech.

iv) A student shall be promoted from II to III year only if he/she fulfils the academic requirements of attendance and internal marks as stipulated in clause 6 and 7 and also must secure 70% of the credits of the subjects that have been studied up to I year II semester from irrespective of whether the candidate takes the end examination or not as per the normal course of study. At the time of commencement of class work, he must attain the re quired credits.

v) A student shall be promoted from third year to fourth year only if he fulfills the academic requirements of attendance and internal marks as stipulated in clause 6 and 7 and also must secure 70% of the credits of the subjects that have been studied up to II-year II semester. At the time of commencement of class work, he must attain the required credits

And in case of getting detained for want of credits by sections ii and iii above, the student may make up the credits through supplementary exams of the above exams before the date of class work commencement of Third or Fourth year I semester respectively.

8. MINIMUM ACADEMIC REQUIREMENTS (FOR LATERAL ENTRY STUDENTS):

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.6

i) A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project if he secures not less than 40% of marks in the end examination and a minimum of 50% of marks in the sum total of the internal evaluation and end examination taken together. In the Seminar & Comprehensive viva-voce he/she should secure 40%.

ii) A student who could not secure a minimum of 50% aggregate from midterm examination marks is not eligible to appear for the semester end examination and shall have to repeat that semester.

iii) A student shall be promoted from II to III year only if he/she fulfils the academic requirements of attendance and internal marks as stipulated in clause 6 and 7 irrespective of back log subjects in II/IV B.Tech.

iv) A student shall be promoted from III to IV year only if he/she fulfils the academic requirement of attendance and internal marks as stipulated in clause 6 and 7 and also must secure 70% of the subjects that have been studied up to III year I semester from

9. GRADING:

After each subject is evaluated for 100 marks, the marks obtained in each subject will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

Table – Conversion into Grades and Grade Points assigned

Range in which the marks in the subject fall	Grade	Grade points assigned
≥ 90	O (Outstanding)	10
80-89	A+ (Excellent)	9
70-79	A (Very Good)	8
60-69	B+ (Good)	7
50-59	B (Above Average)	6
45-49	C (Average)	5
40-44	D (Pass)	4
< 40	F (Fail)	0
Absent	Ab (Absent)	0

i) A student obtaining Grade F shall be considered failed and will be required to reappear for that subject when the next supplementary examination offered.

ii) For non credit courses ‘Satisfactory’ or “Unsatisfactory’ shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

9.1. SEMESTER GRADE POINT AVERAGE (SGPA) AND CUMULATIVE GRADE POINT AVERAGE (CGPA):

i) The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by

a student and the sum of the number of credits of all the courses undergone by a student, i.e.

$$SGPA = \Sigma (Ci \times Gi)/ \Sigma Ci$$

Where, Ci is the number of credits of the i^{th} subject and Gi is the grade point scored by the student in the i^{th} course.

ii) The Cumulative Grade Point Average (CGPA) will be computed in the same manner taking into account all the courses undergone by a student over all the semesters of a program, i.e.

$$CGPA = \Sigma (Ci \times Si)/ \Sigma Ci$$

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

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

iv) While computing the GPA/CGPA the subjects in which the student is awarded Zero grade points will also be included.

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale.

Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by letters O, A+, A, B+, B, C, P and F.

10. GAP - YEAR:

Gap Year – concept of Student Entrepreneur in Residence shall be introduced and outstanding students who wish to pursue entrepreneurship are allowed to take a break of one year at any time after I year/II year/III year to pursue entrepreneurship full time. This period may be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation. An evaluation committee shall be constituted to evaluate the proposal submitted by the student and the committee shall decide on permitting the student for having the Gap Year.

11. TRANSITORY REGULATIONS: (Old Regulations Changed)

i) Candidates who admitted into the four year B.Tech. degree course under R-15 regulations but who got detained in any year for want of attendance/minimum aggregate sessional marks may join the appropriate year /semester in the semester system applicable for that batch and be governed by the regulations of that batch from then onwards unless otherwise specified.

ii) A student admitted under credit-based regulations (CR) detained due to lack of sessional marks/attendance at the end of the first semester of II/IV B.Tech. shall join II/IV first semester of R-15 batch. Such students will study all the courses prescribed for that R-15

in which the student joins. However, the student has to clear all the first-year backlog subjects by appearing the supplementary examination. Such candidates will be governed by the regulations applicable to lateral entry candidates of R-15 batch for the award of the degree.

iii) A student admitted under CR, detained due to lack of sessional marks/attendance at the end of the second semester of II/IV B.Tech. /at the end of subsequent semesters shall follow the credit-based regulations only (CR).

12. WITH–HOLDING OF RESULTS:

If the candidate has any dues not paid to the college or if any case of indiscipline or malpractice is pending against him, the result of the candidate shall be withheld and he will not be allowed / promoted into the next higher semester. The issue of awarding degree is liable to be withheld in such cases.

13. AWARD OF CLASS:

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B. Tech. Degree, he shall be placed in one of the following four classes:

Class Awarded	CGPA Secured
First Class with Distinction	≥ 8.0
First Class	$\geq 6.5 < 8.0$
Second Class	$\geq 5.5 < 6.5$
Pass Class	$\geq 4.0 < 5.5$

14. MINIMUM INSTRUCTION DAYS:

The minimum instruction period for a semester is 16 weeks. The minimum instruction days including exams for each semester shall be for 90 days.

15. BRANCH TRANSFER:

There shall be no branch transfers after the completion of admission process.

16. GENERAL:

i) The academic regulations should be read as a whole for purpose of any interpretation.
ii) Malpractice rules - nature and punishments is appended
iii) Where the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”, “hers”.

iv) In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the BOS is final.
v) The University may from time to time, revise, amend or change the Regulations, Schemes of Examinations, and/or Syllabi.

17. CONDUCT AND DISCIPLINE:

a) Students shall conduct themselves within and outside the premises of the institute in a manner befitting the students of our institution.
b) As per the order of Honorable 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.
c) 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.
   i) Lack of courtesy and decorum, indecent behavior anywhere within or outside the campus.
   ii) Will full damage of college / individual property
   iii) Possession, consumption or distribution of alcoholic drinks or any kind of narcotics or hallucinogenic drugs.
   iv) Mutilation or unauthorized possession of library books.
   v) Noisy and unseemly behavior, disturbing studies of fellow students.
   vi) 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.)
   vii) Usage of camera / cell phone in the campus
   viii) Plagiarism of any nature
   ix) Any other acts of gross indiscipline as decided by the academic council from time to time.
d) 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.
e) 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.
f) Cases of adoption of unfair means and / or any malpractice in an examination shall be reported to the principal for taking appropriate action.
g) All cases of serious offence, possibly requiring punishment other than reprimand, shall be reported to the academic council.
h) 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.
i) The principal shall deal with any academic problem, which is not covered under these rules and regulations, in consultation with the programs 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.

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

18. PUNISHMENTS FOR MALPRACTICE CASES – GUIDELINES:

The examinations committee may take the following guidelines into consideration while dealing with the suspected cases of malpractice reported by the invigilators/squad members etc. During end examinations. The punishment may be more severe or less severe depending on the merits of the individual cases.

S.No.	Nature of Malpractices/Improper conduct	Punishment
1.	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the student which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
2	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks	Cancellation of the performance in that subject.
3	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester / year examinations.
4	Gives assistance or guidance or receives it from any other student orally or by any other body language methods or communicates through cell phones with any other student or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the students involved. In case of an outsider, he will be handed over to the p is registered against him olice and a case

5	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the student is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects including practical examinations and project work of that semester/year
6	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects including practical examinations and project work of that semester/year.
7	Smuggles in the Answer book or takes out or arranges to send out the question paper during the examination or answer book during or after the examination	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects including practical examinations and project work of that semester/year. The student is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
8	Refuses to obey the orders of the Chief Superintendent / Assistant Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer- in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects of that semester / year. The students also are debarred and forfeit their seats. In case of outsiders, they will be handed over tothe police and a police case is registered against them.

	act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	
9	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects including practical examinations and project work of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
10	Possesses any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects including practical examinations and project work of that semester/year. The student is also debarred and forfeits the seat.
11	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 7 to 9.	For Student of the college: Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects including practical examinations and project work of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
12	Impersonates any other student in connection with the examination	The student who has impersonated shall be expelled from examination hall. The student is debarred from writing the remaining exams, and rusticated from the college fur one academic year during which period the student will not be permitted to write

		any exam. If the imposter is an outsider, he will be handed over to the police and a case is registered against him. The performance of the original student who has been impersonated, shall be cancelled in all the subjects of the examination including practical's and project work of that semester/year. The student is rusticated from the college for two consecutive years during which period the student will not be permitted to write any exam. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat
13	If any malpractice is detected which is not covered in the above clauses 1 to 12 it shall be reported to the college academic council for further action to award suitable punishment	
14	Malpractice cases identified during sessional examinations will be reported to the examination committee nominated by Academic council to award suitable punishment.	

CURRICULAR FRAMEWORK FOR REGULAR AND HONORS B.TECH. PROGRAMS OF ALL BRANCHES:

AWARD OF THE DEGREE:

A student will be declared eligible for the award of B. Tech. degree if he/she fulfills the following:

i) Pursues a course of study in not less than four and not more than eight academic years.
ii) After eight academic years from the year of their admission, he/she shall forfeit their seat in B. Tech course and their admission stands cancelled.
iii) Registers for 160 credits and must secure all the 160 credits.
iv) A student shall be eligible for the award of B.Tech. degree with Honors or Minor if he/she earns 20 credits in addition to the 160 credits. A student shall be permitted to register either for Honors or for Minor and not for both simultaneously.

CURRICULAR FRAMEWORK FOR HONORS PROGRAM:

1) Students of a Department/Discipline are eligible to opt for Honors Program offered by the same Department/Discipline.
2) A student shall be permitted to register for Honors program at the beginning of 4th semester provided that the student must have acquired a minimum of 8.0 SGPA up to the end of 2nd semester without any backlogs. In case of the declaration of the 3rd semester results after the commencement of the 4th semester and if a student fails to score the required minimum of 8 SGPA, his/her registration for Honors Program stands cancelled and he/she shall continue with the regular Program.
3) Students can select the additional and advanced courses from their respective branch in which they are pursuing the degree and get an honors degree in the same. e.g. If a Mechanical Engineering student completes the selected advanced courses from same branch under this scheme, he/she will be awarded B.Tech. (Honors) in Mechanical Engineering.
4) In addition to fulfilling all the requisites of a Regular B.Tech. Program, a student shall earn 20 additional credits to be eligible for the award of B. Tech (Honors) degree. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e., 160 credits).
5) Of the 20 additional Credits to be acquired, 16 credits shall be earned by undergoing specified courses listed as pools, with four courses, each carrying 4 credits. The remaining 4 credits must be acquired through two MOOCs, which shall be domain specific, each with 2 credits and with a minimum duration of 8/12weeks as recommended by the Board of studies.
6) It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. The courses offered in each pool shall be domain specific courses and advanced courses.
7) The concerned BoS shall decide on the minimum enrolments for offering Honors program by the department. If minimum enrolments criteria are not met then the students shall be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BoS.

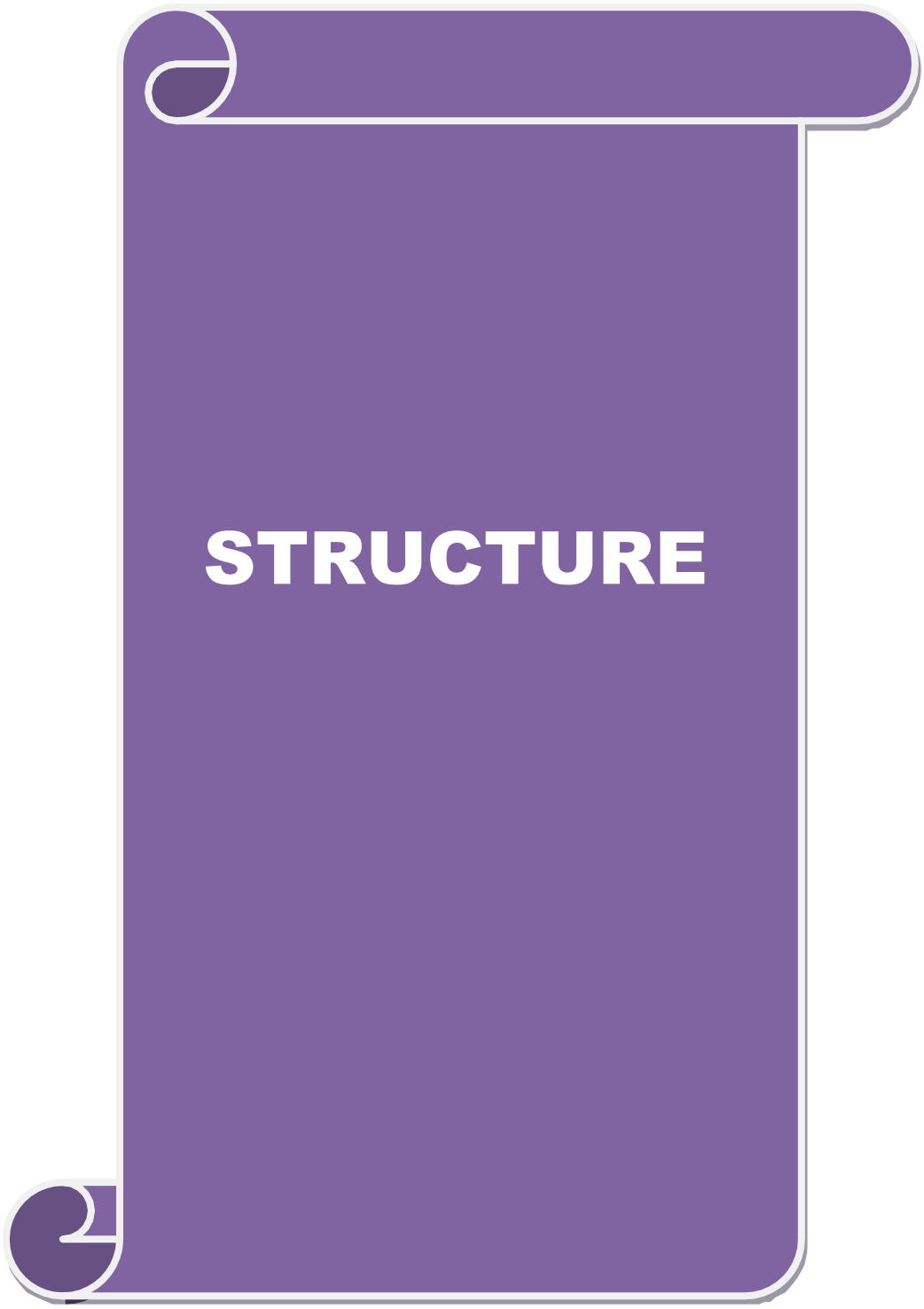
8) Each pool can have theory as well as laboratory courses. If a course comes with a lab component, that component has to be cleared separately. The concerned BoS shall explore the possibility of introducing virtual labs for such courses with lab component. (Model pool list is enclosed in the Annexure-2)
9) MOOC courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Students have to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned will be as decided by the university/academic council.
10) The concerned BoS shall also consider courses listed under professional electives of the respective B. Tech programs for the requirements of B. Tech (Honors). However, a student shall be permitted to choose only those courses that he/she has not studied in any form during the Program.
11) If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a "pass (P)" grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript.
12) In case a student fails to meet the CGPA requirement for Degree with Honors at any point after registration, he/she will be dropped from the list of students eligible for Degree with Honors and they will receive regular B.Tech. degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.
13) Honors must be completed simultaneously with a major degree program. A student cannot earn Honors after he/she has already earned bachelor's degree.

CURRICULAR FRAMEWORK FOR MINOR PROGRAM:

1) a) Students who are desirous of pursuing their special interest areas other than the chosen discipline of Engineering may opt for additional courses in minor specialization groups offered by a department other than their parent department. For example, If Mechanical Engineering student selects subjects from Civil Engineering under this scheme, he/she will get Major degree of Mechanical Engineering with minor degree of Civil Engineering
   b) Student can also opt for Industry relevant tracks of any branch to obtain the Minor Degree, for example, a B.Tech. Mechanical student can opt for the industry relevant tracks like Data Mining track, IOT track, Machine learning track etc.
2) The BOS concerned shall identify as many tracks as possible in the areas of emerging technologies and industrial relevance / demand. For example, the minor tracks can be the fundamental courses in CSE, ECE, EEE, CE, ME etc or industry tracks such as Artificial Intelligence (AI), Machine Learning (ML), Data Science (DS), Robotics, Electric vehicles, Robotics, VLSI etc.

3) The list of disciplines/branches eligible to opt for a particular industry relevant minor specialization shall be clearly mentioned by the respective BoS.
4) There shall be no limit on the number of programs offered under Minor. The University/Institution can offer minor programs in emerging technologies based on expertise in the respective departments or can explore the possibility of collaborating with the relevant industries/agencies in offering the program.
5) The concerned BoS shall decide on the minimum enrolments for offering Minor program by the department. If a minimum enrolments criterion is not met, then the students may be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BoS.
6) A student shall be permitted to register for Minors program at the beginning of 4th semester subject to a maximum of two additional courses per semester, provided that the student must have acquired 8 SGPA (Semester Grade point average) up to the end of 2nd semester without any history of backlogs. It is expected that the 3rd semester results may be announced after the commencement of the 4th semester. If a student fails to acquire 8 SGPA up to 3rd semester or failed in any of the courses, his registration for Minors program shall stand cancelled. An SGPA of 8 has to be maintained in the subsequent semesters without any backlog in order to keep the Minors registration active. 18
7) A student shall earn additional 20 credits in the specified area to be eligible for the award of B. Tech degree with Minor. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e., 160 credits).
8) Out of the 20 Credits, 16 credits shall be earned by undergoing specified courses listed by the concerned BoS along with prerequisites. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. If a course comes with a lab component, that component has to be cleared separately. A student shall be permitted to choose only those courses that he/she has not studied in any form during the Program.
9) In addition to the 16 credits, students must pursue at least 2 courses through MOOCs. The courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Student has to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned as decided by the university/academic council.
10) Student can opt for the industry relevant minor specialization as approved by the concerned departmental BoS. Student can opt the courses from Skill Development Corporation (APSSDC) or can opt the courses from an external agency recommended and approved by concerned BOS and should produce course completion certificate. The Board of studies of the concerned discipline of Engineering shall review such courses being offered by eligible external agencies and prepare a fresh list every year incorporating latest skills based on industrial demand.

11) A committee should be formed at the level of College/Universities/department to evaluate the grades/marks given by external agencies to a student which are approved by concerned BoS. Upon completion of courses the departmental committee should convert the obtained grades/marks to the maximum marks assigned to that course. The controller of examinations can take a decision on such conversions and may give appropriate grades.
12) If a student drops (or terminated) from the Minor program, they cannot convert the earned credits into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a "pass (P)" grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript. 19
13) In case a student fails to meet the CGPA requirement for B.Tech. degree with Minor at any point after registration, he/she will be dropped from the list of students eligible for degree with Minors and they will receive B. Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.
14) Minor must be completed simultaneously with a major degree program. A student cannot earn the Minor after he/she has already earned bachelor's degree.


STRUCTURE

ACHARYA NAGARJUNA UNIVERSITY

Dr. Y.S.R. ANU COLLEGE OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING

COURSE STRUCTURE (R20)

I/IV B. TECH - SEMESTER-I

S. No.	Course Details		Category	Scheme of Instruction			Scheme of Examination		
	Code	Subject Name		Hours in a Week			Marks		Credits
				L	T	P	Internal	External	
1	**EC111(R20)**	Mathematics - I	BS	3	0	0	30	70	3
2	**EC112(R20)**	Engineering Chemistry	BS	3	0	0	30	70	3
3	**EC113(R20)**	Professional Communication Skills	HS	3	0	0	30	70	3
4	**EC114(R20)**	Engineering Graphics	ES	3	0	0	30	70	3
5	**EC115(R20)**	Computer Programming With C	ES	3	0	0	30	70	3
6	**EC151(R20)**	Communication Skills Lab	HS	0	0	3	30	70	1.5
7	**EC152(R20)**	Engineering Chemistry Lab	BS	0	0	3	30	70	1.5
8	**EC153(R20)**	Computer Programming Lab	ES	0	0	3	30	70	1.5
TOTAL CREDITS									**19.5**

S.No.	Category	Abbreviation	Required Credits Criteria
1	**BS**	**Basic Science Course**	**7.5**
2	**ES**	**Engineering Science Course**	**7.5**
3	**HS**	**Humanities & Social Science Course**	**4.5**

I/IV B. TECH - SEMESTER-II

S. No.	Course Details		Category	Scheme of Instruction			Scheme of Examination		
	Code	Subject Name		Hours in a Week			Marks		Credits
				L	T	P	Internal	External	
1	**EC121(R20)**	Mathematics - II	BS	3	0	0	30	70	3
2	**EC122(R20)**	Engineering Physics	BS	3	0	0	30	70	3
3	**EC123(R20)**	Basic Electrical Engineering	ES	3	0	0	30	70	3
4	**EC124(R20)**	Python	ES	3	0	0	30	70	3
5	**EC125(R20)**	Engineering Mechanics	ES	3	0	0	30	70	3
6	**EC126(R20)**	Environmental Science	MC	2	0	0	30	70	0
7	**EC161(R20)**	Engineering Physics Lab	BS	0	0	3	30	70	1.5
8	**EC162(R20)**	Basic Electrical Engineering Lab	ES	0	0	3	30	70	1.5
9	**EC163(R20)**	Python Lab	ES	0	0	3	30	70	1.5
TOTAL CREDITS									**19.5**

S.No.	Category	Abbreviation	Required Credits Criteria
1	**BS**	**Basic Science Course**	**7.5**
2	**ES**	**Engineering Science Course**	**12**
3	**MC**	**Mandatory Course**	**0**

II/IV B. TECH -SEMESTER-I

S. No.	Course Details		Category	Scheme of Instruction			Scheme of Examination		
	Code	Subject Name		Hours in a Week			Marks		Credits
				L	T	P	Internal	External	
1	**EC211(R20)**	Electronic Devices	PC	3	0	0	30	70	3
2	**EC212(R20)**	Digital Logic Design	PC	3	0	0	30	70	3
3	**EC213(R20)**	Signals & Systems	PC	3	0	0	30	70	3
4	**EC214(R20)**	Network Theory	PC	3	0	0	30	70	3
5	**EC215(R20)**	Mathematics-III	BS	3	0	0	30	70	3
6	**EC216(R20)**	Essence of Indian Traditional Knowledge	MC	2	0	0	30	70	0
7	**EC251(R20)**	Electronics Devices Lab	PC	0	0	3	30	70	1.5
8	**EC252(R20)**	Digital Logic Design Lab	PC	0	0	3	30	70	1.5
9	**EC253(R20)**	Signals & Systems Lab	PC	0	0	3	30	70	1.5
10	**EC254(R20)**	MATLAB	SC	0	0	3	30	70	2
TOTAL CREDITS									**21.5**

S.No.	Category	Abbreviation
1	**MC**	**Mandatory Course**
2	**PC**	**Program Core Course**
3	**PEC**	**Professional Elective Course**
4	**OEC**	**Open Elective Course**
5	**SC**	**Skill Oriented Course**

II/IV B. TECH - SEMESTER-I

S. No.	Course Details		Category	Scheme of Instruction			Scheme of Examination		
	Code	Subject Name		Hours in a Week			Marks		Credits
				L	T	P	Internal	External	
1	**EC221(R20)**	Electromagnetic Field Theory	PC	3	0	0	30	70	3
2	**EC222(R20)**	Analog Circuits	PC	3	0	0	30	70	3
3	**EC223(R20)**	Probability theory and Stochastic Process	PC	3	0	0	30	70	3
4	**EC224(R20)**	Microprocessor & Microcontrollers	PC	3	0	0	30	70	3
5	**EC225(R20)**	Programming through JAVA	ES	3	0	0	30	70	3
6	**EC261(R20)**	Analog Circuits Lab	PC	0	0	3	30	70	1.5
7	**EC262(R20)**	Microprocessor & Microcontrollers Lab	PC	0	0	3	30	70	1.5
8	**EC263(R20)**	Communicative English Lab-II	PC	0	0	3	30	70	1.5
9	**EC264(R20)**	Java Programming	SC	0	0	3	30	70	2
TOTAL CREDITS									**21.5**
Internship 2 Months (Mandatory) during summer vacation									
Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)									**4**

S.No.	Category	Abbreviation
1	**MC**	**Mandatory Course**
2	**PC**	**Program Core Course**
3	**PEC**	**Professional Elective Course**
4	**OEC**	**Open Elective Course**
5	**SC**	**Skill Oriented Course**

III/IV B. TECH -SEMESTER-I

S. No.	Course Details		Category	Scheme of Instruction			Scheme of Examination		
	Code	Subject Name		Hours in a Week			Marks		Credits
				L	T	P	Internal	External	
1	**EC311(R20)**	Linear Control Systems	PC	3	0	0	30	70	3
2	**EC312(R20)**	Analog Communications	PC	3	0	0	30	70	3
3	**EC313(R20)**	Digital Signal Processing	PC	3	0	0	30	70	3
4	**EC314(R20)**	VLSI-Design	PE-I	3	0	0	30	70	3
5	**EC315(R20)**	Pulse Circuits & LICA	OE-I	3	0	0	30	70	3
6	**EC316(R20)**	Constitution of India	MC	2	0	0	30	70	0
7	**EC351(R20)**	Analog Communications Lab	PC	0	0	3	30	70	1.5
8	**EC352(R20)**	Digital Signal Processing Lab	PC	0	0	3	30	70	1.5
9	**EC353(R20)**	Mobile App Development	SC	1	0	2	30	70	2
10	**EC354(R20)**	Summer Internship	MC	0	0	0	100	0	1.5
TOTAL CREDITS									**21.5**
Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)									**4**

Professional Elective Course -I		Open Elective Course-I	
1	**314/1 VLSI-Design**	**1**	**315/1 Pulse Circuits & LICA**
2	**314/2 Power Electronics**	**2**	**315/2 Computer Organization**
3	**314/3 High Speed Electronics**	**3**	**315/3 Nano Electronics**

III/IV B. TECH -SEMESTER-II

S. No.	Course Details		Category	Scheme of Instruction			Scheme of Examination		
	Code	Subject Name		Hours in a Week			Marks		Credits
				L	T	P	Internal	External	
1	**EC321(R20)**	Microwave Engineering	PC	3	0	0	30	70	3
2	**EC322(R20)**	Digital Communication	PC	3	0	0	30	70	3
3	**EC323(R20)**	Antennas and Wave Propagation	PC	3	0	0	30	70	3
4	**EC324(R20)**	Fiber Optic Communication	PE-II	3	0	0	30	70	3
5	**EC325(R20)**	Embedded Systems	OE-II	3	0	0	30	70	3
6	**EC361(R20)**	Microwave & Optical Communication Lab	PC	0	0	3	30	70	1.5
7	**EC362(R20)**	Digital Communication Lab	PC	0	0	3	30	70	1.5
8	**EC363(R20)**	Electronic Circuit Simulation	PC	0	0	3	30	70	1.5
9	**EC364(R20)**	HDL Programming	SC	1	0	2	30	70	2
TOTAL CREDITS									**21.5**
Industrial/Research Internship (2 Months) after 3rd Year during summer vacation									
Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)									**4**

Professional Elective Course -II		Open Elective Course-II	
1	**324/1 Fiber Optic Communication**	**1**	**325/1 Embedded Systems**
2	**324/2 Adaptive Signal Processing**	**2**	**325/2 Computer Networks**
3	**324/3 Error Correcting Codes**	**3**	**325/3 Sensors &Instrumentation**

IV/IV B. TECH -SEMESTER-I

S. No.	Course Details		Category	Scheme of Instruction			Scheme of Examination		
	Code	Subject Name		Hours in a Week			Marks		Credits
				L	T	P	Internal	External	
1	**EC411(R20)**	Image and Video Processing	PC	3	0	0	30	70	3
2	**EC412(R20)**	Wireless Communications and Cellular Networks	PC	3	0	0	30	70	3
3	**EC413(R20)**	Information Theory and Coding	PC	3	0	0	30	70	3
4	**EC414(R20)**	RADAR Systems & Navigational Aids	PE-III	3	0	0	30	70	3
5	**EC415(R20)**	Artificial Neural Networks	OE-III	3	0	0	30	70	3
6	**EC416(R20)**	IPR & Patents	BS	3	0	0	30	70	3
7	**EC451(R20)**	High-Frequency Structure Simulator (HFSS)	SC	1	0	2	30	70	2
8	**EC452(R20)**	Industrial/Research Internship (2 Months) after 3rd Year(to be evaluated during VII semester)	MC	0	0	0	100	0	3
TOTAL CREDITS									**23**
Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)									**4**

Professional Elective Course -III		Open Elective Course-III	
1	**414/1- RADAR &Navigational Aids**	**1**	**415/1- Artificial Neural Networks**
2	**414/2- Bio-Medical Instrumentation**	**2**	**415/2- Machine Learning**
3	**414/3- Satellite Communication**	**3**	**415/3- Speech & Audio Signal Processing**

IV/IV B. TECH -SEMESTER-II

S. No.	Course Details		Category	Scheme of Instruction			Scheme of Examination		
	Code	Subject Name		Hours in a Week			Marks		Credits
				L	T	P	Internal	External	
1	**EC461(R20)**	Project Work	Project	0	0	0	50	100	8
2	**EC462(R20)**	Seminar	Seminar	0	0	0	50	0	2
3	**EC463(R20)**	MOOCs	MOOC	0	0	0	100	0	2
TOTAL CREDITS									**12**

MINOR DEGREE COURSES [R-20]

S. No.	Course Details		Category	Scheme of Instruction			Scheme of Examination		
	Code	Subject Name		Hours in a Week			Marks		Credits
				L	T	P	Internal	External	
1	**ECM001(R20)**	Analog Electronic Circuit Design	Minor	3	0	0	30	70	4
2	**ECM002(R20)**	Information Theory and Coding	Minor	3	0	0	30	70	4
3	**ECM003(R20)**	Nano-electronics	Minor	3	0	0	30	70	4
4	**ECM004(R20)**	Bio-Medical Electronics	Minor	3	0	0	30	70	4
5	**ECM005(R20)**	MEMS Technology	Minor	3	0	0	30	70	4
6	**ECM006(R20)**	Embedded Systems	Minor	3	0	0	30	70	4

HONOURS DEGREE COURSES COMMUNICATIONS DOMAIN

S. No.	Course Details		Category	Scheme Of Instruction			Scheme of Examination		
	Code	Subject Name		Hours in A Week			Marks		Credits
				L	T	P	Internal	External	
1	**ECHT101(R20)**	Advanced Communications and Networks	Honour	3	0	0	30	70	4
2	**ECH T102(R20)**	Advanced Digital Signal Processing	Honour	3	0	0	30	70	4
3	**ECH T103(R20)**	IOT And Its Applications	Honour	3	0	0	30	70	4
4	**ECH T104(R20)**	Coding Theory And Techniques	Honour	3	0	0	30	70	4

HONOURS DEGREE COURSES VLSI DESIGN DOMAIN

S. No.	Course Details		Category	Scheme of Instruction			Scheme of Examination		
	Code	Subject Name		Hours in a Week			Marks		Credits
				L	T	P	Internal	External	
1	**ECHT201(R20)**	VLSI Technology and Design	Honour	3	0	0	30	70	4
2	**ECHT202(R20)**	Advanced Digital System Design	Honour	3	0	0	30	70	4
3	**ECHT203(R20)**	System On Chip Architecture	Honour	3	0	0	30	70	4
4	**ECHT204(R20)**	Design of Fault Tolerant Systems	Honour	3	0	0	30	70	4

I/IV B.Tech.

SEMESTER I

ACHARYA NAGARJUNA UNIVERSITY

DR. Y.S.R. ANU COLLEGE OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING

I/IV B.Tech. SEMESTER-I

CE/ME/EE/EC/CS 111 (R20): MATHEMATICS-I

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Using Matrix method find the inverse of matrix, and using other methods solving Homogeneous and non-homogeneous equations. Determining the eigen values and eigen vectors.
CO2	Finding the approximate real root of given equation.
CO3	Finding partial derivatives of first and higher orders and maxima and minima of functions of two variables.
CO4	Evaluate double integrals techniques over a region of two dimensional and with polar coordinates.
CO5	Familiarize with special functions to evaluate some proper and improper integrals using beta and gamma functions.

CO-PO/PSO MATRIX MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	-	-	-	-	-	-	-	2	3	-	-	-
CO2	1	3	-	-	-	-	-	-	-	1	3	-	-	-
CO3	2	3	-	-	-	-	-	-	-	2	2	-	-	-
CO4	2	2	-	-	-	-	-	-	-	3	2	-	-	-
CO5	2	3	-	-	-	-	-	-	-	1	3	-	-	-
AVG_CO	2	3	-	-	-	-	-	-	-	2	3	-	-	-

UNIT I:

MATRIX OPERATIONS AND SOLVING SYSTEMS OF LINEAR EQUATIONS: Rank of a matrix by echelon form, solving system of homogeneous and non-homogeneous equations linear equations. Eigen values and Eigen vectors and their properties, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley Hamilton theorem, diagonalization of a matrix, quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical forms by orthogonal transformation.

