# REGULATIONS,
# COURSE STRUCTURE
# AND SYLLABUS

**Aligned with AICTE model Curriculem 2018-2019**

## SITE 2018(M) REGULATION

**for**

**B.Tech.**

## Electronics and Communication Technology

**With Effective from the academic year**

**2020-2021**

sasi autonomous INSTITUTE OF TECHNOLOGY & ENGINEERING

Accredited by NAAC with "A" Grade
Recognised by UGC under section 2(f) &12(B)
Approved by AICTE - New Delhi
Permanently Affiliated to JNTUK, SBTET
Ranked as "A" Grade by Govt. of A.P.

# Chapter-I

# UG
# Regulations

## B.Tech. Regulations

### 1.1 Short title and Commencement

The regulations listed under this head are common for all degree level under graduate programs (B.Tech.) offered by the college with effect from the academic year 2020-21 and they are called as “SITE18M” regulations.

The regulations here under are subject to amendments as may be made by the Academic Council of the college from time to time, keeping the recommendations of the Board of Studies in view. Any or all such amendments will be effective from such date and to such batches of candidates including those already undergoing the program, as may be decided by the Academic Council.

### 1.2. Definitions

a. “Commission” means University Grants Commission (UGC)
b. “Council” means All India Council for Technical Education (AICTE)
c. “University” Means Jawaharlal Nehru Technological University Kakinada (JNTUK)
d. “College” means Sasi Institute of Technology & Engineering, Tadepalligudem.
e. “Program” Means any combination of courses and /or requirements leading to award of a degree
f. “Course” Means a subject either theory or practical identified by its course title and code number and which is normally studied in a semester.
g. For example, (Data Structures) is a course offered at third semester of B.Tech (CST) and its code is (18MCSCST3020)
h. “Degree” means an academic degree conferred by the university upon those who complete the undergraduate curriculum
i. “Regular Student” means student enrolled into the four year program in the first year
j. “Lateral entry Students” Means student enrolled into the four year program in the second year

### 1.3. Academic Programs

#### 1.3.1. Nomenclature of Programs

The nomenclature and its abbreviation given below shall continue to be used for the degree programs under the University, as required by the Council and Commission. The name of specialization shall be indicated in brackets after the abbreviation. For e.g. UG engineering degree in Mechanical Engineering program is abbreviated as B.Tech. (ME). Bachelor of Technology (B.Tech.) degree program offered in:

1. Civil Engineering(CE)
2. Computer Science and Engineering(CSE)
3. Computer Science and Technology(CST)
4. Electronics and Communication Engineering(ECE)
5. Electronics and Communication Technology(ECT)
6. Electrical and Electronics Engineering(EEE)
7. Information Technology(IT)
8. Mechanical Engineering(ME)

- Curriculum framework is important in setting the right direction for a Degree program as it takes into account the type and quantum of knowledge necessary to be acquired by a student to qualify for a award in his/her chosen branch or specialization.
- Besides, this also helps in assigning the credits for each course, sequencing the courses semester-wise and finally arriving at the total number of courses to be studied and the total number of credits to be earned by a student to fulfill the requirements for conferment of degree.
- Each theory course shall consist of five units.

**1.3.2. Curriculum Structure**

The curriculum structure is designed in such a way that it facilitates the courses required to attain the expected knowledge, skills and attitude by the time of their graduation as per the needs of the stakeholders. The curriculum structure consists of various course categories (as described in 1.6.3 to 1.6.9) to cover the depth and breadth required for the program and for the attainment of program outcomes of the corresponding program. Each Program of study will be designed to have 40-45 theory courses and 16-18 laboratory courses. The distribution and types of courses offered from the above is indicated in the following table 3.

**1.3.3. Induction Program**

The Induction Program for two weeks is designed to make the newly joined students feel comfortable, sensitize them towards exploring their academic interests and activities, reducing competition and making them work for excellence, promote bonding within them, build relations between teachers and students and building of character. Induction program covers:

- Physical activity
- Creative arts

- Universal human values
- Literary and Proficiency modules
- Lectures by Eminent peoples

**1.4Admission Criteria**

The eligibility criteria for admission into UG engineering programs are as per the norms approved by government of Andhra Pradesh from time to time. The sanctioned seats in each program in the college are classified into CATEGORY-A and CATEGORY-B at first year level and Lateral Entry at second year level.

- **CATEGORY – A Seats:** These seats will be filled as per the norms approved by the Government of Andhra Pradesh.
- **CATEGORY – B Seats:** These seats will be filled by the College as per the norms approved by the Government of Andhra Pradesh.
- **CATEGORY – Lateral Entry Seats:** Lateral entry candidates shall be admitted into the Third semester directly as per the norms approved by government of Andhra Pradesh. The percentages of Category-A, Category-B and Lateral Entry Seats are decided time to time by the Government of Andhra Pradesh.

**2. Award of B. Tech. Degree**

a) A student will be declared eligible for the award of B. Tech. Degree if he fulfils the following academic regulations:

   i. A student shall be declared eligible for the award of B. Tech Degree, if he pursues a course of study in not less than four and not more than eight academic years. 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.

   ii. The candidate shall register for 160 credits and secure all the 160 credits.

b) The medium of instruction for the entire under graduate program in Engineering &Technology will be in **English** only.

**3. Program Pattern:**

a) Total duration of the of B. Tech (Regular) Program is four academic years

b) Each Academic year of study is divided into Two Semesters.

c) Minimum number of instruction days in each semester is 90.

d) Grade points, based on percentage of marks awarded for each course will form the basis for calculation of SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average).

e) The total credits for the Program is 160.

f) Three week induction program is mandatory for all first year UG students and shall be conducted as per AICTE/UGC/APSCHE guidelines.

g) Student is introduced to "Choice Based Credit System (CBCS)".

h) A pool of interdisciplinary and job-oriented mandatory skill courses which are relevant to the industry are integrated into the curriculum of concerned branch of engineering (total five skill courses: two basic level skill courses, one on soft skills and other two on advanced level skill courses)

i) A student has to register for all courses in a semester.

j) All the registered credits will be considered for the calculation of final CGPA.

k) Each semester has - 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'. Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated by UGC and course structure as suggested by AICTE are followed.

l) A 10 months industry/field mandatory internship, both industry and social, during the summer vacation and also in the final semester to acquire the skills required for job and make engineering graduates to connect with the needs of the industry and society at large.

m) All the students shall be mandatorily registered for NCC, NSS activities and Community Service Project as per the Government and University norms.

n) Each college shall assign a faculty advisor/mentor after admission to each student or group of students from same department to provide guidance in courses registration/career growth/placements/ opportunities for higher studies/GATE/other competitive exams etc.

**4. Registration for Courses:**

a) In each semester a student shall mandatorily register courses which he/she wishes to pursue within a week from the starting of the class work with the advice of Head of the Department and mentor of the student of the concerned department of the college.

b) If any student wishes to withdraw the registration of the course, he/she shall submit a letter to the Principal of the college through the Head of the Department and mentor within fifteen days.

c) The concerned college shall thoroughly verify and upload the data/courses registered by each student in the university examination center within 20 days. The Principal of the concerned college shall ensure that there no wrong registration courses by the student. The university registration portal will be closed after 20 days.

5. **(a) Award of B. Tech. Degree:** A student will be declared eligible for the award of B. Tech. Degree if he fulfills the following academic regulations:

   i. A student shall be declared eligible for award of the B. Tech Degree, if he pursues a course of study in not less than four and not more than eight academic years. 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.

   ii. The student shall register for 160 credits and must secure all the 160 credits.

   iii. All students shall mandatorily register for the 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 at least 40% of the marks allotted in the internal evaluation for passing the course and shall maintain 75% of attendance in the subject.

   iv. All students shall mandatorily register for NCC/NSS activities and will be required to participate in an activity specified by NSS officer 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.

   v. Credits are defined as per AICTE norms.

**(b) Award of B. Tech. (Honor)/B. Tech. (Minor):** B. Tech. with Honors or a B. Tech. with a Minor will be awarded if the student earns 20 additional credits are acquired as per the regulations/guidelines. The regulations/guidelines are separately provided. Registering for an Honors/Minor is optional.

6. **Attendance Requirements**

   a) A student is eligible to write the University examinations if he acquires a minimum of 40% in each subject and 75% of attendance in aggregate of all the subjects.

   b) Condonation of shortage of attendance in aggregate up to 10% (65% and above, and below 75%) may be granted by the College Academic Committee. However, this Condonation concession is applicable only to any two semesters during the entire program.

   c) Shortage of Attendance below 65% in aggregate shall not be condoned.

   d) A student who is short of attendance in a semester may seek re-admission into that semester when offered within 4 weeks from the date of commencement of class work.

e) Students whose shortage of attendance is not condoned in any semester are not eligible to write their end semester examination of that class.

f) A stipulated fee of Rs. 1000/- in the concerned semester shall be payable towards Condonation of shortage of attendance. Students availing Condonation on medical ground shall produce a medical certificate issued by the competitive authority.

g) A student will be promoted to the next semester if he satisfies the (i) attendance requirement of the present semester and (ii) minimum required credits.

h) If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

i) For induction program attendance shall be maintained as per AICTE norms.

j) For non-credit mandatory courses the students shall maintain the attendance similar to credit courses

**7. Evaluation-Distribution and Weightage of marks**

i. Paper setting and evaluation of the answer scripts shall be done as per the procedures laid down by the University Examination section from time to time.

ii. To maintain the quality, external examiners and question paper setters shall be selected from reputed institutes like IISc, IITs, IIITs, IISERs, NITs and Universities.

iii. For non-credit mandatory courses, like Environmental Sciences, Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge, the 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.

iv. A student is deemed to have satisfied the minimum academic requirements if he has earned the credits allotted to each theory/practical design/drawing subject/ project etc by securing not less than 35% of marks in the end semester exam and minimum 40% of marks in the sum total of the internal marks and end semester examination marks together.

v. **Distribution and Weightage of marks:**

The assessment of the student's performance in each course will be as per the details given:

| S.No. | Components | Internal | External | Total |
|---|---|---|---|---|
| 1 | Theory | 30 | 70 | 100 |
| 2 | Engineering | 30 | 70 | 100 |
| 3 | Practical | 15 | 35 | 50 |
| 4 | Mini Project/Internship/Industrial Training/ Skill Development programs/Research Project | - | 50 | 50 |

| S.No. | Components | Internal | External | Total |
|---|---|---|---|---|
| 5 | Project Work | 60 | 140 | 200 |

vi. **Continuous Internal Theory Evaluation:**

a) For theory subjects, during a semester, there shall be two mid-term examinations. Each mid-term examination consists of (i) one online objective examination (20 multiple choice questions) for 10 marks for duration of 20 minutes (ii) one descriptive examination (3 full questions for 5 marks each) for 15 marks for duration of 90 minutes and (iii) one assignment for 05 marks. All the internal exams shall be conducted as per university norms from first 50% of the syllabi.

b) In the similar lines, the second online, descriptive examinations assignment shall be conducted on the rest of the 50% syllabus.

c) The total marks secured by the student in each mid-term examination are evaluated for 30 marks. The first mid marks (Mid-1) consisting of marks of online objective examination, descriptive examination and assignment shall be submitted to the University examination section within one week after completion of first mid examination.

d) The mid marks submitted to the University examination section shall be displayed in the concerned college notice boards for the benefit of the students.

e) If any discrepancy found in the submitted Mid-1 marks, it shall be brought to the notice of university examination section within one week from the submission.

f) Second mid marks (Mid-2) consisting of marks of online objective examination, descriptive examination and assignment shall also be submitted to University examination section within one week after completion of second mid examination and it shall be displayed in the notice boards. If any discrepancy found in the submitted mid-2 marks, it shall be brought to the notice of university examination section within one week from the submission.

g) Internal marks can be calculated with 80% Weightage for better of the two mids and 20% Weightage for other mid exam.

Example:

**Mid-1 marks** = Marks secured in

(Online examination-1 + descriptive examination-1 +one assignment-1)

**Mid-2 marks** = Marks secured in

(Online examination-2+descriptive examination-2+one assignment-2)

**Final internal Marks** = (Best of (Mid-1/Mid-2) marks x 0.8 + Least of (Mid-1/Mid-2) marks x 0.2)

h) With the above criteria, university examination section will send mid marks of all subjects in consolidated form to all the concerned colleges and same shall be displayed in the concerned college notice boards. If any discrepancy found, it shall be brought to the notice of university examination section through proper channel within one week with all proofs. Discrepancies brought after the given deadline will not be entertained under any circumstances.

**vii. Semester End Theory Examinations Evaluation:**

a) The semester end examinations will be conducted university examination section for 70 marks consists of five questions carrying 14 marks each. Each of these questions is from one unit and may contain sub-questions. For each question there will be an "either" "or" choice, which means that there will be two questions from each unit and the student should answer either of the two questions.

b) For practical subjects there shall be continuous evaluation during the semester for 15 internal marks and 35 end examination marks. The internal 15 marks shall be awarded as follows: day to day work - 5 marks, Record-5 marks and the remaining 5 marks to be awarded by conducting an internal laboratory test. The end examination shall be conducted by the teacher concerned and external examiner appointed.

c) 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 (15 marks for continuous Assessment (day–to–day work) and 15 marks for internal tests) and 70 marks for end examination. There shall be two internal tests in a Semester for 15 marks each and final marks can be calculated with 80% Weightage for better 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.

d) Evaluation of the summer internships: It shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Industries, Hydel and thermal power projects and also in software MNCs in the area of concerned specialization of the UG program. Students shall pursue this course during summer vacation just before its offering as per course structure. The minimum duration of this course is at least 6 weeks. The student shall register for the course as per course structure after commencement of academic year. A supervisor/mentor/advisor has to be allotted to guide the students for taking up the summer internship. The supervisor shall monitor the attendance of the students while taking up the internship. Attendance requirements are as per the norms of the University. After successful completion, students shall submit a summer internship technical report to the concerned department and appear for an oral presentation before the departmental committee consists of an external examiner; Head of the Department; supervisor of the internship and a senior faculty member of the department. A certificate from industry/skill development center shall be included in the report. The report and the oral presentation shall carry 40% and 60% Weightage respectively. It shall be evaluated for 50 external marks at the end of the semester. There shall be no internal marks for Summer Internship. A student shall secure minimum 40% of marks for successful completion. In case, if a student fails, he/she shall reappear as and when semester supplementary examinations are conducted by the University.

e) The job oriented skill courses may be registered at the college or at any accredited external agency. A student shall submit a record/report on the on the list skills learned. If the student completes job oriented skill course at external agency, a certificate from the agency shall be included in the report. The course will be evaluated at the end of the semester for 50 marks (record: 15 marks and viva-voce: 35 marks) along with laboratory end examinations in the presence of external and internal examiner (course instructor or mentor). There are no internal marks for the job oriented skill courses.

f) Mandatory Course (M.C): Environmental Sciences, Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge etc non-credit (zero credits) mandatory courses. Environmental Sciences shall be offered compulsorily as mandatory course for all branches. A minimum of 75% attendance is mandatory in these subjects. There shall be an external examination for 70 marks and it shall be conducted by the college internally. Two internal examinations shall be conducted for 30 marks and a student has to secure at least 40% of the marks for passing the course. There is no online internal exam for mandatory courses. No marks or letter grade shall be printed in the transcripts for all mandatory non-credit courses, but only Completed (Y)/Not-completed (N) will be specified.

g) **Procedure for Conduct and Evaluation of MOOC:** There shall be a Discipline Centric Elective Course through Massive Open Online Course (MOOC) as Program Elective course. The student shall register for the course (Minimum of 12 weeks) offered by SWAYAM/NPTEL through online with the approval of Head of the Department. The Head of the Department shall appoint one mentor for each of the MOOC subjects offered. The student needs to register the course in the SWAYAM/NPTEL portal. During the course, the mentor monitors the student's assignment submissions given by SWAYAM /NPTEL. The student needs to submit all the assignments given and needs to take final exam at the proctor center. The student needs to earn a certificate by passing the exam. The student will be awarded the credits given in curriculum only by submission of the certificate. In case if student does not pass subjects registered through SWAYAM/NPTEL, the same or alternative equivalent subject may be registered again through SWAYAM/NPTEL in the next semester with the recommendation of HOD and shall be pass.

**h) Major Project *(*Project - Project work, seminar and internship in industry):**

In the final semester, the student should mandatorily register and undergo internship and in parallel 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.

**Evaluation**: The total marks for project work 200 marks and distribution shall be 60 marks for internal and 140 marks for external evaluation. The supervisor assesses the student for 30 marks (Report: 15 marks, Seminar: 15 marks). At the end of the semester, all projects shall be showcased at the department for the benefit of all students and staff and the same is to be evaluated by the departmental Project Review Committee consisting of supervisor, a senior faculty and HOD for 30 marks. The external evaluation of Project Work is a Viva-Voce Examination conducted in the presence of internal examiner and external examiner and is evaluated for 140 marks.

**8 Results Declaration:**

i. Before results declaration, an academic council meeting shall be conducted and results shall be placed before the academic council for approval.

ii. With the approval of academic council, the results shall be submitted to the University to get the Approval from Honorable Vice-Chancellor.

iii. The University may normalize the result, if required, before declaration of the result (Guidelines for normalization will be provided separately)

iv. A copy of approved results in a CD shall be submitted to the University Examination Center.

**9. Academic Audit:** Academic audit in each semester will be conducted as per norms.

**10. Recounting or Re-evaluation of Marks in the End Semester Examination:** A student can request for recounting of revaluation of his/her answer book on payment of a prescribed fee as per norms.

**11. Supplementary Examinations:** A student who has failed to secure the required credits can appear for a supplementary examination, as per the schedule announced by the University.

**12. Malpractices in Examinations:** Disciplinary action shall be taken in case of malpractices during Mid/End examinations as per the rules framed by the University.

**13. Promotion Rules:** The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.5 for promotion to higher classes

a) A student shall be promoted from first year to second year if he fulfills the minimum attendance requirement as per University norm.

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.

**14. Course Pattern**

a) The entire course of study is for four academic years; all years are on semester pattern.

b) A student eligible to appear for the end semester examination in a subject, but absent from it or has failed in the end semester examination, may write the exam in that subject when conducted next.

c) When a student is detained for lack of credits / shortage of attendance, he may be re-admitted into the same semester/year in which he has been detained. However, the academic regulations under which he was first admitted shall continue to be applicable to him.

**15. Earning of Credit**: A student shall be considered to have completed a course successfully and earned the credits if he/she secures an acceptable letter grade in the range A+ to E as given below. Letter grade 'F' in any course implies failure of the student in that course and no credits earned. Absent is also treated as no credits earned. For project same % percentages will be followed for grading.

| **Marks Range Max:100** | **Marks range Max:50** | **Level** | **Letter Grade** | **Grade point** |
|---|---|---|---|---|
| ≥ 90 | ≥ 45 | Outstanding | A+ | 10 |
| ≥80 to <89 | ≥40 to <44 | Excellent | A | 9 |
| ≥70 to <79 | ≥35 to <39 | Very Good | B | 8 |

| | | | | |
|---|---|---|---|---|
| ≥60 to <69 | ≥30 to <34 | Good | C | 7 |
| ≥50 to <59 | ≥25 to <29 | Fair | D | 6 |
| ≥40 to <49 | ≥20 to <24 | Satisfactory | E | 5 |
| <40 | <20 | Fail | F | 0 |
| - | | Absent | AB | 0 |

**16. Award of Class:**

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

| **Class Awarded** | **CGPA to be secured** | **Remarks** |
|---|---|---|
| First Class with Distinction | ≥7.75 (Without any supplementary appearance) | From the CGPA secured from 160 Credits |
| First Class | ≥ 6.75 | |
| Second Class | ≥ 5.75 to < 6.75 | |
| Pass Class | ≥ 5.00 to < 5.75 | |

**17. Minimum Instruction Days:**

The minimum instruction days for each semester shall be 90 working days. There shall be no branch transfers after the completion of the admission process. There shall be no transfer from one college/stream to another within the Constituent Colleges and Units of Jawaharlal Nehru Technological University Kakinada.

**18. Withholding of Results:**

If the student is involved in indiscipline/malpractices/court cases, the result of the student will be withheld.

**19. Transitory Regulations**

a) Discontinued or detained candidates are eligible for re-admission as and when next offered.

b) The re-admitted candidate will be governed by the rules & regulations under which the candidate has been admitted.

c) In case of transferred students from other Universities, credits shall be transferred to JNTUK as per the academic regulations and course structure of JNTUK.

d) The students seeking transfer to colleges affiliated to JNTUK from various other Universities / Institutions have to obtain the credits of any equivalent subjects as prescribed by JNTUK. In addition, the transferred candidates have to pass the failed subjects at the earlier Institute with already obtained internal/sessional marks to be conducted by JNTUK.

**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/II/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.

**21. General:**

a) Wherever the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”, “hers”.

b) The academic regulation should be read as a whole for the purpose of any interpretation.

c) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.

d) The University may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the University.

## ACADEMIC REGULATIONS (SITE18M) FOR B. Tech

## (LATERAL ENTRY SCHEME)

Applicable for the students admitted into II year B. Tech. from the Academic Year 2021-22 onwards

**1. Award of B. Tech. Degree**

A student will be declared eligible for the award of B. Tech. Degree if he fulfills the following academic regulations:

a) A student shall be declared eligible for the award of the B. Tech Degree, if he pursues a course of study in not less than three academic years and not more than six academic years. After six academic years from the year of their admission, he/she shall forfeit their seat in B. Tech course and their admission stands cancelled.

b) The candidate shall register for 122 credits and secure all the 122 credits.

2. The attendance regulations of B. Tech. (Regular) shall be applicable to B. Tech (lateral entry)

3. **Promotion Rules:** A student shall be promoted from second year to third year if he fulfills the minimum attendance requirement.

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.

4. **Award of Class**

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

| Class Awarded | CGPA to be secured | Remarks |
|---|---|---|
| First Class with Distinction | ≥ 7.75 (Without any supplementary appearance) | From the CGPA secured from 121 Credits from II Year to IV Year |
| First Class | ≥ 6.75 | |
| Second Class | ≥ 5.75 to < 6.75 | |
| Pass Class | ≥ 5.00 to < 5.75 | |

The Grades secured, Grade points and Credits obtained will be shown separately in the memorandum of marks.

5. All the other regulations as applicable to **B. Tech. 4-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme)**

**COMMUNITY SERVICE PROJECT**

***Introduction***

1. Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development
2. Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.
3. 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;

1. To sensitize the students to the living conditions of the people who are around them,
2. To help students to realize the stark realities of the society.
3. To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
4. To make students aware of their inner strength and help them to find new /out of box solutions to the social problems.
5. To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
6. To help students to initiate developmental activities in the community in coordination with public and government authorities.
7. 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***

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

3. 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
4. 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 in charge.
5. Evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.
6. The final evaluation to be reflected in the grade memo of the student.
7. The Community Service Project should be different from the regular programs of NSS/NCC/Green Corps/Red Ribbon Club, etc.
8. 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.
9. Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training

***Procedure***

1. 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.
2. The Community Service Project is a twofold one –
   a) 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.
   b) 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***

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

***Personal Outcomes***

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

***Social Outcomes***

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

***Career Development***

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

***Relationship with the Institution***

1. Stronger relationships with faculty

2. Greater satisfaction with college
3. Improved graduation rates

**BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS**

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

**BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES**

1. Improved institutional commitment
2. Improved student retention
3. Enhanced community relations

**BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY**

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

**SUGGESTIVE LIST OF PROGRAMS 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 programs
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 programs 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. Utilization of free electricity to farmers and related issues
40. Gender ration in schooling level- observation.

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

**Programs for School Children:**

1. Reading Skill Program (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 Program on Good Touch and Bad Touch (Sexual abuse)
7. Awareness Program on Socially relevant themes.

***Programs for Women Empowerment***

1. Government Guidelines and Policy Guidelines
2. Women's' 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 Bharat
7. AIDS awareness camp
8. Anti Plastic Awareness
9. Programs on Environment
10. Health and Hygiene
11. Hand wash programs
12. Commemoration and Celebration of important days

***Programs for Youth Empowerment***

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

5. Personality Development

***Common Programs***

1. Awareness on RTI
2. Health intervention programs
3. Yoga
4. Tree plantation
5. Programs 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:***

1. Students may not have the expertise to conduct all the programs on their own. The students then can play a facilitator role.
2. For conducting special camps like Health related, they will be coordinating with the Government agencies.
3. As and when required the College faculty themselves act as Resource Persons.
4. 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.
5. And also, with the Governmental Departments. If the program is rolled out, the District Administration could be roped in for the successful deployment of the program.

6. An in-house training and induction program 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) A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.

b) 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.

c) The Governmental agencies, like revenue administration, corporation and municipal authorities and village secretariats 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 programs to be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.

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

Along with the Community Awareness Programs, the student batch can also work with any one of the below listed governmental agencies and work in tandem with them. This community involvement program will involve the students in exposing themselves to the experiential learning about the community and its dynamics. Programs 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 works 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.

**Course Numbering Scheme**

The Course number code consists of 11 alphabets. A typical course number code is illustrated in the following Figure-1.

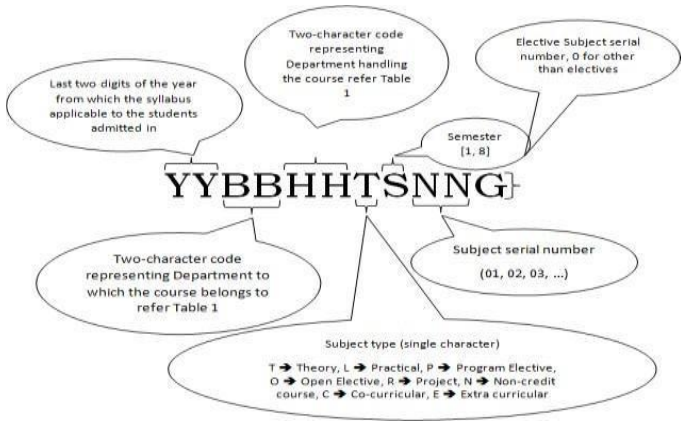



**Figure 1:** Course Numbering Scheme

The department codes are in given in following table 1.

**Table 1: Department Codes**

| Department | Two-character code |
|---|---|
| Civil Engineering | CE |
| Electrical & Electronics Engineering | EE |
| Mechanical Engineering | ME |
| Electronics and Communication Engineering | EC |
| Electronics and Communication Technology | ET |
| Computer Science and Engineering | CS |
| Computer Science and Technology | CT |
| Information Technology | IT |
| Management Science | MS |
| Mathematics | MA |
| Physics | PH |
| Chemistry | CH |
| English | EG |
| Biology | BI |
| Common to All Branches | CM |

**Example:** STLD in 3rd semester for ECE with S. No 2

**Course Code:** 18ECECT3020

**Table 2: Comparison of Number of credits given by AICTE and Approved credits**

| S. No. | Category | No. of Credits | | | | |
|---|---|---|---|---|---|---|
| | | ECE/ | EEE | CSE/IT/CST | ME | CE |

| | | AICTE | Approved | AICTE | Approved | AICTE | Approved | AICTE | Approved | AICTE | Approved |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Humanities and Social Sciences | 12 | 11 | 12 | 11 | 12 | 11 | 12 | 11 | 12 | 08 |
| 2 | Basic Science courses | 25 | 23 | 26 | 25 | 24 | 26 | 25 | 26 | 26 | 26 |
| 3 | Engineering Science courses | 24 | 23 | 20 | 20 | 29 | 29.5 | 24 | 23 | 29 | 24.5 |
| 4 | Professional Core courses | 48 | 56 | 53 | 62 | 49 | 48.5 | 48 | 55 | 47 | 56.5 |
| 5 | Professional Elective Courses | 18 | 20 | 18 | 15 | 18 | 18 | 18 | 18 | 23 | 21 |
| 6 | Open elective courses | 18 | 12 | 18 | 12 | 12 | 12 | 18 | 12 | 11 | 9 |
| 7 | Project work , Seminar and Internship | 15 | 15 | 11 | 15 | 15 | 15 | 15 | 15 | 12 | 15 |
| 8 | Mandatory Courses | - | - | - | - | - | - | - | - | - | - |
| Total Credits | | 160 | 160 | 160 | 160 | 160 | 160 | 160 | 160 | 160 | 160 |

**DISCIPLINARY ACTION FOR MALPRACTICES /IMPROPER CONDUCT IN EXAMS**

| S. No. | Nature of Malpractices/Improper conduct | Punishment |
|---|---|---|
| | If the candidate: | |
| 1. (a) | Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination) | Expulsion from the examination hall and cancellation of the performance in that subject only. |

| | | |
|---|---|---|
| 1. (b) | Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter. | Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him. |
| 2. | Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing. | Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University. |
| 3. | Impersonates any other candidate in connection with the examination. | The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him. |
| 4. | Smuggles in the Answer book or | Expulsion from the examination |

| | | |
|---|---|---|
| | additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination. | hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. |
| 5. | Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks. | Cancellation of the performance in that subject. |
| 6. | Refuses to obey the orders of the Chief Superintendent/Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the | In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them. |

| | | |
|---|---|---|
| | examination. | |
| 7. | Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall. | Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. |
| 8. | Possess any lethal weapon or firearm in the examination hall. | Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. |
| 9. | If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8. | Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.<br>Person(s) who do not belong to the College will be handed over to police and, a police case will |

| | | |
|---|---|---|
| | | be registered against them. |
| 10. | Comes in a drunken condition to the examination hall. | Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. |
| 11. | Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny. | Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations. |
| 12. | If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment. | |

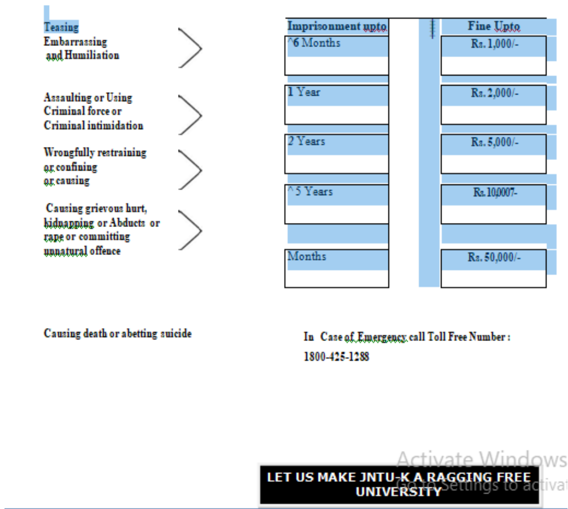
**MALPRACTICES**

- The Principal shall refer the cases of malpractices in Continuous Evaluation and Semester-End Examinations, to Malpractice Enquiry Committee, constituted by him/her for the purpose. Such committee shall follow the approved scales of punishment. The Principal shall take necessary action, against the erring students based on the recommendations of the committee.
- Any action on the part of student at an examination trying to get undue advantage in the performance or trying to help another, or derive the same through unfair means is punishable according to the provisions contained hereunder. The involvement of the Staff, who are in charge of conducting examinations, valuing examination papers and preparing/keeping records of documents relating to the examinations in such acts (inclusive of providing incorrect or misleading information) that infringe upon the course of natural justice to one and all concerned at the examination shall be viewed seriously and recommended for award of appropriate punishment after thorough enquiry.

