Course Structure and Syllabus - R20 Regulation

for

F*our Year Degree: B.Tech Program*

of

*E*lectronics & Communication Engineering

Chalapathi Institute of Engineering & Technology
(Autonomous)
Accredited by NAAC with 'A' Grade & NBA
Approved by AICTE: Affiliated to Acharya Nagarjuna University
Chalapathi Nagar, Lam, Guntur - 522 034
Andhra Pradesh, India.

Website: http://www.chalapathiengg.ac.in

Curricular Framework for Academic Regulations Honor B.Tech Programmes of all Branches

1. 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.

2. Structure of the Undergraduate Engineering program:
   Every course of B. Tech. Program shall be placed in one of the nine categories as listed in table below:

S.No.	Category	Code	Suggested breakup of Credits (APSCHE)	Suggested breakup of Credits (AICTE)
1	Humanities and social science including Management courses	HSMC	10	12
2	Basic Science courses	BSC	21	25
3	Engineering science courses	ESC	24	24
4	Professional core Courses	PCC	51	48
5	Open Elective Courses	OEC	12	18
6	Professional Elective Courses	PEC	15	18
7	Internship, seminar, project wok	PROJ	17	15
8	Mandatory courses	MC	Non-credit	Non-credit
9	Skill Oriented Courses	SC	10	-
	Total Credits		160	160

3. Assigning of Credits:
   1 Hr. Lecture (L) per week - 1 credit
   1 Hr. Tutorial (T) per week - 1 credit
   1 Hr. Practical (P) per week - 0.5 credits
   2 Hours Practical (Lab)/week - 1 credit

4. There shall be mandatory student induction program for freshers, with a three-week duration before the commencement of first semester. Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to Dept./Branch & Innovations etc., shall be included in the guidelines issued by AICTE

5. All undergraduate students shall register for NCC/NSS activities. A student will be required to participate in an activity for two hours in a week during second and third semesters. Grade shall be awarded as Satisfactory or Unsatisfactory in the mark sheet on the basis of participation, attendance, performance and behavior. If a student gets an unsatisfactory Grade, he/she shall repeat the above activity in the subsequent years, in order to complete the degree requirements.

6. Courses like Environmental Sciences, Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge etc., shall be included in the curriculum as non-credit mandatory courses. Environmental Sciences is to be offered compulsorily as mandatory course for all branches. A student has to secure 40% of the marks allotted in the internal evaluation for passing the course. No marks or letter grade shall be allotted for all mandatory non-credit courses.

7. Universities/Institutions may swap some of the courses between first and second semesters to balance the work load.

8. The concerned Board of studies can assign tutorial hours to such courses wherever it is necessary, but without change in the total number of credits already assigned for semester.

9. There shall be 05 Professional Elective courses and 04 Open Elective courses. All the Professional & Open Elective courses shall be offered for 03 credits, wherever lab component is involved it shall be (2-0-2) and without lab component it shall be (3-0-0). 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.

10. All Open Electives are offered to students of all branches in general. However, a student shall choose an open Elective from the list in such a manner that he/she has not studied the same course in any form during the Programme.

11. A student shall be permitted to pursue up to a maximum of two elective courses under MOOCs during the Programme. Each of 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 3 credits. The Head of the department shall notify the list of such courses at the beginning of the semester.

12. The college shall invite registration forms from the students at the beginning of the semester for offering professional and open elective courses. There shall be a limit on the minimum and maximum number of registrations based on class/section strength.
13. Students shall undergo mandatory summer internships for a minimum of six weeks duration at the end of second and third year of the Programme. There shall also be mandatory full internship in the final semester of the Programme along with the project work.
14. There shall be 05 skill-oriented courses offered during III to VII semesters. Among the five skill courses, four courses shall focus on the basic and advanced skills related to the domain courses and the remaining one shall be a soft skills course.
15. Under graduate Degree with Honors/Minor shall be issued by the University to the students who fulfill all the academic eligibility requirements for the B. Tech program and Honors/Minor program. The objective is to provide additional learning opportunities to academically motivated students.
16. **Assessment:** The performance of a student in each semester shall be evaluated subject wise with a maximum of 100 marks for theory as well as for practical subject. The distribution shall be 30 marks for Internal Evaluation and 70 marks for the End Semester Examinations. A student has to secure not less than 35% of marks in the endsemester examination and minimum 40% of marks in the sum total of internal and endsemester examination marks to earn the credits allotted to each course.

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

    ii. For theory subjects, during the semester there shall be two midterm examinations. The weightage of internal marks 30 consists of Descriptive – 18, Assignment – 12. The assignment examination is for 45 minutes duration conducted for 12 marks and the descriptive examination is for 90 minutes duration conducted for 18 marks.

    iii. **Internal Marks can be calculated with 80% weightage for best of the two Mids and 20% weightage for other Mid Exam. As the syllabus is framed for 5 units, the 1st midterm examination is conducted in 50% of the syllabus and 2nd midterm examination is in the rest of the syllabus of each subject in a semester.**

    iv. For practical subjects there shall be continuous evaluation during the semester for 40 internal marks and 60 end examination marks. The internal 40 marks shall be awarded as follows: day to day work – 15 marks, Record-10 marks and the remaining 15 marks to be awarded by conducting an internal laboratory test. The end examination shall be conducted by the teacher concerned and external examiner.

v. For the subject having design and / or drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing) and estimation, the distribution shall be 30 marks for internal evaluation (20 marks for day – to – day work, and 10 marks for internal tests) and 70 marks for end examination. There shall be two internal tests in a Semester and the Marks for 10 can be calculated with 80% weightage for best of the two tests and 20% weightage for other test and these are to be added to the marks obtained in day to day work.

vi. For the seminar, Each student has to be evaluated based on the presentation of any latest topic with report of 10-15 pages and a ppt of min 10 slides. The student shall collect the information on a specialized topic and prepare a technical report, showing his understanding over the topic, and submit to the department, which shall be evaluated by the Departmental committee consisting of Head of the department, seminar supervisor and a senior faculty member. The seminar report shall be evaluated for 50 marks. There shall be no external examination for seminar.

vii. Out of a total of 200 marks for the project work, 60 marks shall be for Internal Evaluation and 140 marks for the End Semester Examination. The End Semester Examination (Viva – Voce) shall be conducted by the committee. The committee consists of an external examiner, Head of the Department and Supervisor of the Project. The evaluation of project work shall be conducted at the end of the IV year.The Internal Evaluation shall be on the basis of two seminars given by each student on the topic of his project and evaluated by an internal committee

17. Attendance Requirements:

i. A student shall be eligible to appear for end semester 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 for 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 semester 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. (a) A student is eligible to write the University examinations if he acquires a minimum of 50% in each subject and 75% of attendance in aggregate of all the subjects.

18. Promotion Rules:

a) A student shall be promoted from first year to second year if he fulfills the minimum attendance requirements.

b) A student will be promoted from II year to III year if he fulfills the academic requirement of 40% of credits up to either II year I-Semester or II year II-Semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in II year II semester.

c) A student shall be promoted from III year to IV year if he fulfills the academic requirements of 40% of the credits up to either III year I semester or III year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester.

19. 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.

Marks Range	Level	Letter Grade	Grade Point
≥ 90	Outstanding	A+	10
80-89	Excellent	A	9
70-79	Very Good	B	8
60-69	Good	C	7
50-59	Fair	D	6
40-49	Satisfactory	E	5
< 40	Fail	F	0
-	Absent	Ab	0

Calculation of 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.

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

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.

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

where 'Si' is the SGPA of the i^{th} semester and C_i 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 SGPA/CGPA, the subjects in which the student is awarded Zero grade points will also be included.

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

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

vii. As per AICTE regulations, conversion of CGPA into equivalent percentage as follows:

Equivalent Percentage = (CGPA – 0.50) x 10

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/she shall be placed in one of the following:

Class Awarded	CGPA Secured
First Class with Distinction	≥ 7.5
First Class	≥ 6.5 < 7.5
Second Class	≥ 5.5 < 6.5
Pass Class	≥ 4.0 < 5.5

20. 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 shall be counted for the maximum time for graduation. An evaluation committee at university level shall be constituted to evaluate the proposal submitted by the student and the committee shall decide on permitting the student for availing the Gap Year.

Curricular Framework for Mandatory Internships

1. Two summer internships each with a minimum of six weeks duration, done at the end of second and third years, respectively are mandatory. The internship can be done by the students at local industries, Govt. Organizations, construction agencies, Industries, Hydel and thermal power projects and also in software MNCs.

2. Evaluation of the summer internships shall be through the departmental committee. A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the departmental committee. The report and the oral presentation shall carry 40% and 60% weightages respectively.

3. In the final semester, the student should mandatorily undergo internship and parallelly he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship. The project report shall be evaluated with an external examiner.

4. The College shall facilitate and monitor the student internship programs. Completion of internships is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student shall repeat and complete the internship.

Curricular Framework for Skill oriented

1. For skill oriented/skill advanced course, one theory and 2 practical hours or two theory hours may be allotted as per the decision of concerned BOS.
2. Out of the five skill courses two shall be skill-oriented courses from the same domain and shall be completed in second year. Of the remaining 3 skill courses, one shall be necessarily be a soft skill course and the remaining 2 shall be skill-advanced courses either from the same domain or Job oriented skill courses, which can be of inter disciplinary nature. (See Annexure 1 for model skill courses)
3. A pool of interdisciplinary job-oriented skill courses shall be designed by a common Board of studies by the participating departments/disciplines and the syllabus along with the pre requisites shall be prepared for each of the laboratory infrastructure requirements. The list of such courses shall be included in the curriculum structure of each branch of Engineering, so as to enable the student to choose from the list.
4. The student shall be given an option to choose either the skill courses being offered by the college or to choose a certificate course being offered by industries/Professional bodies/APSSDC or any other accredited bodies as approved by the concerned BoS.
5. The Board of studies of the concerned discipline of Engineering shall review the skill advanced courses being offered by eligible external agencies and prepare a fresh list every year incorporating latest courses based on industrial demand.
6. If a student chooses to take a Certificate Course offered by industries/Professional bodies/APSSDC or any other accredited bodies, in lieu of the skill advanced course offered by the Department, the credits shall be awarded to the student upon producing the Course Completion Certificate from the agency/professional bodies as approved by the Board of studies.
7. If a student prefers to take a certificate course offered by external agency, the department shall mark attendance of the student for the remaining courses in that semester excluding the skill course in all the calculations of mandatory attendance requirements upon producing a valid certificate as approved by the concerned Board of Studies, the student is deemed to have fulfilled the attendance requirement of the course and acquire the credits assigned to the course.
8. A committee shall be formed at the level of the college to evaluate the grades/marks given for a course by external agencies and convert to the equivalent marks/grades. The recommended conversions and appropriate grades/marks are to be approved by the University/Academic Council.

Curricular Framework for Honors Programme

1. Students of a Department/Discipline are eligible to opt for Honors Programme 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 upto 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 Programme stands cancelled and he/she shall continue with the regular Programme.
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 Programme, 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 Programme.

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 Programme:

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 4^{th} semester subject to a maximum of two additional courses per semester, provided that the student must have acquired 8 SGPA (Semester Grade point average) upto the end of 2^{nd} semester without any history of backlogs. It is expected that the 3rd semester results may be announced after the commencement of the 4^{th} semester. If a student fails to acquire 8 SGPA upto 3^{rd} 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.

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 Programme.
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.

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.

INDUSTRIAL COLLABORATIONS (CASE STUDY)

University-Industry linkages refer to the interaction between firms and universities or public research centers with the goal of solving technical problems, working on R&D, innovation projects and gathering scientific as well as technological knowledge. It involves the collaboration of Industries and Universities in various areas that would foster the research ecosystem in the country and enhance growth of economy, industry and society at large.

The Universities/Institutions (Autonomous) are permitted to design any number of Industry oriented minor tracks as the respective BoS feels necessary. In this process the Universities/Institutions can plan to have industrial collaborations in designing the minor tracks and to develop the content and certificate programs. Industry giants such as IBM, TCS, WIPRO etc., may be contacted to develop such collaborations. The Universities/Institutions shall also explore the possibilities of collaborations with major Industries in the core sectors and professional bodies to create specialized domain skills.

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ANNEXURE 1
(MODEL ONLY)
SKILL, JOB ORIENTED TRACKS

1. BoS chairman concerned can add more subjects/tracks as per the availability of individual department needs.
2. Two skill-oriented subjects will be from the Domain knowledge only.
3. One skill subject shall be communication skills (including laboratory)
4. Remaining two skill subjects will be from the same domain/interdisciplinary/Industry relevant subjects as per the choice of the student.
5. Pre requisites and eligibility can be decided by the concerned BoS.

SKILL, JOB ORIENTED TRACKS FOR MECHANICAL ENGINEERING

1. **Design/Analysis/Simulation**- CAD, UGNX, Solid Works, Ansys, FEA, CATIA, CREO etc
2. **Production/Manufacturing-** CAM, Piping, A/QC, CNC
3. **Thermal/Computational-** Computational Fluid Dynamics, MATLAB etc
4. **Service Sector-** Industrial Safety and Management, Operation Research, Oil & Gas safety.

SKILL, JOB ORIENTED TRACKS FOR CIVIL ENGINEERING

1. **Structural Design**- AutoCAD 2D 3D, ANSYS Civil, ETABS, PRO Steel, etc.
2. **Building Design-** Revit Architecture, ANSYS Civil, STAAD.PRO, AECOsim etc.
3. **Land survey -** Surveying, 2D Drafting, 3D Modeling, Analysis,
4. **Transportation Design**- Road & Transport Design etc.

SKILL, JOB ORIENTED TRACKS FOR COMPUTER SCIENCE & ENGINEERING

1. **Animation course**- VFX, CARTOONING, ANIMATION DESIGN etc
2. **Mobile app development-** App design for IOS and Android etc.
3. **Data Science-** Natural language processing, sentiment analysis, fore casting, regression models etc
4. **Python programming-** Deep learning, IOT natural language processing, Game Graphics Programming etc..

ANNEXURE 2

MODEL FOR HONORS

Note 1. The subjects opted for Honors should be Advanced type which are not covered in regular curriculum

2. Students has to acquire 16 credits with minimum one subject from each pool. (04 courses @4 credits

3. Concerned BoS can add or delete the subjects as per the decision of the board.

4. Pre requisites to be defined by the board for each course.

5. Compulsory MOOC/NPTEL Courses for 04 credits (02 courses@ 2 credits each)

DEPARTMENT OF MECHANICAL ENGINEERING					
S.NO.	**COURSE NAME**	**L-T-P**	**CR**	**PRE-REQ.**	**OFFERED TO**
POOL1					
1	Automobile Engine Design				ME
2	Automotive Transmission				ME
3	Autotronics & Safety				ME
4	Alternative Energy Sources for Automobiles				ME
POOL2					
1	Robotics: Modelling, Analysis and Control				ME
2	Modelling and Analysis of Dynamic Physical				ME
3	Theory and Design of Control Systems				ME
4	Smart Materials for Mechatronic Applications				ME
POOL3					
1	Mechanical Vibrations				ME
2	Product Design/CAD/CAM				ME
3	Flexible Manufacturing Systems/Design for manufacturing				ME
4	Reverse Engineering and Rapid Prototyping/Concurrent Engineering				
POOL4					
1	Advanced Thermodynamics				ME
2	Heat transfer/Heat power Engineering				ME
3	Jet Propulsion and rocket Engineering				ME
4	Computational Fluid Dynamics				ME

(MODEL FOR HONORS)

DEPARTMENT OF CIVIL ENGINEERING					
S.NO.	**COURSE NAME**	**L-T-P**	**CR**	**PRE-REQ.**	**OFFERED TO**
POOL1					
1	Stability of Structures				CE
2	Experimental Methods in Structural Engineering				CE
3	Nonlinear Structural Analysis				CE
4	Advanced Design of Steel Structures				CE
POOL2					
1	Advanced Geotechnical Engineering				CE
2	Geotechnical Measurements and Explorations				CE
3	Geotechnical Earthquake Engineering				CE
4	Rock Mechanics				CE
POOL3					
1	Advanced Hydrology				CE
2	Advanced Hydraulics				CE
3	Computational Methods in Hydraulics and Hydrology				CE
4	Stochastic Hydrology				CE
POOL4					
1	Global Navigation Satellite System				CE
2	Machine Processing of Remotely Sensed Data				CE
3	Geospatial Data Processing				CE
4	Introduction to Geodesy				CE

(MODEL FOR HONORS)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING					
S.NO.	**COURSE NAME**	**L-T-P**	**CR**	**PRE-REQ.**	**OFFERED TO**
POOL1					
1	Data Mining and Data Warehousing				CSE/IT
2	Object Oriented Modelling and Design				CSE/IT
3	Cryptography				CSE/IT
4	Network Security and Cyber Law				CSE/IT
POOL2					
1	Mobile Application Development				CSE/IT
2	Introduction to Data Structures and Algorithms				CSE/IT
3	Python Application Programming				CSE/IT
4	Soft Computing				CSE/IT
POOL3					
1	Software Architecture and Design Patterns				CSE/IT
2	Advanced JAVA and J2EE				CSE/IT
3	Storage Area Networks				CSE/IT
4	High Performance Computing				CSE/IT
POOL4					
1	Machine Learning				CSE/IT
2	Natural Language Processing				CSE/IT
3	Perception and Computer Vision				CSE/IT
4	Multi Agent Systems				CSE/IT

(MODEL FOR HONORS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING					
S.NO.	**COURSE NAME**	**L-T-P**	**CR**	**PRE-REQ.**	**OFFERED TO**
	POOL1				
1	Advanced Embedded Systems				ECE
2	Advanced Digital Signal Processing				ECE
3	Digital Image Processing				ECE
4	Wireless Broadband Communications				ECE
	POOL2				
1	Non-Linear Optical Communication				ECE
2	Satellite Communications				ECE
3	Advanced VLSI				ECE
4	Internet of Things				ECE
	POOL3				
1	Radar Engineering				ECE
2	Cellular and Mobile Communications				ECE
3	Advanced Wireless Broadband Communications				ECE
4	Optical Networks				ECE
	POOL4				
1	Multicarrier Communication Systems				ECE
2	Nano Electronics				ECE
3	RF and Mixed Signals Circuits				ECE
4	Microelectronic Devices, Technology and Circuits				ECE

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING (MODEL FOR HONORS)					
S.NO.	**COURSE NAME**	**L-T-P**	**CR**	**PRE-REQ.**	**OFFERED TO**
POOL1					
1	Advance Power Electronics				EEE
2	Opto Electronics				EEE
3	Electric power quality				EEE
4	Remote sensing systems				EEE
POOL2					
1	Advanced Power systems				EEE
2	Photonic network				EEE
3	Power Systems dynamics and control				EEE
4	Advanced Electrical Vehicles				EEE
POOL3					
1	Embedded systems				EEE
2	Power system protection				EEE
3	Distribution system Engineering				EEE
4	Microwave design and measurement				EEE
POOL4					
1	Advanced High voltage Engineering				EEE
2	Grid Integration of Renewable Energy Systems				EEE
3	Advanced Electric Machines				EEE
4	Semiconductor Device Modelling				EEE

Annexure-3(a)

GENERAL MINOR TRACKS (MODEL ONLY)

Note 1. The student can opt any 4 subjects from each pool. (04 courses@4credits each)

2. Concerned BoS can add or delete the subjects as per the decision of the board.

3. Pre requisites to be defined by the board for each course.

4. Compulsory MOOC/NPTEL Courses for 04 credits (02 courses@ 2 credits each)

Department of Mechanical Engineering

S.No	Subject	L-T-P	Credit
1	Engineering Mechanics	3-1-0	4
2	Thermal Engineering	3-1-0	4
3	Production Technology	3-1-0	4
4	Fundamentals of Engineering Design	3-1-0	4
5	Production Planning and control	3-1-0	4
6	Materials Technology	3-1-0	4

Department of Civil Engineering

S.No	Subject	L-T-P	Credit
1	Strength of Materials	3-1-0	4
2	Fluid Mechanics	3-1-0	4
3	Hydraulic Machines	3-1-0	4
4	Structural Analysis	3-1-0	4
5	Surveying	3-1-0	4
6	Geology/ Soil Mechanics	3-1-0	4

Department of Computer Science and Engineering

S.No	Subject	L-T-P	Credit
1	Operating systems	3-1-0	4
2	Data Structures Using C	3-1-0	4
3	Computer organization and Architecture	3-1-0	4
4	DBMS	3-1-0	4
5	Object oriented Programming	3-1-0	4
6	Computer Networks	3-1-0	4

Department of Electrical and Electronics Engineering

S.No	Subject	L-T-P	Credit
1	Network Theory	3-1-0	4
2	EDC/EMFT	3-1-0	4
3	DC Machines	3-1-0	4
4	Electronic circuit analysis	3-1-0	4
5	Network Analysis	3-1-0	4
6	AC Machines	3-1-0	4

Department of Electronics and Communications Engineering

S.No	Subject	L-T-P	Credit
1	Microprocessors	3-1-0	4
2	EDC/EMFT	3-1-0	4
3	Digital Logic Design	3-1-0	4
4	Electronic circuit analysis	3-1-0	4
5	Network Analysis	3-1-0	4
6	Signals and systems	3-1-0	4

ANNEXURE 3B

(MODEL FOR MINOR) SPECIALIZED TRACKS

Note

1. **A student can opt Four subjects from each track @ 4 credits per subject**
2. **Concerned BoS can add or delete the subjects as per the decision of the board.**
3. **Pre requisites to be defined by the board for each course.**
4. **Compulsory MOOC/NPTEL Courses for 04 credits (02 courses@ 2 credits each)**

DEPARTMENT OF MECHANICAL ENGINEERING

S.NO.	COURSE NAME	L-T-P	CR	PRE-REQ.	OFFERED TO
TRACK-1 (NANO ENGINEERING)					
1	Nanoengineering				ME
2	Green nanotechnology				ME
3	Nano-biotechnology				ME
4	Nano architectonics				ME
5	Nano mechanics				ME
TRACK2 (ADVANCED VEHICLE ENGINEERING)					
1	Chassis design and packaging:				ME
2	Vehicle body styling and aerodynamics				ME
3	Ergonomics, seating and Instrument panels				ME
4	Analysis of vehicle handling:				ME
5	Vehicle stability and design considerations				ME
TRACK-3 (BIO-MEDICAL AND MICRO ENGINEERING)					
1	Biomechanics				ME
2	Bio materials				ME
3	Medical Device Design				ME
4	micro electro mechanical systems				ME
5	advanced lithography techniques				
TRACK 4 RESEARCH AND APPLICATION OF MACHINING PROCESSES (RAMP)					
1	Machining of advanced workpiece materials				ME
2	Hybrid machining approaches				ME
3	Automatic machining algorithms				ME
4	Tool and part probing integration				ME
5	Statistical process control and six sigma				ME

DEPARTMENT OF CIVIL ENGINEERING

(MODEL FOR MINOR)

S.NO.	COURSE NAME	L-T-P	CR	PRE-REQ.	OFFERED TO
TRACK-1 STRUCTURAL ENGINEERING					
1	Advanced Design of Steel Structures				CE
2	Bridge Engineering				CE
3	Earthquake Resistant Design of Structures				CE
4	Prestressed Concrete				CE
5	Prefabricated Structures				CE
TRACK-2 GEOTECHNICAL ENGINEERING					
1	Ground Improvement Techniques				CE
2	Advanced Foundation Engineering				CE
3	Geotechnical Earthquake Engineering				CE
4	Design of Earth Retaining Structures				CE
5	Geo synthetics and reinforced soil structure				CE
TRACK-3 ENVIRONMENTAL AND WATER RESOURCES ENGINEERING					
1	Design of Hydraulics Structures				CE
2	Advanced Water Resources Engineering				CE
3	Environmental impact assessment				CE
4	Solid waste management and landfills				CE
5	Advanced Environmental Engineering				CE
TRACK-4 TRANSPORTATION ENGINEERING					
1	Advanced Highway Engineering				CE
2	Traffic Engineering				CE
3	Advanced Pavement Design Engineering				CE
4	Urban Transport Systems Planning				CE
5	Railways, Docks, Harbors and airports				CE

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

(MODEL FOR MINOR)

S.NO.	COURSE NAME	L-T-P	CR	PRE-REQ.	OFFERED TO
TRACK-1 NETWORKING & SECURITY					
1	TCP/IP Protocol Suite				CSE/IT
2	Network Architecture and Design				CSE/IT
3	Network Security				CSE/IT
4	Cryptography				CSE/IT
5	Computer Forensics				CSE/IT
TRACK-2 SOFTWARE ENGINEERING					
1	Software Metrics and Measurements				CSE/IT
2	Software Verification and Validation				CSE/IT
3	Software Architecture and Design Patterns				CSE/IT
4	Software Project Management				CSE/IT
5	Fault Tolerant Computing				CSE/IT
TRACK-3 DISTRIBUTED & CLOUD COMPUTING					
1	Enterprise Storage Systems				CSE/IT
2	Parallel Algorithms				CSE/IT
3	Cloud Networking				CSE/IT
4	Cloud Computing				CSE/IT
5	High Performance Computing				CSE/IT
TRACK-4 COMPUTATIONAL INTELLIGENCE					
1	Soft Computing				CSE/IT
2	Machine Learning				CSE/IT
3	Natural Language Processing				CSE/IT
4	Perception and Computer Vision				CSE/IT
5	Multi Agent Systems				CSE/IT

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

(MODEL FOR MINOR)

S.NO.	COURSE NAME	L-T-P	CR	PRE-REQ.	OFFERED TO
	TRACK-1 VLSI				
1	Analog VLSI Design/VSLI Technology				ECE
2	Applications of MEMS Technology				ECE
3	CAD for VLSI Design				ECE
4	Design for Testability/ Low power VLSI				ECE
5	Design of Semi-Conductor Memories				ECE
	TRACK-2 COMMUNICATION ENGINEERING				
1	RF System Design				ECE
2	Radiation Systems				ECE
3	RADAR and Navigational Aids				ECE
4	Cellular Communications				ECE
5	Satellite Communication				ECE
	TRACK-3 DIGITAL SYSTEMS				
1	Computer Architecture				ECE
2	PLD's & FPGAs				ECE
3	VLSI Design				ECE
4	Embedded System Design				ECE
5	DSP Processors				ECE
	TRACK-4 SIGNAL PROCESSING				
1	Intelligent Systems and Control				ECE
2	Adaptive Signal Processing				ECE
3	Statistical Signal Processing				ECE
4	Speech Signal Processing				ECE
5	Multimedia Signal Processing				ECE

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

(MODEL FOR MINOR)

S.NO.	COURSE NAME	L-T-P	CR	PRE-REQ.	OFFERED TO
	TRACK -1 POWER SYSTEMS				
1	Distribution System Planning & Automation				EEE
2	Restructured Power Systems				EEE
3	HVDC & FACTS				EEE
4	Power Quality				EEE
5	Smart Grid Technologies				EEE
	TRACK -2 POWER ELECTRONICS				
1	Advanced Power Electronics				EEE
2	Advanced Electrical Drives				EEE
3	HVDC & FACTS				EEE
4	Power Quality				EEE
5	Hybrid Electrical Vehicles				EEE
	TRACK- 3 CONTROL SYSTEMS				
1	State Estimation & System Identification				EEE
2	Digital Control Systems				EEE
3	Non Linear Control Systems				EEE
4	Optimal Control Systems				EEE
5	Adaptive Control Systems				EEE
	TRACK- 4 ENERGY SYSTEMS				
1	Energy Conservation & Audit				EEE
2	Utilization of Electrical Energy				EEE
3	Solar & Fuel cell Energy Systems				EEE
4	Wind & Biomass Energy Systems				EEE
5	Nuclear, Geothermal & Tidal Energy Systems				EEE

ANNEXURE 4

COMMUNITY SERVICE PROJECT

……Experiential learning through community engagement

As per the decision of the decision of the concerned department BoS

Introduction

- Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development
- Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.
- Community Service Project is meant to link the community with the college for mutual benefit. The community will be benefited with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and also emerge as a socially responsible institution.