UNIT II:

MEAN VALUE THEOREMS:

Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof);

UNIT III:

MULTIVARIABLE CALCULUS:

Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

UNIT IV:

DOUBLE INTEGRALS:

Double integrals, change of order of integration, double integration in polar coordinates, areas enclosed by plane curves.

UNIT V:

SPECIAL FUNCTIONS:

Beta and Gamma functions and their properties, relation between beta and gamma functions.

TEXTBOOKS:

1) Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2) B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.

REFERENCES:

1) R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
2) George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
3) Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 201.

CE/ME/EC 112 (R20): ENGINEERING CHEMISTRY

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Develop innovative methods to produce soft water for industrial use and potable water at cheaper cost
CO2	Substitute metals with conducting polymers and also produce cheaper biodegradable polymers to reduce environmental pollution. Design economically and new methods of synthesis nano materials.
CO3	Identify electronic components that can provide protection and specify a minimum set of protections needed - Compute stored energy in a battery pack - List the manufacturing steps of different types of lithium-ion cells and possible failure modes and apply their knowledge for protection of different metals from corrosion
CO4	Ability to understand, explain and select instrumental techniques for analysis
CO5	Develop the technique involved in the manufacturing process of cement Apply the knowledge about the properties of chemical fuels for the generation of power Apply the knowledge of various polymeric material, their synthesis and applications and synthesize medicinal compounds and the physical chemical properties of drugs using drug design software.

CO-PO/PSO MATRIX MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	1	2	-	-	1	-	3	3	3
CO2	3	2	1	1	-	-	2	-	-	1	-	3	2	2
CO3	3	2	1	2	1	-	-	-	-	1	-	3	2	2
CO4	3	3	2	1	1	-	-	-	-	1	-	2	2	3
CO5	3	3	2	2	-	1	-	-	-	1	-	3	3	2
AVG_CO	**3**	**3**	**2**	**1**	**1**	**1**	**2**	**-**	**-**	**1**	**-**	**3**	**3**	**3**

UNIT-I:

WATER TECHNOLOGY

Various impurities of Water, WHO guidelines, Hardness unit sand determination by EDTA method, water treatment for drinking purpose-sedimentation, coagulation, filtration (slow sand filter), various methods of chlorination, breakpoint chlorination.

Water treatment 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:

POLYMER CHEMISTRY: Introduction to polymers, Functionality of monomers, chain growth and step growth polymerization, Co-polymerization (Stereo specific polymerization) with specific examples and mechanisms of polymer formation.

PLASTICS: Thermoplastics and Thermosetting, preparation, properties and applications of Bakelite, Elastomers, Preparation, properties and applications of BUNA-S and BUNA-N Rubbers.

Conducting Polymers- Introduction, examples, general applications and mechanism of Conduction on Polyacetylene.

Chemistry of Nano materials: Introduction to nano chemistry, preparation of nano materials - carbon nanotubes and fullerenes and their engineering applications.

UNIT-III:

ELECTRO CHEMISTRY AND APPLICATIONS

Electrodes-concepts, types of cells, electro chemical series, Nernst equation.

BATTERIES: Primary cell (Dry cell), Secondary cell (Lead-acid), Lithium batteries and their advantages, Fuel cell (H_2-O_2 cell).

Corrosion: Types of corrosions- chemical corrosion, dry corrosion, electro chemical corrosion and wet corrosion, galvanic series, pitting and differential aeration of corrosion, factors affecting corrosion.

Corrosion control: Cathodic protection, Corrosion Inhibitors, Electro plating (Au) & (Ni).

UNIT-IV:

INSTRUMENTAL METHODS

Electromagnetic spectrum-Absorption of Radiation: Beer-Lambert's Law-Principle and applications of Ultra-Violet, Infra-Red and Nuclear Magnetic Resonance Spectroscopy. Principle and applications of Gas Chromatography and HPLC Techniques.

UNIT-V:

(i) Cement and Concrete Chemistry: Introduction to Building Materials, Portland Cement, Constituents, Manufacturing Process, Setting and Hardening Cement.

(ii) Organic reactions and synthesis of a drug molecule: Introduction to reactions involving substitution (SN_1 and SN_2), elimination reactions (E_1 and E_2), Synthesis of commonly used drug molecule – Aspirin and Paracetamol.

TEXT BOOKS:

1) Engineering Chemistry, P.C. Jain and M. Jain - Dhanpati Rai & Sons, Delhi.
2) A text book of Engineering Chemistry, S.S. Dara - S. Chand & Co. New Delhi.
3) Engineering Chemistry, B.K. Sharma - Krishna Prakashan, Meerut.

4) Shashi chawla, A text book of engineering chemistry,3rd Edition, Dhanpat rai & co new delhi, 2007.
5) Gurudeep raj & chatwal anand, "Instrumental methods of analysis ", 7th edition, CBS publications, 1986.
6) Quantitative analysis by day & underwood.
7) A Text book of Instrumental methods by Skoog and West.
8) H.W. Wilard and demerit, "Instrumental methods of analysis ", 7th edition, CBS publications, 1986.
9) Text book of Nano Science and Nano technology, B.S. Murthy and P. Shankar, University press.

EE/EC 113 (R20): PROFESSIONAL COMMUNICATION SKILLS

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1	Identify the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English (L3)
CO2	Formulate sentences using proper grammatical structures and correct word forms (L3)
CO3	Speak clearly on a specific topic using suitable discourse markers in informal discussions
CO4	Write summaries based on global comprehension of reading texts (L3)
CO5	Produce a coherent paragraph interpreting a figure/graph/chart/table (L4)

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	2	2	-	-	2	3	-	3	3	-	-
CO2	-	-	-	2	2			2	3	-	3	3	-	-
CO3	-	-	-	2	2	-	-	2	3	-	3	3	-	-
CO4	-	-	-	2	2			2	3	-	3	3	-	-
CO5	-	-	-	2	2	-	-	2	3	-	3	3	-	-
AVG_CO	-	-	-	2	2			2	3	-	3	3	-	-

UNIT-1:

1. Reading: Listening Skills – The Boy who broke the Bank (English & Soft Skills)
2. Writing: Paragraph Writing
3. Grammar: Common Errors in Nouns- Pronoun Agreement
4. Vocabulary Building: Functional word list -100

UNIT- II:

1. Reading: Assertive Skills – The Verger (English & Soft Skills)
2. Writing: Letter Writing (Formal and Informal)
3. Grammar: Correction of Errors in Subject- Verb Agreement
4. Vocabulary Building: Sign Post

UNIT - III:

1. Reading: Learning Skills – Three Questions (English & Soft Skills)
2. Writing: Note Making, Note Taking
3. Grammar: Correction of in Tense Usage
4. Vocabulary Building: One Word Substitutes

UNIT - IV:

1. Reading: Adaptability Skills – Senor Payroll (English & Soft Skills)
2. Writing: Pictorial Description
3. Grammar: Correction of Errors in Adjectives, Articles, Prepositions
4. Vocabulary Building: Synonyms and Antonyms

UNIT - V:

1. Reading: Written Communication Skills - Gateman's Gift (English & Soft Skills)
2. Writing: Information Transfer
3. Grammar: Correction of Errors in Wh- questions, Question Tags
4. Vocabulary Building: Idioms and Phrasal Words (200)

TEXT BOOKS:

1) Dhanavel S. P. *English and Soft Skills*, Orient Black Swan Pvt. Limited, 2013.
2) Barun K Mitra, *Effective Technical Communication*, Oxford University Publication, 2014.

REFERENCE BOOKS:

1) Bailey, Stephen. *Academic writing: A handbook for International Students*. Routledge, 2014.
2) Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking.* Heinley ELT; 2nd Edition, 2018.
3) Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012.
4) Michael Swan. *Practical English Usage*, OUP. 1995.
5) F.T. Wood. *Remedial English Grammar*, Macmillan.2007
6) Liz Hamp-Lyons and Ben Heasly. *Study Writing*, Cambridge University Press. 2006.
7) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad.
8) Sharon J.Gerson, Steven M.Gerson, *Technical Writing*, New Delhi: Pearson education, 2007.
9) Sanjay Kumar and Pushp Lata, *Communication Skills*, Noida: Oxford University Press, 2012.
10) Dr. Shalini Verma, *Word Power Made Handy*, S. Chand & Co Ltd., 2009.

EC/ME/CE 114 (R20): ENGINEERING GRAPHICS

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	To understand how to construct and analyze different types of curves used in engineering design and manufacturing to study conic sections, cycloids, helixes, spirals, and involutes.
CO2	To analyze their drawing skills through regular practice of the different techniques taught in the course, including freehand sketching, orthographic and isometric projections.
CO3	Applying of their drawing skills through regular practice of the different techniques taught in the course, including orthographic projections, section views, and dimensioning.
CO4	To understand various topics such as projections of lines in different planes, true length and true inclination of lines, and projection of planes in different planes, true shape and true size of planes, and the concept of auxiliary planes.
CO5	To evaluate various topics such as sectioning of solids, different types of sections, and the application of sectioning in engineering design and manufacturing.

CO-PO/PSO MATRIX MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	2	-	-	-	-	-	2	3	3
CO2	3	3	3	3	3	2	-	-	-	-	-	2	3	3
CO3	3	3	3	3	3	2	-	-	-	-	-	3	3	3
CO4	3	3	3	3	3	2	-	-	-	-	-	2	3	3
CO5	3	3	3	3	3	2	-	-	-	-	-	3	3	3
AVG_CO	3	3	3	3	3	2	-	-	-	-	-	2	3	3

UNIT-I

INTRODUCTION TO ENGINEERING GRAPHICS: Principles of Engineering Graphics and their significance-Conventions in drawing-lettering - BIS conventions. Dimensioning principles and conventional representations

a) Conic sections including the rectangular-hyperbola- general method only,

b) Cycloid, epicycloids and hypocycloid

c) Involutes

UNIT-II

PROJECTION OF POINTS, LINES AND PLANES: Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, angle made by line. Projections of regular plane surfaces. .

UNIT-III

PROJECTIONS OF SOLIDS: Projections of regular solids inclined to one or both planes by rotational.

Sections of solids: Section planes and sectional view of right regular solids- prism, cylinder, pyramid and cone. True shapes of the sections.

UNIT-IV

DEVELOPMENT OF SURFACES: Development of surfaces of right regular solids-prism, cylinder, pyramid, cone and their sectional parts.

ISOMETRIC PROJECTIONS: Principles of isometric projection- Isometric scale; Isometric views: lines, planes, figures, simple and compound solids.

UNIT-V

Orthographic Projections: Systems of Projections, Orthographic Projection (Simple Figures)

TEXT BOOKS:

1) K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
2) N.D.Bhatt, Engineering Drawing, 53/e, Charotar Publishers, 2016.

REFERENCE BOOKS:

1) Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2009
2) Shah and Rana, Engineering Drawing, 2/e, Pearson Education, 2009
3) Venugopal, Engineering Drawing and Graphics, 3/e, New Age Publishers, 2000
4) K.C.John, Engineering Graphics, 2/e, PHI, 2013
5) Basant Agarwal & C.M. Agarwal, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2008.
6) Youtube: http-sewor,Carleton.cag,kardos/88403/drawings.html conic sections-online, red woods.edu

CE/ME/EE/EC/CS 115 (R20): COMPUTER PROGRAMMING WITH C

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Design and develop flowcharts using Raptor to solve simple problems related to basic programming constructs
CO2	Write basic programs in C using different data types, operators, and control structures
CO3	Develop programs using functions and understand concepts like scope, storage classes, and recursion
CO4	Implement programs using arrays, pointers, and strings for solving problems related to data manipulation.
CO5	Understand the concept of structures and files in C programming, and develop programs using structures and file handling functions.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	2	-	2	-	-	-	-	-	1	1
CO2	2	-	-	2	-	-	-	1	-	2	2	2	2	2
CO3	-	-	2	-	2	2	-	-	-	-	3	3	3	3
CO4	-	2	-	-	2	2	-	-	2	-	3	-	3	3
CO5	1	-	-	2	-	-	-	2	-	-	-	3	1	2
AVG_CO	1	1	1	1	1	1	1	1	1	1	2	2	2	2

UNIT-1

FLOWCHART DESIGN THROUGH RAPTOR: Flow chart symbols, Input/Output, Assignment, operators, conditional if, repetition, function and sub charts. Example problems (section 1) – Finding maximum of 3 numbers, Unit converters, Interest calculators, multiplication tables, GCD of 2 numbers.

Example problems (section 2) - Fibonacci generation, prime number generation. Minimum, Maximum and average of n numbers, Linear search, Binary Search.

UNIT-2

C BASICS: C-Basics: C-character set, Data types, Constants, Expressions, Structure of C program, Operators and their precedence & associatively, Simple programs in C using all the operators, Type casting, type coercion.

UNIT-3

CONTROL STRUCTURES AND FUNCTIONS: Control Structures, Basic input and output statements, Preprocessor directives.

Functions: Concept of a function, passing the parameters, automatic variables, scope and extent of variables, storage classes, recursion, iteration vs recursion, types of recursions, Simple recursive and non-recursive programs, Towers of Hanoi problem.

UNIT-4

ARRAYS AND POINTERS: Arrays: Single and multidimensional Arrays, Character array as a string, string functions, Programs using arrays and string manipulation.

Pointers: Pointer's declarations, Pointer expressions, Pointer parameters to functions. Pointers, Pointers and array, Pointer arithmetic.

UNIT-5

STRUCTURES AND FILES: Structures: Declaring and using structures, operations on structures, structures and arrays, user defined data types, pointers to structures. Command line arguments.

Files: Introduction, file structure, file handling functions, file types, file error handling, Programs using file functions.

TEXT BOOKS:

1) https://raptor.martincarlisle.com/
2) Programming with C-Gottfried-Schaums Outline Series-TMH
3) C Programming – AnithaGoel/Ajay Mittal/E.Sreenivasa Reddy-Pearson India

REFERRENCE BOOKS:

1) Problem Solving with C- Somasekharan-PHI.
2) C Programming- Behrouz A forouzan – CENGAGE Learning
3) Test your c skills-Yaswanth kanithker
4) Let us C- Yaswanthkanithker

EE/EC 151 (R20): COMMUNICATION SKILLS LAB

L-3	T-0	P-0	M-100	C-1.5

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Identify the sounds of English and use of stress and intonation in connected speech
CO2	Able to listen carefully to communicate effectively in cross- cultural contexts
CO3	Capable to make the students communicate in Daily life situations
CO4	Capable to read for content/ main idea.
CO5	Able to communicate confidently in oral presentations

CO-PO/PSO MAPPING MATRIX:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	2	2	-	-	2	3	3	-	3	-	-
CO2	-	-	-	2	2	-	-	2	3	3	-	3	-	-
CO3	-	-	-	2	2	-	-	2	3	3	-	3	-	-
CO4	-	-	-	2	2	-	-	2	3	3	-	3	-	-
CO5	-	-	-	2	2	-	-	2	3	3	-	3	-	-
AVG_CO	-	-	-	2	2	-	-	2	3	3	-	3	-	-

LIST OF ACTIVITIES:

1) Identifying phonic sounds, listening to the sounds, practice and record the sounds from the English learning software
2) Common mispronounced words
3) Listening to the short audios and complete the tasks based on the audios
4) Listening to motivational speeches and answering the questions
5) Comprehending Spoken material in British English & American English
6) Situational Dialogues
7) Role plays
8) Reading comprehension exercises for GRE, TOEFL, GATE etc.
9) Reading articles from newspaper
10) Specific reading for enhancing vocabulary
11) Vocabulary building exercises
12) Extempore
13) JAM sessions
14) Small talks
15) Oral presentations

CE/ME/EC 152 (R20): ENGINEERING CHEMISTRY LABORATORY

L-3	T-0	P-0	M-100	C-1.5

COURSE OUTCOMES:

After completion of this course, students will be able to**:**

CO1	Explain various methods of volumetric analysis i.e., Redox, Iodometric, complex metric, Neutralization etc. and use of conductivity meter for measurement of conductance of water sample.
CO2	Apply the use of internal and external indicators and their comparison for redox titrations and mechanisms of iodometric titrations and use of double indicator method in a single titration.
CO3	Estimate the % values of moisture, volatile matter, ash and carbon of fuel by Proximate analysis and instrument handling
CO4	Analyse the properties of lubricants viz. Flash & fire point, viscosity, cloud & pour point and their significance.
CO5	Produce a coherent paragraph interpreting a figure/graph/chart/table (L4) Explain synthetic technique of drug like Aspirin, Paracetamol etc.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	1	-	-	-	-	-	-	-	-
CO2	2	-	-	1	-	-	-	-	-	-	-	-
CO3	2	1	-	2	3	-	-	-	-	-	-	-
CO4	2	1	-	2	3	-	-	-	-	-	-	-
CO5	2	-	1	-	-	-	-	-	-	-	-	-

LIST OF EXPERIMENTS:

1) Determination of hardness of water by EDTA method
2) Estimation of Mohr's salt by Permanganometry
3) Estimation of Mohr's salt by Dicrometry
4) Determination of alkalinity of water
5) Percentage of purity of washing soda
6) Determination of available chlorine in bleaching powder
7) Preparation of Urea-formaldehyde resin
8) Determination on strength of NaoH using HCl conducto metrically
9) Acid-Base titration by P^H meter
10) Acid-Base titration by Potentiometer
11) Determination of viscosity of lubricating oil
12) Determine of Surface tension.

CE/ME/EE/EC/CS 153 (R20): COMPUTER PROGRAMMING LAB

L-3	T-0	P-0	M-100	C-1.5

COURSE OUTCOMES:

After completion of this course, students will be able to**:**

CO 1	Understand and apply fundamental programming concepts such as variables, data types, operators, control structures, functions, arrays, pointers, and structures in C language.
CO 2	Develop efficient algorithms and use appropriate data structures to solve programming problems in C
CO 3	Demonstrate the ability to write and debug C programs using appropriate tools and techniques, including integrated development environments (IDEs) and debugging utilities
CO 4	Evaluate the efficiency and complexity of C programs in terms of time and space complexity, and apply appropriate techniques to optimize program performance.
CO 5	Work collaboratively in teams to develop complex C programs, and effectively communicate technical information and programming solutions to others.

MAPPING MATRIX OF CO'S AND PO'S:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	2	2	2	-	-	2	2	2	1
CO2	-	2	2	2	-	-	1	2	-	2	2	2	3	1
CO3	1	-	2	1	-	-	1	-	1	-	2	2	3	1
CO4	2	-	-	2	-	-	-	1	1	2	2	2	3	1
CO5	-	2	1	-	2	-	-	1	-	-	2	2	2	1
AVG_CO	1	1	1	1	1	1	1	1	1	1	2	2	2	1

CYCLE 1:

1) Construct flowcharts to
   a) Calculate the maximum, minimum and average of N numbers
   b) Develop a calculator to convert time, distance, area, volume and temperature from one unit to another.
2) Construct flowcharts with separate procedures to
   a) calculate simple and compound interest for various parameters specified by the user
   b) calculate the greatest common divisor using iteration and recursion for two numbers as specified by the user

3) Construct flowcharts with procedures to
   a) Generate first N numbers in the Fibonacci series
   b) Generate N Prime numbers
4) Design a flowchart to perform Linear search on list of N unsorted numbers (Iterative and recursive)
5) Design a flowchart to perform Binary search on list of N sorted numbers (Iterative and recursive)
6) Design a flowchart to determine the number of characters and lines in a text file specified by the user.

CYCLE 2:

1. EXERCISES ON DATA TYPES AND OPERATORS?

a) Practice exercises 3.1 to 3.16 and 4.1 to 4.17 and 14.1 to 14.20 Test your C Skills – yaswanth kanitkar text book.
b) Write a program which determines the largest and the smallest number that can be stored in different data types of like short, int., long, float and double. What happens when you add 1 to the largest possible integer number that can be stored?
c) Write a program to find greatest of three numbers using conditional operator?
d) Write a program to swap two numbers with and without temp variable?
e) Practice a program using multiple unary increment and decrement operators in arithmetic expressions?

2. EXERCISES ON CONTROL STRUCTURES?

a) Practice exercise 2.1 to 2.15 Test your C Skills – yaswanth kanitkar text book.
b) Write a program to find greatest of three numbers? Use nested if, if else if and switch statements?
c) Write a program to read marks of a student and print the sum and average?
d) Display the grade based on the sum of marks?
e) write a program to count the digits of a number? Use for loop
f) Write a program to check whether a number is perfect or not? Use do-while
g) Write a program to check whether a number is strong or not? Use while
h) Write a program to check whether a number is amstrong or not? Use for
i) Write a program to check whether a number is palindrome or not? Use for
j) Write a program to find the Fibonacci series upto the given number? Use while
k) Write a program to print the pascals triangle? Used do-while
l) Write a program to print the result of the series 1+x^2/2+x^3/3+….+x^n/n

3. EXERCISES ON FUNCTIONS?

a) Practice exercise 5.1 to 5.14 Test your C skills –yaswanth kanitkar text book.
b) Write program to swap two variables using functions? Write a program to perform menu driven arithmetic operations using functions?
c) Write a program to find the factorial of a number using recursive and non- recursive functions?
d) Write a program to find the Fibonacci series using recursive functions?
e) Write a program to find the solution for towers of Hanoi using recursive function?
f) Write a program to pass parameters to a functions using call by value and call by reference?

4. EXERCISES ON ARRAYS?

a) Practice exercise 9.1 to 9.17 Test your C skills - yaswanthkanitkar text book.
b) Write a program to read n numbers and sort them?
c) Write a program to find the minimum and maximum numbers of the array?
d) Write a program to read two matrices and find their sum, difference and product of them?
e) Find the transpose of a matrix?
f) Write a program to print upper and lower triangle of a given matrix?

5. EXERCISES ON STRINGS?

a) Practice exercise 10.1 to 10.15 yaswanthkanitkar text book.
b) Write a program to demonstrate the use of string manipulation functions?
c) Write a program to compare two strings?
d) Write a program to sort the names in Alphabetical order?

6. EXERCISES ON POINTERS?

a) Practice exercise 7.1 to 8.26 yaswanthkanitkar text book.
b) Write a program to read dynamic array and sort the elements?
c) Write a program to read dynamic array and find the minimum and maximum of the elements?
d) Write a program to perform pointer arithmetic?
e) Write a program on pointers for strings?
f) Write a program to use array of pointers?

7. EXERCISES ON STRUCTURES?

a) Practice exercise 11.1 to 11.30 yaswanth kanitkar text book.

b) Write a program to create student structure and read marks of three subjects and find the sum and total of the student?
c) Write a program on arrays of structures for 60 student's record using the above student structure?
d) Write a program for complex structure? Perform addition, subtraction and multiplication of two complex numbers?
e) Write a program for addition and multiplication of two polynomials?

8. WRITE A PROGRAM ON FILES?

a) Practice exercise 12.1 to 12.20 yaswanth kanitkar text book.
b) Write a program to append content of a file?
c) Write a program to display the content of a file?
d) Write a program to copy content of one file to other file?
e) Write a program to count the no of characters in a file?
f) Write a program to compare the contents of two files?

REFERENCES:

1) Test your C Skills by – Yaswanth Kanithkar-BPB Publishers.
2) C programming; Test your skills-A.N.Kamthane-Pearson India.

I/IV B.Tech.
SEMESTER II

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING

I/IV B.TECH. SEMESTER-II

CE/ME/EE/EC/CS121 (R20): MATHEMATICS-II

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO 1	Using variable separable method and using other methods solving the higher order differential equation.
CO 2	Reducing the given differential equations and solving for the required solutions.
CO 3	Student should be known about first order partial differential equations and its solutions obtained by using different methods.
CO 4	Student should able to understand about vectors, vector differentiation methods.
CO 5	Student should able to find vector integration by using different methods and also applications of vectors in various fields.

MAPPING MATRIX OF CO'S AND PO'S:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	-	-	-	-	-	-	-	2	3	-	-	-
CO2	1	3	-	-	-	-	-	-	-	1	3	-	-	-
CO3	2	3	-	-	-	-	-	-	-	2	2	-	-	-
CO4	2	2	-	-	-	-	-	-	-	3	2	-	-	-
CO5	1	2	-	-	-	-	-	-	-	3	3	-	-	-
AVG-CO	1	2	-	-	-	-	-	-	-	2	3	-	-	-

UNIT-I

LINEAR DIFFERENTIAL EQUATIONS OF HIGHER ORDER: Definitions, complete solution, operator D, rules for finding complimentary function, inverse operator, rules for finding particular integral, method of variation of parameters.

UNIT-II

Equations Reducible to Linear Differential Equations and Applications: Cauchy's and Legendre's linear equations, simultaneous linear equations with constant coefficients,

UNIT-III

PARTIAL DIFFERENTIAL EQUATIONS – FIRST ORDER: First order partial differential equations, solutions of first order linear and non-linear PDEs.Solutions to homogenous and non-homogenous higher order linear partial differential equations.

UNIT-IV

MULTIVARIABLE CALCULUS (VECTOR DIFFERENTIATION): Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions-Divergence and Curl, vector identities.

UNIT-V

MULTIVARIABLE CALCULUS (VECTOR INTEGRATION): Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof).

TEXT BOOKS:

1) Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2) B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

REFERENCE BOOKS:

1) Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2011.
2) Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018
3) George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
4) R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
5) Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2011.

CE/ME/EC 122(R0): ENGINEERING PHYSICS

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES: After completion of this course, students will be able to:

CO1	Distinguish the phenomena of light- Interference, diffraction, and determination of the wavelength of given light using these phenomena.
CO2	Apply the concepts of light in optical fiber and lasers in communication system. Use of fibers in communication system. Major applications of fibers and Lasers in medical field.
CO3	Classify the magnetic materials and apply the magnetic, dielectric materials for given engineering applications.
CO4	Classify the semiconductors and study the properties of Semiconductors. Hall effect.
CO5	Calculate the energy of quantum particle at different energy levels, de Broglie's hypothesis, Schrodinger's wave function and its applications, study of the properties of superconductors. BCS Theory of Superconductivity.

CO-PO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	-
AVG_CO	**3**	**3**	**2**	-	-	-	-	-	-	-	-	-	-	-

UNIT-I

INTERFERENCE: Principle of Superposition-Interference of light-Theory of Interference Fringes-Conditions for sustained Interference-Interference in thin films by reflected light-Newton's Rings-Determination of Wavelength.

DIFFRACTION: Fraunhofer Diffraction-Single slit Diffraction - Diffraction Grating – Grating Spectrum -Determination of Wavelength.

UNIT-II

LASERS: Laser characteristics, Spontaneous and Stimulated emissions, Basic requirements of a laser, Population inversion – Solid state laser (Ruby laser), Gas (He-Ne) laser, Semiconductor (GaAs) laser, applications of lasers.

FIBER OPTICS: Introduction to Optical Fibers-Principle of optical fiber-Critical angle, Acceptance Angle-Numerical Aperture-Classification of fibers based on Refractive index profile, Modes-Propagation of electromagnetic wave through optical fiber - Fiber optic Communication system-applications of Optical fibers.

UNIT – III

DIELECTRICS: Introduction to Dielectrics--Electric Polarization-Dielectric polarizability, Susceptibility and Dielectric constant- Types of polarizations-Lorentz (internal) field - Claussius -Mossotti equation.

MAGNETICS: Introduction to Magnetics-Magnetic dipole moment-Magnetization-Magnetic susceptibility and permeability-Origin of permanent magnetic moment-Classification of Magnetic Materials-Hysteresis-soft and hard magnetic materials-applications of magnetic materials.

UNIT – IV

SEMICONDUCTORS:

Origin of energy band formation in solids-Classification of materials into conductors, semi-conductors & insulators – Semiconductors-Intrinsic semiconductors-dependence of Fermi level on carrier concentration and temperature (Qualitative)- Extrinsic semiconductors - P-type & N-type-dependence of Fermi level on carrier concentration and temperature (Qualitative)- Direct and Indirect band gap semiconductors-Hall effect- applications of Semiconductors.

UNIT-V

PRINCIPLES OF QUANTUM MECHANICS: Dual nature of light, Matter waves & properties, de Broglie's concept of matter waves, Davisson and Germer experiment, Heisenberg's uncertainty principle and application (non-existence of electron in nucleus). One dimensional time independent Schrodinger's wave equation, Physical significance of the wave function, Particle in a box (one dimensional).

SUPERCONDUCTIVITY: First experiment, critical parameters (Tc, Hc, Ic), Meissner effect, BCS Theory (in brief) and Applications of superconductors.

TEXT BOOKS:

1) M.N. Avadhanulu, P.G.Kshirsagar "A Text book of Engineering Physics"-S.Chand Publications,2017
2) H.K.Malik & A.K.Singh "Engineering Physics",- McGraw Hill Publishing Company Ltd, 2018.
3) Gaur R.K. and Gupta S.L., "Engineering Physics"- Dhanpat Rai publishers, 2012.

REFERENCE BOOKS:

1) Gerd Keiser “Optical Fiber Communications”- 4/e, Tata Mc GrawHill,2008
2) S.M.Sze “Semiconductor devices-Physics and Technology”-Wiley,2008
3) D.K. Bhattacharya and A. Bhaskaran, “Engineering Physics”- Oxford Publications-2015

EE/EC 123(R20): BASIC ELECTRICAL ENGINEERING

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Understand the fundamental concepts of DC and AC circuits, including Kirchhoff's laws, series and parallel connections, and nodal and loop analysis
CO2	Analyze single-phase AC circuits consisting of RL, RC, and RLC series circuits, including series resonance and band width
CO3	Demonstrate knowledge of magnetic circuits and their properties, including Faraday's laws of electromagnetic induction, dynamically and statically induced EMF, and self and mutual inductance
CO4	Explain the principle and operation of DC machines, including DC generators and motors, and understand their performance characteristics and speed control methods.
CO5	Describe the principle, operation, and construction of AC machines, including single-phase transformers and three-phase induction motors, and understand their losses, efficiency, and testing methods.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	-	-	-	-	-	-	-	3	3	3	-
CO2	-	-	-	2	2	-	-	1	-	3	3	3	-	-
CO3	2	2	2	-	-	-	-	-	-	-	-	-	3	3
CO4	-	-	-	-	-	2	2	2	2	2	-	3	3	-
CO5	-	-	2	-	-	1	1	-	-	-	3	1	2	-
AVG_CO	1	1	1	1	1	1	1	1	1	1	2	1	2	1

UNIT – I

DC & AC CIRCUITS: Electrical circuit elements (R - L and C) - Kirchhoff laws - Series and parallel connection of resistances with DC excitation. Nodal and loop analysis. Thevenin's and Superposition Theorems, Representation of sinusoidal waveforms - peak and rms values - phasor representation - real power - reactive power - apparent power - power factor - Analysis of single-phase ac circuits consisting of RL - RC - RLC series circuits. Series Resonance and band width.

UNIT-II

POLY PHASE & MAGNETIC CIRCUITS: Generation of 3-phase voltages - phase sequence - star & delta connections - voltage, current & power in star & delta connected systems - analysis of 3-phase balanced circuits - measurement of 3-phase power by 2 wattmeter method.

Faraday's Laws of Electromagnetic Induction. Dynamically induced EMF –Statically induced EMF – Self Inductance – Mutual Inductance - Coefficient of coupling –Inductances in Series – Inductances in parallel – Dot convention.

UNIT-III

DC MACHINES: Principle and operation of DC Generator - EMF equation - OCC characteristics of DC generator – Principle and operation of DC Motor – Performance Characteristics of DC Motors - Speed control of DC Motors

UNIT-IV

AC MACHINES: Principle and operation of Single-Phase Transformer - EMF equations-losses in transformers, regulation and efficiency. OC and SC test on transformer – auto transformer.

Principle, operation and construction of Three phase Induction Motor –torque equation and torque slip characteristics-power losses and efficiency.

UNIT-V

SEMICONDUCTOR DEVICES: Characteristics of Semiconductor junction Diode, Zener diode, transistor, JFET, UJT, SCR and their applications. Half-wave, Full-wave rectifiers and Bridge rectifier, with (L and LC) and without filters.

BIPOLAR JUNCTION TRANSISTOR: Transistor operation, Common base configuration, Common emitter configuration, Transistor amplifying action, Common collector configuration, Operating point

TEXT BOOKS:

1) D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2) E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.

REFERENCE BOOKS:

1) L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
2) D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.