**Ragging**

**Prohibition of ragging in educational institutions Act 26 of 1997 Salient Features**

- Ragging within or outside any educational institution is prohibited.
- Ragging means doing an act which causes or is likely to cause Insult or Annoyance of Fear or Apprehension or Threat or Intimidation or outrage of modesty or Injury to a student.



# COURSE STRUCTURE AND DETAILED SYLLABUS

# for

# B.Tech.-SITE18M

# With Effective from the Academic Year

# 2020-2021

**Program Outcomes for an Engineering Graduates:**

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**I -B. Tech I- Semester Course structure for the**
**Academic Year 2020-2021**
**Common for ME/CE/EEE/ECT/CST**

| S. No. | Subject Code | Subject title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | 18CMEGT1010 | Technical English | 3 | 0 | 0 | 3 |
| 2 | 18CMMAT1020 | Engineering Mathematics-I | 3 | 1 | 0 | 4 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 3 | 18CMCHT1030 | Engineering Chemistry | 3 | 1 | 0 | 4 |
| 4 | 18CMEET1040 | Basic Electrical Engineering | 3 | 1 | 0 | 4 |
| 5 | 18CMEGL1050 | English Communication skills lab | 0 | 0 | 2 | 1 |
| 6 | 18CMCHL1060 | Engineering Chemistry Lab | 0 | 0 | 3 | 1.5 |
| 7 | 18CMEEL1070 | Basic Electrical Engineering Lab | 0 | 0 | 3 | 1.5 |
| 8 | 18CMEEL1080 | Constitution of India, professional ethics & human rights (Non - Credit course) | 3 | 0 | 0 | -- |
| | | | | | **Total Credits** | **19** |

**I B. Tech II Semester Course structure for the Academic Year 2020-2021 Common for ME/CE/EEE/ECT/CST**

| S. No. | Subject Code | Subject title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | 18CMMAT2010 | EngineeringMathematics II | 3 | 1 | 0 | 4 |
| 2 | 18EEPHT2020, 18MEPHT2020, 18CEPHT2020 | Engineering Physics | 3 | 1 | 0 | 4 |
| 3 | 18CMCST2030 | Programming forproblem solving | 3 | 0 | 0 | 3 |
| 4 | 18CMMEL2040 | Engineering Graphics | 1 | 0 | 4 | 3 |
| 5 | 18EEPHL2050, 18MEPHL2050, 18CEPHL2050 | Engineering Physics Lab | 0 | 0 | 3 | 1.5 |
| 6 | 18CMCSL2060 | Programming for problem solving lab | 0 | 0 | 4 | 2 |
| 7 | 18CMMEL2070 | Work Shop/ Manufacturing practice | 0 | 0 | 3 | 1.5 |
| 8 | 18CMMEL2080 | Environmental Science (Non - Credit course) | 3 | 0 | 0 | --- |
| | | | | | **Total Credits** | **19** |

## TECHNICAL ENGLISH

| | | | |
|---|---|---|---|
| Subject Code | 18CMEGT1010 | IA Marks | 30 |
| Number of Lecture Hours/Week | 03 | Exam Marks | 70 |
| Total Number of Lecture Hours | 50 | Exams Hours | 03 |
| **Credits -02** | | | |

| | |
|---|---|
| **Course Objectives:**<br>To enable the students to learn and apply fundamental principles in Technical English & Communication by focusing on:<br>• Technical English Vocabulary<br>• Writing Skills<br>• Common Errors in Writing<br>• Nature and Style of Sensible Technical Writing<br>• Writing Technical Reports and Letters<br>• Providing an inspiring reading experience from the biography of a renowned technocrat. | |
| **Unit I** | |
| **Principles of Scientific Vocabulary**<br>• **Principles of Scientific vocabulary**: short and simple words-compact substitutes for wordy phrases- redundant words and expressions-Avoid hackneyed and stilted phrases, verbosity and incorrect use of words<br>• The role of roots in word building prefixes and suffixes, confusing words and expressions.<br>• Non-detailed text-Karma yogi: 1-4 chapters, Page No 1-53 | 10 hours |
| **Unit II** | |
| **Writing Skills**<br>• Distinguishing between academic and personal styles of writing<br>• Use of clauses in technical phrases and sentences<br>• Techniques of Sentence and paragraph writing<br>• Measuring the clarity of a text through Fog Index or Clarity Index<br>Non-detailed text- Karma yogi: 5-8 chapters, Page No 54-100 | 10 hours |
| **Unit III** | |
| **Common Errors in Writing**<br>• Subject-verb agreement and concord of nouns, pronouns and possessive adjectives<br>• Common errors in the use of articles, prepositions, adjectives and adverbs<br>• Punctuation<br>• Technical Guidelines for Communication<br>• Avoiding the pitfalls<br>Non-detailed text-Karma yogi: 9-12 chapters, Page No101- 151 | 10 hours |
| **Unit IV** | |
| **Nature and Style of Sensible Technical Writing**<br>• Academic Writing Process<br>• Describing, processes and products<br>• Defining, Classifying<br>• Effective use of charts, graphs, and tables<br>Non-detailed text- Karma yogi: 13-16 chapters, Page No 152-203 | 10 hours |
| **Unit V** | |
| **Report writing and Letter writing**<br>• Writing Technical Reports<br>• Précis writing<br>• Letter Writing<br>• Essay writing<br>• Non-detailed text- Karma yogi: 13-16 chapters, Page No 204-250 | 10 hours |

**COURSE OUTCOMES**

On Completion of the course student will acquire

1. Ability to understand Scientific vocabulary and use them confidently
2. Familiarity with the basic principles of writing clear sentences and paragraphs
3. Ability to write error free simple technical passages
4. Knowledge of writing different writing styles
5. Confidence to write letters and technical reports clearly and coherently
6. Get inspired by achievements and values upheld by a renowned technocrat.

**Question paper pattern:**

1. Question paper consists of 10 questions.
2. Each full question carrying 14 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

**Text Books**

1. Effective Technical Communication by Barun K Mitra, Oxford University Publication

**Non-detailed Text**

1. Karma yogi: A Biography of E Sreedharan by M SAshokan

**Reference Books**

1. *Communication Skills* by Sanjay Kumar &PushpaLatha, OUP
2. Study Writing by LizHamp-Lyonsand Ben Heasly, Cambridge University Press.
3. Remedial English Grammar by F T Wood, Macmillian2007
4. *Practical English Usage* by Michael Swan Oxford University Press
5. *English Collocations in Use* by Michael McCarthy &Felicity O'Dell
6. *Effective Technical Communication* by Arsah f Rizvi,
7. *Essential English Grammar by Raymond Murphy, CUP, 2017*

**COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | - | - | - | - | - | - | - | - | - | **2** | - | - | - | - | - |
| 2 | - | - | - | - | - | - | - | - | - | **2** | - | - | - | - | - |
| 3 | - | - | - | - | - | - | - | - | - | **2** | - | - | - | - | - |
| 4 | - | - | - | - | - | - | - | - | - | **2** | - | - | - | - | - |
| 5 | - | - | - | - | - | - | - | - | - | **2** | - | - | - | - | - |
| 6 | - | - | - | - | - | - | - | - | - | **2** | - | - | - | - | - |

# ENGINEERING MATHEMATICS-I

Common to all the branches

SEMESTER - I

| | | | |
|---|---|---|---|
| Subject Code | 18CMMAT1020 | IA Marks | 30 |
| Number of Lecture Hours/Week | 3+ 1(T) | Exam Marks | 70 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |

**Credits – 04**

**Course Objectives:**

To enable the students to apply the knowledge of Mathematics in various engineering fields by making them to learn the following:

- To solve first order differential equations.
- To solve linear differential equations with constant coefficients.
- To find the extreme of a function.
- To solve partial differential equations
- To evaluate multiple integrals
- To verify vector integral theorems

| | |
|---|---|
| **Unit -1** | |
| **First order and first degree Ordinary Differential Equations** Exact, reducible to exact, linear and Bernoulli's differential equations. Orthogonal trajectories in Cartesian and polar form. Simple problems on Newton's law of cooling. Law of natural growth and decay. | **Hours – 10** |
| **Unit -2** | |
| **Linear differential equations with constant coefficients:** Solutions of second and higher order differential equations - inverse differential operator methods, Method of variation of parameters. Application: LCR Circuits | **Hours – 8** |
| **Unit – 3** | |
| **Partial derivatives** –Definition and Euler's theorem (without proof), total derivatives, partial differentiation of composite functions. Jacobian - Functional dependence.<br>Taylor's and Maclaurin's theorems for function of two variables (statement only). Maxima andminima- Lag ranges method of undetermined multipliers | **Hours – 10** |
| **Unit – 4** | |
| **First order Partial differential equations:** Formation of Partial differential equations by elimination of arbitrary constants and arbitrary functions – solutions of first order linear ( Lagrange) equation and non linear (standard type) equations<br>**Higher order Partial differential equations:** Solutions of Homogeneous and Non Homogeneous partial differential equations with constant coefficients – Classification of partial differential equations. | **Hours – 10** |
| **Unit – 5** | |
| **Double and triple integrals:** Evaluation of double and triple integrals. Evaluation of double integrals by changing the order of integration and by changing into polar co-ordinates. Beta and gamma functions and their properties<br>**Vector Calculus** – Gradient – Divergence - Curl **-** Line integrals-definition and problems, surface and volume integrals definition, Green's theorem in a plane, Stokes and Gauss-divergence theorems (without proof) and problems. | **Hours – 12** |

**Course outcomes:**

On completion of this course, students are able to

1. Solve first order differential equations.
2. Solve linear differential equations with constant coefficients.
3. Find the extreme of a function.
4. Solve partial differential equations
5. Evaluate multiple integrals

6. Verify vector integral theorems

**Question paper pattern:**

1. Question paper consists of 10 questions.
2. Each full question carrying 14 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

**Text Books:**

1. B.S. Grewal, **"Higher Engineering Mathematics"**, Khanna publishers, 44$^{th}$edition, 2016.
2. Erwin Kreyszig, **"Advanced Engineering Mathematics**, Wiley, 9$^{th}$edition, 2013.

**Reference Books**:

1. B.V. Ramana, **"Higher Engineering Mathematics"**, TataMc Graw-Hill,2006
2. N.P. Baliand Manish Goyal, **"A textbook of Engineering mathematics"**, Laxmi publications, latest edition.
3. H.K. Dass and Er. RajnishVerma, **"Higher Engineering Mathematics"**, S. Chand publishing, 1$^{st}$edition, 2011.

**COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 4 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 6 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Course** | 2 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |

## ENGINEERING CHEMISTRY

| | | | |
|---|---|---|---|
| Subject Code | 18CMCHT1030 | IA Marks | 30 |
| Number of Lecture Hours/Week | 3(L) + 1(T) | Exam Marks | 70 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |
| **Credits – 04** | | | |

**COURSE OBJECTIVES:**

The objectives of this course, help the students to

- Rationalize periodic properties like ionization potential, electro negativity and oxidation states.
- Apply the concepts of electro chemistry.
- Analyze bulk properties and processes using thermodynamic considerations.
- List major chemical reactions that are used in the synthesis of molecules.
- Understand the concepts of atomic and molecular orbital's.
- Know various spectroscopic techniques.

| | |
|---|---|
| **Unit -1** | |
| **PERIODIC PROPERTIES:** Effective nuclear charge of fluorine and magnesium, penetration of orbital's, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electro negativity, oxidation states, coordination numbers 2 & 3and geometries, hard soft acids and bases. | **Hours – 10** |
| **Unit -2** | |
| **USE OF FREE ENERGY IN CHEMICAL EQUILIBRIA**<br>**Thermo dynamic functions:** State and Path functions, First and second laws of thermodynamics, Gibbs Helmholtz Equation, concept of entropy and enthalpy.<br>**Electro chemistry:** Introduction, electrode potential, standard electrodes – Hydrogen and Calomel electrodes, Nernst equation and applications.<br>**Water chemistry:** Surface and subsurface water quality parameters – turbidity, pH, total dissolved salts, chloride content, and break point chlorination.<br>**Corrosion:** Wet chemical theory, control methods – Proper designing, cathodic protection- Sacrificial anodic and impressed current cathodic protection. | **Hours – 10** |
| **Unit -3** | |
| **STEREO CHEMISTRY:** Principles of stereochemistry, representations of 3 dimensional structures of organic compounds, geometrical and stereoisomer's, configuration and symmetry, enantiomers.<br>**ORGANIC REACTIONS AND SYNTHESIS OF A DRUG MOLECULE**<br>Introduction to reactions involving Substitution – $SN^1$ & $SN^2$ with mechanism, Addition – Free radical, Elimination – E1 & E2 with examples (mechanism is not involved), Synthesis of aspirin drug molecule. | **Hours – 10** |
| **Unit -4** | |
| **ATOMIC, MOLECULAR STRUCTURE AND ADVANCED MATERIALS:** Schrodinger equation. Particle in a box solution and their applications for conjugated molecules.<br>**Nano particles**: Introduction, preparation methods – Sol-gel method, Chemical reduction method – properties and applications.<br>**Surface properties:** Determination of surface tension and viscosity of liquids.<br>**Ceramics:** Classification, examples and applications. | **Hours – 10** |

| | |
|---|---|
| Crystal field theory and the energy level diagrams fortransition metal ions. | |
| **Unit -5** | |
| **SPECTROSCOPIC TECHNIQUES**<br>Regions of electromagnetic spectrum - Principles of vibration and rotational spectroscopy. Vibration and rotational spectroscopy of diatomic molecules: Rigid diatomic molecules - selection rule - simple Harmonic Oscillator - diatomic vibrating rotator. Nuclear magnetic resonance – Principle and Instrumentation. Principles of chromatography – TLC & Paper. | **Hours – 10** |

**COURSE OUTCOMES:**

On completion of the course student will be

1. Able to rationalize periodic properties like ionization potential, electro negativity and oxidation states.
2. Able to know the nature and working of various electrodes.
3. Able to analyze bulk properties and processes using thermodynamic considerations.
4. Abletosynthesizeorganicmoleculesusingdifferenttypes of chemical reactions.
5. Able to understand the concepts of atomic and molecular orbital's.
6. Able to gain knowledge on spectroscopic techniques and the ranges of the electromagnetic spectrum used for exciting different molecular energy levels.

**Question paper pattern:**

1. Question paper consists of 10 questions.
2. Each full question carrying 14 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

**TEXT BOOKS:**

1. Stereo chemistry of Carbon Compounds by Ernest Eliel; McGraw Hill Education.
2. Fundamentals of Molecular Spectroscopy, by C.N. Banwell.
3. Concise In organic Chemistry, J.D. Lee, 5th Edition; Wiley India.
4. Engineering Chemistry – Fundamentals and applications by Shikha Agarwal; Cambridge University Press
5. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition http://bcs.whfreeman.com/vollhardtschore5e/default.asp
6. Engineering Chemistry by Jain & Jain; Dhanpat Rai Publishing Company

**REFERENCE BOOKS**:

1. Engineering Chemistry (NPTELWeb-book), by B.L. Tembe, Kamaluddin and M.S.Krishnan.
2. Physical Chemistry, by P. W. Atkins.
3. Physical Chemistry, by Glasstone, S
4. Advanced in organic chemistry by Wilkinson G and Cotton FA

**COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **2** | - | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **3** | - | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **4** | - | - | 3 | - | - | - | - | - | - | - | - | - | - | - | - |
| **5** | - | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **6** | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Course** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |

## BASIC ELECTRICAL ENGINEERING

SEMESTER-I

| | | | |
|---|---|---|---|
| Subject Code | 18CMEET1040 | IA Marks | 30 |
| Number of Lecture Hours/week | 3(L)+1(T) | Exam Marks | 70 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |

**Credits – 04**

**Course Objectives:**

This course will enable student to :

- Describe the basics electrical circuit concepts and how to apply the various theorems for given electrical network
- Describe the representation of sinusoidal wave form and also analysis of single phase ac circuit with various elements
- Describe the principle and operation of ac and dc electrical machines
- Describe the basic operation of different converters circuits
- Describe the necessity of the batteries and importance of the basic switch gear unit

| Unit | Hours |
|---|---|
| **Unit -1** | |
| **DC Circuits:** Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff's current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenins and Norton Theorems (Simple Numerical problems).Time-domain analysis of first-order RL and RC circuits. | **Hours- 10** |
| **Unit – 2** | |
| **AC Circuits:** Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single- phase ac circuits consisting of R, L, C, RL, RC,RLC combinations (series and parallel), resonance. Three- phase balanced circuits, voltage and current relations instar and delta connections. | **Hours- 10** |
| **Unit – 3** | |
| **Transformers:** Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, OC and SC tests, regulation and efficiency. Auto transformer and three-phase transformer connections. | **Hours- 10** |
| **Unit – 4** | |
| **Electrical Machines: Ac machines-** Generation of rotating magnetic fields, construction details and working of three phase induction motor, significance of torque – slip characteristics. Loss components and efficiency, starting and speed control of induction motor. Single phase induction motor. Construction and working of synchronous generators.<br>**DC machines**- Construction, working, torque-speed characteristics and speed control of dc shunt motor. | **Hours- 10** |
| **Unit – 5** | |
| **Power Converters and Electrical Installations**<br>DC – DC Buck and boost converters, duty ratio control, PWM techniques, single phase voltage source inverters. Classification of batteries and Low Voltage switch gear. | **Hours- 10** |

**Course outcomes:**

On completion of the course student will be

1. Able to analyze DC circuits by using KCL, KVL and Network theorems
2. Able to analyze AC circuits
3. Able to explain the operation and compute performance of transformer
4. Able to explain the construction and working of rotating electrical machines
5. Able to describe DC-DC and DC-AC converters
6. Able to explain about types of LV switch gear and types of batteries

**Question paper pattern:**

1. Question paper consists of 10 questions.
2. Each full question carrying 14 marks.
3. Each full question will have sub question covering all topics under a unit.

4. The student will have to answer 5 full questions selecting one full question from each unit.

**Test books**.

1. E. Hughes, *"Electrical and Electronics Technology"*, Pearson, 2010.
2. D.C. Kulshreshtha, *"Basic Electrical Engineering"*, McGraw Hill, 2009.
3. D.P. Kothari, I.J. Nagrath, *"Basic Electrical Engineering"*, Tata McGraw Hill, 2010.
4. J.P. Tewari, *"Basic Electrical Engineering"*, New Age International Publishers, 2003

**References**

1. M.D. Singh, *"Power Electronics"*, 2$^{nd}$edition.
2. *"Battery Energy Storage for Smart Grid Applications"*, Eurobat 2013.
3. L.S. Bobrow, *"Fundamentals of Electrical Engineering"*, Oxford University Press, 1996.
4. V.D. Toro, *"Electrical Engineering Fundamentals"*, Prentice Hall India, 1989.
5. R.M. Dell, D.A.J. Rand, *"Understanding Batteries"*, 2001.
6. BhaveshBhalja, R.P., Maheshwari, Nilesh G. Chothani,*"Protection and Switchgear"*, Oxford University Press, 5$^{th}$impression, 2014.

**Course Outcomes to Program Outcomes mapping**

| **COs / POs** | **PO1** | **PO2** | **PO3** | **PO 4** | **PO 5** | **PO 6** | **PO7** | **PO 8** | **PO9** | **PO1 0** | **PO1 1** | **PO1 2** | **PSO 1** | **PSO 2** | **PSO 3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | 3 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2** | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **3** | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **4** | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **5** | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **6** | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Course | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

## ENGLISH LANGUAGE COMMUNICATION SKILLS LAB

| | | | |
|---|---|---|---|
| Subject Code | 18CMEGL1050 | IA Marks | 50 |
| Number of Practical Hours/Week | 02 | ExamMarks | 50 |
| Total Number of Practical Hours | 32 | Exam Hours | 03 |

**Credits – 01**

**Objectives:** To enable the students to learn communication skills of Listening, Speaking, Reading and Writing by focusing on:

- Listening Comprehension
- Pronunciation
- Functional English in formal and Informal Situations
- Interpersonal Communication Skills
- Presentation Skills

**List of Experiments**

**UNIT I -** Listening Comprehension

**UNIT II -** Pronunciation , Stress, Intonation & Rhythm

**UNIT III -**Common Everyday Situations: Conversations & Dialogues, Communication at Workplace

**UNIT IV -** Interpersonal Communication Skills- Group discussions and debates

**UNIT V -** Formal Presentations

**Course Outcomes:**

By the end of the course the students will be able to acquire basic Proficiency in English by practicing the following:

- Listening Comprehension
- Pronunciation
- Dialogues
- Interpersonal Communication Skills
- Presentation Skills
- Discussions and Debates

**Question paper pattern:**

**Examination is evaluated for 35 marks and as follows**: Ten questions are given, and student should choose one question (blind option), which carries 35 marks in total.

a. 10 marks are allotted for procedure including circuit diagrams and model graphs.
b. 10 marks for conduction of the experiment.
c. 05 marks for results and conclusions.
d. 10 marks for viva voce.

**The internal 15 marks shall be awarded as follows:**

a. 05 marks-day to day evaluation and submission of record.
b. 10 marks to be awarded by conducting an internal laboratory test.

**Learning Resources:**

- Interact–English Lab Manual for Undergraduate Students by Orient Black Swan
- Ted Talks, Interviews with Achievers and select movies
- Toastmaster's speeches and table topics
- Book Reviews and movie reviews
- Exercises in Spoken English Parts: I-III, CIEFL, Hyderabad.
- Oxford Guide to Effective Writing and Speaking by John Seely.
- https://www.ted.com/talk

**Course Outcomes Vs Program Outcomes Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | - | - | - | - | - | - | - | - | - | 2 | - | - |
| 2 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| 4 | - | - | - | - | - | - | - | - | - | 2 | - | - |
| 5 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| 6 | - | - | - | - | - | - | - | - | - | 2 | - | - |

## ENGINEERING CHEMISTRY LABORATORY

| | | | |
|---|---|---|---|
| Subject Code | 18CMCHL1060 | IA Marks | 15 |
| Number of Practice Hours/Week | 03 | Exam Marks | 35 |
| Total Number of Practice Hours | 36 | Exam Hours | 03 |
| **Credits – 1.5** | | | |

**COURSE OBJECTIVES:**

The objectives of this course, help the students to

- Measure molecular properties like surface tension and viscosity
- Determine chloride content of water of given water sample.
- Familiarize the synthesis of a simple drug.
- Determine rate constant as a function of time.
- Determine the strength of acids using conductivity meter.
- Determine amount of Fe (II) using potentiometer.

**List of Experiments (Any 10 experiments must be conducted)**

1. Determination of surface tension
2. Determination of viscosity of a liquid by Ostwald viscometer
3. Thin layer chromatography
4. Determination of chloride content of water
5. Determination hardness of water by EDTA.
6. Determination of the rate constant of first order reaction (Ester hydrolysis)
7. Determination of strength of strong acid using conductivity meter titration.
8. Determination of strength of weak acid using conductivity meter titration.
9. Determination of Ferrous iron using potentiometer.
10. Synthesis of a drug –Aspirin
11. Determination of the partition coefficient of a substance between two immiscible liquids
12. Determination of strength of acetic acid using charcoal adsorption.

**Demonstration Experiments:**

1. Preparation of lattice structure and determination of atomic packing factor.
2. Chemical oscillations- Iodine clock reaction
3. Synthesis of Phenol formal dehyderesin
4. Saponification of oil

**COURSE OUTCOMES:**

On completion of the course student will be

1. Able to measure molecular properties like surface tension and viscosity
2. Able to determine chloride content of given water sample.
3. Able to synthesize a drug.
4. Able to determine rate constant as a function of time.
5. Able to determine strength of acids using conductivity meter.
6. Able to determine amount of Fe (II) using potentiometer.

**Question paper pattern:**

**Examination is evaluated for 35 marks and as follows**:

Ten questions are given, and student should choose one question (blind option), which carries
35 marks in total.

a. 10 marks are allotted for procedure including circuit diagrams and model graphs.
b. 10 marks for conduction of the experiment.
c. 05 marks for results and conclusions.
d. 10 marks for viva voce.

**The internal 15 marks shall be awarded as follows:**

a. 05 marks-day to day evaluation and submission of record.
b. 10 marks to be awarded by conducting an internal laboratory test.

**COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | - | 3 | - | - | - | - | - | - | - | - | - | - |
| **2** | - | 3 | - | - | - | - | - | - | - | - | - | - |
| **3** | - | 3 | - | - | - | - | - | - | - | - | - | - |
| **4** | 3 | - | - | - | - | - | - | - | - | - | - | - |
| **5** | - | 3 | - | - | - | - | - | - | - | - | - | - |
| **6** | - | 3 | - | - | - | - | - | - | - | - | - | - |
| **Course** | **2** | **3** | - | - | - | - | - | - | - | - | - | - |

# BASIC ELECTRICAL ENGINEERING LAB

SEMESTER-I

| | | | |
|---|---|---|---|
| Subject Code | 18CMEEL1070 | IA Marks | 15 |
| Number of Practice Hours/Week | 2 | Exam Marks | 35 |
| Total Number of Practice Hours | 32 | Exam Hours | 03 |

**Credits – 1.5**

**The objectives of this course, help the students to**

- Learn how to find the frequency response and resonance of RL& RC circuits
- Learn how to verify the given networks using theorems
- Learn how to measure the power and determination of efficiency of a single phase transformer and how to measure the power in three phase transformer
- Learn how to determine the Torque-slip characteristics of a dc shunt and induction motors.
- Learn how to find the regulation of an alternator
- Learn the operation of different converter circuits and know about the switch gear system

**List of Experiments (Any Ten experiments must be conducted)**

1. Study of R-L, R-C,R-L-C circuits.
2. Verification of superposition theorem.
3. Verification of Thevenin's and Norton's theorems.
4. Series and Parallel resonance of RL and RC circuits.
5. Open circuit & Short circuit tests on a single phase transformer.
6. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
7. Speed control of DC shunt motor.
8. Torque Speed Characteristic on single phase induction motor
9. Regulation of Alternator.
10. Demonstration of Buck and Book converter
11. Demonstration of Voltage Source Inverter

**COURSE OUTCOMES:**

On completion of this course, students are

1. Able to determine the time response and resonance of given RL, RC and RLC circuits
2. Able to determine the response using Superposition, Norton and Thevinins.
3. Able to determine the power, efficiency and regulation of ac machines

**Question paper pattern:**

**Examination is evaluated for 35 marks and as follows**:

Ten questions are given, and student should choose one question (blind option), which carries 35 marks in total.

a. 10 marks are allotted for procedure including circuit diagrams and model graphs.
b. 10 marks for conduction of the experiment.
c. 05 marks for results and conclusions.
d. 10 marks for viva voce.

**The internal 15 marks shall be awarded as follows:**

a. 05 marks-day to day evaluation and submission of record.
b. 10 marks to be awarded by conducting an internal laboratory test.