Objective

Community Service Project should be an integral part of the curriculum, as an alternative to the 2 months of Summer Internships / Apprenticeships / On the Job Training, whenever there is an exigency when students cannot pursue their summer internships. The specific objectives are;

- To sensitize the students to the living conditions of the people who are around them,
- To help students to realize the stark realities of the society.
- To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
- To make students aware of their inner strength and help them to find new /out of box solutions to the social problems.
- To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
- To help students to initiate developmental activities in the community in coordination with public and government authorities.
- To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

Implementation of Community Service Project

- Every student should put in a minimum of **180 hours** for the Community Service Project during the summer vacation.
- Each class/section should be assigned with a mentor.

- Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, house-wives, etc
- A log book has to be maintained by each of the student, where the activities undertaken/involved to be recorded.
- The log book has to be countersigned by the concerned mentor/faculty incharge.
- Evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.
- The final evaluation to be reflected in the grade memo of the student.
- TheCommunity Service Projectshould be different from the regular programmes of NSS/NCC/Green Corps/Red Ribbon Club, etc.
- Minor project report should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.
- Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training

Procedure

- A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, so as to enable them to commute from their residence and return back by evening or so.
- The Community Service Project is a twofold one –
    - First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, it could be another primary source of data.
    - Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –
        - Agriculture
        - Health
        - Marketing and Cooperation
        - Animal Husbandry
        - Horticulture
        - Fisheries
        - Sericulture
        - Revenue and Survey
        - Natural Disaster Management
        - Irrigation
        - Law & Order
        - Excise and Prohibition
        - Mines and Geology
        - Energy
        - Internet
        - Free Electricity
        - Drinking Water

EXPECTED OUTCOMES

BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS

Learning Outcomes

- Positive impact on students' academic learning
- Improves students' ability to apply what they have learned in "the real world"
- Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development
- Improved ability to understand complexity and ambiguity

Personal Outcomes

- Greater sense of personal efficacy, personal identity, spiritual growth, and moral development
- Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills

Social Outcomes

- Reduced stereotypes and greater inter-cultural understanding
- Improved social responsibility and citizenship skills
- Greater involvement in community service after graduation

Career Development

- Connections with professionals and community members for learning and career opportunities
- Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity

Relationship with the Institution

- Stronger relationships with faculty
- Greater satisfaction with college
- Improved graduation rates

BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS

- Satisfaction with the quality of student learning
- New avenues for research and publication via new relationships between faculty and community
- Providing networking opportunities with engaged faculty in other disciplines or institutions
- A stronger commitment to one's research

BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES

- Improved institutional commitment
- Improved student retention
- Enhanced community relations

BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY

- Satisfaction with student participation
- Valuable human resources needed to achieve community goals
- New energy, enthusiasm and perspectives applied to community work
- Enhanced community-university relations.

SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT

The following the recommended list of projects for Engineering students. The lists are not exhaustive and open for additions, deletions and modifications. Colleges are expected to focus on specific local issues for this kind of projects. The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of projects. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting shall be ensured.

For Engineering Students

1. Water facilities and drinking water availability
2. Health and hygiene
3. Stress levels and coping mechanisms
4. Health intervention programmes
5. Horticulture
6. Herbal plants
7. Botanical survey
8. Zoological survey
9. Marine products
10. Aqua culture
11. Inland fisheries
12. Animals and species
13. Nutrition
14. Traditional health care methods
15. Food habits
16. Air pollution
17. Water pollution
18. Plantation
19. Soil protection
20. Renewable energy
21. Plant diseases
22. Yoga awareness and practice
23. Health care awareness programmes and their impact
24. Use of chemicals on fruits and vegetables
25. Organic farming
26. Crop rotation
27. Floury culture
28. Access to safe drinking water
29. Geographical survey
30. Geological survey

31. Sericulture
32. Study of species
33. Food adulteration
34. Incidence of Diabetes and other chronic diseases
35. Human genetics
36. Blood groups and blood levels
37. Internet Usage in Villages
38. Android Phone usage by different people
39. Utilisation of free electricity to farmers and related issues
40. Gender ration in schooling lvel- observation.

Complimenting the community service project the students may be involved to take up some awareness campaigns on social issues/special groups. The suggested list of programmes are;

Programmes for School Children

1. Reading Skill Programme (Reading Competition)
2. Preparation of Study Materials for the next class.
3. Personality / Leadership Development
4. Career Guidance for X class students
5. Screening Documentary and other educational films
6. Awareness Programme on Good Touch and Bad Touch (Sexual abuse)
7. Awareness Programme on Socially relevant themes.

Programmes for Women Empowerment

1. Government Guidelines and Policy Guidelines
2. Womens' Rights
3. Domestic Violence
4. Prevention and Control of Cancer
5. Promotion of Social Entrepreneurship

General Camps

1. General Medical camps
2. Eye Camps
3. Dental Camps
4. Importance of protected drinking water
5. ODF awareness camp
6. Swatch Bharath
7. AIDS awareness camp
8. Anti Plastic Awareness
9. Programmes on Environment
10. Health and Hygiene
11. Hand wash programmes
12. Commemoration and Celebration of important days

Programmes for Youth Empowerment

1. Leadership
2. Anti-alcoholism and Drug addiction
3. Anti-tobacco
4. Awareness on Competitive Examinations
5. Personality Development

Common Programmes

1. Awareness on RTI
2. Health intervention programmes
3. Yoga
4. Tree plantation
5. Programmes in consonance with the Govt. Departments like –
    i. Agriculture
    ii. Health
    iii. Marketing and Cooperation
    iv. Animal Husbandry
    v. Horticulture
    vi. Fisheries
    vii. Sericulture
    viii. Revenue and Survey
    ix. Natural Disaster Management
    x. Irrigation
    xi. Law & Order
    xii. Excise and Prohibition
    xiii. Mines and Geology
    xiv. Energy

Role of Students:

- Students may not have the expertise to conduct all the programmes on their own. The students then can play a facilitator role.
- For conducting special camps like Health related, they will be coordinating with the Governmental agencies.
- As and when required the College faculty themselves act as Resource Persons.
- Students can work in close association with Non-Governmental Organizations like Lions Club, Rotary Club, etc or with any NGO actively working in that habitation.
- And also with the Governmental Departments. If the programme is rolled out, the District Administration could be roped in for the successful deployment of the programme.
- An in-house training and induction programme could be arranged for the faculty and participating students, to expose them to the methodology of Service Learning.

Timeline for the Community Service Project Activity

Duration: 8 weeks

1. **Preliminary Survey (One Week)**
   - A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.
   - A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.
   - The Governmental agencies, like revenue administration, corporation and municipal authorities and village secreteriats could be aligned for the survey.

2. **Community Awareness Campaigns (Two Weeks)**
   - Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmes to be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.

3. **Community Immersion Programme (Four Weeks)**

   Along with the Community Awareness Programmes, the student batch can also work with any one of the below listed governmental agencies and work in tandem with them. This community involvement programme will involve the students in exposing themselves to the experiential learning about the community and its dynamics. Programmes could be in consonance with the Govt. Departments.

4. **Community Exit Report (One Week)**
   - During the last week of the Community Service Project, a detailed report of the outcome of the 8 weeks work to be drafted and a copy shall be submitted to the local administration. This report will be a basis for the next batch of students visiting that particular habitation. The same report submitted to the teacher-mentor will be evaluated by the mentor and suitable marks are awarded for onward submission to the University.

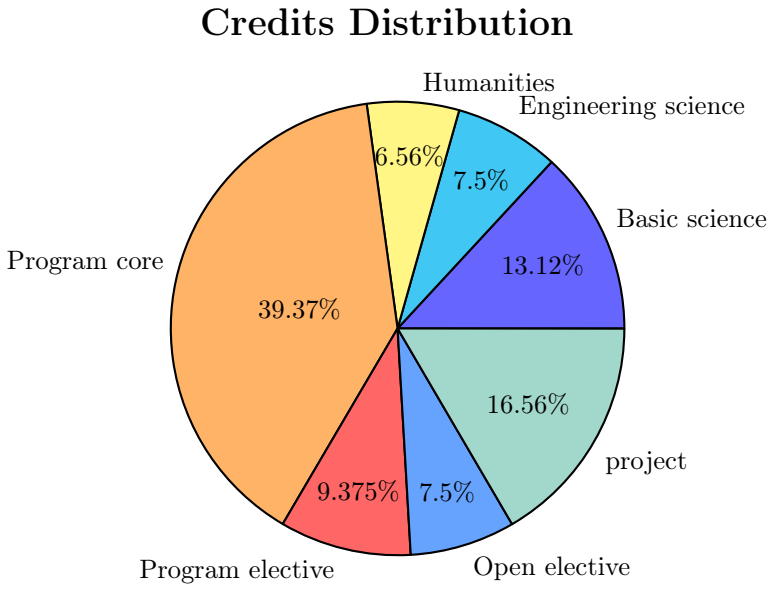
   Throughout the Community Service Project, a daily log-book need to be maintained by the students batch, which should be countersigned by the governmental agency representative and the teacher-mentor, who is required to periodically visit the students and guide them.

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

B.Tech - ELECTRONICS & COMMUNICATION ENGINEERING

Program curriculum grouping based on course components

Course Component	Curriculum Content (% of total number of credits program)	Total number of contact hours	Total number of credits
Basic Sciences (BSC)	13.12	15	21
Engineering Sciences (ESC)	7.5	14	12
Humanities and Social Sciences (HSC)	6.56	12	10.5
Program Core (PCC)	39.37	40	63
Program Electives (PEC)	9.375	15	15
Open Electives (OEC)	7.5	8	12
Others(Projects /Internships and Skill development) (OT)	16.56	7	26.5
Total number of Credits			**160**



B.Tech - ELECTRONICS & COMMUNICATION ENGINEERING

(w.e.f. the batch of students admitted from the academic year 2020-2021)

A student should undergo with an "Induction program" before the commencement of I Year I Semester course.

I YEAR I SEMESTER COURSE STRUCTURE

S.No	Course Details		Scheme of Instruction			Scheme of Examination			Category
	Code No	Subject Name	Periods per week			Maximum Marks		Credits	Code
			L	T	P	SES	EXT		
1	EC-111	Mathematics-I	3	1	0	30	70	3	BSC
2	EC-112	Engineering Chemistry	3	0	0	30	70	3	BSC
3	EC-113	Professional Communication Skills	3	0	0	30	70	3	HSC
4	EC-114	C & Data Structures	3	0	0	30	70	3	ESC
5	EC-115	Network Theory	3	1	0	30	70	3	PCC
6	EC-151	Communicative English Lab	0	0	3	30	70	1.5	HSC
7	EC-152	Engineering Chemistry Lab	0	0	3	30	70	1.5	BSS LAB
8	EC-153	C & Data Structures Lab	0	0	3	30	70	1.5	ESC LAB
TOTAL			15	2	9	240	560	19.5	-
9	—	Induction Program	-	-	-	-	-	-	MC

I YEAR II SEMESTER COURSE STRUCTURE

S.No	Course Details		Scheme of Instruction			Scheme of Examination			Category
	Code No	Subject Name	Periods per week			Maximum Marks		Credits	Code
			L	T	P	SES	EXT		
1	EC-121	Mathematics-II	3	1	0	30	70	3	BSC
2	EC-122	Engineering Physics	3	1	0	30	70	3	BSC
3	EC-123	Electronic Devices and Circuits	3	0	0	30	70	3	PCC
4	EC-124	Python Programming	3	0	0	30	70	3	ESC
5	EC-125	Engineering Graphics	1	0	3	30	70	3	ESC
6	EC-161	Python Programming Lab	0	0	3	30	70	1.5	ESC
7	EC-162	Engineering Physics Lab	0	0	3	30	70	1.5	BSC
8	EC-163	Electronic Devices Circuits Lab	0	0	3	30	70	1.5	PCC
9	—	Design Thinking	2	0	0	30	70	-	MC
TOTAL			15	2	12	270	630	19.5	-

II YEAR I SEMESTER COURSE STRUCTURE

S.No	Course Details		Scheme of Instruction			Scheme of Examination			Category
	Code No	Subject Name	Periods per week			Maximum Marks		Credits	Code
			L	T	P	SES	EXT		
1	EC-211	Mathematics-III	3	1	0	30	70	3	BSC
2	EC-212	Electronic Circuit Analysis	3	1	0	30	70	3	PCC
3	EC-213	Switching Theory and Logic Design	3	0	0	30	70	3	PCC
4	EC-214	Probability Theory and Stochastic Processes	3	1	0	30	70	3	PCC
5	EC-215	Signals and Systems	3	1	0	30	70	3	PCC
6	EC-251	Electronic Circuit Analysis Lab	0	0	3	30	70	1.5	PCC
7	EC-252	Digital Logic Design Lab	0	0	3	30	70	1.5	PCC LAB
8	EC-253	Signals and Systems Lab	0	0	3	30	70	1.5	PCC LAB
9	—	Skill Oriented Course	1	0	2	30	70	2	-
10	—	Environmental Science	2	0	0	30	70	0	MC
TOTAL			18	4	8	300	700	21.5	-

II YEAR II SEMESTER COURSE STRUCTURE

S.No	Course Details		Scheme of Instruction			Scheme of Examination			Category
	Code No	Subject Name	Periods per week			Maximum Marks		Credits	Code
			L	T	P	SES	EXT		
1	EC-221	Mathematics-IV	3	1	0	30	70	3	BSC
2	EC-222	Pulse and Digital Circuits	3	1	0	30	70	3	PCC
3	EC-223	Electromagnetic Waves & Waveguides	3	1	0	30	70	3	PCC
4	EC-224	Analog & Digital Communication	3	0	0	30	70	3	PCC
5	EC-225	Professional Ethics and Human Values	3	0	0	30	70	3	HSC
6	EC-261	Pulse and Digital Circuits Lab	0	0	3	30	70	1.5	PCC LAB
7	EC-262	Analog & Digital Communication Lab	0	0	3	30	70	1.5	PCC LAB
8	EC-263	Electronic Circuits Simulation Lab	0	0	3	30	70	1.5	PCC LAB
9	—	Skill Oriented Course	1	0	2	30	70	2	-
TOTAL			16	3	11	270	630	21.5	-

III YEAR I SEMESTER COURSE STRUCTURE

S.No	Course Details		Scheme of Instruction			Scheme of Examination			Category
	Code No	Subject Name	Periods per week			Maximum Marks		Credits	Code
			L	T	P	SES	EXT		
1	EC-311	Microprocessors and Microcontrollers	3	0	0	30	70	3	PCC
2	EC-312	Control Systems	3	1	0	30	70	3	PC
3	EC-313	Analog and Digital Integrated Circuits	3	0	0	30	70	3	PCC
4	EC-314	Open Elective-I	3	0	0	30	70	3	OEC
5	EC-315	Program Elective –I	3	0	0	30	70	3	PEC
6	EC-351	Microprocessors and Microcontrollers Lab	0	0	3	30	70	1.5	PCC LAB
7	EC-352	Linear IC Applications Lab	0	0	3	30	70	1.5	PCC LAB
8	—	Skill Advanced Course/ Soft Skill Course*	1	0	2	30	70	2	-
9	—	Life Science for Engineers	2	0	0	30	70	0	MC
10	Summer Internship 2 months (Mandatory) After second Year		0	0	0	-	-	1.5	MC
TOTAL			18	1	8	270	630	21.5	-

Program Elective - I : Any one of the following courses can be registered
EC-315A Data Communication Networks
EC-315B Information Theory & Coding
EC-315C Electronic Measurements & Instrumentation
EC-315D Microelectromechanical Devices and Systems

III YEAR II SEMESTER COURSE STRUCTURE

S.No	Course Details		Scheme of Instruction			Scheme of Examination			Category
	Code No	Subject Name	Periods per week			Maximum Marks		Credits	Code
			L	T	P	SES	EXT		
1	EC-321	Microwave Engineering and Antennas	3	1	0	30	70	3	PCC
2	EC-322	Principles of VLSI Design	3	0	0	30	70	3	PCC
3	EC-323	Digital Signal Processing	3	1	0	30	70	3	PCC
4	EC-324	Program Elective -II	3	0	0	30	70	3	PEC
5	EC-325	Open Elective-II(MOOCS–I)	3	0	0	30	70	3	OEC
6	EC-361	VLSI Design Lab	0	0	3	30	70	1.5	PCC LAB
7	EC-362	Microwave Engineering Lab	0	0	3	30	70	1.5	PCC LAB
8	EC-363	Digital Signal Processing Lab	0	0	3	30	70	1.5	PCC LAB
9	—	Skill Advanced Course /Soft Skill Course	1	0	2	30	70	2	-
10	—	Constitution of India	2	0	0	30	70	0	-
TOTAL			18	2	11	300	700	21.5	-

Program Elective - II : Any one of the following Course can be registered
EC-324A Introduction to Embedded Systems
EC-324B Digital Design using Verilog
EC-324C Advanced Control Systems
EC-324D Telecommunication Switching Systems

IV YEAR I SEMESTER COURSE STRUCTURE

S.No	Course Details		Scheme of Instruction			Scheme of Examination			Category
	Code No	Subject Name	Periods per week			Maximum Marks		Credits	Code
			L	T	P	SES	EXT		
1	EC-411	Program Elective -III	3	0	0	30	70	3	PEC
2	EC-412	Program Elective -IV	3	0	0	30	70	3	PEC
3	EC-413	Program Elective -V	3	0	0	30	70	3	PEC
4	EC-414	Open Elective – III(MOOCS-II)	3	0	1	30	70	3	OEC
5	EC-415	Open Elective - IV	3	0	1	30	70	3	OEC
6	EC-416	Humanities and Social Science Elective	3	0	0	30	70	3	HSC
7	-	Skill Advanced Course /Soft Skill Course	1	0	2	30	70	2	-
9	—	Industrial/ Research Internship 2 months	0	0	0	-	-	3	-
TOTAL			19	0	4	380	420	23	-

Program Elective -III: Any one of the following Course can be registered
EC-411A Advance Digital Signal Processing
EC-411B Digital Image Processing
EC-411C Radar Signal Processing
EC-411D Speech Signal Processing

Program Elective -IV: Any one of the following Course can be registered
EC-412A Generations of Cellular Mobile Communications
EC-412B Optical Fibre Communication
EC-412C Satellite Communication
EC-412D Smart Antennas

Program Elective -V: Any one of the following Course can be registered
EC-413A Pattern Recognition and Machine Learning
EC-413B Artificial Neural Networks
EC-413C Internet of Things
EC-413D Introduction to Fuzzy logic systems

Humanities and Social Science Elective -I: Any one of the following Course can be registered
EC-416A Managerial Economics and Financial Analysis
EC-416B Industrial Management
EC-416C Management Science
EC-416D Entrepreneurship and Development

IV YEAR II SEMESTER COURSE STRUCTURE

S.No	Course Details		Scheme of Instruction			Scheme of Examination			Category
	Code No	Subject Name	Periods per week			Maximum Marks		Credits	Code
			L	T	P	SES	EXT		
1	Proect	Major Project, Seminar and Internship in Industry	0	0	0	30	70	12	-
TOTAL			0	0	0	30	70	12	-

EC-111: Mathematics-I

I Year, I Semester

Department: ECE	Category Code: BSC
Credits: 3	Internal marks: 30
L-T-P : 3-1-0	External marks: 70

Course Objectives

1. To introduce theory of matrices and solving system of linear equations.
2. To explain the role of eigen values and eigen vectors for orthogonal transformations.
3. To impart knowledge related to mean value theorems and series expansions.
4. To explain the importance of partial differentiation and improper integrals.
5. To describe the role of multiple integrals in calculating areas and volumes.

Syllabus

UNIT-I Matrices: Types of matrices, Rank, Echelon form, Normal form, Inverse of a matrix by Gauss-Jordan, Solution of homogeneous linear systems, Solution of non-homogeneous linear systems, Gauss elimination, Gauss seidel methods.

UNIT-II Eigen Values – Eigen Vectors : Eigen values, Eigen vectors, Properties, Cayley Hamilton theorem (without proof), Inverse, Power of matrix by Cayley Hamilton theorem, Reduction of quadratic form to canonical form (Orthogonal transformation) , Rank, Index, and Signature of a quadratic form.

UNIT–III Mean Value Theorems & Sequences -Series: Rolle's theorem, Lagrange's mean value theorem, Geometrical interpretation, Cauchy's mean value theorem, Geometrical interpretation, Taylor's theorem, Maclaurin's series. Sequences and Series: Convergence and divergence, Oscillatory sequences and series, Ratio test, Comparison test, D-Alembert's ratio test, Integral test , Cauchy's root test, Alternate series, Leibnitz's rule.

UNIT–IV Special Functions & Calculus: Definitions of improper integrals, Beta & Gamma functions and their applications Partial differentiation homogeneous function, Euler's theorem,

Total derivative, Chain rule, Taylor's and Maclaurin's series, Expansion of two variable functions, Functional dependence, Jacobin maxima and minima of functions of two variables without constraints and Lagrange's method of multipliers.

UNIT–V Multivariable Calculus: Double integrals, Change of order of integration, Double integration in polar coordinates, Area enclosed by plane curves. Triple Integrals : Evaluation of triple integrals, Change of variables between cartesian and cylindrical.

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.

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, 2011.

Web Resources

1. https://nptel.ac.in/courses/111/105/111105121/
2. https://ocw.mit.edu/high-school/mathematics/exam-prep/derivative-as-a-function/mean-value-theorem-geometric-consequences/
3. https://soaneemrana.org/onewebmedia/ADVANCED%20ENGINEERING%20MATHEMATICS%20BY%20ERWIN%20ERESZIG1.pdf

Course Outcomes

At the end of course, the student will be able to

1. Solve system of linear equations applicable in the engineering.
2. Apply multiple variable calculus to evaluate the rate of change of physical quantities in engineering.
3. Compare different types of mean value theorems.
4. Apply improper integrals (special functions) for estimating/solving error functions.
5. Evaluate the multiple integrals in cartesian, spherical, and cylindrical coordinate systems.

EC-112: Engineering Chemistry

I Year, I Semester

Department: ECE	Category Code: BSC
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Objectives

1. To familiarize engineering chemistry and its applications.
2. To impart the concept of soft and hard waters, softening methods of hard water.
3. To train the students on the principles and applications of electrochemistry, polymers, surface chemistry, and cement.
4. To compare the materials of construction for battery and electrochemical sensors.
5. To explain the preparation, properties, and applications of thermoplastics, thermo settings, elastomers & conducting polymers.
6. To explain the principles of spectrometry, GC and HPLC in separation of gaseous and liquid mixtures.

Syllabus

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 Poly acetylene. Chemistry of Nano Materials: Introduction to nano chemistry, Preparation of nano materials - carbon nano tubes 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 (H2-O2 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 Cement and Concrete Chemistry: Introduction to building materials, Portland cement, Constituents, Manufacturing Process, Setting and hardening cement. Organic reactions and synthesis of a drug molecule: Introduction to reactions involving substitution (SN1 and SN2), Elimination reactions (E1 and E2), Synthesis of commonly used drug molecule, Aspirin and Paracetmol.

Text Books

1. Engineering Chemistry, P.C. Jain and M. Jain - Dhanapathi Rai Sons, Delhi.
2. A text book of Engineering Chemistry, S.S. Dara - S. Chand Co. New

References

1. Engineering Chemistry, B.K. Sharma - Krishna Prakashan, Meerut
2. A text book of engineering chemistry,3rd Edition, Shashi chawla Dhanpat rai co
3. Instrumental methods of analysis, 7th edition, Gurudeep raj Chatwal Anand, CBS Publications,1986.
4. Quantitative analysis - Day Underwood.
5. A Text book of Instrumental methods - Skoog and West.
6. Instrumental methods of analysis, 7th edition, H.W. Wilard and Demerit, CBS Publications,1986.
7. Text book of Nano Science and Nano technology, B.S. Murthy and P. Shankar, University press.

Web Resources

1. http://www.nptelvideos.in/2012/11/chemistry-of-materials.html
2. https://ocw.mit.edu/courses/chemistry/
3. https://www.erforum.net/2016/01/engineering-chemistry-by-jain-and-jain-pdf-free-ebook.html

Course Outcomes

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

1. Explain the manufacturing of portland cement.
2. Demonstrate the scheme of concrete formation.
3. Identify the constituents of portland cement.
4. Enumerate the reactions at different temperatures in the manufacture of cement.
5. Explain the synthesis of aspirin and paracetmol drug molecules.

EC-113: Professional Communication

I Year, I Semester

Department: ECE	Category Code: HSS
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Objectives

1. To inculcate a sense of professionalism among the students while emphasizing on vocabulary building.
2. To adopt activity based teaching-learning methods to ensure that learners would be engaged in use of language.
3. To provide pertinent reading strategies for comprehension.
4. To impart effective strategies for sensible writing and demonstrate the same in briefing.