EE/EC124 (R20): PYTHON

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Understand the basic building blocks in python programming language to construct different applications.
CO2	Apply the necessary data structures to solve a given problem
CO3	Extract and import packages for developing different solutions for real time problems.
CO4	Implement the problems in terms of real -world objects using concept of OOPS.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	2	-	-	3	2	1
CO2	2	2	2	-	-	-	-	-	2	-	-	3	1	2
CO3	2	2	2	-	-	-	-	-	2	-	-	3	3	2
CO4	2	2	2	-	-	-	-	-	2	-	-	3	3	1
AVG_CO	2	2	2	-	-	-	-	-	2	-	-	3	2	2

UNIT-I

CONTEXT OF SOFTWARE DEVELOPMENT: Software, Development tools, Learning programming with Python, Writing a python program.

VALUES AND VARIABLES: Variables and assignments, identifier, Control codes within Strings, User Input, The eval function, the print function.

Expressions and Arithmetic: Expressions, Operator precedence and Associativity, Comments, Errors, more arithmetic operators.

UNIT-II

CONDITIONAL EXECUTION: Boolean Expressions, Simple if and if else, nested conditionals, multiway decision statements, conditional expressions, errors in conditional statements.

ITERATION: While statements, for statement, definite loops and indefinite loops, nested loops, abnormal loop termination, infinite loops, iteration examples: computing square root, drawing a tree, printing prime numbers.

UNIT-III

FUNCTIONS: Introduction, standard mathematical functions, time functions, Random numbers, main function, parameter passing, Function examples: Better organized prime number, Command Interpreter, Restricted Input, Better Die rolling simulator, Tree-Drawing Function, Floating –Point equality, Custom functions Vs Standard functions.

MORE ON FUNCTIONS: Global variables, Default Parameters, recursion, Making functions reusable, documenting functions and modules, functions as data.

UNIT-IV

LISTS: Using Lists, List assignment and equivalence, list bounds, Slicing, Lists and functions, Prime generation with a list

LISTS PROCESSING: Sorting, flexible sorting, search, list permutations, randomly permuting a list, reversing a list.

UNIT-V

OBJECTS: Using Objects, String Objects, List Objects.

CUSTOM TYPES: geometric points, Methods, Custom type examples, Class inheritance.

HANDLING EXCEPTIONS: Motivation, Exception examples, Using Exceptions, Custom Exceptions.

REFERNECE BOOKS:

1) LEARNING TO PROGRAM WITH PYTHON Richard L. Halterman
2) Core Python Programming by Dr. R.Nageswara Rao, dreamtech, second edition

CE/ME/EC/125 (R20): ENGINEERING MECHANICS

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Determine resultants and apply conditions of static equilibrium to plane force systems.
CO2	Develop complete and correct free body diagrams and write the appropriate equilibrium equations from the free body diagrams.
CO3	Analyze systems that include frictional forces.
CO4	Locate the centroid of area, moment of inertia, product of inertia of various shape.
CO5	Apply the theorem of virtual work on beam, frame and link problem.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO2	2	2	1	-	-	-	-	-	-	-	-	1	-	-
CO3	2	2	1	-	-	-	-	-	-	-	-	1	-	-
CO4	2	2	1	-	-	-	-	-	-	-	-	1	-	-
CO5	2	2	1	-	-	-	-	-	-	-	-	1	-	-
AVG_CO	2	2	1	-	-	-	-	-	-	-	-	1	-	-

UNIT I

INTRODUCTION TO ENGINEERING MECHANICS: Composition and resolution of forces, parallelogram law, principle of transmissibility, types of force systems - concurrent and concurrent coplanar forces, resultant of coplanar force systems couple, moment of a force Varignon's theorem, concept of free body diagrams, concept of equilibrium of coplanar force systems.

FRICTION: Laws of friction, types of friction, equilibrium of force systems involving frictional forces, wedge friction. Free body diagrams involving frictional forces.

UNIT II

ANALYSIS OF STRUCTURES: Introduction to plane trusses, analysis of plane trusses by method of joints and method of sections.

PROPERTIES OF SURFACES AND VOLUMES: Centroid and center of gravity, derivation of centroids from first moment of area, centroids of composite sections, center of gravity of common volumes - cylinder, cone, sphere, theorem of Pappus-guidinus.

UNIT III

MOMENT OF INERTIA: Area moment of inertia of plane and composite shapes, parallel axis theorem, perpendicular axis theorem, polar moment of inertia, mass moment of inertia of common volumes -thin plates, thin rod, cylinder, cone, sphere, rectangular prism, radius of gyration.

UNIT IV

KINEMATICS: Equations of motion for rigid bodies, constant and variable acceleration, rectilinear and curvilinear motion, motion under gravity -projectile motion, use of rectangular coordinates, tangential and normal coordinates.

UNIT V

KINETICS: Principles of dynamics - Newton's Laws of motion, D'Alembert's principle in rectilinear translation, principle of work and energy.

IDEAL SYSTEMS: Principle of conservation of energy, concept of power, conservation of linear and angular momentum, principle of momentum and impulse.

TEXT BOOKS:

1) N H Dubey, Engineering Mechanics: Statics and Dynamics, McGraw Hill, 2014.
2) S Timoshenko, DH Young, JV Rao, SukumarPati, Engineering Mechanics (in SI units), 5/e, McGraw Hill, 20
3) S SBhavikatti, Engineering Mechanics, 4/e, New Age International, 2008.

REFERENCE BOOKS:

1) Basudeb Bhattacharya., Engineering Mechanics, 2/e, Oxford University Press (India), 2015.
2) Irving Shames, G K M Rao, Engineering Mechanics: Statics and Dynam-ics, 4/e, Pearson, 2009.
3) K L Kumar, Veenu Kumar, Engineering Mechanics, 4/e, Tata McGraw Hill, 2010

CE/ME/EC126 (R20): ENVIRONMENTAL SCIENCE

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1	Gain knowledge about environment and importance of Environmental Studies in the life. They have to know about resources, its importance and environmental impacts of human activities on natural resources.
CO2	Students will learn about the Ecosystem functioning and Importance of biodiversity and its Conservation.
CO3	Gain knowledge about the environmental pollution control, management of waste and pollution related aspects
CO4	Aware students about social issues and natural calamities, constitutional tools provisions for human welfare.
CO5	Students will learn about increase in population growth and its impact on environment and study of different ecosystems through field visit.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	C	3	3	1	1	1	1	3	2
CO2	3	2	2	2	2	2	3	3	1	1	1	1	3	2
CO3	3	2	2	2	2	2	3	3	1	1	1	1	3	2
CO4	3	3	2	2	3	2	3	3	1	1	1	1	3	2
CO5	3	3	2	2	3	2	3	3	1	1	1	1	3	2
AVG_CO	3	2	2	2	2	2	3	3	1	1	1	1	3	2

UNIT – I

MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES: Definition, Scope and Importance – Need for Public Awareness.

NATURAL RESOURCES: Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources.

UNIT – II

ECOSYSTEMS: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

BIODIVERSITY AND ITS CONSERVATION: Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III

ENVIRONMENTAL POLLUTION: Definition, Cause, effects and control measures of:

a) Air Pollution.
b) Water pollution
c) Soil pollution
d) Marine pollution
e) Noise pollution
f) Thermal pollution
g) Nuclear hazards

SOLID WASTE MANAGEMENT: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT – IV:

SOCIAL ISSUES AND THE ENVIRONMENT: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT – V:

HUMAN POPULATION AND THE ENVIRONMENT: Population growth, variation among nations. Population explosion – Family Welfare Programd. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

FIELD WORK: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc..

TEXT BOOKS:

1) Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press.
2) Environmental Studies by Palaniswamy – Pearson education
3) Environmental Studies by Dr.S.Azeem Unnisa, Academic Publishing Company

REFERENCE BOOKS:

1) Textbook of Environmental Science by Deeksha Dave and E.Sai Baba Reddy, Cengage Publications.
2) Text book of Environmental Sciences and Technology by M.Anji Reddy, BS Publication.
3) Comprehensive Environmental studies by J.P.Sharma, Laxmi publications.
4) Environmental sciences and engineering – J. Glynn Henry and Gary W. Heinke – Prentice hall of India Private limited.
5) A Text Book of Environmental Studies by G.R.Chatwal, Himalaya Publishing House
6) Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Prentice hall of India Private limited.

CE/ME/EC161 (R20): ENGINEERING PHYSICS LABORATORY

L-3	T-0	P-0	M-100	C-1.5

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1	Examine the physical properties of light using interference and diffraction.
CO2	Calculate the numerical aperture and acceptance angle of optical fiber
CO3	Analyze the characteristics of semiconducting material
CO4	Demonstrate the magnetizing behavior of magnetic materials
CO5	Calculate the dielectric constant of a material

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	3	-	-	-	3	-	-	-	-	-
CO2	3	-	-	-	3	-	-	-	3	-	-	-	-	-
CO3	3	3	-	-	3	-	-	-	3	-	-	-	-	-
CO4	3	-	-	-	3	-	-	-	3	-	-	-	-	-
CO5	3	-	-	-	3	-	-	-	3	-	-	-	-	-
AVG_CO	3	1	-	-	3	-	-	-	3	-	-	-	-	-

LIST OF PHYSICS EXPERIMENTS:

1) Determination of the radius of curvature of the lens by Newton's ring method.
2) Determination of wavelength by plane diffraction grating method.
3) Dispersive power of a Prism.
4) Resolving power of a grating.
5) Photo cell – I-V Characteristic curves and determination of stopping potential.
6) Magnetic field along the axis of a circular coil carrying current.
7) B-H Curve
8) To determine the numerical aperture of a given optical fiber and hence to find its acceptance angle.
9) Hall Effect.
10) Photo voltaic cell - Determination of fill-factor.
11) To determine the energy gap of a semiconductor.
12) Determination of Acceleration due to gravity by using compound Pendulum.
13) Poisson's ratio of aluminum and rubber.
14) Rigidity modulus of material by wire-dynamic method (torsional pendulum).
15) Determination of a.c. Frequency – Sonometer.
16) Determine the wavelength of Laser source.

EEE/ECE16 (R20):BASIC ELECTRICAL ENGINEERING LABORATORY

L-3	T-0	P-0	M-100	C-1.5

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Understand basic safety precautions and be able to use measuring instruments such as voltmeter, ammeter, multi-meter, and oscilloscope.
CO2	Verify Kirchhoff's laws by performing experiments on electrical circuits.
CO3	Verify the Superposition theorem by performing experiments on electrical circuits.
CO4	Verify Thevenin's theorem by performing experiments on electrical circuits.
CO5	Understand the open circuit characteristics of a DC shunt generator and be able to perform experiments to determine its behavior.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	-	1	1	-	-	2	-	-	-	2	3	1
CO2	2	3	1	3	2	-	-	2	-	-	-	2	3	1
CO3	-	2	-	1	-	-	-	2	-	-	-	2	3	1
CO4	2	3	-	3	2	-	-	2	-	-	-	2	3	1
CO5	3	3	2	3	-	-	-	2	-	-	1	3	2	1
AVG_CO	2	2	1	2	1	-	-	2	-	-	1	2	3	1

LIST OF EXPERIMENTS:

1) Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2) Verification of Kirchhoff laws.
3) Verification of Superposition Theorem.
4) Verification of Thevenin's Theorems
5) Open circuit characteristics of a DC Shunt Generator.
6) Speed control of DC Shunt Motor.
7) Brake test on DC Shunt Motor.
8) OC & SC test of 1 – Phase Transformer.
9) Brake test on 3 - Phase Induction Motor.
10) Characteristics of PN junction and zener diode
11) Characteristics of transistor in common emitter configuration
12) Verification of transistor self bias circuit.

EC163 (R20): PYTHON PROGRAMMING LAB

L-3	T-0	P-0	M-100	C-1.5

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Implement python programming constructs to build small to large scale applications.
CO2	Implement the problems in terms of real -world objects using OOPs technology.
CO3	Evaluate and handle the errors during runtime involved in a program
CO4	Extract and import packages for developing different solutions for real time problems.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	2	-	-	-	-	-	2	-	-	3	2	1
CO2	3	2	2	-	-	-	-	-	2	-	-	3	1	2
CO3	2	2	2	-	-	-	-	-	2	-	-	3	3	2
CO4	2	2	2	-	-	-	-	-	2	-	-	3	3	1
AVG-CO	2	2	2	-	-	-	-	-	2	-	-	3	2	1

LIST OF EXPERIMENTS:

1) Design a Python script to convert a Binary number to Decimal number and verify if it is a Perfect number.
2) Design a Python script to determine if a given string is a Palindrome using recursion
3) Design a Python script to sort numbers specified in a text file using lists.
4) Design a Python script to determine the difference in date for given two dates in YYYY:MM:DD format(0 <= YYYY <= 9999, 1 <= MM <= 12, 1 <= DD <= 31) following the leap year rules.
5) Design a Python Script to determine the Square Root of a given number without using inbuilt functions in Python.
6) Design a Python Script to determine the time difference between two given times in HH:MM:SS format.(0 <= HH <= 23, 0 <= MM <= 59, 0 <= SS <= 59)
7) Design a Python Script to find the value of (Sine, Cosine, Log, PI, *e*) of a given number using infinite series of the function.
8) Design a Python Script to convert a given number to words

9) Design a Python Script to convert a given number to roman number.
10) Design a Python Script to generate the frequency count of words in a text file.
11) Design a Python Script to print a spiral pattern for a 2 dimensional matrix.
12) Design a Python Script to implement Gaussian Elimination method.
13) Design a Python script to generate statistical reports (Minimum, Maximum, Count, Average, Sum etc) on public datasets.
14) Design a Python script using the Turtle graphics library to construct a turtle bar chart representing the grades obtained by N students read from a file categorising them into distinction, first class, second class, third class and failed.
15) Design a Python script to search an element in the given list.
16) Design a Python script on *str* methods and *list* methods.

II/IV B.Tech.
SEMESTER I

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING

II/IV B.Tech. SEMESTER-I

EC211 (R20): ELECTRONIC DEVICES

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Demonstrate understanding of the characteristic behavior of various electronic devices such as Diodes, Transistors etc.
CO2	Apply the acquired knowledge in the analysis of various diode and Transistor circuits
CO3	Compare and contrast the characteristics of BJT and FET in various configurations.
CO4	Evaluate the performance parameters of various diode circuits and Transistor circuits
CO5	Design and analyse amplifier circuits and relate the knowledge of BJT and FET behavior in the design of various biasing and amplifier circuits.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	-	1	1	-	-	2	-	-	-	2	3	1
CO2	2	3	1	3	2	-	-	2	-	-	-	2	3	1
CO3	-	2	-	1	-	-	-	2	-	-	-	2	3	1
CO4	2	3	-	3	2	-	-	2	-	-	-	2	3	1
CO5	3	3	2	3	-	-	-	-	-	-	1	3	2	1
AVG_CO	**2**	**3**	**2**	**3**	**2**	**-**	**-**	**2**	**-**	**-**	**1**	**2**	**3**	**1**

UNIT I

THE PN JUNCTION DIODE: Basic Structure of the PN Junction, Biasing of PN Junction Diode, V-I characteristics of PN junction diode, Diode Current Equation, Effect of temperature on PN junction diodes, Static and Dynamic Resistances, Break Down of PN Junction Diode, Diffusion Capacitance, Transition Capacitance of The Diode, Diode Switching times, Piecewise Linear Diode Model.

UNIT II

BIPOLAR JUNCTION TRANSISTOR (BJT): Transistor Construction, Operation, Specification Sheet, Transistor Testing, Transistor Casing and Terminal Identification, Transistor Biasing, Operation of NPN and PNP transistor, Transistor as an Amplifier, Transistor configurations and their characteristics, Ebers Moll Model.

UNIT III

TRANSISTOR BIASING AND STABILIZATION: Need for Biasing, Operating Point, Load lines and Quiescent Point, Fixed Bias Circuit, Self-Bias Circuit, Voltage Divider Bias Circuit, Collector to Base Bias Circuit Emitter Stabilized Bias Circuit, Bias Compensation using Diodes and Transistors Stabilization Factors, Stabilization against variations in VBE and β, Bias Compensation using Diodes and Transistors, Thermal Runaway, Thermal Stability,

UNIT IV

JFET BIASING: Biasing Circuits for FET: Fixed Bias Circuit, Voltage Divider Bias Circuit, Self-Bias Circuit, Graphical Solution for Self-Bias.

MOSFET: Depletion MOSFET, Enhancement MOSFET, Comparison of BJT, JFET and MOSFET, Comparison of DMOSFET and EMOSFET, Biasing of MOSFET.

UNIT V

SINGLE STAGE AMPLIFIERS: Small Signal Low Frequency Amplifier Circuits: CE, CB, CC Amplifier Circuits, Small Signal Analysis of Junction Transistor: Analysis of CE, CB, CC using Hybrid Model, Analysis of CE Amplifier with Collector to Base Bias, Millers Theorem, Analysis of CE Amplifier with Emitter Resistance: Exact and Approximate Analysis.

TEXT BOOKS:

1) Jacob Millman, Christos C. Halkias, and SatyabrataJit "Electronic devices and Circuits", 2nd Edition TMH, 1998.
2) Donald A. Neamen, "Semiconductor Physics and Devices", 3rd edition, TMH,2003
3) Robert L.Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory, Tenth Edition, PEARSON Publications.

REFERENCE BOOKS:

1) S.Salivahanan, N.Suresh Kumar and A.Vallavaraju, "Electronic Devices and Circuits" 2nd Edition, 2008, TMH.
2) U.A.Bakshi and A.P.Godse "Electronic Devices and Circuits" 1st Edition, 2014, Technical Publications.

EC/EE 212 (R20): DIGITAL LOGIC DESIGN

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Manipulate numeric information in different forms, able to manipulate simple Boolean expressions using the theorems and postulates of Boolean algebra and to minimize combinational functions
CO2	Design and analyze small combinational circuits and to use standard combinational functions to build larger more complex circuits.
CO3	Design and analyze small sequential circuits and to use standard sequential functions to build larger more complex circuits
CO4	Design and analyze synchronous sequential circuits with finite state machines
CO5	Understand and analyze the circuit design of various Logic Families.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	-	1	3	-	3	3	2
CO2	3	2	1	1	-	-	-	-	1	3	-	3	2	2
CO3	3	2	1	1	-	-	-	-	1	3	-	3	2	2
CO4	3	3	2	1	-	-	-	-	1	3	-	3	3	3
CO5	3	3	2	1	-	-	-	-	1	3	-	3	3	3
AVG-CO	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**1**	**3**	**-**	**3**	**3**	**3**

UNIT-I

NUMBER SYSTEMS AND CODES: Decimal, Binary, Hexadecimal Number Systems and their Conversions Arithmetic Additions Subtraction using the method of Complements, Multiplication and Division Codes: BCD, Excess-3, Gray and Alphanumeric Codes

BOOLEAN ALGEBRA: Boolean Expressions and Theorems, Logic Gates, Universal Gates, Canonical and Standard forms, Boolean functions, Simplification of Boolean functions using K maps, Minimal Functions and their properties, Tabulation Method NAND and NOR Implementations Two Level and Multi Level

UNIT-II

COMBINATIONAL LOGIC CIRCUITS: EX-OR EX-NOR Circuits, General procedure **for combinational logic circuits, design and application of binary** Adders and Subtractors, Comparators, Encoders, Decoders Multiplexers and Demultiplexers, Design of BCD to 7 Segment Decoder, Parity Generator and Checker, BCD Adder/Subtractor, Carry Look Ahead Adders.

UNIT-III

SEQUENTIAL LOGIC CIRCUITS: **Latches, characteristic table, characteristic:** Equation, Excitation Table, State table and State Diagrams for SR, JK, Master Slave JK, D and T flip-flops, Conversion from one type of Flip-Flop to another, shift registers, Analysis and Synthesis of Sequential Circuits, Sequence Generator, Sequence detector, Parity Generator

COUNTERS USING FLIP-FLOPS: Design of Ripple Counters, Synchronous Counter Up/Down Counters using Flip-Flops.

UNIT-IV

SYNCHRONOUS SEQUENTIAL CIRCUITS: Basic Design Steps, Sate Assignment Problem, Mealy State Model, Serial Adder Example, State Minimization, Design of a Counter using the Sequential Circuit Approach, FSM as an Arbiter Circuit, Analysis of Synchronous Sequential Circuits, ASM Charts, Formal Model for Sequential Circuits.

UNIT V

IC LOGIC FAMILIES: RTL, DTL, TTL, ECL and IIL families and their comparison

TEXT BOOKS:

1) M Morris Mano and Micael D. Ciletti, Digital Design, Pearson Education, 2008
2) Digital Principles and Design, Donald D. Givone, TMH,20Cb

REFERENCE BOOKS:

1) Thomas L. Floyd, Digital Fundamentals 7th Edition, Pearson
2) Charles H. Roth jr., Fundamentals of logic Design, Jaico publications, 1992
3) Taub and Schilling, Digital Integrated Electronics.

EC213 (R20): SIGNALS & SYSTEMS

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Use mathematical concepts to analyze signals and systems
CO2	Explain and design the state space analysis of LTI system.
CO3	Comprehend the effects of sampling on a continuous time signal.
CO4	Calculate Fourier series and Fourier transform of continuous and discrete time signals.
CO5	Analyze signal and system properties like stability and causality using Laplace and Z transforms.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	-	-	-	-	-	3	-	-	3	2
CO2	3	3	2	3	-	-	-	-	-	2	-	-	2	2
CO3	3	3	2	3	-	-	-	-	-	3	-	-	3	2
CO4	3	3	2	2	-	-	-	-	-	3	-	-	3	2
CO5	3	3	2	2	-	-	-	-	-	3	-	-	3	2
AVG_CO	**3**	**3**	**2**	**2.6**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**3**	**2**

UNIT -I

SIGNAL ANALYSIS: Introduction to signals and systems, classification of signals and systems (both discrete and continuous), approximation of a function by a set of mutually orthogonal functions, evaluation of mean square error, orthogonality in complex functions, trigonometric and exponential Fourier series.

UNIT - II

FOURIER TRANSFORM: 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 transform, Energy density spectrum.

SIGNAL TRANSMISSION THROUGH LINEAR NETWORKS: Linear time- invariant system, Time response, Convolution and it's graphical interpretation, Causality and stability, Paley-Wiener criterion, Frequency response, Filter characteristics of linear systems, Conditions for distortionless transmission, Relation between bandwidth and rise time.

UNIT - III

SPECTRAL DENSITY AND CORRELATION: Energy and power spectral density, Properties, Auto-correlation and Cross-correlation functions, Properties of correlation function, Parseval's theorem.

SAMPLING THEOREM AND ITS IMPLICATIONS RECONSTRUCTION: ideal interpolator, Zero-order hold, First order hold, Aliasing and its effects.

UNIT-IV

LAPLACE TRANSFORM: The Laplace transform, Region of Convergence, the inverse Laplace transform, Properties of Laplace transform, problems.

UNIT -V

Z-transform: Z-transform, Region of Convergence, Properties of Z-transform, Inverse Z-transform

TEXT BOOKS:

1) B P Lathi, Signals, Systems and Communications, BSP, 2003
2) P.Z Peebles, Jr, Probability, random variables and random signal principles, TMH.
3) Simon Haykin, Signals and Systems, John Wiley, 2004

REFERENCE BOOKS:

1) A V Oppenheim, A S Wilsky and IT Young, Signals and Systems, PHI/ Pearson,2003
2) David K Cheng, Analysis of Linear Systems, Narosa Publishers, 1990.

EC214 (R20): NETWORK THEORY

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Understand the concepts of basic circuit laws, mesh and Nodal analysis of circuits and circuit theorems.
CO2	Apply the knowledge of basic circuit law to simplify the networks using network theorems.
CO3	Solve circuit problems using Fourier series, Fourier transform and Laplace transform.
CO4	Calculate frequency response of filter, and various parameters of two port networks.
CO5	Analyze the transient, steady state and resonating behaviour of circuits.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	1	-	3	2	1
CO2	3	3	2	2	-	-	-	-	-	1	-	3	3	1
CO3	3	3	2	2	-	-	-	-	-	1	-	3	3	1
CO4	3	3	2	2	-	-	-	-	-	1	-	3	3	1
CO5	3	3	2	2	-	-	-	-	-	1	-	3	3	1
AVG_CO	**3**	**3**	**2**	**2**	-	-	-	-	-	**1**	-	**3**	**3**	**1**

UNIT – I

REVIEW OF R, L,C AND M(MUTUAL INDUCTANCE) AND THEIR V-I CHARACTERISTICS-DOT RULE-Energy Sources, 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.

GRAPH THEORY: Introduction to Graph Theory, Tree, Branch, Link, Cutset and loop matrices, relationship among various matrices and parameters, Mesh and Nodal Analysis for DC circuits. Formulation of mesh & nodal equations involving are R,L,C and M.

UNIT – II

REVIEW OF SINUSOIDAL ANALYSIS: Phase relation in pure resistor, Inductor and capacitor; Impedance diagram, phasor diagram, series and parallel circuits, compound circuits. Computation of active, reactive and complex powers; power factor.

First order R-L, R-C circuits, Initial conditions in RLC elements- initial conditions for complicated network-time constant-second order circuits (RLC series and parallel circuits).

UNIT – III

LAPLACE TRANSFORMS:

Laplace Transforms of typical signals, periodic functions, Inverse transforms, Initial and final value theorems, Application of Laplace transforms in circuit analysis.

TRANSFORMED NETWORK ANALYSIS: Response of RL, RC, RLC circuits for impulse and pulse excitations using Laplace Transform method. Definition of operational/ transformed impedances and admittances of L, C and transformer with initial conditions; development of transformed networks incorporating initial conditions as sources and solution of transformed networks.

UNIT – IV

NETWORK 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. Sinusoidal steady state Mesh and Node Analysis. Application of network theorems to AC circuits.

UNIT V

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. Frequency response of RL, RC circuits.

TEXT BOOKS:

1) William H. Hayt, Jack E. Kemmerly and Steven M. Durbin, Engineering Circuit Analysis, 6th Edition,TMH, 2002.
2) M.E.Vanvalkenburg, Network Analysis, 3rd Edition, PHI, 2003.
3) A Sudhakar and Shyam Mohan SP, Circuits and Networks: Analysis and Synthesis, 4th Ed, TMH,2010

REFERENCE BOOKS:

1) Franklin F.Kuo, Network Analysis and Synthesis, 2nd Edition, John Wiley & Sons, 2003.
2) MahmoodNahvi and Joseph Edminister, Electric Circuits, 4th Edition, Schaum's outlineseries, TMH, 2004.

EC215 (R20): MATHEMATICS – III

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO 1	Using Laplace transforms find the improper integrals, solving the ODE by using Laplace transforms.
CO 2	Using Fourier series find the expansions of functions in series infinite form and complex form.
CO 3	Using Fourier transform find the integrals and some identities, evaluating improper integrals.
CO 4	Student should able to understand about finding the solution of linear equations and linear simultaneous equations by using numerical methods.
CO 5	Finding interpolation value, finite differences identities using numerical methods.

MAPPING MATRIX OF CO'S AND PO'S:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	3	-	-	-	-	-	-	-	2	2	-	-	-
CO2	3	2	-	-	-	-	-	-	-	1	1	-	-	-
CO3	2	1	-	-	-	-	-	-	-	1	2	-	-	-
CO4	2	1	-	-	-	-	-	-	-	1	2	-	-	-
CO5	1	3	-	-	-	-	-	-	-	3	2	-	-	-
AVG_CO	2	2	-	-	-	-	-	-	-	2	2	-	-	-

UNIT – I

LAPLACE TRANSFORM AND ITS APPLICATIONS TO ORDINARY DIFFERENTIAL EQUATIONS: Definition of Integral transform, Domain of the function and Kernel for the Laplace transforms. Existence of Laplace transform. Laplace transform of standard functions, first shifting Theorem, Laplace transform of functions when they are multiplied or divided by "t". Laplace transforms of derivatives and integrals of functions. – Unit step function – second shifting theorem. Dirac's delta function, Periodic function – Inverse Laplace transform by Partial fractions (Heaviside method) Inverse Laplace transforms of functions when they are multiplied or divided by" s", Inverse Laplace Transforms of derivatives and integrals of functions, Convolution Theorem-Solving ordinary differential equations by Laplace transforms.

UNIT – II

FOURIER SERIES: Introduction and Euler's formulae, Conditions for a Fourier expansion, Functions having points of discontinuity, Change of interval, Even and Odd functions, Half range series, Typical wave forms and Parseval's formulae, Complex form of the Fourier series).

UNIT-III

INTEGRAL TRANSFORMS: Introduction- Definition – Fourier integrals – Fourier integral theorem (without proof)-Fourier sine and cosine integrals – complex form of Fourier integral - Fourier Transforms - Properties of Fourier Transforms - Finite Fourier sine and cosine transforms - Convolution theorem (without proof), Parseval's Identity for Fourier Transforms (without proof)

UNIT-IV

NUMERICAL SOLUTIONS OF EQUATIONS: Introduction - Solution of Algebraic and Transcendental Equations - Bisection method-Newton- Raphson Method - Solutions of linear Simultaneous Linear Equations: iterative Methods - Gauss-Seidel Method

UNIT-V

FINITE DIFFERENCES AND INTERPOLATION: Finite Differences – Differences of a polynomial – factorial notation – relations between operators – Newton's Interpolation formulae – central difference interpolation formulae - Gauss interpolation formulae – stirlings formula - interpolation with unequal intervals – Lagranges interpolation – inverse interpolation.

TEXT BOOKS:

1) B.S. Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.

REFERENCE BOOKS:

1) N.P. Bali, A textbook of Engineering Mathematics, Laxmi publications.
2) Erwin Kreyszig, Advanced Engineering Mathematics, 8th Edition, New Age International (P) Ltd.
3) N.P. Bali, Satyanarayana Bhavanari and IndraniKelker Engineering Mathematics-I by Laxmi publications, New Delhi.
4) Engineering Mathematics-II by T.K.V.Iyengar and B.Krishna Gandhi Etc.

EC 216 (R20): ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

L-2	T-0	P-0	M-100	C-0

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Understand the basic structure of Indian knowledge system.
CO2	Explain basic principles of thought process.
CO3	Understand the basic concept of reasoning and inferencing.
CO4	Understand the basic concept of Indian traditional knowledge in modern Scientific perspective.
CO5	Implementing modern India, aims of Education, subjects

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	2	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	2	-	3	-	2	-	-	-	-
CO3	-	-	-	-	-	3	-	3	-	3	-	-	-	-
CO4	-	-	-	-	-	3	-	-	-	3	-	-	-	-
CO5	-	-	-	-	-	3	-	3	-	-	-	-	-	-
AVG_CO	-	-	-	-	-	3	-	3	-	3	-	-	-	-

UNIT I:

INTRODUCTION TO CULTURE: Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India.

UNIT II:

INDIAN LANGUAGES, CULTURE AND LITERATURE: The role of Sanskrit, Significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of South India.

UNIT III:

RELIGION AND PHILOSOPHY: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious reform movements in Modern India(selected movements only).

UNIT IV:

FINE ARTS IN INDIA: (ARTS, TECHNOLOGY & ENGINEERING): Indian painting, Indian handicrafts, music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (Ancient, Medieval and Modern), Science and Technology in India, development of science in ancient, medieval and modern India.

UNIT V:

Education system in India: Education in Ancient, Medieval and Modern India, aims of Education, subjects, languages, science and scientists of Ancient India, Medieval and Modern India.

REFERENCE BOOKS:

1) KapilKapoor, "Text and Interpretation: The India Tradition", ISBN: 81246033375, 2005
2) "Science and Samskrit", SamskritaBhartiPublisher, ISBN 13:978-8187276333, 2007
3) NCERT, "Position paper on Arts, Music, Dance and Theatre", ISBN: 81-7450 494- X, 200

EC251 (R20): ELECTRONIC DEVICES LAB

L-0	T-0	P-3	M-100	C-1.5

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Demonstrate the characteristic behavior of PN junction diode, Zener diode and special purpose semiconductor diodes
CO2	Examine the characteristics of BJT and FET in various configurations.
CO3	Examine the characteristics of MOSFET in various configurations.
CO4	Evaluate and compare the significant parameters obtained from the characteristics of BJT and FET, and MOSFET
CO5	Design various BJT biasing circuits to identify the appropriate circuit for faithful amplification.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	1	2	-	-	2	2	2	2	2	3	3
CO2	2	2	-	1	2	-	-	2	2	2	2	2	3	3
CO3	2	2	-	1	2	-	-	2	2	2	2	2	3	3
CO4	2	2	-	1	2	-	-	2	2	2	2	2	3	3
CO5	2	1	3	2	2	-	-	-	2	1	-	1	3	2
AVG_CO	**2**	2	3	2	**2**	**-**	**-**	**2**	2	2	2	**2**	**3**	3

LIST OF EXPERIMENTS:

1) Study of C.R.O
2) Characteristics of Silicon and Germanium diodes
3) Characteristics of Zener diode and regulator
4) Characteristics of Common Base configuration
5) Characteristics of Common Emitter configuration
6) Characteristics of Emitter follower circuit
7) Drain and Transfer Characteristics of JFET
8) Drain and Transfer Characteristics of Depletion MOSFET
9) Drain and Transfer Characteristics of Enhancement MOSFET
10) Design and verification of Self bias circuit

11) Characteristics of LDR and Thermistor
12) Characteristics of source follower circuit
13) Characteristics of Photo transistor
14) Design and verification of collector to base bias circuit
15) Design and verification of Current Source Bias Circuit

EC252 (R20): DIGITAL LOGIC DESIGN LAB

L-0	T-0	P-3	M-100	C-1.5

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Understand the pin description of digital IC's.
CO2	Implement Arithmetic logic circuits using digital IC's.
CO3	Implement combinational circuits using digital IC's.
CO4	Apply concept of universal logic gates for digital circuit designing.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	-	-	1	1	1	1	1	2	1
CO2	3	3	2	2	2	-	-	1	1	1	1	1	2	1
CO3	3	3	2	2	2	-	-	1	1	1	1	1	2	1
CO4	3	3	2	2	2	-	-	1	1	1	1	1	2	1
AVG_CO	3	3	**2**	**2**	2	-	-	1	1	1	1	1	**2**	1

LIST OF EXPERIMENTS:

1) Realization of Gates using Discrete Components.
2) Realization of Gates using Universal Building Block (NAND only).
3) Design of Combinational Logic Circuits like Half-adder, Full-adder, Half- Subtractor and Full- Subtractor.
4) Verification of 4-bit Magnitude Comparator.
5) Design of Decoders like BCD-Decimal decoder.
6) Applications of IC Parallel Adder (1's&2'scomplimentaddition).
7) Design of Code Converters (Binary to Gray).
8) Design of Multiplexers/De-Multiplexers.
9) Verification of Truth-Table of Flip-Flops using Gates.
10) Design of Shift registers (To Verify Serial to parallel, parallel to Serial, Serial to Serial and parallel to parallel Converters) usingFlip-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.