**Summary of Course Outcomes mapping to Program Outcomes**

| COs / POs | PO1 | PO2 | PO3 | PO 4 | PO 5 | PO 6 | PO7 | PO 8 | PO9 | PO1 0 | PO1 1 | PO1 2 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 2 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2** | 2 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **3** | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **4** | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **5** | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **6** | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Course** | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

# CONSTITUTION OF INDIA, PROFESSIONAL ETHICS & HUMAN RIGHTS

Common to all

| | | | |
|---|---|---|---|
| Subject Code | 18CMMSN1080 | IA Marks | 30 |
| Number of Lecture Hours/Week | 3+1(T) | Exam Marks | 70 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |

**Credits – 00**

**COURSE OBJECTIVES:**

The objectives of this course help the students to

- To provide basic information about Indian constitution.
- To identify individual role and ethical responsibility towards society.
- To understand human rights and its implications.

| Unit | Hours |
|---|---|
| **Unit -1** | |
| Lesson: Introduction to the Constitution of India, The Making of the Constitution and Salient features of the Constitution. Preamble to the Indian Constitution Fundamental Rights & its limitations. | **Hours– 10** |
| **Unit -2** | |
| Lesson: Directive Principles of State Policy & Relevance of Directive Principles State Policy Fundamental Duties.<br>Union Executives – President, Prime Minister Parliament Supreme Court of India. | **Hours– 10** |
| **Unit – 3** | |
| Lesson: State Executives – Governor, Chief Minister, State Legislature High Court of State.<br>Electoral Process in India, Amendment Procedures, $42^{nd}$, $44^{th}$, $74^{th}$, $76^{th}$, $86^{th}$&$91^{st}$Amendments. | **Hours– 10** |
| **Unit – 4** | |
| Lesson: Special Provision for SC & ST Special Provision for Women, Children & Backward Classes<br>Emergency Provisions.<br>Human Rights –Meaning and Definitions, Legislation Specific Themes in Human Rights- Working of National Human Rights Commission in India<br>Powers and functions of Municipalities, Panchayats and Co - Operative Societies. | **Hours–10** |
| **Unit – 5** | |
| Lesson: Scope & Aims of Engineering Ethics, Responsibility of Engineers Impediments to Responsibility. Risks, Safety and liability of Engineers, Honesty, Integrity & Reliability in Engineering. | **Hours– 10** |

**COURSE OUTCOMES:**

On completion of the course student will

1. Have general knowledge and legal literacy and thereby to take up competitive examinations.
2. Understand state and central policies, fundamental duties.
3. Understand Electoral Process, special provisions.
4. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies, and
5. Understand Engineering ethics and responsibilities of Engineers
6. Understand Engineering Integrity &Reliability

**Question paper pattern:**

1. Question paper consists of 10 questions.
2. Each full question carrying 14 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

**Text Books:**

1. Durga Das Basu: **"Introduction to the Constitution on India",** (Students Edn.) Prentice –Hall EEE, 19th / 20thEdn.,2001
2. Charles E. Haries, Michael S Pritchard and Michael J.Robins**"Engineering Ethics"** Thompson Asia, 2003-08-05.

**REFERENCE BOOKS**:

1. M.V.Pylee, "An Introduction to Constitution of India", Vikas Publishing,2002.
2. M. Govindarajan, S. Natarajan, V.S.Senthilkumar, **"Engineering Ethics",** Prentice –Hall of India Pvt. Ltd. New Delhi,2004
3. Brij Kishore Sharma,**" Introduction to the Constitution of India"**, PHI Learning Pvt. Ltd., New Delhi,2011.
4. Latest Publications of Indian Institute of Human Rights, New Delhi

**Website Resources**

1. www.nptel.ac.in
2. www.hnlu.ac.in
3. www.nspe.org
4. www.preservearticles.com

**COURSE OUTCOMESTOPROGRAMOUTCOMES MAPPING:**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | - | - | - | - | - | 3 | - | - | - | - | - | - | - | - | - |
| **2** | - | - | - | - | - | 3 | - | - | - | - | - | - | - | - | - |
| **3** | - | - | - | - | - | 1 | - | | - | - | - | - | - | - | - |
| **4** | - | - | - | - | - | 2 | - | - | - | - | - | - | - | - | - |
| **5** | | | | | | 3 | | | | | | | | | |
| **6** | - | - | - | - | - | - | - | 5 | - | - | - | - | - | - | - |
| **Course** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **5** | **-** | | **-** | **-** | **-** | **-** | **-** |

# ENGINEERING MATHEMATICS-II

Common to all the branches

SEMESTER - II

| | | | |
|---|---|---|---|
| Subject Code | 18CMMAT2010 | IA Marks | 30 |
| Number of Lecture Hours/Week | 3(L)+ 1(T) | Exam Marks | 70 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |

**Credits – 04**

**Course objectives:**

To enable students to apply the knowledge of Mathematics in various engineering fields by making them to learn the following

1. To solve system of linear equations
2. To find eigen values and eigen vectors of a matrix
3. To solve initial value problems by using Laplace transforms
4. To find the solution of algebraic /transcendental equations and also interpolate the functions.
5. To evaluate numerical integration and to solve ordinary differential equations by using numerical methods.
6. To find Fourier series of a periodic function and to determine the Fourier transform of a function

| | |
|---|---|
| **Unit -1** | |
| **Linear Algebra:** Rank of a matrix by elementary transformations, solution of system of linear equations - Gauss-elimination method, Gauss-Jordan method – Jacobi method and Gauss-Seidel method – Eigen values and Eigen vectors, Properties of Eigen values and Eigen vectors - Linear transformation, Diagonalization of a square matrix. Cayley-Hamilton theorem(without proof)- Reduction of Quadratic form to Canonical form. | **10 Hours** |
| **Unit -2** | |
| **Laplace Transforms:** Laplace transforms of standard functions-Shifting theorems - Transforms of derivatives and integrals – Unit step function – Dirac’s delta function Inverse Laplace transforms– Convolution theorem(without proof).<br>Applications: Solving ordinary differential equations (initial value problems) using Laplace transforms | **10 Hours** |
| **Unit – 3** | |
| **Numerical Methods**: Numerical solution of algebraic and transcendental equations by Regula- Falsi Method and Newton-Raphson method.<br>Finite differences: Error functions – Forward, backward and central differences, Newton’s forward and backward interpolation formulae. Gauss`s forward and backward interpolation formulae - Lagrange’s interpolation formula (all formulae without proof) | **10 Hours** |
| **Unit – 4** | |
| **Numerical integration**: Trapezoidal rule - Simpson’s (1/3)rd and (3/8)th rules. Numerical solutions of ordinary differential equations-Taylors series method-Picard’s method-Euler’s method-Modified Euler’s method-Runge-Kutta methods | **8 Hours** |
| **Unit – 5** | |
| **Fourier Series**: Periodic functions, Dirichlet’s condition, Fourier Series of periodic functions with period $2\pi$ and with arbitrary period. Fourier series of even and odd functions, Half range Fourier Series.<br>**Fourier Transforms**: Infinite Fourier transforms, Fourier sine and cosine transforms Inverse Fourier transforms. | **12 Hours** |

**Course outcomes:**

| |
|---|
| On completion of this course, students are able to,<br>1. Solve system of linear equations<br>2. Find Eigen values and Eigen vectors of a matrix<br>3. Solve initial value problems by using Laplace transforms<br>4. Find the solution of algebraic/transcendental equations and also interpolate the functions.<br>5. Evaluate numerical integration and to solve ordinary differential equations by using numerical methods.<br>6. Find Fourier series of a periodic function and to determine the Fourier transform of a function |
| **Question paper pattern:**<br>1. Question paper consists of 10 questions.<br>2. Each full question carrying 14 marks.<br>3. Each full question will have sub question covering all topics under a unit.<br>4. The student will have to answer 5 full questions selecting one full question from each unit. |
| **Text Books:**<br>1. B.S. Grewal, "Higher Engineering Mathematics", Khanna publishers, 44$^{th}$Edition, 2016.<br>2. Kreyszig, "Advanced Engineering Mathematics"-Wiley, 9$^{th}$Edition, 2013. |
| **Reference Books:**<br>1. B.V. Ramana "Higher Engineering Mathematics" TataMc Graw-Hill,2006<br>2. N P Baliand Manish Goyal," A text book of Engineering mathematics", Laxmi publications, 7$^{th}$edition.<br>3. H. K Dass and Er. RajnishVerma ,"Higher Engineering Mathematics", S. Chand publishing,1st edition,2011.<br>4. Dr.K.V. Nageswara Reddy and Dr.B. Rama BhupalReddy,“Engineering Mathematics, Volume II” Scitech Publications, 2017. |

**COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 2 | 3 | - | - | - | - | - | - | - | - | - | - |
| **2** | 2 | 3 | | | | | | | | | | |
| **3** | 2 | 3 | - | - | - | - | - | - | - | - | - | - |
| **4** | 2 | 3 | - | - | - | - | - | - | - | - | - | - |
| **5** | 2 | 3 | - | - | - | - | - | - | - | - | - | - |
| **6** | 2 | 3 | - | - | - | - | - | - | - | - | - | - |
| **Course** | 2 | 3 | - | - | - | - | - | - | - | - | - | - |

| Common to ECE & ECT | | | |
|---|---|---|---|
| **ENGINEERING PHYSICS**<br>**(Introduction to Electromagnetic Theory**) (Syllabus for the academic year 2018 -19) | | | |
| Subject Code | 18ETPHT2020 | IA Marks | 30 |
| Number of Lecture Hours/Week | 3+1(T) | Exam Marks | 70 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |
| **Credits – 04** | | | |

**COURSE OBJECTIVES:**

The objectives of this course, help the students:

- To impart the knowledge of Electrostatics and Magneto statics in vacuum and in dielectric medium.
- To impart the knowledge of Maxwell's equations to understanding the propagation of EM waves.

| **Unit -1** | |
|---|---|
| **Electrostatics in vacuum:** Calculation of electric field and electrostatic potential for a charge distributions; Divergence and curl of electrostatic field; Energy of a charge distribution and its expression in terms of electric field; Laplace's and Poisson's equations for electrostatic potential and uniqueness of their solution, Method of images; Boundary conditions of electric field and electrostatic potential. | **Hours – 11** |
| **Unit -2** | |
| **Electrostatics in a linear dielectric medium:** Electrostatic field and potential of a dipole, Bound charges due to electric polarization; Electric displacement; boundary conditions on displacement; Solving simple electrostatics problems in presence of dielectrics – Point charge at the center of a dielectric sphere, charge in front of a dielectrics lab, dielectrics lab and dielectric sphere in uniform electric field. | **Hours – 9** |
| **Unit – 3** | |
| **Magneto statics:** Biot - Savart's law, Magnetic field on the axis of a current loop, Magnetic field induction due to a solenoid, Divergence and curl of static magnetic field; Vector potential and calculating it for a given magnetic field using Stokes' theorem; Equation for the vector potential and its solution for given current densities. Ampere's circuital law, Amperian loop, Differential form of Ampere's circuital law, Motion of charged particle in electrical field and in magnetic field, Hall effect. | **Hours –11** |
| **Unit – 4** | |
| **Faraday's law:** Faraday's law in terms of EMF produced by changing magnetic flux; Equivalence of Faraday's law and motional EMF; Lenz's law; Electromagnetic breaking and its applications; Differential form of Faraday's law expressing curl of electric field in terms of time-derivative of magnetic field and calculating electric field due to changing magnetic fields in quasi-static approximation; Energy stored in a magnetic field.<br>**Displacement current, Magnetic field due to time- dependent electric field** Continuity equation for current densities; Modifying equation for the curl of magnetic field to satisfy continuity equation; Displace current and magnetic field arising from time dependent electric field; Calculating magnetic field due to changing electric fields in quasi static approximation. | **Hours – 10** |
| **Unit – 5** | |

| | |
|---|---|
| **Maxwell's equations:** Maxwell's equation in vacuum and non-conducting medium; Energy in an electromagnetic field; Flow of energy and Poynting vector with examples, Qualitative discussion of momentum in electromagnetic fields.<br>**Electromagnetic waves:** The wave equation; Plane electromagnetic waves in vacuum, their transverse nature and polarization; Relation between electric and magnetic fields of an electromagnetic wave; Energy carried by electromagnetic waves and examples, Momentum carried by electromagnetic waves and resultant pressure, Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence. | **Hours – 9** |

**COURSE OUTCOMES:**

On completion of the course student will able to

1. Calculate the electric field intensity and electrostatic potential for a charge distribution.
2. Solve the electrostatics problems in presence of dielectrics.
3. Calculate the magnetic field induction using the Biot- Savart's law.
4. Calculate the magnetic fields due to time varying electrical fields.
5. Derive the relation between electrical field intensity and time varying magnetic fields.
6. Apply Maxwell's equations to understanding the propagation of EM wave in vacuum and non-conducting medium.

**Question paper pattern:**

1. Question paper consists of 10 questions.
2. Each full question carrying 14 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

**TEXT BOOKS:**

3. Saroj K. Dash, Smaruti R. Khuntia, Fundamentals of Electromagnetic theory.
4. David Griffiths, Introduction to Electrodynamics.

**REFERENCE BOOKS**:

1. Ch. Srinivas, Ch. Seshubabu, Engineering Physics, Cengage learning.
2. W. Saslow, Electricity, magnetism and light.
3. S.L Gupta& D.L. Gupta, Unified physics.

**COURSEOUTCOMESTOPROGRAMOUTCOMES MAPPING:**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO 9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| **2** | 3 | 2 | 1 | 3 | - | - | - | - | - | - | - | - | - | - | - |
| **3** | 3 | 2 | 1 | 3 | - | - | - | - | - | - | - | - | - | - | - |
| **4** | 3 | 2 | 1 | 3 | - | - | - | - | - | - | - | - | - | - | - |
| **5** | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| **6** | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| **Course** | **3** | **2** | **3** | **1** | - | - | - | - | - | - | - | - | - | - | - |

## PROGRAMMING FOR PROBLEM SOLVING

(Common for all branches)

<table>
<tr><td>Subject Code:</td><td>18CMCST2030</td><td>IAMarks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>3+1(T)</td><td>EAMarks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">Credits - 03</td></tr>
<tr><td colspan="3">Unit-I: Introduction to computer systems and programming</td><td>Hours</td></tr>
<tr><td colspan="3">History & Hardware: Computer Hardware, components, Types of Software, Memory units.<br>Introduction to Problem solving: Algorithm, characteristics of Algorithms, Basic operations of algorithms, Pseudo code, Flowchart, Types of languages, Relation between Data, Information, Input and Output.<br>Basics of C: History and Features of C, Importance of C, Procedural Language, Compiler versus Interpreter, Structure of C Program, Program development steps, programming errors.</td><td>Hours- 08</td></tr>
<tr><td colspan="4">Unit-II: C Expressions, evaluation and control statements</td></tr>
<tr><td colspan="3">Overview of C: Character Set, C-Tokens, Data Types, Variables, Constants, Operators, Operator precedence and Associativity, converting mathematical expressions to C- expressions, evaluation of C-expressions, Input/output functions.<br>Conditional Branching: if statement, if...else statement, Nested if...else statement, if…else…if ladder, switch statement.<br>Unconditional Branching: goto.<br>Control flow statements: break, continue.<br>Looping Constructs: do-while statement, while statement, for statement.</td><td>Hours- 12</td></tr>
<tr><td colspan="4">Unit-III: Arrays and Functions</td></tr>
<tr><td colspan="3">Arrays: Introduction, 1-D Arrays, Character arrays and string representation, 2-D Arrays (Matrix), Multi- Dimensional Arrays.<br>Functions: Basics, necessity and advantages, Types of functions, Parameter passing mechanisms, Recursion, Storage Classes, Command Line Arguments, Conversion from Recursion to Iteration and vice-versa.<br>Strings: Working with strings, String Handling Functions(both library and user defined).</td><td>Hours-10</td></tr>
<tr><td colspan="4">Unit-IV: Derived and User Defined Data types</td></tr>
<tr><td colspan="3">Pointers: Understanding Pointers, Pointer expressions, Pointer and Arrays, Pointers and Strings, Pointers to Functions.<br>Dynamic Memory Allocation: Introduction to Dynamic Memory Allocation malloc, calloc, realloc, free.<br>Structures and Unions: Defining a Structure, type def, Advantage of Structure, Nested structures, Arrays of Structures, Structures and Arrays, Structures and Functions, Structures and Pointers, Defining Unions, Union within union, Structure with in union, Union within structure, self-referential structures, bit fields, enumerations.</td><td>Hours-12</td></tr>
<tr><td colspan="4">Unit-V: Preprocessing and File Handling</td></tr>
<tr><td colspan="3">Preprocessing Directives: Macro Substitution, File Inclusion, conditional compilation and other directives<br>File Management in C: Introduction to File Management, Modes and Operations on Files, Types of files, Error Handling During I/O Operations.</td><td>Hours-8</td></tr>
<tr><td colspan="4">Text Books:<br>1. Computer Programming ANSIC, E Balagurusamy, McGraw Hill Education(Private), Limited(TB1)<br>2. Programming in C, ReemaThareja, Second Edition, Oxford Higher Education (TB2)</td></tr>
<tr><td colspan="4">Reference Books:<br>1. Computer Basics and C Programming, V Raja Raman, Second Edition, PHI(RB1)</td></tr>
<tr><td colspan="4">Course Outcomes: Student will able to</td></tr>
</table>

1. Formulate algorithms, translate the min to programs and correct program errors.
2. Choose right control structures suitable for the problem to be solved.
3. Decompose reusable code in a program into functions.
4. Make use of arrays, pointers, structures and unions effectively.
5. Store and retrieve data from permanent storage.
6. learn file operations

**Question paper pattern:**

1. Question paper consists of 10 questions.
2. Each full question carrying 14 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

**COs VS POs MAPPING**

| CO | PO 1 | PO2 | PO3 | PO 4 | PO5 | PO6 | PO7 | PO 8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 2 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | - | - |
| **2** | 2 | 3 | 3 | - | 1 | - | - | - | - | - | - | - | - | - |
| **3** | 3 | 2 | 3 | - | 1 | - | - | - | - | - | - | - | - | - |
| **4** | 2 | 2 | 3 | - | 1 | - | - | - | - | - | - | - | - | - |
| **5** | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| **6** | 2 | 2 | 2 | - | 1 | - | - | - | - | - | - | - | - | - |
| **Course** | 2 | 2 | 3 | - | 2 | - | - | - | - | - | - | - | - | - |

## ENGINEERING GRAPHICS

| | | | |
|---|---|---|---|
| Subject Code | **18CMMEL2040** | IA Marks | 30 |
| Number of Lecture Hours/Week | 1(L)+04(T) | Exam Marks | 70 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |

**Credits – 03**

**COURSE OBJECTIVES:**

1. Students should be able to construct Polygons using general methods, inscribe and describe polygons on circles, draw curves (parabola, ellipse and hyperbola, cycloids, involutes by general methods
2. Students should be able to read, interpret and construct plain scales, diagonal scales and venier scales
3. Student should be able to draw orthographic projections of points, lines, Planes & Solids inclined to one reference plane. Students are should be able to apply various concepts to solve practical problems related to engineering.
4. Student should be able to draw sections and sectional views of Solids
5. Student should be able to draw isometric view of lines, plane figures and simple solids. Student should be able to convert given isometric views into orthographic views. Students should be able to apply various concepts to solve practical problems related to engineering
6. Student should be able to draw objects using draw and modify toolbars of Auto CAD

| **Unit -1** | |
|---|---|
| Introduction to Engineering Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections – Ellipse, Parabola, Hyperbola (General method only); Cycloid, Epicycloids, Hypocycloid and Involutes; Scales – Plain, Diagonal and Venier Scales; | **Hours–10** |
| **Unit -2** | |
| Projections of Points and lines inclined to both planes; Projections of planes inclined to one plane | **Hours–08** |
| **Unit – 3** | |
| Projections of Solids – Prisms, Pyramids, Cones and Cylinders with the axis inclined to one of the planes | **Hours–10** |
| **Unit – 4** | |
| Sections and Sectional Views of Right Angular Solids covering, Prism, Cylinder, Pyramid, Cone | **Hours–10** |
| **Unit – 5** | |
| Isometric Projections covering, Principles of Isometric projection –Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions<br>**Introduction to AUTOCAD**-The Menu System, Toolbars(Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows | **Hours–12** |

**COURSE OUTCOMES:**

1. Students will be able to construct Polygons using general methods, inscribe and describe polygons on circles, draw curves (parabola, ellipse and hyperbola, cycloids, involutes by general methods
2. Students will be able to read, interpret and construct plain scales, diagonal scales and vernier scales
3. Student will be able to draw orthographic projections of points, lines, Planes & Solids inclined to one reference plane. Students will be able to apply various concepts to solve practical problems related to engineering.
4. Student will be able to draw sections and sectional views of Solids
5. Student will be able to draw isometric view of lines, plane figures and simple solids. Student will be able to convert given isometric views into orthographic views.

| |
|---|
| Students will be able to apply various concepts to solve practical problems related to engineering<br>6. Student will be able to draw objects using draw and modify toolbars of AutoCAD |
| **Question paper pattern:**<br>1. Question paper consists of 10 questions.<br>2. Each full question carrying 14 marks.<br>3. Each full question will have sub question covering all topics under a unit.<br>4. The student will have to answer 5 full questions selecting one full question from each unit. |
| **Text/Reference Books:**<br>1. Engineering Drawing by N.D. Bhatt, Chariot Publications<br>2. Engineering Drawing by Agarwal & Agarwal, TataMcGraw Hill Publishers<br>3. Engineering Drawing by K.L.Narayana & P.Kannaiah, Scitech Publishers<br>4. Engineering Graphics for Degree by K.C. John, PHI Publishers |

**COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:**

| PO\CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 2 | | 3 | | | | | | | 3 | | 2 | | | |
| **2** | 2 | | 3 | | | | | | | 3 | | 2 | | | |
| **3** | 2 | | 3 | | | | | | | 3 | | 2 | | | |
| **4** | 2 | | 3 | | | | | | | 3 | | 2 | | | |
| **5** | 2 | | 3 | | | | | | | 3 | | 2 | | 2 | |
| **6** | 2 | | 3 | | | | | | | 3 | | 2 | | 2 | |
| **Over all** | 2 | | 3 | | | | | | | 3 | | 2 | | 2 | |

| ENGINEERING PHYSICS LABORATORY | | | |
|---|---|---|---|
| Subject Code | 18ETPHL2050 | IA Marks | 15 |
| Number of Practice Hours/Week | 03 | Exam Marks | 35 |
| Total Number of Practice Hours | 36 | Exam Hours | 03 |
| **Credits – 1.5** | | | |

**COURSE OBJECTIVES:**

The objectives of this course, help the students

1. To apply the theoretical knowledge of Physics through hands on the experimental instruments
2. To improve the experimental knowledge in the later studies
3. To understand the basic need of experiments.
4. To know how to measure the different physical quantities.
5. To gain the knowledge about different electrical components and basic electrical circuits.

**List of Experiments**

1. To determine the static potentials and the accompanying electric field intensities of different diameters of electrically charged conducting sphere.
2. To determine the strength of the uniform electric field produced between the charged plates of a plate capacitor.
3. To determine the dielectric constant of a medium (plastic or glass) filling between the plates of the capacitor of a plate capacitor.
4. To measure the magnetic field induction of circular coil- Stewart-Gee's experiment.
5. To measure the spatial distribution of the field strength between a pair of coils in the Helmholtz arrangement.
6. To investigated the relation between magnetic field strength and coils of different dimensions using Hall probe (Tesla meter).
7. To determine Self Inductance of a Coil by Anderson's Bridge using AC.
8. To study the motion of charged particle in electric and magnetic fields and determine the value of e/m by magnetic focusing.
9. To determine Hall coefficient and estimate the concentration of charge carriers using Hall Effect.

**COURSE OUTCOMES:**

On completion of the course student will able to

1. Determine the electrostatic field and static potentials.
2. Apply the Biot- Savart's law in case of circular coils.
3. Determine the self inductance of a coil.
4. Measure value of a charged particle in electrical

**Question paper pattern:**

**Examination is evaluated for 35 marks and as follows**:

Ten questions are given, and student should choose one question (blind option), which carries 35 marks in total.

a. 10 marks are allotted for procedure including circuit diagrams and model graphs.
b. 10 marks for conduction of the experiment.
c. 05 marks for results and conclusions.
d. 10 marks for viva voce.

**The internal 15 marks shall be awarded as follows:**

a. 05 marks-day to day evaluation and submission of record.
b. 10 marks to be awarded by conducting an internal laboratory test.

**COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:**

| CO | PO 1 | PO 2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO 8 | PO 9 | PO10 | PO1 1 | PO12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | - | - | - | - |
| 2 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | - | - | - | - |
| 3 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | - | - | - | - |
| 4 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | - | - | - | - |
| 5 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | - | - | - | - |
| 6 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | - | - | - | - |
| **Course** | 3 | 1 | - | 3 | - | - | - | - | - | - | - | - | - | - | - |

# PROGRAMMING FOR PROBLEM SOLVING LAB

(Common for all branches)

| | | | |
|---|---|---|---|
| Subject Code | 18CMCSL2060 | IA Marks | 15 |
| Number of Practice Hours/Week | 03 | Exam Marks | 35 |
| Total Number of Practice Hours | 36 | Exam Hours | 03 |

**Credits – 2**

**COURSE OBJECTIVES:**

The objectives of this course, help the students

1. To apply programming for basic mathematical functions
2. To design and program mathematical concepts.
3. To create and use the functions and library functions
4. Able to apply the theoretical knowledge of formatting of documents
5. To create and apply user defined types to the real world problems.
6. To create files and shapes of the concepts.

**List of Experiments**

**Exercise 1 (Familiarization with programming environment)**

a) Familiarization of CODEBLOCKS C++ Editor to edit, compile, execute test and debugging C programs.
b) Familiarization of RAPTOR Tool to draw flow charts and understand flow of control.
c) Acquaintance with basic LINUX commands.

**Exercise 2 (Simple computational problems using arithmetic expressions)**

a) Write a C Program to display real number with 2 decimal places.
b) Write a C Program to convert Celsius to Fahrenheit and vice versa.
c) Write a C Program to calculate the area of triangle using the formula area = $\sqrt{s(s-a)(s-b)(s-c)}$ where $s = a+b+c$
d) Write a C program to find the largest of three numbers using ternary operator.
e) Write a C Program to swap two numbers without using a temporary variable.

**Exercise 3 (Problems involving if-then-else structures)**

a) Write a C Program to check whether a given number is even or odd using bitwise operator, shift operator and arithmetic operator.
b) Write a C program to find the roots of a quadratic equation.
c) WriteaCProgramtodisplaygradebasedon6subjectmarks using if…else…if ladder.
d) Write a C program, which takes two integer operands and one operator form the user, performs the operation and then prints the result using switch control statement. (Consider the operators +, -, *, /, %)

**Exercise 4 (Iterative problems)**

a) WriteaCProgramtocountnumberof0'sand1'sinabinary representation of a given number.
b) Write a C program to generate all the prime numbers between two numbers supplied by the user.
c) Write a C Program to print the multiplication table corresponding to number supplied as input.

**Exercise 5 (Iterative problems)**

a) Write a C Program to Find Whether the Given Number is
   i) Armstrong Number
   ii) Palindrome Number
b) Write a C Program to print sum of digits of a given number

**Exercise 6 (Series examples)**

a) Write a C Program to calculate sum of following series
   i. 1+2+3+….n
   ii. 1+1/2+1/3+……+1/n
   iii. $1+x+x^2+x^3$……$+x^n$

**Exercise 7 (1D Array manipulation)**

a) Write a C program to interchange the largest and smallest numbers in the array.
b) Write a C program to search an element in an array (linear search).
c) Write a C Program to print the following pattern using a character array SSA SASSASI

**Exercise 8 (Matrix problems, String operations)**

a) Write a C program to add two matrices.
b) Write a C program to multiply two matrices if they are compatible or print an error message "incompatible matrix sizes" otherwise.
c) Write a C program to check given matrix is symmetric or not.
d) Implement the following string operations with and without library functions.
   i) Copy ii) concatenate iii) length iv) compare

**Exercise 9 (Simple functions)**

a) Write a C Program demonstrating the following function types
   i. With arguments and with return value.
   ii. With arguments and without return value
   iii. Without arguments and without return value.
   iv. Without arguments and with return value.
b) Write a C Program illustrating call by reference

**Exercise 10 (Recursive functions)**

a) Write a C Program illustrating the following with Recursion without Recursion
   i) Factorial ii) GCD iii) Power iv) Fibonacci

**Exercise 11(Pointers and structures)**

a) Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc () function.
b) Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc () function.

   *Note: Understand the difference between the above two programs.*

c) Write a C Program to read and print student details using structures.

**Exercise 12 (File operations)**

a) Write a C program to open a file and to print it contents on screen.
b) Write a C program to copy files
c) Write a C program merges two files onto a new file.
d) Write a C program to delete a file.

**COURSE OUTCOMES:**

1. Attain knowledge on using CODE BLOCKS and RAPTOR tools in solving problems.
2. Examine and analyze alternative solutions to a problem.
3. Design an algorithmic solution to a problem using problem decomposition and step-wise refinement.
4. Demonstrate conversion of iterative function store cursive and vice-versa.
5. Implement the concepts of arrays.
6. Implement the structures, Unions and files.

**Question paper pattern:**

**Examination is evaluated for 35 marks and as follows**:

Ten questions are given, and student should choose one question (blind option), Which carries 35marks in total.

a. 10 marks are allotted for procedure including circuit diagrams and model graphs.
b. 10 marks for conduction of the experiment.
c. 05 marks for results and conclusions.
d. 10 marks for viva voce.

**The internal 15 marks shall be awarded as follows:**

a. 05 marks-day to day evaluation and submission of record.
b. 10 marks to be awarded by conducting an internal laboratory test.

**COs VS POs**

| **CO/ PO** | PO1 | PO2 | PO 3 | PO4 | PO 5 | PO6 | PO7 | PO8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | 3 | 3 | | 3 | | | | | | | | | |
| **2** | 2 | 3 | 3 | | 2 | | | | | | | | | |
| **3** | 2 | 3 | 3 | | 2 | | | | | | | | | |
| **4** | 2 | 3 | 3 | | 2 | | | | | | | | | |
| **5** | 2 | 3 | 3 | | 2 | | | | | | | | | |
| **6** | 2 | 3 | 3 | | 2 | | | | | | | | | |
| **Course** | **2** | **3** | **3** | | **2** | | | | | | | | | |

# WORKSHOP/MANUFACTURING PRACTICE

| | | | |
|---|---|---|---|
| Subject Code | 18CMMEL 2070 | IA Marks | 15 |
| Number of Practice Hours/Week | 01(L)+4(P) | Exam Marks | 35 |
| Total Number of Practice Hours | 36 | Exam Hours | 03 |

**Credits – 1.5**

**COURSE OBJECTIVES:**

1. Students should be able to learn the basic manufacturing processes, study the various tools and equipment used and gain hands-on experience in different trades.
2. Students should be able to learn the engineering and technology involved in carpentry, fitting, black smithy, foundry, welding, machining and plastic moulding.
3. Students should understand the workmanship required, working of machinery or equipment necessary.