Syllabus

UNIT-I Vocabulary Building: The concept of word formation , Root words from foreign languages and their use in english, Acquaintance with prefixes and suffixes from foreign languages in english to form derivatives, Synonyms, Antonyms, and Standard abbreviations, One word substitutes and Idioms.

UNIT-II Basic Writing Skills: Sentence structures , Use of phrases and clauses in sentences, Importance of proper punctuation, Organizing principles of paragraphs in documents .

UNIT–III Identifying Common Errors in Writing: Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions.

UNIT–IV Nature and Style of Sensible Writing: Positive, Negative and Interrogative sentences, Making polite requests, Letter writing: Format of a formal and Informal letters, Writing formal letters and informal letters, Describing.

UNIT–V Writing Practices: Reading comprehension , Precis writing, Essay writing.

Text Books

1. Academic writing: A handbook for International Students Bailey, Stephen. . Routledge, 2014.
2. Pathways: Listening, Speaking and Critical Thinking Chase, Becky Tarver. . Heinley ELT; 2nd Edition, 2018.
3. Skillful Level 2 Reading Writing Student's Book Pack (B10), Macmillan Educational.

References

1. Practical English Usage, Michael Swan. OUP. 1995.
2. Remedial English Grammar F.T. Wood., Macmillan.2007
3. Study Writing- Liz Hamp-Lyons and Ben Heasly., Cambridge University Press. 2006.
4. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad.
5. Technical Writing Sharon J.Gerson, Steven M.Gerson, , New Delhi: Pearson education, 2007.
6. Communication Skills Sanjay Kumar and Pushp Lata, , Noida: Oxford University Press, 2012.
7. Word Power Made Handy Dr. Shalini Verma, , S.Chand Co Ltd., 2009.

Web Resources

1. https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-hs27/
2. https://libguides.ecu.edu/c.php?g=17496p=97710
3. https://www.kau.edu.sa/files/0013287/subjects/academic-writing-handbook-international-students-3rd-ed%20(2).pdf

Course Outcomes

At the end of course, the student will be able to

1. Express their feelings using relevant vocabulary.
2. Apply the use of cohesive devices for better reading comprehension.
3. Write appropriate structures on relevant topics.
4. Frame proper sentences using grammatical structures and correct word forms.

EC-114: C & Data Structures

I Year, I Semester

Department: ECE	Category Code: ESC
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Objectives

1. Student will able to understand computer programming language concepts and code with branching iterations.
2. Design modular programming recursive solution formulation using the concept of functions and arrays.
3. Ability to design well-structured programs with the concept of structures and pointers
4. To design and implement arrays, stacks, queues, and linked lists.

Syllabus

UNIT-I 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-II 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 recursion, Simple recursive and non recursive programs, Towers of Hanoi problem.

UNIT–III Arrays and Pointers: Arrays: Single and multidimensional Arrays, Character array as a string, string functions, Programs using arrays and string manipulation. Pointers: Pointers declarations, Pointer expressions, Pointer parameters to functions. Pointers, Pointers and array, Pointer arithmetic.

UNIT–IV 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.

UNIT–V Linked Lists:Linked stacks and queues, Operations on polynomials, Doubly linked lists, Circularly linked lists, Dynamic storage management, Garbage collection and compaction, Searching and Sorting algorithms

Text Books

1. Programming in ANSI in C, E Balaguruswamy, Tata McGraw Hill
2. C Programming – AnithaGoel/Ajay Mittal/E.Sreenivasa Reddy-Pearson India
3. Computer Concepts and Programming in C, R.S. Salaria, Khanna Publishing

References

1. Problem Solving with C- Somasekharan-PHI.
2. C Programming- Behrouz A forouzan – CENGAGE Learning
3. Let us C, Yashavant P. Kanetkar, BBP Publications, Delhi

Web Resources

1. https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-cs25/
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-s096-introduction-to-c-and-c-january-iap-2013/lectures-and-assignments/data-structures-debugging/
3. https://www.javatpoint.com/data-structure-tutorial

Course Outcomes

At the end of course, the student will be able to

1. Explain the basic programming skills.
2. Choose data types and structures to solve mathematical and scientific problems.
3. Develop modular programs using control structures.
4. Analyze and interprets the concept of pointers, declarations, initialization, operations on pointers and their usage.
5. Demonstrate the concepts of Stack, Queue and Linked List and apply various operations on them.

EC-115: Network Theory

I Year, I Semester

Department: ECE	Category Code: ESC
Credits: 3	Internal marks: 30
L-T-P : 3-1-0	External marks: 70

Course Objectives

1. To introduce Kirchhoff's voltage and current laws to perform node and loop analysis in linear circuits.
2. To prepare the student to solve mathematical representations of simple RLC circuits.
3. To impart the concept of circuit analysis theorems and methods.
4. To teach the transient response and analysis of first and second order systems.
5. To make the student to understand the concepts of two-port networks.

Syllabus

UNIT-I Introduction to Electrical Circuits: Passive components and their V-I relations, Energy sources - Ideal, Non-ideal, Independent and dependent sources, Source transformation, Kirchoff's laws, Star–to-Delta or Delta-to-Star transformations, Mesh analysis and Nodal analysis problem solving, Super node and Super mesh for DC excitations.

UNIT-II Network Theorems: Superposition theorem, Thevenin and Norton theorems, Maximum power transfer theorem, Reciprocity theorem, Millmans theorem, Compensation theorem, Problem solving using dependent sources, Duality and Dual networks.

UNIT–III Transients: First order differential equations, Definition of time constants, R-L circuit, R-C circuit with DC excitation, Evaluating initial conditions procedure, Second order differential equations, Homogeneous, non-homogenous, problem solving using R-L-C elements with DC excitation and AC (sinusoidal) excitation.

UNIT–IV Resonance and Coupled Circuits: Self inductance, Mutual inductance, dot rule, coefficient of coupling, Analysis of multi-winding coupled circuits, series parallel connection of

coupled inductors. Resonance: Introduction, Definition of Q, Series resonance, Bandwidth of series resonance, Parallel resonance, Condition for maximum impedance, current in anti resonance, Bandwidth of parallel resonance, general case of resistance present in both branches, anti resonance at all frequencies.

UNIT–V Two Port Networks and Network Functions: Two Port Networks, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters, hybrid and inverse hybrid parameters, relationship between parameters, interconnection of two port networks. Concept of complex frequency, driving point and transfer functions for one port and two port network, poles zeros of network functions.

Text Books

1. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013.
2. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.

References

1. D. Roy Choudhury, "Networks and Systems", New Age International Publications,1998.
2. Network lines and Fields by John. D. Ryder 2nd edition, Asia publishing house.
3. Bhise, Chadda, Kulshreshtha, "Engineering network analysis and filter design" Umesh Publication, 2000.
4. Joseph Edminister and Mahmood Nahvi, "Electric Circuits", Schaum's Outline Series, Fourth Edition, Tata McGraw Hill Publishing Company, New Delhi, 2003.

Web Resources

1. https://nptel.ac.in/courses/108/105/108105159/
2. https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-022-introduction-to-network-models-fall-2018/
3. https://pdf-ebooks-for-free.blogspot.com/2015/01/network-theory-by-alaxender-and-sadiku.html

Course Outcomes

At the end of course, the student will be able to

1. Use network techniques, like node analysis and loop analysis, to write equations for large linear circuits.
2. Apply network theorems to solve/analyze electrical networks.

3. Analyze the concepts of linearity and the associated technique of superposition principle.
4. Evaluate the concept of steady state analysis of electrical systems.
5. Apply phasor analysis to AC circuits in sinusoidal steady state.

EC-151: Professional Communication Skills Lab

I Year, I Semester

Department: ECE	Category Code: HSS LAB
Credits: 1.5	Internal marks: 30
L-T-P : 0-0-3	External marks: 70

Course Objectives

1. To make the students aware to different kinds of learner-friendly modes of language to a variety of self-instructional learning.
2. To make the students enhance their communicative competence and equip students with interactive skills.
3. To make the students get clear understanding and learn correct usage of rules and regulations of grammar.
4. To achieve a reasonably good level of competency in writing, Group Discussions and Public speaking.

List of Modules

Module-1 Phonetics:

a) Introduction to Phonetics

b) Vowels and Consonants

c) Accent, Intonation and Rhythm

Module-2 Listening Comprehension:

a) Comprehending Spoken material in British English

b) Comprehending Spoken material in American English

c) Intelligent listening in situations

Module-3 Every Day Situations: Conversation and Dialogues:

a) Introducing oneself others

b) Asking for giving permissions

c) Asking for and responding to give directions

d) Seeking request

e) Inviting and responding invitations

f) Apologizing

Module-4 Interview Skills:

a) Introduction and Definition

b) Process of Interviews

c) Stress Interview

d) Technical Interview

Module-5 Presentation Skills:

a) Extempore (JAM) Sessions

b) Group discussion

c) Identification of Source Material

d) Arrangement of Collected Data Elocution

e) Paper Presentation

Course Outcomes

At the end of course, the student will be able to

1. Realize the importance of communication skills in job arena to enhance the students ability to communicate.

2. Realize the importance of body language while communicating with others in professional life.
3. Acquire the ability to participate in all recruitment procedures.
4. Communicate effectively over a phone and proficient to demonstrate telephoning skills.

EC-152: Engineering Chemistry Lab

I Year, I Semester

Department: ECE	Category Code: BSC LAB
Credits: 1.5	Internal marks: 30
L-T-P : 0-0-3	External marks: 70

Course Objectives

1. Verify the fundamental concepts of Engineering Chemistry with experiments

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 Dichrometry
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 conductometry
9. Acid-Base titration by PH meter
10. Acid-Base titration by Potentiometer
11. Determination of viscosity of lubricating oil
12. Determination of Surface tension

Course Outcomes

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

1. Measure the strength of an acid present in secondary batteries.
2. Determine the cell constant and conductance of solutions.
3. Prepare advanced polymer materials.
4. Determine the physical properties like surface tension, adsorption and viscosity.
5. Estimate the Iron and Calcium in cement.

EC-153: C & Data Structures Lab

I Year, I Semester

Department: ECE	Category Code: ESC LAB
Credits: 1.5	Internal marks: 30
L-T-P : 0-0-3	External marks: 70

Course Objectives

1. To learn a programming language and problem solving techniques.
2. To develop programs using C.
3. To strengthen the ability to identify and apply the suitable data structure for the given real world problem.

List of Experiments

Program- 1:

Write a program

1. Which determines the largest and the smallest number that can be stored in different data types such as short, int., long, float and double.
2. To find greatest of three numbers using conditional operator.
3. To swap two numbers with and without temporary variable.
4. To use multiple unary increment and decrement operators in arithmetic expressions.

Program- 2:

Write a program

1. To find greatest of three numbers.
2. To find arithmetic operations using switch statement.

3. To count the number of digits in a given number.
4. To check whether a number is perfect or not.

Program- 3:

Write a program

1. To check whether a number is strong or not.
2. To check whether a number is armstrong or not.
3. To check whether a number is palindrome or not.
4. To print the Fibonacci series upto the given number.

Program- 4:

Write a program

1. To swap two variables using functions.
2. To perform menu driven arithmetic operations using functions.
3. To find the factorial of a number using recursive and non- recursive functions.
4. To find the Fibonacci series using recursive functions.
5. To find the solution for towers of Hanoi using recursive function.
6. To pass parameters to a functions using call by value and call by reference.

Program- 5:

Write a program on Arrays

1. To read n numbers and sort them.
2. To find the minimum and maximum numbers.
3. To read two matrices and find their sum, difference and product.

Program- 6:

Write a program on Strings

1. To demonstrate the use of string manipulation functions.
2. To sort the names in alphabetical order.

Program- 7:

Write a program using pointers

1. To read dynamic array and sort the elements.
2. To demonstrate pointer arithmetic.

Program- 8:

Write a program

1. To create student structure and read marks of three subjects and find the sum and total marks of the student.
2. To create 60 students record using the above student structure.
3. To implement complex structure, perform addition, subtraction and multiplication of two complex numbers.

Program- 9:

Write a program on Files

1. To append content of a file.
2. To display the content of a file.
3. To copy content of one file to other file.
4. To count the number of characters in a file.
5. To compare the contents of two files.

Program- 10:

Write a program to demonstrate Single Linked List.

Program- 11:

Write a program to demonstrate Double Linked List.

Program- 12:

Write a program to demonstrate Circular Linked List.

Program- 12:

Write programs to implement Stack and Queue.

Course Outcomes

At the end of course, the student will be able to

1. Implement the C code for a given algorithm and flowchart.
2. Implement programs using pointers and arrays.
3. Implement structures, perform pointer arithmetic, and use of pre-processor directives.
4. Experiment with file manipulation concepts.
5. Choose and implement efficient data structures and apply them to solve engineering problems.

EC-121: Mathematics-II

I Year, II Semester

Department: ECE	Category Code: BSC
Credits: 3	Internal marks: 30
L-T-P : 3-1-0	External marks: 70

Course Objectives

1. To teach concepts of differential equations and related methods.
2. To familiarize the techniques to solve partial differential equations in electronics engineering domain.
3. To teach the fundamentals of vector calculus and its applications.
4. To make the students aware about the relation between mathematics and engineering.

Syllabus

UNIT-I Linear Differential Equations of First Order: Exact, Reducible to exact differential equations, Linear and Bernoulli's equations, Applications: Orthogonal trajectories, Newton's law of cooling, Law of exponential growth and decay.

UNIT-II Linear Differential Equations of Higher Order: Non homogeneous equations of higher order with constant coefficients with Right hand side terms of the type: $e^{ax}, sinax, cosax, x^k, e^{ax}V(x)$ and $x^mV(x)$. Applications: Method of variation of parameters, Equations reducible to linear ODE with constant coefficients: Legendre's equation, Cauchy- Euler equation.

UNIT–III Partial Differential Equations and Applications: Introduction, Formation of PDE, Solution of PDE, Linear equations of first order, Non-linear equations of first order. Applications: Method of separation of variables, One dimensional wave, Heat equations and Laplacian equation.

UNIT–IV Vector Calculus and Vector Differentiation: Scalar and vector point functions, Del applied to scalar point functions, Gradient, Divergence, Curl, Vector identities.

UNIT–V Vector Integration: Line integral, Work done, Potential function, Area, Surface and volume integrals, Vector integral theorems (without proof) viz. Greens, Stokes and Gauss divergence and related problems

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.

References

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.

Web Resources

1. https://nptel.ac.in/courses/111/105/111105134/
2. https://ocw.mit.edu/courses/mathematics/18-02-multivariable-calculus-fall-2007/index.htm
3. https://soaneemrana.org/onewebmedia/ADVANCED%20ENGINEERING%20MATHEMATICS%20BY%20ERWIN%20ERESZIG1.pdf

Course Outcomes

At the end of course, the student will be able to

1. Determine the solutions of ordinary differential equations by applying different methods.
2. Solve the higher order differential equations and apply the same to the real world problems.
3. Acquire the knowledge on partial differential equations (wave, heat, and Laplace equations).
4. Explain the physical significance of gradient, divergence, and curl.
5. Apply Green's, Stoke's, and Gauss divergence theorems to evaluate double and triple integrals.

EC-122: Engineering Physics

I Year, II Semester

Department: ECE	Category Code: BSC
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Objectives

1. To explain electric and magnetic fields, Poisson's & Laplace equations.
2. To describe the nature of dielectric materials and boundary conditions of dielectric and magnetic fields.
3. To teach steady state magnetic forces, fields and magnetic potentials.
4. To derive magnetic forces between current elements and torque
5. To describe and analyze maxwell's equations and electromagnetic wave propagation in free space.

Syllabus

UNIT-I Mathematical Techniques: Vector algebra, Gradient, Divergence and curl, Line, Surface and volume integrals, Curvilinear co-ordinates, Dirac delta function, Theory of vector fields.

UNIT-II Electrostatics: Introduction, Coulomb's law and field intensity, Electric fields due to continuous charge distribution, Electric flux density, Gauss law, Electrical potential, Relation between E and V, Work and energy in electrostatics, Electric dipole and flux lines.

UNIT–III Electric Fields in Matter: Introduction, Properties of materials, Conduction, Surface charge and force on a conduction, Polarization in dielectrics, Diectric constant and strength, Linear, Isotropic and Homogeneous dielectrics, Boundary conditions, Poissons and Laplace equation, Resistance and Capacitance.

UNIT–IV Magneto Static Fieldds: Introduction, Biot-Savart law, Ampere's circuit law and application, Magnetic flux density, Maxwell's equations for static electro magnetic(EM) fields, Magnetic vector potential, Magnetic dipole, Magnetic boundary condition, Inductance.

UNIT–V Electrodynamics: Electromotive force, Ohm's law, Electromagnetic induction, Faraday's law, Energy in magnetic fields, Maxwell's equations, Boundary conditions, Wave equation.

Text Books

1. N.O. Sadiku, "Elements of Electromagnetics," Oxford Univ. Press, 4th ed., 2008.
2. David J. Griffiths, "Introduction to Electrodynamics", Pearson Education Inc., Fourth Edition, 2012.

References

1. David Halliday, Robert Resnick and Kenneth S. Krane, Physics, Vol. 2, John Wiley Sons, Inc., Fifth edition, 2002
2. W. Saslow, Electricity, magnetism and light, 2002.
3. John D. Krauss, "Electromagnetics", McGraw- Hill publications, 3rd ed., 1988.
4. Matthew William H. Hayt Jr. and John A. Buck, "Engineering Electromagnetics," TMH, 7th ed., 2006.

Web resources

1. http://alumni.media.mit.edu/ aggelos/papers/EM_Hayt_6th.pdf
2. https://nptel.ac.in/courses/108/106/108106073/
3. https://ocw.mit.edu/resources/res-6-002-electromagnetic-field-theory-a-problem-solving-approach-spring-2008/

Course Outcomes

At the end of course, the student will be able to

1. Define gradient, divergence and curl.
2. Explain laws of electromagnetics.
3. Compute electric field intensity, displacement and potential for various charge distributions.
4. Compare the relations between electrostatics and magneto-statics.
5. Analyze time-varying behaviour of electromagnetic wave.

EC-123: Electronic Devices and Circuits

I Year, II Semester

Department: ECE	Category Code: ESC
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Objectives

1. To teach the principles, models and the analysis of diodes in analog circuits with applications.
2. To make the students to understand the operation of BJTs and its configurations.
3. To make the student to understand the concepts of operating point and the load line analysis.
4. To teach the concepts of stability for different biasing circuits.
5. To familiarize with the principles of MOSFETs and their applications.

Syllabus

UNIT-I Semiconductor Devices and Characteristics: Introduction to semiconductor physics: Energy bands in semiconductor, Direct and indirect band-gap semiconductors, Carrier concentration in semiconductor, Drift and diffusion current, Hall effect, Mobility and resistivity, Generation and recombination of carriers; P-N junction Diode: Formation of P-N junction, Working of diode, I-V characteristics, Small signal switching models, Avalanche breakdown, Operation and characteristics of Zener diode, Schottky diode, Tunnel diodes, Varactor diode, PIN diode.

UNIT II: Applications of Diodes: Diode circuits: Half wave, Full wave and Bridge rectifiers, Filters, Voltage multiplier, Clipper circuits, Clamper circuits, Voltage regulator circuit using Zener diode.

UNIT–III: Bipolar Junction Transistors: Introduction, Transistor construction, Transistor operation, Transistor current components, Transistor as an amplifier, Common base configuration, Common emitter configuration, Common collector configuration, Limits of operation, Transistor specifications.

UNIT–IV Field Effect Transistors: Junction Field Effect Transistor (JFET) - Principle of operation, Volt ampere characteristics, Advantages of JFET over BJT, Introduction to MOSFETs - depletion and enhancement type MOSFETs, Operation and Volt-ampere characteristics.

UNIT–V BJT and FET Biasing: Need for biasing, Operating point, Load line analysis, Bias stabilization techniques: Fixed bias, Collector to base bias, Self-bias, Stabilization against variations in Ico, VBE and β for the self bias circuit, Bias compensation techniques, Thermal runaway and Thermal stability. FET Biasing: Biasing techniques: Fixed bias, Source self-bias, Voltage divider bias.

Text Books

1. Electronic Devices and Circuits – J.Millman, C.C.Halkias, and Satyabratha Jit Tata McGraw Hill, 2nd Ed., 2007.
2. Neamen, Donald A. Semiconductor physics and devices: basic principles. New York, NY: McGraw-Hill,, 2012.

References

1. Electronic Devices and Circuits – R.L. Boylestad and Louis Nashelsky, Pearson/Prentice Hall,9th Edition,2006.
2. Electronic Devices and Circuits – Dr. K. Lal Kishore, B.S. Publications, 2nd Edition, 2005.
3. Electronic Devices and Circuits – T.F. Bogart Jr., J.S.Beasley and G.Rico, Pearson Education, 6th edition, 2004.
4. Principles of Electronic Circuits – S.G.Burns and P.R.Bond, Galgotia Publications, 2nd Edn.., 1998.
5. Microelectronics – Millman and Grabel, Tata McGraw Hill, 1988.

Web Resources

1. https://nptel.ac.in/courses/117/103/117103063/
2. http://conceptselectronics.com/diodes/structure-pn-junction-diode/
3. http://ecee.colorado.edu/ bart/book/pncap.htm

Course Outcomes

At the end of course, the student will be able to

1. Explain fundamentals of semiconductor physics.

2. Apply the principles of modern physics to analyze the operation of semiconductor diodes and transistors.
3. Evaluate the transistor (BJT and FET) configurations, and plot their characteristics.
4. Compare the performance of BJTs and FETs.
5. Design electronic circuits using diodes, BJTs, and FETs.

EC-124: Python Programming

I Year, II Semester

Department: ECE	Category Code: ESC
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Objectives

1. To make the students to understand the concept of programming skills in python.
2. To make the students to understand the concepts of functions in python.
3. To learn using of different data types in python.
4. To impart knowledge on object oriented skills in python.

Syllabus

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, 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.

Text Books

1. Taming Python by Programming, Jeeva Jose, Khanna Publishing House.
2. Learning To Program With Python Richard L. Halterman.

References

1. Core Python Programming by Dr. R.Nageswara Rao, dream tech, second edition.
2. Introduction to Computing and Problem Solving with Python, J. Jose, Khanna Publications.
3. Python Programming, Seema Thareja, Pearson.

Web Resources

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-0001-introduction-to-computer-science-and-programming-in-python-fall-2016/
2. https://www.w3schools.com/python/
3. https://nptel.ac.in/courses/106/106/106106145/

Course Outcomes

At the end of course, the student will be able to

1. Interpret the fundamental python syntax and semantics and be fluent in the use of Python control flow statements.
2. Express proficiency in the handling of strings and functions.
3. Determine the methods to create and manipulate Python programs by utilizing the data structures.
4. Identify the commonly used operations involving file systems and regular expressions.
5. Demonstrate the Object-Oriented Programming concepts.

EC-125: Engineering Graphics

I Year, II Semester

Department: ECE	Category Code: ESC
Credits: 3	Internal marks: 30
L-T-P : 1-0-3	External marks: 70

Course Objectives

1. To introduce the use and the application of drawing instruments and to make the students construct the polygons, curves and the student will be able to understand the need to enlarge or reduce the size of objects in representing them.
2. To make the students to draw the projection of points and lines inclined to one principle plane and inclined to both the planes.
3. To make the students draw the projections of the various types of solids in different positions inclined to one of the planes.
4. To make the students draw the development of surfaces of regular solids.
5. To represent the object in 3D view through isometric views. The student will be able to represent and convert the isometric view to orthogonal view and vice versa.

Syllabus

UNIT-I Manual Drawing: Introduction to engineering graphics, Principles of engineering graphics and their significance, Conventions in drawing, lettering, BIS conventions. Dimensioning principles and conventional representations: Conic sections including the rectangular hyperbola (general method only), Cycloid, Epicycloids and Hypocycloid , 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. Projections of solids: Projections of regular solids inclined to one or both planes by rotational.

UNIT–III Sections of Solids: Section planes and Sectional view of right regular solids- Prism, Cylinder, Pyramid and Cone. True shapes of the sections. Development of surfaces: Development of surfaces of right regular solids-Prism, Cylinder, Pyramid, Cone and their sectional parts.

UNIT–IV Orthographic Projections: Systems of projections, Orthographic projections (Simple Figures).

UNIT–V Isometric Projections: Principles of isometric projection, Isometric scale, Isometric views: Lines, Planes, Figures, Simple and compound solids.

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.

References

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.

Web Resources

1. https://nptel.ac.in/courses/112/105/112105294/
2. https://ocw.mit.edu/courses/mechanical-engineering/2-007-design-and-manufacturing-i-spring-2009/related-resources/drawing_and_sketching/
3. https://www.udemy.com/course/ed/

Course Outcomes

At the end of course,the student will be able to

1. Construct regular polygons and engineering curves(Ellipse, parabola, Hyperbola, Cycloids and involutes).
2. Draw the orthographic projections of the points, planes and lines parallel to one plane, inclined to one principle plane and inclined to both the planes.
3. Draw orthographic projections of solids in simple positions and inclined to one plane.

4. Draw the development of surface of solids like prism, cylinder, pyramid and cones.
5. Visualize and draw engineering objects in 3D view through isometric views and convert isometric to orthographic and vice versa.

EC-161: Engineering Physics Lab

I Year, II Semester

Department: ECE
Credits: 1.5
L-T-P : 0-0-3

Category Code: BSC LAB
Internal marks: 30
External marks: 70

Course Objectives

1. Make the students to learn about Compound, Hall effect and A.C Sonometer.
2. Familiarize the students to know the Electrical, Magnetic and Light experiments.
3. Learn the important experimental techniques in Physics lab which related to theoretical concepts.
4. Understand the various Instruments of Physic lab.

List of Experiments

1. Determination of radius of curvature of plano convex lens by Newton's rings method
2. Determination of wavelength by using plane diffraction grating.
3. Determination of dispersive power of a Prism
4. Determination of wavelength of given Laser source
5. Determination of numerical aperture of a given optical fiber and hence to find its acceptance angle
6. Photo cell – I-V Characteristic curves and determination of stopping potential
7. Hall effect –Determination of Hall Coefficient
8. Photo voltaic cell - Determination of fill-factor
9. Determination of energy gap of a semiconductor
10. Measurement of resistance with varying temperature

11. Carey- Foster's bridge: Determination of specific resistance/Temperature coefficient of resistance.
12. Magnetic field along the axis of a circular coil carrying current.
13. Series LCR resonance circuit - Determination of "Q" factor
14. Determination of frequency of A.C supply using Sonometer
15. Determination of acceleration due to gravity by using compound Pendulum

Course Outcomes

At the end of course, the student will be able to

1. Handle optical instruments like microscope and spectrometer.
2. Use CRO, Function generator, Hall apparatus setup, Telescope, and Spectrometer for making measurements.
3. Determine the given parameters by using the various instruments of physics lab related to theoretical concepts.
4. Develop skills in experimental design.
5. Demonstrate measurement of electrical parameters such as Q factor, specific resistance and frequency.