EC253 (R20): SIGNALS AND SYSTEMS LAB

L-0	T-0	P-3	M-100	C-1.5

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Understand the fundamentals of signals and systems to generate elementary signals. Use mathematical concepts to analyze signals and systems
CO2	Determine Linearity and Time Invariance Properties of a Continuous/Discrete System.
CO3	Explain the different operations on continuous and discrete signals. Comprehend the effects of sampling on a continuous time signal.
CO4	Apply the concepts of convolution to find the response of the system. Calculate Fourier series and Fourier transform of continuous and discrete time signals.
CO5	Analyze the PDF of randomly distributed signal. Analyze signal and system properties like stability and causality using Laplace and Z transforms.

CO-PO/PSO MATRIX MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	-	-	3	-	-	3	3
CO2	3	3	3	2	3	-	-	-	-	3	-	-	3	3
CO3	3	3	3	3	3	-	-	-	-	3	-	-	3	3
CO4	3	2	3	3	2	-	-	-	-	3	-	-	3	3
CO5	3	3	3	3	3	-	-	-	-	3	-	-	3	3
AVG_CO	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**3**	**3**

LIST OF EXPERIMENTS:

1) Write a program to generate the discrete sequences
   i) Unit step
   ii) Unit impulse
   iii) Ramp
   iv) Periodic sinusoidal sequences.
   Plot all the sequences.
2) Write a MATLAB program to perform addition, subtraction, multiplication, amplitude-scaling, time-scaling and time-shifting on a given signal.
3) Calculate the Energy and Power of a given Signal

4) Write a program to find the trigonometric and exponential Fourier series coefficients of a rectangular periodic signal. Reconstruct the signal by combining the Fourier series coefficients with appropriate weightings.
5) Write a MATLAB program to determine the Fourier transform of a given input signal and also plot its magnitude and phase response plots.
6) Write a MATLAB program to determine the Inverse Fourier transform of a given signal and also plot its magnitude and phase response plots.
7) Verification of Linearity and Time Invariance Properties of a Given Continuous/Discrete System.
8) Convolve the given two discrete time sequences. Plot all the sequences. Verify the result by analytical calculation
9) Program to find frequency response of analog LP/HP/BP/BS filters.
10) Sampling Theorem Verification
11) Write a program to find the autocorrelation and cross correlation of sequences.
12) The signal x(t) is defined as below. The signal is sampled at a sampling rate of 1000 samples per second. Find the power content and power spectral density for this signal.
    i. X(t) = cos (2pi * 47t)+ cos(2pi* 219t), 0 < t < 10 X(t) = 0, otherwise
13) Write a MATLAB program to perform waveform synthesis using Laplace Transform of a given signal
14) Write a MATLAB program to determine the Z-transform and plot the pole-zero locations in Z-plane.
15) Program to find the impulse response of a system defined by a difference equation.
16) **Note**:** A minimum of 10(Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

EC254 (R20): MATLAB

L-0	T-0	P-2	M-100	C-2

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Understand Basics of MATLAB coding
CO2	Write the program for a given problem in MATLAB coding.
CO3	Simulate various electric circuits in MATLAB simulation tool

CO-PO/PSO MATRIX MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	-	-	-	-	-	-	-	-	-	3	3
CO2	2	3	3	-	-	-	-	-	-	-	-	-	3	3
CO3	2	3	3	-	-	-	-	-	-	-	-	-	3	3
AVG_CO	2	**3**	**3**	-	-	-	-	-	-	-	-	-	**3**	**3**

LIST OF EXPERIMENTS:

1) Write a MATLAB program to find greatest of three numbers? Use nested if, else if ladder
2) Write a MATLAB program to read marks of a student and print the sum, average and display the grade?
3) Write a MATLAB program to count the digits of a number? Use for loop
4) Write a MATLAB program to check whether a number is perfect or not? Use do-while
5) Write a MATLAB program to check whether a number is strong or not? Use while
6) Write a MATLAB program to check whether a number is armstrong or not? Use for
7) Write a MATLAB program to check whether a number is palindrome or not? Use for
8) Write a MATLAB program to find the Fibonacci series upto the given number? Use while
9) Write a MATLAB program to print the result of the series 1+x^2/2+x^3/3+….+x^n/n
10) Write a MATLAB program to perform menu driven arithmetic operations using functions?
11) Write a MATLAB program to find the factorial of a number using recursive and non-Recursive functions?
12) Write a MATLAB program to find the Fibonacci series using recursive functions?

13) Write a MATLAB program to find the solution for towers of Hanoi using recursive function?
14) Write a MATLAB program to read an array and sort the elements in an array?
15) Write a MATLAB program to find the minimum and maximum numbers of the array?
16) Write a MATLAB program to read two matrices and find their sum, difference and product?
17) Write a MATLAB program to find the transpose of a matrix?
18) Write a MATLAB program to print upper and lower triangle of a given matrix?
19) Write a MATLAB program to read a file and write data into file?
20) Write a GUI MATLAB program to create student application form?
21) Write a MATLAB program on creating simple plots?
22) Write a MATLAB program to read an image, perform different operations on image and Display the resulting images?

II/IV B.Tech.
SEMESTER II

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING

II/IV B.Tech. SEMESTER-II

EC221 (R20): ELECTROMAGNETIC FIELD THEORY

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Analyse the relation between electric and magnetic fields using vector analysis.
CO2	Understand the fundamental electromagnetic laws and concepts.
CO3	Evaluate the Maxwell's Equation in Static Electric and Magnetic Field.
CO4	Apply Maxwell's equations in Electromagnetic fields.
CO5	Solve problems requiring estimation of electric and magnetic quantities based on these concepts and laws.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	-	-	-	-	3	3	2	2
CO2	3	3	3	3	3	3	-	-	-	-	3	3	2	2
CO3	3	3	3	3	3	3	-	-	-	-	3	3	2	2
CO4	3	3	3	3	3	3	-	-	-	-	3	3	2	2
CO5	3	3	3	3	3	3	-	-	-	-	3	3	2	2
AVG_CO	3	3	3	3	3	3	-	-	-	-	3	3	2	2

UNIT – I

ELECTROSTATICS-I: Coulomb's Law, Electric Field Intensity - Electric Fields due to Continuous Charge Distributions – Line Charge, Surface Charge, Volume Charge - Electric Flux Density - Gauss Law – Applications of Gauss Law – Point Charge, Infinite Line Charge, Infinite Sheet Charge - Electric Potential - Relations Between E and V.

UNIT – II

ELECTROSTATICS-II: The nature of dielectric materials, boundary conditions for perfect dielectric materials. Capacitance, Several capacitance examples: Parallel Plate Capacitor, Capacitance of a Coaxial Cable, Spherical Capacitor. Derivations of Poisson's and Laplace's equations. Current and current density, Energy density, continuity of current.

UNIT – III

THE STEADY MAGNETIC FIELD: Biot-Savart's 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, Magnetic Energy, the nature of magnetic materials, magnetization and permeability, magnetic boundary conditions.

UNIT – IV

TIME VARYING FIELDS AND MAXWELL'S EQUATIONS: Faraday's Law - Transformer and Motional EMFs – Stationary Loop in Time Varying B Field, Moving Loop in Static B Field, Moving Loop in Time Varying Field - Displacement Current – Maxwell's Equations in Different Final Forms.

UNIT – V

WAVE EQUATIONS: Waves equations for: a conducting medium, free space – Relation between E and H in a Uniform plane wave - Wave propagation: Lossless medium, Conducting medium, Good Dielectric, Good Conductor - Poynting Vector and Poynting theorem - Reflection of a Plane wave at Normal Incidence - Reflection of a Plane wave at Oblique.

TEXT BOOKS:

1) Matthew N.O. Sadiku, Elements of Electromagnetics, Oxford University Press, 3rd edition, 2008.
2) William H. Hayt Jr. and John A. Buck, Engineering Electromagnetics, Tata McGraw-Hill publications, 7th edition, 2006.
3) G S N Raju, Electromagnetic Field Theory and transmission lines, 1st Edition, Pearson Education
4) India, 2005.

REFERENCE BOOKS::

1) E.C. Jordan and K.G. Balmain, Electromagnetic Waves and Radiating Systems, PHI, 2nd Edition, 2000
2) John D. Krauss, Electromagnetics, Tata McGraw-Hill publications, 4th edition, 1991.
3) Schaum'sout line series, Electromagnetics, 2nd edition, Tata McGraw-Hill publications, 2006.

EC222 (R20): ANALOG CIRCUITS

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Apply low frequency models of transistor in the analysis of multistage amplifiers
CO2	Apply low frequency models of transistor in the analysis of single stage amplifiers using FET
CO3	Design and analyze feedback amplifier and power amplifier circuits and also operational amplifier circuits
CO4	Design and analyze oscillator circuits.
CO5	Interpret a given analog circuit and evaluate its performance parameters by applying acquired knowledge.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	-	-	-	-	-	-	-	1	3	2
CO2	3	3	3	2	-	-	-	-	-	-	-	1	3	2
CO3	3	3	3	2	-	-	-	-	-	-	-	1	3	2
CO4	3	3	3	3	-	-	-	-	-	-	-	1	3	2
CO5	3	2	1	2	-	-	-	-	-	-	-	1	3	2
AVG_CO	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**2**

UNIT – I

MULTI STAGE AMPLIFIERS: Need for cascading, Methods of Inter stage Coupling, Gain, Selection of Configuration in cascading Amplifiers, RC Coupled CE-CE Amplifier, CE-CB Cascade Amplifier, CE-CC Amplifier, Effect of cascading on Bandwidth and Gain

UNIT - II

FET AMPLIFIERS: JFET Low Frequency small signal Model, Analysis of Common Source, Common Drain, Common Gate Amplifiers using small signal model.

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

POWER AMPLIFIERS: Power Amplifiers, Power Transistors, Classification of Amplifiers: Class-A, Class B, Class C, Class AB Power Amplifiers.

UNIT - IV

FEEDBACK AMPLIFIERS: Introduction to Feedback, Basic Feedback Concepts, Ideal Feedback Topologies, Voltage Amplifiers, Current Amplifiers, Transconductance Amplifiers, Trans resistance Amplifiers

Oscillators: Brausen Criterion, The Phase Shift Oscillator, Resonant Circuit Oscillator and Crystal Oscillator.

UNIT - V

OPERATIONAL AMPLIFIERS: Operational amplifier and block diagram representation, op-amp with negative feedback. Block diagram representation of feedback configurations, voltage series feedback amplifier, voltage shunt feedback amplifier, differential amplifier with one op-amp

TEXT BOOKS:

1) Electronic devices and circuit theory", Robert L. Boylestad and Louis Nashelsky.
2) Microelectronics: Circuit Analysis and Desigm, DONALD A. NEAMEN, 4th Edition, McGraw-Hill, 2010.

REFERENCE BOOKS:

1) Microelectronic Circuits, 7th Edition, Sedra/Smith, Oxford University Press, 2010.
2) "Integrated electronics", Jacob Millman and Christos C Halkias.

EC223 (R20): PROBABILITY THEORY AND STOCHASTIC PROCESS

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Understand the concepts of Random Process and its Characteristics.
CO2	Utilization of Random signals and systems in Communications and Signal Processing areas.
CO3	Identify and explain one- and two-dimensional random variables along with their distributions and statistical averages
CO4	Find the random processes and compute their averages.
CO5	Solve the problems on Ergodic process and transmission of random process

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-	-
AVG_CO	**3**	**2**	-	-	-	-	-	-	-	-	-	-	-	-

UNIT – I

PROBABILITY: Probability introduced through Sets and Relative Frequency, Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Probability as a Relative Frequency, Joint Probability, Conditional Probability, Total Probability, Baye's Theorem, Independent Events.

UNIT – II

RANDOM VARIABLE: Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous, and Mixed Random Variables, Distribution & Density Functions: Distribution and Density functions and their properties – Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh and Conditional Distribution, Methods of defining Conditional Event, Conditional Density, and Properties.

UNIT - III

OPERATION ON ONE RANDOM VARIABLE – EXPECTATIONS: Introduction, Expected Value of a Random Variable, function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebyshev's Inequality, Characteristic Function, Moment Generating Function.

TRANSFORMATIONS OF A RANDOM VARIABLE: Monotonic Transformations for a Continuous Random Variable, Non-monotonic Transformations of Continuous Random Variable, Transformation of a Discrete Random Variable.

UNIT – IV

Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density – Point Conditioning, Conditional Distribution and Density – Interval conditioning, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem.

UNIT – V

RANDOM PROCESSES: The Random Process Concept, Classification of Processes, Distribution and Density Functions, concept of Stationary and Statistical Independence, Mean and covariance functions, Ergodicity. Transmission of random process through LTI.Power spectral density. Time Averages, Autocorrelation Function and Its Properties, Cross-Correlation Function and its Properties. The Power Spectrum: Properties, Properties, Energy density spectrum.

TEXT BOOKS:

1) H. Stark and J. Woods, ``Probability and Random Processes with Applications to Signal Processing," Third Edition, Pearson Education
2) A.Papoulis and S. UnnikrishnanPillai, ``Probability, Random Variables and Stochastic Processes," Fourth Edition, McGraw Hill.
3) K. L. Chung, Introduction to Probability Theory with Stochastic Processes, Springer International

REFERENCE BOOKS:

1) P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability, UBS Publishers,
2) P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Stochastic Processes, UBS Publishers
3) S. Ross, Introduction to Stochastic Models, Harcourt Asia, Academic Press.

EC224 (R20): MICROPROCESSOR & MICROCONTROLLERS

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Explain the architecture and instruction set of Microprocessor
CO2	Discuss about System Bus Structure for Multiprocessor Configuration.
CO3	Illustrate the functions of various interfacing devices with Microcontroller
CO4	Understand the architectures and instruction set of Microcontroller
CO5	Build an assembly language program for interfacing with microcontroller

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	2	2	1	-	-	-	-	-	-	-	-	-	2	-
CO3	2	2	1	-	-	-	-	-	-	-	-	-	2	-
CO4	2	3	2	-	-	-	-	-	-	-	-	-	3	-
CO5	2	3	2	-	-	-	-	-	-	-	-	-	3	-
AVG_CO	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

UNIT – I

MICROPROCESSOR: Introduction to microcomputers and microprocessors, introduction and architecture of 8086 family, addressing modes, instruction description and assembler directives of 8086 microprocessors.

UNIT - II

8086 PROGRAMMING AND SYSTEM CONNECTIONS: Program development steps, writing programs for use with an assembler, assembly language program development tools, writing and using procedures and assembler macros. 8086 interrupts and interrupt responses.

UNIT - III

DIGITAL INTERFACING: Programmable parallel ports, handshake IO, interface Microprocessor to keyboards.

ANALOG INTERFACING: DAC principle of operation, specifications and different types of DAC's and interfacing.

PROGRAMMABLE DEVICES: Introduction to Programmable peripheral devices 8255, 8254, 8259, 8251, DMA data transfer, RS232 communication standard.

UNIT-IV

MICRO-CONTROLLERS: Introduction to Micro controllers, comparing microprocessors and microcontrollers Architecture of 8051, Registers, Pin configuration of 8051, I/O Ports, Memory Organization, Addressing Modes.

UNIT - V

Programming & Interfacing 8051- Instruction set, Assembly language Programming, Counters& Timers, Serial data Communication– Interrupts,

Interfacing of 8051 – keyboard, Displays, ADC converters.

TEXT BOOKS:

1) Microprocessor architecture programming & applications with the 8085, Ramesh Gaonkar, PRI
2) Publishers. 6th Edition
3) Advanced Microprocessors & Peripheral interfacing, Ray Bhurchandi, 3rd edition, MC Graw hill Publications
4) The INTEL Microprocessors, Brey, 6th edition, PHI Publishers 4. The 8051 Microcontroller and architecture, Kenneth J. Ayala, PRI Publishers 2nd edition

REFERENCE BOOKS:

1) Microprocessor and Microcontrollers, N.Senthil Kumar, M.Saravanan, S.Jeevanathan, Oxford Publishers. 1st Edition, 2010
2) The X86 Microprocessors, Architecture, Programming and Inerfacing, Lyla B. Das, Pearson Publications, 2010

EC225 (R20): OBJECT ORIENTED PROGRAMMING THROUGH JAVA

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Understand the basics of object-oriented programming using JAVA
CO2	Apply the concept of classes, Java, JDK Components and develop Simple Java Programs.
CO3	Develop Simple Java Programs using inheritance and Exception handling
CO4	Develop Multi-threading Programming and Interfaces.
CO5	Accessing files and developing event handling programs.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	-	-	-	-	-	-	2	2	-
CO2	3	2	2	-	3	-	-	-	-	-	-	3	3	-
CO3	3	2	1	-	2	-	-	-	-	-	-	2	2	-
CO4	3	3	3	-	3	-	-	-	-	-	-	3	3	-
CO5	3	3	3	-	3	-	-	-	-	-	-	3	3	-
AVG_CO	3	2	2	-	3	-	-	-	-	-	-	3	3	-

UNIT - I: OOPS CONCEPTS AND JAVA PROGRAMMING

OOP CONCEPTS: procedural and object-oriented programming paradigm, Class and object, data abstraction, encapsulation, inheritance, benefits of inheritance, polymorphism.

Java programming: History of java, comments, data types, variables, constants, scope and life time of variables, operators, operator hierarchy, expressions, type conversion and casting, enumerated types, control flow statements, jump statements, simple java programs, arrays, console input and output, formatting output, constructors, methods, parameter passing, static fields and methods, access control, this reference, overloading methods and constructors, recursion, garbage collection, exploring string class.

UNIT - II: INHERITANCE

INHERITANCE: Inheritance hierarchies, super and subclasses, member access rules, super keyword, preventing inheritance: final classes and methods, the object class and its methods;

POLYMORPHISM: dynamic binding, method overriding, abstract classes and methods.

UNIT – III: INTERFACES AND PACKAGES

INTERFACE: Interfaces VS Abstract classes, defining an interface, implement interfaces, accessing implementations through interface REFERENCE BOOKS:, extending interface.

PACKAGES: Defining, creating and accessing a package, understanding CLASSPATH, importing packages.

UNIT - IV: EXCEPTION HANDLING AND MULTITHREADING

EXCEPTION HANDLING: Benefits of exception handling, the classification of exceptions, exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, rethrowing exceptions, exception specification, built in exceptions, creating own exception sub classes.

MULTITHREADING: Differences between multiple processes and multiple threads, thread states, creating threads, interrupting threads, thread priorities, synchronizing threads, inter thread communication.

UNIT – V: FILES

IO PROGRAMMING: Introduction to Streams, Byte Streams, Character stream, Readers and Writers, File Class, File Input Stream, File Output Stream, Input Stream Reader, Output Stream Writer, File Reader, File Writer, Buffered Reader, random access file operations.

TEXT BOOKS:

1) Herbert Schildt and Dale Skrien “Java Fundamentals –A comprehensive Introduction”, McGraw Hill, 1st Edition, 2013.
2) Herbert Schildt, “Java the complete reference”, McGraw Hill, Osborne, 11th Edition, 2018.
3) T. Budd “Understanding Object-Oriented Programming with Java”, Pearson Education, Updated Edition (New Java 2 Coverage), 1999

REFERENCE BOOKS:

1) P.J. Dietel and H.M. Dietel “Java How to program”, Prentice Hall, 6thEdition, 2005.
2) P. Radha Krishna “Object Oriented programming through Java”, CRC Press,1st Edition, 2007.
3) Malhotra and S. Choudhary “Programming in Java”, Oxford University Press, 2nd Edition, 2014

EC261 (R20): ANALOG CIRCUITS LAB

L-0	T-0	P-3	M-100	C-1.5

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Analyse the behavior of rectifier circuits using diodes.
CO2	Experiment with single stage and multistage BJT/FET amplifiers including large signal amplifiers.
CO3	Compare and contrast different types of feedback topologies.
CO4	Develop and test various oscillator circuits.
CO5	Evaluate and compare the significant parameters obtained from the frequency response plots of BJT and FET amplifier circuits.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	3	2	2	-	-	-	2	1	-	1	3	2
CO2	2	1	3	2	2	-	-	-	2	1	-	1	3	2
CO3	2	1	3	2	2	-	-	-	2	1	-	1	3	2
CO4	2	1	3	2	2	-	-	-	2	1	-	1	3	2
CO5	2	1	3	2	2	-	-	-	2	1	-	1	3	2
AVG_CO	**2**	**1**	**3**	**2**	**2**	**-**	**-**	**-**	**2**	**1**	**-**	**1**	**3**	**2**

LIST OF EXPERIMENTS:

1) Study of Full Wave Rectifier with and without Filters.
2) Frequency Response of Common Emitter Amplifier.
3) Frequency Response of Common Source Amplifier.
4) Measurement of Parameters of Emitter Follower; R_I, A_V, A_I& R_O.
5) Measurement of Parameters of Source Follower; R_I, A_V, A_I& R_O.
6) Two Stage RC-Coupled Amplifier.
7) Study of Cascade Amplifier.
8) Current series feedback topology
9) Class-A Power Amplifier
10) RC Phase Shift Oscillator
11) Hartley Oscillator
12) Colpitts Oscillator

EC262 R20): MICROPROCESSOR & MICROCONTROLLERS LAB

L-0	T-0	P-3	M-100	C-1.5

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Demonstrate the skills in Assembly Language Programming of microprocessors and microcontroller.
CO2	Interpret the basic knowledge of microprocessor interfacing, delay generation, and waveform generation.
CO3	Apply the concepts of Interfacing to connect external devices with the microprocessor 8086.
CO4	Apply the concepts of Interfacing to connect external devices with the microcontroller 8051.
CO5	Implement microcontroller based simple real time applications.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	3	3	-	-	-	3	3	-	3	3	2
CO2	2	3	2	3	3	-	-	-	3	3	-	3	3	2
CO3	2	3	2	3	3	-	-	-	3	3	-	3	3	2
CO4	2	3	2	3	3	-	-	-	3	3	-	3	3	2
CO5	2	3	2	3	3	-	-	-	3	3	-	3	3	2
AVG_CO	**2**	**3**	**2**	**3**	**3**	**-**	**-**	**-**	**3**	**3**	**-**	**3**	**3**	**2**

LIST OF EXPERIMENTS:

EXPERIMENTS BASED ON ALP (8086)

1) Programs on Data Transfer Instructions.
2) Programs on Arithmetic and Logical Instructions.
3) Programs on Branch Instructions.
4) Programs on Subroutines.
5) Sorting of an Array.
6) Programs on Interrupts (Software and Hardware).
7) 8086 Programs using DOS and BIOS Interrupts.

EXPERIMENTS BASED ON INTERFACING & MICROCONTROLLER (8051)

1) DAC Interface-Waveform generations.
2) Stepper Motor Control.
3) Keyboard Interface / LCD Interface.
4) Data Transfer between two PCs using RS.232 C Serial Port
5) Programs on Data Transfer Instructions using 8051 Microcontroller.
6) Programs on Arithmetic and Logical Instructions using 8051 Microcontroller.
7) Applications with Microcontroller 8051.

EC263 (R20): COMMUNICATIVE ENGLISH LAB II

L-0	T-0	P-3	M-100	C-1.5

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Understand the importance of communication skills in job arena and ability to communicate efficiently.
CO2	Able to learn vocabulary for GRE, TOEFL, IELTS, IES etc.
CO3	Students will evaluate the impact of interpersonal communication on their performance as a professional and in obtaining professional excellence at the workplace.
CO4	Able to communicate effectively over a phone and proficient to demonstrate telephoning skills
CO5	Able to describe procedures and improves analytical thinking

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	2	2	-	-	2	3	3	-	3	-	-
CO2	-	-	-	2	2	-	-	2	3	3	-	3	-	-
CO3	-	-	-	2	2	-	-	2	3	3	-	3	-	-
CO4	-	-	-	2	2	-	-	2	3	3	-	3	-	-
CO5	-	-	-	2	2	-	-	2	3	3	-	3	-	-
AVG_CO	-	-	-	2	**2**	-	-	**2**	**3**	3	-	3	-	-

MODULE-L: COMMUNICATION SKILLS:

I. Verbal
   a) Types of Communication
   b) Barriers to Communication
   c) Strategies for effective communication

II. Nonverbal Skills -
   a) Body Language – Voluntary and Involuntary
   b) Kinesics
   c) Facial Expressions
   d) Proxemics
   e) Oculesics
   f) Haptics and Chronemics

MODULE-2: ADVANCED VOCABULARY:

a) Word list (GRE & TOEFL related)
b) One Word Substitutes
c) Idioms

MODULE-3: EMPLOYABILITY SKILLS (REF: 6):

a) Interview Skills
b) Group Discussion
c) Resume Writing

MODULE-4: TELEPHONIC SKILLS:

a) Formal &Informal interaction
b) Receiving Messages & Complaints
c) Tone modulation

MODULE-5: DESCRIPTIONS:

a) Process Description
b) Pictures
c) Narration

MODULE-6: BEHAVIOURAL SKILLS:

a) Emotional Intelligence
b) Positive Attitude
c) Team Work
d) Organization Skills

EC264 (R20): JAVA PROGRAMMING

L-0	T-0	P-3	M-100	C-2

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Develop and implement Java programs for simple applications that make use of classes
CO2	Design applications using file processing
CO3	Apply the concepts of classes, packages, interfaces, exception handling
CO4	Develop and implement Java programs with array list
CO5	Build software development skills using java programming for real-world applications

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	-	-	-	-	-	-	-	2	2
CO2	3	2	2	1	-	-	-	-	-	-	-	-	2	2
CO3	3	2	2	1	-	-	-	-	-	-	-	-	2	2
CO4	3	2	2	1	-	-	-	-	-	-	-	-	2	2
CO5	3	2	2	1	-	-	-	-	-	-	-	-	3	2
AVG_CO	3	2	2	1	-	-	-	-	-	-	-	-	2	2

BASIC PROGRAMS:

1) Write java programs to find the following
   a) largest of given three numbers
   b) reverses the digits of a number
   c) given number is prime or not
   d) GCD of given two integers
2) Try debug step by step with small program of about 10 to 15 lines which contains at least one if else condition and a for loop.
3) Write a java program that prints all real solutions to the quadratic equation $ax^2+bx+c=0$. Read in a, b, c and use the quadratic formula.
4) The Fibonacci sequence is defined by the following rule. The first two values in the sequence are 1 and 1. Every subsequent value is the sum of the two values preceding it. Write a java program that uses both recursive and non-recursive functions.

MATRICES, OVERLOADING, OVERRIDING:

1) Write a java program to multiply two given matrices.
2) Write a java program to implement method overloading and constructors overloading.
3) Write a java program to implement method overriding.

PALINDROME, ABSTRACT CLASS:

1) Write a java program to check whether a given string is palindrome.
2) Write a java program for sorting a given list of names in ascending order.
3) Write a java program to create an abstract class named Shape that contains two integers and an empty method named print Area (). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape

INTERFACE:

1) Write a program that creates a user interface to perform integer division. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 and Num2 were not integers, the program would throw a Number Format Exception. If Num2 were zero, the program would throw an Arithmetic Exception Display the exception in a message dialog box.

MULTITHREADING:

1) Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
2) Write a java program that correct implements of producer consumer program
3) Write a program that creates three threads. First thread displays “Good Morning” every one second, the second thread displays “Hello” every two seconds and the third thread displays “Welcome” every three seconds.

FILES:

1) Write a java program that reads a file name from the user, and then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes.
2) Write a java program that displays the number of characters, lines and words in a text file.
3) Write a java program that reads a file and displays the file on the screen with line number before each line.

WEB REFERENCE BOOKS:

1) http://java.sun.com
2) http://www.oracle.com/technetwork/java/index.html
3) http://java.sun.com/javase

III/IV B.Tech.
SEMESTER I

B.TECH. ELECTRONICS & COMMUNICATION ENGINEERING

III/IV B.TECH. SEMESTER-I

EC/EE311 (R20): LINEAR CONTROL SYSTEMS

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Understand the basic concepts of open-loop and closed-loop control systems and the types of feedback control systems
CO2	Develop mathematical models and transfer functions for physical systems, including differential equations, impulse response, and signal flow graphs.
CO3	Analyze control systems in the time domain, including transient response, error constants, and stability analysis using Routh-Hurwitz criterion
CO4	Analyze control systems in the frequency domain using polar plots, Bode plots, Nyquist plots, and root locus techniques.
CO5	Understand the concepts of state space analysis, including state models, controllability, and observability.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	1	2	-	2	-	-	-	-	-	3	1
CO2	3	2	3	2	-	-	-	2	-	2	1	-	2	3
CO3	-	2	3	2	2	-	-	-	-	-	1	2	2	2
CO4	3	2	-	1	1	-	-	2	-	2	-	2	2	3
CO5	2	2	1	2	2	-	-	-	1	1	-	1	1	2
AVG_CO	2	2	2	2	1	-	1	1	1	1	1	1	2	2

UNIT – I

Introduction: Basic concept of simple control system – open loop – closed loop control systems. Effect of feedback on overall gain – stability sensitivity and external noise. Types of feedback control systems – Liner time invariant, time variant systems and nonlinear control systems.

Mathematical models and Transfer functions of Physical systems: Differential equations – impulse response and transfer functions – translational and rotational mechanical systems. Transfer functions and open loop and closed loop systems. Block diagram representation of control systems – block diagram algebra – signal flow graph – Mason's gain formula.

Components of control systems: DC servo motor – AC servo motor – synchro transmitter & receiver.

UNIT – II

Time domain analysis: Standard test signals – step, ramp, parabolic and impulse response function – characteristic polynomial and characteristic equations of feedback systems – transient response of first order and second order systems to standard test signals. Time domain specifications - steady state response – steady state error and error constants. Effect of adding poles and zeros on over shoot, rise time, band width – dominant poles of transfer functions.

Stability analysis in the complex plane: Absolute, relative, conditional, bounded input – bounded output, zero input stability, conditions for stability, Routh –Hurwitz criterion.

UNIT - III

Frequency domain analysis: Introduction – correlation between time and frequency responses – polar plots – Bode plots – Nyquist stability criterion – Nyquist plots. Assessment of relative stability using Nyquist criterion – closed loop frequency response.

UNIT – IV

Root locus Technique: Introduction – construction of root loci Introduction to Compensation Techniques- Lag Compensation, Lead Compensation, Lag Lead Compensation.

UNIT-V

State space analysis: Concepts of state, state variables and state models –diagonalization – solution of state equations – state models for LTI systems. Concepts of controllability and Observability.

TEXT BOOKS:

1) B.C. Kuo, Automatic control systems, 7th edition, PHI.
2) I.J.Nagrath & M Gopal, Control Systems Engineering, 3rd edition, New Age International.
3) K. Ogata, Modern Control Engineering, 3rd edition, PHI.

REFERENCE BOOKS:

1) Schaum Series, Feedback and Control Systems, TMH
2) M.Gopal, Control Systems Principles and Design, TMH
3) John Van de Vegta, Feedback Control Systems, 3rd edition, Prentice Hall, 1993.