**i. Lectures & videos: (10hours)**

1. Manufacturing Methods - casting, forming, machining, joining, advanced manufacturing methods **(3 lectures)**
2. CNC machining, Additive manufacturing **(1 lecture)**
3. Fitting operations & power tools **(1 lecture)**
4. Electrical & Electronics **(1 lecture)**
5. Carpentry **(1 lecture)**
6. Plastic molding, glass cutting **(1 lecture)**
7. Metal casting **(1 lecture)**
8. Welding (arc welding & gas welding), brazing **(1 lecture)**

**ii. Work shop Practice:**

| S.No. | Name of Shop floor | Exercises |
|---|---|---|
| 1 | Black smithy | 1. S-Hook |
| | | 2. Square Rod To Round Rod |
| 2 | Carpentry | 1. T-Lap Joint |
| | | 2. Cross Lap Joint |
| 3 | Foundry | 1. Mould for a Solid |
| | | 2. Mould for a Split Pattern. |
| 4 | Fitting | 1. Square Fitting |
| | | 2. V-Fitting |
| 5 | Welding | 1. Butt Joint |
| | | 2. Lap Joint |
| 6 | Machine Tools | 1. Turning |
| | | 2. Knurling |
| 7 | Plastic Moulding | 1. Key chain |

**COURSE OUTCOMES:**

1. Students will be able to make use of basic carpentry joints to make furniture.
2. Students will be able to fabricate mechanical engineering assemblies using fitting joints.
3. Students will be able to produce various machine components by using foundry, black smithy, machining and plastic moulding techniques.

**Question paper pattern:**

**Examination is evaluated for 35 marks and as follows**:

Ten questions are given, and student should choose one question (blind option), which carries 35 marks in total.

a. 10 marks are allotted for procedure including circuit diagrams and model graphs.
b. 10 marks for conduction of the experiment.

c. 05 marks for results and conclusions.
d. 10 marks for viva voce.

**The internal 15 marks shall be awarded as follows:**

a. 05 marks-day to day evaluation and submission of record.
b. 10 marks to be awarded by conducting an internal laboratory test.

**COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:**

| CO\PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | | | | | | | | | | | | | | |
| 2 | 3 | | | | | | | | | | | | | | |
| 3 | 2 | | | | 1 | | | | 1 | | | | | | |
| Course | 3 | | | | 1 | | | | 1 | | | | | | |

| ENVIRONMENTAL SCIENCE | | | |
|---|---|---|---|
| Subject Code | 18CMCHN2080 | IA Marks | 30 |
| Number of Lecture Hours/Week | 04 | Exam Marks | 70 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |
| **Credits – 00** | | | |

**COURSE OBJECTIVES:**

The objectives of this course, help the students to

1. Know the importance of Environmental studies and the measures to be taken to overcome global environmental challenges.
2. Understand the concept of ecosystem and its diversity.
3. Gain knowledge on natural resources.
4. Understand the concept of biodiversity.
5. Gain knowledge on environmental pollution.
6. Gain knowledge on environmental legislation and global treaties.

| **Unit -1** | |
|---|---|
| **MULTIDISCIPLINARYNATUREOF ENVIRONMENTALSTUDIES**<br>**Environment**-Definition, Introduction - Scope and Importance - Global environmental challenges, global warming & climate change - Acid rains, ozone layer depletion - Carbon credits - Sustainability, Stockholm & Rio Summit - Population growth & explosion - Role of Information Technology in Environment and human health. **Ecosystem** - Concept of an ecosystem. - Structure and function of an ecosystem. - Producers, consumers and decomposers. - Energy flow in the ecosystem - Ecological succession. -Food chains, food webs and ecological pyramids. Introduction, types, characteristic features,structure and function of the different ecosystems | **Hours– 10** |
| **Unit -2** | |
| **NATURAL RESOURCES**<br>Renewable and non-renewable resources – Natural resources and associated problems –Forest resources – Use and over – exploitation, deforestation - Timber extraction – Mining, dams and other effects on forest and tribal people Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems<br>Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.<br>Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles. | **Hours– 12** |
| **Unit -3** | |
| **BIODIVERSITY AND ITS CONSERVATION**<br>Introduction - Definition: genetic, species and ecosystem diversity. – Biogeographically classification of India - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, National and local levels. India as a mega- diversity nation - Hot-spots of biodiversity - Threats to biodiversity: habitat loss - Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. | **Hours– 6** |
| **Unit -4** | |
| **ENVIRONMENTAL POLLUTION** | **Hours– 12** |

| | |
|---|---|
| Definition, Cause, effects and control measures of :<br>a. Air pollution<br>b. Water pollution<br>c. Soil pollution<br>d. Marine pollution<br>e. Noise pollution<br>f. Thermal pollution<br>g. Nuclear hazards<br>Solid waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution. - Pollution case studies. | |
| **Unit -5** | |
| **SOCIAL ISSUES AND THE ENVIRONMENT**<br>Urban problems related to energy -Water conservation, rain water harvesting, watershed management - Resettlement and rehabilitation of people its problems and concerns. Environment Protection Act - Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act - Wildlife Protection Act -Forest Conservation Act -Issues involved in enforcement of environmental legislation. -Public awareness.<br>**Field work:** Visit to a local area to document environmental assets River /forest grassland/hill/mountain<br>-Visit to a local polluted site Urban/Rural/industrial/<br>Agricultural Study of common plants, insects, birds. - Study of simple ecosystems - pond, river, hill slopes, etc. | **Hours– 10** |

**COURSE OUTCOMES:**

On completion of the course student will be

1. Able to know the importance of Environmental studies and the measures to be taken to overcome global environmental challenges.
2. Able to understand the concept of eco system and its diversity.
3. Able to gain knowledge on natural resources.
4. Able to understand the concept of biodiversity.
5. Able to gain knowledge on environmental pollution.
6. Gain knowledge on environmental legislation and global treaties.

**Question paper pattern:**

1. Question paper consists of 10 questions.
2. Each full question carrying 14 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

**TEXT BOOKS:**

1. E. Bharucha (2003), “Environmental Studies”, University Publishing Company, New Delhi.
2. J.G. Henry and G.W. Heinke (2004), “Environmental Science and Engineering”, Second Edition, Prentice Hall of India, New Delhi
3. G.M. Masters (2004)” Introduction to Environmental Engineering and Science”, Second Edition, Prentice Hall ofIndia, New Delhi

**REFERENCE BOOKS**:

1. Text Book of Environmental Studies by Deeshita Dave&P. UdayaBhaskar, Cengage Learning.
2. Environmental Studies by K.V.S.G. Murali Krishna, VGS Publishers, Vijayawada.
3. Environmental Studies, P.N. Paliniswamy, P. Manikandan,A. Geeta and K. Manjula Rani, Pearson Education, Chennai.

**Course Outcomes to Program Outcomes Mapping:**

| CO | PO1 | PO2 | PO 3 | PO4 | PO5 | PO6 | PO7 | PO 8 | PO9 | PO 10 | PO11 | PO12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | - | - | - | - | - | - | 3 | - | - | - | - | - | - | - | - |
| **2** | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **3** | - | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **4** | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **5** | - | 3 | 3 | - | - | - | - | - | - | - | - | - | - | - | - |
| **6** | - | 3 | | - | - | - | - | - | - | - | - | - | - | - | - |
| **Course** | **3** | **3** | **3** | **-** | **-** | **-** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** |

**Course Structure for**

**B.Tech. (Electronics and Communication Technology)**

**Semester III (Second year)**

| S.No | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | 18CMMAT3010 | Engineering Mathematics-III | 3 | 1 | 0 | 4 |
| 2 | 18ETETT3020 | Electronic Devices | 3 | 0 | 0 | 3 |
| 3 | 18ETETT3030 | Network Theory | 3 | 0 | 0 | 3 |
| 4 | 18ETETT3040 | Signals & Systems | 3 | 0 | 0 | 3 |
| 5 | 18ETETT3050 | Probability & Stochastic Processes | 3 | 0 | 0 | 3 |
| 6 | 18ETETL3060 | Electronic Devices Lab | 0 | 0 | 3 | 1.5 |
| 7 | 18ETETL3070 | Network Theory Lab | 0 | 0 | 3 | 1.5 |
| 8 | 18ETETN3080 | Pulse & Digital Circuits (MC) | 3 | 0 | 0 | 0 |
| | | **Total Credits** | | | | 19 |

**Semester IV (Secondyear)**

| S.No | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | 18ETETT4010 | Digital System Design | 3 | 0 | 0 | 3 |
| 2 | 18CMMET4020 | Engineering Mechanics | 3 | 1 | 0 | 4 |
| 3 | 18ETETT4030 | Electro Magnetic Waves &Transmission Lines | 3 | 0 | 0 | 3 |
| 4 | 18ETETT4040 | Analog Circuits | 3 | 0 | 0 | 3 |
| 5 | 18ETETT4050 | Analog & Digital Communications | 3 | 0 | 0 | 3 |
| 6 | 18ETETL4060 | Digital System Design Lab | 0 | 0 | 3 | 1.5 |
| 7 | 18ETETL4070 | Analog Circuits Lab | 0 | 0 | 3 | 1.5 |
| 8 | 18ETETL4080 | Analog & Digital Communications Lab | 0 | 0 | 3 | 1.5 |
| | | **Total Credits** | | | | 20.5 |

# ENGINEERING MATHEMATICS – III

(Common for ECE & ECT)

SEMESTER - III

| | | | |
|---|---|---|---|
| Subject Code | 18CMMAT3010 | Internal Marks | 30 |
| Number of Lecture Hours/Week | 3(L) + 1(T) | External Marks | 70 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |

**Credits – 04**

**Course Objectives:**
**This course will enable students to:**

1. Find the function of a complex variable
2. EvaluatecomplexintegrationandexpandfunctionsusingTaylor&Maclaurin's series
3. Evaluate integrals using Residues
4. Find the statistical parameters for distributions
5. Test the hypothesis

| Unit -1 | Hours |
|---|---|
| **Function of a complex variable**<br>Introduction –continuity –differentiability- analyticity – properties – Cauchy – riemann equations in Cartesian and polar coordinates. Harmonic and conjugate harmonic functions – Milne – Thompson method. | **10** |
| **Unit -2** | |
| **Integration and series expansions**<br>Complex integration: Line integral – Cauchy's integral theorem, Cauchy's in integral formula, generalized integral formula (all without proofs)<br>Radius of convergence – expansion in Taylor's series, Maclaurin's series and Laurent series | **10** |
| **Unit – 3** | |
| **Singularities and Residue Theorem**<br>Zeros of an analytic function, Singularity, Isolated singularity, Removable singularity, Essential singularity, pole of order m, simple pole, Residues, Residue theorem, Calculation of residues, Residue at a pole of order m**,** Evaluation of real definite integrals: Integration around the unit circle**,** Integration around semicircle, In denting the contour shaving poles on the real axis. | **10** |
| **Unit – 4** | |
| **Discrete Random variables and Distributions:**<br>Introduction-Random variables- Discrete Random variable-Distribution function-Expectation. Discrete distributions: Binomial, Poisson and Geometric distributions and their fitting to data.<br>**Continuous Random variable and distributions:**<br>Introduction-Continuous Random variable-Distribution function- Expectation-Continuous distribution: Uniform, Exponential and Normal distributions, Normal approximation to Binomial distribution | **10** |
| **Unit – 5** | |
| **Test of Significance:**<br>Introduction - Population and samples- Sampling distribution of means ($\sigma$-known) t-distribution- Sampling distribution of means($\sigma$-unknown), chi-square and F- test Hypothesis-Null and Alternative Hypothesis- Type I and Type II errors –Level of significance - One tail and two-tail tests- Tests concerning one mean and<br>proportion, two means- Proportions and their differences - ANOVA for one – way | **10** |

| | |
|---|---|
| and two – way classified data | |
| **Course outcomes:**<br>On completion of this course, students are able to<br>1. Find the function of a complex variable<br>2. Evaluate complex integration and expandfunctionsusing Taylor &Maclaurin's series<br>3. Evaluate integrals using Residues<br>4. Find the statistical parameters for discrete distributions<br>5. Find the statistical parameters for continuous distributions<br>6. Test the hypothesis | |

**Question paper pattern:**

1. Question paper consists of 10 questions.
2. Each full question carrying 14 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

**Text Books:**

1. B.S. Grewal, **"Higher Engineering Mathematics"**, Khanna publishers, 44$^{th}$edition, 2016.
2. Erwin Kreyszig, **"Advanced Engineering Mathematics**, Wiley, 9$^{th}$Edition, 2013.

**Reference Books**:

1. B.V. Ramana, **"Higher Engineering Mathematics"**, Tata Mc Graw-Hill,2006
2. N.P.BaliandManishGoyal,**"AtextbookofEngineeringmathematics"**,Laxmi publications, 7$^{th}$Edition.
3. H.K.Dassand, Er.RajnishVerma,**"HigherEngineeerigMathematics"**,S.Chand publishing, 1$^{st}$edition,2011.
4. Dr. B. Rama Bhupal Reddy**, "Probability and Statistics for Engineers",**Research India Publications (DELHI), 2015.

**Course Outcomes to Program Outcomes mapping:**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 4 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 6 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Course** | **2** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** |

# ELECTRONIC DEVICES
(Common for ECE &ECT)
SEMESTER III

| | | | |
|---|---|---|---|
| Subject Code | 18ETETT3020 | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |
| Pre-requisite | Engineering Physics | **Credits –03** | |

**Course Objectives:**
This course will enable the students to:
- Provide insight of intrinsic and extrinsic semiconductors, semiconductor diodes, special purpose diodes
- Learn about rectifier circuits using diodes.
- Introduce the construction and operation of BJT, JFET and MOSFET and their biasing techniques
- Learn the small signal analysis of BJT, JFET and MOSFET.

| **Unit -1** | **Hours** |
|---|---|
| **Semiconductor Physics:** Insulators, Semi conductors, and Metals classification using energy bands, mobility and conductivity, electrons and holes in intrinsic semi conductors and extrinsic semi conductors, drift and diffusion, charge densities in semiconductors, Hall effect, continuity equation, law of junction, Fermi level in intrinsic and extrinsic Semiconductors. **Junction Diode:** Open circuited p-n junction, current components in p-n Diode, diode equation, V-I Characteristics, Diode resistance, Diode capacitance. | **10** |
| **Unit -2** | |
| **Special Semiconductor Diodes**: Zener Diode, Breakdown mechanisms, Photo diode, LED. Construction, operation and characteristics of all the devices are to be considered. **Applications of Diode:** Basic Rectifier setup, half wave rectifier, full wave rectifier, bridge rectifier, derivations of characteristics of rectifiers, rectifier circuits-operation, input and output waveforms, Filters, Inductor filter, Capacitor filter, comparison of various filter circuits in terms of ripple factors. | **12** |
| **Unit – 3** | |
| **BJT:** Transistor current components, Transistor equation, Characteristics of CB, CE and CC configurations, punch through/ reach through, Photo transistor. **FET:** Basic structure and operation of JFET & MOSFET characteristics, parameters, comparison between FET and BJT. | **08** |
| **Unit – 4** | |
| **Transistor Biasing and Thermal Stabilization:** Operating point, load line analysis, BJT biasing- methods: fixed bias, collector to base bias, self-bias,Stabilization against variations in Ico, VBE, and β, Stability factors, (S, S', S'’), Thermal runaway, Thermal stability. | **08** |
| **Unit – 5** | |

| | |
|---|---|
| **Small Signal Low Frequency Transistor Amplifier Models:**<br>**BJT:** Two port network, Transistor hybrid model, h-parameters, conversion of h-parameters, generalized analysis of transistor amplifier model using h-parameters, Analysis of CB, CE and CC amplifiers, Comparison of transistor amplifiers.<br>**FET:** Small signal model of a MOSFET, Analysis of CG, CS and CD amplifiers, comparison of FET amplifiers. | **12** |

**Course outcomes:**

On completion of the course student will be able to:

1. Understand the basic concepts of semiconductor physics.
2. Understand the construction and operating principle of p-n junction diode and special semiconductor diodes
3. Apply diodes as rectifiers and analyze characteristics with and without filters
4. UnderstandtheconstructionandprincipleofoperationofBJTandFETw.r.t V-I characteristics.
5. Analyze various biasing techniques for BJT and FET.
6. Analyze BJT and FET using small signal analysis.

**Question paper pattern:**

1. Question paper consists of 10 questions.
2. Each full question carrying 14 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

**Text Books:**

1. Jacob Millman, C. Halkies, C.D. Parikh, **"Integrated Electronics"**, Tata Mc-Graw Hill, 2009.
2. G. Streetman and S. K. Banerjee, **"Solid State Electronic Devices",** 2$^{nd}$edition, Pearson,2014.

**Reference Books**:

1. Robert L Boyelstad, LovisNashelsky, **"Electronic Devices & Theory",**10$^{th}$edition
2. David A Bell, **"Electronic Devices and Circuits",** 5$^{th}$edition, Oxford Publications
3. J. Millman, C. Halkias, **"Electronic Devices and Circuits",** 3$^{rd}$Edition, Tata Mc-Graw Hill.
4. Salivahanan, Kumar, Vallavaraj, **"Electronic Devices andCircuits",**2$^{nd}$Edition, Tata Mc-Graw Hill.

**Web References:**

1. http://nptel.ac.in/video.php?subjectId=117103063
2. https://nptel.ac.in/courses/122106025/2

**Course Outcomes to Program Outcomes mapping:**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | - | - |
| 2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 2 | - | 2 |
| 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 2 | - | 2 |
| 4 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| 5 | 3 | 3 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| 6 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | 1 | - | 2 |
| **Course** | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | - | 1 |

| S. No. | Unit Name | Text Book / Reference | Chapter No. |
|---|---|---|---|
| 1 | Semi Conductor Physics & Junction Diode | T1 | 2, 3 & 19 |
| | | T2 | 3 |
| | | R4 | 4 |
| 2 | Special Semiconductor Diodes & Applications of Diode | T1 | 3, 4 & 18 |
| | | R1 | 2 |
| 3 | BJT & FET | T1 | 5 & 10 |
| | | T2 | 6,7 |
| | | R3 | 7 & 12 |
| 4 | Transistor Biasing an Thermal Stabilization | T1 | 9 |
| | | R2 | 5 |
| 5 | Small Signal Low Frequency Transistor Amplifier Models | T1 | 8 & 10 |

# NETWORK THEORY
(Common for ECE & ECT)
SEMESTER III

| | | | |
|---|---|---|---|
| Subject Code | 18ETETT3030 | Internal Marks | 30 |
| Number of Lecture Hours/Week | 3 | External Marks | 70 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |
| Pre-requisite | --- | **Credits – 03** | |

**Course Objectives:**
This course will enable students to:
- Analyze the electrical circuits using various circuit analysis techniques
- Determine the transient response of R-L-C Networks
- Analyze two port networks and determine filter characteristics

| Unit -1 | Hours |
|---|---|
| **Introduction to Electrical Circuits**: Review on Mesh analysis and Nodal analysis problem solving for AC Circuits.<br>**Network Topology:** Definitions of branch, node, tree, planar, non-planar graph, incidence matrix, basic tie set schedule, basic cut set schedule. Star-Delta and Delta - Star conversions | **9** |
| **Unit -2** | |
| **Network Theorems:** Thevinin's, Norton's, Milliman's, Reciprocity, Compensation, Substitution, Superposition, Max Power Transfer, Tellegens theorems problem solving for AC circuits | **10** |
| **Unit – 3** | |
| **Transients:** First order differential equations, Evaluating initial conditions procedure, Definition of time constants, R-L circuit, R-C circuit with DC excitation and AC excitation, second order differential equations, homogeneous, non homogenous, problem solving using R-L-C elements with DC excitation and AC excitation. | **11** |
| **Unit – 4** | |
| **Two-port networks:** Relationship of two port networks, Z-parameters, Y-parameters, Transmission line parameters, h-parameters, Inverse h-parameters, Inverse Transmission line parameters, Relationship between parameter sets, Parallel connection of two port networks, Cascading of two port networks, series connection of two port networks, problem solving including dependent sources also. | **10** |
| **Unit – 5** | |
| **Filters & Attenuators:**<br>**Filters:** Classification Filters, Filter Networks, Equations of Filter Networks, Classification of Pass Band and Stop Band, Constant - K Low Pass Filter, Constant - K High Pass Filter, m-Derived T-Section, Band Pass Filter, Band Elimination Filter<br>**Attenuators:** T-Type Attenuator, π - Type Attenuator, Lattice Attenuator, Bridged -T Attenuator, L-Type Attenuator | **10** |

**Course outcomes:**
On completion of the course student will be able to
1. Analyze basic electrical networks using mesh, nodal techniques.
2. Analyzebasicelectricalnetworksusingtopologicaldescriptionofthenetwork.
3. Apply and analyze various network theorems for DC and AC circuits.
4. Analyze the transient response of R-L, R-C and R-L-C networks
5. Analyze two port networks.

6. Analyze the characteristics of Filters and Attenuator

**Question paper pattern:**

1. Question paper consists of 10 questions.
2. Each full question carrying 14 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

**Text Books:**

1. Van, Valken burg, "Network analysis", 3rd Edition, Prentice hall of India, 2000.
2. AWilliamHayt,"EngineeringCircuitAnalysis",8thEdition,McGraw-HillEducation
3. Sudhakar,A.,Shyammohan,S.P,"CircuitsandNetwork",TataMcGraw-HillNew Delhi,1994

**Reference Books:**

1. John.D.Ryder,"NetworklinesandFields",2ndedition,Asiapublishinghouse.
2. D R Cunninghan, "Basic Circuit Analysis", Jaico Publishers.
3. Chadha, "Network Analysis and Filter Design", Umesh Publications.

**Web References:**

1. http://www.nptelvideos.in/2012/11/circuit-theory.html
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-and-electronics-spring-2007/video-lectures/lecture-2/
3. http://www.infocobuild.com/education/audio-video courses/electronics/CircuitTheory-IIT-Delhi/lecture-09.html

**Course Outcomes to Program Outcomes mapping:**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 2 | - |
| 2 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 2 | - |
| 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 4 | - | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 6 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Course** | **2** | **3** | **1** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **1** | **-** |

| S. No. | Unit Name | Text Book /Reference | Chapter No. |
|---|---|---|---|
| 1 | Introduction to Electrical Circuits & Network Topology | T1&T3 | (2 – 3) &(1-2) |
| | | R1 & R2 | 1 & 4 |
| 2 | Network Theorems | T1 & T3 | 9 & 3 |
| | | R1 & R2 | 1 & 11 |
| 3 | Transients | T2 | 8 & 9 |
| | | T3 | 12 |
| | | R2 | 8 |
| 4 | Two-port networks | T1 | 11 |
| | | T3 | 15 |
| 5 | Filters & Attenuators | T3 | 16 |
| | | R1 | 4 |

| SIGNALS & SYSTEMS<br>(Common for ECE &ECT)<br>SEMESTER III | | | |
|---|---|---|---|
| Subject Code | 18ETETT3040 | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |
| Pre-requisite | Engineering Mathematics-II | **Credits – 03** | |

**Course Objectives:**

This course will enable students to:

- Know the concepts of signals and systems and perform operations on LTI systems.
- Analyze the signals and systems by using transforms.
- Know the process of sampling.

| **Unit -1** | **Hours** |
|---|---|
| **Introduction:** Definition of Signals and Systems, Singularity functions and related functions. Complex exponential and sinusoidal signals. Classification of Signals, Operations on signals. Classification of Systems, System Properties.<br>Analogy between vectors and signals, orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, closed or complete set of orthogonal functions, Orthogonality in complex functions. | **12** |
| **Unit -2** | |
| **Fourier Series & Fourier Transform:** Fourier series representation of continuous time periodic signals, properties of Fourier series, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series, Complex Fourier spectrum. Deriving Fourier transform from Fourier series, Fourier transform of arbitrary signal, Fourier transform of standard signals, Fourier transform of periodic signals, properties of Fourier transforms. Introduction to Hilbert Transform. | **12** |
| **Unit – 3** | |
| **Sampling Theorem**: Representation of a CT signal by its samples: The Sampling theorem, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling –Aliasing, Introduction to Band Pass sampling.<br>Review of Laplace Transforms, Properties, Relation between L.T and F.T of a signal. | **8** |
| **Unit – 4** | |
| **Analysis of Linear Systems:** Linear Time Invariant systems, impulse response, Response of a linear system, Transfer function of a LTI system, Concept of convolution in time domain and frequency domain, Graphical representation of convolution.<br>Cross-correlation and auto-correlation of functions, properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between auto correlation function and energy/power spectral density function. Relation between convolution and correlation. Detection of periodic signals in the presence of noise by correlation, Extraction of signal from noise by filtering. | **10** |
| **Unit – 5** | |

| | |
|---|---|
| **Z–Transforms**: Discrete time signal representation using complex exponential and sinusoidal components, Periodicity of discrete time using complex exponential signal. Concept of Z- Transform of a discrete sequence. Distinction between Laplace, Fourier and Z transforms. Region of convergence, constraints on ROC for various classes of signals, Properties of Z-transforms, Inverse Z-transform. | **8** |

**Course outcomes:**

On completion of the course student will be able to

1. Understand various signals and systems and demonstrate their properties.
2. Interpret Fourier analysis of continuous-time Signals.
3. Applysamplingtheoremforsignalconversionfromcontinuous-timesignalsto discrete-time.
4. Analyze continuous time signals by using Laplace transforms.
5. Understand various operations on LTI systems.
6. Apply z-transform to analyze discrete-time signals and systems.

**Question paper pattern:**

1. Question paper consists of 10 questions.
2. Each full question carrying 14 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

**Text Books:**

1. A.V. Oppenheim, A.S. Willsky and S.H. Nawab, **"Signals and Systems"**,2$^{nd}$Edition, PHI,2009.
2. B.P. Lathi, **"Signal Processing & Linear Systems"**, 1$^{st}$Edition, Oxford University Press, 2006.

**Reference Books**

1. Simon Haykin and Van Veen, **"Signals & Systems"**, 2$^{nd}$Edition, John Wiley India, 2011.
2. M.J.Roberts,**"AnalysisusingTransformmethodsandMATLAB"**,1$^{st}$Edition, TMH, 2005.
3. T.K.Rawat,**"SignalsandSystems"**,1$^{st}$Edition,OxfordUniversitypress,2014

**Web References:**

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-003-signals-and-systems-fall-2011/lecture-videos/
2. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/video-lectures/
3. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/lecture-notes/
4. https://nptel.ac.in/courses/117104074/

**Course Outcomes to Program Outcomes mapping:**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | 3 | - |
| 2 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 | - |
| 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 | - |
| 4 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 | - |
| 5 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | 3 | - |
| 6 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 | - |
| **Course** | **3** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** |

| S. No. | Unit Name | Text Book/ Reference | Chapter No. |
|---|---|---|---|
| 1 | Introduction | T1 | 1 |
| | | T2 | 3 |
| | | R2 | 2 |
| 2 | Fourier Series & Fourier Transform | T1 | 3 & 4 |
| | | T2 | 3 & 4 |
| | | R1 | 3 |
| | | R2 | 4 & 5 |
| 3 | Sampling Theorem | T1 | 7 & 9 |
| | | T2 | 11 & 5 |
| 4 | Analysis of Linear Systems | T2 | 6 & 12 |
| | | R2 | 8 |
| 5 | Z–Transforms | T1 | 10 |
| | | R1 | 7 |
| | | R2 | 11 & 12 |

<table>
<tr><td colspan="5">PROBABILITY & STOCHASTIC PROCESSES<br>(Common for ECE & ECT)<br>SEMESTER III</td></tr>
<tr><td>Subject Code</td><td>18ETETT3050</td><td>Internal Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>03</td><td>External Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50</td><td>Exam Hours</td><td>03</td></tr>
<tr><td>Pre-requisite</td><td>---</td><td colspan="2">Credits – 03</td></tr>
<tr><td colspan="4">Course Objectives:<br>This course will enable students to<ul><li>Understandtheconceptofdistribution,densityfunctionsofdifferentrandom variables</li><li>Apply statistical operations on 1-d and multiple random variables.</li><li>ClassifytherandomprocessesandanalyzetheLTIsystemswithrandomprocess</li></ul></td></tr>
<tr><td colspan="3">Unit -1</td><td>Hours</td></tr>
<tr><td colspan="3">Review of Probability Theory: Probability introduced through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Mathematical Model of Experiments, Probability as a Relative Frequency, Joint Probability, Conditional Probability, Total Probability, Bayes' Theorem, independent Events.<br>The Random Variable: Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variables, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Conditional Distribution, Conditional Density, Properties.</td><td>12</td></tr>
<tr><td colspan="4">Unit -2</td></tr>
<tr><td colspan="3">Operation on One Random Variable – Expectations : Introduction, Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable: Monotonic Transformations for a Continuous Random Variable, Non monotonic Transformations of Continuous Random Variable.</td><td>10</td></tr>
<tr><td colspan="4">Unit – 3</td></tr>
<tr><td colspan="3">Multiple Random Variables: Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem: Unequal Distribution, Equal Distributions.<br>Operations on Multiple Random Variables: Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variables case, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.</td><td>10</td></tr>
<tr><td colspan="4">Unit – 4</td></tr>
<tr><td colspan="3">Random Processes – Temporal Characteristics: The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, Concept of Stationary and Statistical Independence. First-Order Stationary Processes, Second-order and Wide-Sense Stationarity, $N^{th}$-order and Strict-Sense Stationarity, Time Averages and Ergodicity, Autocorrelation Function and its Properties, Cross-Correlation Function and its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process.</td><td>8</td></tr>
</table>

| Unit – 5 | |
|---|---|
| **Random Processes – Spectral Characteristics:** The Power Density Spectrum: Properties, Relationship between Power Density Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Density Spectrum and Cross-Correlation Function. **Linear Systems With Random Inputs:** Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean-squared Value of System Response, Autocorrelation Function of Response, Cross-Correlation Functions of Input and Output, Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectra of Inputand Output | **10** |

**Course outcomes:**

On completion of the course student will be able to

1. Understand the axiomatic formulation of Probability Theory
2. Demonstrate the concept of random variable and its distribution, density functions
3. Applystatisticaloperationsandtransformationson1-Drandomvariable
4. Extendtheconceptof1-drandomvariabletomultiplerandomvariables
5. Analyze random processes by understanding its temporal and Spectral characteristics
6. Analyze linear Time Invariant systems with random inputs

**Question paper pattern:**

1. Question paper consists of 10 questions.
2. Each full question carrying 14 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

**Text Books:**

1. Peyton Z. Peebles, Probability, **"Random Variables & Random Signal Principles"**, $4^{th}$Edition, TMH,2001.
2. Papoulis and S. Unnikrisha, **"Probability, Random Variables and Stochastic Processes"**, $4^{th}$Edition, PHI,2002.