EC-162: Electronic Devices and Circuits Lab

I Year, II Semester

Department: ECE	Category Code: PC LAB
Credits: 1.5	Internal marks: 30
L-T-P : 0-0-3	External marks: 70

Course Objectives

1. To study the application of electronic components.
2. To identify and test various electronic components.
3. To use various measuring instruments.
4. To plot the input-output characteristics of diodes and transistors (BJTs and FETs) and to demonstrate the performance of different biasing techniques.

List of Experiments

1. Study of Cathode Ray Oscilloscope
2. Verify the V-I characteristics of PN Junction diode.
3. Verify the V-I and regulation characteristics of Zener diode.
4. Obtain the input and output characteristics of Common Base configuration.
5. Obtain the input and output Characteristics of Common Emitter configuration
6. Obtain the input and output Characteristics of Emitter follower circuit
7. Obtain Drain and Transfer characteristics of Junction Field Effect Transistor.
8. Plot the Drain and Transfer Characteristics of Depletion MOSFET.
9. Plot the Drain and Transfer Characteristics of Enhancement MOSFET.
10. Design and verification of Self bias circuit.
11. Verify the characteristics of LDR and Thermistor.

12. Verify the characteristics of Source follower circuit.
13. Design and verification of collector to base bias circuit
14. Design and verification of Current Source Bias Circuit

Course Outcomes

At the end of laboratory course, the student will be able to

1. Demonstrate the characteristics of PN junction and Zener diodes.
2. Analyze the input-output characteristics of BJT and FET.
3. Design the biasing mechanisms for transistors .
4. Demonstrate the characteristics of LDR and Thermistor.
5. Implement mini electronic projects using diodes and transistors.

EC-163: Python Programming Lab

I Year, II Semester

Department: ECE	Category Code: ESC LAB
Credits: 1.5	Internal marks: 30
L-T-P : 0-0-3	External marks: 70

Course Objectives

1. To interpret the use of procedural statements like assignments, conditional statements, loops and function calls.
2. To infer the supported data structures like lists, dictionaries and tuples in Python.
3. To describe the importance of Object-Oriented Programming concepts in Python.

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 Square Root of a given number without using inbuilt functions in Python.
5. Design a Python Script to convert a given number to words
6. Design a Python Script to convert a given number to roman number.
7. Design a Python script to generate statistical reports(Minimum, Maximum, Count,Average, Sum etc) on public data sets.
8. 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 categorizing them into distinction, first class, second class, third class and failed.

9. Design a Python script to search an element in the given list.
10. Design a Python script on string methods and list methods.

Course Outcomes

At the end of course, the student will be able to

1. Evaluate the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python.
2. Express different Decision Making statements and Functions.
3. Interpret Object oriented programming methodology in Python.
4. Implement string and list manipulations.
5. Demonstrate Graphic libraries.

EC-211: Mathematics-III

II Year, I Semester

Department: ECE	Category Code: BSC
Credits: 3	Internal marks: 30
L-T-P : 3-1-0	External marks: 70

Course Objectives

1. To make the student to learn the transformation techniques such as Fourier series and Fourier transforms.
2. To teach the concepts of basic complex analysis and their applications.
3. To teach how to relate Fourier series and Fourier transform.
4. To teach contour integral using parametrization, fundamental theorem of calculus and Cauchy's integral formula

Syllabus

UNIT-I 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-II 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), Parsevals identity for fourier transforms(without proof)

UNIT–III Complex Numbers and Functions: Complex numbers and their geometrical representation, Polar form of complex numbers, Powers and roots, Derivative, Analytic function, C-R equations, Laplace equation, Exponential function, Trigonometric and Hyperbolic functions, Logarithmic, Euler's formula, General power and principle value, Harmonic functions, Milne-Thomson method, Orthogonal systems, Applications to flow problems.

UNIT–IV Complex Integration:Integration of complex function, Line integral of a complex function, Cauchy's theorem (only statement), Cauchy's integral formula, Morare's theorem, Caushy's inequality, Liouville's theorem, Poison integral formula.

UNIT–V Series Expansions & Residue Theorem: Absolutely convergent and uniformly convergent of series of complex terms, Radius of convergence, Taylor's series, Maclaurin's series expansion, Laurent's series. Zeros of an analytic function, Singularity, Isolated singularity, Removable singularity, Essential singularity Calculation of residues, Residue theorem. Evaluation of real definite integrals: Integration around the unit circle, Integration around semi circle.

Text Books

1. B.S. Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 8th Edition, New Age International.

References

1. J.W. Brown and R.V.Churchil , Complex variables and applications – 8e- Mc Graw hills higher education.
2. N.P. Bali, A textbook of Engineering Mathematics, Laxmi publications

Web Resources

1. https://nptel.ac.in/courses/111/106/111106046/
2. https://ocw.mit.edu/resources/res-18-008-calculus-revisited-complex-variables-differential-equations-and-linear-algebra-fall-2011/part-i/lecture-1-the-complex-numbers/
3. https://easyengineering.net/higher-engineering-mathematics-by-b-s-grewal/

Course Outcomes

At the end of course, the student will be able to

1. Find the Fourier series expansion for periodic functions.
2. Examine the properties of Fourier transforms.
3. Use of the Cauchy residue theorem to evaluate complex integrals.
4. Evaluate the integrals bounded by a curve in a complex plane.
5. Apply Taylor's, Laurent's series expansions to obtain infinite series expansion of complex functions.

EC-212: Electronic Circuit Analysis

II Year, I Semester

Department: ECE
Credits: 3
L-T-P : 3-1-0

Category Code: PCC
Internal marks: 30
External marks: 70

Course Objectives

1. To describe the operation and analysis of BJT and FET.
2. To summarize operation principles and analysis of multi-stage amplifiers.
3. To introduce the concepts of power amplifiers
4. To provide an overview of amplifiers, feedback amplifiers and oscillators.

Syllabus

UNIT-I Single Stage Amplifiers: Classification of amplifiers, Distortion in amplifiers, Analysis of CE, CC and CB configurations with simplified hybrid model, Analysis of CE amplifier with emitter resistance and emitter follower, Miller's theorem and its dual, Design of single stage RC coupled amplifier using BJT. Multistage amplifiers: Analysis of cascaded RC coupled BJT amplifiers, Cascode amplifier, Darlington pair, Different coupling schemes used in amplifiers, RC coupled amplifiers, Transformer coupled amplifier, Direct coupled amplifier.

UNIT-II BJT Amplifiers - Frequency Response: Logarithms, Decibels, General frequency considerations, Frequency response of BJT amplifier, Analysis at low and high frequencies, Effect of coupling and bypass capacitors, The Hybrid pi model, Common emitter transistor model, CE Short Circuit current gain, current gain with resistive load, Single stage CE transistor Amplifier response, Gain, Bandwidth product, Emitter follower at high frequencies. MOS amplifiers: Basic concepts, MOS small signal model, Common source amplifier with resistive load.

UNIT–III Feedback Amplifiers: Concepts of feedback, Classification of feedback amplifiers, General characteristics of negative feedback amplifiers, Effect of feedback on amplifier characteristics, Voltage series, Voltage shunt, Current series and Current shunt feedback configurations, Illustrative examples. Oscillators: Classification of oscillators, Condition for oscillations, RC

Phase shift Oscillators, Generalized analysis of LC oscillators: Hartley and Colpitts oscillators, Wien bridge and crystal oscillators, Stability of oscillators

UNIT–IV Large Signal Amplifiers: Classification, Class A large signal amplifiers, Transformer coupled class A audio power amplifier, Efficiency of class A amplifier, Class B amplifier, Efficiency of class B amplifier, Class B push pull amplifier, Complementary symmetry class B push pull amplifier, Distortion of power amplifiers, Thermal stability and Heat sinks

UNIT–V Tuned Amplifiers: Introduction, Q factor, Small signal tuned amplifiers, Effect of cascading single tuned amplifiers on bandwidth, Effect of cascading double tuned amplifiers on bandwidth, Stagger tuned amplifiers, Stability of tuned amplifiers. Single tuned amplifiers: Introduction, Classification of small signal tuned amplifiers, Single tuned capacitance coupled amplifier, Tapped single tuned capacitance coupled amplifier, Single tuned inductively coupled amplifier, Double tuned amplifier.

Text Books

1. Jacob Milliman, Christos C. Halkias, Chetan D. Parikh (2015), Integrated Electronics-Analog and Digital Circuits and Systems, 2nd edition, Tata McGraw Hill Education Private Limited, New Delhi.
2. G. K. Mithall (1998), Electronic Devices and Circuits, Khanna Publishers, New Delhi.

References

1. Electronic Circuit Analysis – Rashid, Cengage Learning, 2013
2. Robert L. Boylestad, Louis Nashelsky (2006), Electronic Devices and Circuits Theory, 9th edition, Pearson/Prentice Hall, India.
3. Jacob Millman, Arvin Grabel (2003), Microelectronics, 2nd edition, Tata McGraw Hill, New Delhi.
4. Electronic Devices and Circuits – S. Salivahanan, N. Suresh Kumar, A. Vallavaraj, 2Ed., 2009, TMH.

Web Resources

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-and-electronics-spring-2007/video-lectures/
2. https://nptel.ac.in/courses/108/102/108102112/
3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-and-electronics-spring-2007/video-lectures/lecture-2/

Course Outcomes

At the end of course, the student will be able to

1. Explain the general operation of amplifiers, feedback circuits and oscillators.
2. Apply the concepts of feedback in various electronic circuits.
3. Analyze the frequency response of amplifiers.
4. Design single stage and multi stage amplifiers using transistors.
5. Design mini projects using BJTs and FETs for real time applications.

EC-213: Switching Theory and Logic Design

II Year, I Semester

Department: ECE	Category Code: PCC
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Objectives

1. To impart the essential knowledge on the fundamentals and applications of digital circuits and digital computing principles.
2. To provide an overview on the design principles of digital computing systems.
3. To provide technical knowledge about various digital hardware components.
4. To identify basic requirements for a design application and propose cost effective solutions.

Syllabus

UNIT-I Number System,Boolean Algebra and Switching Functions: Review of number systems, Complements of numbers. Codes: Binary codes, Binary coded decimal code and its properties, Unit distance codes, Error detecting and correcting codes. Boolean algebra: Basic theorems and properties, Switching functions, Canonical and standard form, Algebraic simplification of digital logic gates, Properties of XOR gates, Universal gates, Multilevel NAND/NOR realizations.

UNIT-II Minimization and Design of Combinational Circuits: Introduction, The minimization of switching function using theorem, The karnaugh map method-up to five variable maps, Don't care map entries, Tabular method. Design of combinational logic: Adders, Subtractors, Comparators, Multiplexers, Demultiplexers, Decoders, Encoders and Code converters, Hazards and Hazard free relations.

UNIT–III Sequential Machines Fundamentals and Applications: Introduction, Basic architectural distinctions between combinational and sequential circuits, The binary cell, Fundamentals of sequential machine operation, Latches, Flip flops: SR, JK, Race around condition in JK,JK

master slave, D and T type Flip flops, Excitation table of all flip flops, Design of a clocked flip-flop, Timing and Triggering consideration, Clock skew, Conversion from one type of flip-flop to another.Registers and Counters: Shift registers, Data transmission in shift registers, Operation of shift registers, Shift register configuration, Bidirectional shift registers, Applications of shift registers, Design and operation of ring and twisted ring counter, Operation of asynchronous and synchronous counters.

UNIT–IV Sequential Circuits - I: Introduction, State diagram, Analysis of synchronous Sequential circuits, Approaches to the design of synchronous sequential finite state machines, Synthesis of synchronous sequential circuits, Serial binary adder, Sequence detector, Parity-bit generator, Design of asynchronous counters, Design of synchronous modulo N –counters.

UNIT–V Sequential Circuits - II: Finite state machine capabilities and limitations, Mealy and Moore models, Minimization of completely specified and incompletely specified sequential machines, Partition techniques, Merger chart methods, Concept of minimal cover table.

Text Books

1. Switching and Finite Automata Theory- Zvi Kohavi Niraj K. Jha, 3rdEdition, Cambridge
2. Digital Design- Morris Mano, 5rd Edition, Pearson

References

1. Modern Digital electronics RP Jain 4th Edition, McGraw Hill
2. Switching Theory and Logic Design – A Anand Kumar, 3rd Edition, PHI, 2013

Web Resources

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-042j-mathematics-for-computer-science-spring-2015/proofs/tp2-2/digital-logic-video/digital-logic/
2. https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-cs74/
3. https://www.pdfdrive.com/fundamentals-of-switching-theory-and-logic-design-d17528650.html

Course Outcomes

At the end of course, the student will be able to

1. Explain number systems and arithmetic operations.
2. Identify the importance of SOP and POS canonical forms in the minimization or other optimization of Boolean functions.

3. Evaluate functions using various types of minimizing algorithms like Boolean algebra, Karnaugh map or tabulation method.
4. Design the combinational & sequential logic circuits.
5. Apply the concepts of finite state machines to design complex digital circuits.

EC-214: Probability Theory and Stochastic Processes

II Year, I Semester

Department: ECE	Category Code: PCC
Credits: 3	Internal marks: 30
L-T-P : 3-1-0	External marks: 70

Course Objectives

1. To introduce the basic methodology of "probabilistic thinking" and to apply it to problems.
2. To understand basic concepts of probability theory and random variables
3. To teach concept of random process in time and frequency domains.
4. To differentiate time averages and statistical averages.

Syllabus

UNIT-I Probability and Random Variable: Probability introduced through sets ,Joint and Conditional probability, Independent events, Combined experiments and Bernoulli trials. Random variable: Introduction, Concept, Distribution and Density functions, Gaussian random variable, Other distribution and density examples, Conditional and Density functions.

UNIT-II Operations of a One Random Variable Expectation: Introduction, Expectation, Moments, Function that give moments, Transformations of a random variable, Problems.

UNIT–III Multiple Random variables and their Operations: Introduction, Vector random variables, Joint distribution and its properties, Joint density and its properties, Conditional distribution and Density, Statistical independence,, Distribution and density of a sum of random variables, Central limit theorem, Problems, Expected value of a function of random variable, Joint characteristic functions, Joint gaussian random variables, Transformations, Linear transformation of gaussian random variables and Complex random variables.

UNIT–IV Random Process: Introduction, The Random process concept, Stationarity and Independence, Correlation functions, Measurement of correlation functions, Gaussian random functions, Complex random process.

UNIT–V Spectral Characteristics of Random Processes: Introduction, Power density spectrum and its characteristics, Relation between power spectrum and autocorrelation functions, Cross – power density and its properties, Relationship between cross-Power spectrum and Cross-correlation function, Noise modelling, Power spectrum of complex processes. Linear Systems with Random Inputs: Introduction, Linear system fundamentals, Random signal response, System evaluation using random noise, Spectral characteristics of system response and Noise bandwidth.

Text Books

1. Probability, Random Variables Random Signal Principles - Peyton Z. Peebles, TMH, 4th Edition, 2001.
2. Probability, Random Variables Random Processes, Schaum's Outlines, Hwei HSU, TMH, 2009
3. Probability and Random Processes- Geoffrey Grimmett, David Stirzaker, Oxford , 3rd Edition, 2001

References

1. Probability Methods of Signal and System Analysis- George R. Cooper, Clave D. MC Gillem, Oxford, 3rd Edition, 1999.
2. Probability, Random Variables and Stochastic Processes- Athanasios Papoulis and S.Unnikrishna Pillai, PHI, 4th Edition, 2002.
3. Fundamentals of Applied Probability and Random Processes-Oliver C Lbe, Second Edition, 2014

Web Resources

1. https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-ma19/
2. https://ocw.mit.edu/courses/mathematics/18-445-introduction-to-stochastic-processes-spring-2015/
3. https://mrcet.com/downloads/ECE/PTSP.pdf

Course Outcomes

At the end of course, the student will be able to

1. Define probability and interpret probability by modeling sample spaces.
2. Estimate probability of random experiments for standard random variables.

3. Solve the problems involving multiple random variables.
4. Apply the concepts of random process in communication and signal processing.
5. Evaluate response of a linear system to random Process.

EC-215: Signals and Systems

II Year, I Semester

Department: ECE	Category Code: PCC
Credits: 3	Internal marks: 30
L-T-P : 3-1-0	External marks: 70

Course Objectives

1. To classify signals and systems from the electronics and communication engineering perspective.
2. To introduce the analysis of signals and systems in time and frequency domains.
3. To analyze Linear Time Invariant (LTI) systems using transform techniques.
4. To impart fundamentals for understanding of high-end courses such as signal processing, control systems and communications.

Syllabus

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.

UNIT-II Time-domain analysis of LTIC systems: Representation of LTIC systems, Representation of signals using dirac delta functions, Impulse response of a LTIC system, Convolution integral, Auto-correlation and Cross-correlation functions, Properties of correlation function.

UNIT–III Fourier Series and Fourier Transform: Trigonometric and exponential Fourier series, Representation of an arbitrary function over the entire interval: Fourier transform, Fourier transform of standard functions, Singularity functions, Fourier transform of periodic function, Properties of Fourier transform, Energy density spectrum.

UNIT–IV Signal Transmission through Linear Systems: Response of a Linear time invariant (LTI) system, Filter characteristics of linear systems, Distortion less transmission through a system, Signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics, Causality

and Poly-Wiener criterion for physical realization, Relationship between bandwidth and rise time. Energy and power spectral density, Sampling theorem and its implications.

UNIT–V Laplace Transform: The Laplace transform, Relationship between Laplace and Fourier transform, Region of Convergence, the inverse Laplace transform, Properties of Laplace transform, Applications of Laplace transforms, Stability analysis of LTI system.

Text Books

1. A V Oppenheim, A S Wilsky and IT Young, Signals and Systems, PHI/ Pearson,2003
2. Mandal, Mrinal Kr, and Amir Asif. Continuous and discrete time signals and systems, Cambridge University Press, 2007.

References

1. B P Lathi, Signals, Systems and Communications, BSP, 2003
2. Simon Haykin, Signals and Systems, John Wiley, 2004
3. David K Cheng, Analysis of Linear Systems, Narosa Publishers, 1990.

Web Resources

1. https://nptel.ac.in/courses/117/101/117101055/
2. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/video-lectures/
3. https://eee.guc.edu.eg/Courses/Communications/COMM401%20Signal%20%20System%20Theory/Alan%20V.%20Oppenheim,%20Alan%20S.%20Willsky,%20with%20S.%20Hamid-Signals%20and%20Systems-Prentice%20Hall%20(1996).pdf

Course Outcomes

At the end of course, the student will be able to

1. Explain mathematical description and representation of continuous and discrete time signals and systems.
2. Develop input-output relationship for linear shift invariant system.
3. Illustrate the convolution operator for continuous and discrete time system.
4. Resolve the signals in frequency domain using Fourier series and Fourier transforms.
5. Evaluate the limitations of Fourier transform and need for Laplace transform.

EC-251: Electronic Circuit Analysis Lab

II Year, I Semester

Department: ECE
Credits: 1.5
L-T-P : 0-0-3

Category Code: PCC LAB
Internal marks: 30
External marks: 70

Course Objectives

1. To design and analyze the transistor at high frequencies.
2. To analyze multistage amplifiers at low, mid and high frequencies.
3. To design and experiment the power amplifiers with high efficiency.
4. To design and experiment oscillator circuits.

List of Experiments

Experiments Based on Electronic Circuits

1. Frequency response of common base amplifier.
2. Frequency response of common gate amplifier.
3. Frequency response of common emitter amplifier.
4. Frequency Response of common source amplifier.
5. Measurement of parameters of Emitter follower and Source follower; $R_I, A_V, A_I R_O$.
6. Two Stage RC-coupled amplifier.
7. Study of Cascode amplifier.
8. Current series feedback topology
9. Voltage series feedback topology
10. RC Phase shift Oscillator
11. Class-A Power amplifier
12. Class-B complementary symmetry amplifier

Course Outcomes

At the end of course, the student will be able to

1. Analyze the performance of single and multistage amplifiers.
2. Verify the frequency response of BJT amplifier circuits.
3. Design/Validate the RC coupled amplifier.
4. Experiment and compute different parameters of a two port networks.
5. Design/Validate power amplifier circuits.

EC-252: Digital Logic Design Lab

II Year, I Semester

Department: ECE	Category Code: PCC LAB
Credits: 1.5	Internal marks: 30
L-T-P : 0-0-3	External marks: 70

Course Objectives

1. To provide hands-on experience in designing of digital circuits using integrated circuits (ICs).
2. To investigate the operation of several combinational and sequential circuits.

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 3 to 8 decoder.
6. Applications of parallel adder (1's and 2's compliment addition).
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)using flip-flops.
11. Design of ring johnson counters using flip-flops.

12. Conversion of flip-flops (JK-T, JK-D).
13. Design of binary/decade counter
14. Design of asynchronous counter, mod counter, up counter, down counter up/down counter.
15. Design of synchronous counter, mod counter, up counter, down counter up/down counter.

Course Outcomes

At the end of course, the student will be able to

1. Verify Boolean expressions using digital logic gates.
2. Design the combinational circuits using logic gates.
3. Construct different sequential circuits using flip-flops and gates.
4. Experiment and verify the operation of counters and shift registers.
5. Design digital logic systems involving both combinational and sequential circuits.

EC-253: Signals and Systems Lab

II Year, I Semester

Department: ECE	Category Code: PCC LAB
Credits: 1.5	Internal marks: 30
L-T-P : 0-0-3	External marks: 70

Course Objectives

1. To provide a thorough understanding and analysis of signals and systems using octave.

List of Experiments

1. Write a program to generate the discrete sequences:
   (a) Unit step.
   (b) Unit impulse.
   (c) Ramp.
   (d) Periodic sinusoidal sequences.
2. Find the fourier transform of a square pulse. Plot its amplitude and phase spectrum.
3. Write a program to convolve two discrete time sequences. Plot all the sequences. Verify the result by analytical calculation.
4. Write a program to find the trigonometric fourier series coefficients of a rectangular periodic signal. Reconstruct the signal by combining the fourier series coefficients with appropriate weightings.
5. Write a program to find the trigonometric and exponential fourier series coefficients of a periodic rectangular signal. Plot the discrete spectrum of the signal.
6. Generate a discrete time sequence by sampling a continuous time signal. Show that with sampling rates less than Nyquist rate, aliasing occurs while reconstructing the signal.

7. 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.

   X(t)=cos (2π * 47t)+ cos(2π* 219t), 0<t<10

   X(t)= 0, otherwise.

8. Write a program to find the magnitude and phase response of first order low pass and high pass filter. Plot the responses in logarithmic scale.
9. Write a program to find the response of a low pass filter and high pass filter, when a real time signal is passed through these filters.
10. Write a program to find the autocorrelation and cross correlation of sequences.
11. Generate a uniformly distributed length 1000 random sequence in the range (0,1). Plot the histogram and the probability function for the sequence. Compute the mean and variance of the random signal.
12. Generate a Gaussian distributed length 1000 random sequence. Compute the mean and variance of the random signal by a suitable method.
13. Write a program to generate a random sinusoidal signal and plot four possible realizations of the random signal.
14. Generate a discrete time sequence of N=1000 i.i.d uniformly distributed random numbers in the interval (-0.5,-0.5) and compute the autocorrelation of the sequence.
15. Obtain and plot the power spectrum of the output process when a white random process is passed through a filter with specific impulse response.

Course Outcomes

At the end of course, the student will be able to

1. Generate and characterize various continuous and discrete time signals.
2. Perform the basic operations on continuous and discrete time signals.
3. Design linear time-invariant (LTI) systems and compute its response.
4. Analyze the spectral characteristics of signals using Fourier analysis.
5. Implement analog filters for real time signals.

EC-221: Mathematics-IV

II Year, II Semester

Department: ECE	Category Code: BSC
Credits: 3	Internal marks: 30
L-T-P : 3-1-0	External marks: 70

Course Objectives

1. To study the concepts of curvature, envolopes and curve tracing.
2. To introduce laplacian transformation techniques for solving ordinary differential equations.
3. To educate the students about Z-transforms and its applications in engineering.
4. To learn different numerical methods to solve non linear algebraic equations
5. To provide the learners with basic concepts and techniques of numerical computing to deal with real world application.

Syllabus

UNIT-I Radius of Curvature and Curve Tracing: Radius of curvature, Cartesian curves, Parametric equations at origin, Newton's formula, Polar curves, Pedal curves, Centre of curvature, Circle of curvature, Evaluates, Envelopes, Increasing and decreasing functions, Maxima and Minima, Practical problems, Asymptotes, Curve tracing, Cartesian, Parametric and Polar curves.

UNIT-II Laplace Transforms: Laplace transforms of standard functions, shifting theorems, transforms of derivative's and integrals, Unit step function, Dirac's delta function. Inverse laplace transforms, Convolution theorem (without proof), Solving ordinary differential equations (Initial value problems) using laplace transforms.

UNIT–III Z-Transforms: Definition of Z-transform, Elementary properties, Linearity property, Damping rule, Shifting to the right and left, Multiplication by n, Initial value theorem, Final value theorem, Inverse Z-transform, Convolution theorem, Solution of difference equations using Z-transforms.

UNIT–IV Numerical Solutions of Equations: Introduction, Solution of algebraic and transcendental Equations, Bisection method, Newton- Raphson Method, Iterative Methods. 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.

UNIT–V Numerical Integration and Solution of Ordinary Differential Equations: Trapezoidal rule, Simpson's one-third rule, Simpson's three-eighth. Numerical Solution of Ordinary Differential Equations: Introduction, Picard's Method, Euler's Method, Runge- Kutta method of fourth order.

Text Books

1. B. S. Grewal, Higher Engineering Mathematics, 43 edition, Khanna Publishers
2. Erwin Kreyszig, Advanced Engineering Mathematics, 8^{th} edition, New Age International (P) Ltd

References

1. N. P. Bali, A text book of Engineering Mathematics, Lakshmi publications
2. S. S. Sastry, Introductory Methods of Numerical Analysis, 5th edition, PHI learning (P) Ltd
3. N. P. Bali, Satyanarayana Bhvanari and Indrani Kelker, Lakshmi Publications, New Delhi.
4. Anthony C. Grove, An introduction to Laplace transform and the Z-transform, Prentice Hall, New York.(1991).