EC312 (R20): ANALOG COMMUNICATIONS

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Define the need of modulation for communication systems.
CO2	Explain the behavior of the communication systems in the presence of noise.
CO3	Compare the different analog and digital modulation schemes for transmission of information.
CO4	Calculate the bit error rate for different digital modulation schemes.
CO5	Analyze the received signal with the optimum detection over the band-limited channel.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	-	-	-	-	-	1		3	2	1
CO2	3	3	1	1	-	-	-	-	-	1	-	3	3	1
CO3	3	3	1	1	-	-	-	-	-	1	-	3	3	1
CO4	3	3	1	1	-	-	-	-	-	1	-	3	3	1
CO5	3	3	2	1	-	-	-	-	-	1	-	3	3	1
AVG_CO	**3**	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**3**	**3**	**1**

UNIT – I

Amplitude Modulation: Time domain description, Frequency domain description, Single tone modulation, 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, Coherent detection of DSBSC modulated waves, Costas loop, Quadrature-Carrier multiplexing.

UNIT – II

SSB and VSB Modulations: 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 AM techniques, Frequency Division Multiplexing (FDM).

UNIT – III

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, Linearized model of PLL, FM demodulation employing first order PLL, Practical Considerations, FM limiters, Applications.

UNIT – IV

Discrete Modulation: Generation and Demodulation of PAM, PWM and PPM; TDM, Comparison of Discrete Modulation Techniques.

Noise in Analog Modulation: 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.

UNIT-V

Radio Transmitters: Frequency allocation for radio communication systems, Block diagrams and functions of radio transmitters for AM and FM systems.

Radio Recivers: TRF and super heterodyne receivers, RF, Mixer and IF stages, Choice of 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, Fading and diversity reception

TEXT BOOKS:

1) Simon Haykin, Introduction to Analog and Digital Communication Systems, John Wiley and Sons, 3rd Edition, 2001
2) Leon W Couch II, Digital and Analog Communication Systems, Pearson Education, 2004
3) George Kennedy, Electronic Communication Systems, Mc Graw Hill, 4th Edition, 1999

REFERENCE BOOKS:

1) Taub and Schilling, Principles of Communication Systems, TMH, 2nd Edition, 1986
2) Sam Shanmugam, Analog and Digital Communication Systems, John Wiley, 1992.

EC313 (R20): DIGITAL SIGNAL PROCESSING

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Understand the concept of signals and systems along with frequency analysis
CO2	Explain the concept of multi rate signal processing.
CO3	Apply FFT Algorithm to compute DFT of discrete signals.
CO4	Illustrate the effect of finite register length in FIR digital filters.
CO5	Analyze the frequency characteristics of IIR and FIR digital filters for given requirements or specifications.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	-	-	1	-	3	3	3
CO2	3	2	1	1	-	-	-	-	-	1	-	3	3	3
CO3	3	2	1	1	-	-	-	-	-	1	-	3	3	3
CO4	3	2	1	1	-	-	-	-	-	1	-	3	3	3
CO5	3	3	1	2	-	-	-	-	-	1	-	3	3	3
AVG_CO	**3**	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**3**	**3**	**3**

UNIT – I

Discrete Signals and Systems: Introduction to digital signal processing, Advantages and applications, Discrete time signals, LTI system: Stability and causality, Frequency domain representation of discrete time signals and systems.

Review of **Z-transforms** and **Inverse Z-transforms**

UNIT – II

DFT and FFT: Discrete Fourier Series, Properties of DFS, Discrete Fourier Transform, Properties of DFT, Linear convolution using DFT, Computations for evaluating DFT, Decimation in time FFT algorithms, Decimation in frequency FFT algorithm, Computation of inverse DFT.

UNIT – III

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 – IV

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, Generalised Hamming window, Bartlett triangular window, Kaiser window, Processing Comparison of IIR and FIR filters

UNIT – V

Realization of Digital Filters: Direct, Canonic, Cascade, Parallel and Ladder realizations Effect of finite register length in FIR filter design, Introduction to Multi rate Signal Processing-Decimation, Interpolation, sampling rate conversion

TEXT BOOKS:

1) Lonnie C Ludeman, Fundamentals of Digital Signal Processing, John Wiley & Sons, 2003.
2) S K Mitra, Digital Signal Processing: A Computer Based Approach, 2nd Edition, TMH, 2003
3) Alan V Oppenheim and Ronald W Schafer, Digital Signal Processing, Pearson Education/PHI, 2004. 4. P. Ramesh Babu, Digital Signal Processing, 2nd Edition, Scitech Publications, 2004.

REFERENCE BOOKS:

1) Johnny R. Johnson, Introduction to Digital Signal Processing, PHI, 2001.
2) Andreas Antoniou, Digital Signal Processing,TMH, 2006.
3) John G.Proakis, Dimitris G Manolakis, digital Signal Processing: Principles, Algorithms and Applications, Pearson Education / PHI, 2003

EC314/1 (R20): VLSI DESIGN

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Identify the various IC fabrication methods.
CO2	Express the Layout of simple MOS circuit using Lambda based design rules.
CO3	Apply the Lambda based design rules for subsystem design.
CO4	Design arithmetic building blocks and memory subsystems.
CO5	Differentiate PLA, PAL, CPLD and FPGA architectures

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	2	-	-	-	-	2	2	1	1
CO2	2	2	3	-	3	-	-	-	-	-	2	2	2	2
CO3	2	2	3	-	3	-	-	-	-	-	2	2	2	2
CO4	3	3	3	3	3	3	-	-	-	-	3	3	2	2
CO5	3	2	3	-	2	2	-	-	-	-	3	3	2	2
AVG_CO	3	2	3	3	3	2	-	-	-	-	2	2	2	2

UNIT – I

An introduction to MOS technology: Introduction to IC technology, Basic MOS transistors, NMOS fabrication, CMOS fabrication and BiCMOS technology. Basic Electrical Properties of MOS and BiCMOS Circuits: I_{ds} versus V_{ds} relationships, threshold voltage V_t, Transconductance ($g_{m)}$, Figure of merit (ω), Pass transistor, NMOS inverter, Pull-up to pull-down ratio, CMOS inverter, BICMOS inverters, Latch-up in CMOS circuits.

UNIT – II

MOS and BICMOS circuit Design processes: MOS layers, Stick diagrams, Layout diagrams, Design rules and layout, Sheet resistance Rs, Standard unit of capacitance, The Delay unit, Inverter delays, Propagation delays, Wiring capacitances, Scaling models, Scaling factors for device parameters.

UNIT – III

Subsystem design and layout: Architectural issues, Switch logic, Gate Logic, examples of Structured Design (combinational logic). Design of an ALU subsystem: Design of 4-bit adder, adder element requirements, a standard adder element, Implementing ALU functions with an adder, A further consideration of adders: Manchester carry chain, carry select adder, carry skip adder.

UNIT – IV

VLSI design flow, Introduction to ASICs, Full Custom ASICs, standard cell based ASICs, Gate array based ASICs, Programmable logic devices, PLAs, PALs, CPLDs and FPGAs.

UNIT – V

VHDL Hardware Description Language: Program Structure, Types and Constants, functions and Procedures, Libraries and Packages, Structural Design Elements, Dataflow design Elements, Behavioral design Elements, VHDL programs, The Time Dimension and Simulation, Synthesis.

TEXT BOOKS:

1) Douglas A.Pucknell and Kamran Eshranghian, Basic VLSI Design, 3rd edition, PHI, 2002.
2) Debaprasad Das, VLSI Design, Oxford University Press, 2nd edition, 2015.
3) Michael John Sebastian Smith, Application Specific Integrated Circuits, Addison Wesley, 2003.
4) K Lal Kishore and VSV Prabhakar, VLSI Design, I K International Publishing House, 2009
5) J.Bhasker, A VHDL Primer, Pearson Education India, 3rd edition, 2015.
6) John F Wakerly, Digital Design Principles & Practices, 3rd Edition, Pearson Education, 2002.

REFERENCE BOOKS:

1) Neil H E Weste and Kamran Eshranghian, Principles of CMOS VLSI Design, A system perspective, 2nd edition, Pearson Education, 2002.
2) Stephen Brown and Z Vonko Vranesic, Fundamentals of Digital Logic with VHDL Design, TMH, 2002.
3) Douglas L. Perry, VHDL Programming by Example, McGraw Hill Education, 4th edition 2017

EC314/2 (R20): POWER ELECTRONICS

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	To provide sufficient knowledge about theoretical and analytical background to understand the concepts of various Power Electronics devices.
CO2	To provide sufficient knowledge about various semi and full bridge converters for R, RL, RLE and level loads.
CO3	To understand and learn about various Quadrant operations of Different Types and Step up chopper, Multiphase Chopper.
CO4	Describe the operation of Single phase Inverters and applications.
CO5	. To provide sufficient knowledge about various power electronic converters.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	2	-	3	2	2
CO2	3	2	3	2	-	-	-	-	-	2	-	3	3	2
CO3	3	2	2	-	-	-	-	-	-	2	-	3	2	3
CO4	3	3	2	2	-	-	-	-	-	3	-	3	3	3
CO5	3	3	2	2	-	-	-	-	-	2	-	3	2	2
AVG_CO	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**3**	**3**	**3**

UNIT-I

Characteristics of Semiconductor Power Devices: Thyristor, power MOSFET and IGBT- Treatment should consist of structure, Characteristics, operation, ratings, protections and thermal considerations. Brief introduction to power devices viz. TRIAC, MOS controlled thyristor (MCT), Power Integrated Circuit (PIC) (Smart Power), Triggering/Driver, commutation and snubber circuits for thyristor, power MOSFETs and IGBTs (discrete and IC based).Concept of fast recovery and schottky diodes as freewheeling and feedback diode.

UNIT-II

Controlled Rectifiers: Single phase: Study of semi and full bridge converters for R, RL, RLE and level loads. Analysis of load voltage and input current- Derivations of load form factor

and ripple factor, Effect of source impedance, Input current Fourier series analysis of input current to derive input supply power factor, displacement factor and harmonic factor.

UNIT-III

Choppers: Quadrant operations of Type A, Type B, Type C, Type D and type E choppers, Control techniques for choppers – TRC and CLC, Detailed analysis of Type A chopper. Step up chopper. Multiphase Chopper

UNIT-IV

Single-phase inverters: Principle of operation of full bridge square wave, quasi-square wave, PWM inverters and comparison of their performance. Driver circuits for above inverters and mathematical analysis of output (Fourier series) voltage and harmonic control at output of inverter (Fourier analysis of output voltage). Filters at the output of inverters, Single phase current source inverter

UNIT-V

Switching Power Supplies: Analysis of fly back, forward converters for SMPS, Resonant converters - need, concept of soft switching, switching trajectory and SOAR, Load resonant converter - series loaded half bridge DC-DC converter. Applications: Power line disturbances, EMI/EMC, power conditioners. Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings, sizing of UPS. Separately excited DC motor drive. P M Stepper motor Drive.

TEXT /REFERENCE BOOKS:

1) Muhammad H. Rashid, “Power electronics” Prentice Hall of India.
2) Ned Mohan, Robbins, “Power electronics”, edition III, John Wiley and sons.
3) P.C. Sen., “Modern Power Electronics”, edition II, Chand& Co.
4) V.R.Moorthi, “Power Electronics”, Oxford University Press.
5) Cyril W., Lander,” Power Electronics”, edition III, McGraw Hill.

EC314/3 (R20): HIGH SPEED ELECTRONICS

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	To understand and learn the impact of packages and Noise Analysis
CO2	To understand and study different kinds of devices.
CO3	To understand and learn about RF Amplifier Design and Power Amplifiers.
CO4	Acquire knowledge on Converters and Oscillators
CO5	To understand and learn about CAD tools for PCB design and Board Assembly.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	1	-	2	3	2
CO2	3	2	1	1	-	-	-	-	-	1	-	2	2	2
CO3	3	1	2	-	-	-	-	-	-	1	-	3	2	2
CO4	3	3	2	2	-	-	-	-	-	1	-	2	1	3
CO5	3	3	1	2	-	-	-	-	-	1	-	3	3	2
AVG_CO	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	1	**-**	**3**	**3**	**3**

UNIT – I

Transmission line theory (basics) crosstalk and non ideal effects; signal integrity: impact of packages, vias, traces, connectors; non-ideal return current paths, high frequency power delivery, methodologies for design of high speed buses; radiated emissions and minimizing system noise; Noise Analysis: Sources, Noise Figure, Gain compression, Harmonic distortion, Inter modulation, Cross-modulation, Dynamic range

UNIT – II

Devices: Passive and active, Lumped passive devices (models), Active (models,low vs highfrequency)

UNIT -III

RF Amplifier Design, Stability, Low Noise Amplifiers, Broadband Amplifiers (and Distributed) Power Amplifiers, Class A, B, AB and C, D E Integrated circuit realizations, Cross-over distortion Efficiency RF power output stages

UNIT – IV

Mixers –Upconversion Downconversion, Conversion gain and spurious response.Oscillators Principles.PLL Transceiver architectures

UNIT – V

Printed Circuit Board Anatomy, CAD tools for PCB design, Standard fabrication, Micro via Boards.

Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Design challenges.

TEXT /REFERENCE BOOKS:

1) Stephen H. Hall, Garrett W. Hall, James A. McCall "High-Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices", August 2000, Wiley-IEEE Press
2) Thomas H. Lee, "The Design of CMOS Radio-Frequency Integrated Circuits", Cambridge University Press, 2004, ISBN 0521835399.
3) Behzad Razavi, "RF Microelectronics", Prentice-Hall 1998, ISBN 0-13-887571-5.
4) Guillermo Gonzalez, "Microwave Transistor Amplifiers", 2nd Edition, Prentice Hall.
5) Kai Chang, "RF and Microwave Wireless systems", Wiley.
6) R.G. Kaduskar and V.B.Baru, Electronic Product design, Wiley India, 2011

EC/EE315/1 (R20): PULSE CIRCUITS & LINEAR IC APPLICATIONS

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Understand the response of Linear & Non-Linear Wave shaping circuits to different inputs.
CO2	Analyze the design and Operation of Multivibrator Circuits and sweep circuits.
CO3	Understand the basic concepts of Differential Amplifier circuits and characteristics of OP-Amp
CO4	To obtain knowledge on various types of Linear And Non-Linear Applications Of Op-Amps
CO5	To understand the Design and Analyse the Active Filters and Applications of special ICS

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	3	-	3	3	2
CO2	3	2	1	1	-	-	-	-	-	3	-	3	2	2
CO3	3	3	3	3	-	-	-	-	-	3	-	3	2	2
CO4	3	3	2	2	-	-	-	-	-	3	-	3	3	3
CO5	3	2	2	1	-	-	-	-	-	3	-	3	3	3
AVG_CO	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**3**	**3**	**3**

UNIT – I

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, Ringing circuit.

NON-LINEAR WAVE SHAPING: Clipping circuits with diodes, Multi-diode circuits, Transient and steady state response of a diode clamping circuit, Clamping circuit theorem, and Practical clamping circuits.

UNIT – II

MULTIVIBRATORS (using BJTs): Bistable Multivibrator: Fixed bias and self-bias transistor binary, Commutating capacitors, Non-saturated binary, Direct coupled binary, Unsymmetrical and Symmetrical triggering of binary, Schmitt Trigger circuit, Collector Coupled Monostable and Astable Multivibrators operation & design

SWEEP CIRCUITS: Voltage sweep circuits, Deviation from linearity expressed as errors, Exponential and Constant current charging voltage sweep circuits, Principles of Miller and Bootstrap Sweep circuits, Simple current sweep circuit, Need for a trapezoidal waveform for linearity correction, its generation and application.

UNIT III

INTEGRATED CIRCUITS:

Differential Amplifier- DC and AC analysis of Dual input Balanced output Configuration, Properties of other differential amplifier configuration (Dual Input Unbalanced Output, Single Ended Input – Balanced/ Unbalanced Output), DC Coupling and Cascade Differential Amplifier Stages, Level translator.

Characteristics of OP-Amps: Integrated circuits-Types, Classification, Package Types and Temperature ranges, Power supplies, Op-amp Block Diagram, ideal and practical Op- amp Specifications, DC and AC characteristics, 741 op-amp & its features, Op-Amp parameters & Measurement, Input & Out put Off set voltages & currents, slew rate, CMRR, PSRR, drift, Frequency Compensation techniques.

UNIT-IV

LINEAR and NON-LINEAR APPLICATIONS OF OP-AMPS: Inverting and Non-inverting amplifier, Integrator and differentiator, Difference amplifier, Instrumentation amplifier, AC amplifier, V to I, I to V converters, BufferS.No.n- Linear function generation, Comparators, Multivibrators, Triangular and Square wave generators, Log and Anti log Amplifiers, Precision rectifiers.

UNIT V:

ACTIVE FILTERS: Design & Analysis of Butterworth active filters – 1st order, 2nd order LPF, HPF filters. Band pass, Band reject and all pass filters. Four Quadrant Multiplier, IC 1496, Sample & Hold circuits. **APPLICATIONS OF SPECIAL ICS:** The 555 timer, 555 as Monostable and Astable Multivibrator and applications. Phase Locked Loops, Operating principles, Monolithic PLLs, 565 PLL applications, A 723 Voltage Regulator and its design.

TEXT BOOKS:

1) A. S. Sedra and K. C. Smith, “Microelectronic Circuits”, New York, Oxford University Press, 1998.
2) J. V. Wait, L. P. Huelsman and G. A. Korn, “Introduction to Operational Amplifier theory and applications”, McGraw Hill U. S., 1992.
3) J. Millman and A. Grabel, “Microelectronics”, McGraw Hill Education, 1988.
4) Linear Integrated Circuits - D. Roy Choudhury, ShailB.Jain, New Age International Publishers, 2nd Edition, 2006.
5) J Millman and H Taub, Pulse, Digital and Switching Circuits, TMH, 2003.

EC315/2 (R20): COMPUTER ORGANIZATION

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Understand basics of Computer Organization, concepts of program as sequences and operation of computers.
CO2	Apply different ways of communication with I/O devices and standard I/O interfaces
CO3	Design arithmetic and logical operations with integer and floating-point operands.
CO4	Model a pipeline for consistent execution of instructions with minimum hazards
CO5	Analyze the memory access operations and memory architecture

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	-	-	-	-	-	-	-	1	-	-	2	2
CO2	2	3	1	-	-	-	-	-	-	1	-	-	2	2
CO3	2	2	1	-	-	-	-	-	-	1	-	-	2	2
CO4	2	3	1	1	-	-	-	-	-	1	-	-	2	2
CO5	2	3	1	1	-	-	-	-	-	1	-	-	2	2
AVG_CO	**2**	**3**	1	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**2**	**2**

UNIT – I

Register Transfer and Micro-Operations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro-operations, Logic micro-operations, Shift micro-Operations, Arithmetic Logic shift Unit.

Basic Computer Organization and Design: Instruction codes, Computer Registers, computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instruction, Input-output and Interrupt, Design of basic Computer, design of Accumulator logic.

UNIT-II

Micro Programd Control: Control Memory, Address Sequencing, MicroProgram example, Design of Control unit

Central Processing Unit: General Register organization, stack organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced instruction set (RISC).

UNIT -III

Computer Arithmetic: Addition and Subtraction, Multiplication Algorithms, Division Algorithms Floating-point Arithmetic operations.

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associative Memory Cache Memory, Virtual Memory, Memory Management hardware.

UNIT-IV

Input-Output Organization: Peripheral Devices, Input-output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA), Input-Output Processor, Serial Communication.

UNIT-V

Multi Processors: Characteristics of multiprocessors, Interconnection structures, Inter-processor arbitration, serial arbitration procedure, parallel arbitration logic, Inter-processor communication, Inter-processor synchronization, mutual exclusion with a semaphore.

TEXT BOOKS:

1) M.Morris Mano, Computer System Architecture, 3rd Edition, PHI, 2003.

REFERENCE BOOKS:

1) John P Hayes, ‘Computer Architecture and Organization’, 2nd edition.
2) V.Carl Hamacher et.al, ‘Computer Organization’ 2nd edition.
3) Tanenbaum: Structured Computer Organization, Pearson Education
4) William Stallings: Computer Organization and Architecture, PHI

EC315/3 (R20): NANO ELECTRONICS

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Explain the fundamental science and quantum mechanics behind nanoelectronics, concepts of a quantum well, quantum transport and tunneling effects.
CO2	Describe the spin-dependent electron transport in magnetic devices.
CO3	Calculate the energy levels of periodic structures and nanostructures. Calculate the I-V characteristics of Nanoelectronics devices.
CO4	Explore various application areas of Nano electronics.
CO5	Design and analysis of Nano structure and Nano electronics devices using MOSFET, FINFETs, CNTFETs

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	-	-	-	-	-	-	-	-	-	2	2
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	2
CO3	2	3	3	-	-	-	-	-	-	-	-	-	2	1
CO4	3	2	2	-	-	-	-	-	-	-	-	-	3	1
CO5	3	2	2	-	-	-	-	-	-	-	-	-	2	2
AVG_CO	3	2	2	-	-	-	-	-	-	-	-	-	2	1

UNIT-I

Introduction to nanotechnology, meso structures,Basics of Quantum Mechanics: Schrodinger equation, Density of States. Particle in a box Concepts, Degeneracy.

UNIT-II

Band Theory of Solids. KronigPenny Model. Brillouin Zones. Shrink-down approaches: Introduction, CMOS Scaling, The nanoscale MOSFET, Finfets, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.),

UNIT-III

Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors,

UNIT-IV

Carbon nanotube electronics, Band structure and transport, devices, applications,

UNIT-V

2D semiconductors and electronic devices, Graphene, atomistic simulation

TEXT/ REFERENCE BOOKS:

1) G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.
2) W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Materialand Novel Devices), Wiley-VCH, 2003.
3) K.E. Drexler, Nanosystems, Wiley, 1992.
4) J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University Press, 1998.
5) C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, 2003

EC316 (R20): CONSTITUTION OF INDIA

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Understand the basic features of Constitution of India.
CO2	Understand about salient features of the Constitution of India.
CO3	Understand fundamental duties and federal structure of Constitution of India
CO4	Understand about fundamental rights under constitution of India.
CO5	Understand about emergency provisions in Constitution of India.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	3	-	3	-	-	-	-	-	-
CO2	-	-	-	-	-	3	-	3	-	-	-	-	-	-
CO3	-	-	-	-	-	3	-	3	-	-	-	-	-	-
CO4	-	-	-	-	-	3	-	3	-	-	-	-	-	-
CO5	-	-	-	-	-	3	-	3	-	-	-	-	-	-
AVG_CO	-	-	-	-	-	**3**	-	3	-	-	-	-	-	-

UNIT-I

Introduction to Indian Constitution: Constitution meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

UNIT-II

Union Government and its Administration Structure of the Indian Union: Federalism, Centre-State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, LokSabha, RajyaSabha, The Supreme Court and High Court: Powers and Functions;

UNIT-III

State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

UNIT-IV

Local Administration - District's Administration Head - Role and Importance, Municipalities – Mayor and role of Elected Representative - CEO of Municipal Corporation PachayatiRaj: FunctionsPRI: ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials – Importance of grass root democracy

UNIT-V

Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission:, Functions of Commissions for the welfare of SC/ST/OBC and women

REFERENCE BOOKS:

1) Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. NewDelhi
2) SubashKashyap, Indian Constitution, National Book Trust
3) J.A. Siwach, Dynamics of Indian Government & Politics
4) D.C. Gupta, Indian Government and Politics
5) H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
6) J.C. Johari, Indian Government and Politics Hans
7) J. Raj Indian Government and Politics
8) M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi
9) Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012

E-RESOURCES:

1) nptel.ac.in/courses/109104074/8
2) nptel.ac.in/courses/109104045/
3) nptel.ac.in/courses/101104065/
4) www.hss.iitb.ac.in/en/lecture-details

EC351 (R20): ANALOG COMMUNICATIONS LAB

L-0	T-0	P-3	M-100	C-1.5

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Demonstrate generation and detection of analog and digital modulation techniques.
CO2	Explain sampling, PCM, delta modulation, adaptive delta modulation and superheterodyne receiver.
CO3	Compare the different analog and digital modulation techniques.
CO4	Distinguish various line coding schemes used for digital data transmission.
CO5	Apply time division multiplexing concepts in different pulse modulation techniques.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	3	-	-	-	-	2	3	-	3	3	3
CO2	3	3	1	3	-	-	-	-	2	3	-	3	3	3
CO3	3	3	1	3	-	-	-	-	2	3	-	3	3	3
CO4	3	3	1	3	-	-	-	-	2	3	-	3	3	3
CO5	3	3	1	3	-	-	-	-	2	3	-	3	3	3
AVG_CO	**3**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**2**	**3**	**-**	**3**	**3**	**3**

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 and Reconstruction.
8) PWM and PPM: Generation and Reconstruction
9) Effect of Noise on the Communication Channel
10) Time Division Multiplexing & amp; De multiplexing
11) Frequency Synthesizer.
12) AGC Characteristics.
13) PLL as FM Demodulator.
14) Spectrum analyzer and analysis of AM & amp; FM signals
15) Frequency Division Multiplexing & amp; De multiplexing

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

EC352 (R20): DIGITAL SIGNAL PROCESSING LAB

L-0	T-0	P-3	M-100	C-1.5

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Understand the mathematical operation on discrete signals.
CO2	Sketch the magnitude and phase response of DFT, Inverse DFT and FFT of discrete time signals.
CO3	Calculate linear and circular convolution of discrete sequences.
CO4	Implement Z transform and inverse Z transform of discrete signals
CO5	Model IIR and FIR filter using window techniques

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	2	-	-	-	-	3	-	3	3	3
CO2	3	2	1	2	2	-	-	-	-	3	-	3	3	3
CO3	3	2	1	2	2	-	-	-	-	3	-	3	3	3
CO4	3	2	1	2	2	-	-	-	-	3	-	3	3	3
CO5	3	3	1	3	2	-	-	-	-	3	-	3	3	3
AVG_CO	**3**	**3**	**1**	**3**	**2**	-	-	-	-	**3**	-	**3**	**3**	**3**

EXPERIMENTS BASED ON TOOL BOXES:

PART-A:

1) Simulation of AM.
2) Simulation of FM.
3) Simulation of ASK.
4) Simulation of PSK.
5) Simulation of FSK.
6) Simulation of DPCM.
7) Simulation of QPSK

PART-B:

8) Evaluation of 8 point IDFT
9) Evaluation of DFT of 16 Sample Sequence using FFT Algorithm.
10) Evaluation of IDFT of 16 Sample Sequence using IFFT Algorithm.

11) Design of IIR Butterworth Filter using Impulse Invariant Method.
12) Design of FIR Filter using Windowing Technique.
13) Convolution of Two Signals.
14) Correlation of Two Signals.
15) DFT Analysis of a Noise Corrupted Signal.

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

EC353 (R20): MOBILE APP DEVELOPMENT

L-0	T-0	P-3	M-100	C-2

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Design and develop user interfaces for mobile apps using basic building blocks, UI components and application structure using Emulator
CO2	Write simple programs and develop small applications using the concepts of UI design, layouts and preferences
CO3	Develop applications with multiple activities using intents, array adapter, exceptions and options menu.
CO4	Implement activities with dialogs, spinner, fragments and navigation drawer by applying themes
CO5	Develop mobile applications using SQLite.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	1	3	2	3	-	2	-	-	-	-	-
CO2	3	3	3	2	3	2	3	-	2	-	-	-	-	-
CO3	3	3	3	2	3	2	3	-	2	-	-	-	-	-
CO4	3	3	3	2	3	2	3	-	2	-	-	-	-	-
CO5	3	3	3	2	3	2	3	-	2	-	-	-	-	-
AVG_CO	3	3	3	2	3	2	3	-	2	-	-	-	-	-

1) Develop an application that uses GUI components, Font and Colours
2) Develop an application that uses Layout Managers and event listeners.
3) Develop an application that makes use of databases.
4) Develop an application that makes use of Notification Manager
5) Develop a native application that uses GPS location information
6) Implement an application that for basic calculator
7) Implement an application that creates an alert upon receiving a message
8) Write a mobile application that makes use of RSS feed
9) Develop a mobile application to send an email.
10) Develop a Mobile application for simple needs (Mini Project)

EC354 (R20): SUMMER INTERNSHIP 2 MONTHS

L-0	T-0	P-0	M-100	C-1.5

S. No.	Course Details		Category	Scheme of Instruction			Scheme of Examination		
				Hours in a Week			Marks		Credits
	Code	Subject Name		L	T	P	Internal	External	
1	EC 354(R20)	**SUMMER INTERNSHIP 2** Months after second year (to be evaluated during V semester)	MC	0	0	0	100	0	1.5

III/IV B.Tech.
SEMESTER II

B.Tech. ELECTRONICS & COMMUNICATION ENGINEERING

III/IV B.Tech. SEMESTER-II

EC321 (R20): MICROWAVE ENGINEERING

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Analyse fundamental concepts of EM fields and wave guides.
CO2	Understand devices designed for microwave frequencies applications like magic tee, ferrite devices
CO3	Evaluate mathematically microwave sources, klystrons, magnetron, traveling wave tubes.
CO4	Characterize different microwave diodes like gunn diode, tunnel diode, Impatt diode trapatt diode, baritt diode.
CO5	Apply microwave theory for measuring different parameters like VSWR, Power, Impedance, S parameters.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	3	1	2	-	-	1	-	3	3	2
CO2	3	3	2	3	3	1	2	-	-	1	-	3	3	2
CO3	3	3	2	3	3	1	2	-	-	1	-	3	3	2
CO4	3	3	2	3	3	1	2	-	-	1	-	3	3	2
CO5	3	3	2	3	3	1	2	-	-	1	-	3	3	2
AVG_CO	**3**	**3**	**2**	**3**	**3**	**1**	**2**	**-**	**-**	**1**	**-**	**3**	**3**	**2**

Unit- I

Introduction to Microwave Engineering-Microwave frequency band designations, Advantages and applications of Microwaves. Rectangular Waveguide, Circular Waveguide, Cavity Resonators-Rectangular cavity resonators, circular cavity Resonators. Wave guide components-Microwave TEE junctions-Coupling mechanism and scattering parameters for H-plane TEE, E-plane TEE, Magic Tee. Applications of Magic Tee.

Unit-II

Power transmission in wave guides. Directional couplers, Scattering matrix and applications. Faraday rotation based Isolator and circulator. Microwave Measurement of- Impedance, frequency, Power and VSWR, S-Parameters.

Unit- III

Limitations of conventional tubes at Microwave Frequencies. Microwave Tubes-Linear Beam (O type) tubes-Two cavity Klystron- amplifier process, Expression for output power and efficiency, multi cavity klystron, Reflex klystron- Mathematical theory of bunching, output power and efficiency. Structure of TWT and amplification process.

M type tubes- eight cavity cylindrical magnetron, resonance and π mode operation, Hull cut-off voltage equation, separation of π mode, sustained oscillations in magnetron.

Unit- IV

Microwave semiconductor devices-Transferred Electron Devices - Gunn Diode - Operation and characteristics of Gunn Diode, Domain formation, RWH theory of Gunn Diode, equivalent circuit of Gunn Diode, Basic modes of operations, Applications. Tunnel Diode.

Unit V

Avalanche transit time devices- IMPATT diode, BARITT diode, TRAPATT diode. PIN Diode, Schottky Diode, Varactor Diode, Spectrum analyzer.

TEXT BOOKS:

1) Microwave and Radar Engineering, Dr. M. Kulkarni, 5th Edition, Umesh publications.
2) Samuel Y Liao, Microwave Devices and Circuits, 3rd Edition, Pearson Education, 2003.
3) ML Sisodia and V.L.Gupta, Microwave Engineering, New Age International, 2005

REFERENCE BOOKS:

1) RE Collin, Foundations for Microwave Engineering, IEEE Press Series, 2003
2) M.L.Sisodia and GS Raghuvamshi, Microwave Circuits and Passive Devices, Wiley Eastern, 1987

EC322 (R20): DIGITAL COMMUNICATION

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Represent the signals using signal space representation
CO2	Demonstrate different spread spectrum techniques.
CO3	Apply the concept of Digital Modulation techniques for digital communication systems.
CO4	Evaluate the performance of various digital modulation schemes over AWGN and fading channels
CO5	Analyze the performance of different receivers

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	3	-	-	-	-	-	-	-	-	-	3	1
CO2	3	1	3	-	-	-	-	-	-	-	-	-	3	1
CO3	2	1	3	-	-	-	-	-	-	-	-	-	3	1
CO4	2	1	3	-	-	-	-	-	-	-	-	-	3	1
CO5	2	1	3	-	-	-	-	-	-	-	-	-	3	1
AVG_CO	**2**	**1**	**3**	-	-	-	-	-	-	-	-	-	**3**	**1**

UNIT – I

Pulse Code Modulation: Quantization Process, Quantization Noise, Pulse Code Modulation Line Codes Noise Considerations in PCM Systems Virtues, Limitations, and Modifications of PCM Delta Modulation, Differential Pulse Code Modulation, Adaptive differential Pulse Code Modulation.

Base Band Pulse Transmission: Matched filter, Properties, Error Rate due to Noise Inter symbol interference, Nyquist's criterion for Distortion less Baseband Binary Transmission, Correlative level coding, Optimum Linear receiver Eye Pattern.