**Reference Books**:

1. Henry Starkand John W. Woods, **"Probability and Random Processes with Applications to Signal Processing"**, ThirdEdition, Pearson Education.
2. Gardener W.A, **"Introduction to Random Processes with Applications to Signals and Systems"**, SecondEdition, McGraw-Hill.

**Web References:**

1. https://nptel.ac.in/courses/117105085/
2. https://ocw.mit.edu/courses/mathematics/18-440-probability-and-random- variables-spring-2014/

**Course Outcomes to Program Outcomes mapping:**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | 3 | - |
| 2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | 1 | - |
| 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | 1 | - |
| 4 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | 3 | - |
| 6 | 3 | 1 | - | - | - | - | - | - | - | - | - | - | - | 2 | - |
| **Cour** | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | 2 | - |

| se | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| S. No. | Unit Name | Text Book / Reference | Chapter No. |
|---|---|---|---|
| 1 | Review of Probability Theory & The Random Variable | T1 | 1 & 2 |
| | | T2 | 1,2 & 4 |
| | | R1 | 1 & 2 |
| | | R2 | 1 & 2 |
| 2 | Operation on One Random Variable – Expectations | T1 | 3 |
| | | T2 | 5 |
| | | R1 | 3 &4 |
| 3 | Multiple Random Variables | T1 | 4 & 5 |
| | | T2 | 6 |
| | | R2 | 4 |
| 4 | Random Processes – Temporal Characteristics | T1 | 6 |
| 5 | Random Processes – Spectral Characteristics & Linear Systems With Random Inputs | T1 | 7 & 8 |

# ELECTRONIC DEVICES LAB

(Common for ECE & ECT)
SEMESTER - III

| | | | |
|---|---|---|---|
| Subject Code | 18ETETL3060 | Internal Marks | 15 |
| Number of Lecture | 03 | External Marks | 35 |
| Total Number of Lecture Hours | 36 | Exam Hours | 03 |

**Credits – 1.5**

**Course objectives:**

The objectives of the course are to make students to

- Provide insight of intrinsic and extrinsic semiconductors, semiconductor diodes, special purpose diodes
- Learn about rectifier circuits using diodes.
- Introduce the operation of BJT, JFET and MOSFET and their biasing techniques
- Learn the small signal analysis of BJT, JFET and MOSFET.

| List of Experiments: | Hours |
|---|---|
| **Electronic Workshop Practice:**<br>1. Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Coils, Gang Condensers, Relays, Bread Boards.<br>2. Identification, Specifications and Testing of active devices, Diodes, BJTs, JFETs, LEDs, LCDs, SCR, UJT.<br>3. Soldering Practice-Simple circuits using active and passive components.<br>4. Study and operation of Ammeters, Voltmeters, Transformers, Analog and Digital Multi meter, Function Generator, Regulated Power Supply and CRO.<br>**List of Experiments:**<br>1. P-N Junction Diode Characteristics<br>2. Zener Diode Characteristics without and with Regulator<br>3. Half-wave Rectifier (without and with C-filter)<br>4. Full-wave Rectifier (without and with C-filter)<br>5. BJT Characteristics (CE Configuration)<br>Part A: Input Characteristics Part B: Output Characteristics<br>6. FET Characteristics (CS Configuration)<br>Part A: Drain Characteristics Part B: Transfer Characteristics<br>7. Transistor Biasing<br>8. BJT-CE Amplifier<br>9. Emitter Follower-CC Amplifier<br>10. FET-CS Amplifier<br><br>**Course outcomes:**<br>After completing this course, students will be able to:<br>1. Analyze the characteristics of Semi conductor devices.<br>2. Design and verify the biasing circuit for BJT<br>3. Design and analyze BJT and FET Amplifier Circuits<br>**Question paper pattern:**<br>**Examination is evaluated for 35 marks and as follows**:<br>Ten questions are given, and student should choose one question (blind option), which carries 35<br>marks in total.<br>a. 10 marks are allotted for procedure including circuit diagrams and model graphs. | **36** |

| | |
|---|---|
| b. 10 marks for conduction of the experiment.<br>c. 05 marks for results and conclusions.<br>d. 10 marks for viva voce.<br>**The internal 15 marks shall be awarded as follows:**<br>a. 05 marks-day to day evaluation and submission of record.<br>b. 10 marks to be awarded by conducting an internal laboratory test. | |

# NETWORK THEORY LAB

(Common for ECE & ECT)

SEMESTER - III

| | | | |
|---|---|---|---|
| Subject Code | 18ETETL3070 | Internal Marks | 15 |
| Number of Lecture Hours/Week | 03 | External Marks | 35 |
| Total Number of Lecture Hours | 36 | Exam Hours | 03 |

**Credit-1.5**

**Course objectives:**

The course objective is make students to

- Understand the concepts of design and analysis of Electrical circuits.
- Analyze the electrical circuits using various circuit analysis techniques
- Determine the transient response of R-L-C Networks
- Analyze two port networks and determine filter characteristics

| The students are required to design the electrical circuits to verify the laws, theorems, two port parameters, time response of AC circuits and have to experimentally find the results. Experimental results should be verified with theoretical values. | **Hours** |
|---|---|
| **Part-A: Computation of two port network parameters and transients**<br>1. Two port network parameters–Z-Y Parameters and analytical verification.<br>2. Two port network parameters – Hybrid& ABCD parameters, Analytical verification.<br>3. Transient response of RL & RC Networks for DC and AC Inputs<br>4. Transient response of RLC Circuit for DC and AC inputs | **12** |
| **Part-B: Simulation of electrical networks using PSPICE**<br>1. Introduction to PSPICE and verification of Kirchhoff's laws for basic electrical networks.<br>2. Simulation of DC Electrical circuits and verification using Kirchhoff's laws<br>3. Simulation of AC Electrical circuits and verification using Kirchhoff's laws<br>4. Verification of Thevenin’s and Norton’s equivalent circuits using PSPICE. Verification on DC with Resistive loads<br>5. Verification of Thevenin’s and Norton’s equivalent circuits using PSPICE. Verification on AC with Reactive loads<br>6. Transient Response of RLC Circuits for DC and AC Inputs<br>7. Determination of Two port network parameters<br>8. Low pass and High Pass Filter characteristics | **24** |

For the above circuits verify all the characteristics and laws experimentally and compare with theoretical calculations

**Course outcomes:**

After studying this course, students will be able to:

1. Analyze complex DC and AC linear circuits
2. Apply concepts of electrical circuits across engineering
3. Analyze the given electrical network by using PSPICE Simulation tool

**Question paper pattern:**

**Examination is evaluated for 35 marks and as follows**:

Ten questions are given, and student should choose one question (blind option), which carries 35
marks in total.

a. 10 marks are allotted for procedure including circuit diagrams and model graphs.
b. 10 marks for conduction of the experiment.
c. 05 marks for results and conclusions.
d. 10 marks for viva voce.

**The internal 15 marks shall be awarded as follows:**

a. 05 marks-day to day evaluation and submission of record.
b. 10 marks to be awarded by conducting an internal laboratory test.

**Hardware/Software Requirements:**

1. Regulated Power supplies
2. Cathode Ray Oscilloscopes
3. Function Generators
4. Digital Multi meters
5. Decade Resistance Boxes/Rheostats
6. Decade Capacitance Boxes
7. Ammeters (Analog or Digital)
8. Voltmeters (Analog or Digital)
9. Active & Passive Electronic Components
10. PSPICE Software

# PULSE & DIGITAL CIRCUITS

(Common for ECE & ECT)

SEMESTER III

| | | | |
|---|---|---|---|
| Subject Code | 18ETETN3080 | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |
| Pre-requisite | -- | **Credits – 0** | |

**Course Objectives:**

This course will enable students to

1. Understand Wave shaping circuits.
2. Analyze switching characteristics of electronic devices.
3. Design multi vibrators and time base generators.

| Unit -1 | Hours |
|---|---|
| **Linear Wave Shaping:** High pass, low pass RC circuits, their response for sinusoidal, step, pulse, square, ramp and exponential inputs. RC network as differentiator and integrator; Attenuators , its applications in CRO probe, RL and RLC circuits and their response for step input, Ringing circuit. | **10** |
| **Unit -2** | |
| **Non-Linear Wave Shaping:** Diode clippers, Transistor clippers, clipping at two independent levels, Transfer characteristics of clippers, Emitter coupled clipper; Clamping operation, clamping circuits using diode with different inputs,Clampingcircuittheorem,practicalclampingcircuits,effectofdiode characteristics on clamping voltage, Transfer characteristics of clampers. | **12** |
| **Unit – 3** | |
| **Switching Characteristics of Devices:** Diode as a switch, piecewise linear diode characteristics, Design and analysis of Transistor as a switch, Break down voltage consideration of transistor, saturation parameters of Transistor and their variation with temperature, Design of transistor switch, transistor- switching times.<br>**Bistable Multivibrator:** Analysis And Design of Fixed Bias, Self Bias Bistable Multi Vibrator, Collector Catching Diodes, Commutating Capacitors, Triggering of Binary Circuits, Emitter Coupled Bistable Multivibrator (Schmitt Trigger). | **12** |
| **Unit – 4** | |
| **Monostable Multivibrator:** Analysis and Design of Collector Coupled Monostable Multi vibrator, Triggering of Monostable Multivibrator, Applications of Monostable Multivibrator.<br>**Astable Multivibrator:** Analysis and Design of Collector Coupled Astable Multivibrator, Application of Astable Multivibrator as a Voltage to Frequency Converter. | **9** |
| **Unit – 5** | |
| **Voltage Time Base Generators**: General features of a time base signal, Methods of generating time base waveform Exponential Sweep Circuits, Negative Resistance Switches, basic principles in Miller and Bootstrap time base generators, Transistor Miller time base generator, Transistor Bootstrap time base generator. | **7** |

**Course outcomes:**

On completion of the course, student will be able to

1. Analyze linear wave shaping circuits with different inputs.
2. Design Non linear wave shaping circuits.
3. Design switching circuits.
4. Analyze different Multivibrators.

5. Design different Multivibrators.
6. Understand different types of time base generators

**Question paper pattern:**

1. Question paper consists of 10 questions.
2. Each full question carrying 14 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

**Text Books:**

1. A. Anand Kumar, **"Pulse and Digital Circuits"**, PHI, 2005

**Reference Books**:

1. J. Millman and H. Taub, Mothiki S Prakash Rao, **"Pulse, Digital and Switching Waveforms"**, McGraw-Hill, Second Edition, 2007.
2. Venkata Rao, K,Ramasudha K, Manmadha Rao, G, **"Pulse & Digital Circuits"**, Pearson, 2010

**Web References:**

1. http://www.iitg.ac.in/apvajpeyi/ph218/Lec-18.pdf
2. http://www.nptelvideos.in/2012/12/digital-circuits-and-systems.html
3. http://www.allaboutcircuits.com/video-lectures/

**Course Outcomes to Program Outcomes mapping:**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 2 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | - | 2 |
| 4 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | 2 |
| 5 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | - | 2 |
| 6 | 3 | 3 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| **Course** | **3** | **3** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **2** |

| S. No. | Unit Name | Text Book / | Chapter No. |
|---|---|---|---|
| 1 | Linear Wave Shaping | T1 | 1 |
| | | R1 | 2 |
| 2 | Non-Linear Wave Shaping | T1 | 2 |
| | | R1 | 5,6 |
| 3 | Switching Characteristics of | T1 | 3,4 |
| | | R2 | 6 |
| 4 | Monostable Multivibrator & Astable Multivibrator | T1 | 4 |
| | | R2 | 7,8 |
| 5 | Voltage Time Base Generators | T1 | 5 |
| | | R3 | 14,15 |

# DIGITAL SYSTEM DESIGN

(Common for ECE & ECT)

SEMESTER IV

| | | | |
|---|---|---|---|
| Subject Code | 18ETETT4010 | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |
| Pre-requisite | Electronic Devices | **Credits -03** | |

**Course Objectives:**

This course will enable students to

1. Introducetheconceptsandtechniquesassociatedwiththenumbersystemsand Boolean algebra.
2. Design various combinational circuits, sequential circuits and memories using logic gates and PLDs
3. Know various logic families
4. Understand the use of VHDL in Digital systems design

| Unit -1 | Hours |
|---|---|
| **Number Systems And Boolean Algebra:** Number representation of different radix, conversion of bases, r-l's complements and r's complements of signed and unsigned numbers, weighted and non-weighted codes; Boolean theorems, principle of complementation & duality, De-morgans theorems, Basic logic operations and gates, Standard SOP and POS Forms, Minimization of logic functions using Boolean theorems and K-Map. | **10** |
| **Unit -2** | |
| **Combinational Circuit Design:** Design with basic logic gates, Design of Half adder, full adder ,4 bit parallel adder, BCD Adder, Carry look ahead adder circuit, adder- subtractor circuit, Comparators, Multiplexer, Demultiplexer, priority encoder, decoders, comparators, realization of Boolean functions using decoders and multiplexers. | **10** |
| **Unit – 3** | |
| **Sequential Circuit Design:** Memory elements and their excitation functions SR, JK, T, and D latches and flip-flops, Conversion from one flip-flop to another flip-flop, master slave JK flip-flop, edge-triggered flip-flop, Design of synchronous and asynchronous counters, Design of registers, finite-state machine, Realization of circuits using various flip-flops, minimization and transformation of sequential machines,. | **11** |
| **Unit – 4** | |
| **Logic Families:** Introduction to logic families, CMOS logic, CMOS steady state electrical behavior, CMOS dynamic electrical behavior, CMOS logic families, Bipolar logic, Transistor logic, TTL families, CMOS/TTL interfacing, Emitter coupled logic.<br>**Memories** – PAL, PLA, PROM, ROM Architecture, Types of ROMS &Applications, RAM Architecture, Static & Dynamic RAMs. | **9** |
| **Unit – 5** | |
| **Hardware Description Language:** Design flow, program structure, types and constants, functions and procedures, libraries and packages, Structural design elements, data flow design elements, behavioral design elements.<br>VHDL implementation of Carry look ahead adder, Decoder and Priority encoder, Synchronous counter, Universal shift register, Sequence Detector. | **10** |

**Course outcomes:**

Upon completion of the course, students will be able to

1. Understand the basic number systems, conversions and Boolean algebra.
2. Design digital systems using combinational circuits.
3. Design digital systems using sequential circuits.
4. Understand the concepts of logic families and corresponding logic levels.
5. DesigndigitalsystemusingPLDsandUnderstandtheconstructionandworkingof memories
6. Design digital systems using VHDL

**Question paper pattern:**

**Section A:**

1. Thissectioncontainstenoneortwolineanswerquestioncarrying1markeach.
2. Two questions from each unit should present.

**Section B:**

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12marks.
3. Each full question will have sub question covering all topics under a unit.
4. Thestudentwillhavetoanswer5fullquestionsselectingonefullquestionfromeach unit

**TEXT BOOKS:**

1. John F. Wakerly, **"Digital Design Principles & Practices"**, 3rd Edition PHI/Pearson Education Asia,2005.
2. Morris Mano, Michael D Ciletti , **"Digital Design"** ,4th Edition, PEA

**Reference Books**:

1. W.H.Gothmann,**"DigitalElectronics-Anintroductiontotheoryandpractice"**,2nd Edition, PHI,2006.
2. Charles H. Roth Jr, **"Fundamentals of Logic Design"**, 5th Edition, Jaico Publishers. 2008
3. D.V. Hall, **"Digital Circuits and Systems"**,1st Edition, Tata McGraw Hill,1989.
4. Charles Roth, **"Digital System Design using VHDL"**, 2nd Edition Tata McGrawHill, 2012.
5. Stephen Brown and ZvonkoVramesic, **"Fundamentals of Digital Logic with VHDL Design"**, 2nd Edition, McGraw Hill, 2005.

**Web References:**

1. http://www.nptelvideos.in/2012/12/digital-systems-design.html
2. https://www.coursera.org/learn/digital-systems
3. https://www.iare.ac.in/sites/default/files/lecture_notes/stld%20notes%20final.pdf
4. http://www.notesvillage.com/upload/FUNDAMENTALS%20OF%20SWITCHING%20THEORY%20AND%20LOGIC%20DESIGN_2.pdf

**Course Outcomes to Program Outcomes mapping:**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | 3 |
| 2 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 |
| 3 | 2 | 2 | 2 | - | 2 | - | - | - | - | - | - | - | - | - | 2 |
| 4 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 |
| 5 | 2 | 2 | 2 | - | 2 | - | - | - | - | - | - | - | - | - | 2 |
| 6 | 3 | 3 | 3 | - | 3 | - | - | - | - | - | - | - | - | - | 3 |
| **Course** | **3** | **3** | **3** | **-** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** |

| S. No. | Unit Name | Text Book/ Reference | Chapter No. |
|---|---|---|---|
| 1 | Number Systems And Boolean Algebra | T2 | 1,2 & 3 |
| | | R1 | 1 & 3 |
| 2 | Combinational Circuit Design | T2 | 4 & 5 |
| | | R2 | 5 & 6 |
| 3 | Sequential Circuit Design | T2 | 6,7,8 & 9 |
| | | R5 | 8 |
| 4 | Logic Families &Memories | T1 | 3 & 10 |
| | | R1 | 5 |
| | | R4 | 3 |
| 5 | Hardware Description Language | T1 | 4 & 5 |
| | | R4 | 2 & 8 |

# ENGINEERING MECHANICS

(Common for ECE & ECT) SEMESTER - IV

| | | | |
|---|---|---|---|
| Subject Code | 18CMMET4020 | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03(L)+1(T) | External Marks | 70 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |

**Credits – 04**

**Course Objectives:**

This course will enable students to:

1. Develop an understanding of the principles of statics and the ability to analyze problems using static equilibrium equations.
2. Introduce the basic principles of mechanics applicable to rigid bodies in equilibrium.
3. Teach the basic principles of mechanics applicable to the motion of particles and rigid bodies.
4. Introduce with mathematical description of the plane motion of rigid bodies.
5. Developthefundamentalsofengineeringmechanicsandproblemsolvingskills essential for mechanical engineering

| Unit -1 | Hours |
|---|---|
| Introduction to Engg. Mechanics – Basic Concepts.<br>**Systems of Forces:** Coplanar Concurrent Forces – Components in Space – Resultant – Moment of Force and its Application – Couples and Resultant of Force Systems.<br>**Friction:**Introduction,limitingfrictionandimpendingmotion,coulomb’slawsof dry friction, coefficient of friction, cone of friction | **10** |
| **Unit -2** | |
| **Equilibrium of Systems of Forces:** Free Body Diagrams, Equations of Equilibrium of Coplanar Systems, Spatial Systems for concurrent forces. Lamis Theorem, Graphical method for the equilibrium of coplanar forces, Converse of the law of Triangle of forces, converse of the law of polygon of forces condition of equilibrium, analysis of plane trusses. | **8** |
| **Unit – 3** | |
| **Centroid and Centre of Gravity covering,** Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections;<br>**Mass moment inertia** of circular plate, Cylinder, Cone, Sphere, Hook. | **10** |
| **Unit – 4** | |
| **Kinematics:** Rectilinear and Curvilinear motions – Velocity and Acceleration – Motion of Rigid Body – Types and their Analysis in Planar Motion.<br>**Kinetics:** Analysis as a Particle and Analysis as a Rigid Body in Translation – Central Force Motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies. | **12** |
| **Unit-5** | |
| **Work – Energy Method:** Equations for Translation, Work-Energy Applications to Particle Motion, Connected System-Fixed Axis Rotation and Plane Motion. Impulse momentum method. | **10** |

**Course Outcomes:**

On completion of the course student will be able to

1. Able to Resolve the forces into components, moment of force and its applications
2. Construct free body diagrams and develop appropriate equilibrium equations.
3. Determine centroid and moment of inertia for composite areas.
4. Determine the kinematic relations of particles & rigid bodies.
5. Apply equations of motion to particle and rigid body.
6. Analyzemotionofparticles&rigidbodiesusingtheprincipleofenergyand momentum methods.

**Question paper pattern:**

1. Question paper consists of 10 questions.
2. Each full question carrying 14 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

**Text Books:**

1. Engg.Mechanics-S.Timoshenko&D.H.Young.,4$^{th}$Edn-, Mc Graw Hill publications.
2. Engineering Mechanics-Statics and Dynamics by A Nelson, Tata McGraw Hill Education Private Ltd, New Delhi, 2009.

**Reference Books:**

1. EngineeringMechanicsstaticsanddynamics–R.C.Hibbeler,11$^{th}$Edn–Pearson Publ.
2. Engineering Mechanics, statics – J.L. Meriam, 6th Edn – Wiley India Pvt Ltd.
3. Engineering Mechanics, statics and dynamics – I.H. Shames, – Pearson Publ.
4. Mechanics For Engineers, statics-F.P.Beer&E.R.Johnston–5$^{th}$EdnMcGrawHill Publ.
5. Theory & Problems of engineering mechanics, statics & dynamics – E.W. Nelson, C.L.Best&W.G.McLean,5$^{th}$Edn–Schaum'soutlineseries-McGrawHillPubl.
6. Singer'sEngineeringMechanics:StaticsAndDynamics,K.VijayKumarReddy,J. Suresh Kumar, Bs Publications
7. Engineering Mechanics, Fedinand . L. Singer, Harper –Collins.

**Course Outcomes to Program Outcomes mapping:**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 4 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 6 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Course** | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |

# ELECTROMAGNETIC WAVES AND TRANSMISSION LINES

(Common for ECE & ECT)

SEMESTER IV

| | | | |
|---|---|---|---|
| Subject Code | 18ETETT4030 | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |
| Pre-requisite | Engineering Physics | **Credits – 03** | |

**Course Objectives:**

This course will enable students to

1. Learn the concepts of transmission lines
2. Familiarize with the rectangular and circular waveguides

| Unit -1 | Hours |
|---|---|
| **Electromagnetic Wave Characteristics:** Review of Maxwell's equations, Uniform Plane Waves: Introduction, Wave equations for conducting and perfect dielectric, Relation between E & H, Sinusoidal Wave equations, Wave Propagation in lossless and conducting media, Wave propagation in good Conductors and good dielectrics, Skin Effect, Pointing Vector and Pointing Theorem – Applications, Power loss in plane conductor, Wave polarization and its types. Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance, Illustrative Problems. | **12** |
| **Unit -2** | |
| **Transmission Lines-1:** Introduction, Types of transmission lines, Parameters, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line Concepts, Lossless lines, Low Loss lines, Distortion less lines andMinimum Attenuation lines, Loading Types of Loading. Illustrative Problems. | **08** |
| **Unit – 3** | |
| **Transmission Lines-II:** Input Impedance Relations, SC and OC Lines, Reflection Coefficient, VSWR. UHF Lines as Circuit Elements; $\lambda/4$, $\lambda$ /2, $\lambda/8$ Lines – Impedance Transformations. Smith Chart –Configuration and Applications, Single and Double Stub Matching. Illustrative Problems. | **08** |
| **Unit – 4** | |
| **Microwave Transmission Lines:** **Rectangular Waveguides**: Introduction, TE/TM mode analysis, Expressions for Fields, Characteristic Equation and Cut-off Frequencies, Filter Characteristics, Dominant and Degenerate Modes, Sketches of TE and TM mode fields in the cross-section, Mode Characteristics – Phase and GroupVelocities, Wavelengths and Impedance Relations; Power Transmission and Power Losses in Rectangular Guide, Impossibility of TEM mode. | **11** |
| **Unit – 5** | |
| **Circular Waveguides**: Introduction, Nature of Fields, Characteristic Equation, Dominant and Degenerate Modes. Impossibility of TEM mode. **Micro strip Lines**– Introduction, Zo Relations, Effective Dielectric Constant, Losses, Q factor. **Cavity Resonators**– Introduction, Rectangular and Cylindrical Cavities, Dominant Modes and Resonant Frequencies, Q factor and CouplingCoefficients. Related Problems. | **11** |

**Course outcomes:**

On completion of the course student will be able to

1. Analyze wave equations in different mediums

2. Understandthereflectionandrefractionmechanismofplanewaveswithnormaland oblique incidences
3. Demonstrate types of transmission lines and its fundamental characteristics
4. Apply the characteristics of transmission lines to analyze the impedance matching
5. Understand TE/TM/TEM modes of propagation in rectangular waveguides
6. Demonstrate the working mechanism of Micro strip and cavity resonators

**Question paper pattern:**

1. Question paper consists of 10 questions.
2. Each full question carrying 14 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

**Text Books:**

1. E.C. Jordan and K.G. Balman**, "Electromagnetic Waves and Radiating systems",** 2$^{nd}$Edition, PHI.
2. MatthewN.O.Sadiku,**"ElementsofElectromagnetics"**,3$^{rd}$Edition, Oxford Univ. Press,2004

**Reference Books**:

1. R.K. Shevgaonkar, **"Electromagnetic Waves"**, Tata McGraw Hill India,2005
2. UmeshSinha, Satya Prakashan, **"Transmission Lines and Networks"**, Tech.India Publications, New Delhi, 2001.
3. K.D.Prasad, Satya Prakashan, **"Antennas and Wave Propagation"**, Tech India Publications, New Delhi, 2001.
4. Samuel Y. Liao, **"Microwave Devices and Circuits",** 3rd Edition, PHI, 1994.