Web Resources

1. https://nptel.ac.in/courses/108/104/108104100/
2. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/video-lectures/lecture-22-the-z-transform/
3. https://easyengineering.net/higher-engineering-mathematics-by-b-s-grewal/

Course Outcomes

At the end of course, the student will be able to

1. Define the concepts of radius of curvature and envolopes.
2. Apply Laplace and Z transforms for solving differential and difference equations.
3. Compare the properties of Laplace and Z transforms.

4. Develop curve tracing methods in cartesian, polar, and parametric form.
5. Demonstrate the method of computing the rate of change of physical variables in engineering using numerical methods.

EC-222: Pulse and Digital Circuits

II Year, II Semester

Department: ECE	Category Code: PCC
Credits: 3	Internal marks: 30
L-T-P : 3-1-0	External marks: 70

Course Objectives

1. To introduce the linear wave shaping circuits.
2. To analyse the non linear wave shaping circuits.
3. To understand and design different types of multivibrators.
4. To analyse sampling gates and relaxation circuits.
5. To introduce time base generators and realization of logic gates using different logic families.

Syllabus

UNIT-I Linear Wave Shaping: High pass and low pass RC circuits, Response of high pass and low pass RC circuits to sinusoidal, Step, Pulse, Square, Exponential and Ramp inputs, High pass RC circuit as a differentiator, Low pass RC circuit as an integrator, Attenuators and its application as CRO probe.

UNIT-II Nonlinear Wave Shaping: Diode clippers, Transistor clippers, Clipping at two independent levels, Comparator, Applications of voltage comparators, Diode comparator, Clamping Operation, Clamping circuits using diode with different inputs, Clamping circuit theorem, Practical clamping circuits.

UNIT–III Multivibrators: Transistor as a switch, Switching times of a transistor, Design and analysis of fixed-bias and self-bias transistor, Bi-stable multivibrator, Commutating capacitors, Triggering schemes of Bi-stable multivibrator, Transistor schmitt trigger and its applications. Monostable and Astable multivibrators: Design and analysis of collector coupled monostable multivibrator.

UNIT–IV Sampling Gates and Digital Logic Gates:Basic operating principles of sampling gates, Unidirectional and bi-directional sampling gates, Four diode sampling gate, Reduction of pedestal in gate circuits, Six diode gate, Application of sampling gates.

Logic Gates: Realization of gates using diodes and transistors, RTL, DTL and CMOS.

UNIT–V Time Base Generators: General features of a time-base signal, Methods of Generating time base waveform, Exponential voltage sweep circuit, Basic principles of Miller and Bootstrap time base generators, Transistor miller sweep generator, Transistor bootstrap sweep generator, Current sweep circuit

Text Books

1. Pulse Digital and Switching Waveforms, J. Millman and H. Taub, McGraw-Hill, 2nd Edition 1991.
2. Pulse switching and digital circuits – David A.Bell,PHI ,5th Edn., oxford university press.

References

1. Pulse and Digital Circuits, K.VenkatRao, Pearson Education India, 2nd Edition, 2010.
2. Pulse and Digital Circuits, A. Anand Kumar, PHI, second edition, 2005.

Web Resources

1. https://nptel.ac.in/courses/117/101/117101106/
2. https://www.youtube.com/watch?v=aISoyZQFGKs
3. http://www.introni.it/pdf/Millman

Course Outcomes

At the end of course, the student will be able to

1. Explain the operation of linear and nonlinear circuits.
2. Interpret low pass and high pass RC circuits to sinusoidal and non-sinusoidal inputs.
3. Sketch the outputs of different clippers and clampers.
4. Design the multi-vibrator circuits using transistors.
5. Illustrate voltage & current sweep circuits and sampling gates.

EC-223: Electromagnetic Waves & Waveguides

II Year, II Semester

Department: ECE	Category Code: PCC
Credits: 3	Internal marks: 30
L-T-P : 3-1-0	External marks: 70

Course Objectives

1. To introduce the concepts of electrostatic and electromagnetic fields and their application in electrical and electronics engineering fields.
2. To derive Maxwell's equation in integral and differential form, their interpretation and applications.
3. To explain the propagation of EM wave in free space, conductors dielectrics.
4. To describe the fundamentals and essential features of waveguides and transmission lines.

Syllabus

UNIT-I Concept of Electromagnetism and Maxwell Equation: Basic of vector, Vector calculus: Gradient, Divergence, Curl, Line and surface integral. Basic law of Electromagnetic, Basic of Maxwell equation in integral and differential form, Boundary condition at media interface.

UNIT-II Uniform Plane Waves: Basic concept of uniform plane wave, Propagation of wave in free space, Wave polarization, Wave polarization at different interface, Wave propagation in dielectric and conducting medium, phase and group velocity, Pointing vector, Surface current and skin effect in a conductor.

UNIT–III Reflection and Refraction of Plane wave: Plane waves at a media interface, Plane wave in arbitrary direction, Reflection and refraction at dielectric interface, Total internal reflection, Reflection from a conducting boundary.

UNIT–IV Waveguides: Wave propagation in parallel plate waveguide: TE, TM, TEM Modes, Analysis of waveguide general approach, Mode analysis of Rectangular waveguide, Surface currents on the waveguide walls, Field visualization, Rectangular Cavity resonator and Q-factor.

UNIT–V Transmission Line Analysis: Transmission Line Equations, Primary & Secondary constants, Infinite line concepts, Lossless / Low loss characterization, Distortion condition for Distortion-less and minimum attenuation, Loading, Types of Loading, Input Impedance relations, SC and OC Lines, Reflection coefficient, SWR,$\lambda/4$, $\lambda/2$, $\lambda/8$ Lines, Impedance transformations, Load matching-Single stub, Smith chart and its applications.

Text Books

1. N.O. Sadiku, "Elements of Electromagnetics," Oxford Univ. Press, 4th ed., 2008.
2. E.C. Jordan and K.G. Balmain, Electromagnetic Waves and Radiating Systems –PHI,2_ndEdition,2000.

References

1. R.K.Shevgaonkar, " Electromagnetic Waves", McGraw Hill , 2017.
2. Inan, Umran S., Ryan K. Said, and Aziz S. Inan. "Engineering electromagnetics and waves. Pearson", 2014.

Web Resources

1. https://nptel.ac.in/courses/108/104/108104087/
2. https://ocw.mit.edu/courses/mechanical-engineering/2-71-optics-spring-2009/video-lectures/lecture-2-reflection-and-refraction-prisms-waveguides-and-dispersion/
3. https://www.pdfdrive.com/elements-of-electromagnetics-sadiku-e184804873.html

Course Outcomes

At the end of course, the student will be able to

1. Explain the phenomenon of plane wave propagation with the aid of Maxwell's equations.
2. Classify the Guided Wave solutions -TE,TM, and TEM
3. Analyze and design rectangular waveguides and understand the propagation of electromagnetic waves.
4. Evaluate the resonance frequency of cavity resonators and the associated modal field.
5. Analyze the transmission lines and their parameters using the Smith Chart.

EC-224: Analog and Digital Communication

II Year, II Semester

Department: ECE	Category Code: PCC
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Objectives

1. To provide knowledge on complete analysis of analog communications.
2. To provide the basic concepts of pulse modulation techniques.
3. To introduce the basic concepts of digital communication in baseband domains .
4. To introduce the basic concepts of digital communication in passband domains.
5. To give an exposure to coding techniques and spread spectrum communication.

Syllabus

UNIT-I Amplitude Modulation - Transmission and Reception: Principles of amplitude modulation, AM envelope, Frequency spectrum and bandwidth, Modulation index and percent modulation, AM power distribution, AM modulators and demodulators, AM transmitters, low level transmitters, high level transmitters, Receiver parameters, AM reception , AM receivers, TRF, Superheterodyne receiver, Double conversion AM receivers.

UNIT-II Angle Modulation - Transmission and Reception: Angle modulation, FM and PM waveforms, Modulation index, Frequency deviation, Phase and Frequency modulators and demodulators, Frequency spectrum of angle modulated waves, Bandwidth requirements for angle modulated waves, Average power of an angle-modulated wave, Frequency and phase modulators, Direct FM transmitters, Indirect transmitters, Angle modulation vs Amplitude modulation, FM receivers: FM demodulators, PLL FM demodulators, FM noise suppression, Frequency vs Phase modulation.

UNIT–III Digital Transmission: Introduction, Pulse modulation, PCM sampling, Sampling rate, Signal to quantization noise ratio, companding, Delta modulation, Adaptive delta modulation, Differential pulse code modulation, Pulse transmission – ISI, Eye pattern, Matched filter.

UNIT–IV Digital Communication: Introduction, Shannon limit for information capacity, Amplitude shift keying, Frequency shift keying, FSK bit rate and baud, FSK transmitter, BW consideration of FSK, FSK receiver, Phase shift keying, Binary phase shift keying, QPSK, Quadrature amplitude modulation, Bandwidth efficiency, Carrier recovery: Squaring loop, Costas loop, DPSK.

UNIT–V Spread Spectrum and Multiple Access Techniques: Introduction, Pseudo-noise sequence, DS spread spectrum with coherent binary PSK, Processing gain, FH spread spectrum, Multiple access techniques, Wireless communication, TDMA and FDMA, Wireless communication systems, Source coding of speech for wireless communications.

Text Books

1. Simon Haykin, "Communication Systems", 4^{th} Edition, John Wiley Sons., 2001.
2. Wayne Tomasi, "Electronic Communication Systems: Fundamentals Through Advanced", Pearson Education, 2001.

References

1. Blake, "Electronic Communication Systems", Thomson Delmar Publications, 2002.
2. Martin S.Roden, "Analog and Digital Communication System", 3^{rd} Edition, PHI, 2002.

Web Resources

1. https://nptel.ac.in/courses/117/105/117105143/
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-450-principles-of-digital-communications-i-fall-2006/
3. https://www.pdfdrive.com/communication-systems-e18773990.html

Course Outcomes

At the end of the course, the student will be able to

1. Acquire the knowledge about analog modulation techniques.
2. Apply the concept of analog pulse modulation.
3. Convert analog signal to digital signal for base-band transmission and apply proper techniques to retrieve the signal at the receiver.
4. Identify and analyze the performance parameters of various digital modulation techniques.
5. Describe the spread spectrum techniques for reliable communication.

EC-225: Professional Ethics and Human Values

II Year, II Semester

Department: ECE	Category Code: HSC
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Objectives

1. To teach the moral values that ought to guide the management profession, resolve the moral issues in the profession.
2. To justify the moral judgment concerning the profession.
3. Intended to develop a set of beliefs, attitudes, and habits that engineers should display concerning morality.
4. To create an awareness on management ethics and human values.
5. To inspire moral, social values and loyalty and to appreciate the rights of others.

Syllabus

UNIT-I Human Values: Morals, Values and ethics, Integrity, Work ethic, Service learning, Civic virtue, Respect for others, Living peacefully, Caring, Sharing, Honesty, Courage, Valuing time, Co-operation, Commitment, Empathy, Self confidence, Character, Spirituality.

UNIT-II Engineering Ethics: Senses of engineering ethics, Variety of model issues, Types of inquiry, Moral dilemmas, Moral autonomy, Kohlberg's theory, Gilligan's theory, Consensus and Controversy, Professions and Professionalism, Professional ideals and virtues, Theories about right action, Self-interest, Customs and Religion, Uses of ethical theories.

UNIT–III Engineering as Social Experimentation: Engineering as experimentation, Engineers as responsible experimenters, Codes of ethics, A balanced outlook on law. Safety, Responsibility and Rights: Safety and Risk, Assessment of safety and risk, Risk benefit analysis and reducing risk. Collegiality and Loyalty , Respect for authority, Collective bargaining, Confidentiality, Conflicts of interest, Occupational crime, Professional rights, Employee Rights, Intellectual property rights (IIPR), Discrimination.

UNIT–IV Global Issues: Multinational corporations, Environmental ethics, Computer ethics, Weapons development, Engineers as managers, Consulting engineering, Engineers as expert witnesses and Advisors.

UNIT–V Codes of Ethics: Moral leadership, Sample code of ethics like ASME, ASCE, IEEE, Institution of engineers (India), Indian institute of materials management, Institution of electronics and telecommunication engineers (IETE), India, etc.

Text Books

1. Mike Martin and Roland Schinzinger, Ethics in Engineering, McGraw Hill, New York 1996.
2. Govindarajan. M, Natarajan. S, Senthilkumar. V.S, Engineering Ethics, PHI, 2004.

References

1. Charles D Fleddermann, Engineering Ethics, Prentice Hall, New Jersey, 2004
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, Engineering Ethics Concepts and Cases, Thomson Learning, United States, 2000.
3. John R Boatright, Ethics and the Conduct of Business, PHI,New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, Fundamentals of ethics for Scientists and Engineers,Oxford University Press, 2001.

Web Resources

1. https://nptel.ac.in/courses/109/104/109104068/
2. https://www.youtube.com/watch?v=vS31O3XfH_0
3. http://course.sdu.edu.cn/G2S/eWebEditor/uploadfile/20131018102149728.pdf

Course Outcomes

At the end of course, the student will be able to

1. Aware of professional ethics and human values.
2. Discuss about Engineering Ethics and explain Ethical Theories and human values.
3. Make use of codes of ethics and related issues.
4. Apply risk assessment, global issues like environmental ethics, computer ethics in profession.
5. Define different Rights, ASME, ASCE, and IEEE.

EC-261: Pulse and Digital Circuits Lab

II Year, II Semester

Department: ECE	Category Code: PCC LAB
Credits: 1.5	Internal marks: 30
L-T-P : 0-0-3	External marks: 70

Course Objectives

1. To design and to verify pulse circuits.
2. To verify the functionality of digital circuits along with their applications.
3. To design multivibrators using transistors.
4. To design time base generators.
5. To design and verify clippers and clampers.

List of Experiments

1. Realization of Linear wave shaping (RC Integrator RC differentiator).
2. Realization of Non linear wave shaping – Clippers.
3. Realization of Non linear wave shaping – Clampers.
4. Design of transistor as a switch.
5. Design and verify Sampling Gates.
6. Verify the operation of Astable multivibrator using transistors.
7. Verify the operation of Monostable multivibrator using transistors.
8. Verify the operation of Bistable multivibrator using transistors.
9. Design a Schmitt trigger using transistor.
10. Verify the operation of UJT Relaxation oscillator.

11. Design and perform Bootstrap sweep circuit.
12. Design a constant current sweep generator using BJT.

Course Outcomes

At the end of course, the student will be able to

1. Process sinusoidal signals by using clippers and clampers.
2. Verify the linear wave shaping circuits excited by non sinusoidal inputs.
3. Design and analyze various multivibrator circuits.
4. Design and analyze UJT relaxation oscillator and boot-strap sweep circuits.
5. Design and verify sampling gates.

EC-262: Analog and Digital Communication Lab

II Year, II Semester

Department: ECE	Category Code: PCC LAB
Credits: 1.5	Internal marks: 30
L-T-P : 0-0-3	External marks: 70

Course Objectives

1. Familiarize the students with basic analog and digital communication systems. Integrate theory with experiments so that the students appreciate the knowledge gained from the theory course.

List of Experiments

1. Study of Amplitude Modulation and Demodulation.
2. Study of DSB SC Modulation and Demodulation.
3. Study of SSB SC Modulation and Demodulation.
4. Realization of Frequency Modulation and Demodulation.
5. Realization of Pre Emphasis - De Emphasis Circuits.
6. Verification of Sampling Theorem.
7. Design of PAM and Reconstruction.
8. Design of PWM and PPM: Generation and Reconstruction.
9. Generation and Detection of Time Division Multiplexing.
10. Generation and Detection of Pulse Code Modulation.
11. Generation and Detection of DM.
12. Generation and Detection of DPSK.
13. Generation and Detection of ASK, FSK and PSK.

Course Outcomes

At the end of course, student will be able to

1. Verify analog and digital modulation and demodulation schemes.
2. Design various pulse modulation techniques as PAM, PPM, PWM.
3. Experiment and verify ASK, FSK, and PSK schemes.
4. Analyze the response of pre-emphasis and de-emphasis.
5. Experiment and verify sampling theorem.

EC-263: Electronic Circuits Simulation Lab

II Year, II Semester

Department: ECE	Category Code: PCC LAB
Credits: 1.5	Internal marks: 30
L-T-P : 0-0-3	External marks: 70

Course Objectives

1. Simulate various electronic circuits.
2. To design various amplifier circuits.
3. To obtain the frequency response of various circuits.
4. To analyze the power amplifier circuits.

List of Experiments

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.
9. Design and simulate class A power Amplifier.
10. Simulate a RC phase shift and Weinbridge oscillator.
11. Design and simulate a constant resistance and bridged T equalizer.
12. Design and simulate cascode amplifier.

Course Outcomes

At the end of course, the student will be able to

1. Simulate and verify multistage feedback and power amplifiers.
2. Design and verify the frequency response of BJT amplifier circuits through simulation.
3. Design and simulate the RC coupled amplifier circuit.
4. Discriminate the design of oscillator circuits.
5. Simulate and verify power amplifier circuits.

EC-311: Microprocessors & Microcontrollers

III Year, I Semester

Department: ECE	Category Code: PCC
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Objectives

1. To introduce students with the architecture and operation of typical microprocessors and microcontrollers.
2. To familiarize the students with the programming and interfacing of microprocessors and microcontrollers.
3. To provide strong foundation for designing real world applications using microprocessors and microcontrollers.

Syllabus

UNIT-I 8086/8088 Processor: Features, Pin Diagram and Description, Architecture, Addressing Modes, Instruction Set and Assembly language Programming.

UNIT-II Programming Peripheral Interface and I/O Devices: Interfacing Programming peripheral interface PPI 8255, Bus architectures: PCI, ISA, VME, Interfacing memory and I/O Devices. LED and Switch interfacing to 8086 using 8255. Universal Synchronous Asynchronous Receiver Transmitter – Interfacing of 8251,RS-232 Communication standard.

UNIT–III Direct Memory Access and Interrupt system: DMA, Need of DMA, Memory management, Interfacing 8257, DMA controller, Interrupts, Programmable interrupt controller PIC-8259.

UNIT–IV Introduction to Micro-controllers: Overview of 8051 micro-controller, Architecture, I/O ports, Memory organization, addressing modes and instruction set of 8051, Simple programs.

UNIT–V 8051 Real Time Control: Programming Timer interrupts, programming external hardware interrupts, Programming the serial communication interrupts, Programming 8051 timers and counters, Communication Protocols: CAN, I2C, SPI.

Text Books

1. 1. Microprocessor and interfacing by Douglas V.Hall, McGraw Hill International Edition, 1992.
2. Kenneth.J.Ayala. The 8051 microcontroller, 3rd edition, Cengage learning,2010

References

1. The Intel microprocessor 8086/8088, 80186, 80286, 80386, and 80486 by Barry B. Brey, PHI, 1998.
2. Advanced microprocessors and peripherals-A.K ray and K.M.Bhurchandani, TMH, 2nd edition 2006.
3. 8086/8088 Microprocessors by Walter A. Tribel and Avtar Singh, PHI, 1991.

Course Outcomes

At the end of course, the student will be able to

1. Assess and solve basic binary math operations using the microprocessor and explain the internal architecture of processors and micro-controllers.
2. Apply knowledge and demonstrate programming proficiency using the various addressing modes and data transfer instructions of the target microprocessor and micro-controller.
3. Compare accepted standards and guidelines to select appropriate microprocessor/micro-controller to meet specified performance requirements.
4. Analyze assembly language programs, select appropriate assembler/cross assembler utility of a microprocessor and micro-controller.
5. Evaluate assembly language programs and download the machine code that will provide solutions real-world control problems.

EC-312: Control Systems

III Year, I Semester

Department: ECE	Category Code: PCC
Credits: 3	Internal marks: 30
L-T-P : 3-1-0	External marks: 70

Course Objectives

1. To get familiarized with type of system, dynamics of physical systems and classification of control system.
2. To introduce the concepts of system representation by using transfer function, block diagram reduction method and Mason's gain formula.
3. To learn time response analysis and demonstrate their knowledge to frequency response.
4. To identify stability analysis of system using Root locus, bode plot, polar plot, and Nyquist plot.

Syllabus

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, Linear time invariant, time variant systems and non-linear control systems.

UNIT-II 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, black diagram algebra, signal flow graph, Mason's gain formula Components of Control Systems: DC servo motor, AC servo motor, synchro transmitter receiver.

UNIT–III 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–IV 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–V Root Locus Technique: Introduction, construction of root loci, Introduction to Compensation Techniques State space analysis: Concepts of stat, state variables and state models, digitalization, solution of state equations, state models for LTI systems. Concepts of controllability and Observability.

Text Books

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

References

1. K. Ogata, Modern Control Engineering, 3rd edition, PHI.
2. Schaum Series, Feedback and Control Systems, TMH
3. M.Gopal, Control Systems Principles and Design, TMH
4. John Van de Vegta, Feedback Control Systems, 3rd edition, Prentice Hall,1993.

Course Outcomes

At the end of course, the student will be able to

1. Analyze the basic elements and structures of feedback control systems.
2. Explain block diagram reduction techniques and Mason's gain formulae.
3. Correlate the pole-zero configurations of transfer functions and their time-domain response.
4. Apply Routh-Hurwitz criterion, Root Locus, Bode Plot and Nyquist Plot to determine the stability of linear time- invariant systems.
5. Determine the steady-state response, errors of stable control systems and design compensators to achieve the desired Performance.
6. Express control system models using state space models.

EC-313: Analog and Digital ICs

III Year, I Semester

Department: ECE
Credits: 3
L-T-P : 3-0-0

Category Code: PCC
Internal marks: 30
External marks: 70

Course Objectives

1. To introduce the fundamentals of analog and digital integrated circuits.
2. To design methodologies of integrated circuits.
3. Describe the application areas of integrated circuits.

Syllabus

UNIT-I 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, input offset voltage, input bias current, input offset current, total output offset voltage, frequency response of op-amp, stability, slew rate.

UNIT-II Op-Amp Applications: The summing amplifier, Differential and instrumentation amplifiers, Voltage to current and current to voltage conversion, The Op-amp with complex impedances, Differentiators and integrators, Non Linear Op Amp circuits, Precision rectifiers. Comparators: Introduction to comparator, Basic comparator, Zero-crossing detector, Schmitt Trigger, Comparator characteristics, Limitations of Op-Amps as comparators, Voltage limiters.

UNIT–III Oscillators: Oscillator principles, Oscillator types, Frequency stability, Phase shift oscillator, Wein bridge oscillator, Quadrature oscillator, Square-wave generator, Triangular wave generator, Saw tooth wave generator, Voltage controlled oscillator. Clippers, Clampers Converters: Positive and negative clippers, Positive and negative clampers, Absolute value output circuit, Peak detector, Sample and hold circuit. D/A conversion fundamentals, Weighted resistor summing D/A Converter, R-2R Ladder D/A converter, A/D conversion: Ramp converters, Successive Approximation A/D converters, Dual slope converters, Parallel A/D converters. Tracking A/D converters.

UNIT–IV Introduction to Digital Integrated Circuits: Classification of Integrated Circuits. Standard TTL NAND Gate-Analysis Characteristics, TTL Open Collector Outputs. Tristate TTL, MOS, CMOS open drain and tristate outputs, Comparison of Various Logic Families. IC interfacing-TTL driving CMOS and CMOS driving TTL

UNIT–V Combinational and Sequential circut ICs: Use of TTL-74XX Series and CMOS 40XX Series ICs, TTL ICs - Code Converters, Decoders, Demultiplexers, Encoders, Priority Encoders, Multiplexers and their applications. Priority Generators, Arithmetic Circuit ICs-Parallel Binary Adder/Subtractor Using 2's Complement System, Magnitude Comparator Circuits.Commonly Available 74XX and CMOS 40XX Series ICs - RS, JK.JK Master-Slave. D and T Type Flip-Flops their Conversions, Synchronous and Asynchronous counters. Decade counters. Shift Registers and applications.

Text Books

1. D.Roy and Choudhury, ShailB.Jain, Linear Integrated Circuits, 2nd Edition, New Age International, 2003.
2. John F. Wakerly, Digital Design principles And Practices, Pearson Education , 3rd Edition, 2010.

References

1. Rama Kant A. Gayakwad, Op-Amps and Linear Integrated Circuits, 4 th Edition, PHI/ Pearson Education, 2003.
2. Floyd and Jain ,Digital Fundamentals -, Pearson Education,8th Edition, 2005.
3. J.Michael Jacob, Applications and Design with Analog Integrated Circuits, 2nd Edition, PHI, 2003.
4. RP Jain, Modern Digital Electronics - - 4/e - TMH, 2010.

Course Outcomes

At the end of course, the student will be able to

1. Explain the Integrated Circuit (IC) technology.
2. Compare different types of integrated circuits(SSI, MSI, LSI, VLSI).
3. Demonstrate the ability to design practical circuits using operational amplifiers.
4. Develop the systems building approach using analog and digital integrated circuits.
5. Choose the appropriate digital ICs to build a combinational and sequential systems.

EC-315-A: Data Communications & Networks

III Year, I Semester

Department: ECE	Category Code: PEC
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Objectives

This subject deal with the basic concepts of data communication, layered model, protocols and inter- working between computer networks and switching components in telecommunication systems.

1. To introduce the Fundamentals of data communication networks To demonstrate the Functions of various protocols of Data link layer.
2. To demonstrate Functioning of various Routing protocols.
3. To introduce the Functions of various Transport layer protocols.
4. To understand the significance of application layer protocols

Syllabus

UNIT-I Introduction to Data Communications: Components, Data Representation, Data Flow, Networks Distributed Processing, Network Criteria, Physical Structures, Network Models, Categories of Networks Interconnection of Networks, The Internet - A Brief History, The Internet Today, Protocol and Standards - Protocols, Standards, Standards Organizations, Internet Standards. Network Models, Layered Tasks, OSI model, Layers in OSI model, TCP/IP Protocol Suite, Addressing Introduction, Wireless Links and Network Characteristics, WiFi: 802.11 Wireless LANs -The 802.11 Architecture.