UNIT – II

Digital Passband Transmission: Geometric representation of signals, Conversion of the continuous AWGN channel into A vector channel Likelihood Functions Maximum Likelihood decoding Correlation Receiver probability of error Passband Transmission model coherent BPSK, QPSK, M-PSK Coherent BFSK, MSK, GMSK Non Coherent BFSK DPSK Comparison of Digital Modulation Schemes.

UNIT – III

Spread Spectrum Modulation: PN sequence A Notion of spread spectrum direct Sequence spectrum spread spectrum with Coherent BPSK Signal Space Dimensionality and Processing gain Probability of error frequency Hop spread spectrum.

UNIT - IV

Fundamental Limits in Information Theory: Uncertainty, Information, Entropy, Source Coding Theorem, Data Compaction, Discrete memoryless channels, Mutual information, Channel capacity, Channel coding theorem, Information capacity theorem, Data Compression.

UNIT – V

Error Control Coding: Discrete Memoryless channels Linear Block codes, Cyclic Codes, Convolution Codes, Maximum Likelihood and Sequential Decoding of Convolution Codes.

TEXT BOOKS:

1) Simon Haykin, Communication Systems, 4th edition John Wiley & Sons, 2001
2) Modern Digital and Analog Communication Systems, 3rd edition, OUP, 1998
3) Leon W Couch II, Digital and Analog Communication Systems, 6th Edition, Pearson, 2004.

REFERENCE BOOKS:

1) John G Proakis, Digital Communications, 4th Edition, McGraw Hill, 2001.
2) Bernard Sklar, Digital Communication, 2nd Edition, Pearson Education, 2001.
3) Taub and Schilling, Principles of Communication Systems, 2nd Edition, TMH, 1986.

EC323 (R20): ANTENNAS AND WAVE PROPAGATION

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	To attain knowledge on the concept of radiation and its application towards antennas
CO2	To understand basic terminology and concepts of Antennas.
CO3	To analyse the fundamental of Antenna Arrays and its derivations
CO4	To obtain knowledge on various types of antennas and its operation and as well as its usage in real time filed
CO5	To understand the classification of the wave spectrum and respective band usage and also to know the propagation of the waves at different frequencies through different layers in the existing layered free space environment.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	1	3	-	3	3	2
CO2	3	2	1	1	-	-	-	-	1	3	-	3	2	2
CO3	3	3	3	3	-	-	-	-	1	3	-	3	2	2
CO4	3	3	2	2	-	-	-	-	1	3	-	3	3	3
CO5	3	2	2	1	-	-	-	-	1	3	-	3	3	3
AVG_CO	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**3**	**-**	**3**	**3**	**3**

UNIT-I

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, Traveling wave antennas and the effect of the point of feed on standing wave antennas.

UNIT-II

Antenna Fundamentals: Isotropic, Directional, Omni-directional patterns, principal pattern, near-andfar-field regions, Radiation density, Radiation intensity, reciprocity, directivity and power gain, effective aperture, Half power Beam width, polarization, input impedance, efficiency, Friss transmission equation.

UNIT-III

Array Antennas: Two element array, Uniform linear array, Side lobe level and beam width of broadside array, Beam width of end fire array, Principle of multiplication of patterns, Effect of earth on vertical patterns, Binomial array, Basic principle of Dolph-Tschebyscheff array.

UNIT-IV

Characteristics of Typical 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, Basic principles of slot antennas, Basic characteristics of micro strip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas.

UNIT-V

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, Extended-range Propagation resulting from Tropospheric Scattering, ionospheric Propagation, Gyro frequency, Refraction and reflection of Sky Waves by the Ionosphere, Critical Frequency, Skip Distance, Maximum Usable Frequency.

TEXT BOOKS:

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.
4) J.D. Kraus, Antennas, McGraw Hill, 1988.

REFERENCE BOOKS:

1) R.E. Collin, Antennas and Radio Wave Propagation, McGraw Hill, 1985.
2) R.C. Johnson and H. Jasik, Antenna Engineering Handbook, McGraw ill, 1984.
3) J. Bahl and P. Bhartia, Micro Strip Antennas, Artech House, 1980.
4) R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill, 2005
5) F.E. Terman, Electronic and Radio Engineering, Mc Graw Hill, 1985.

EC324/1 (R20): FIBER OPTIC COMMUNICATION

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	To understand and learn the laws of light transmission, elements of optical fiber transmission link, fiber structures, modes.
CO2	To understand and study different kinds of losses in fiber and various optical components.
CO3	To understand and learn about various optical sources like Light Emitting Diode and LASER.
CO4	Acquire knowledge on optical transmitter and receiver circuits and different optical fiber measurements. Design a fiber optic link based on budgets to assess the losses in fibers.
CO5	To understand and learn about SONET/SDH Rings and Networks.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	2	-	3	2	2
CO2	3	2	2	2	-	-	-	-	-	2	-	3	2	2
CO3	3	2	2	-	-	-	-	-	-	2	-	3	2	2
CO4	3	3	2	2	-	-	-	-	-	2	-	2	3	3
CO5	3	3	2	2	-	-	-	-	-	2	-	3	2	2
AVG_CO	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**3**	**3**	**3**

UNIT – I

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

TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS: Attenuation, absorption, scattering and bending losses in fibers, Dispersion: Inter model and intra model.

FIBER OPTIC COMPONENTS: Splicing, Connectors, Connection losses, Fiber Optic couplers, Fiber Optic Switches.

UNIT – III

OPTICAL SOURCES: General characteristics, Principles of Light Emission. Light Emitting Diodes Types-Planar, Dome, Surface emitting, Edge emitting, Super luminescent LED's. LED Characteristics – Optical output power & efficiency, output spectrum, modulation bandwidth, reliability.

LASER: Working of DH injection laser, DFB laser and Threshold condition for lasing.

DETECTORS: Principles of photo detection. PIN Photodiode, Avalanche Photodiode and their characteristics.

UNIT – IV

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, Advanced Multiplexing Strategies – OTDM, WDM.

UNIT – V

OPTICAL FIBER MEASUREMENTS: Numerical Aperture, attenuation, refractive index, dispersion losses, cutback and OTDR.

OPTICAL NETWORKS: Basic Networks. Network Topologies, Performance of passive linear buses.

SONET/ SDH: Transmission formats and speeds, Optical interfaces, SONET/SDH Rings, SONET/ SDH Networks.

TEXT BOOKS:

1) John M Senior, Optical Fiber Communications: Principles and Practice, 2nd Edition, PHI, 2002.
2) Henry Zanger and Cynthia Zanger, Fiber Optics: Communication and other Applications, Maxwell Macmillan Edition.
3) JC Palais, Fiber Optic Communications, 2nd Edition, PHI, 2001.
4) W.Tomasi, Advanced Electronic Communication Systems, Pearson Education, 2002.

EC324/2 (R20): ADAPTIVE SIGNAL PROCESSING

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Understand the basics of continuous time and discrete time signals and systems.
CO2	Analyze different variants of LMS algorithm
CO3	Comprehend the effects of sampling on a continuous time signal.
CO4	Calculate Fourier series and Fourier transform of continuous and discrete time signals.
CO5	Analyze signal and system properties like stability and causality using Laplace and Z transforms.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	-	-	-	-	-	1	-	3	3	2
CO2	3	3	1	1	-	-	-	-	-	1	-	3	2	2
CO3	3	3	1	1	-	-	-	-	-	1	-	3	3	2
CO4	3	3	1	2	-	-	-	-	-	1	-	3	3	2
CO5	3	3	1	2	-	-	-	-	-	1	-	3	3	2
AVG_CO	**3**	**3**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**3**	**3**	**2**

UNIT-I

General concept of adaptive filtering and estimation, applications and motivation, Review of probability, random variables and stationary random processes, Correlation structures, properties of correlation matrices.

UNIT-II

Optimal FIR (Wiener) filter, Method of steepest descent, extension to complex valued The LMS algorithm (real, complex), convergence analysis, weight error correlation matrix, excess mean square error and mis-adjustment

UNIT-III

Variants of the LMS algorithm: the sign LMS family, normalized LMS algorithm, block LMS and FFT based realization, frequency domain adaptive filters, Sub-band adaptive filtering. Signal space concepts - introduction to finite dimensional vector space theory, subspace, basis, dimension, linear operators, rank and nullity, inner product space, orthogonality, Gram Schmidt orthogonalization, concepts of orthogonal projection, orthogonal decomposition of vector spaces.

UNIT-IV

Vector space of random variables, correlation as inner product, forward and backward projections, Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modeling, joint process estimator, gradient adaptive lattice.

UNIT-V

Introduction to recursive least squares (RLS), vector space formulation of RLS estimation, pseudo inverse of a matrix, time updating of inner products, development of RLS lattice filters, RLS transversal adaptive filters. Advanced topics: affine projection and subspace based adaptive filters, partial update algorithms, QR decomposition and systolic array.

TEXT/REFERENCE BOOKS:

1) S. Haykin, Adaptive filter theory, Prentice Hall, 1986.
2) C.Widrow and S.D. Stearns, Adaptive signal processing, Prentice Hall, 1984.

EC324/3 (R20): ERROR CORRECTING CODES

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Explain the fundamental science and quantum mechanics behind nanoelectronics, concepts of a quantum well, quantum transport and tunneling effects.
CO2	Describe the spin-dependent electron transport in magnetic devices.
CO3	Calculate the energy levels of periodic structures and nanostructures. Calculate the I-V characteristics of Nanoelectronics devices.
CO4	Explore various application areas of Nano electronics.
CO5	Design and analysis of Nano structure and Nano electronics devices using MOSFET, FINFETs, CNTFETs

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	-	-	-	-	-	-	-	-	-	2	2
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	2
CO3	2	3	3	-	-	-	-	-	-	-	-	-	2	1
CO4	3	2	2	-	-	-	-	-	-	-	-	-	3	1
CO5	3	2	2	-	-	-	-	-	-	-	-	-	2	2
AVG_CO	3	2	2	-	-	-	-	-	-	-	-	-	2	1

UNIT-I

Linear block codes: Systematic linear codes and optimum decoding for the binary symmetric channel; Generator and Parity Check matrices, Syndrome decoding on symmetric channels;

UNIT-II

Hamming codes; Weight enumerators and the McWilliams identities; Perfect codes, Introduction to finite fields and finite rings;factorization of (X^n-1) over a finite field;

UNIT-III

Cyclic Codes. BCH codes; Idempotents and Mattson-Solomon polynomials; Reed-Solomon codes, Justeen codes, MDS codes, Alterant, Goppa and generalized BCH codes; Spectral properties of cyclic codes.

UNIT-IV

Decoding of BCH codes: Berlekamp's decoding algorithm, Massey's minimum shift register synthesis technique and its relation to Berlekamp's algorithm. A fast Berlekamp - Massey algorithm.

UNIT-V

Convolution codes; Wozencraft's sequential decoding algorithm, Fann's algorithm and other sequential decoding algorithms; Viterbi decoding algorithm.

TEXT/REFERENCE BOOKS:

1) F.J. McWilliams and N.J.A. Slone, The theory of error correcting codes, 1977.
2) R.E. Balahut, Theory and practice of error control codes, Addison Wesley, 1983.

EC325/1 (R20): EMBEDDED SYSTEMS

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Understand the basic operations of embedded microcontroller cores, processor and memories.
CO2	Applying the concept of Embedded System and its design for real life applications.
CO3	Explain the technological aspects of embedded systems through analog and digital blocks, sub systems and user interfacing.
CO4	Examine design metrics, design tradeoffs and software aspects of embedded systems.
CO5	Illustrate Real Time Programming Languages and Real Time operating systems

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1	1	-	-	-	-	-	1	-	3	1	1
CO2	2	3	1	1	-	-	-	-	-	1	-	3	2	2
CO3	2	3	1	1	-	-	-	-	-	1	-	3	2	2
CO4	3	3	1	1	-	-	-	-	-	1	-	3	2	2
CO5	3	3	1	1	-	-	-	-	-	1	-	3	2	2
AVG_CO	**3**	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**3**	**2**	**2**

UNIT – I

Introduction - Introduction to Embedded Systems: Processor Technology, Role of Processor Selection in Embedded Systems, Design cycle in the development phase for an Embedded System, Using of target system or its Emulator and in-Circuit emulator, Use of software tools for development of an Embedded Systems.

Design Technology: Design of custom single purpose processor, optimization of custom single purpose processor, RT level - combination logic and sequential logic.

UNIT – II

RTOS and Overview:

Real Time Operating Systems: Architecture of Kernel, Task, Task States and Task Scheduler, Message Queues, Event Registers, Pipes, Signals, Semaphores, Memory Management, Interrupt Routines in an RTOS environment, Basic Design Using RTOS.

UNIT – III

ARM Microcontroller Overview

ARM-32 bit Microcontroller: Thumb-2 technology and applications of ARM, Architecture of ARM Cortex M3, Various Units in the Architecture, Debugging support, General Purpose Registers, Special Registers, Exceptions, Interrupts, Stack operation, Reset sequence

UNIT – IV

ARM Cortex M3 Microcontroller

ARM Cortex M3 Instruction Sets and Programming: Assembly basics, Instruction list and description, Thumb and ARM instructions, Special instructions, Useful instructions, CMSIS, Assembly and C language Programming

UNIT – V

Networks for Embedded Systems: The I^2C Bus, The CAN bus, SHARC link ports, Ethernet, Bluetooth: specification, Core protocol, IEEE 1149.1 (JTAG) Testability.

TEXT BOOKS:

1) Raj kamal "Embedded systems architecture, programming and design" Tata McGraw-Hill Publishing company Limited.
2) Embedded System Design: A Unified Hardware/Software Introduction Frank Vahid and Tony Givargis
3) Joseph Yiu, The Definitive Guide to the ARM Cortex-M3, 2nd Edition, Newnes, (Elsevier), 2010

REFERENCE BOOKS:

1) Jonathan W Valvano, Embedded Microcomputer Systems, Brooks / cole, Thompson Learning.
2) David E. Simon, An Embedded Software Primer, Pearson edition.
3) KVKK Prasad, Embedded and real time systems, Dreemtech Press, 2005.
4) ARM System Developer's Guide-Designing and Optimizing System Software, Andrew N.Sloss, Dominic SYMES, Chris Wright

EC325/2 (R20): COMPUTER NETWORKS

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Understand the concept and functionalities of OSI & TCP/IP reference models.
CO2	Discuss the OSI model's protocol and their functioning.
CO3	Compute IP addresses and assignment of IP addresses to an organization.
CO4	Apply various routing algorithms to find shortest paths for delivery of packet.
CO5	Analyze flow control and error control mechanisms.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	-	-	-	-	-	1	-	3	2	2
CO2	2	3	1	1	-	-	-	-	-	1	-	3	2	2
CO3	2	3	1	1	-	-	-	-	-	1	-	3	2	2
CO4	2	3	1	1	-	-	-	-	-	1	-	3	2	2
CO5	2	3	2	1	-	-	-	-	-	1	-	3	2	2
AVG_CO	2	3	1	1	-	-	-	-	-	1	-	3	2	2

UNIT I:

Introduction: Uses of Computer Networks, Network Hardware, LANs, MANs, WANs, Network Software. Reference Models: The OSI Reference Model, TCP/IP Reference Model, the comparison of OSI, and TCP/IP reference models. The Physical Layer: Guided transmission media: Magnetic Media, Twisted Pair, Coaxial Cable, and Fiber Optics.

UNIT II:

The Data Link Layer: Data link layer design issues, Error detection and correction, Elementary data link protocols, and Sliding window protocols. The Medium Access Control Sub layer: The channel allocation problem, multiple access protocols, ETHERNET, and Wireless LANs.

UNIT III:

The Network Layer: Network Layer Design Issues, Routing Algorithms: Shortest Path, Flooding, DVR, and Link State routing algorithm, Congestion Control Algorithms, and Quality of Service. IP protocol and IP address.

UNIT – IV:

The Transport Layer: The Transport Service, Elements of Transport Protocols, and the Internet Transport Protocols: UDP- Remote Procedure Call, The Real-Time Transport Protocol, TCP- Introduction to TCP, The TCP Service model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release, TCP Connection Management Modeling, TCP Transmission Policy, Congestion Control, TCP Timer Management.

UNIT - V:

Application Layer: The Domain Name System (DNS) – Resource Records, Name Servers, E-Mail – Architecture and Services, POP3, IMAP, World Wide Web – Architectural Overview, Server side, Uniform Resource Locators, Statelessness and Cookies.

TEXT BOOKS / REFERENCE BOOKS:

1) Andrew S Tanenbaum, Computer Networks.4 ed, Pearson Education / PHI.
2) Behrouz A.Forouzan, Data Communications and Networking. 4 ed, TATA McGraw Hill
3) Kurose and Ross, Computer Networks – A Top-down Approach Featuring the Internet. ‘Pearson Education.

EC325/3 (R20): SENSORS & INSTRUMENTATION

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Analyzing different static, dynamic and performance characteristics of instruments
CO2	Demonstrate the use of Signal Generators, analyzers, frequency counter, CRO, DAS, ADC and DAC for appropriate measurement
CO3	Design AC and DC bridges for relevant parameter measurement.
CO4	Select a suitable sensors, actuators, and control systems for instruments.
CO5	Design instruments based on Ultrasound and Infrasound sensors

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	1	2	-
CO2	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO3	3	3	2	-	-	-	-	-	-	-	-	1	2	-
CO4	3	3	-	-	-	-	-	-	-	-	-	1	2	-
CO5	3	3	-	-	-	-	-	-	-	-	-	1	2	-
AVG_CO	3	3	1	-	-	-	-	-	-	-	-	1	2	-

UNIT I

Performance characteristics of instruments, Static characteristics, Accuracy, Resolution, Precision, Expected value, Error, Sensitivity. Errors in Measurement, Dynamic Characteristics-speed of response, Fidelity, Lag and Dynamic error. DC Voltmeters- Multi-range, Range extension/Solid state and differential voltmeters, AC voltmeters- multi range, range extension, shunt. Thermocouple type RF ammeter, Ohmmeters series type, shunt type, Multi-meter for Voltage, Current and resistance measurements.

UNIT II

Signal Generator- fixed and variable, AF oscillators, Standard and AF sine and square wave signal generators, Function Generators, Square pulse, Random noise, sweep, Arbitrary waveform. Wave Analyzers, Harmonic Distortion Analyzers, Spectrum Analyzers, Digital Fourier Analyzers.

UNIT III

AC Bridges Measurement of inductance- Maxwell's bridge, Anderson Bridge. Measurement of capacitance -Schearing Bridge. Wheat stone bridge. Wien Bridge, Errors, and precautions in using bridges. Q-meter.

UNIT IV

Sensor Fundamentals and applications

Sensor Characteristics, System Characteristics, Instrument Selection, Data Acquisition and Readout, Installation, Acceleration, Shock and Vibration Sensors: Technology Fundamentals, Selecting and Specifying Accelerometers, Applicable Standards, Interfacing and Designs

UNIT V

Sound, Ultrasound and Infrasound sensors

Principles, Audio to electrical sensors and transducers: moving iron microphone, moving coil microphone, capacitor microphones. Microphone problems, frequency and wavelengths. Electrical to audio transducers: moving iron transducer, moving coil transducer, Capacitor transducers. Ultrasonic transducers, Infrasound sensors.

TEXT BOOKS:

1) Electronic instrumentation, second edition - H.S.Kalsi, Tata McGraw Hill, 2004.
2) Modern Electronic Instrumentation and Measurement Techniques – A.D. Helfrick and W.D. Cooper, PHI, 5th Edition, 2002.
3) Sensor Technology Handbook Hardcover – Import, 21 December 2004 by Jon S. Wilson (Author), Publisher: Newnes; Har/Cdr edition (21 December 2004)

REFERENCE BOOKS:

1) Electronic Instrumentation & Measurements - David A. Bell, PHI, 2nd Edition, 2003.
2) Electronic Test Instruments, Analog and Digital Measurements - Robert A.Witte, Pearson Education, 2nd Ed., 2004.
3) Patranabis D, Sensors and Transducers, 2nd Edition, PHI, New Delhi, 2010

EC361 (R20): MICROWAVE & OPTICAL COMMUNICATION LAB

L-0	T-0	P-3	M-100	C-1.5

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Analyse fundamental concepts of EM fields and wave guides.
CO2	Understand devices designed for microwave frequencies applications like magic tee, ferrite devices,
CO3	Evaluate mathematically microwave sources, klystrons, magnetron, traveling wave tubes.
CO4	Characterize different microwave diodes like gunn diode, tunnel diode, Impatt diode trapatt diode, baritt diode.
CO5	Apply microwave theory for measuring different parameters like VSWR, Power, Impedance, S parameters.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	3	1	2	-	-	1	-	3	3	2
CO2	3	3	2	3	3	1	2	-	-	1	-	3	3	2
CO3	3	3	2	3	3	1	2	-	-	1	-	3	3	2
CO4	3	3	2	3	3	1	2	-	-	1	-	3	3	2
CO5	3	3	2	3	3	1	2	-	-	1	-	3	3	2
AVG_CO	**3**	**3**	**2**	**3**	**3**	**1**	**2**	**-**	**-**	**1**	**-**	**3**	**3**	**2**

PART-A:

1) Reflex Klystron Characteristics
2) Gunn Diode Characteristics
3) Attenuation Measurement
4) Directional Coupler Characteristics
5) Impedance and Frequency Measurement
6) Scattering parameters of Circulator
7) Scattering parameters of Magic Tee
8) Radiation Pattern of Horn and Parabolic Antennas
9) Verification of waveguide expression.

PART-B:

10) Characterization of LED.
11) Characterization of Laser Diode.
12) Measurement of Data rate for Analog Optical link.
13) Measurement of Data rate for Digital Optical link.
14) Measurement of NA.
15) Measurement of losses for Analog Optical link.

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

EC362 (R20):DIGITAL COMMUNICATION LAB

L-0	T-0	P-3	M-100	C-1.5

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Analyze different modulation techniques for communication systems
CO2	Design various types of digital filters with a given set of specifications
CO3	Evaluate the performance of spread spectrum communication technique.
CO4	Analyze and synthesize digital signal and systems using FFT.
CO5	Understand the basics of adaptive filter design.

CO-PO/PSO MAPPING MATRIX:

COs	PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	3	2	3	3	3
CO2	3	2	3	3	3
CO3	3	2	3	3	3
CO4	3	2	3	3	3
CO5	3	2	3	3	3
AVG_CO	3	2	3	3	3

1) Generation and Detection of Time Division Multiplexing.
2) Generation and Detection of Pulse Code Modulation.
3) Generation and Detection of Delta Modulation.
4) Generation and Detection of DPCM.
5) Generation and Detection of DPSK.
6) Generation and Detection of Spread spectrum.
7) Generation and Detection of QPSK.
8) Generation and Detection of ASK.
9) Generation and Detection of FSK.
10) Generation and Detection of PSK.
11) Study of Companding system.
12) Error detection and correction using hamming code.
13) Adaptive Delta Modulation and CVSD.
14) Differential Pulse Code Modulation and Demodulation.
15) Differential Phase Shift Keying.

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

EC363 (R20): ELECTRONIC CIRCUIT SIMULATION

L-0	T-0	P-3	M-100	C-1.5

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Construct the different types of feedback amplifiers
CO2	Simulate electronic circuits using PSPICE
CO3	Analyze the characteristics of rectifiers
CO4	Determine the frequency response of a two stage RC couple CE amplifier.
CO5	To implement a voltage regulator

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	1	3	-	-	-	-	3	-	3	2	-
CO2	3	3	-	-	3	-	-	-	-	3	-	3	3	-
CO3	3	3	2	3	3	-	-	-	-	3	-	3	3	-
CO4	3	3	2	3	3	-	-	-	-	3	-	3	3	-
CO5	3	3	-	3	3	-	-	-	-	3	-	3	3	-
AVG_CO	**3**	**3**	**1**	**2**	**3**	**-**	**-**	**-**	**-**	**3**	**-**	**3**	**3**	**-**

PART-A:

1) Obtain the V-I characteristics of silicon and Germanium diodes.
2) Design a Zener diode voltage regulator.
3) Design and verify the operating point for a self-bias circuit.
4) Study the characteristics of a half wave and full wave rectifier.
5) Study the characteristics of a bridge rectifier.
6) Obtain the frequency response of a CE amplifier.
7) Obtain the frequency response of a two stage RC couple CE amplifier.
8) Design and simulate class A power Amplifier.

PART-B:

9) Simulate a differentiator and integrator using OPAMP.
10) Simulate a low pass and high pass filter using OPAMP.
11) Simulate a RC phase shift and Wein bridge oscillator using OPAMP.
12) Design and simulate a constant resistance and bridged T equalizer.
13) Simulate an Amplitude Modulator and Demodulator.
14) Simulate a Clipping and Clamping Circuit.
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 University Practical Examination.

EC364 (R20): HDL PROGRAMMING

L-1	T-0	P-2	M-100	C-2

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Understand the physical design process of Digital Integrated Circuits.
CO2	Describe procedure for designing of programmable circuits.
CO3	Demonstrate the ability to use various EDA tools for digital system design
CO4	Implement various combinational and sequential circuits using VHDL on FPGA.
CO5	Implement schematic and layout of various digital CMOS logic circuits using EDA tools.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1	2	2	-	-	-	-	3	-	3	3	2
CO2	2	3	2	2	2	-	-	-	-	3	-	3	3	2
CO3	2	3	2	3	3	-	-	-	-	3	-	3	3	2
CO4	2	3	2	3	3	-	-	-	-	3	-	3	3	2
CO5	2	3	2	3	3	-	-	-	-	3	-	3	3	2
AVG_CO	**2**	**3**	**2**	**3**	**3**	**-**	**-**	**-**	**-**	**3**	**-**	**3**	**3**	**2**

PART-A

VHDL Modelling and Synthesis of the following Experiments

1) Logic gates
2) Adders (Hall adder & Full Adder)
3) Code Converter (Binary to Gray & Gray to Binary)
4) 4x16 Decoder
5) 16x4 Encoder
6) Comparator
7) Arithmetic Logic Unit (ALU)
8) BCD to 7-Segment Display

Verilog Modeling and Synthesis of the following Experiments

PART-B

1) Multiplexer/De-multiplexer
2) Flip Flops: JK/T/D
3) Counter
4) Moore state Machine
5) Mealy State Machine
6) Traffic light controller
7) Universal Asynchronous Receiver Transmitter (UART)

Additional experiments beyond the syllabus

1) Stop Watch
2) Sine Wave Generator
3) Delay Generator
4) PN Sequence Generator
5) Cyclic Redundancy Checker

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

IV/IV B.Tech.
SEMESTER I

B.Tech. ELECTRONICS & COMMUNICATION ENGINEERING

IV/IV B.Tech. SEMESTER-I

EC411 (R20): IMAGE AND VIDEO PROCESSING

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Understand theory and models in Image and Video Processing.
CO2	Explain the need of spatial and frequency domain techniques for image compression.
CO3	Comprehend different methods, models for video processing and motion estimation.
CO4	Illustrate quantitative models of image and video segmentation.
CO5	Apply the process of image enhancement for optimal use of resources.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	-	2	-	-	-	1	-	3	2	2
CO2	3	3	1	1	-	2	-	-	-	1	-	3	2	2
CO3	2	3	1	1	-	2	-	-	-	1	-	3	3	2
CO4	2	3	1	1	-	2	-	-	-	1	-	3	3	2
CO5	2	3	1	1	-	2	-	-	-	1	-	3	3	2
AVG_CO	**2**	**3**	**1**	**1**	**-**	**2**	**-**	**-**	**-**	**1**	**-**	**3**	**3**	**2**

UNIT – I

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 FUNDAMENTALS: Elements of Visual perception, Image sampling and Quantization, Basic relationships between Pixels, Linear and Non-linear operations.

UNIT – II

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

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.

IMAGE COMPRESSION: Fundamentals – Image Compression models – Error Free Compression, Lossy Compression.

UNIT – IV

IMAGE SEGMENTATION: Detection of discontinuities, Thresholding, Edge based Segmentation and Region based Segmentation.

IMAGE REPRESENTATION AND DESCRIPTION: Representation schemes, Boundary Descriptors, Regional Descriptors.

VIDEO REPRESENTATION: Video formation, perception and representation, Analog Video Raster, Analog Color Television Systems, Digital Video

UNIT – V

VIDEO SAMPLING-Basics of Lattice Theory, Sampling of Video Signals.

VIDEO MODELLING-Two-dimensional Motion Models, Two-Dimensional Motion Estimation-Types, Optical Flow, Pixel Based Motion, Block matching Algorithm.

TEXT BOOKS:

1) R C Gonzalez and Richard E Woods, Digital Image Processing, Pearson Education, Second Edition, 2002
2) Video Processing and Communication – 1st edition - Yao Wang, J.Ostermann, Ya Zhang, Prentice Hall, 2001.

REFERENCE BOOKS:

1) A K Jain, Digital Image Processing, PHI, 1989
2) B Chanda and D Dutta Majumder, Digital Image Processing and Analysis, PHI,
3) MilanSonka, Vaclav Hlavac and Roger Boyle, Image Processing Analysis and Machine Vision, Thomson learning, Second Edition, 2001.
4) Multidimensional, signal, image and video processing and coding - Woods, Elsevier, Academic press, 2006.

EC412 (R20): WIRELESS COMMUNICATIONS & CELLULAR NETWORKS

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Able to describe the principles of wireless communications, networking and cellular system design concepts
CO2	Distinguish various multiple access schemes used in wireless communication
CO3	Understand wireless wide area networks and their performance analysis
CO4	Classify the various diversity techniques
CO5	Compare existing and emerging wireless standards.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	1	-
CO2	2	2	-	-	-	-	-	-	-	-	-	3	1	-
CO3	2	2	-	-	-	-	-	-	-	-	-	3	2	-
CO4	2	2	-	-	-	2	-	-	-	-	2	3	2	-
CO5	2	2	-	-	-	2	-	-	-	-	2	3	2	-
AVG_CO	**2**	2	-	-	-	2	-	-	-	-	2	3	2	-

UNIT – I

INTRODUCTION TO MOBILE COMMUNICATION: Evolution of Mobile Radio Communication, Mobile Radio Telephony in US and around the world, Examples of Wireless Communication Systems: Paging system, Cordless telephones systems, Cellular telephone Systems, Trends in Cellular Radio and personal Communications.

The Cellular concept: Frequency reuse, Channel Assignment strategies, Hand off Strategies, Interference and system capacity, improving coverage and capacity in cellular systems.

UNIT – II

MOBILE RADIO PROPAGATION: Large Scale Fading: Introduction, Free space propagation model, Relating power to electric field, The Three basic propagation mechanisms: Reflection, Ground reflection (Two-Ray) model, Diffraction, scattering, Practical Link budget design using path loss models.

Small Scale Fading: Small-scale Multipath Propagation, Impulse response model of a multipath channel, Parameters of mobile multipath channels, Types of small scale fading: Fading effects due to multipath time delay spread and Doppler spread Rayleigh and Ricean distributions.

UNIT – III

Equalization: Fundamentals of equalizers, Equalizers in a communication receiver, Linear equalizers, Nonlinear equalizers: Decision feedback equalizers, Maximum likelihood sequence Estimation (MLSE) equalizer.

Diversity Techniques: Space diversity: Selection diversity, feedback, MRC, EGC diversity, Polarization diversity, Frequency diversity, Time diversity, Rake Receiver.

UNIT – IV

Multiple Access in Wireless communications: Principle and applications of Multiple Access Techniques FDMA, TDMA, CDMA, Spread Spectrum Multiple Access.

UNIT – V

Wireless Generations Technologies up to 3G:1G, TDMA-based 2G, IS-95, 2.5G, 3G development, Air interface technologies, Internet speeds of 2G, 2.5G, and 3G technologies, Limitations of 3G, Quality of services (QOS) in 3G. 4GTechnology:4G evolution, Advantages of 4G over 3G, Applications of 4G, Limitations of 4G.

TEXT / REFERENCE BOOKS:

1) WCY Lee, Mobile Cellular Telecommunications Systems, McGraw Hill, 1990.
2) WCY Lee, Mobile Communications Design Fundamentals, Prentice Hall, 1993.
3) Raymond Steele, Mobile Radio Communications, IEEE Press, New York, 1992.
4) AJ Viterbi, CDMA: Principles of Spread Spectrum Communications, Addison Wesley, 1995.
5) VK Garg &JE Wilkes, Wireless & Personal Communication Systems, Prentice Hall, 1996.

EC413 (R20): INFORMATION THEORY AND CODING

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Quantify the notion of information, entropy, channel capacity in a mathematically sound way and understand its significance in the communications systems.
CO2	Understand the different encoding methods and algorithms of data compression methods
CO3	How to control error and linear block coding.
CO4	Learn binary cyclic codes & BCH codes and systems
CO5	Learn convolution codes and various time domain design approaches

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	2	2	-	-	-	-	-	3	-	3	2	2
CO2	1	2	2	2	-	-	-	-	-	3	-	3	3	3
CO3	1	2	2	2	-	-	-	-	-	3	-	3	3	3
CO4	1	3	2	2	-	-	-	-	-	3	-	3	3	3
CO5	1	3	2	2	-	-	-	-	-	3	-	3	3	3
AVG_CO	**1**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**3**	**3**	**3**

Unit I

Introduction: Measure of information, Average information content of symbols in long independent and dependent sequences, Entropy calculation for extension of source. Mark-off statistical model for information source, Entropy and information rate of mark-off source.