**Web References:**

1. http://nptel.ac.in/courses/117101056/
2. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-632-electromagnetic-wave-theory-spring-2003/
3. faculty.ece.illinois.edu/rao/TL/index.html

**Course Outcomes to Program Outcomes mapping:**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | - | 1 | - |
| 2 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 1 | - |
| 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 | - |
| 4 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | - | 1 | - |
| 5 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | - | 1 | - |
| 6 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | - | 1 | - |
| **Course** | **3** | **3** | **1** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **1** | **-** |

| S. No. | Unit Name | Text Book/ Reference | Chapter No. |
|---|---|---|---|
| 1 | Electromagnetic Wave Characteristics | T1 | 5 & 6 |
| | | T2 | 10 |
| | | R1 | 4 & 5 |
| 2 | Transmission Lines-1 | T1 | 7 |
| | | T2 | 11 |
| | | R1 | 02 |
| | | R3 | 12 |
| 3 | Transmission Lines-II | T1 | 7 |
| | | T2 | 11 |
| | | R1 | 02 |
| | | R3 | 12 |
| 4 | Rectangular Waveguides | T1 | 8 |
| | | T2 | 12 |
| | | R4 | 4 |
| | | R3 | 13 |
| 5 | Circular Waveguides , Micro strip Lines & Cavity Resonators | T1 | 8 |
| | | R3 | 13 |
| | | R4 | 4 |

# ANALOG CIRCUITS

(Common for ECE & ECT)

SEMESTER IV

| | | | |
|---|---|---|---|
| Subject Code | 18ETETT4040 | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |
| Pre-requisite | Electronic Devices | **Credits – 03** | |

**Course Objectives:**

This course will enable the students to:

- Understand the working of single stage and multi stage amplifiers
- Understand different feedback amplifiers, power amplifiers and oscillator circuits.
- Demonstrate op-amp and 555 timer applications and Data Converters

| Unit -1 | Hours |
|---|---|
| **Small Signal High Frequency Transistor Amplifier models:**<br>**BJT:** Transistor at high frequencies: Hybrid- π CE transistor model, Hybrid π conductance, Hybrid π capacitances, validity of hybrid π model, CE short circuit current gain, current gain with resistive load, cut-off frequencies, single stage CE transistor amplifier response and gain bandwidth product.<br>**FET:** Analysis of common Source and common drain Amplifier circuits at high frequencies. | **12** |
| **Unit -2** | |
| **Feedback Amplifiers:** Classification of Amplifiers, Feedback concept, feedback topologies, General Characteristics of negative feedback amplifiers, Method of analysis of feedback amplifiers.<br>**Oscillators:** Condition for oscillations, RC-phase shift and Wien bridge oscillators with BJT and analysis, General form of oscillator circuit, Hartley and Colpitts oscillators with BJT and analysis. | **08** |
| **Unit – 3** | |
| **Power Amplifiers:** Transformer coupled Class A power Amplifier and its efficiency, Class B amplifier and its efficiency, Class AB amplifier, Complementary symmetry push pull amplifier, Class-C power amplifier, Thermal stability and Heat sinks.<br>**Differential Amplifier:** DC and AC analysis of differential amplifier, Circuits for improving CMRR. | **12** |
| **Unit – 4** | |
| **Operational Amplifier:** The ideal Operational Amplifier, Operational Amplifier Internal Circuit<br>**Operational Amplifier Characteristics**: DC Characteristics, AC Characteristics.<br>**OperationalAmplifierApplications:**Basic OP-Amp Applications, Instrumentation Amplifier, AC Amplifier, V to I and I to V Converter, OP-Amp Circuits Using Diodes, Log and Antilog Amplifier. Differentiator, integrator. | **08** |
| **Unit – 5** | |
| **555 Timer & Phase Locked Loops**: 555 timer, functional diagram, applications of 555 timers. PLL: Basic principles, phase detector, VCO, Low pass filter, PLL applications<br>**D-A and A-D:** Weighted resistor DAC, R-2R ladder DAC, R-2R Ladder DAC, parallel Comparator A/D Converter, Counter type A/D Converter, successive approximation ADC and dual slope ADC. | **10** |

**Course outcomes:**

On completion of the course student will be able to:

1. Analyze and design single and multi stage amplifiers at low, midand high frequencies.
2. Understand the concept of feedback and design different oscillator circuits.
3. Analyze and design different types of feedback amplifiers
4. Design different Power amplifiers and evaluating the efficiency.
5. Demonstrate linear and non-linear applications of operational amplifiers.
6. Demonstrate 555 timer applications and different Data Converters

**Question paper pattern:**

1. Question paper consists of 10 questions.
2. Each full question carrying 14 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

**Text Books:**

1. A.S. Sedra and K.C. Smith, **"Microelectronic Circuits"**, 5$^{th}$Edition
2. D. Roy Choudhury, **"Linear Integrated Circuits",** New Age International (p)Ltd,

**Reference Books**:

1. Jacob Millman, C. Halkies, **"Integrated Electronics",** Tata McGraw Hill Electronic
2. David A. Bell, **"Electronic Devices and Circuits",** 5$^{th}$Edition Oxford University press
3. K Venkatarao, K Rama Sudha, **"Electronic Devices and Circuits",** Tata Mc-Graw Hill
4. David A Bell, **"Operational Amplifiers & Linear ICs",** 3$^{rd}$Edition, Oxford Uni. Press,

**Web References:**

1. https://nptel.ac.in/courses/117101106/
2. https://nptel.ac.in/courses/108102095/

**Course Outcomes to Program Outcomes mapping:**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| 2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 4 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| 6 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - | 2 |
| **Course** | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | 1 |

| S. No. | Unit Name | Text Book/ Reference | Chapter No. |
|---|---|---|---|
| 1 | Small Signal High Frequency Transistor Amplifier models | T1 | 3 & 4 |
| | | R1 | 10 & 11 |
| 2 | Feedback Amplifiers & Oscillators | T1 | 7& 11 |
| | | R3 | 9 & 10 |
| 3 | Power Amplifiers | T1 | 12 |
| | | T2 | 2 |
| | | R1 | 18 |
| 4 | Operational Amplifier | T1 | 9 |
| | | T2 | 2, 3 & 4 |
| | | R3 | 14 & 15 |
| 5 | 555 Timer & Phase Locked Loops D-A and A-D | T2 | 8, 9 & 10 |
| | | R3 | 21 |

<table>
<tr><td colspan="4">ANALOG & DIGITAL COMMUNICATIONS<br>(Common for ECE & ECT)<br>SEMESTER IV</td></tr>
<tr><td>Subject Code</td><td>18ETETT4050</td><td>Internal Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>03</td><td>External Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50</td><td>Exam Hours</td><td>03</td></tr>
<tr><td>Pre-requisite</td><td>Signals & Systems</td><td colspan="2">Credits – 03</td></tr>
<tr><td colspan="4">Course Objectives:<br>The student will be able to<br>1. Understandtheconceptofmodulationandlearncontinuouswavemodulationand pulse modulation techniques.<br>2. Measure the effect of noise in different modulation schemes.<br>3. Study the Digital Modulation techniques.</td></tr>
<tr><td colspan="3">Unit -1</td><td>Hours</td></tr>
<tr><td colspan="3">Amplitude Modulation : Introduction to communication system, Need for modulation, Amplitude Modulation, Definition, Time domain and frequency domain description, single tone modulation, power relations in AM waves, Generation of AM waves, square law Modulator, Switching modulator, Detection of AM Waves; Square law detector, Envelope detector.</td><td>10</td></tr>
<tr><td colspan="4">Unit -2</td></tr>
<tr><td colspan="3">DSB & SSB Modulation: Double side band suppressed carrier modulators, Generation of DSBSC Waves, Balanced Modulators, Ring Modulator, Coherent detection of DSB-SC Modulated waves, COSTAS Loop, Frequency discrimination and Phase discrimination method for generating AM SSB Modulated waves, Demodulation of SSB Waves, Vestigial side band modulation: Generation of VSB Modulated wave, Comparison of AM Techniques, Applications of different AMSystems. Noise in amplitude modulated systems.</td><td>10</td></tr>
<tr><td colspan="4">Unit – 3</td></tr>
<tr><td colspan="3">Angle Modulation: Basic concepts, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave, Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave - Generation of FM Waves, Direct FM, Detection of FM Waves: Balanced Frequency discriminator, Phase locked loop, Pre-emphasis & De-emphasis, Comparison of FM & AM. Noise in frequency modulated systems threshold effect in angle modulation.</td><td>10</td></tr>
<tr><td colspan="4">Unit – 4</td></tr>
<tr><td colspan="3">Pulse Modulation:Time Division Multiplexing, Types of Pulse modulation, PAM (Single polarity, double polarity) PWM: Generation & demodulation of PWM, PPM, Generation and demodulation of PPM, TDM Vs FDM.<br>Pulse Digital Modulation: Elements of digital communication systems, advantages of digital communication systems, Elements of PCM: Sampling, Quantization & Coding, Quantization error, Commanding in PCM systems. Differential PCM systems (DPCM).Delta modulation, its draw backs, adaptive delta modulation, comparison of PCM and DM systems, noise in PCM and DM systems</td><td>10</td></tr>
<tr><td colspan="4">Unit – 5</td></tr>
<tr><td colspan="3">Digital Modulation Techniques: Introduction, ASK, FSK, PSK, DPSK, DEPSK, QPSK, M-array PSK, ASK, FSK. Calculation of error probability of ASK, BPSK, BFSK,QPSK.</td><td>10</td></tr>
</table>

**Course outcomes:**

After going through this course the student will be able to

1. Understand the concept of modulation and amplitude modulation.
2. Differentiate various schemes of amplitude modulation and demodulation techniques.
3. Understandthefundamentalsofanglemodulationanddemodulationtechniques.
4. Extend the various analog modulation schemes for pulse carrier
5. Establish various pulse modulation schemes in digital domain
6. Interpret probability error for digital modulation techniques.

**Question paper pattern:**

1. Question paper consists of 10 questions.
2. Each full question carrying 14 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

**Text Books:**

1. Simon Haykin, **"Principles of Communication Systems"**, $2^{nd}$Ed, John Wiley.
2. Simon Haykin, **"Digital communications"**, John Wiley,2005
3. H. Taub and D.Schilling, **"Principles of Communication Systems"**, TMH, 2003

**References Books:**

1. B.P. Lathi, **"Communication Systems"**, BS Publication, 2006.
2. Proakis J. G. and SalehiM., **"Communication Systems Engineering"**, Pearson Education, 2002.

**Web References:**

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-02-introduction-to-eecs-ii-digital-communication-systems-fall-2012/lecture-videos/
2. https://nptel.ac.in/courses/117102059/
3. https://nptel.ac.in/courses/117101051/

**Course Outcomes to Program Outcomes mapping:**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 | - |
| 2 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 | - |
| 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 | - |
| 4 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 | - |
| 5 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 | - |
| 6 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 | - |
| **Course** | **3** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** |

| S. No. | Unit Name | Text Book / Reference | Chapter No. |
|---|---|---|---|
| 1 | Amplitude Modulation | T1 | 3 |
| | | R1& R2 | 3&3 |
| 2 | DSB & SSB Modulation | T1 | 3 |
| | | R1& R2 | 3&3 |
| 3 | Angle Modulation | T1 | 4 |
| | | R1 | 4 |
| 4 | Pulse Modulation | T1 | 7 |
| | Pulse Digital Modulation | T3& T4 | 7&5 |
| | | R1 | 5 |
| 5 | Digital Modulation Techniques | T3& T4 | 5&6 |
| | | R1 | 9 |

# DIGITAL SYSTEM DESIGN LAB

(Common for ECE & ECT)

SEMESTER IV

| | | | |
|---|---|---|---|
| Subject Code | 18ETETL4060 | Internal Marks | 15 |
| Number of Lecture Hours/Week | 03 | External Marks | 35 |
| Total Number of Lecture Hours | 36 | Exam Hours | 03 |

**Credits – 1.5**

**Course Objectives:**

This course will enable students to

1. Introduce the concepts and techniques associated with the number systems and Boolean algebra.
2. Design various combinational circuits, sequential circuits and memories using logic gates and PLDs
3. Know various logic families
4. Understand the use of VHDL in Digital systems design

| The students are required to design combinational and sequential logic circuits, simulate using Model sim, synthesis using Xilinx ISE and implement on FPGA board. | **Hours** |
|---|---|
| 1. Realization of Logic Gates<br>2. Design of Full Adder using 3 modeling systems<br>3. 3 to 8 Decoder-74138<br>4. 8 to 3 Encoder (with and without parity)<br>5. 8 x 1 Multiplexer-74151 and 2x 4De-multiplexer-74155<br>6. 4- Bitcomparator-7485<br>7. DFlip-Flop-7474<br>8. Decade counter-7490<br>9. Shiftregisters-7495<br>10. 8-bit serial in-parallel out and parallel in-serial out<br>11. Fast In& Fast Out(FIFO)<br>12. MAC (Multiplier &Accumulator)<br>13. ALU Design. | **36** |

**Course outcomes:**

Upon completion of the course, students will be able to

1. Design digital systems using combinational circuits using VHDL.
2. Design digital systems using sequential circuits using VHDL.
3. Design Memories using VHDL

**Question paper pattern:**

**Examination is evaluated for 35 marks and as follows**:

Ten questions are given, and student should choose one question (blind option), which carries 35 marks in total.

a. 10 marks are allotted for procedure including circuit diagrams and model graphs.
b. 10 marks for conduction of the experiment.
c. 05 marks for results and conclusions.
d. 10 marks for viva voce.

**The internal 15 marks shall be awarded as follows:**

a. 05 marks-day to day evaluation and submission of record.
b. 10 marks to be awarded by conducting an internal laboratory test.

**Hardware/Software Requirements:**

Modelsim and Xilinx ISE Software, Xilinx FPGA Devices

## ANALOG CIRCUITS LAB

(Common for ECE & ECT)

SEMESTER -IV

| | | | |
|---|---|---|---|
| Subject Code | 18ETETL4070 | Internal Marks | 15 |
| Number of Lecture Hours/Week | 03 | External Marks | 35 |
| Total Number of Lecture Hours | 36 | Exam Hours | 03 |

**Credits – 1.5**

**Course objectives:**

The objective of the course is to make students to understand the concepts of Amplifiers, Oscillators, OP-Amps and 555 timer.

| For the following amplifier circuits, Frequency response and frequency of oscillations needs to be executed both in hardware and multisim software | **Hours** |
|---|---|
| 1. Two Stage RC Coupled Amplifier<br>2. Voltage-Series Feedback Amplifier<br>3. Current-Shunt Feedback Amplifier<br>4. RC Phase Shift and Wien Bridge Oscillator<br>5. Hartley and Colpitts Oscillator<br>6. Class A Series-fed Power Amplifier<br>7. Complementary Symmetry Class B Push-Pull Power Amplifier<br>8. OP AMP Applications – Adder, Subtractor, Comparator Circuits.<br>9. Integrator and Differentiator Circuits using IC 741.<br>10. IC 741 Oscillator Circuits – Phase Shift and Wien Bridge Oscillators.<br>11. IC 555 Timer – Monostable/ Astable Operation Circuit.<br>12. R-2R D/A Converter – using IC741 | **36** |

**Course outcomes:**

After completing this course, students will be able to:

1. Design two stage amplifiers and analyze frequency response at low, mid and high frequencies.
2. Design feedback amplifier and analyze its frequency response
3. Design different oscillator circuits and evaluate its frequency of oscillation
4. Design different Power amplifiers and evaluate the efficiency.
5. Design linear and non-linear applications of operational amplifiers.

**Question paper pattern:**

**Examination is evaluated for 35 marks and as follows**:

Ten questions are given, and student should choose one question (blind option), which carries 35 marks in total.

a. 10 marks are allotted for procedure including circuit diagrams and model graphs.
b. 10 marks for conduction of the experiment.
c. 05 marks for results and conclusions.
d. 10 marks for viva voce.

**The internal 15 marks shall be awarded as follows:**

a. 05 marks-day to day evaluation and submission of record.
b. 10 marks to be awarded by conducting an internal laboratory test.

# ANALOG & DIGITAL COMMUNICATIONS LAB

(Common for ECE & ECT)

SEMESTER - IV

| | | | |
|---|---|---|---|
| Subject Code | 18ETETL4080 | Internal Marks | 15 |
| Number of Lecture Hours/Week | 03 | External Marks | 35 |
| Total Number of Lecture Hours | 36 | Exam Hours | 03 |

**Credits – 1.5**

**Course objectives:**

The objective of the lab is to

1. Perform the continuous wave & Pulse modulation & demodulation techniques.
2. Perform the Digital Modulation techniques.

| **List of Experiments:**<br>(Note: Each Experiment is verified using)Hardware b)MATLAB program (or) MATLAB Simulink) | **Hours** |
|---|---|
| 1. Amplitude Modulation and demodulation<br>2. DSB-SC Modulation and demodulation and also verify using Spectrum Analyzer<br>3. Frequency Modulation and demodulation<br>4. Pre-emphasis and de-emphasis<br>5. Sampling Theorem<br>6. PWM, PPM Modulation and demodulation<br>7. Pulse Code Modulation<br>8. Delta Modulation<br>9. Amplitude Shift Keying<br>10. Frequency Shift Keying<br>11. Phase Shift Keying<br>12. Differential Phase Shift Keying | **36** |

**Course outcomes:**

**After studying this course, students will be able to:**

1. Infer the modulation and demodulation techniques for continuous wave.
2. Apply the sampling theorem.
3. Analyze the modulation and demodulation techniques for pulse carrier.

**Question paper pattern:**

**Examination is evaluated for 35 marks and as follows**:

Ten questions are given, and student should choose one question (blind option), which carries 35 marks in total.

a. 10 marks are allotted for procedure including circuit diagrams and model graphs.
b. 10 marks for conduction of the experiment.
c. 05 marks for results and conclusions.
d. 10 marks for viva voce.

**The internal 15 marks shall be awarded as follows:**

a. 05 marks-day to day evaluation and submission of record.
b. 10 marks to be awarded by conducting an internal laboratory test.

**III B. Tech I Sem Course Structure for**

**(Electronics & Communication Technology)**

**Semester V (Third year)**

| S.No | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | 18ETETT5010 | Management science | 3 | 0 | 0 | 3 |
| 2 | 18ETETT5020 | Control Systems | 3 | 0 | 0 | 3 |
| 3 | 18CMMST5030 | Telecommunications and Switching Networks | 3 | 0 | 0 | 3 |
| 4 | 18ETETT5040 | Microprocessors and Micro Controllers | 3 | 0 | 0 | 3 |
| 5 | 18ETETT5050 | Digital Signal Processing | 3 | 0 | 0 | 3 |
| 6 | 18ETETP5060 | Professional Elective – 1* | 3 | 0 | 0 | 3 |
| 7 | 18ETETL5070 | Microprocessors and Micro Controllers Lab | 0 | 0 | 3 | 1.5 |
| 8 | 18ETETL5080 | Digital Signal Processing Lab | 0 | 0 | 3 | 1.5 |
| 9 | 18CMAHS5090 | Skill Oriented Course – I<br>(Soft skills& Aptitude Builder -1 ) | 1 | 0 | 2 | 2 |
| 10 | 18ETETN50A0 | Biology for Engineers | 3 | 0 | 0 | 0 |
| | | **Total Credits** | | | | 23 |

**Professional Elective -I**

| S.No | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | 18ETETP506A | Radiation Systems | 3 | 0 | 0 | 3 |
| 2 | 18ETETP506B | Digital Design Through Verilog | 3 | 0 | 0 | 3 |
| 3 | 18ETETP506C | IoT Fundamentals | 3 | 0 | 0 | 3 |
| 4 | 18ETETP506D | Spread Spectrum Techniques | 3 | 0 | 0 | 3 |

**III B. Tech II Sem Course Structure for**

**(Electronics & Communication Technology)**

**Semester VI (Third year)**

| S.No | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | 18ETETT6010 | Engineering Economics and Financial Management | 3 | 0 | 0 | 3 |
| 2 | 18ETETT6020 | VLSI Design | 3 | 0 | 0 | 3 |
| 3 | 18CMMST6030 | Computer Networks | 3 | 0 | 0 | 3 |
| 4 | 18ETETP6040 | Professional Elective – II* | 3 | 0 | 0 | 3 |
| 5 | 18ETXXO605X | Open Elective – I** | 3 | 0 | 0 | 3 |
| 6 | 18ETXXO606X | Open Elective – II** | 3 | 0 | 0 | 3 |
| 7 | 18ETETL6070 | Computer Networks Lab | 0 | 0 | 3 | 1.5 |
| 8 | 18ETETL6080 | VLSI Design Lab | 0 | 0 | 3 | 1.5 |
| 9 | 18CMAHS6090 | Skill Oriented Course – II<br>(Soft skills & Aptitude Builder -2) | 1 | 0 | 2 | 2 |
| | | **Total Credits** | | | | 23 |

**Professional Elective -II**

| S.No | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | 18ETETP604A | Micro Wave and Optical Communications | 3 | 0 | 0 | 3 |
| 2 | 18ETETP604B | Design of Fault Tolerant Systems | 3 | 0 | 0 | 3 |
| 3 | 18ETETP604C | Embedded System Design | 3 | 0 | 0 | 3 |
| 4 | 18ETETP604D | Digital Image and Video Processing | 3 | 0 | 0 | 3 |

**IV B. Tech I Sem Course Structure for**

**(Electronics & Communication Technology)**

**Semester VII (Fourth year)**

| S.No | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | 18ETETT7010 | RF System Design | 3 | 0 | 0 | 3 |
| 2 | 18ETETP7020 | Professional Elective – III* | 3 | 0 | 0 | 3 |
| 3 | 18ETETP7030 | Professional Elective – IV* | 3 | 0 | 0 | 3 |
| 4 | 18ETETP7040 | Professional Elective – V* | 3 | 0 | 0 | 3 |
| 5 | 18ETXXO705X | Open Elective – III** | 3 | 0 | 0 | 3 |
| 6 | 18ETXXO706X | Open Elective – IV** | 3 | 0 | 0 | 3 |
| 7 | 18ETETL7070 | RF System Design Lab | 0 | 0 | 3 | 1.5 |
| 8 | 18ETETI7080 | Research Internship | 0 | 0 | 3 | 3 |
| 9 | 18ETETS7090 | Skill Oriented Course – III ( Image Processing With Open CV)**OR** (Electromagnetic Simulation Tools (HFSS, CST & FEKO)) | 1 | 0 | 2 | 2 |
| 10 | 18ETETN70A0 | Electronics Measurements & Instrumentation | 3 | 0 | 0 | 0 |
| | | **Total Credits** | | | | 24.5 |

**Professional Elective -III**

| S.No | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | 18ETETP702A | Radar and Satellite Communications | 3 | 0 | 0 | 3 |
| 2 | 18ETETP702B | Low Power VLSI Design | 3 | 0 | 0 | 3 |
| 3 | 18ETETP702C | System On Chip Architectures | 3 | 0 | 0 | 3 |
| 4 | 18ETETP702D | Bio-Medical Signal Processing | 3 | 0 | 0 | 3 |

**Professional Elective -IV**

| S.No | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | 18ETETP703A | Software Defined Radio | 3 | 0 | 0 | 3 |
| 2 | 18ETETP703B | CPLD and FPGA Architectures & Applications | 3 | 0 | 0 | 3 |
| 3 | 18ETETP703C | Wireless Technologies for IOT | 3 | 0 | 0 | 3 |
| 4 | 18ETETP703D | Artificial Neural Networks | 3 | 0 | 0 | 3 |

## Professional Elective -V

| S.No | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | 18ETETP704A | Global Positioning Systems | 3 | 0 | 0 | 3 |
| 2 | 18ETETP704B | CAD Tools for VLSI | 3 | 0 | 0 | 3 |
| 3 | 18ETETP704C | Big Data Analytics for IoT | 3 | 0 | 0 | 3 |
| 4 | 18ETETP704D | Fuzzy Logic Systems | 3 | 0 | 0 | 3 |

**IV B. Tech II Sem Course Structure for**

**(Electronics and Communication Technology)**

**Semester VIII (Fourth year)**

| S.No | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | 18ETETPR8010 | Project Work, Seminar & Internship in Industry | 0 | 0 | 0 | 12 |
| | | **Total Credits** | | | | 12 |
| **INTERNSHIP (6 MONTHS)** | | | | | | |

**Course Structure for B.Tech. ECT**
**B. Tech (Electronics and Communication Technology)**
**Open Electives**

| S.No | Subject Code | Name of the subject | L | T | P | Cr |
|---|---|---|---|---|---|---|
| 1 | 18ETETOXXXX | Signals and Systems | 3 | 0 | 0 | 3 |
| 2 | 18ETETOXXXX | Principles of Signal Processing | 3 | 0 | 0 | 3 |
| 3 | 18ETETOXXXX | Consumer Electronics | 3 | 0 | 0 | 3 |
| 4 | 18ETETOXXXX | Transducers and Sensors | 3 | 0 | 0 | 3 |
| 5 | 18ETETOXXXX | IOT and Applications | 3 | 0 | 0 | 3 |
| 6 | 18ETETOXXXX | IC Applications | 3 | 0 | 0 | 3 |
| 7 | 18ETETOXXXX | Principles of Communication Systems | 3 | 0 | 0 | 3 |
| 8 | 18ETETOXXXX | Data Communications | 3 | 0 | 0 | 3 |
| 9 | 18ETETOXXXX | Digital Logic design | 3 | 0 | 0 | 3 |
| 10 | 18ETETOXXXX | Remote Sensing and GIS | 3 | 0 | 0 | 3 |

| Management Science<br>SEMESTER V | | | |
|---|---|---|---|
| Subject Code | 18CMMST5010 | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| Pre-requisite | | Credits - 03 | |

**Course objectives:**

This course will enable the students to

- Understand the concepts of Management its nature & importance, Management theories and organization principles.
- Analyse the Work study, SQC, inventory management and its techniques.
- Learn various concepts like PERT, CPM and Project crashing and recent trends in management.

| Unit -I | Hours |
|---|---|
| **Introduction to Management:** Concept –nature and importance of Management – Functions of Management – Evaluation of Management thought- Theories of Motivation – Decision making process-Designing organization structure- Principles of organization - Types of organization structure. | **8** |
| **Unit –II** | |
| **Operations Management**: Principles and Types of Layouts – Work study- Statistical Quality Control- Control charts (P-chart, R-chart, and C chart). Simple problems- Material Management: Need for Inventory control- EOQ, ABC analysis (simple problems) and Types of ABC analysis (HML, SDE, VED, and FSN analysis). | **10** |
| **Unit-III** | |
| **Functional Management** & **Strategic Management**:<br>**Functional Management**: Concept of HRM, HRD and PMIR- Functions of HRM - Marketing Management- Functions of Marketing, Marketing strategies based on product Life Cycle, Channels of distributions.<br>**Strategic Management**: Vision, Mission, Goals, Strategy – Elements of Corporate Planning Process – Environmental Scanning – SWOT analysis- Steps in Strategy Formulation and Implementation, Generic Strategy alternatives | **10** |
| **Unit –IV** | |
| **Project Management**: **(PERT/CPM):** Development of Network – Difference between PERT and CPM Identifying Critical Path- Probability- Project Crashing (Simple Problems). | **10** |
| **Unit-V** | |
| **Contemporary Management Practices:** Basic concepts of MIS, MRP, Justin- Time (JIT) system, Total Quality Management (TQM), Six sigma , Supply Chain Management, Enterprise Resource Planning (ERP), Business Process outsourcing (BPO), Business process Re-engineering and Bench Marking, Balanced Score Card. | **10** |

**Course outcomes:**

On completion of the course student will be able to:

1. Execute the functions of Management, Principles of Management &Leadership

styles.

2. Examine Statistical Quality Control Techniques, Methods of inspection, the concept of Inventory Management and Control
3. Predict the Customer Behavior and Employees Contribution towards success of Organization.
4. Identify different Strategies for the Development of the Organization.
5. Analyze Project Management Techniques like CPM, PERT and Crashing.
6. Apply various contemporary issues in Management Practices like TQM, Business Process Reengineering and BPO etc.

**Text Books:**


1. Dr. A. R. Aryasri – Management Science, TMH 2011.
2. Dr. P.G.Ramanujam, Dr. B.V.R.Naidu and Prof.P.V.Rama Sastry: Management Science, Himalaya Publishing House 2013.


**Reference Books:**


1. Koontz & Weihrich: 'Essentials of Management' TMH 2011.
2. Seth & Rastogi: Global Management Systems, Cengage Learning, Delhi, 2011.
3. Robbins: Organizational Behaviors, Pearson Publications, 2011


**Web References:**


1. https://www.managementstudyguide.com/management_principles.htm
2. https://businessjargons.com/strategic-management.html

| CONTROL SYSTEMS<br>SEMESTER V | | | |
|---|---|---|---|
| Subject Code | 18ETETT5020 | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| Pre-requisite | Engineering Mathematics | Credits – 03 | |

**Course Objectives:**

This course will enable students to

1. Understand concepts of the mathematical modelling of Control System.
2. Analyze the system stability using Routh Hurwitz and Root locus techniques
3. Analyze the system stability using Time & Frequency response analysis
4. Analyze the system with state variable analysis techniques..

| Unit -1 | Hours |
|---|---|
| **Introduction:** System, Control System, Open Loop Control System, Closed loop Control System, Different Examples.<br>**Mathematical models of Physical Systems:** Differential equations of physical systems, Transfer functions of Electrical, Mechanical translational and rotational systems. Block diagram Algebra, Signal flow graph | **9** |
| **Unit -2** | |
| **Time Response Analysis:** Standard test Signals, Time response of first and second order systems, steady state errors and error constants, Design specifications of second order systems. | **10** |
| **Unit – 3** | |
| **Concepts of Stability and Algebraic Criteria:** The concept of Stability, Necessary Conditions for Stability, Routh Hurwitz Stability Criterion.<br>**The Root Locus Technique:** Introduction, The Root Locus concepts, Construction of Root Loci, Effect of adding poles and zeros to a system. | **10** |
| **Unit – 4** | |
| **Frequency response analysis:** Introduction, Correlation between time and frequency response, Polar Plots, Bode Plots, Nyquist Stability Criterion, Performance specifications in frequency-domain | **10** |
| **Unit – 5** | |
| **State Variable Analysis and Design:** Introduction, Concepts of State, State Variables and State models, State models for linear continuous-time systems, Solution of state equations and Concepts of Controllability and Observability | **9** |

**Course outcomes:**

On completion of the course student will be able to

1. Characterize a control system and Develop mathematical model of the physical systems.
2. Apply time response analysis on first and second order systems
3. Analyze the system stability using Routh Hurwitz and Root locus techniques
4. Analyze the system stability using frequency response analysis
5. Apply state variable analysis to continuous time systems and obtain the relationship between state variable representation and transfer functions..

**Text Books:**


1. J. Nagarath and M. Gopal, Control Systems, New Age International Publishers, 5$^{th}$Edition, 2014
2. Katsuhiko Ogata, Modern Control Engineering, Pearson, 4$^{th}$Edition, 2012

**Reference Books**:

1. Ambikapathy, **"Control Systems"**, Khanna Book Publishing Co. (P) Ltd., Delhi
2. Anand Kumar, **"Control Systems",** 2nd Edition, PHI learning PVT. Ltd,2014

**Web References:**

1. https://nptel.ac.in/courses/108101037/
2. http://www.ee.surrey.ac.uk/Projects/CAL/control/index.htm

| **Telecommunications and Switching Networks**<br>SEMESTER V | | | |
|---|---|---|---|
| Subject Code | 18ETETT5030 | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| Pre-requisite | DC | Credits – 03 | |

**Course Objectives:**

This course will enable the students to:

- To provide students with a balanced blend of theoretical and practical aspects regarding Telecommunication Switching System.
- To expose through the evolution of switching systems from manual and Electromechanical systems to stored-program-controlled digital systems
- To provide knowledge to the students regarding design and performance analysis of various switching systems.
- To train the students about basic Telephone Networks structures and traffic Engineering concepts
- To inculcate students on various internet concepts like OSI reference model, LAN, WAN, WAN, Repeaters, bridges, routers ,gateways ,data communication networks and ISDN

| **Unit -1** | **Hours** |
|---|---|
| **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. | **9** |
| **Unit -2** | |
| **Electronic Space Division Switching:** Stored Program Control, Centralized SPC, Distributed SPC, Software Architecture, Application Software, Enhanced services, Two Stage 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. | **10** |
| **Unit – 3** | |
| **Telecommunications Traffic:** Introduction, The Unit of Traffic, Congestion; Traffic Measurement, A Mathematical Model, Lost-Call Systems-Theory, Traffic Performance, Loss Systems in Tandem, Use of Traffic Tables.<br>**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. | **10** |
| **Unit – 4** | |

| | |
|---|---|
| **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.<br>**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. | **10** |
| **Unit – 5** | |
| **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, and STS I, Virtual Tributaries, and Higher rate of service. | **9** |

**Course outcomes:**

On completion of the course student will be able to:

1. Students will be able to analyze different switching methodologies.
2. Students will be able to differentiate between signaling methods used in Telecommunication Networks
3. Students will be able to understand queuing systems and models.
4. Students will exhibit a good knowledge on data communication networks and ISDN and be able to differentiate LAN, MAN, WAN
5. Students will demonstrate an ability to work on various Telecommunication Network concepts.
6. Students will demonstrate knowledge on modern telecommunication concepts like DSL & SONET.