UNIT-II Data Link Layer: Links, Access Networks, and LANs- Introduction to the Link Layer, The Services Provided by the Link Layer, Types of errors, Redundancy, Detection vs Correction, Forward error correction Versus Retransmission Error-Detection and Correction Techniques, Parity Checks, Check summing Methods, Cyclic Redundancy Check (CRC) , Framing, Flow Control and Error Control protocols , Noisy less Channels and Noisy Channels, HDLC, Multiple Access

Protocols, Random Access ,ALOHA, Controlled access, Channelization Protocols. 802.11 MAC Protocol, IEEE 802.11 Frame

UNIT–III The Network Layer: Introduction, Forwarding and Routing, Network Service Models, Virtual Circuit and Datagram Networks-Virtual-Circuit Networks, Datagram Networks, Origins of VC and Datagram Networks, Inside a Router-Input Processing, Switching, Output Processing, Queuing, The Routing Control Plane, The Internet Protocol(IP):Forwarding and Addressing in the Internet- Datagram format, Ipv4 Addressing, Internet Control Message Protocol(ICMP), IPv6

UNIT–IV Transport Layer: PIntroduction and Transport Layer Services : Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing, Connectionless Transport: UDP -UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer-Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, GoBack-N(GBN), Selective Repeat(SR), Connection Oriented Transport: TCP - The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control - The Cause and the Costs of Congestion, Approaches to Congestion Control

UNIT–V Application Layer: Principles of Networking Applications, Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the File Transfer: FTP,- FTP Commands and Replies, Electronic Mail in the Internet- STMP, Comparison with HTTP, DNS-The Internets Directory Service, Service Provided by DNS, Overview of How DNS Works, DNS Records and messages.

Text Books

1. Computer Networking A Top-Down Approach â€“ Kurose James F, Keith W, 6th Edition, Pearson.
2. Data Communications and Networking Behrouz A. Forouzan 4th Edition McGraw-Hill Education

References

1. Data communication and Networks - Bhusan Trivedi, Oxford university press, 2016
2. Computer Networks – Andrew S Tanenbaum, 4th Edition, Pearson Education
3. Understanding Communications and Networks, 3rd Edition, W. A. Shay, Cengage Learning.

Course Outcomes

At the end of course, the student will be able to

1. Explain the concept of Data Communication and Networks.

2. Analyse protocol stack development issues for Communication networks.
3. Evaluate data communication link considering elementary concepts of data link layer protocols for error detection and correction.
4. Apply various network layer techniques for designing subnets and supernets.
5. Estimate the congestion control mechanism to improve QOS of a networking application.

EC-315-B: Information Theory and Coding

III Year, I Semester

Department: ECE	Category Code: PE
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Objectives

1. Understand and explain the basic concepts of information theory, source coding, channel and channel capacity, channel coding and relation among them.
2. Introduce the concept of amount of information, entropy, channel capacity, error detection and error correction codes, block coding, convolution coding, and Viterbi decoding algorithm.
3. Calculate entropy, channel capacity, bit error rate, code rate, and steady-state probability.
4. Implement the encoder and decoder of one block code or convolution code using any program language.

Syllabus

UNIT-I Introduction: 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. Source Codes: Shannon-fano coding, Huffman coding

UNIT-II 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–III 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–IV Convolutional Codes: Encoding of Convolutional Codes- Structural and Distance Properties, state, tree, trellis diagrams, 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–V BCH Codes: Minimum distance and BCH bounds, Decoding procedure for BCH codes, Syndrome computation and iterative algorithms, Error locations polynomials for single and double error correction.

Text Books

1. Error Control Coding- Fundamentals and Applications –Shu Lin, Daniel J.Costello,Jr, Prentice Hall, Inc 2014.
2. Error Correcting Coding Theory-Man Young Rhee, McGraw – Hill Publishing 1989

References

1. Digital Communications- John G. Proakis, 5th ed., , TMH 2008.
2. Introduction to Error Control Codes-Salvatore Gravano-oxford
3. Error Correction Coding – Mathematical Methods and Algorithms – Todd K.Moon, 2006, Wiley India.
4. Information Theory, Coding and Cryptography – Ranjan Bose, 2nd Edition, 2009, TMH

Course Outcomes

At the end of course, the student will be able to

1. Design the channel performance using Information theory.
2. Evaluate various error control code properties
3. Apply linear block codes for error detection and correction
4. Apply convolution codes for performance analysis cyclic codes for error detection and correction.
5. Formulate BCH RS codes for Channel performance improvement against burst errors.

EC-315-C: Electronic Measurements and Instrumentation

III Year, I Semester

Department: ECE	Category Code: PEC
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Objectives

1. The objective of the course is to introduce the fundamentals of Electronics Instruments and Measurement providing an in-depth understanding of Measurement errors, Bridge measurements, Digital Storage Oscilloscope, Function Generator and Analyzer, Display devices, Data acquisition systems and transducers.
2. To address the underlying concepts and methods behind Electronics measurements.

Syllabus

UNIT-I Measurement and Error: Definitions, Accuracy, Precision, Resolution and Significant Figures, Types of Errors, Measurement error combinations. Ammeters: DC Ammeter, Multirange Ammeter, The Ayrton Shunt or Universal Shunt, Requirements of Shunt, Extending of Ammeter Ranges, RF Ammeter (Thermocouple), Limitations of Thermocouple. Voltmeters and Multimeters: Introduction, Basic Meter as a DC Voltmeter, DC Voltmeter, Multirange Voltmeter, Extending Voltmeter Ranges, Loading, AC Voltmeter using Rectifiers. True RMS Voltmeter, Multimeter.

UNIT-II Digital Voltmeters: Introduction, RAMP technique, Dual Slope Integrating Type DVM, Integrating Type DVM, Most Commonly used principles of ADC, Successive Approximations, -Digit, Resolution and Sensitivity of Digital Meters, General Specifications of DVM, Digital Instruments: Introduction, Digital Multimeters, Digital Frequency Meter, Digital Measurement of Time, Universal Counter, Digital Tachometer, Digital pH Meter, Digital Phase Meter, Digital Capacitance Meter.

UNIT–III Oscilloscopes: Introduction, Basic principles, CRT features, Block diagram of Oscilloscope, Simple CRO, Vertical Amplifier, Horizontal Deflecting System, Sweep or Time Base Generator, Measurement of Frequency by Lissajous Method, Digital Storage Oscilloscope. Signal

Generators: Introduction, Fixed and Variable AF Oscillator, Standard Signal Generator, Laboratory Type Signal Generator, AF sine and Square Wave Generator, Function Generator.

UNIT–IV Measuring Instruments: Field Strength Meter, Stroboscope, Phase Meter, Q Meter, Megger. Bridges: Introduction, Wheatstone's bridge, Kelvin's Bridge; AC bridges, Capacitance Comparison Bridge, Inductance Comparison Bridge, Maxwell's bridge, Wien's bridge.

UNIT–V Transducers: Introduction, Electrical transducers, Selecting a transducer, Resistive transducer, Resistive position transducer, Strain gauges, Resistance thermometer, Thermistor, Inductive transducer, LVDT, Piezoelectric transducer, Photo cell, Photo voltaic cell, Semiconductor photo diode and transistor.

Text Books

1. Electronic Instrumentation, H. S. Kalsi, TMH, 2004
2. Electronic Instrumentation and Measurements, David A Bell, PHI / Pearson Education2006/ Oxford Higher Education, 2013.
3. Electrical and Electronic Measurements and Instrumentation – A. K. Sawhney, 17th Edition (Reprint 2004), DhanpatRai Co. Pvt. Ltd., 2004.

References

1. "Principles of Measurement Systems", John P. Beately, 3rdEdition, Pearson Education, 2000
2. "Modern Electronic Instrumentation and Measuring Techniques", Cooper D A D Helfrick, PHI, 1998.

Course Outcomes

At the end of course, the student will be able to

1. Identify the various parameters that are measurable in electronic instrumentation.
2. Employ appropriate instruments to measure given sets of parameters.
3. Practice the construction of testing and measuring set up for electronic systems.
4. Explain about instrumentation concepts which can be applied to Control systems.
5. Relate the usage of various instrumentation standards.

EC-315-D: Microelectromechanical Devices and Systems (MEMS)

III Year, II Semester

Department: ECE
Credits: 3
L-T-P : 3-1-0

Category Code: PEC
Internal marks: 30
External marks: 70

Course objectives

1. To provide the knowledge of the fabrication of different micro electronics system.
2. To understand the definition of micromachining and MEMS as well as an historical perspective of this emerging field.
3. To deal different topic related with the micro system, fabrication technology at micro level.
4. To learn applications of microelectromechanical devices and systems (MEMS).
5. To provide in-depth analysis of sensors, actuator principles, and integrated microfabrication techniques for MEMS.
6. To investigate the state-of-the-art MEMS devices and systems.

Syllabus

UNIT-I MEMS Materials and Fabrication Methods: An Introduction To Micro Sensors and MEMS, Evolution Of Micro Sensors And MEMS, Micro Sensors And MEMS Applications, Introduction To MOEMS. MEMS Materials Properties, Microelectronic Technology for MEMS, Micromachining Process, Etch Stop Techniques and Microstructure, Surface and Quartz Micromachining, fabrication of Micromachined Microstructure, Microstereolithography.

UNIT-II Micromatching and Sensors: Microelectronic Technologies For MEMS, Micromachining Technology, Surface, Bulk Micromachining, Other Micromachining Techniques, New Materials From MEMS ; Micro Machined Micro Sensors: Mechanical, Inertial, Biological, Chemical And Acoustic.

UNIT–III Basic MEMS Operating Principles: Mechanics, Dynamics, Electrostatics, Advanced MEMS Operating, Principles For Sensing And Actuation Including Piezoresistive, Piezoelectric, Thermo-Mechanical, Microfluidics: Flow, Heat And Mass, Transfer At Small Scales; Electro kinetics.

UNIT–IV Microsystems Technology: Microsystems Technology, Integrated Smart Sensors and MEMS, Interface Electronics for MEMS, MEMS Simulators, MEMS for RE Applications.

UNIT–V MEMS Technology: Wafer Bonding, Chemical Mechanical Polishing ,Bonding IC Packaging Of MEMS, Micro Scaling Considerations, Applications In Automotive Industry, Mechanical, Optical, Biomedical Chemical Transducers, Optical MEMS, Bio MEMS, Plastic MEMS. Multi Disciplinary Applications. Future Developments.

Text Books

1. Chang Liu, Foundations of MEMS
2. Stephen D. Senturia, "Microsystem Design", Kluwer Academic Publishers, 1st Ed., 2001.

References

1. Marc Madou, "Fundamentals of Microfabrication" , CRC Press, 1st Ed., 1997.
2. Gregory Kovacs, "Micromachined Transducers Sourcebook", WCB McGraw-Hill, Boston, 1 st Ed., 1998.
3. M. H. Bao, "Micromechanical Transducers: Pressure sensors, accelerometers, and gyroscopes" by Elsevier, New York, 1st Ed., 2000.
4. Julian W. Gardner, "Microsensors â€" Principles and Applications", John Wiley and Sons, inc., NY, 1st Ed., 1994.
5. Maluf N., "An Introduction to Micro electromechanical Systems Engineering", Norwood, MA: Artech House, 2000.
6. Julian W. Gardner, "Micro sensors - Principles and Applications", John Wiley and Sons, Inc.1997.
7. Ljubisa Ristic, "Sensor Technology and Devices", Artech House, 1994.

Course Outcomes

At the end of course, the student will be able to

1. Demonstrate sensors and actuator principles.
2. Explain integrated microfabrication techniques for MEMS.
3. Analyze spring-mass-damper systems for resonant frequency.

4. Analyze the strengths/weaknesses of a MEMS sensor/actuator approach.
5. Apply the principles of MEMS approach to deal real-time problems .

EC-351: Microprocessors & Microcontrollers Lab

III Year, I Semester

Department: ECE	Category Code: PCC LAB
Credits: 1.5	Internal marks: 30
L-T-P : 0-0-3	External marks: 70

Course Objectives

1. To study programming based on 8086 microprocessor and 8051 microcontroller.
2. To write Assembly language programs for various arithmetic and logical operations.
3. To interface 8086 with I/O and other devices.

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)
8. DAC Interface-Waveform generations.
9. Stepper Motor Control.
10. Keyboard Interface / LCD Interface.

11. Data Transfer between two PCs using RS.232 C Serial Port
12. Programs on Data Transfer Instructions using 8051 Microcontroller.
13. Programs on Arithmetic and Logical Instructions using 8051 Microcontroller.
14. Applications with Microcontroller 8051.

Course Outcomes

At the end of course, the student will be able to

1. Set up programming strategies and select proper mnemonics and run their program on the training boards.
2. Demonstrate ability to handle arithmetic and logical operations using assembly language programming in MASM and training boards.
3. Implement the algorithms for sorting and string manipulations in 8086 microprocessor.
4. Experiment with standard microprocessor real time interfaces including serial ports, digital-to-analog converters and analog-to-digital converters.

EC-352: Linear IC Applications Lab

III Year, I Semester

Department: ECE
Credits: 1.5
L-T-P : 0-0-3

Category Code: PCC LAB
Internal marks: 30
External marks: 70

Course Objectives

1. To Gain the practical hands-on experience of various analog IC circuits terminal voltage regulators.

List of Experiments

1. Design of op-amp Adder and Subtractor.
2. Verify op-amp as Integrator and Differentiator.
3. Design of precision Rectifiers.
4. Verify the operation of op-amp as a Comparator.
5. Realise op-amp as a Clipper and Clamper.
6. Generate a Triangular waveform using op-amp.
7. Design an Astable Multivibrator using 555 Timer.
8. Design an Monostable Multivibrator using 555 Timer.
9. Design of LPF, HPF, BPF and Band Reject Filters.
10. Design of IC-723 Voltage Regulator.
11. Verify the operation of a 4-bit R -2R ladder DAC.
12. Verify the operation of Flash Type ADC.
13. Design an Instrumentation amplifier using op-amp.

Course Outcomes

At the end of course, the student will be able to

1. Design various op-amp circuits that perform linear applications.
2. Analyse the non-linear application of op-amp.
3. Design and obtain filter circuits and their frequency response using op-amp.
4. Calculate frequency generators using op-amp.
5. Design and analyse the various application of 555 timer.

EC-321: Microwave Engineering and Antennas

III Year, II Semester

Department: ECE
Credits: 3
L-T-P : 3-1-0

Category Code: PCC
Internal marks: 30
External marks: 70

Course Objectives

1. To provide the framework for students to attain the necessary background in electromagnetics for solving design problems in microwave circuits and antennas.
2. To teach design of antennas arrays for various microwave applications.
3. To impart knowledge on microwave networks using impedance, admittance, transmission and scattering matrix representations.
4. To develop an ability to understand the functionality of various microwave solid state active devices.

Syllabus

UNIT-I Antenna Fundamentals: Introduction, Basic antenna Parameters – Radiation Patterns, Beam Area, Radiation Intensity, Beam Efficiency, directivity, Gain and Resolution, Antenna Apertures, Aperture Efficiency, Effective Height. Related Problems. Fields from Oscillating Dipole, field zones, shape impedance considerations, Antenna temperature, Front to back ratio, Antenna Theorems. Antenna Arrays: Point sources-definitions, patterns,2 element arrays - different cases, Principle of Pattern Multiplication, N element Uniform Linear Arrays, Broadside, End fire Arrays, EFA with Increased Directivity, Derivation of their characteristics and comparison, BSA's with non-uniform amplitude distributions- Binomial Arrays, illustrative problems.

UNIT-II VHF, UHF and Microwave Antennas - I: Frequency dependent and independent antenna's, Arrays with Parasitic Elements, Folded Dipoles their characteristics, Yagi - Uda Arrays, Helical Antennas - Significance, Geometry, basic properties; Axial Mode and Normal Modes. Horn Antennas- Types, Optimum Horns.

UNIT–III VHF, UHF and Microwave Antennas - II: Micro strip Antennas- Rectangular patch antennas- geometry and parameters, characteristics of micro strip antenna. Reflector Antennas:

Flat Sheet and Corner Reflectors. Parabolic Reflectors : Geometry, characteristics, feeding methods. Measurement of Microwave antenna parameters: Impedance, pattern, gain and directivity.

UNIT–IV Microwave Tubes:Limitations and Losses of conventional Tubes at Microwave Frequencies, Microwave Tubes — O Type and M Type Classifications, O-type Tubes : 2 Cavity Klystrons Structure, Reentrant Cavities, Velocity Modulation Process and Applegate Diagram, Bunching Process and Small Signal Theory, Expressions for O/P Power and Efficiency. Reflex Klystrons Structure, Velocity Modulation and Applegate Diagram, Mathematical Theory of Bunching, Power Output, Efficiency, Oscillating Modes and 0/P Characteristics, Effect of Repeller Voltage on Power O/P, Illustrative Problems, Structure of TWT and Amplification Process (qualitative treatment), Suppression of Oscillations, Gain Considerations

UNIT–V Microwave Measurements:Scattering Matrix— Significance, Formulation and Properties, S Matrix Calculations for — 2 port Junctions, E plane and H plane Tees, Magic Tee, Circulator and Isolator, Illustrative Problems. Description of Microwave Bench — Different Blocks and their Features, Errors and Precautions, Microwave Power Measurement, Bolometers Measurement of Attenuation, Frequency Standing wave Measurements — Measurement of Low and High VSWR, Cavity Q, Impedance Measurements.

Text Books

1. Antennas and wave propagation - John D. Kraus and Ronald J. Marhefka, TMH, 4th Edn.,.
2. Electromagnetic Waves and Radiating Systems - E.C. Jordan and K.G. Balmain, PHI, 2nd ed.,
3. Microwave Devices and Circuits — Samuel V. Liao, Pearson, 3rd Edition, 2003.

References

1. Antennas and Wave Propagation -K.D. Prasad, Satya Prakashan, Tech India Publications,
2. Antennas - John D. Kraus, McGraw-Hill, SECOND EDITION, 1988
3. Transmission and Propagation - E.V.D. Glazier and H.R.L. Lamont,
4. Foundations for Microwave Engineering — R.E. Collin, IEEE Press, John Wiley, 2ndEdition, 2002.
5. Microwave Engineering —A. Das and S.K. Das, TMH, 2nd Ed., 2009,
6. Microwave Engineering – G. S. Raghuvanshi and K. Satya Prasad, Cengage Learning, 2012

Course Outcomes

At the end of course, the student will be able to

1. Explain the fundamentals of Antenna theory and their applications.

2. Explain working of microwave passive circuits such as isolator, circulator, directional couplers, attenuators etc.
3. Design microwave matching networks using L section, single and double stub and quarter wave transformer
4. Evaluate the structural and operational characteristics of microwave tubes.
5. Perform measurements on microwave devices and networks using power meter and vector network analyzer.

EC-322: Principles of VLSI Design

III Year, II Semester

Department: ECE
Credits: 3
L-T-P : 3-0-0

Category Code: PCC
Internal marks: 30
External marks: 70

Course Obectives

1. To introduce the technology, design concepts, electrical properties and modeling of Very Large Scale Integrated circuits.
2. To deal with models of moderately sized CMOS circuits that realize specified digital functions.
3. Estimation and optimization of combinational circuit delay using RC delay models and logical effort
4. To introduce the concepts and techniques of modern integrated circuit design and testing (CMOS VLSI).

Syllabus

UNIT-I 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: Ids versus Vds relationships, threshold voltage Vt, Transconductance gm, Figure of merit uo , 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, 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 FPGA Design: FPGA design flow, Basic FPGA architecture, FPGA Technologies, FPGA families- Altera Flex 8000FPGA, Altera Flex 10FPGA, Xilinx XC4000 series FPGA, Xilinx Spartan XL FPGA, Xilinx Spartan II FPGAs, Xilinx Vertex FPGA. Case studies: FPGA Implementation of Half adder and full adder. Introduction to synthesis: Logic synthesis, RTL synthesis, High level Synthesis.

Text Books

1. Douglas A.Pucknell and Kamran Eshranghian, Basic VLSI Design, Third edition, PHI, 2002.
2. Michael John Sebastian Smith, Application Specific Integrated Circuits, Addison Wesley, 2003.
3. J.Bhasker, A VHDL Primer, Pearson Education, Third edition, 1999.
4. John F Wakerly, Digital Design Principles Practices, 3rd Edition, Pearson Education, 2002.

References

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. David Hodges. Analysis and Design of Digital Integrated Circuits in Deep submicron Technology, 3'rd edition.

Course Outcomes

At the end of course, the student will be able to

1. Evaluate the trends in semiconductor technology, and how it impacts scaling and performance.
2. Draw the Layout and Stick diagrams and explain about delays.
3. Analyze the MOS transistor as a switch and compute its capacitance.
4. Design the different circuits like ALU, ADDERS and multipliers etc.
5. Describe general FPGA architectures.

EC-323: Digital Signal Processing

III Year, II Semester

Department: ECE
Credits: 3
L-T-P : 3-1-0

Category Code: PCC
Internal marks: 30
External marks: 70

Course objectives

1. Use z-transform and discrete time Fourier transforms to analyze a digital systems.
2. Understand the Discrete Fourier Transform(DFT), its applications and its implementation by FFT techniques.
3. Design and understand infinite and finite impulse response filters for various applications.
4. Provides understanding and working knowledge of design, implementation, analysis and comparison of digital filters for processing of discrete time signals.

Syllabus

UNIT-I Discrete - Time Signals and Systems: Discrete - Time Signal's Sequences, Linear Shift - Invariant Systems, Stability and Casuality, Linearity, Linear constant - Coefficient Difference Equations, Frequency Domain Representation of Discrete - Time Signals and Systems.

UNIT-II Z-Transforms: Z-transforms, Region of convergence, Z-transform theorems and properties, Parseval's relation, Relation between Z-transform and Fourier transform of a sequence, Inverse Z transform using Cauchy's integration theorem, Partial fraction method, Long division method, Solution of differential equations using one sided Z-transform, Frequency response of a stable system.

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

UNIT–IV IIR Filter Design Techniques: Introduction, Properties of IIR filters, Design of Digital Butterworth and Chebyshev filters using bilinear transformation, Impulse invariance transformation methods. Design of digital filters using frequency transformation method.

UNIT–V FIR Filter Design Techniques: Introduction to characteristics of linear phase FIR filters, Frequency response, Designing FIR filters using windowing methods: Rectangular window, Hanning window, Hamming window, Generalized Hamming window, Bartlett triangular window, Comparison of IIR and FIR filters.

Text Books

1. Alan V Oppenheim and Ronald W Schafer - Digital Signal Processing, PearsonEducation/PHI, 2004.
2. John G.Proakisand Dimitris G.Manolakis - Digital Signal Processing Principles, Algorithms and Applications, 2007.
3. P Ramesh Babu - Digital Signal Processing, 5th edition, scitech, 2014.

References

1. Tarun Kumar Rawat - Digital Signal Processing, Oxford University Press,2015.
2. Johnny R. Johnson - Introduction to Digital Signal Processing, PHI, 2001.
3. Andreas Antoniou - Digital Signal Processing,TMH, 2006.
4. Lonnie C Ludeman - Fundamentals of Digital Signal Processing, John Wiley Sons, 2003.
5. S K Mitra - Digital Signal Processing: A Computer Based Approach, 4th Edition, TMH, 2011.

Course Outcomes

At the end of course, the student will be able to

1. Explain discrete time signals and systems.
2. Evaluate the Z transform and inverse Z transforms.
3. Differentiate discrete fourier transform and fast fourier transforms.
4. Analyze IIR, Butterworth and Chebyshev filters using by Bilinear transformation and impulse invariance transformation methods.
5. Design and realize FIR filters by using rectangular, hamming, hanning, Bartlett triangular, Windowing techniques and digital filters.

EC-324-A: Introduction to Embedded Systems

III Year, II Semester

Department: ECE	Category Code: PEC
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Obectives

1. To introduce the Building Blocks of Embedded System.
2. To Educate in Various Embedded Development Strategies.
3. To impart knowledge in various processor scheduling algorithms.
4. To introduce Basics of Real time operating system and example tutorials to discuss on one real time operating system tool.

Syllabus

UNIT-I Introduction: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

UNIT-II Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS). Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT–III Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

UNIT–IV RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

UNIT–V Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

Text Books

1. Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill.
2. Embedded Systems - Raj Kamal, MC GRAW HILL EDUCATION.
3. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.

References

1. Embedded Systems – Lyla, Pearson, 2013
2. An Embedded Software Primer - David E. Simon, Pearson Education.

Course Outcomes

At the end of course, the student will be able to

1. Design an embedded system.
2. Distinguish between RISC and CISC.
3. Analyze ARM, Cortex for design of embedded system
4. Use Embedded software development tools for designing embedded system applications
5. Apply their understanding in building real time systems.

EC-324-B: Digital Design Using VERILOG

III Year, II Semester

Department: ECE	Category Code: PEC
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course objectives

1. To design combinational, sequential circuits using Verilog HDL.
2. To understand behavioral and RTL modeling of digital circuits
3. To verify that a design meets its timing constraints, both manually and through the use of computer aided design tools.
4. To simulate, synthesize, and program their designs on a development board.
5. To verify and design the digital circuit by means of Computer Aided Engineering tools which involves in programming with the help of Verilog HDL.

Syllabus

UNIT-I Introduction to Verilog HDL: Verilog as HDL, Levels of Design Description, Concurrency, Simulation and Synthesis, Functional Verification, System Tasks, Programming Language Interface (PLI), Module, Simulation and Synthesis Tools. Language Constructs and Conventions: Introduction, Keywords, Identifiers, White Space Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars and Vectors, Parameters, Operators.

UNIT-II Gate Level Modeling: Introduction, AND Gate Primitive, Module Structure, Other Gate Primitives, Illustrative Examples, Tri-State Gates, Array of Instances of Primitives, Design of Flip-flops with Gate Primitives, Delays, Strengths and Construction Resolution, Net Types, Design of Basic Circuits. Modeling at Dataflow Level: Introduction, Continuous Assignment Structure, Delays and Continuous Assignments, Assignment to Vectors, Operators.

UNIT–III Behavioral Modeling: Introduction, Operations and Assignments, Functional Bifurcation, Initial Construct, Always Construct, Assignments with Delays, Wait construct, Multiple

Always Blocks, Designs at Behavioral Level, Blocking and Non-Blocking Assignments, The case statement, Simulation Flow if and if-else constructs, Assign-De-Assign construct, Repeat construct, for loop, the Disable construct, While loop, Forever loop, Parallel Blocks, Force-Release construct, Event.

UNIT–IV Switch Level Modeling: Basic Transistor Switches, CMOS Switch, Bi-directional Gates, Time Delays with Switch Primitives, Instantiations with Strengths and Delays, Strength Contention with Trireg Nets, Exercises. System Tasks, Functions and Compiler Directives: Parameters, Path Delays, Module Parameters, System Tasks and Functions, File-Based Tasks and Functions, Computer Directives, Hierarchical Access, User Defined Primitives.