Unit II

Encoding of source output Shannon‘s encoding algorithm for dependent and independent sequences. Discrete communication channels, Continuous channels. Source coding theorem, Huffman coding, discrete memory less Channels, Mutual information, Properties of mutual information, Channel Capacity. Channel coding theorem, Differential entropy and mutual information for continuous ensembles, Channel capacity Theorem.

Unit III

Error Control coding: Introduction, Types of errors, examples, Types of codes.

Linear Block Codes: Matrix description, Error detection and correction, Standard arrays and table look up for decoding.

Unit IV

Binary cycle codes: Algebraic structures of cyclic codes, encoding using an (n-k) bit shift register, Syndrome calculation, BCH codes, RS Codes, Olay codes, Shortened cyclic codes, Burst error correcting codes. Burst and Random Error correcting codes.

Unit V

Convolution Codes: Block diagram of encoder, Impulse response of encoder, Time domain approach and Transform domain approach. State representation and state diagram, Tree diagram, Trellis diagram.

TEXT BOOKS:

1) K. Sam Shanmugam, Digital and Analog communication systems, John Wiley, (1996).
2) Simon Haykin, Digital communications, John Wiley, (2003).
3) R Bose, Information Theory, Coding and Cryptography, TMH 2007

REFERENCE BOOKS:

1) Elements of Information Theory by Thomas Cover, Joy Thomas
2) Channel Codes: Classical and Modern by William Ryan, Shu Lin
3) Information Theory and Reliable Communication by Robert Gallager
4) Kennedy-Electronic Communication systems||, McGraw Hill, 4th Ed., 1999.

EC414/1 (R20): RADAR SYSTEMS & NAVIGATIONAL AIDS

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Analyse fundamental concepts of Radars and mathematical equations.
CO2	Understand devices designed for Radars applications like CW radar, FMCW radar, multiple frequency continuous wave Radar.
CO3	Evaluate different Radars based on principle of operation and moving/ sationary targets.
CO4	Characterize different Radar antennas and their applications.
CO5	Analyse Radar signals in noise, Radar Receivers, Radar displays.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	3	1	2	-	-	1	-	3	3	2
CO2	3	3	2	3	3	1	2	-	-	1	-	3	3	2
CO3	3	3	2	3	3	1	2	-	-	1	-	3	3	2
CO4	3	3	2	3	3	1	2	-	-	1	-	3	3	2
CO5	3	3	2	3	3	1	2	-	-	1	-	3	3	2
AVG_CO	**3**	**3**	**2**	**3**	**3**	**1**	**2**	**-**	**-**	**1**	**-**	**3**	**3**	**2**

Unit - I

Introduction: Nature of Radar, Maximum Unambiguous Range, Radar Waveforms, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications. Related Problems. Radar Equation: Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise and SNR, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets-sphere, cone-sphere). Transmitter power.

Unit - II

PRF and Range Ambiguities, System Losses. CW and Frequency Modulated Radar: Doppler effect, CW Radar Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirement, Applications of CW radar. FMCW Radar-Block Diagram and Characteristics, FM-CW altimeter, Measurement Errors, Multiple Frequency CW Radar.

Unit - III

MTI and Pulse Doppler Radar: Introduction, Principle, MTI Radar with- Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers, Filter Characteristics, Blind Speeds, Double Cancellation, staggered PRFs. Range Gated Doppler Filters. MTI Radar Parameters, Limitations to MTI Performance. Non-coherent MTI, MTI versus Pulse Doppler Radar.

Tracking Radar: Tracking with Radar, Sequential Lobing, Conical Scan, Mono-pulse Tracking.Radar Amplitude Comparison Mono-pulse (one and two coordinates), Phase Comparison Mono-pulse. Tracking in Range. Comparison of Trackers.

Unit -IV

Radar Antennas: Antenna Parameters, Reflector Antennas, Electronically Steered Phased Array Antennas, Phase Shifters, Frequency scan Arrays, Radiation for Phased Array, Architecture for Phased Arrays.

Unit-V

Detection of Radar Signals in Noise: Introduction, Matched Filter Receiver, Detectors, Automatic Detection, Constant False Alarm Rate Receiver. Radar Receivers -Noise Figure and Noise Temperature. Superheterodyne Receiver. Displays types. Duplexer Branch type and Balanced type, Radomes.

TEXT BOOKS:

1) Introduction to Radar Systems Merrill I. Skolnik, SECOND EDITION, McGraw Hill, 1981.
2) Radar systems and Radio Aids to Navigation, Dr.A.K.Sen, Dr.A.B. Bhattacharya, Khanna publishers

REFERENCE BOOKS:

1) Introduction to Radar Systems Merrill I. Skolnik, THIRD EDITION, Tata McGraw Hill, 2001.
2) Radar: Principles, Technologies, Applications- Byron Edde, Pearson Education.
3) Radar Engineering and fundamentals of Navigational Aids- G.S.N.Raju, I.K International, 2008.

EC414/2 (R20): BIO-MEDICAL INSTRUMENTATION

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	To understand physiological system of the human body and problems measuring in a living systems.
CO2	Measure biomedical and physiological information
CO3	Apply Electronics in diagnostics and therapeutic area
CO4	Implement measurement techniques for cardiovascular systems
CO5	Analyzing respiratory systems and its measurement techniques.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	1	2	1	-	-	-	-	1	2	2
CO2	2	2	2	2	2	2	1	-	-	-	-	1	3	2
CO3	3	3	2	2	2	1	1	-	-	-	-	1	3	2
CO4	3	1	2	2	1	2	2	-	-	-	-	1	3	2
CO5	3	2	3	1	1	1	2	-	-	-	-	1	3	2
AVG_CO	**2**	**2**	**2**	**1**	**1**			**-**	**-**	**-**	**-**	**1**	**3**	**2**

UNIT – I

Components of Medical Instrumentation System: Bio amplifier Static and dynamic characteristics of medical instruments, Bio signals and characteristics, Problems encountered with measurements from human beings.

UNIT – II

Organization of cell: Nernst equation for membrane Resting Potential Generation and Propagation of Action Potential, Conduction through nerve to neuromuscular junction, Bio Electrodes: Bio potential Electrodes- External electrodes, Internal Electrodes. Bio chemical Electrodes

UNIT – III

Mechanical function: Electrical Conduction system of the heart, Cardiac cycle, Relation between electrical and mechanical activities of the heart, Cardiac Instrumentation: Blood pressure and Blood flow measurement. Specification of ECG machine, Einthoven triangle, Standard 12-lead configurations, Interpretation of ECG waveform with respect to electro mechanical activity of the heart.

UNIT – IV

Neuro-Muscular Instrumentation: Specification of EEG and EMG machines Electrode placement for EEG and EMG recording. Interpretation of EEG and EMG

UNIT – V

Therapeutic equipment: Pacemaker, Defibrillator, Shortwave diathermy, Haemodialysis machine, Respiratory Instrumentation: Mechanism of respiration, Spirometry, Pnemuotachograph Ventilators

TEXT BOOKS:

1) Hand-book of Biomedical Instrumentation – by R.S. Khandpur, McGraw-Hill, 2003.
2) Medical Instrumentation, Application and Design – by John G. Webster, John Wiley.

REFERENCE BOOKS:

1) Principles of Applied Biomedical Instrumentation – by L.A. Geoddes and L.E. Baker, John Wiley and Sons.
2) Biomedical Equipment Technology – Carr & Brown, Pearson.

EC414/3 (R20): SATELLITE COMMUNICATION

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Understand the architecture of satellite systems as a means of high speed, high communication range system.
CO2	Explain the fundamentals of orbital mechanics.
CO3	Explain various aspects related to satellite systems such as orbital equations, sub-systems in a satellite, link budget, modulation and multiple access
CO4	Assess the Phenomena of satellite communication technologies and compare them to alternative systems..
CO5	Calculate numerical problems related to orbital motion and design of link budget for the given parameters and conditions.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	1	-	-	-	-	-	-	-	-	-	3	1
CO2	-	1	-	-	-	-	-	-	-	-	-	-	2	1
CO3	1	-	-	-	-	-	-	-	-	-	-	-	2	1
CO4	1	-	2	-	-	-	-	-	-	-	-	-	1	1
CO5	1	-	2	-	-	-	-	-	-	-	-	-	1	1
AVG_CO	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**1**

UNIT-I

Introduction to Satellite Communication: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication.

UNIT-II

Orbital Mechanics: Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc. of a satellite, concepts of Solar day and Sidereal day.

UNIT-III

Satellite sub-systems: Study of Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems etc.

UNIT-IV

Typical Phenomena in Satellite Communication: Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift. Satellite link budget Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions.

UNIT-V

Modulation and Multiple Access Schemes: Various modulation schemes used in satellite communication, Meaning of Multiple Access, Multiple access schemes based on time, frequency, and code sharing namely TDMA, FDMA and CDMA.

TEXT /REFERENCE BOOKS:

1) Timothy Pratt Charles W. Bostian, Jeremy E. Allnutt: Satellite Communications: Wiley India. 2nd edition 2002
2) Tri T. Ha: Digital Satellite Communications: Tata McGraw Hill, 2009
3) Dennis Roddy: Satellite Communication: 4th Edition, McGraw Hill,2009

ECE415/1 (R20): ARTIFICIAL NEURAL NETWORKS

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Model Neuron and Neural Network, and to analyze ANN learning, and its applications.
CO2	Understand the different learning models of neural networks
CO3	Implement different single layer/multiple layer Perception learning algorithms
CO4	Able to perform the optimization of Neural Network models
CO5	Develop network models to do classification and generalization

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	1	-	1	3	1
CO2	3	2	2	1	-	-	-	-	-	1	-	1	2	1
CO3	3	3	2	2	2	-	-	-	-	1	-	1	2	1
CO4	3	3	3	3	2	-	-	-	-	1	-	1	1	1
CO5	3	3	3	3	2	-	-	-	-	1	-	1	1	1
AVG_CO	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**1**	**2**	**1**

UNIT-I

Fundamentals of Artificial Neural Networks, Evolution of Neural Networks, Structure and functions of biological and artificial neuron, Models of Artificial Neural Networks, Activation functions, Neural network architectures, Important Terminologies in ANN

UNIT-II

Neural Network Learning Rules (Hebbian learning rule, Perceptron learning rule, Delta learning rule, Widrow-Hoff learning rule, Winner–takes all learning rule). McCulloch Pitts Neuron Model, Linear separability, Adaline and Madaline.

UNIT-III

Backpropagation Algorithm, Importance of learning parameter and momentum term, Polynomial Networks. Counter Propagation Networks, Kohonen Self- Organizing maps, Learning Vector Quantizers, Adaptive Resonance Theory, Hamming Net, Max Net.

UNIT-IV

Associative memories, Recurrent and Associative Memory, Continuous and Discrete Hopfield Networks, Boltzman Machines, Bi- directional Associative Memory, Optimization of Neural Networks.

UNIT-V

Learning from examples and generalization, Support Vector Machines, Applications to image classification, Radial Basis Function networks, Regularization Theory route to RBFN Generalized Radial Basis function network, Learning in RBFN, Application to Face recognition.

TEXT BOOKS:

1) Introduction to Artificial Neural Systemsby Jacek M. Zurada
2) Introduction to Neural Networks using Matlab 6.0 by S.N Sivanandam, S.Sumathi, S.N Deepa
3) Neural Networks and Deep Learning, Charu C. Aggarwal
4) Satish Kumar, “Neural Networks, A Classroom Approach”, Tata McGraw -Hill, 2007.

REFERENCE BOOKS:

1) B. Yegnanarayana, Artificial Neural Networks, PHI, New Delhi
2) Kishan Mehrotra, Chelkuri K. Mohan, Sanjav Ranka, elements of ArtificialNeuralNetworks, Tenram International
3) Simon Haykin, “Neural Networks, A Comprehensive Foundation”, 2nd Edition, Addison Wesley Longman, 2001.

EC415/2 (R20): MACHINE LEARNING

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1	Understand the basic concept of pattern recognition, probability distribution, regression and its types.
CO2	Apply procedures for error minimization and linear programming algorithms for pattern recognition.
CO3	Implement k-means, fuzzy, and hierarchical clustering methods for unsupervised learning
CO4	Analyze back propagation, training methods and deep learning for neural networks
CO5	Differentiate among types of classifiers for algorithm independent machine learning.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	-	2	-	1	-	-	-	-	-	3	1
CO2	3	1	2	-	2	-	1	-	-	-	-	-	3	2
CO3	3	1	2	-	2	-	2	-	-	-	-	-	3	2
CO4	3	1	2	-	2	-	2	-	-	-	-	-	3	1
CO5	3	1	2	-	2	-	2	-	-	-	-	-	3	2
AVG_CO	**3**	**1**	**2**	-	**2**	-	**2**	-	-	-	-	-	**3**	**2**

UNIT – I

Introduction to machine learning: Concept Learning and the General to Specific Ordering: Concept learning task, concept learning as search, Find-S: finding a Maximally Specific hypothesis,Version Spaces and the Candidate-Elimination algorithm, remarks on Version Spaces and Candidate-Elimination and inductive bias. **Decision Tree Learning:** Decision Tree representation, appropriate problems for Decision Tree learning, hypothesis space search in Decision Tree learning, inductive bias in Decision Tree learning and issues in Decision Tree learning.

UNIT – II

Artificial Neural Networks: Neural Network representations, appropriate problems for Neural Network learning, Perceptrons, Multilayer Networks and the Back propagation algorithm and remarks on the Back propagation algorithm. **Evaluating Hypotheses**: Estimating hypothesis accuracy, basics of sampling theory, general approach for deriving confidence intervals, difference in error of two hypotheses and comparing learning algorithms.

UNIT – III

Bayesian Learning: Bayes theorem and concept learning, maximum likelihood and least squared error hypotheses, maximum likelihood hypotheses for predicting probabilities, minimum description length principle, Bayes optimal classier, Gibbs algorithm, Naive Bayes classier, Bayesian belief networks and EM algorithm.

UNIT-IV

Computational learning theory: Introduction, probably learning an approximately correct hypothesis, sample complexity for finite hypothesis spaces and sample complexity for infinite hypothesis spaces and mistake bound model of learning.

UNIT – V

Instance Based Learning: Introduction, k-Nearest Neighbour learning, locally weighted regression,radial basis functions, Case Based Reasoning and remarks on Lazy and Eager learning. **Genetic Algorithms**: Introduction, hypothesis space search, Genetic programming and models of evolution and learning.

TEXT BOOKS:

1) Tom M. Mitchell, “Machine Learning”, Mc. Graw Hill Publishing

EC415/3 (R20): SPEECH AND AUDIO SIGNAL PROCESSING

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1	Understand speech recognition principles, methods, models and implementation
CO2	Apply speech recognition principles &methods to characterize the speech signal and to recognize the speech.
CO3	Apply the Pattern Comparison Techniques and Hidden Markov Models to recognise the speech
CO4	Analyse the speech recognition methods, pattern comparison techniques and Hidden Markov Models.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	2	-	-	2	-
CO2	2	-	-	-	-	-	-	-	-	2	-	-	2	-
CO3	3	-	-	-	-	-	-	-	-	2	-	-	2	-
CO4	-	3	-	-	-	-	-	-	-	2	-	-	2	-
AVG_CO	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**-**

UNIT-I

Introduction- Speech production and modeling - Human Auditory System; General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid ; Requirements of speech codecs –quality, coding delays, robustness.

UNIT-II

Speech Signal Processing- Pitch-period estimation, all-pole and all-zero filters,convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation. Linear Prediction of Speech- Basic concepts of linear prediction;

UNIT-III

Linear Prediction Analysis of non stationary signals –prediction gain, examples; Levinson-Durbin algorithm; Long term and short-term linear prediction models; Moving average prediction. Speech Quantization- Scalar quantization–uniform quantizer, optimum quantizer, logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization – distortion measures, codebook design, codebook types.

UNIT-IV

Scalar Quantization of LPC- Spectral distortion measures, Quantization based onreflection coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions, quantization based on LSF. Linear Prediction Coding- LPC model of speech production; Structures of LPCencoders and decoders; Voicing detection; Limitations of the LPC model.

UNIT-V

Code Excited Linear Prediction-CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders; Excitation codebook search – state-save method, zero-input zero-state method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP. Speech Coding Standards-An overview of ITU-T G.726, G.728 and G.729standards

TEXT/REFERENCE BOOKS:

1) "Digital Speech" by A.M.Kondoz, Second Edition (Wiley Students‟ Edition), 2004.
2) "Speech Coding Algorithms: Foundation and Evolution of Standardized Coders", W.C. Chu, WileyInter science, 2003.

EC416 (R20): IPR & PATENTS

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1	Able to Define different types of Intellectual Property Rights.
CO2	Able to Classify different Intellectual Property Rights
CO3	Able to Identify importance of Trademark & Copy Right Laws.
CO4	Able to Explain importance of Patents, Trade Secret Laws
CO5	Able to Create new Intellectual Properties

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	3	-	-	-	-	-	-
CO2	-	2	-	-	-	-	-	3	-	-	-	-	-	-
CO3	3	-	3	-	-	3	-	3	-	-	-	-	-	-
CO4	3	2	-	-	-	3	-	3	-	-	-	-	-	-
CO5	3	-	-	-	2	-	-	3	-	-	-	1	-	-
AVG_CO	**3**	**2**	**3**	**-**	**2**	**3**	**-**	**3**	**-**	**-**	**-**	**1**	**-**	**-**

Unit -I

Introduction to Intellectual Property Rights: Concept of Property – Introduction to IPR – International Instruments and IPR – WIPO – TRIPS – WTO -Laws Relating to IPR – IPR Tool Kit – Protection and Regulation – Copyrights and Neighboring Rights – Industrial Property – Patents – Agencies for IPR Registration – Traditional Knowledge –Emerging Areas of IPR – Layout Designs and Integrated Circuits – Use and Misuse of Intellectual Property Rights.

Unit -II

Copyrights and Neighboring Rights: Introduction to Copyrights – Principles of Copyright Protection – Law Relating to Copyrights – Subject Matters of Copyright – Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works –Rights of Distribution – Rights of Performers – Copyright Registration – Limitations – Infringement of Copyright – Relief and Remedy – Case Law – Semiconductor Chip Protection Act.

Unit -III

Patents: Introduction to Patents – Laws Relating to Patents in India – Patent Requirements

Product Patent and Process Patent – Patent Search – Patent Registration and Granting of Patent – Exclusive Rights – Limitations – Ownership and Transfer — Revocation of Patent – Patent Appellate Board – Infringement of Patent – Compulsory Licensing — Patent Cooperation Treaty – New developments in Patents – Software Protection and Computer related Innovations

Unit -IV

Trademarks: Introduction to Trademarks – Laws Relating to Trademarks – Functions of Trademark – Distinction between Trademark and Property Mark – Marks Covered under Trademark Law – Trade Mark Registration – Trade Mark Maintenance – Transfer of rights – Deceptive Similarities, Likelihood of Confusion – Dilution of Ownership – Trademarks Claims and Infringement, Remedies – Passing Off Action.

Unit -V

Trade Secrets & Cyber Law and Cyber Crime: Introduction to Trade Secrets – General Principles – Laws Relating to Trade Secrets – Maintaining Trade Secret – Physical Security – Employee Access Limitation – Employee Confidentiality Agreements – Breach of Contract – Law of Unfair Competition – Trade Secret Litigation – Applying State Law.

Cyber Law – Information Technology Act 2000 – Protection of Online and Computer Transactions –E-commerce – Data Security – Authentication and Confidentiality – Privacy – Digital Signatures – Certifying Authorities – Cyber Crimes – Prevention and Punishment – Liability of Network Providers.

TEXT BOOKS/REFERENCE BOOKS:

1) Intellectual Property Rights (Patents & Cyber Law), Dr. A. Srinivas. Oxford University Press, New Delhi.
2) Deborah E.Bouchoux: Intellectual Property, Cengage Learning, New Delhi. 3) PrabhuddhaGanguli: Intellectual Property Rights, Tata Mc-Graw –Hill, New Delhi 4) Richard Stim: Intellectual Property, Cengage Learning, New Delhi.
3) Kompal Bansal &Parishit Bansal Fundamentals of IPR for Engineers, B. S. Publications (Press).
4) Cyber Law – Texts & Cases, South-Western's Special Topics Collections.
5) R.Radha Krishnan, S.Balasubramanian: Intellectual Property Rights, Excel Books. New Delhi.
6) M.Ashok Kumar and MohdIqbal Ali: Intellectual Property Rights, Serials Pub.

EC451 (R20): HIGH FREQUENCY STRUCTURE SIMULATOR (HFSS)

L-1	T-0	P-2	M-100	C-2

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1	Ability to understand basic programming concepts of the High Frequency Structure Simulation (HFSS) Tool
CO2	Ability to develop HFSS program to implement basic antennas structures
CO3	Ability to obtain the radiation pattern, antenna gain, S-parameters, return loss of the antenna, antenna array
CO4	Ability to design, implement and validate the antenna structures using HFSS
CO5	Ability to design, implement and demonstrate the Block/Convolution codes using Matlab / Multisim.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	-	-	-	-	-	-	-	-	-	1	-
CO2	3	2	3	-	-	-	-	-	-	-	-	-	1	-
CO3	3	2	3	-	-	-	-	-	-	-	-	-	2	-
CO4	3	2	3	-	-	-	-	-	-	-	-	-	2	-
CO5	3	2	3	-	-	-	-	-	-	-	-	-	2	-
AVG_CO	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**

1) Introduction to HFSS
2) Study of optimization and preprocessing steps
3) Design and simulation of monopole antenna
4) Design and simulation of Dipole antenna
5) Design and simulation of Rectangular patch antenna
6) Design and simulation of Probe feed patch antenna
7) Design and simulation of Triangular microstrip antenna
8) Design and simulation of slot antenna
9) Study of antenna arrays.
10) Design of antenna array using tool kit.
11) Design and simulation 1D arrays using HFSS

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

EC452 (R20): INDUSTRIAL/RESEARCH INTERNSHIP

L-0	T-0	P-3	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1	Participate in the projects in industries during his or her industrial training.
CO2	Describe use of advanced tools and techniques encountered during industrial internship and visit.
CO3	Interact with industrial personnel and follow engineering practices and discipline prescribed in industry.
CO4	Develop awareness about general workplace behavior and build interpersonal and team skills.
CO5	Prepare professional work reports and presentations.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	-	-	-	2	-	3	3	3	2	-	2	-	-
CO 2	2	-	-	-	2	-	3	3	3	2	-	2	-	-
CO 3	2	-	-	-	2	-	3	3	3	2	-	2	-	-
CO 4	2	-	-	-	2	-	3	3	3	2	-	2	-	-
CO 5	2	-	-	-	2	-	3	3	3	2	-	2	-	-
AVG_CO	**2**	**-**	**-**	**-**	**2**	**-**	**3**	**3**	**3**	**2**	**-**	**2**	**-**	**-**

S.No.	Course Details		Category	Scheme of Instruction			Scheme of Examination		
	Code	Subject Name		Hours in a Week			Marks		Credits
				L	T	P	Internal	External	
1	EC 452 (R20)	**INDUSTRIAL/RESEARCH INTERNSHIP** (Industrial/Research Internship (2 Months) after 3rd Year(to be evaluated during VII semester))	MC	0	0	0	100	0	3

IV/IV B.Tech.
SEMESTER II

B.Tech. ELECTRONICS & COMMUNICATION ENGINEERING

IV/IV B.Tech. SEMESTER-II

EC461 (R20): PROJECT WORK

COURSE OUTCOMES:

CO1	Identify technically and economically feasible problems with a good technical relevance
CO2	Plan and build the project team with assigned responsibilities
CO3	Identify and survey the relevant literature for getting exposed to related solutions
CO4	Analyse, design and develop adaptable and reusable solutions of minimal complexity by using modern tools
CO5	Implement and test solutions to trace against the user requirements

MAPPING MATRIX OF COS AND POS:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	2	1	-	2	2	2	2	2	2	1	1	1
CO 2	3	3	3	3	2	2	2	2	2	2	2	1	2	2
CO 3	3	3	3	3	2	2	2	2	2	2	2	1	2	2
CO 4	3	3	3	3	2	2	2	2	2	2	2	1	2	2
CO 5	3	3	3	3	2	2	2	2	2	2	2	1	2	2
AVG_CO	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	1	**2**	**2**

S. No.	Course Details		Category	Scheme of Instruction			Scheme of Examination		
	Code	Subject Name		Hours in a Week			Marks		Credits
				L	T	P	Internal	External	
1	**EC461 (R20)**	Project Work	Project	0	0	0	50	100	8
2	**EC 462 (R20)**	Seminar	Seminar	0	0	0	50	0	2
3	**EC 463 (R20)**	MOOCs	MOOC	0	0	0	100	0	2
TOTAL CREDITS									**12**

MINOR DEGREE COURSES

B.Tech. ELECTRONICS & COMMUNICATION ENGINEERING

Minor Degree Courses

ECM001 (R20): ANALOG ELECTRONIC CIRCUIT DESIGN

L-3	T-1	P-0	M-100	C-4

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Understanding push pull amplifier & different configurations of feedback amplifier.
CO2	Illustrate series and shunt voltage regulator and calculate line regulation & ripple factor.
CO3	Implement adder, scalar & various filter circuits using operational amplifier.
CO4	Calculate oscillator frequency of various oscillators.
CO5	Analyze frequency response of BJT & FET amplifiers.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	2	-	1	3	3
CO2	3	3	3	3	-	-	-	-	-	3	-	1	3	3
CO3	3	3	3	3	-	-	-	-	-	3	-	1	3	3
CO4	3	3	3	3	-	-	-	-	-	3	-	1	3	3
CO5	3	3	3	3	-	-	-	-	-	3	-	1	3	3
AVG_CO	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	1	**3**	**3**

Unit I

Diodes: Concepts of diode as a switching element, diode as Limiter, design of: Clipper, half wave & full wave rectifier, Clamper, Voltage multiplier, Capacitor filters, Concepts of Regulators: Series and shunt voltage regulator, Zener diode, Design of Zener diode regulator, Concept of junction capacitance, Varactor diode, LED.

Unit II

Transistors: Concepts of amplifier, Q point, load line analysis, Biasing of BJT, Self-Bias CE, High and low frequency –small signal models of Transistors, Expression of voltage gain, current gain, input & output impedance, Designing CE amplifier, FET fundamentals, Configurations, current-voltage characteristics, Biasing of JFET, Biasing of MOSFET FET small signal model, Design and analysis of RC coupled amplifier, Concept of Feedback, Feedback amplifier configurations, Emitter follower.

Unit III

Op-amps: Ideal OPAMP, Concept of differential amplifier, CMRR, Open & closed loop circuits, importance of feedback loop (positive & negative), inverting & non-inverting amplifiers, Voltage follower, Adder, Design and analysis of Integrator & Differentiator, Comparator, Schmitt Trigger, Instrumentation Amplifier.

Unit IV

Filter Circuits: Design and Analysis of Low pass, High pass, Bandpass, Band reject filters Design and analysis of Oscillators: Barkhausen criterion, Colpitt, Hartley's, RC Phase shift, Wien bridge, & Crystal oscillators.

Unit V

555 applications: Design and analysis of Monostable & Astable multi vibrators using 555 and their applications

TEXT BOOKS:

1) Muhammad H. Rashid, ―Microelectronic Circuit Analysis and Design, Oxford Press.
2) Sedra & Smith, ―Micro-Electronic Circuits theory and applications, 2nd edition, Cengage Learning.

REFERENCE BOOKS:

1) Jacob Millman & Christos C. Halkias, Integrated Electronics‖, Tata-McGraw Hill, 2nd Edition,(2010).
2) Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory‖, PHI. 9 th Edition.

ECM002 (R20): INFORMATION THEORY AND CODING

L-3	T-1	P-0	M-100	C-4

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Quantify the notion of information, entropy, channel capacity in a mathematically sound way and understand its significance in the communications systems.
CO2	Understand the different encoding methods and algorithms of data compression methods
CO3	How to control error and linear block coding.
CO4	Learn binary cyclic codes & BCH codes and systems
CO5	Learn convolution codes and various time domain design approaches

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	2	2	-	-	-	-	-	3	-	3	2	2
CO2	1	2	2	2	-	-	-	-	-	3	-	3	3	3
CO3	1	2	2	2	-	-	-	-	-	3	-	3	3	3
CO4	1	3	2	2	-	-	-	-	-	3	-	3	3	3
CO5	1	3	2	2	-	-	-	-	-	3	-	3	3	3
AVG_CO	**1**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**3**	**3**	**3**

Unit I

Introduction: Measure of information, Average information content of symbols in long independent and dependent sequences, Entropy calculation for extension of source. Mark-off statistical model for information source, Entropy and information rate of mark-off source.

Unit II

Encoding of source output Shannon‘s encoding algorithm for dependent and independent sequences. Discrete communication channels, Continuous channels. Source coding theorem, Huffman coding, discrete memory less Channels, Mutual information, Properties of mutual information, Channel Capacity. Channel coding theorem, Differential entropy and mutual information for continuous ensembles, Channel capacity Theorem

Unit III

Error Control coding: Introduction, Types of errors, examples, Types of codes Linear Block Codes: Matrix description, Error detection and correction, Standard arrays and table look up for decoding.

Unit IV

Binary cycle codes: Algebraic structures of cyclic codes, encoding using an (n-k) bit shift register, Syndrome calculation, BCH codes, RS Codes, Olay codes, Shortened cyclic codes, Burst error correcting codes. Burst and Random Error correcting codes.

Unit V

Convolution Codes: Block diagram of encoder, Impulse response of encoder, Time domain approach and Transform domain approach. State representation and state diagram, Tree diagram, trellis diagram.

TEXT BOOKS:

1) K. Sam Shanmugam, Digital and Analog communication systems, John Wiley, (1996).
2) Simon Haykin, Digital communication, John Wiley, (2003).
3) R Bose, Information Theory, Coding and Cryptography, TMH 2007

REFERENCE BOOKS:

1) Elements of Information Theory by Thomas Cover, Joy Thomas
2) Channel Codes: Classical and Modern by William Ryan, Shu Lin
3) Information Theory and Reliable Communication by Robert Gallager
4) Kennedy, Electronic Communication systems||, McGraw Hill, 4th Ed., 1999.

ECM003 (R20): NANO-ELECTRONICS

L-3	T-1	P-0	M-100	C-4

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Explain the fundamental science and quantum mechanics behind nanoelectronics, concepts of a quantum well, quantum transport and tunneling effects.
CO2	Describe the spin-dependent electron transport in magnetic devices.
CO3	Calculate the energy levels of periodic structures and nanostructures. Calculate the I-V characteristics of Nanoelectronics devices.
CO4	Explore various application areas of Nano electronics.
CO5	Design and analysis of Nano structure and Nano electronics devices using MOSFET, FINFETs, CNTFETs

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	-	-	-	-	-	-	-	-	-	2	2
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	2
CO3	2	3	3	-	-	-	-	-	-	-	-	-	2	1
CO4	3	2	2	-	-	-	-	-	-	-	-	-	3	1
CO5	3	2	2	-	-	-	-	-	-	-	-	-	2	2
AVG_CO	3	2	2	-	-	-	-	-	-	-	-	-	2	1

Unit I

Introduction to Nanoelectronics: Nanotechnology potential, Development of Microelectronics, Region of Nanostructures, Complexity Problem, Challenge initiated by Nanoelectronics, Top-down and bottom-up approach and Nanostructures.

Unit II

Quantum electron devices: From classical to quantum physics: upcoming electronic devices, Electrons in mesoscopic structure, Short channel MOS transistor, Split gate transistor, Electron wave transistor, Electron spin transistor, Quantum Cellular Automate, Quantum Dot Array.

Unit III

Nano electronics with tunnelling Devices: Tunnelling Element, Technology of RTD, digital circuit design based on RTD, Principles of Single Electron Transistor (SET), SET circuit design – comparison between FET and SET circuit designs.

Unit IV

Nanofabrication: Nano patterning of nanostructures (e-beam/X-ray, Optical lithography, STM/AFM- SEM & Softlithography).

Unit V

Memory devices and sensors: Nano ferroelectrics, Ferroelectric Random-Access Memory, circuit design, thin film properties and integration. Calorimetric sensors, Electrochemical cells, Surface and bulk acoustic devices, Gas sensitive FETs, Resistive semiconductor gas sensors, Electronic noses, Identification of hazardous solvents and gases, Semiconductor sensor array.