**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


**Reference Books**:


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.
4. An Engineering approach to computer networking - S. Keshav, Addison W

# MICROPROCESSORS & MICROCONTROLLERS

Common to ECE & ECT

SEMESTER V

| | | | |
|---|---|---|---|
| Subject Code | 18ETETT5040 | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| Pre-requisite | Digital System Design | Credits – 03 | |

**Course Objectives:**

This course will enable students to

1. Understand internal architecture and functional description of 8086 microprocessors.
2. Apply interfacing concepts of 8086 with memory and other peripherals
3. Apply interfacing concepts of 8086 with basic hardware components
4. Interpret the concept of 8051 microcontrollers internal architecture like Timer/Counter, I/O ports, memory interfacing.
5. Apply the programming model of 8051 Microcontroller using embedded C.

| **Unit -1** | **Hours** |
|---|---|
| **8086 Architectures**: Introduction to 8-bit Processors, Features, Pin Description, 8086 Microprocessor Family, 8086 Internal Architecture, Interrupts, Minimum Mode and Maximum Mode Configuration of 8086.8087 Coprocessor. | 8 |
| **Unit -2** | |
| **8086 Programming & Interfacing-1:** Instruction set, Addressing Modes, Assembler Directives, Writing Simple Programs with an Assembler, Assembly Language Program Development Tools. Semiconductor memories interfacing (RAM, ROM), Intel 8259 programmable interrupt controller, software and hardware interrupt applications. | 10 |
| **Unit -3** | |
| **8086 Interfacing-2:** Intel 8255 programmable peripheral interface, keyboard interfacing, alphanumeric displays (LED,7-segment display), Intel 8279 programmable keyboard/display controller, stepper motor, A/D and D/A converters. | 10 |
| **Unit – 4** | |
| **Intel 8051 Microcontroller:** Architecture, Hardware concepts, input/output ports and circuits, external memory, counters/timers, serial data input/output, Interrupts. Assembly language programming**:** Instructions, addressing modes, simple programs, Introduction to Embedded C. | 10 |
| **Unit – 5** | |
| **Advanced Processors:** Introduction to RISC & CISC Processors, features of to 16/32 Bit processors, Advanced processor Architectures- 286, 386,486, Pentium.<br>**ARM:** Introduction to ARM Processor Families, ARM Pipelining operation, ARM 7 (LPC2148) architecture and organization, ARM / Thumb instruction set & programming model. ARM 7 GPIO programming using Embedded C. | 10 |
| **Total** | **48** |

**Course outcomes:**
On completion of the course student will be able to

1. Understand the internal operation and programming concepts of 8086 microprocessor
2. Apply the interfacing concepts of 8086 with memory and other peripherals.
3. Applying the interfacing concepts of 8086 with basic hardware components
4. Interpret the concept of 8051 microcontrollers internal architecture like Timer/Counter, I/O ports, memory interfacing.
5. Apply the programming model of 8051 Microcontroller using embedded C.

**Text Books:**
1. K. Ray, K. M. Bhurchandi, Advanced Microprocessors and Peripherals, Tata McGraw Hill Education Private Limited, 3rd Edition, 2006
2. Muhammad Ali Mazidi, RolinMcKinlay Janice GillispieMazidi, The 8051 Microcontroller and Embedded Systems Using Assembly and C, Pearson Education India, Second Edition, 2007.
3. A. Sloss, D. Symes, C. Wright, ARM system Developers Guide: Designing and Optimizing System Software, Morgan Kaufmann publishers, 2004.

**Reference Books**:
1. SSSP Rao, Douglas V Hall, Microprocessors and Interfacing Programming and Hard ware. Tata McGraw Hill Education Private Limited, 3rd Edition,
2. Kenneth J. Ayala, The 8051 Microcontroller, Penram International Publishing, 1996.
3. R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing, 1996

| **DIGITAL SIGNAL PROCESSING**<br>Common to ECE & ECT<br>SEMESTER V | | | |
|---|---|---|---|
| Subject Code | 18ETETT5050 | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| Pre-requisite | Signals and Systems | Credits – 03 | |

**Course Objectives:**

This course will enable students to

1. Analyze the Discrete time signals.
2. Compute DFT of a signal using different FFT algorithms.
3. Learn the IIR and FIR filter design procedures.
4. Understand the need of multi-rate signal Processing.
5. Understand the basics of DSP Processors.

| **Unit -1** | **Hours** |
|---|---|
| **Introduction:** Introduction to Digital Signal Processing: Discrete time signals & sequences, Classification of Discrete time systems, stability of LTI systems, Inevitability, Response of LTI systems to arbitrary inputs. Solution of Linear constant coefficient difference equations. Frequency domain representation of discrete time signals and systems. Review of Z-transforms, solution of difference equations using Z-transforms, System function. | 10 |
| **Unit -2** | |
| **Discrete Fourier Series & Fourier Transforms:** Properties of discrete Fourier series, DFS representation of periodic sequences, Discrete Fourier transforms: Properties of DFT, linear filtering methods based on DFT, Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT. | 10 |
| **Unit -3** | |
| **Design of IIR Digital Filters& Realizations:** Analog filter approximations – Butter worth and Chebyshev, Design of IIR Digital filters from analog filters, Design Examples, Analog and Digital frequency transformations. Basic structures of IIR systems, Transposed forms.<br>**Design of FIR Digital Filters & Realizations:** Characteristics of FIR Digital Filters, frequency response. Design of FIR Digital Filters using Window Techniques and Frequency Sampling technique, Comparison of IIR & FIR filters, Basic structures of FIR systems, Lattice structures, Lattice-ladder structures. | 10 |
| **Unit – 4** | |
| **Multirate Digital Signal Processing:** Introduction, Decimation, Interpolation Sampling rate conversion, Implementation of sampling rate converters. Applications – Sub-band Coding of Speech Signals. | 8 |
| **Unit – 5** | |
| **DSP Processors:** Introduction to programmable DSPs: Multiplier and Multiplier Accumulator, Modified bus structures and memory access schemes in P-DSPs, Multiple Access Memory, Multi-ported memory, VLIW architecture, Pipelining, Special addressing modes, On-Chip Peripherals. | 10 |
| **Total** | **48** |

**Course outcomes:**

On completion of the course student will be able to

1. Illustrate the Discrete time signals and systems.
2. Apply the FFT algorithm for solving the DFT of a given signal.
3. Construct a Digital IIR and FIR filter for the given specifications.
4. Apply Multi-rate signal Processing concepts in various applications.
5. Apply the signal processing concepts on DSP Processor.

**Text Books:**

1. John G. Proakis, Dimitris G. Manolakis, Digital Signal Processing, Principles, Algorithms, and Applications, Pearson Education, 2007.
2. A.V. Oppenheim and R.W. Schaffer, Discrete Time Signal Processing, PHI, 3rd Edition, 2010.
3. Venkataraman, Bhaskar, Digital Signal Processors, Architecture, Programming and Applications, TATA McGraw Hill, 2002.

**Reference Books**:

1. Andreas Antoniou, Digital Signal Processing, TATA McGraw Hill, 2006.
2. Robert J. Schilling, Sandra L. Harris, Fundamentals of Digital Signal Processing using MATLAB, Thomson, 2007.

# MICROPROCESSORS & MICROCONTROLLERS LAB

Common to ECE & ECT

SEMESTER V

| | | | |
|---|---|---|---|
| Subject Code | 18ETETL5070 | Internal Marks | 15 |
| Number of Lecture Hours/Week | 02 | External Marks | 35 |
| Total Number of Hours | 36 | Exam Hours | 03 |
| | | | Credits – 1.5 |

**Course Objectives:**

This course will enable students to

- Performing hardware interfacing with 8086 microprocessor board.
- Understand basic components interfacing with 8051 control board.
- Performing sensors and display module interfacing with 8051 board.
- Understanding the interfacing concepts of ARM board.

| List of Experiments: | Hours |
|---|---|
| **PART- A: (Perform any three experiments)**<br><br>**8086 Assembly Language Programming using MASAM/TASM**<br><br>1. Signed and unsigned Arithmetic operation- (Multi byte Addition and Subtraction, Multiplication and Division)<br>2. Logical Operations- (Shift and rotate- Converting packed BCD to unpacked BCD, BCD to ASCII conversion)<br>3. Factorial of given n-numbers<br>4. String Operations - (Move Block, Reverse string, Sorting, Inserting, Deleting, Length of the string, String comparison).<br>5. DOS/BIOS programming: Reading keyboard (Buffered with and Without echo) - Display characters, Strings.<br>**PART- B: (Perform any three experiments)**<br><br>**8086 Interfacing**<br><br>1. Hardware/Software Interrupt Application<br>2. A/D Interface through Intel 8255<br>3. Keyboard and Display Interface through Intel 8279<br>4. Generation of waveforms using Intel 8255<br>5. Stepper Motor interfacing<br><br>**PART- C: (Perform any three experiments)**<br><br>**8051 Embedded C Programming and Interfacing**<br><br>1. Different timer mode operations for LEDs Interfacing with 8051<br>2. Simple Calculator using 4 digits seven segment display and Hex<br>3. Keyboard interface to 8051<br>4. Stepper motor interfacing with 8051 for clockwise and anticlockwise rotation.<br>5. External ADC and Temperature control interface to 8051<br>6. Serial Communication Implementation between system and 8051<br>**PART- D: (Perform any three experiments)** | **36** |

| | |
|---|---|
| **LPC2148 with Embedded C Programming and Interfacing**<br>1. Switches and LEDs interfacing with the ARM- LPC 2148 controller board<br>2. Interfacing of 2*16 LCD display with the ARM- LPC 2148 controller board<br>3. Implement the developer board as a modem for data communication using serial port communication between two PC's.<br>4. Implement two digit 7-segment display with the ARM- LPC 2148 controller board. | |
| **Course outcomes:**<br>On completion of the course student will be able to<br>1. Perform the Arithmetic and logic operations with 8086 processors.<br>2. Learn the various interfacing concepts with 8086 processors.<br>3. Design a real time clock with modern microcontroller boards.<br>4. Learn the various interfacing mechanisms with modern microcontroller boards.<br>5. Compile, design and test a simple microcontroller based system with their programming models . | |

# DIGITAL SIGNAL PROCESSING LAB

Common to ECE & ECT

SEMESTER V

| | | | |
|---|---|---|---|
| Subject Code | 18ETETL5080 | Internal Marks | 15 |
| Number of Lecture Hours/Week | 02 | External Marks | 35 |
| Total Number of Hours | 36 | Exam Hours | 03 |
| | | | Credits – 1.5 |

**Course Objectives:**

This course will enable students to

1. Generate the fundamental discrete time signals.
2. Perform Convolution and DFT operation
3. Design Infinite Impulse Response filters.
4. Design Finite Impulse Response filters.
5. Understand the concept of Noise removal in a signal.
6. Perform basic operations in image processing.

| **Unit -1** | **Hours** |
|---|---|
| **List of Experiments:**<br>1. Generation of discrete time signals for discrete signals<br>2. To verify the Linear Convolution<br>3. To verify the Circular Convolution for discrete signals<br>4. To verify Discrete Fourier Transform (DFT) and Inverse Discrete Fourier Transform (IDFT)<br>5. Frequency Response of IIR low pass Butterworth Filter<br>6. Frequency Response of IIR high pass Butterworth Filter<br>7. Frequency Response of IIR low pass Chebyshev Filter<br>8. Frequency Response of IIR high pass Chebyshev Filter<br>9. Frequency Response of FIR low pass Filter using Window Techniques<br>10. Frequency Response of FIR high pass Filter using Window Techniques<br>11. Implementation of Decimation Process<br>12. Implementation of interpolation process<br>Appendices<br>1. User Guide to code composer Studio<br>2. Introduction to MAT lab | **36** |

**Course outcomes:**

On completion of the course student will be able to

1. Illustrate the fundamental discrete time signals
2. Apply linear and circular convolution operations.
3. Apply DFT and IDFT operations.
4. Construct a Digital IIR filter for the given specifications.
5. Construct a Digital FIR filter for the given specifications.
6. Apply basic operations in image processing and its applications.

| Soft Skills & Aptitude Builder - 1 | | | |
|---|---|---|---|
| Subject Code | 18CMAHS5090 | IA Marks | 15 |
| Number of Practice Hours/Week | 4 | Exam Marks | 35 |
| Total Number of Practice Hours | 64 | Exam Hours | 3 |
| Credits - 2 | | | |

| Section A - Soft Skills | |
|---|---|
| **Unit – 1: Intrapersonal Communication** | **Hours** |
| Introduction to Soft Skills and its Significance<br>**Personal Effectiveness**: Who am I and What am I; My Strengths and Weaknesses; SWOT Analysis; SMART Goal Setting; Being Proactive<br>**Principles of Personal Vision**: Beginning with the End in Mind; Time Management: Understanding Priorities; Put First-Things-First<br>**Activity**: Psychometric Tests and SWOT Analysis, SMART Goal Setting | **11** |
| **Unit 2: Interpersonal Communication** | |
| **Principles of Creative Cooperation and Organisation Skills**: Think Win-Win; Seek First to Understand then to be Understood; Synergize; Life-Long Learning<br>**Emotional Intelligence**: Self-Awareness, Self-Regulation, Empathy, Assertiveness, Adoptability, Managing Emotions<br>**Activity**: Resolving a Conflict with your Friend/Colleague/Family Member; Group Discussions & Debates | **11** |
| **Unit – 3: 21$^{st}$ Century Skills** | |
| **What are 21$^{st}$ Century Skills? Learning Skills- Digital Literacy- Life Skills**<br>**Critical Thinking**: Active Listening, Observation, Introspection, Analytical Thinking, Open Mindedness<br>**Problem Solving**: Understanding the Complexity of the Problem, Defining the Problem, Cause and Effect Analysis, Exploring Possible Solutions, Planning Actions, Analysing Results of your Actions, Getting Feedback, Redefining the Problem, The Problem Solving Cycle<br>**Decision Making**: Managing Conflict, Conflict Resolution, Methods of Decision Making, Effective Decision Making in Teams – Methods & Styles<br>**Activity**: Case Study | **10** |
| **Section B - Aptitude Builder** | |
| **Unit – 4: Ratios & Percentages** | |
| Definition of Ratio, Properties of Ratios, Comparison of Ratios, Problems on Ratios, Compound Ratio, Problems on Proportion, Mean Proportional and Continued Proportion.<br>**Partnership:** Introduction, Relation between Capitals, Period of Investments and Shares<br>**Number System:** Classification of Numbers, Divisibility Rules, Finding the Units Digit,Finding Remainders in Divisions Involving Higher Powers, LCM and HCF Models<br>**Percentages:** Introduction, Converting a Percentage into Decimals, Converting a Decimal into Percentage, Percentage Equivalent of Fractions, Problems on Percentages<br>**Profit And Loss:** Problems on Profit and Loss Percentage, Relation between Cost Price and Selling Price, Discount and Marked Price, Two Different Articles Sold at Same Cost Price, Two Different Articles Sold at Same Selling Price Gain% / Loss% on Selling Price<br>**Problems on Ages:** Introduction, Problems based on Ages<br>**Averages:** Definition of Average, Rules of Average, Problems on Average, Problems on Weighted Average, Finding Average using Assumed Mean Method<br>**Alligation and Mixture:** Problems on Mixtures, Alligation Rule, Problems on | **16** |

| | |
|---|---|
| Alligation | |
| **Unit – 5: Mental Ability** | |
| Difference Series, Product Series, Squares Series, Cubes Series, Alternate Series Combination Series, Miscellaneous Series, Place Values of Letters<br>**Number and Letter Analogies:** Definition of Analogy, Problems on Number Analogy, Problems on Letter Analogy, Problems on Verbal Analogy<br>**Odd Man Out:** Problems on Number Odd Man Out, Problems on Letter Odd Man Out, Problems on Verbal Odd Man Out<br>**Coding and Decoding:** Coding using Same Set of Letter, Coding using Different Set of Letters, Coding into a Number, Problems on R-Model<br>**Blood relations:** Defining the Various Relations among the Members of a Family, Solving Blood Relation Puzzles, Solving the Problems on Blood Relations using Symbols and Notations<br>**Direction Sense:** Solving Problems by Drawing the Paths, Finding the Net Distance Travelled, Finding the Direction, Problems on Clocks ,Problems on Shadows | **16** |
| | |

| | |
|---|---|
| **Section-A: Text (T) / Reference (R ) Books:** | |
| **For Units 1, 2, & 3** | |
| T1 | English and Soft Skills, Dr. S. P. Dhanvel, Orient Blackswan, 2011 |
| R1 | Seven Habits of Highly Effective People, Stephen R Covey |
| R2 | Emotional Intelligence, Daniel Goleman, Bantom Book, 2006 |
| R3 | 21$^{st}$ Century Skills: Learning for Life in our Times, Bernie Trilling, Charles Fadel; John Wiley & Sons |
| For Units 4&5 | |
| T1 | R S Agarwal, S Chand, 'Quantitative Aptitude' |
| T2 | R S Agarwal, S.Chand , 'A Modern Approach to Logical Reasoning' |
| R1 | Quantitative Aptitude for CAT By Arun Sharma |
| R2 | GL Barrons, Mc Graw Hills, Thorpe's Verbal Reasoning, LSAT Materials |
| Course Outcomes: On completion of this course, students can | |
| Section A: Soft Skills | |
| CO1 | re-engineer attitude and understand its influence on behaviour |
| CO 2 | develop interpersonal skills and be an effective goal oriented team player |
| CO 3 | develop holistic personality with a mature outlook to function effectively in different circumstances |
| Section B: Aptitude Builder | |
| CO 4 | solve the real-time problems for performing job functions easily |
| CO 5 | analyse the problems logically and critically |

**Course Outcomes to Programs Outcomes Mapping: ( 1: Low, 2: Medium, 3: High)**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | - | - | - | - | - | - | - | - | - | 1 | - | 3 | - | - | - |
| 2 | - | - | - | - | - | - | - | - | 2 | 1 | - | 3 | - | - | - |
| 3 | - | - | - | - | - | - | - | - | 1 | 1 | - | 3 | - | - | - |
| 4 | 2 | 2 | - | 1 | - | - | - | - | - | - | - | 1 | - | - | - |
| 5 | 1 | 1 | - | 2 | - | - | - | - | - | - | - | - | - | - | - |
| **Course** | 2 | 2 | - | 2 | - | - | - | - | 2 | 1 | - | 3 | - | - | - |

# BIOLOGY FOR ENGINEERS

SEMESTER V

| | | | |
|---|---|---|---|
| Subject Code | 18CMMSN50A0 | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| Pre-requisite | Natural Science | Credits – 00 | |

**Course Objectives:**

This course will enable students to

1. Understand biology as an independent scientific discipline.
2. Understand the Hierarchy of life forms at various phenomenological level
3. Understand Gene and gene mapping
4. Understand molecules of life and enzymes
5. Understand proteins and enzymology
6. Understand microbiology and metabolis

| **Unit -1** | **Hours** |
|---|---|
| **Introduction**- Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology. How biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. | 8 |
| **Unit -2** | |
| **Classification-** Hierarchy of life forms at phenomenological level- classification based on (a) cellularity- Unicellular or multicellular (b) ultra-structure- prokaryotes or eucaryotes. (c) energy and Carbon utilization - Autotrophs, heterotrophy, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureoteli (e) Habitata - acquatic or terrestrial (f) Molecular taxonomy- three major kingdoms of life. Model organisms for the study of biology come from different groups. E. coli, S.cerevisiae, D.Melanogaster, C. elegance, A. Thaliana, M. Musculus | 10 |
| **Unit -3** | |
| **Genetics** - Mendel’s laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be given not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about single gene disorders in humans. Discuss the concept of complementation using human genetics.<br>**Molecules of life** Monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids. | 10 |
| **Unit – 4** | |
| **Enzymes**: How to monitor enzyme catalyzed reactions. How does an enzyme catalyze reactions - Enzyme classification- Mechanism of enzyme action. - examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.<br>**Proteins:** Proteins- structure and function. Hierarchy in protein structure. Primary secondary, tertiary and Quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.<br>**Information Transfer:** The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a | 10 |

| | |
|---|---|
| genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosides. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination | |
| **Unit-5** | |
| **Microbiology & Metabolism**: Thermodynamics as applied to biological systems - Exothermic and endothermic versus undergone and exergonic reactions. Concept of Keq and its relation to standard free energy - Spontaneity - ATP as an energy currency. This should include the breakdown of glucose to CO2 + H2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO2 and H2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge<br>**Concept of single celled organisms**. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics | 10 |
| **Total** | **48** |

**Course outcomes:**

On completion of the course student will be able to

1. Able to describe how biological observations of 18th Century that lead to major discoveries.
2. Able to convey that classification per se is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological
3. Able to demonstrate the highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring.
4. Able to convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine.
5. Able to classify enzymes and distinguish between different mechanisms of enzyme action.
6. Able to demonstrate that "Genetics is to biology what Newton's laws are to Physical Sciences".

**Text Books:**


1. Campbell, N. A, Reece, J. B, Urry, Lisa Cain, M, L. Wasserman, S. A. Minorsky, P. V. Jackson, R. B, Biology: A Global Approach: Pearson Education. Pearson Publishers, 11th Edition,2017
2. Conn, E.E, Stumpf, P.K, Bruening, G. Doi, R.H, Outlines of Biochemistry, John Wiley and Sons, 1987
3. L.M J.P. Harley and C.A. Klein, Microbiology, C. Brown Publishers, 2nd Edition, 1995.


**Reference Books**:


1. Nelson, D. L. and Cox, M. M, Principles of Biochemistry, W.H. Freeman and Company, 7th Edition, 2017
2. Stent, G. S, Richard Calender, Molecular Genetics: An Introductory Narrative, W.H. Freeman and Co., 1978

## Professional Elective -I

| S. No | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | 18ETETP5060A | Radiation Systems | 3 | 0 | 0 | 3 |
| 2 | 18ETETP5060B | Digital Design Through Verilog | 3 | 0 | 0 | 3 |
| 3 | 18ETETP5060C | IoT Fundamentals | 3 | 0 | 0 | 3 |
| 4 | 18ETETP5060D | Spread Spectrum Communication | 3 | 0 | 0 | 3 |

**Radiation Systems**
**(Professional Elective – I)**
SEMESTER V

| | | | |
|---|---|---|---|
| Subject Code | 18ETETP5060A | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| Credits – 03 | | | |

**Course Objectives:**

This course will enable students to:

- To give insight into the radiation phenomena.
- To give a thorough understanding of the radiation characteristics of different types of antennas
- To create awareness about the different types of propagation of radio waves at different frequencies

| Unit -1 | Hours |
|---|---|
| **FUNDAMENTALS OF RADIATION**- Antenna parameters - Gain, Directivity, Effective aperture, Radiation Resistance, Radiation patterns, Main lobe and side lobes Bandwidth, Beam width, Antenna height, Impedance matching: BALUNS, Polarization mismatch, Antenna temperature, half wave dipole and folded dipole, yagiUda array, log periodic antenna. | **10** |
| **Unit -2** | |
| **ANTENNA ARRAYS** Two element array, N-element linear array, Pattern multiplication, Broadside and end fire array, Array synthesis: Binomial array, Adolph-Tschebyscheff array, planar array antennas. | **8** |
| **Unit – 3** | |
| **APERTURE ANTENNAS** - Huygens' principle, radiation from rectangular aperture, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, parabolic reflector antennas and feeding techniques, microstrip patch antenna . | **11** |
| **Unit – 4** | |
| **MODERN ANTENNAS** - Phased array antennas, Smart antennas – switched beam and adaptive arrays,UWB antennas, RFID Antennas, Wearable antennas, Reconfigurable antennas, Dielectric resonator antennas, bandwidth enhancement techniques, gain enhancement techniques. | **10** |
| **Unit – 5** | |
| **ANTENNA MEASURMENTS** – Required equipment in antenna measurement, ,Anechoic chamber, Measurements: Gain measurement, ,Directivity measurement , Impedance measurement, Antenna Gain Radiation pattern and polarization. | **9** |

**Course outcomes:**

On completion of this course, students are able to

1. Comprehend and appreciate the significance and role of this course in the present contemporary world.
2. Understand the fundamentals of the antenna by gaining technical knowledge regarding antenna parameters.
3. Have insight into the radiation phenomena.
4. Have a thorough understanding of the radiation characteristics of different types of Antennas.
5. Identify the different types of propagation of radio waves at various frequencies.

**Text Books:**

1. John D Kraus, "Antennas for all Applications", Mc Graw Hill, 5 th Edition, 2005.
2. R.E.Collin, "Antennas and Radiowave propagation", Mc Graw Hill, 1985.

**References:**

1. Constantine.A.Balanis, "Antenna Theory Analysis and Design", Wiley student edition,3rd Edition, 2009.
2. Edward C.Jordan and Keith G.Balmain, "Electromagnetic Waves and Radiating Systems", Prentice Hall of India, 2006.
3. S. Drabowitch, "Modern Antennas", Springer Publications, 2 nd Edition, 2007.
4. Robert S.Elliott, "Antenna theory and Design", Wiley student edition, 2010.
5. H.Sizun, "Radio Wave Propagation for Telecommunication Applications", First Indian Reprint, Springer Publications, 2007.

# Digital Design Through Verilog

**(Professional Elective – I)**

SEMESTER V

| | | | |
|---|---|---|---|
| Subject Code | 18ETETP5060B | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| Credits – 03 | | | |

**Course Objectives:**

This course will enable students to:

- Understand the basic concepts of Verilog HDL and learn different modelling techniques.
- Construct digital circuits and corresponding RTL modelling using different styles along with related test bench based verification.
- Learn FPGA based design concepts depending on available architectures.

| Unit -1 | Hours |
|---|---|
| **Introduction to Verilog HDL:** Verilog as HDL, Levels of Design Description, Concurrency, Simulation and Synthesis, Function Verification, System Tasks, Programming Language Interface, 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. | **8** |
| **Unit -2** | |
| **Gate Level Modeling:** Introduction, AND Gate Primitive, Module Structure, Other Gate Primitives, Illustrative Examples, Tristate Gates, Array of Instances of Primitives, Design of Flip-Flops with Gate Primitives, Delay, Strengths and Construction Resolution, Net Types, Design of Basic Circuit. **Modeling at Dataflow Level:** Introduction, Continuous Assignment Structure, Delays and Continuous Assignments, Assignment to Vector, Operators. | **10** |
| **Unit – 3** | |
| **Behavioural Modeling:** Introduction, Operations and Assignments, Functional Bifracation, 'Initial' Construct, Assignments with Delays, 'Wait' Construct, Multiple Always Block, Designs at Behavioral Level, Blocking and Non-Blocking Assignments, The 'Case' Statement, Simulation Flow, 'If' an 'if-Else' Constructs, 'Assign- De-Assign' Constructs, 'Repeat' Construct, for loop, 'The Disable' Construct, 'While Loop', Forever Loop, Parallel Blocks, Force- | **10** |
| **Unit – 4** | |
| **Switch Level Modeling:** Basic Transistor Switches, CMOS Switches, Bi-Directional Gates, Time Delays with Switch Primitives **Sequential Circuit Description:** Sequential Models - Feedback Model, Capacitive Model, Implicit Model, Basic Memory Components, Functional Register, Static Machine Coding, Sequential Synthesis. | **10** |
| **Unit – 5** | |
| **FPGA Fundamentals:** Basic FPGA architecture, FPGA configuration, configuration modes, FPGA design process- FPGA design flow, FPGA families, FPGA design examples-stack, queue and shift register implementation using VHDL, step-by-step approach of FPGA design process on Xilinx environment. | **10** |

**Course outcomes:**

On completion of this course, students are able to

1. Understand the basics of Verilog hardware description languages.
2. Apply the gate level and dataflow modeling styles to all digital circuits
3. Construct digital circuits using behavioral modelling
4. Understand switch level modeling along with system tasks and functions.
5. Implement sequential logic design and analyze the models by learning test bench programming
6. Understand various architectures of commercial FPGAs.

**Text Books:**

1. T.R. Padmanabhan, B Bala Tripura Sundari, "Design Through Verilog HDL", Wiley 2009.
2. J. Bhasker, "Verilog HDL Primer", 2nd Edition, BS Publications,2001. Michael D.Ciletti, "Advanced Digital Design with the Verilog HDL
3. Michael D.Ciletti, "Advanced Digital Design with the Verilog HDL", Xilinx Design Series, Pearson Education.

**References:**

1. Stephen Brown, Zvonkoc Vranesic, "Fundamentals of Digital Logic with Verilog Design", TMH, 2nd Edition.
2. Sunggu Lee, "Advanced Digital Logic Design using Verilog, State Machines & Synthesis for FPGA", Cengage Learning, 2012.
3. Samir Palnitkar, "Verilog HDL", 2nd Edition, Pearson Education, 2009.
4. Michel D. Ciletti, "Advanced Digital Design with Verilog HDL", PHI,2009.