UNIT–V Sequential Circuit Description: Sequential Models – Feedback Model, Capacitive Model, Implicit Model, Basic Memory Components, Functional Register, Static Machine Coding, Sequential Synthesis. Components Test and Verification: Test Bench- Combinational Circuit Testing, Sequential Circuit Testing, Test Bench Techniques, Design Verification, Assertion Verification.

Text Books

1. T.R. Padmanabhan, B. Bala Tripura Sundari , Design through Verilog HDL, Wiley, 2009.
2. Zainalabdien Navabi, Verilog Digital System Design, TMH, 2nd Edition.

References

1. Fundamentals of Logic Design with Verilog Design– Stephen. Brown and Zvonko Vranesic, TMH, 2nd Edition 2010.
2. Advanced Digital Logic Design using Verilog, State Machine Synthesis for FPGA – Sunggu Lee, Cengage Learning , 2012.
3. Verilog HDL – Samir Palnitkar, 2nd Edition, Pearson Education, 2009.
4. Advanced Digital Design with Verilog HDL – Michael D. Ciletti, PHI, 2009.

Course outcomes

At the end of course, the student will be able to

1. Explain the basic concepts of verilog HDL.
2. Model digital systems in verilog HDL at different levels of abstraction.
3. Analyze the simulation techniques and test bench creation.
4. Describe the design flow from simulation to synthesizable version
5. Demonstrate process of synthesis and post-synthesis.

EC-324-C: Advanced Control Systems

III Year, II Semester

Department: ECE	Category Code: PEC
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Objectives

1. This course introduces students to recently developed and advanced techniques in control systems for solving complex control problems.
2. To teach theory and methodology for analysis and modelling of systems and signals.
3. To teach methods for design and synthesis of feedback controllers.
4. To teach how to apply linearization techniques for nonlinear dynamical systems.
5. To discuss the basic principles behind model-predictive control.
6. To explain how the design parameters influence the closed-loop performance of the system

Syllabus

UNIT-I State Space Analysis: State Space Representation, Solution of state equation, State transition matrix, Canonical forms, Controllable canonical form, Observable canonical form, Jordan Canonical Form.

UNIT-II Controllability, Observability and Design of pole placement: Tests for controllability and observability for continuous time systems, Time varying case, Minimum energy control, Time invariant case, Principle of duality Controllability and observability form Jordan canonical form and other canonical forms, Effect of state feedback on controllability and observability, Design of state feedback control through pole placement.

UNIT–III Describing Function Analysis: Introduction to nonlinear systems, Types of nonlinearities, describing functions, Introduction to phase–plane analysis.

UNIT–IV Stability Analysis: Stability in the sense of Lyapunov, Lyapunov's stability and Lypanov's instability theorems , Direct method of Lypanov for the linear and nonlinear continuous time autonomous systems.

UNIT–V Calculus of Variations: Minimization of functional of single function, Constrained minimization, Minimum principle, Control variable inequality constraints, Control and state variable inequality constraints, Euler lagrangine equation.

Text Books

1. Modern Control Engineering – by K. Ogata, Prentice Hall of India, 3rd edition, 1998
2. Automatic Control Systems by B.C. Kuo, Prentice Hall Publication

References

1. Modern Control System Theory – by M. Gopal, New Age International Publishers, 2nd edition, 1996
2. Control Systems Engineering by I.J. Nagarath and M.Gopal, New Age International (P) Ltd.
3. Digital Control and State Variable Methods – by M. Gopal, Tata Mc Graw– Hill Companies, 1997.
4. Systems and Control by Stainslaw H. Zak , Oxford Press, 2003.
5. Optimal control theory: an Introduction by Donald E.Kirk by Dover publications.

Course Outcomes

At the end of course, the student will be able to

1. Explain the behavior of nonlinear control systems.
2. Demonstrate non-linear system behavior by phase plane and describing function methods.
3. Derive discrete-time mathematical models in both time domain and frequency domain .
4. Analyze transient and steady-state response of time-invariant, discrete-time control system.
5. Apply the principles to assess the stability and sensitivity of both open-loop and closed-loop linear time-invariant discrete time system.

EC-324-D: Telecommunication Switching Systems

III Year, II Semester

Department: ECE
Credits: 3
L-T-P : 3-0-0

Category Code: PEC
Internal marks: 30
External marks: 70

Course objectives

1. To understand the working principles of switching systems from manual and electro mechanical systems to stored program control systems.
2. To understand and designing of multistage networks
3. understand different switching systems and different signaling techniques and networks and topologies.
4. understand different networks, charging and routing plans.
5. To understand the overall data communication and switching networks.

Syllabus

UNIT-I Telecommunication Switching Systems: Introduction, Elements of switching systems, switching network configuration, Rotary switches, Uniselector, Two motion selector, Trunking principle ,principles of cross bar switching, Crossbar Switch Configuration, Cross point Technology, Crossbar Exchange Organization.

UNIT-II Electronic Space Division Switching: Stored Program Control, Centralized SPC, Distributed SPC, Software Architecture, Application Software, Enhanced services, TwoStage Networks, Three-Stage Networks, n-Stage Networks. Time Division Switching: Basic Time Division Space Switching, Basic Time Division Time Switching, Time Multiplexed Space Switching, Time Multiplexed Time Switching, Combination Switching, Three Stage Combination Switching, n - Stage Combinational Switching.

UNIT–III Telecommunications Traffic: Introduction; The Unit of Traffic, Congestion; Traffic Measurement, A Mathematical Model, Lost-Call Systems-Theory, Traffic Performance, Loss Sys-

tems in Tandem, Use of Traffic Tables, Queuing Systems-The Second Erlang Distribution, Probability of Delay, Finite Queue Capacity, Some Other Useful Results, Systems with a Single Server, Queues in Tandem, Delay Tables, Applications of Delay Formulae.

UNIT–IV Telephone Networks: Subscriber loop systems, switching hierarchy and routing, transmission plan, transmission systems, numbering plan, charging plan, Signaling techniques: In channel signaling, common channel signaling, Cellular mobile telephony. Data Networks: Data transmission in PSTNs, Switching techniques for data transmission, data communication architecture, link to link layers, end to end layers, satellite based data networks, LAN, MAN, Internetworking.

UNIT–V Integrated Services Digital Network (ISDN): Introduction, motivation, new services, Network and protocol architecture, Transmission channels, User-Network interfaces, functional grouping, reference points, signaling, numbering, addressing, BISDN. DSL Technology: ADSL, Cable Modem, Traditional Cable Networks, HFC Networks, Sharing, CM CMTS and DOCSIS. SONET: Devices, Frame, Frame Transmission, Synchronous Transport Signals, STS I, Virtual Tributaries, and Higher rate of service.

Text Books

1. Tele communication switching system and networks – Thyagarajan Viswanath, PHI, 2000.
2. J. E Flood, "Telecommunications Switching and Traffic Networks," Pearson Education, 2006
3. Data Communication Networking - B.A. Forouzan, TMH, 4th Edition, 2004.

References

1. Digital telephony - J. Bellamy, John Wiley, 2nd edition, 2001.
2. Data Communications Networks - Achyut. S. Godbole, TMH, 2004.
3. Principles of Communication Systems – H. Taub D. Schilling, TMH, 2nd Edition, 2003.

Course outcomes

At the end of course, the student will be able to

1. Describe and apply fundamentals of telecommunication systems and associated technologies.
2. Apply the principles of queuing theory in evaluating the performance of congested telecommunication networks.
3. Solve problems and design simple systems related to tele-traffic and trunking efficiency.
4. Explain the reasons for switching, and the relative merits of the possible switching modes.

5. Interpret the principles of the internal design and operation of telecommunication switches, and the essence of the key signaling systems that are used in telecommunication networks .

EC-361: VLSI Design Lab

III Year, II Semester

Department: ECE	Category Code: PCC LAB
Credits: 1.5	Internal marks: 30
L-T-P : 0-0-3	External marks: 70

Course Objectives

1. To understand the programming constructs of VHDL.
2. To demonstrate the programming models of VHDL: gate level, data flow, behavioural and structural modelling.
3. To carry out mini projects using Verilog HDL.

List of Experiments

1. Verification of Logic Gates
2. Design of Combinational Logic circuits
3. Modeling and Synthesis of JK, D, T, and SR flip-flops with preset and clear inputs
4. Design of 4-bit shift register and bidirectional shift register with parallel load
5. Design of 4-bit Ripple/Synchronous counters
6. Design of 4-bit carry look ahead adder
7. Implementation Moore and Mealy state machines
8. Implementation of two 4-bit numbers multiplication using Booth's algorithm
9. Implementation of Traffic light controller
10. Implementation of two floating-point numbers addition
11. Implementation of two floating-point numbers multiplication

12. Construct an 8-bit dedicated data path to generate and add the numbers from n down to 1, where ‘n’ is an 8-bit user input number
13. Construct an 8-bit dedicated control unit to generate and add the numbers from n down to 1, where ‘n’ is an 8-bit user input number
14. Construct an 8-bit general data path to generate and add the numbers from n down to 1, where ‘n’ is an 8-bit user input number
15. Construct an 8-bit general control unit to generate and add the numbers from n down to 1, where ‘n’ is an 8-bit user input number

Course Outcomes

At the end of course, the student will be able to

1. Gain knowledge on VHDL programming.
2. Code and simulate designs in VHDL at various levels of abstraction.
3. Design and simulate combinational and sequential digital circuits.
4. Simulate the floating point adder and multiplier.
5. Design Finite state machines using state-of-the-art tools.

EC-362: Microwave Engineering Lab

III Year, II Semester

Department: ECE	Category Code: PCC LAB
Credits: 1.5	Internal marks: 30
L-T-P : 0-0-3	External marks: 70

Course Objectives

1. To define the range of frequencies for operation in microwave engineering.
2. To discover the functioning of microwave components.
3. To verify the various Characteristics of Active and Passive Microwave Devices Practically.
4. To find Practically Optical Fiber Characteristics.

List of Experiments

1. Characteristics of Reflex Klystron
2. Verification of the Expression $1/\lambda = 1/\lambda + 1/\lambda$.
3. Measurement of VSWR using Microwave Bench.
4. Measurement of Unknown Impedance Using Microwave Bench
5. Determination of Characteristics of a Given Directional Coupler.
6. Measurement of Gain of an Antenna.
7. Measurement of Dielectric Constant of a Given Material.
8. Study of Gunn Diode characteristics.
9. Study of Attenuation Measurement.
10. Determination of Scattering parameters of Circulator.
11. Determination of Scattering parameters of Magic Tee.
12. Study of Radiation pattern of Horn and Parabolic Antennas.

Course Outcomes

At the end of course, the student will be able to

1. Study the characteristics of microwave sources.
2. Estimate the guide wave length and free space wave length of a wave.
3. Analyze the fiber optic analog and digital link characteristics.
4. Plot the radiation characteristics of UHF and microwave antennas.
5. Analyze the characteristics of microwave devices.

EC-363: Digital Signal Processing Lab

III Year, II Semester

Department: ECE
Credits: 1.5
L-T-P : 0-0-3

Category Code: PCC LAB
Internal marks: 30
External marks: 70

Course Objectives

1. To implement Linear and Circular Convolution.
2. To implement FIR and IIR filters.
3. To study the architecture of DSP processor.
4. To demonstrate Finite word length effect

List of Experiments

1. Generation of Discrete time signals for Discrete signals.
2. To verify the Linear Convolution.
3. To verify the Circular Convolution for discrete signals
4. To find the addition of sinusoidal signals.
5. Simulation of M-ary PSK.
6. Simulation of DPCM.
7. Evaluation of DFT and IDFT of 16 Sample Sequence using DIT Algorithm.
8. Evaluation of DFT and IDFT of 16 Sample Sequence using DIF Algorithm.
9. Design of IIR Butterworth Filter using Impulse Invariant Method.
10. Design of FIR Filter using Windowing Technique.
11. Convolution of Two Signals.

Course Outcomes

At the end of course, the student will be able to

1. Simulate discrete/digital signals using MATLAB.
2. simulate and analyze basic operations of signal processing
3. Analyse the spectral parameter of window functions
4. Design IIR, and FIR filters for band pass, band stop, low pass and high pass filters.
5. Gain expertise in MATLAB/octave to develop signal processing algorithms.

EC-411-A: Advanced Digital Signal Processing

IV Year, I Semester

Department: ECE	Category Code: PEC
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Objectives

1. To understand the design of various types of digital filters and implement them using various implementation structures.
2. To study the advantages & disadvantages of procedures and implementation structures.
3. To understand the concept and need for multi-rate signal processing and their applications in various fields of communications.
4. To study parametric & non parametric methods of Power spectrum estimation techniques and their advantages & disadvantages.
5. To understand the effects of finite word/register length used in hardware in implementation of various filters and transforms using finite precision processors.

Syllabus

UNIT-I Multi-rate Digital Signal Processing: Introduction, Decimation by a Factor D, Interpolation by a Factor I, Sampling Rate Conversion by a Rational Factor I/D, Filter Design and Implementation for sampling rate Conversion.

UNIT-II: Multi-rate Digital Signal Processing Multistage Implementation of Sampling Rate Conversion, Applications of Multi-rate Signal Processing, Sampling Rate Conversion of Band pass Signals.

UNIT–III Linear Prediction And Optimum Linear Filters: Innovations Representation of a Stationary Random Process, Forward and Backward linear prediction, Solution of the Normal Equations, Properties of linear prediction-Error Filter, AR Lattice and ARMA Lattice-Ladder Filters.

UNIT–IV Power Spectral Estimation: Estimation of Spectra from Finite Duration Observations of a signal, the Periodogram, Use DFT in power Spectral Estimation, Bartlett, Welch and Blackman, Tukey methods, Comparison of performance of Non-Parametric Power Spectrum Estimation Methods.

UNIT–V Parametric method of Power Spectrum Estimation: Parametric Methods for power spectrum estimation, Relationship between Auto-Correlation and Model Parameters, AR (Auto-Regressive) Process and Linear Prediction, Yule-Walker, Burg and Unconstructrained Least Squares Methods, Sequential Estimation, Moving Average(MA) and ARMA Models Minimum Variance Method, Piscaranko's Harmonic Decomposition Methods, MUSIC Method.

Text Books

1. Proakis JG and Manolakis DG Digital Signal Processing Principles, Algorithms and Application, PHI.
2. Openheim AV Schafer RW, Discrete Time Signal Processing PHI.
3. Samuel D Stearns, "Digital Signal Processing with examples in Matlab. " CRC Press.

References

1. ES Gopi. "Algorithm collections for Digital Signal Processing Applications using Matlab, " Springer.
2. Taan S.Elali, "Discrete Systems and Digital Signal Processing with Matlab, " CRC Press,2005.

Course Outcomes

At the end of course, the student will be able to

1. Design and implement digital filters which are optimal for the given specifications.
2. Design a Multi-rate system for the needed sampling rate and can implement the same using Poly-phase filter structures of the needed order.
3. Estimate the power spectrum of signal corrupted by noise through a choice of estimation methods: Parametric or Non Parametric.
4. Compare the performance of different power spectral density estimation algorithms
5. Compute the output Noise power of different filters due to various finite word length effects.

EC-411-B: Digital Image Processing

IV Year, I Semester

Department: ECE	Category Code: PEC
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Objectives

1. To get knowledge on analytical tools and methods which are currently used in digital image processing as applied to image information for human viewing.
2. To introduce various enhancement and restoration methods in order to improve the visualization of the image.
3. To teach compression of images by lossy and lossless algorithms.
4. To teach Image segmentation, representation and description of images.

Syllabus

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 Fundamentls: 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.

UNIT–V Image Representation And Description: Representation schemes, Boundary Descriptors, Regional Descriptors.

Text Books

1. R C Gonzalez and Richard E Woods, Digital Image Processing, Pearson Education, Second Edition, 2002.

References

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.

Course Outcomes

At the end of course, the student will be able to

1. Understand the rapid advances in Machine vision, need for learning image processing techniques.
2. Apply feature extraction techniques for image analysis and recognition.
3. Develop algorithms for image enhancement, and restoration for a given set of noisy images.
4. Analyze images in time and frequency domain using various transforms.
5. Compare the different techniques for image segmentation, and image compression.
   segmentation.

EC-411-C: Radar Signal Processing

IV Year, I Semester

Department: ECE	Category Code: PEC
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Objectives

1. To discuss signal processing techniques on single and multiple radars.
2. To teach the purpose of pulse compression and clutter suppression.
3. To teach optimization of feed current and array configuration on radar phased arrays.
4. To provide understanding of waveform design on MIMO radars.

Syllabus

UNIT-I Introduction: Basic radar equation, range delay, velocity delay, Doppler effect, accuracy, resolution and ambiguity .Tradeoffs and penalties in waveform design .Significance of matched filter in radar signal analysis: complex representation of band-pass signal, matched filter response to Doppler shifted signal.

UNIT-II Ambiguity Function: Main properties of ambiguity function, cuts through ambiguity function, periodic ambiguity functions .Basic radar signals: constant frequency pulse, linear frequency modulated pulse, Costas frequency modulated pulse, nonlinear frequency modulation.

UNIT–III Phase Coded Pulse: Barker code, chirp-like phase code, asymptotically perfect codes, Huffman code, and bandwidth considerations in phase-coded signals. Diverse pulse repetition interval (PRI) pulse trains: introduction to moving target indication (MTI) radar, blind speed, MTI radar performance analysis, optimal MTI weights, diversifying the PRI.

UNIT–IV:Multi carrier phase coded signal in radar signals.Bistatic radar: advantages of a bistatic configuration, bistatic RCS, bistatic rangeambiguity function, multistatic radar configuration.

Synthetic aperture radar (SAR): SAR principle, k-space understanding of SAR, different compensation techniques, sparse SAR, nonlinear SAR, apodization.

UNIT–V Detection and recognition using Radar:Detection and recognition using 1-D range profile, detection and recognition using SAR image. Space time adaptive processing (STAP): understanding STAP, uses of STAP, bistatic STAP .Civilian uses of radar: space based SAR, segmentation of SAR images from satellite.

Text Books

1. N. Levanon, and E. Mozeson, Radar Signals, Wiley-Interscience, 2004.
2. P. Z. Peebles, Radar Principles, John Wiley, 2004.
3. M. I. Skolnik, Introduction to Radar Systems, Tata McGraw Hill, 2001.
4. D. K. Barton, Radar System Analysis and Modeling, Artech House, 2005
5. IEEE standards on radar related areas, IEEE Explorer.

References

1. Peyton Z Peebles Jr, Radar Principles - John Wiley Inc., 2nd Edition, Prentice-Hall of India, 2004.

Course Outcomes

At the end of course, the student will be able to

1. Explain the building blocks of a radar system.
2. Analyze and able to process different types of radar signals .
3. Summarize the ambiguity function and realize its significance in radar signal processing.
4. Apply the knowledge acquired in this course in software development for radars.
5. Demonstrating attitude for the working in the radar field independently

EC-411-D: Speech Signal Processing

IV Year, I Semester

Department: ECE	Category Code: PEC
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Objectives

1. To spread across a number of fundamental and research areas | including signal processing for separation, recognition, transcription, enhancement, coding, synthesis of speech signals.
2. To teach anatomy and physiology of speech production system and perception model and to design an electrical equivalent of acoustic model for speech production.
3. To make student understand the articulatory and acoustic interpretation of various phonemes and their allophones.
4. To teach speech signal analysis in time domain and extract various time domain parameters which can be used for various applications like pitch extraction, end point detection, Speech Compression.
5. To study the concept of Homomorphic filtering and its use in extracting the vocal tract information from speech.

Syllabus

UNIT-I Production And Classification Of Speech Sounds: Anatomy and Physiology of Speech Production, Categorization of Speech Sounds. Acoustics of Speech Production: Physics of Sound, Uniform tube model, A Discrete-Time model based on Tube Concatenation. Time-Domain Models for Speech Processing: Short-Time energy, average zero crossing rate, Pitch period estimation using autocorrelation.

UNIT-II Short Time Fourier Transform Analysis And Synthesis: Short Time Analysis, Signal estimation from STFT, Frequency Domain Pitch Estimation, A Correlation based Pitch Estimator, Pitch estimation based on a Comb Filter. Digital Representations Of The Speech Waveform: Instantaneous quantization, Delta Modulation, DPCM.

UNIT–III Homomorphic Signal Processing: Homomorphic Systems for Convolution, Complex Cepstrum of Speech-like Sequences, Spectral root Homomorphic Filtering, Short-Time Homomorphic Analysis, Short-time Speech Analysis and Analysis/Synthesis Structures.

UNIT–IV Speech Coding: Linear Prediction, Error minimization, Autocorrelation method, Levinson Recursion, Lattice filter formulation of the inverse filter. Vector Quantization, Distortion Measure, Sub-band coding.

UNIT–V Speaker Recognition: Spectral features for Speaker Recognition, Mel- Cepstrum, Speaker Recognition Algorithms, Minimum – distance classifier.

Text Books

1. Thomas F Quatieri, Discrete-Time Speech Signal Processing Principles and Practice, Pearson Education, 2002.
2. L R Rabiner and R W Schafer, Digital Processing of Speech Signals Pearson Education, 2002.

Course Outcomes

At the end of course, the student will be able to

1. Explain the concept of speech production system.
2. Apply knowledge of speech production to extract the LPC coefficients that can be used to Synthesize or compress the speech.
3. Design a Homomorphic vocoder for coding and decoding of speech.
4. Model HMM to recognize isolated word recognition using enhanced speech signal.
5. Design automatic speaker recognition system which can used for classification.

EC-412-A: Generations of Cellular Mobile Communications

IV Year, I Semester

Department: ECE	Category Code: PEC
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Objectives

1. To teach fundamentals of wireless communications.
2. To make the students to analyze security, energy efficiency, mobility, scalability, and their unique characteristics in wireless networks.
3. To equip the students with basic skills for cellular networks design.
4. To make the students understand TCP/IP protocol extensions for mobile and wireless networking.

Syllabus

UNIT-I Introduction to Mobile Communication: Evolution of Mobile Radio Communication, Examples of Wireless Communication Systems. Paging system, Cordless telephones systems, Cellular telephone Systems, Cellular concept: Frequency reuse, Channel Assignment strategies, Hand off strategies. Interference and System capacity, Improving coverage and capacity in cellular systems.

UNIT-II The second generation (2G) systems:GSM: services, features, architecture, radio link, channel types, frames, call handling. CDMA IS95: forward and reverse channels, system architecture, call handling.

UNIT–III 2.5G systems: GPRS: data rates, basic services, system architecture, protocols, coding schemes, mobility management, hardware and software components EDGE: evolution, advanced modulation methods, radio transmission and data rates, services and protocols.

UNIT–IV 3G systems: Introduction, evolution of 3G networks, ITU IMT 2000, CDMA 2000: bandwidth, chip rate, channels, spreading and modulation, power control, soft handoff, EV-DO, EV-DV UMTS: radio access network, spreading and modulation, channels, core network.

Wireless LANs: IEEE 802.11 system and protocol architecture, physical layer and MAC, options like 802.11b, a g etc. and their purpose. Bluetooth: User scenarios, layered architecture, link management, L2CAP, SDP, IEEE 802.15

UNIT–V 4G Technology: 4G technology and its various flavors, WiMAX (Worldwide Interoperability for Microwave Access), LTE (Long Term Evolution) and HSPA, (High Speed Packet Access) technology. HTML5 on Mobile Devices: This unit deals with the HTML5 technology required for mobile websites and mobile applications on mobile operating systems. You will study the tools of HTML5 which are very relevant for developing the web applications for the mobile devices.

Text Books

1. Mobile Communication, Jochen Schiller, Pearson Education, 2nd Edition
2. Wireless Communication: Principles and Practice, Theodore Rappaport, Pearson Education, 2nd Edition

References

1. Mobile Computing , Asoke K Telukder, Roopa R Yavagal, TMH
2. Mobile Communications, Jochen Schiller, Pearson
3. Wireless Communications and Networks, 3G and beyond, ITI Saha Misra, TMH.
4. Principle of wireless Networks by Kaveh Pahlavan and Prashant Krishnamurthy, Pearson 2002

Course Outcomes

At the end of course, the student will be able to

1. Explain cellular concepts like frequency reuse, hand-off and Interference.
2. Demonstrate basic skills for cellular network design.
3. Choose proper multiple accessing methods depending on the channel model.
4. Compare different generations of mobile cellular communication systems.
5. Calculate key performance metrics of a cellular communication system.

EC-412-B: Optical Fiber Communication

IV Year, I Semester

Department: ECE	Category Code: PEC
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Objectives

1. To make familiar with the fundamental concepts of light, basic laws of light, various types of Optical fibers, modes and configurations.
2. To acquaint with theoretical analysis of the signal propagation and distortion during propagation of light in fibers.
3. To teach optical sources, optical detectors and optical amplifiers
4. To make student to understand the design principles of digital and analog optical fiber communication links

Syllabus

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, Lens coupling to fiber, LED Characteristics – Optical output power efficiency, output spectrum, modulation bandwidth, reliability. Laser: Working of DH injection laser, DFB laser and Threshold

condition for lasing. 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, Direct intensity modulation, Advanced Multiplexing Strategies – OTDM, WDM.

UNIT–V Optical Fiber Measurements: Numerical Aperture, attenuation, refractive index, dispersion losses, cutback and OTDR.

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.

Course Outcomes

At the end of course, the student will be able to

1. Explain the operation of optical fiber transmission, types of optical fibers and modes of propagation.
2. Describe the losses in fiber, types of dispersion, connection losses, fiber optic couplers and switches.
3. Interpret types of Light Emitting Diodes (LED) Characteristics, Working of LASER, and principles of Photo detectors.
4. Analyze the operation of optical receiver operation, error sources, advanced multiplexing strategies, various types of optical fiber measurements and optical fiber tests.
5. Evaluate about optical fiber communication, losses in optical fiber, about LED, Photo Detectors, types of pre amplifiers, and optical fiber measurements.

EC-412-C: Satellite Communication

IV Year, I Semester

Department: ECE	Category Code: PEC
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Objectives

1. To understand sub-systems of satellites and launches.
2. To design the earth station antennas.
3. To know about the parameters affecting the Satellite system performance.
4. To understand the applications of satellites.