TEXT BOOKS:

1) 1..K. Goser, P. Glosekotter & J. Dienstuhl, Nanoelectronic and Nanosystems–From Transistors to Molecular Quantum Devices, Springer, (2004).
2) RainerWaser, Nanoelectronics and Information Technology: Advanced Electronic Materials Novel and Devices, Wiley VCH, (2005).
3) George W. Hanson, ―Fundamentals of Nanoelectronics‖, Prentice Hall, (2008). BoS

REFERENCE BOOKS:

1) Mick Wilson, Kamali Kannangara, Geoff smith, ―Nanotechnology: Basic Science and Emerging Technologies, Overseas press, (2005).
2) W.R. Fahrner, Nanotechnology and Nanoelectronics: Materials, Devices, Measurement Techniques, Springer, (2010).

ECM004 (R20):BIO-MEDICAL ELECTRONICS

L-3	T-1	P-0	M-100	C-4

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	To understand physiological system of the human body and problems measuring in a living systems.
CO2	Measure biomedical and physiological information
CO3	Apply Electronics in diagnostics and therapeutic area
CO4	Implement measurement techniques for cardiovascular systems
CO5	Analyzing respiratory systems and its measurement techniques.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	1	2	1	-	-	-	-	1	2	2
CO2	2	2	2	2	2	2	1	-	-	-	-	1	3	2
CO3	3	3	2	2	2	1	1	-	-	-	-	1	3	2
CO4	3	1	2	2	1	2	2	-	-	-	-	1	3	2
CO5	3	2	3	1	1	1	2	-	-	-	-	1	3	2
AVG_CO	2	2	2	1	1			-	-	-	-	1	3	2

Unit I

Introduction to the physiology of cardiac, nervous & muscular and respiratory systems. Transducers and Electrodes: Different types of transducers & their selection for biomedical applications. Electrode theory, selection criteria of electrodes & different types of electrodes such as, Ag – Ag Cl, pH, etc

Unit II

Cardiovascular measurement: The heart & the other cardiovascular systems. Measurement of Blood pressure-direct and indirect method, Cardiac output and cardiac rate. Electrocardiography-waveform-standard lead systems typical ECG amplifier, phonocardiography, Ballisto cardiography, Cardiac pacemaker –defibrillator –different types and its selection.

Unit III

EEG Instrumentation requirements–EEG electrode –frequency bands – recording systems EMG basic principle-block diagram of a recorder –pre amplifier. Bed side monitor –block diagram- measuring parameters-cardiac tachometer-Alarms-Lead fault indicator-central monitoring. Telemetry – modulation systems – choice of carrier frequency – single channel telemetry systems.

Unit IV

Instrumentation for clinical laboratory: Bio electric amplifiers-instrumentation amplifiers isolation amplifiers-chopper stabilized amplifiers –input guarding – Measurement of pH value of Blood-blood cell counting, blood flow, Respiratory transducers and instruments.

Unit V

Impedance plethysmography. Ultrasonic, X-ray and nuclear imaging. Prostheses and aids: pacemakers, defibrillators, heart-lung machine, artificial kidney, aids for the handicapped. Safety aspects.

TEXT BOOKS:

1) J J Carr, "Introduction to Biomedical Equipment Technology": Pearson Education 4th e/d

REFERENCE BOOKS:

1) K S Kandpur, "Hand book of Biomedical instrumentation", Tata McGraw Hill 2nd e/d.
2) John G Webster, "Medical Instrumentation application and design", John Wiley 3rd e/d.
3) Richard Aston, "Principle of Biomedical Instrumentation and Measurement.

ECM005 (R20): MEMS TECHNOLOGY

L-3	T-1	P-0	M-100	C-4

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Understand the operation of micro devices, micro systems and their applications.
CO2	Apply scaling laws that are used extensively in the conceptual design of micro devices and systems.
CO3	Choose a micromachining technique, such as bulk micromachining and surface micro machining for a specific MEMS fabrication process
CO4	Simplify the design of micro devices, micro systems using the MEMS fabrication Process.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	2	-	-	2	-
CO2	3	-	-	-	-	-	-	-	-	3	-	-	3	-
CO3	2	-	-	-	2	-	-	-	-	2	-	-	2	-
CO4	-	3	-	-	3	-	-	-	3	2	-	-	2	-
AVG_CO	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

Unit I

Overview of MEMS: MEMS and Microsystems - Microsystems and microelectronics, Benefits of miniaturization, Working principle of micro system - Micro sensors, Micro actuators, MEMS with Micro actuators. Materials For MEMS, Scaling Laws in Miniaturization, MEMS Design Considerations

Unit II

Micro fabrication: Introduction, Fabrication Process - Photolithography, Ion implantation, Oxidation, Chemical vapor deposition (CVD), Physical vapor deposition, Deposition by Epitaxy, Etching, Manufacturing Process -Bulk Micromachining, Surface Micromachining and LIGA Process.

Unit III

Microsystems design, Assembly and Packaging: Micro system Design - Design consideration, process design, Mechanical design, Mechanical design using MEMS. Mechanical packaging of Microsystems, Microsystems packaging, interfacings in

Microsystems packaging, packaging technology, selection of packaging materials, signal mapping and transduction

Unit IV

Case Study of MEMS Devices: MEMS with Micro sensors: Pressure sensors, Temperature sensors, Humidity sensors, Accelerometers, Gyroscopes, Biomedical Sensors, Chemical sensors, Optical Sensors. MEMS with micro actuators: Microgrippers, Micromotors, Micro gears, Micropumps.

Unit V

RF MEMS devices: Switch parameters- Basics of switching - Mechanical Switches- Electronic switches for RF and microwave applications - Approaches for low-actuation-voltage switches, Case study of MEMS pressure sensor Packaging.

TEXT BOOKS:

1) Tai-Ran Hsu, MEMS and Microsystems: Design, Manufacture, and Nanoscale Engineering, 2nd Edition, John Wiley & Sons, Inc., Hoboken, New Jersey, 2008.

REFERENCE BOOKS:

1) Marc Madou, ―Fundamentals of Micro Fabrication‖ CRC Press
2) Mohamed Gad-el-Hak, ―The MEMS Handbook, CRC Press
3) Gabriel M Rebeiz, "RF MEMS - Theory Design and Technology", John Wiley, 2004
4) Mohamed Gad-el-Hak, ―The MEMS Handbook, CRC Press, 2002
5) Chang Liu, ―Foundations of MEMS, Pearson Indian Print, 1st Edition, 2012

ECM006 (R20): EMBEDDED SYSTEMS

L-3	T-1	P-0	M-100	C-4

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Understand the basic operations of embedded microcontroller cores, processor and memories.
CO2	Applying the concept of Embedded System and its design for real life applications.
CO3	Explain the technological aspects of embedded systems through analog and digital blocks, sub systems and user interfacing.
CO4	Examine design metrics, design tradeoffs and software aspects of embedded systems.
CO5	Illustrate Real Time Programming Languages and Real Time operating systems

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1	1	-	-	-	-	-	1	-	3	1	1
CO2	2	3	1	1	-	-	-	-	-	1	-	3	2	2
CO3	2	3	1	1	-	-	-	-	-	1	-	3	2	2
CO4	3	3	1	1	-	-	-	-	-	1	-	3	2	2
CO5	3	3	1	1	-	-	-	-	-	1	-	3	2	2
AVG_CO	**3**	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**3**	**2**	**2**

UNIT – I

Introduction - Introduction to Embedded Systems: Processor Technology, Role of Processor Selection in Embedded Systems, Design cycle in the development phase for an Embedded System, Using of target system or its Emulator and in-Circuit emulator, Use of software tools for development of an Embedded Systems. Design Technology: Design of custom single purpose processor, optimization of custom single purpose processor, RT level - combination logic and sequential logic.

UNIT – II

RTOS and Overview: Real Time Operating Systems: Architecture of Kernel, Task, Task States and Task Scheduler, Message Queues, Event Registers, Pipes, Signals, Semaphores, Memory Management, Interrupt Routines in an RTOS environment, Basic Design Using RTOS.

UNIT – III

ARM Microcontroller Overview ARM-32 bit Microcontroller: Thumb-2 technology and applications of ARM, Architecture of ARM Cortex M3, Various Units in the Architecture, Debugging support, General Purpose Registers, Special Registers, Exceptions, Interrupts, Stack operation, Reset sequence

UNIT – IV

ARM Cortex M3 Microcontroller ARM Cortex M3 Instruction Sets and Programming: Assembly basics, Instruction list and description, Thumb and ARM instructions, Special instructions, Useful instructions, CMSIS, Assembly and C language Programming

UNIT – V

Networks for Embedded Systems: The I2C Bus, The CAN bus, SHARC link ports, Ethernet, Bluetooth: specification, Core protocol, IEEE 1149.1 (JTAG) Testability.

TEXT BOOKS:

1) Raj kamal "Embedded systems architecture, programming and design" Tata McGraw-Hill Publishing company Limited.
2) Embedded System Design: A Unified Hardware/Software Introduction Frank Vahid and Tony Givargis
3) Joseph Yiu, The Definitive Guide to the ARM Cortex-M3, 2nd Edition, Newnes, (Elsevier), 2010

REFERENCE BOOKS:

1) Jonathan W Valvano, Embedded Microcomputer Systems, Brooks/cole, Thompson Learning
2) David E. Simon, An Embedded Software Primer, Pearson edition.
3) KVKK Prasad, Embedded and real time systems, Dreemtech Press, 2005.
4) ARM System Developer's Guide-Designing and Optimizing System Software, Andrew N.Sloss.

HONOURS DEGREE COURSES

COMMUNICATIONS DOMAIN

B.Tech. ELECTRONICS & COMMUNICATION ENGINEERING
HONOURS DEGREE COURSES COMMUNICATIONS DOMAIN

ECHT101 (R20): ADVANCED COMMUNICATIONS AND NETWORKS

L-3	T-1	P-0	M-100	C-4

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Understand the analytical tools and conceptual models used in network performance analysis
CO2	Analyze the pass band communication and modulation techniques to understand the small scale fading models.
CO3	Comprehend the concept of Carrier and Symbol Synchronization.
CO4	Describe the concept of communication in band limited channels.
CO5	Build wireless communication architectures

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	-	-	-	-	-	-	-	1	2	2
CO2	2	2	2	2	-	-	-	-	-	-	-	2	3	2
CO3	2	2	3	-	-	-	-	-	-	-	-	2	3	2
CO4	3	1	3	-	-	-	-	-	-	-	-	2	3	2
CO5	3	2	3	-	-	-	-	-	-	-	-	2	3	2
AVG_CO	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	2	**3**	**2**

UNIT - I

Spread Spectrum Communications: Spreading sequences- Properties of Spreading Sequences, Pseudo- noise sequence, Gold sequences, Kasami sequences, Walsh Sequences, Orthogonal Variable Spreading Factor Sequences, Barker Sequence, Complementary Codes Direct sequence spread spectrum: DS-CDMA Model, Conventional receiver, Rake Receiver, Synchronization in CDMA, Power Control, Soft handoff, Multiuser detection – Optimum multiuser detector, Liner multiuser detection.

UNIT - II

Orthogonal Frequency Division Multiplexing: Basic Principles of Orthogonality, Single vs Multicarrier Systems, OFDM Block Diagram and Its Explanation, OFDM Signal Mathematical Representation, Selection parameter for Modulation, Pulse shaping in OFDM Signal and pectral Efficiency, Window in OFDM Signal and Spectrum, Synchronization in OFDM, Pilot Insert in OFDM Transmission and Channel Estimation, Amplitude Limitations in OFDM, FFT Point Selection Constraints in OFDM, CDMA vs OFDM, Hybrid OFDM.

UNIT - III

MIMO Systems: Introduction, Space Diversity and System Based on Space Diversity, Smart Antenna system and MIMO, MIMO Based System Architecture, MIMO Exploits Multipath, Space – Time Processing, Antenna Consideration for MIMO, MIMO Channel Modelling, MIMO Channel Measurement, MIMO Channel Capacity, Cyclic Delay Diversity (CDD), Space Time Coding, Advantages and Applications of MIMO in Present Context, MIMO Applications in 3G Wireless System and Beyond, MIMO-OFDM.

UNIT - IV

Wireless LANs/IEEE 802.11x: Introduction to IEEE802.11x Technologies, Evolution of wireless

LANs, IEEE 802.11 Design Issues, IEEE 802.11 Services, IEEE 802.11 MAC Layer operations, IEEE 802.11 Layer1, IEEE 802.11 a/b/g Higher Rate Standards, Wireless LAN Security, Computing Wireless Technologies, Typical WLAN Hardware.

UNIT - V

Wireless PANs/IEEE 802.15x: Introduction to IEEE 802.15x Technologies: Wireless PAN

Applications and Architecture, IEEE 802.15.1 Physical Layer Details, Bluetooth Link Controllers

Basics, Bluetooth Link Controllers Operational States, IEEE 802.15.1 Protocols and Host Control

Interface. Evaluation of IEEE 802.15 Standards Broad Band Wireless MANs/IEEE 802.16x: Introduction to WMAN/IEEE 802.16x Technology, IEEE 802.16Wireless MANs, IEEE 802.16 MAC Layer Details, IEEE 802.16 Physical Layer Details, IEEE 802.16 Physical Layer Details for 2-11 GHz, IEEE 802.16 Common System Operations.

TEXT BOOKS:

1) Gary J. Mullett, “Introduction to Wireless Telecommunications Systems and Networks”, CENGAGE
2) Upena Dalal, “Wireless Communication”, Oxford University Press, 2009

REFERENCE BOOKS:

1) Ke-Lin Du & M N S Swamy, “Wireless Communication System”, Cambridge University Press, 2010
2) Gottapu Sasibhusan Rao, “Mobile Cellular Communication”, PEARSON.

ECHT102 (R20): ADVANCED DIGITAL SIGNAL PROCESSING

L-3	T-1	P-0	M-100	C-4

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Interpret and Process Discrete/digital Signals and Systems.
CO2	Analyze and Provide Solution to practical Implementation issues of DSP Systems.
CO3	Apply Multirate Signal Processing and Wavelets
CO4	Design Digital Filters for Particular Applications
CO5	Predict time and frequency response of discrete-time systems using various techniques like Z-transform, Hilbert transform, DFT, FFT

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	3	-	-	-	-	-	-	-	-	-	3	3
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO4	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO5	3	3	3	-	-	-	-	-	-	-	-	-	3	2
AVG_CO	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**

UNIT - I

Overview of DSP, Characterization in time and frequency, FFT Algorithms, Digital filter design and structures: Basic FIR/IIR filter design &structures, design techniques of linear phase FIR filters,IIR filters by impulse invariance, bilinear transformation, FIR/IIR Cascaded lattice structures, parallel realization of IIR.

UNIT-II

Multi rate DSP, Decimators and Interpolators, Sampling rate conversion, multistage decimator & interpolator, poly phase filters, QMF, digital filter banks, Applications in subband coding.

UNIT-III

Linear prediction & optimum linear filters, stationary random process, forward-backward linear prediction filters, solution of normal equations, AR Lattice and ARMA Lattice-Ladder Filters, Wiener Filters for Filtering and Prediction.

UNIT-IV

Adaptive Filters, Applications, Gradient Adaptive Lattice, Minimum mean square criterion, LMS algorithm, Recursive Least Square algorithm.

UNIT-V

Estimation of Spectra from Finite-Duration Observations of SignalS.No.nparametric Methods for Power Spectrum Estimation, Parametric Methods for Power Spectrum Estimation, Minimum-Variance Spectral Estimation, Eigen analysis Algorithms for Spectrum Estimation.

TEXT BOOKS:

1) J. G. Proakis and D.G. Manolakis, "Digital signal processing: Principles, Algorithm and Applications", 4th Edition, Prentice Hall, 2007.
2) N. J. Fliege, "Multirate Digital Signal Processing: Multirate Systems -Filter Banks – Wavelets", 1st Edition, John Wiley and Sons Ltd, 1999.

REFERENCE BOOKS:

1) Bruce W. Suter, "Multirate and Wavelet Signal Processing",1st Edition, Academic Press, 1997.
2) M. H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley & Sons Inc., 2002.
3) S. Haykin, "Adaptive Filter Theory", 4th Edition, Prentice Hall, 2001.
4) D. G. Manolakis, V. K. Ingle and S. M. Kogon, "Statistical and Adaptive Signal Processing", McGraw Hill, 2000

ECHT103 (R20): IOT AND ITS APPLICATIONS

L-3	T-1	P-0	M-100	C-4

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Interpret the impact and challenges posed by IoT networks leading to new architectural models.
CO2	Illustrate the smart objects and the technologies to connect them to network.
CO3	Compare different Application protocols for IoT.
CO4	Infer the role of Data Analytics and Security in IoT.
CO5	Identify sensor technologies for sensing real world entities and understand the role of IoT in various domains of Industry.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	1	-
CO2	-	2	3	2	-	-	-	-	-	-	-	-	1	-
CO3	-	2	2	-	-	-	-	-	-	-	-	-	1	-
CO4	1	2	3	-	-	-	-	-	-	-	-	-	1	-
CO5	-	-	3	-	-	-	-	-	-	-	-	-	1	-
AVG_CO	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	1	**-**

UNIT- I

IoT & Web Technology The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.

UNIT- II

M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

UNIT- III

IoT Architecture -State of the Art – Introduction, State of the art, Architecture Reference Model-Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

UNIT- IV

IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.

UNIT- V

Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues,

TEXT BOOKS:

1) Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.
2) Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013.
3) Cuno Pfister, "Getting Started with the Internet of Things", O Reilly Media, 2011.

ECHT104 (R20): CODING THEORY AND TECHNIQUES

L-3	T-1	P-0	M-100	C-4

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Quantify the notion of information, entropy, channel capacity in a mathematically sound way and understand its significance in the communications systems and linear block coding.
CO2	Learn cyclic codes techniques and hamming coding technique designs
CO3	How to control error & also Learn convolution codes and various time domain design approaches.
CO4	Learn different channel coding and space coding & design approaches
CO5	Learn space coding & design and spatial multiplexing approaches

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	2	2	-	-	-	-	-	3	-	3	2	2
CO2	1	2	2	2	-	-	-	-	-	3	-	3	3	3
CO3	1	2	2	2	-	-	-	-	-	3	-	3	3	3
CO4	1	3	2	2	-	-	-	-	-	3	-	3	3	3
CO5	1	3	2	2	-	-	-	-	-	3	-	3	3	3
AVG_CO	**1**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**3**	**3**	**3**

UNIT – I

Coding for Reliable Digital Transmission and storage: Mathematical model of Information, A Logarithmic Measure of Information, Average and Mutual Information and Entropy, Types of Errors, Error Control Strategies. Linear Block Codes Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of a Block code, Error-Detecting and Error-correcting Capabilities of a Block code, Standard array and Syndrome Decoding, Probability of an undetected error for Linear Codes over a BSC, Hamming Codes. Applications of Block codes for Error control in data storage system

UNIT - II

Cyclic Codes Description, Generator and Parity-check Matrices, Encoding, Syndrome Computation and Error Detection, Decoding, Cyclic Hamming Codes, Shortened cyclic codes, Error-trapping decoding for cyclic codes, Majority logic decoding for cyclic codes.

UNIT – III

Convolutional Codes Encoding of Convolutional Codes, Structural and Distance Properties, maximum likelihood decoding, Sequential decoding, Majority- logic decoding of Convolution codes. Application of Viterbi Decoding and Sequential Decoding, Applications of Convolutional codes in ARQ system.

UNIT – IV

Turbo Codes LDPC Codes- Codes based on sparse graphs, Decoding for binary erasure channel, Log-likelihood algebra, Brief propagation, Product codes, Iterative decoding of product codes, Concatenated convolutional codes- Parallel concatenation, The UMTS Turbo code, Serialconcatenation, Parallel concatenation, Turbo decoding

UNIT - V

Space-Time Codes Introduction, Digital modulation schemes, Diversity, Orthogonal space-Time Block codes, Alamouti's schemes, Extension to more than Two Transmit Antennas, Simulation Results, Spatial Multiplexing: General Concept, Iterative APP Preprocessing and Per-layer Decoding, Linear Multilayer Detection, Original BLAST Detection, QL Decomposition and Interface Cancellation, Performance of Multi – Layer Detection Schemes, Unified Description by Linear Dispersion Codes.

TEXT BOOKS:

1) Error Control Coding- Fundamentals and Applications –Shu Lin, Daniel J. Costello, Jr, Prentice Hall, Inc.
2) Error Correcting Coding Theory-Man Young Rhee, McGraw-Hill, 1989.

REFERENCE BOOKS:

1) Digital Communications-Fundamental and Application - Bernard Sklar, PE.
2) Digital Communications- John G. Proakis, 5th ed. TMH, 2008.
3) Error Correction Coding – Mathematical Methods and Algorithms – Todd K. Moon, Wiley India, 2006.
4) Information Theory, Coding and Cryptography – Ranjan Bose, 2nd Edition, TMH, 2009

HONOURS DEGREE COURSES

VLSI DOMAIN

B.Tech. ELECTRONICS & COMMUNICATION ENGINEERING
HONOURS DEGREE COURSES VLSI DOMAIN

ECHT201 (R20): VLSI TECHNOLOGY AND DESIGN

L-3	T-1	P-0	M-100	C-4

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Describe the fabrication process and properties of MOS devices.
CO2	Analyze the impact of scaling on MOS circuits.
CO3	Comprehend the need of Combinational logic networks.
CO4	Understanding about design validation & testing.
CO5	Evaluate the floor planning methods.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	-	2	2
CO2	2	2	2	1	-	-	-	-	-	-	-	-	2	2
CO3	2	2	2	3	-	-	-	-	-	-	-	-	2	2
CO4	2	2	2	2	3	-	-	-	-	-	-	-	2	2
CO5	2	2	2	2	3	-	-	-	-	-	-	-	2	2
AVG_CO	2	2	2	2	3	-	-	-	-	-	-	-	2	2

UNIT -I

Review of Microelectronics and Introduction to MOS Technologies: MOS, CMOS, BiCMOS Technology. Basic Electrical Properties of MOS, CMOS & BiCMOS Circuits: Ids – Vds relationships, Threshold Voltage VT, Gm, Gds and ωo, Pass Transistor, MOS, CMOS & Bi CMOS Inverters, Zpu/Zpd, MOS Transistor circuit model, Latch-up in CMOS circuits.

UNIT -II

Layout Design and Tools: Transistor structures, Wires and Vias, Scalable Design rules, Layout Design tools. Logic Gates & Layouts: Static Complementary Gates, Switch Logic, Alternative Gate circuits, Low power gates, Resistive and Inductive interconnect delays.

UNIT -III

Combinational Logic Networks: Layouts, Simulation, Network delay, Interconnect design, Power optimization, Switch logic networks, Gate and Network testing.

UNIT -IV

Sequential Systems: Memory cells and Arrays, Clocking disciplines, Design, Power optimization, Design validation and testing.

UNIT -V

Floor Planning: Floor planning methods, Global Interconnect, Floor Plan Design, Off-chip connections.

TEXT BOOKS:

1) Essentials of VLSI Circuits and Systems, K. Eshraghian Eshraghian. D, A. Pucknell, 2005, PHI.
2) Modern VLSI Design – Wayne Wolf, 3rd Ed., 1997, Pearson Education. Advanced Digital System Design.

REFERENCE BOOKS:

1) Introduction to VLSI Systems: A Logic, Circuit and System Perspective – Ming-BO Lin, CRC Press, 2011.
2) Principals of CMOS VLSI Design – N.H. E Weste, K. Eshraghian, 2nd Ed., Addison Wesley.

ECHT202 (R20): ADVANCED DIGITAL SYSTEM DESIGN

L-3	T-1	P-0	M-100	C-4

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Identify, design and analyse Synchronous and Asynchronous sequential logic circuits and design and develop system controller
CO2	Learn and apply methods to analyse the timing behaviour and to detect timing hazards in digital circuit
CO3	Evaluate the digital system design by state identification techniques
CO4	Examine the testing of combinational, sequential and logic ciruits
CO5	Design a sequential circuit using different logical and functional blocks of different complexities

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	3	-	-	-	-	-	-	-	-	1	3	2
CO2	3	2	3	-	-	-	-	-	-	-	-	1	3	2
CO3	3	2	3	-	-	-	-	-	-	-	-	1	3	2
CO4	3	3	3	-	-	-	-	-	-	-	-	1	3	2
CO5	3	3	3	-	-	-	-	-	-	-	-	1	3	2
AVG_CO	3	3	3	-	-	-	-	-	-	-	-	1	3	2

UNIT - I

Processor Arithmetic: Two's Complement Number System - Arithmetic Operations; Fixed point Number System; Floating Point Number system - IEEE 754 format, Basic binary codes.

UNIT - II

Combinational circuits: CMOS logic design, Static and dynamic analysis of Combinational circuits, timing hazards. Functional blocks: Decoders, Encoders, Three-state devices, Multiplexers, Parity circuits, Comparators, Adders, Subtractors, Carry look-ahead adder – timing analysis. Combinational multiplier structures.

UNIT - III

Sequential Logic - Latches and Flip-Flops, Sequential logic circuits - timing analysis (Set up and hold times), State machines - Mealy & Moore machines, Analysis, FSM design using D Flip-Flops, FSM optimization and partitioning; Synchronizers and metastability. FSM Design examples: Vending machine, Traffic light controller, Washing machine.

UNIT - IV

Subsystem Design using Functional Blocks (1) - Design (including Timing Analysis) of different logical blocks of varying complexities involving mostly combinational circuits: ALU, 4-bit combinational multiplier, Barrel shifter, Simple fixed point to floating point encoder, Dual Priority encoder, Cascading comparators

UNIT - V

Subsystem Design using Functional Blocks (2) - Design, (including Timing Analysis) of different logical blocks of different complexities involving mostly sequential circuits:

Pattern (sequence) detector, Programmable Up-down counter, Round robin arbiter with 3 requesters, Process Controller FIFO

TEXT BOOKS:

1) John F. Wakerly, “Digital Design”, Prentice Hall, 3rd Edition, 2002.

ECHT203 (R20): SYSTEM ON CHIP ARCHITECTURE

L-3	T-1	P-0	M-100	C-4

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Understand the design of the System Approach.
CO2	Apply the knowledge different types of Processors.
CO3	Evaluate Memory Design for SOC.
CO4	Understand Interconnect Customization and Configuration, Reconfiguration Technologies, Mapping design onto Reconfigurable devices, design and analysis and trade-off.
CO5	SOC Design approach, Design and evaluation, Image compression – JPEG compression.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1								2	2
CO2	2	2	2	2	1								2	2
CO3	2	2	3	2									2	2
CO4	2	-	2	-									2	2
CO5	2	2	3	2									2	2
AVG_CO	2	2	2	2	1								2	2

UNIT – I

Introduction to the System Approach: System Architecture, Components of the system, Hardware & Software, Processor Architectures, Memory and Addressing. System level interconnection, An approach for SOC Design, System Architecture and Complexity.

UNIT – II

Processors: Introduction, Processor Selection for SOC, Basic concepts in Processor Architecture, Basic concepts in Processor Micro Architecture, Basic elements in Instruction handling. Buffers: minimizing Pipeline Delays, Branches, More Robust Processors, Vector Processors and Vector Instructions extensions, VLIW Processors, Superscalar Processors.

UNIT – III

Memory Design for SOC: Overview of SOC external memory, Internal Memory, Size, Scratchpads and Cache memory, Cache Organization, Cache data, Write Policies, Strategies

for line replacement at miss time, Types of Cache, Split – I, and D – Caches, Multilevel Caches, Virtual to real translation, SOC Memory System, Models of Simple Processor – memory interaction.

UNIT - IV

Interconnect Customization and Configuration: Inter Connect Architectures, Bus: Basic Architectures, SOC Standard Buses, Analytic Bus Models, Using the Bus model, Effects of Bus transactions and contention time. SOC Customization: An overview, Customizing Instruction Processor, Reconfiguration Technologies, Mapping design onto Reconfigurable devices, InstanceSpecific design, Customizable Soft Processor, Reconfiguration - overhead analysis and trade-off analysis on reconfigurable Parallelism.

UNIT – V

Application Studies / Case Studies: SOC Design approach, AES algorithms, Design and evaluation, Image compression – JPEG compression.

TEXT BOOKS:

1) Computer System Design System-on-Chip by Michael J. Flynn and Wayne Luk, Wiely India Pvt. Ltd.
2) ARM System on Chip Architecture – Steve Furber –2nd Eed., 2000, Addison Wesley Professional.

REFERENCE BOOKS:

1) Design of System on a Chip: Devices and Components – Ricardo Reis, 1st Ed., Springer, 2004.
2) Co-Verification of Hardware and Software for ARM System on Chip Design (Embedded Technology) – Jason Andrews – Newnes, BK and CDROM
3) System on Chip Verification – Methodologies and Techniques –Prakash Rashinkar, Peter Paterson and Leena Singh L, Kluwer Academic Publishers, 2001.

ECHT204 (R20): DESIGN OF FAULT TOLERANT SYSTEMS

L-3	T-1	P-0	M-100	C-4

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Examine the issues in real time system and their classification.
CO2	To solve various scheduling problems and will be able to apply them in real time applications.
CO3	Develop and implement appropriate algorithm for task assignment in real time system and able to understand the possibility of scheduling a task set.
CO4	Analyze the condition of fault occurrence and apply solutions consequently.
CO5	Address the issues in real time system.

CO-PO/PSO MAPPING MATRIX:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	3	1	1	-	-	-	-	-	-	2	2
CO2	2	1	1	3	1	-	-	-	-	-	-	-	2	2
CO3	1	-	3	2	1	1	-	1	-	-	-	-	2	2
CO4	1	3	1	2	-	2	1	-	-	-	-	-	2	2
CO5	-	1	1	2	1	2	-	1	-	-	-	-	2	2
AVG_CO	**2**	**3**	**2**	2	1	1	1	1	-	-	-	-	2	2

UNIT - I

Fault Tolerant Design: Basic concepts: Reliability concepts, Failures & faults, Reliability and Failure rate, Relation between reliability and mean time between failure, maintainability and availability, reliability of series, parallel and parallel-series combinational circuits. Fault Tolerant Design: Basic concepts-static, dynamic, hybrid, triple modular redundant system (TMR), 5MR reconfiguration techniques, Data redundancy, Time redundancy and software Redundancy concepts.

UNIT - II

Self Checking circuits & Fail safe Design: Self Checking Circuits: Basic concepts of self checking circuits, Design of Totally self checking checker, Checkers using m out of n codes, Berger code, Low cost residue code. Fail Safe Design: Strongly fault secure circuits, fail safe design of sequential circuits using partition theory and Berger code, totally self checking PLA design.

UNIT - III

Design for Testability: Design for testability for combinational circuits: Basic concepts of Testability, Controllability and observability, The Reed Muller's expansion technique, use of control and syndrome testable designs. Design for testability by means of scan: Making circuits Testable, Testability Insertion, Full scan DFT technique- Full scan insertion, flip-flop Structures, Full scan design and Test, Scan Architecturesfull scan design, Shadow register DFT, Partial scan methods, multiple scan design, other scan designs.

UNIT – IV

Logic Built-in-self-test: BIST Basics-Memory-based BIST,BIST effectiveness, BIST types, Designing a BIST, Test Pattern Generation-Engaging TPGs, exhaustive counters, ring counters, twisted ring counter, Linear feedback shift register, Output Response Analysis-Engaging ORA's, One's counter, transition counter, parity checking, Serial LFSRs, Parallel Signature analysis, BIST architectures-BIST related terminologies, A centralized and separate Board-level BIST architecture, Built-in evaluation and self test (BEST), Random Test socket (RTS), LSSD On-chip self test, Self – testing using MISR and SRSG, Concurrent BIST, BILBO, Enhancing coverage, RT level BIST design CUT design, simulation and synthesis, RTS BIST insertion, Configuring the RTS BIST, incorporating configurations in BIST, Design of STUMPS, RTS and STUMPS results.

UNIT – V

Standard IEEE Test Access Methods: Boundary Scan Basics, Boundary scan architecture-Test access port, Boundary scan registers, TAP controller, the decoder unit, select and other units, Boundary scan Test Instructions-Mandatory instructions, Board level scan chain structure-One serial scan chain, multiple-scan chain with one control test port, multiple-scan chains with one TDI,TDO but multiple TMS, Multiple-scan chain, multiple access port, RT Level boundary scan-inserting boundary scan test hardware for CUT, Two module test case, virtual boundary scan tester, Boundary Scan Description language.

TEXT BOOKS:

1) Parag K. Lala, "Fault Tolerant & Fault Testable Hardware Design", 1984, PHI
2) Zainalabedin Navabi, "Digital System Test and Testable Design using HDL models and Architectures", Springer International Edition.

REFERENCE BOOKS:

1) Miron Abramovici, Melvin A. Breuer and Arthur D. Friedman, "Digital Systems Testing and Testable Design", Jaico Books
2) Bushnell & Vishwani D. Agarwal, "Essentials of Electronic Testing", Springer.
3) Alfred L. Crouch, "Design for Test for Digital IC's and Embedded Core Systems", 2008, Pearson Education.

* * * * *