Syllabus

UNIT-I Introduction and Orbital aspects of Satellite Communications: A brief history of Satellite Communications, Types of Orbits, Orbital Mechanics: Developing the Equation of the orbit, Kepler's laws of planetary motion, locating the satellite in the orbit, locating the Satellite with respect to the Earth, Orbital elements, Look angle determination, Orbital perturbations, launch and launch vehicles, Orbital effects in Communication System performance.

UNIT-II Satellite Subsystems: Introduction, Attitude and Orbit Control System (AOCS), Telemetry, Tracking, Command and Monitoring (TTCM), Power Systems, Communication Subsystems, Satellite Antennas Multiple Access Techniques: Introduction, FDMA, TDMA, DAMA and CDMA Satellite Systems Encoder, Decoder, Comparison between FDMA ,TDMA CDMA.

UNIT–III Satellite Link Design: Basic transmission theory, System Noise Temperature and G / T ratio. Design of Uplink and Down link models, Design of Satellite links for specified C / N ratio. Earth Station Technology: Earth Station Design, Design of large antennas, Small earth station Antennas, Propagation Effects on Satellite: Quantifying Attenuation and Depolarization, Rain and Ice Effects, Prediction of Rain Attenuation.

UNIT–IV VSAT Systems:Introduction, overview of VSAT Systems, Network Architectures, One –way Implementation, Split – Two-Way (Split IP) Implementation, Two-Way Implementation,

Access Control Protocols, Delay Considerations, Basic Techniques: Multiple Access Selection, Signal Formats, Modulation, Coding, and Interference Issues.

UNIT–V VSAT Earth Station Engineering:Antennas, Transmitters and Receivers, Calculation of Link Margins for a VSAT Star Network, System Design Procedure. Introduction, GPS Position Location Principles, Position Location in GPS, GPS Time, GPS Receivers and Codes.

Text Books

1. T Pratt and W Bostiain, Satellite Communications, 2nd Edition, John Wiley,
2. W Tomasi, Advanced Electronic Communication Systems, 4th Edition, Pearson Education, 2002.
3. Taub and Schilling, Principles of Communication Systems, TMH, 2003.
4. Simon Haykin, Communication Systems, 4th Edition, John Wiley Sons, 2004.

References

1. D C Agarwal, Satellite Communications, Khanna Publishers, 2003.
2. Robert M Gagliardi, Satellite Communications.

Course Outcomes

At the end of course, the student will be able to

1. Define and understand concepts related to satellite communication.
2. Apply the concepts of satellite link design and suggest enhancements to improve the link performance.
3. Interpret appropriate modulation, multiplexing, coding and multiple access scheme for satellite communication link application.
4. Evaluate analog and digital satellite communication systems as per given specifications.

EC-412-D: Smart Antennas

IV Year, I Semester

Department: ECE	Category Code: PEC
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Objectives

1. To familiarize with smart and adaptive antennas.
2. To study about the different adaptive algorithms for the antennas.
3. To integrate smart antenna technology with overall communication system design.
4. To analyze the effect of mutual coupling and to study the space time analysis.

Syllabus

UNIT-I Applications of Antenna Arrays to Mobile Communications: Performance Improvement, Feasibility, and System Considerations (Complete contents of reference 1) Application of Antenna Arrays to Mobile Communications, BeamForming and Direction-of-Arrival Considerations (Complete contents of reference

UNIT-II Introduction to Smart Antennas: Spatial Processing for Wireless Systems, Key Benefits of Smart Antennas , Smart antenna introduction ,smart antenna configuration, SDMA, architecture of smart antenna systems.

UNIT–III Smart antenna systems : The Vector Channel Impulse Response and the Spatial Signature, Spatial Processing Receivers, Fixed Beam forming Networks, Switched Beam Systems, Adaptive Antenna Systems, Wideband Smart Antennas, Spatial Diversity, Diversity Combining, and Sectoring, Digital Radio Receiver Techniques and Software Radios for Smart Antennas, Transmission Beam forming.

UNIT–IV Smart Antennas Techniques for CDMA: Non-Coherent CDMA Spatial Processors, Coherent CDMA Spatial Processors and the Spatial Processing Rake Receiver, Multi-User Spatial Processing, Dynamic Re-sectoring Using Smart Antennas, Downlink Beam forming for CDMA.

UNIT–V CDMA System Range and Capacity Improvement Using Spatial Filtering: Range Extension in CDMA, Single Cell Systems with Spatial Filtering at the IS-95 Base Station, Reverse Channel Performance of Multi-cell Systems with Spatial Filtering at the Base Station, Reverse Channel Spatial Filtering at the WLL Subscriber Unit, Range and Capacity Analysis Using Smart Antennas – A Vector Based Approach.

Text Books

1. T.S. Rappaport and J.C. Liberti, "Smart Antennas for Wireless Communications", Prentice Hall, 1999

2. Tapan K Sarkar ," Smart Antennas ",IEEE Press, John Wiley & Sons Publications,2003.

Course Outcomes

At the end of course, the student will be able to

1. Explain the concepts of smart antenna and adaptive antennas.
2. Apply different adaptive algorithms for the smart antennas.
3. Estime/predict the direction of arrival estimation methods to combat fading in mobile communication environment.
4. Analyze the time-space processing of the antennas.
5. Evaluate the performance of adaptive algorithms in the context of smart antenna design.

EC-413-A: Pattern Recognition and Machine Learning

IV Year, I Semester

Department: ECE	Category Code: PEC
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Objectives

1. To design, analysis and development methods for the classification or description of patterns, objects, signals, and processes.
2. To introduce basic mathematical and statistical techniques commonly used in pattern recognition.
3. To introduce students to a various pattern recognition algorithms.
4. Enable students to apply machine learning concepts in real life problems.

Syllabus

UNIT-I Introduction: Basics of pattern recognition, Design principles of pattern recognition system, Learning and adaptation, Pattern recognition approaches. Mathematical foundations: Linear algebra, Probability theory, Expectation, Mean and Covariance, Normal distribution, Multivariate normal densities, Chi square test of hypothesis.

UNIT-II Statistical pattern recognition: Statistical Patten Recognition, Bayesian Decision Theory, Classifiers, Normal density and discriminant functions.

UNIT–III Parameter estimation methods: Maximum-Likelihood estimation, Bayesian Parameter estimation, Dimension reduction methods, Principal Component Analysis (PCA), Fisher Linear discriminant analysis, Expectation, maximization (EM), Hidden Markov Models (HMM), Gaussian mixture models.

UNIT–IV Non parametric techniques:Density Estimation, Parzen Windows, K-Nearest Neighbor Estimation, Nearest Neighbor Rule, Fuzzy classification.

UNIT–V Clustering Techniques:Unsupervised Learning and Clustering: Criterion functions for clustering, Clustering Techniques: Iterative square, Error partitional clustering, K-Means, agglomerative hierarchical clustering, Cluster validation.

Text Books

1. Richard O. Duda, Peter E. Hart and David G. Stork, "Pattern Classification", Second Edition, John Wiley, 2006.
2. Bishop, Christopher M., "Pattern Recognition and Machine Learning", First Edition, Springer, 2009.
3. S. Theodoridis, K. Koutroumbas, "Pattern Recognition", Fourth Edition, Academic Press, 2009.

References

1. Keinosuke Fukunaga, "Introduction to Statistical Pattern Recognition", Second Edition, Academic Press, 2003.
2. Sergios Thedoridis, Konstantinos Koutroumbas, "Pattern Recognition", Fourth Edition, Academic Press, 2009.

Course Outcomes

At the end of course, the student will be able to

1. Explain machine learning concepts and solve range of problems that can be handled by machine learning.
2. Compare and parameterize different learning algorithms.
3. Apply the machine learning concepts in real life problems.
4. Demonstrate how machine will have power to accomplish the tasks through simulation.
5. Summarize the concept of developing several pattern recognition.

EC-413-B: Artificial Neural Networks

IV Year, I Semester

Department: ECE	Category Code: PEC
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Objectives

1. To provide students with a sound and comprehensive understanding of artificial neural networks and machine learning.
2. To provide an introduction to the field of artificial neural networks and machine learning.
3. To teach students how to solve practical problems via implementation of these techniques via simulation.
4. To promote further independent learning on the topics of artificial neural networks and machine learning.

Syllabus

UNIT-I: Introduction and ANN Structure, Biological neurons and artificial neurons, Model of an ANN, Activation functions used in ANNs, Typical classes of network architectures.

UNIT-II: Mathematical Foundations and Learning mechanisms, Re-visiting vector and matrix algebra, State-space concepts, Concepts of optimization, Error-correction learning, emory-based learning, Hebbian learning, Competitive learning.

UNIT–III: Single layer perceptrons, Structure and learning of perceptrons, Pattern classifier – introduction and Bayes' classifiers, Perceptron as a pattern classifier, Perceptron convergence, Limitations of a perceptrons.

UNIT–IV:Feed forward ANN. Structures of Multi-layer feed forward networks, Back propagation algorithm, Back propagation- training and convergence, Functional approximation with back propagation, Practical and design issues of back propagation learning.

UNIT–V:Radial Basis Function Networks, Pattern separability and interpolation, Regularization Theory, Regularization and RBF networks, RBF network design and training, Approximation properties of RBF.

Text Books

1. Yegnanarayana, Bayya. Artificial neural networks. PHI Learning Pvt. Ltd., 2009.
2. Simon Haykin, "Neural Networks: A comprehensive foundation", Second Edition, Pearson Education Asia.
3. Satish Kumar, "Neural Networks: A classroom approach", Tata McGraw Hill, 2004.

References

1. Robert J. Schalkoff, "Artificial Neural Networks", McGraw-Hill International Editions, 1997.

Course Outcomes

At the end of course, the student will be able to

1. Model a neuron and express a Artificial neural network
2. Implement ANN using Perception learning algorithm, and Modified Perception algorithms
3. Analyze the limitation of Single layer Perceptron and Develop multi-layer perceptron law with two hidden layers
4. Explain different ANN learning laws.
5. Develop Delta learning rule of the output layer and Multilayer feed forward neural networks.

EC-413-C: Internet of Things

IV Year, I Semester

Department: ECE	Category Code: PEC
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Objectives

1. To provide knowledge in principles of measurement measurement, sensors, and their connectivity through internet.
2. To describe what IoT is and how it works today.
3. To prepare the student to recognise the factors that contributed to the emergence of IoT.
4. To provide comprehensive understanding on how measurement systems are designed and calibrated.
5. To make the student understand IoT protocols for communication.

Syllabus

UNIT-I Introduction to IoT: Internet of Things, Physical Design, Logical Design, IoT Enabling Technologies, IoT Levels Deployment Templates, Domain Specific IoTs, IoT and M2M, IoT System Management with NETCONF, YANG, IoT Platforms Design Methodology.

UNIT-II IoT Architecture: M2M high-level ETSI architecture, IETF architecture for IoT , OGC architecture, IoT reference model, Domain model, information model, functional model, communication model, IoT reference architecture.

UNIT–III IoT Protocols: Protocol Standardization for IoT, Efforts, M2M and WSN Protocols , SCADA and RFID Protocols, Unified Data Standards, Protocols, IEEE 802.15.4, BACNet Protocol, Modbus, Zigbee Architecture , Network layer, 6LowPAN, CoAP, Security.

UNIT–IV Building IoT with Raspberry Pi & **Arduino**:Building IOT with Rasperry PI, IoT Systems, Logical Design using Python, IoT Physical Devices & Endpoints, IoT Device, Building

blocks, Raspberry Pi -Board, Linux on Raspberry Pi, Raspberry Pi Interfaces, Programming Raspberry Pi with Python, Other IoT Platforms, Arduino.

UNIT–V Case studies and real-world applications:Real world design constraints, Applications, Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing, Data Analytics for IoT, Software & Management Tools for IoT Cloud Storage Models & Communication APIs, Cloud for IoT , Amazon Web Services for IoT.

Text Books

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things a hands-on approach”, Universities Press, 2015.
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.
3. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press, 2012.

References

1. Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
2. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012.

Course Outcomes

At the end of course, the student will be able to

1. Explain the concepts of IoT and its usage.
2. Design an IoT device to work with a Cloud Computing infrastructure.
3. Develop programs related to IoT protocols for communication.
4. Define the infrastructure for supporting IoT deployments.
5. Apply the knowledge of principles of measurement to calibrate IoT devices.

EC-413-D: Introduction To Fuzzy Logic Systems

IV Year, I Semester

Department: ECE	Category Code: PEC
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Objectives

1. To provide an understanding of the basic mathematical elements of the theory of fuzzy sets.
2. To discuss the applications related to computational intelligence.
3. To provide an emphasis on the differences and similarities between fuzzy sets and classical sets theories.
4. To get familiariazed with the fundamental concepts of fuzzy set theory and fuzzy logic.
5. Foster competence in recognizing the feasibility and applicability of the design and implementation of intelligent systems.
6. To develop a sufficient understanding of fuzzy system design methodology.

Syllabus

UNIT-I Introduction: Background, Uncertainty and imprecision, Statistics and random processes, Uncertainty in information, Fuzzy sets and membership, Chance versus ambiguity, Classical sets - operations on classical sets to functions, Fuzzy sets-fuzzy set operations, Properties of fuzzy sets, sets as points in hypercube.

UNIT-II Classical Relations And Fuzzy Relations: MTI Radar, Clutter Attenuation, MTI improvement factor, Delay line cancellers, Frequency response of single delay line cancellers, N-pulse delay line canceller, Non recursive and Recursive filters, Staggered PRF, Doppler filter banks.

UNIT–III Membership Functions: Features of the membership function, Standards forms and boundaries, fuzzification, Membership value assignments-intuition, Inference, Rank ordering, Angular fuzzy sets.

UNIT–IV Fuzzy-To-Crisp Conversions And Fuzzy Arithmetic:Lambda-cuts for fuzzy sets, Lambda-cuts for fuzzy relations, Defuzzification methods. Extension principle-crisp functions, Mapping and relations, Functions of fuzzy sets-extension principle, Fuzzy transform (Mapping), Fuzzy numbers Interval analysisin Arithmetic.

UNIT–V Fuzzy Logic Fuzzy Rule-Based Systems:Fuzzy logic, approximate reasoning, Fuzzy tautologies, Contradictions, Equivalence and logical proofs. Natural language, Linguistic hedges, Rule-based system canonical rule forms, composition of compound rules, Likelihood and truth qualification, Aggregation of fuzzy rules.

Text Books

1. Neural Networks and Fuzzy Logic System by Bart Kosko, PHI Publications.
2. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan and Rai – PHI Publication.
3. Fuzzy Sets, Fuzzy Logic, and Fuzzy Systems by Lotfi A. Zadeh
4. Fuzzy logic with engineering application by Timothy J. Ross-wiley

Course Outcomes

At the end of course, the student will be able to

1. Learn crips and fuzzy set theory and decide the difference between crips set and fuzzy set theory.
2. Recognize fuzzy logic membership function and fuzzy inference systems.
3. Analyse statistical data by using fuzzy logic methods and compare these methods with statistical methods.
4. Design applications on Fuzzy logic membership function and fuzzy inference systems.
5. Evaluate fuzzy statistics applications.

EC-416-A: Managerial Economics and Financial Analysis

IV Year, I Semester

Department: ECE	Category Code: BSC
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Objectives

1. To teach student the basics of Managerial economics.
2. To impart analytical skills in helping them take sound financial decisions for achieving higher organizational productivity.
3. To enable them to understand the micro-economics of business operation.
4. To develop the ability to apply the concepts, tools and techniques of economics in analysing and interpreting business decisions.

Syllabus

UNIT-I Introduction to Managerial Economics: Definition, Nature and Scope of Managerial Economics-Demand Analysis: Demand Determinants, Law of Demand and its exceptions. Elasticity of Demand: Definition, Types, Measurement and Significance of Elasticity of Demand. Demand Forecasting, Factors governing demand forecasting, methods of demand forecasting (survey methods, statistical methods, expert opinion method, test marketing, controlled experiments, judgmental approach to demand forecasting)

UNIT-II Theory of Production and Cost Analysis: Production Function - Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs. Cobb-Douglas Production function, Laws of Returns, Internal and External Economies of Scale. Cost Analysis: Cost concepts, Opportunity cost. Fixed vs. Variable costs, Explicit costs Vs. Implicit costs. Out of pocket costs vs. Imputed costs. Break-even Analysis (BEA)-Determination of Break-Even Point (simple problems)- Managerial Significance and limitations of BEA.

UNIT–III Introduction to Markets Pricing Policies: Market structures: Types of competition, Features of Perfect competition, Monopoly and Monopolistic Competition. Price-Output Determination in case of Perfect Competition and Monopoly. Objectives and Policies of Pricing-

Methods of Pricing: Cost Plus Pricing. Marginal Cost Pricing, Sealed Bid Pricing, Going Rate Pricing, Limit Pricing, Market Skimming Pricing, Penetration Pricing. Two-Part Pricing, Block Pricing, Bundling Pricing, Peak Load Pricing, Cross Subsidization.

UNIT–IV Business New Economic Environment:Business New Economic Environment: Characteristic features of Business, Features and evaluation of Sole Proprietorship, Partnership. Joint Stock Company. Public Enterprises and their types, Changing Business Environment in Post-liberalization scenario. Capital and Capital Budgeting: Capital and Capital Budgeting: Capital and its significance. Types of Capital. Estimation of Fixed and Working capital requirements. Methods and sources of raising finance. Nature and scope of capital budgeting, features of capital budgeting proposals. Methods of Capital Budgeting: Payback Method. Accounting Rate of Return (ARR) and Net Present Value Method (simple problems).

UNIT–V Introduction to Financial Accounting:Introduction to Financial Accounting: Double-Entry Book Keeping, Journal. Ledger. Trial Balance- Final Accounts (Trading Account. Profit and Loss Account and Balance Sheet with simple adjustments). Financial Analysis through ratios: Computation, Analysis and Interpretation of Liquidity Ratios (Current Ratio and quick ratio). Activity Ratios (Inventory turnover ratio and Debtor Turnover ratio). Capital structure Ratios (Debt-Equity ratio. Interest Coverage ratio), and Profitability ratios (Gross Profit Ratio, Net Profit ratio. Operating Profit Ratio. P/E Ratio and EPS).

Text Books

1. Aryasri: Managerial Economics and Financial Analysis, TMH, 2009.
2. Varshney Maheswari: Managerial Economics, Sultan Chand, 2009.

Course Outcomes

At the end of course, the student will be able to

1. Outline the different types of business organizations and provide a framework for analyzing money in its functions as a medium of exchange.
2. Assess the functional relationship between Production and factors of production and list out various costs associated with production and able to compute breakeven point to illustrate the various uses of breakeven analysis.
3. Determine the objectives, nature, scope, role & responsibilities of a manager of a business undertaking.
4. Analyze, interpret & comment on the financial statements of a business enterprise by using liquidity leverage, coverage and turnover & profitability ratios.
5. Critically evaluate the policies in view of liberalization, privatization & globalization.

EC-416-B: Industrial Management

IV Year, I Semester

Department: ECE	Category Code: HSC
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Objectives

1. To understand the concepts related to Business.
2. To help the students gain understanding of the functions and responsibilities of managers.
3. To provide them tools and techniques to be used in the performance of the managerial job.
4. To enable them to analyze and understand the environment of the organization.
5. To help the students to develop cognizance of the importance of management principles.

Syllabus

UNIT-I General Management: Principles of scientific management, Brief treatment of Managerial Functions. Forms Of Business Organisation: Salient features of sole proprietorship. Partnership, Joint Stock Company, private limited and public limited companies.

UNIT-II Financial Management: Concept of interest, compound interest, equivalent cash flow diagram Economic Evaluation Of Alternatives: Basic methods, the annual equivalent method, present worth method, future worth method. Depreciation: Purpose, types of depreciation, common methods of depreciation. The straight line method, declining balance method, the sum of the years digits method.

UNIT–III Personnel Management: Functions of Personnel Management – Human Resources Planning, Brief treatment of Recruitment, Selection, Placement, Performance Appraisal, Career Development, Training and Development, Compensation. Staff role of Personnel Department, Organization for the Personnel Function. Goals and Plans of the Organization. Motivation and Leadership, Theories of Motivation and styles of Leadership.

UNIT–IV Material Management:Purchasing, Objective, Source Selection, Procurement Methods, Inventory Management –EOQ, EPQ, ABC Analysis.

UNIT–V Marketing Management:Functions of Marketing, Product life cycle, Channels of distribution, Advertising Sales promotion, Market Research.

Text Books

1. KK Ahuja, Industrial Management, Vol. I II, Dhanpat Rai, 1978.
2. E.Paul Degarmo, John R Chanda, William G Sullivan, Engineering Economy, Mac Millan Publishing Co, 1979.

References

1. Philip Kotler, Marketing Management, 11th Edition, Pearson Education, 2004.
2. P. Gopalakrishnan, Hand Book of Materials Management, PHI, 1999
3. Heinz Weirich and Harold Koontz, Management, 10^{th} Edition, TMH,2004

Course Outcomes

At the end of course, the student will be able to

1. Apply principles of management in his / her extra and co-curricular activity in college and in industrial in-plant training.
2. Understand management of the organization.
3. Implement the leadership and entrepreneurship qualities in business.
4. Organize improvement techniques in an organization.
5. Identify the differences between private limited and public limited companies.

EC-416-C: Management Science

IV Year, I Semester

Department: ECE	Category Code: HSC
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Objectives

1. Aimed to develop management skills throughout the career.
2. To gain knowledge on the functions and responsibilities of managers.
3. To provide tools and techniques to be used in the managerial job.
4. To analyze and understand the environment of the organization.
5. To develop cognizance of the importance of management principles.

Syllabus

UNIT-I Introduction to Management: Entrepreneurship and organization- Nature and Importance of Management, Functions of Management, Taylor's Scientific Management Theory, Fayol's Principles of Management, Maslow's Theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Herzberg's Two-Factor Theory of Motivation, Systems Approach to Management, Leadership Styles, Social responsibilities of Management.

UNIT-II Designing Organisational Structures: Departmentation and Decentralisation, Types of organization structures -Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, Virtual Organisation, Cellular Organisation, team structure, boundaryless organization, inverted pyramid structure, lean and flat organization structure) and their merits, demerits and suitability.

UNIT–III Operations Management: Principles and Types of Plant Layout-Methods of production (Job, batch and Mass Production), Work Study -Basic procedure involved in Method Study and Work Measurement-Statistical Quality Control: chart, R chart, c chart, p chart, (simple Problems), Acceptance Sampling, Deming's contribution to quality.

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

UNIT–V Project Management (PERT/CPM):Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing. (simple problems). Strategic Management: Mission, Goals, Objectives, Policy, Strategy, Programmes, Elements of Corporate Planning Process, Environmental Scanning, SWOT Analysis, Steps in Strategy Formulation and Implementation, Generic Strategy alternatives.

Text Books

1. Aryasri: Management Science, TMH, New Delhi.
2. Kotler Philip & Keller Kevin Lane: Marketing Mangement 12/e, PHI, 2007.

References

1. Koontz & Weihrich: Essentials of Management, 6/e, TMH, 2007.
2. Thomas N.Duening & John M.Ivancevich Management—Principles and Guidelines, Biztantra,2007.
3. Kanishka Bedi, Production and Operations Management, Oxford University Press, 2007.
4. Memoria & S.V.Ganker, Personnel Management, Himalaya, 25/e, 2007.
5. Schermerhorn: Management, Wiley, 2007.
6. Parnell: Strategic Management, Biztantra,2007.
7. L.S.Srinath: PERT/CPM,Affiliated East-West Press, 2007.

Course Outcomes

At the end of course, the student will be able to

1. Apply the concepts related to Business in real-time scenarios.
2. Demonstrate the roles, skills and functions of management.
3. Analyze effective application of knowledge to diagnose and solve organizational problems and develop optimal managerial decisions.
4. Explain the complexities associated with management of human resources in the organizations and integrate the learning in handling these complexities.

EC-416-D: Entrepreneurship and Development

IV Year, I Semester

Department: ECE	Category Code: HSC
Credits: 3	Internal marks: 30
L-T-P : 3-0-0	External marks: 70

Course Objectives

To acquire necessary knowledge and skills required for organizing and carrying out entrepreneurial activities.

1. To develop the ability of analysing and understanding business situations in which entrepreneurs act and to master the knowledge necessary to plan entrepreneurial activities.
2. To develop the ability of analysing various aspects of entrepreneurship especially of taking over the risk, and the specificities as well as the pattern of entrepreneurship development.

Syllabus

UNIT-I Entrepreneur: meaning- importance-Qualities, nature, types, traits, culture, similarities and economic and differences between Entrepreneur and Intrapreneur. Entrepreneurship development-its importance- Role of Entrepreneurship -Entrepreneurial environment.

UNIT-II Evolution of Entrepreneurs: Entrepreneurial promotion. Training and developing motivation : factors - mobility of Entrepreneurs - Entrepreneurial change - occupational mobility-factors in mobility - Role of consultancy organizations in promoting Entrepreneurs-Forms of business for Entrepreneurs.

UNIT–III Creating and starting the venture : Steps for starting a small industry - selection of types of organization - International entrepreneurship opportunities.

UNIT–IV Managing, growing and ending the new venture :Preparing for the new venture launch -early management decisions Managing early growth of the new venture- new venture expansion strategies and issues - Going public - ending the venture.

UNIT–V Entrepreneurship Development and Government:Role of Central Government and State Government in promoting Entrepreneurship - Introduction to various incentives, subsidies

and grants - Export Oriented Units - Fiscal and Tax concessions available. Women Entrepreneurs Reasons for low / no women Entrepreneurs their Role, Problems and Prospects.

Text Books

1. Vasanth Desai " Dynamics of Entrepreneurial Development and Management Himalaya Publishing House.
2. N.P.Srinivasan G.P.Gupta," Entrepreneurial Development ", Sultanchand Sons.
3. P.Saravanavelu "Entrepreneurship Development ",Eskapee Publications.

References

1. Satish Taneja, Entrepreneur Development ", New Venture Creation.
2. Robert D.Hisrich, Michael P.Peters, " Entrepreneurship Development, Tata McGraw Hill edition.

Course Outcomes

At the end of course, the student will be able to

1. Demonstrate an ability to engage in critical thinking by analyzing situations and constructing and selecting viable solutions to solve problems.
2. Explain the importance of the impact of globalization and diversity in modern organizations.
3. Apply the knowledge of current information, theories and models, and techniques and practices in all of the major business disciplines.
4. Analyse various aspects of entrepreneurship and especially of taking over the risk, and the pattern of entrepreneurship development.
5. Develop the ability to communicate effectively both orally and in writing.