# IoT and its Applications

**(Professional Elective –I)**

SEMESTER V

| | | | |
|---|---|---|---|
| Subject Code | 18ETETP5060C | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| Credits – 03 | | | |

**Course Objectives:**

This course will enable students to:

- To learn and understand elements of IoT system.
- Acquire knowledge about various protocols of IoT.
- To learn and understand design principles and capabilities of IoT.

| Unit -1 | Hours |
|---|---|
| **Introduction to IoT :** Introduction to IoT, Architectural Overview, Design principles and needed capabilities, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gate ways, Data management, Business processes in IoT, Everything as a Service (XaaS), Role of Cloud in IoT, Security aspects in IoT. | **9** |
| **Unit -2** | |
| **Elements of IoT** Hardware Components- Computing- Arduino, Raspberry Pi, ARM Cortex-A class processor, Embedded Devices – ARM Cortex-M class processor, Arm Cortex-M0 Processor Architecture, Block Diagram, Cortex-M0 Processor Instruction Set, ARM and Thumb Instruction Set. | **9** |
| **Unit – 3** | |
| **IoT Application Development** Communication, IoT Applications, Sensing, Actuation, I/O interfaces. Software Components- Programming API's (using Python/Node.js/Arduino) for Communication Protocols-MQTT, ZigBee, CoAP, UDP, TCP, Bluetooth.<br>**Bluetooth Smart Connectivity** Bluetooth overview, Bluetooth Key Versions, Bluetooth Low Energy (BLE) Protocol, Bluetooth, Low Energy Architecture, PSoC4 BLE architecture and Component Overview. | **10** |
| **Unit – 4** | |
| **Solution framework for IoT applications** Implementation of Device integration, Data acquisition and integration, Device data storage Unstructured data storage on cloud/local server, Authentication, authorization of devices. | **10** |
| **Unit – 5** | |
| **IoT Case Studies:** IoT case studies and mini projects based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation. | **10** |

**Course outcomes:**

On completion of this course, students are able to

1. Understand internet of Things and its hardware and softwarecomponents.
2. Understand ARM &Interface I/O devices, sensors &communication modules.
3. Understand IoT application development and various protocols.
4. Explain smart connectivity and low energy issues
5. Understand solution framework for IoT applications and remotely monitor data and control devices.

6. Design real time IoT based applications and performs mini projects.

**Text Books:**

1. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education,2017.
2. The Definitive Guide to the ARM Cortex-M0 by JosephYiu,2011
3. Vijay Madisetti, Arshdeep Bahga, Internet of Things, "A Hands on Approach", UniversityPress,2015.

**References:**

1. Cypress Semiconductor/PSoC4 BLE (Bluetooth Low Energy) Product Training Modules.
2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017.

## Spread Spectrum Techniques

**(Professional Elective – I)**

SEMESTER V

| | | | |
|---|---|---|---|
| Subject Code | 18ETETP5060D | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |

Credits – 03

**Course Objectives:**

This course will enable students to:

- Understand the concept of Spread Spectrum and study various types of Spread spectrum sequences and their generation.
- Understand the principles of Code Division Multiple Access (CDMA) and use of Spread spectrum concept in CDMA
- Understand various Code tracing loops for optimum tracking of wideband signals viz Spread spectrum signals.
- Understand the procedure for synchronization of receiver for receiving the Spread spectrum signal.
- Study the performance of spread spectrum systems in Jamming environment, systems with Forward Error Correction and Multiuser detection in CDMA cellular radio.

| Unit -1 | Hours |
|---|---|
| **Introduction to Spread Spectrum Systems**: Fundamental Concepts of Spread Spectrum Systems, Pseudo Noise Sequences, Direct Sequence Spread Spectrum, Frequency Hop Spread Spectrum, Hybrid Direct Sequence Frequency Hop Spread Spectrum, Code Division Multiple Access. Binary Shift Register Sequences for Spread Spectrum Systems: Introduction, Definitions, Mathematical Background and Sequence Generator Fundamentals, Maximal Length Sequences, Gold Codes. | **8** |
| **Unit -2** | |
| **Code Tracking Loops**: Introduction, Optimum Tracking of Wideband Signals, Base Band Delay-Lock Tracking Loop, Tau-Dither Non- Coherent Tracking Loop, Double Dither NonCoherent Tracking Loop. | **8** |
| **Unit – 3** | |
| **Initial Synchronization of the Receiver Spreading Code**: Introduction, Problem Definition and the Optimum Synchronizer, Serial Search Synchronization Techniques, Synchronization using a Matched Filter, Synchronization by Estimated the Received Spreading Code. | **11** |
| **Unit – 4** | |
| **Cellular Code Division Multiple Access (CDMA) Principles**: Introduction, Wide Band Mobile Channel, The Cellular CDMA System, Single User Receiver in a Multi User Channel, CDMA System Capacity. Multi-User Detection in CDMA Cellular Radio: Optimal Multi-User Detection, Linear Suboptimal Detectors, Interference Combat Detection Schemes, Interference Cancellation Techniques. | **11** |
| **Unit – 5** | |
| **Performance of Spread Spectrum Systems in Jamming Environments**: Spread Spectrum Communication System Model, Performance of Spread Spectrum Systems without Coding. Performance of Spread Spectrum Systems with Forward Error Correction: Elementary Block Coding Concepts, Optimum | **10** |

| | |
|---|---|
| Decoding Rule, Calculation of Error Probability, Elementary Convolution Coding Concepts, Viterbi Algorithm, Decoding and Bit-Error Rate. | |

**Course outcomes:**

On completion of this course, students are able to

1. Understand Spread spectrum techniques and various codes used in SST
2. Explain code tracking loops and significance
3. Explain the concept of Synchronization of the receiver Spreading Code
4. Explain the Synchronization of Received Spreading Code.
5. Understand the Interference Combat Detection Schemes, Interference Cancellation Techniques.
6. Analyze the performance of Spread spectrum systems in Jamming environment and systems with Forward Error Correction.

**Text Books:**

1. Rodger E Ziemer, Roger L. Peterson and David E Borth - “Introduction to Spread Spectrum Communication- Pearson, 1st Edition, 1995.
2. Mosa Ali Abu-Rgheff – “Introduction to CDMA Wireless Communications.” Elsevier Publications, 2008.

**References:**

1. George R. Cooper, Clare D. Mc Gillem - “Modern Communication and Spread Spectrum,” McGraw Hill, 1986.
2. Andrew j. Viterbi - “CDMA: Principles of spread spectrum communication,” Pearson Education, 1st Edition, 1995.

| VLSI DESIGN<br>Common to ECE & ECT<br>SEMESTER VI | | | |
|---|---|---|---|
| Subject Code | 18ETETT6020 | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| Pre-requisite | Digital Logic Design | Credits – 03 | |

**Course Objectives:**
This course will enable students to
1. Know about IC technology and MOS transistor characteristics.
2. Demonstrate IC design process.
3. Estimate parametric of CMOS circuits.
4. Design based on scaling of MOS transistors.
5. Calculate yield and test vectors for IC design

| **Unit -1** | **Hours** |
|---|---|
| **Introduction:** Introduction to IC Technology and fabrication – MOS, PMOS, NMOS, CMOS & BiCMOS, Enhancement Mode MOS Transistor and Depletion Mode MOS Transistor Action.<br>**Basic Electrical Properties:** Basic Electrical Properties of MOS and BiCMOS Circuits: Ids-Vds relationships, MOS transistor threshold Voltage, GM, GDS, Figure of merit; Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters. | 8 |
| **Unit -2** | |
| **VLSI Circuit Design Processes:** VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, 2 um Double Metal, Double Poly. CMOS/BiCMOS Rules, 1.2 um Double Metal, Single Poly. CMOS Rules. | 10 |
| **Unit -3** | |
| **Basic Circuit Concepts:**Sheet resistance, Rs concept applied to MOS transistors and inverters, Resistance estimation, Area capacitance of layers, Standard unit of capacitance, Capacitance estimation, Wiring capacitances, Delay unit and Inverter delays, Driving large capacitance loads, Propagation Delay, Wiring Capacitances. | 10 |
| **Unit – 4** | |
| **Scaling of MOS Circuits:** Scaling Models and Scaling Factors for various Device Parameters, Limitations of Scaling, Limits Due to Sub threshold Currents, Limits on Logic Levels and Supply Voltage Due to Noise, Limits Due to Current Density. | 10 |
| **Unit – 5** | |
| **Design for Manufacturability:** Introduction, Process Variations, Basic Concepts and Definitions, Design of Experiments and Performance Modelling, Parametric Yield Estimation and Yield Maximization, Worst-Case Analysis.<br>**Design for Testability:**<br>Introduction, Fault Types and Models, Controllability and Observability Ad Hoc Testable Design Techniques, Scan-Based Techniques, Built-In Self-Test (BIST) Techniques, Current Monitoring IDDQ Test. | 10 |
| **Total** | **48** |

**Course outcomes:**

On completion of the course student will be able to

1. Understand the introduction and basic electrical properties of MOS and BiCMOS circuits.
2. Understand the intricacies of VLSI Circuit design processes.
3. Analyze the parametric for CMOS Circuits.
4. Analysis of VLSI design methodologies.
5. Understand design for Manufacturability and Testability.

**Text Books:**


1. Kamran Eshraghian, Douglas and A. Pucknell and Sholeh Eshraghian, Essentials of VLSI Circuits and Systems, Prentice-Hall of India Private Limited, 2005.
2. Sung-Mo Kang, Yusuf Leblebic, CMOS Digital Integrated Circuits Analysis & Design McGraw-Hill Higher Education, 2002.


**Reference Books**:


1. Introduction to VLSI Design by Eugene D. Fabricius, McGraw Hill International Editions, 1990.
2. Modern VLSI Design System on chip by Wayne Wolf, Pearson Education, 2002.

# COMPUTER NETWORKS

Common to ECE & ECT

SEMESTER VI

| Subject Code | 18ETETT6030 | Internal Marks | 30 |
|---|---|---|---|
| Number of Lecture Hours/Week | 04 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| Pre-requisite | --- | Credits – 03 | |

**Course Objectives:**

This course will enable students to

1. Understand different topologies and networks and physical layer principles.
2. Understand protocols for data link layer.
3. Analyze routing algorithms in computer networks.
4. Understand protocols and services for transport layer.
5. Interpret network security and applications of computer networks.

| Unit -1 | Hours |
|---|---|
| **Introduction to Computer Networks and the Internet:** Network Topologies, Reference models- The OSI Reference Model- the TCP/IP Reference Model, Examples of Networks.<br>**Physical Layer: Switching in networks:** Circuit Switching, Packet switching, Narrow band, broad band ISDN and ATM. | 10 |
| **Unit -2** | |
| **Data Link Layer**: Elementary Data Link Protocols- A Utopian Simplex Protocol-A Simplex Stop and Wait Protocol for an Error free channel-A Simplex Stop and Wait Protocol for a Noisy Channel, Sliding Window Protocols-A One Bit Sliding Window Protocol-A Protocol Using Go-Back-N- A Protocol Using Selective Repeat Link Layer: ALOHA, Multiple access protocols, IEEE 802 standards, Local Area Networks, addressing, Ethernet, Hubs, and Switches. | 10 |
| **Unit -3** | |
| **Network Layer:** Virtual circuit and Datagram networks, Router, Internet Protocol, Routing algorithms, Broadcast and Multicast routing. Congestion Control and Resource Allocation: Issues in Resource Allocation, Queuing Disciplines, TCP congestion Control, Congestion Avoidance Mechanisms and Quality of Service. | 10 |
| **Unit – 4** | |
| **Transport Layer:** Connectionless transport - User Datagram Protocol, Connection-oriented transport – Transmission Control Protocol, Remote Procedure Call, ATM AAL Layer Protocol. | 8 |
| **Unit – 5** | |
| **Application Layer:** Application layer: Principles of network applications, Network Security, The Web and Hyper Text Transfer Protocol, File transfer, electronic mail, Domain name system, Peer-to-Peer file sharing, Socket programming. | 10 |
| **Total** | **48** |

**Course outcomes:**

On completion of the course student will be able to

1. Summarize different type reference models, topologies and networks and functions of physical layer
2. Analyze various data link layer protocols.
3. Demonstrate about different Routing Algorithms in Computer Networks.
4. Analyze transport layer services and protocols.
5. Interpret network security and computer network applications.

**Text Books:**

1. Andrew Tanenbaum, Computer networks, Prentice Hall,2002.
2. B. A. Forouzan, Data Communications and Networking, Tata McGraw Hill, 4th Edition.

**Reference Books**:

1. J.F. Kurose and K. W. Ross, Computer Networking, A top-down approach featuring the Internet, Pearson Education, 5th Edition.
2. L. Peterson and B. Davie, Computer Networks: A Systems Approach, Elsevier Morgan Kaufmann Publisher, 5th Edition.
3. S. Keshav, An Engineering Approach to Computer Networking, Addison Wesley, 2010.
4. William Stallings, Data and computer communications, Prentice Hall, $8^{th}$ Edition, 2006

# COMPUTER NETWORKS LAB

Common to ECE & ECT

SEMESTER VI

| | | | |
|---|---|---|---|
| Subject Code | 18ETETL6070 | Internal Marks | 15 |
| Number of Lecture Hours/Week | 02 | External Marks | 35 |
| Total Number of Hours | 36 | Exam Hours | 03 |
| | | | Credits – 1.5 |

**Course Objectives:**

This course will enable students to

1. Understand the construct of Stack and Queue.
2. Implement Stack and Queue using linked list concept.
3. Understand framing method of DLL.
4. Understand error control mechanism for DLL.
5. Understand routing algorithm for Network layer.
6. Understand transport layer applications.

| List of Experiments | Hours |
|---|---|
| 1. Study of linear data structures like stack, queue and linked list.<br>2. Implement stack (its operations) using arrays.<br>3. Use stack operations to convert infix expression into postfix expression.<br>4. Implement queue (its operations) using arrays.<br>5. Write functions to perform different operations i.e., insertion, deletion on a singly linked list.<br>6. Implement stack (its operations) using linked list.<br>7. Implement queue (its operations) using linked list.<br>8. Implement the data link layer framing methods such as character stuffing, bit stuffing.<br>9. Implement on a data set of characters the CRC polynomials – CRC 12, CRC 16 and CRC CCIP.<br>10. Implement Dijkstra's algorithm to compute the shortest path through a graph.<br>11. Take an example of subnet of hosts and obtain broadcast tree for it.<br>12. Take an example of subnet graph with weights indicating delay between nodes and obtain routing table at each node using distance vector routing algorithm. | **36** |

**Course outcomes:**

On completion of the course student will be able to

1. Construct the stack, Queue and their applications using Arrays.
2. Apply Linked list concepts to implement the stack, Queue and their applications.
3. Develop different framing methods of Data link layer.
4. Experiment with error control mechanisms of data link layers.
5. Develop routing algorithms of Network layer.
6. Construct transport layer applications.

## VLSI DESIGN LAB

Common to ECE & ECT

SEMESTER VI

| Subject Code | 18ETETL6080 | Internal Marks | 15 |
|---|---|---|---|
| Number of Lecture Hours/Week | 02 | External Marks | 35 |
| Total Number of Hours | 36 | Exam Hours | 03 |
| | | | Credits – 1.5 |

**Course Objectives:**

This course will enable students to

1. Design CMOS logic circuits.
2. Simulation of combinational and sequential CMOS Circuits.
3. Analysis of layout combinational CMOS Circuits.
4. Analysis of layouts for sequential CMOS Circuits.
5. Performing DRC and LVS for CMOS design.

| List of Experiments: | Hours |
|---|---|
| 1. Design and Implementation of an Inverter<br>2. Design and Implementation of a NAND Gate<br>3. Design and Implementation of an NOR Gate<br>4. Design and Implementation of Full Adder<br>5. Design and Implementation of 4-bit Ripple Carry Adder<br>6. Design and Implementation of Multiplexer using Transmission Gate<br>7. Design and Implementation of Decoder<br>8. Design and Implementation of D Flipflop<br>9. Design and Implementation 4-bit Register<br>10. Design and Implementation asynchronous counter<br>11. Design and Implementation of static RAM cell<br>12. Design and Implementation of Sequence Detector | **36** |

**Course outcomes:**

On completion of the course student will be able to

1. Design CMOS logic circuits.
2. Design and simulation of Combinational CMOS.
3. Design and simulation of Sequential CMOS.
4. Generation and verification of layouts for combinational CMOS Circuits.
5. Generation and verification of layouts for sequential CMOS Circuits.
6. Design and analysis of DRC and LVS for CMOS.

<table>
<tr><th colspan="4">Soft Skills & Aptitude Builder - 2</th></tr>
<tr><td>Subject Code</td><td>18CMAHS6090</td><td>IA Marks</td><td>15</td></tr>
<tr><td>Number of Practice Hours/Week</td><td>4</td><td>Exam Marks</td><td>35</td></tr>
<tr><td>Total Number of Practice Hours</td><td>64</td><td>Exam Hours</td><td>3</td></tr>
<tr><td colspan="4">Credits - 2</td></tr>
<tr><td colspan="4">Section A<br>Soft Skills</td></tr>
<tr><td colspan="3">Unit – 1: Communicative Competence</td><td>Hours</td></tr>
<tr><td colspan="3">Verbal Reasoning: Selecting Words, Spotting Errors, Ordering of Words, Sentence Formation, Paragraph Formation, Ordering of Sentences, Reading Comprehension, Completing Statements, Verbal Analogies, Cause and Effect, Syllogism, Logical Sequence of Words, Verbal Reasoning, Analysing Arguments, Verification of Truth, Matching Definitions, Theme Detection<br>E-Mail Etiquette, Reporting News<br>Activity: Completing Textual Exercises</td><td>16</td></tr>
<tr><td colspan="3">Unit 2: Career and Employability Skills</td><td></td></tr>
<tr><td colspan="3">What is a Career: Career vs Job, Career Values & Grid, Skills vs Strengths, Spotting Skills/Reflection of Present Skills, Meeting the Expectation of your Employer, Matching your Skills with the Required Skills, Preparing Resume, Preparing for Interviews &Structuring Answers<br>Activity: Resume Building, Interviews, Presentations, Digital Resumes</td><td>16</td></tr>
<tr><td colspan="3">Section B<br>Aptitude Builder</td><td></td></tr>
<tr><td colspan="3">Unit – 3: Time and Work</td><td></td></tr>
<tr><td colspan="3">Pipes and Cisterns: Problems on Unitary method, Relation between Men, Days, Hours and Work, Problems on Man-Day-Hours Method, Problems on Alternate Days, Problems on Pipes and Cisterns.<br>Time , Distance and Speed, Problems on Trains, Boats and Streams: Relation between Speed, Distance and Time, Converting km/h into m/s and vice versa , Problems on Average Speed, Problems on Relative Speed, Problems on Circular Tracks, Problems on Races<br>Problems on Trains: Two Trains Moving in Opposite Direction, Two Trains Moving in same Direction, A Train Crossing a Stationary Object of a Given Length like a Platform or Bridge, A Train Crossing a Stationary Object like a Pole or a Man Boats and Streams: Time Based, which can be considered as a Point Object Speed Based, Distance Based, Average Speed Based</td><td>11</td></tr>
<tr><td colspan="3">Unit – 4: Logical and Analytical Reasoning</td><td></td></tr>
<tr><td colspan="3">Seating Arrangement: Linear Arrangement, Circular Arrangement, Tabler, Triangular Arrangement, Complex Arrangement.<br>Clocks : Finding the Angle When the Time is Given, Finding the Time When the Angle is Known, Relation between Angles, Minutes and Hours, Position of Hands of the Clock, Time Gained or Lost by the Clock, Mirror /Water Image-based Time.<br>Calendars : Definition of a Leap Year, Finding the Number of Odd Days, Framing the Year Code for Centuries, Finding the Day of any Random Calendar Date<br>Syllogisms: Finding the Conclusions using Venn Diagram Method, Finding the Conclusions using Syllogism Method<br>Simple Interest: Definitions, Problems on Interest and Amount, Problems when Rate of Interest and Time Period are Numerically Equal<br>Compound Interest: Definition and Formula for Amount in Compound</td><td>11</td></tr>
</table>

| | |
|---|---|
| Interest, Difference between Simple Interest and Compound Interest for 2 Years on the Same Principle and Time Period. | |
| **Unit – 5: Permutations, Probability, Areas and Volumes** | |
| Definition of permutation , Problems on Permutations , Definition of Combinations , problems on Combinations<br>**Probability:** Definition of Probability, Problems on Coins, Problems on Dice, Problems on Deck of Cards , Problems on Years<br>**Mensuration - 2D:**Formulas for Areas, Formulas for Volumes of Different Solids, Problems on Areas<br>**Mensuration - 3D:** Problems on Volumes, Problems on Surface Areas | **10** |

| | |
|---|---|
| **Text (T) / Reference (R ) Books:** | |
| **For Units 1 & 2** | |
| **T1** | R.S. Agarwal, Verbal & Non-Verbal Reasoning, S. Chand & Co., Latest ed. 2003 |
| **T2** | Soft Skills: Enhancing Employability: Connecting Campus with Corporate by MS Rao, IK International Publishing House |
| **R2** | How to Prepare for Verbal Ability and Reading Comprehension, Arun Sharma, Meenakshi Upadhay, Mc Graw Hill |
| **For Units 3, 4, & 5** | |
| T1 | R S Agarwal, S Chand, 'Quantitative Aptitude' |
| T2 | R S Agarwal, S.Chand , 'A modern approach to Logical reasoning' |
| R1 | Quantitative Aptitude for CAT By Arun sharma |
| R2 | GL Barrons, Mc Graw Hills, Thorpe's verbal reasoning, LSAT Materials |
| **Course Outcomes: On completion of this course, students can** | |
| **Section A: Soft Skills** | |
| **CO1** | learn and practice effective communication skills |
| **CO 2** | develop broad career plans, evaluate the employment market, and become industry ready |
| **Section B: Aptitude Builder** | |
| **CO 3** | develop accuracy on time and distance and units related solutions |
| **CO 4** | solve the real-time problems for performing job functions easily |
| **CO 5** | solve problems related to permutations and combinations, probability, areas and volumes |

**Course Outcomes to Programs Outcomes Mapping: ( 1: Low, 2: Medium, 3: High)**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | - | - | - | - | - | - | - | - | - | 3 | - | 1 | - | - | - |
| 2 | - | - | - | - | - | - | - | - | - | 2 | - | 3 | - | - | - |
| 3 | 2 | 2 | - | 1 | - | - | - | - | - | - | - | 1 | - | - | - |
| 4 | 1 | 1 | - | 2 | - | - | - | - | - | - | - | 1 | - | - | - |
| 5 | 2 | 2 | - | 1 | - | - | - | - | - | - | - | 1 | - | - | - |
| Course | 2 | 2 | - | 1 | - | - | - | - | - | 2 | - | 2 | - | - | - |

## Professional Elective -II

| S.No | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | **18ETETP604A** | Micro Wave and Optical Communications | 3 | 0 | 0 | 3 |
| 2 | **18ETETP604B** | Design of Fault Tolerant Systems | 3 | 0 | 0 | 3 |
| 3 | **18ETETP604C** | Embedded System Design | 3 | 0 | 0 | 3 |
| 4 | **18ETETP604D** | Digital Image and Video Processing | 3 | 0 | 0 | 3 |

# Microwave and Optical Communications

**(Professional Elective – II)**

SEMESTER VII

| | | | |
|---|---|---|---|
| Subject Code | 18ETETP604A | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| Credits – 03 | | | |

**Course objectives:**

This course will enable the students to

- To get familiarized with microwave frequency bands, their applications
- To understand the limitations and losses of conventional tubes at these frequencies.
- To distinguish between different types of microwave tubes, their structures and principles of microwave power generation.
- To impart the knowledge of Scattering Matrix, its formulation and utility, and establish the S-Matrix for various types of microwave junctions.
- Understand the utility of Optical Fibers in Communications

| Unit -I | Hours |
|---|---|
| **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 O/P Characteristics. **Helix TWTs**: Types and Characteristics of Slow Wave Structures; Structure of TWT and Amplification Process (qualitative treatment), Suppression of Oscillations, Gain Considerations. | **9** |
| **Unit –II** | |
| **M-Type Tubes**: Introduction, Cross-field Effects, Magnetrons – Different Types, Cylindrical Traveling Wave Magnetron – Hull Cut-off and Hartree Conditions, Modes of Resonance and PI-Mode Operation, Separation of PIMode, o/p characteristics, **Microwave Solid State Devices**: Introduction, Classification, Applications. TEDs – Introduction, Gunn Diodes – Principle, RWH Theory, Characteristics, Modes of Operation - Gunn Oscillation Modes, Principle of operation of IMPATT and TRAPATT Devices. | **9** |
| **Unit-III** | |
| **Waveguide Components**: Coupling Mechanisms – Probe, Loop, Aperture types. Waveguide Discontinuities – Waveguide Windows, Tuning Screws and Posts, Matched Loads. Waveguide Attenuators – Different Types, Resistive Card and Rotary Vane Attenuators; Waveguide Phase Shifters – Types, Dielectric and Rotary Vane Phase Shifters, Waveguide Multiport Junctions - E plane and H plane Tees. Ferrites– Composition and Characteristics, Faraday Rotation, Ferrite Components – Gyrator, Isolator, | **11** |
| **Unit –IV** | |
| **Scattering matrix**: Scattering Matrix Properties, Directional Couplers – 2 Hole, Bethe Hole, [s] matrix of Magic Tee and Circulator. **Microwave Measurements**: Description of Microwave Bench – Different | **11** |

| | |
|---|---|
| Blocks and their Features, Errors and Precautions, Measurement of Attenuation, Frequency. Standing Wave Measurements, measurement of Low and High VSWR, Cavity Q, Impedance Measurements. | |
| **Unit-V** | |
| **Optical Fiber Transmission Media**: Optical Fiber types, Light Propagation, Optical fiber Configurations, Optical fiber classifications, Losses in Optical Fiber cables, Light Sources, Optical Sources, Light Detectors, LASERS, WDM Concepts, Optical Fiber System link budget. | **8** |
| **Course outcomes:**<br>On completion of the course student will be able to:<br>1. Known power generation at microwave frequencies and derive the performance characteristics.<br>2. Realize the need for solid state microwave sources and understand the principles of solid state devices.<br>3. Distinguish between the different types of waveguide and ferrite components, and select proper components for engineering applications<br>4. Understand the utility of S-parameters in microwave components.<br>5. Design and learn the measurement procedure of various microwave parameters.<br>6. Understand the mechanism of light propagation through Optical Fibres. | |
| **Text Books:**<br>1. Microwave Devices and Circuits – Samuel Y. Liao, Pearson, 3rd Edition, 2003.<br>2. Electronic Communications Systems- Wayne Tomasi, Pearson, 5th Edition | |
| **Reference Books:**<br>1. Optical Fiber Communication – Gerd Keiser, TMH, 4th Ed., 2008.<br>2. Microwave Engineering - David M. Pozar, John Wiley & Sons (Asia) Pvt Ltd., 1989, 3r ed., 2011 Reprint.<br>3. Microwave Engineering - G.S. Raghuvanshi, Cengage Learning India Pvt. Ltd., 2012.<br>4. Electronic Communication System – George Kennedy, 6th Ed., McGrawHill. | |

| Design of Fault Tolerant Systems<br>(Professional Elective –II)<br>SEMESTER VII | | | |
|---|---|---|---|
| Subject Code | 18ETETP604B | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| Credits – 03 | | | |

**Course objectives:**

This course will enable the students to

- To provide or broad understanding of fault diagnosis and tolerant design Approach.
- To illustrate the framework of test pattern generation using semi and full automatic approach.

| Unit -I | Hours |
|---|---|
| **Fault Tolerant Design**: Basic concepts: Reliability concepts, Failures & faults, Reliability and Failure rate, Relation between reliability and mean time between failure, maintainability and availability, reliability of series, parallel and parallel-series combinational circuits. Fault Tolerant Design: Basic concepts-static, dynamic, hybrid, triple modular redundant System (TMR), 5MR reconfiguration techniques, Data redundancy, Time redundancy and software Redundancy concepts. | **10** |
| **Unit –II** | |
| **Self Checking circuits & Fail safe Design**: Self Checking Circuits: Basic concepts of self checking circuits, Design of Totally self checking checker, Checkers using m out of n codes, Berger code, Low cost residue code. Fail Safe Design: Strongly fault secure circuits, fail safe design of sequential circuits using partition theory and Berger code, totally self checking PLA design. | **10** |
| **Unit-III** | |
| **Design for Testability**: Design for testability for combinational circuits: Basic concepts of Testability, Controllability and observability, The Reed Muller's expansion technique, use of Control and syndrome testable designs<br>**Design for testability by means of scan**: Making circuits Testable, Testability Insertion, Full scan DFT technique- Full scan insertion, flip-flop Structures, Full scan design and Test, Scan Architectures-full scan design, Shadow register DFT, Partial scan methods, multiple scan design, other scan designs. | **12** |
| **Unit –IV** | |
| **Logic Built-in-self-test**: BIST Basics-Memory-based BIST,BIST effectiveness, BIST types, Designing a BIST, Test Pattern Generation-Engaging TPGs, exhaustive counters, ring counters, twisted ring counter, Linear feedback shift register, Output Response Analysis Engaging ORA's, One's counter, transition counter, parity checking, Serial LFSRs, Parallel Signature analysis, BIST architectures-BIST related terminologies, A centralized and separate Board-level BIST architecture, Built-in evaluation and self test (BEST), Random Test socket (RTS), LSSD On-chip self test, Self –testing using MISR and SRSG, Concurrent BIST, BILBO, Enhancing coverage, RT level BIST design-CUT design, simulation and synthesis, RTS BIST insertion, Configuring the RTS BIST, incorporating configurations in BIST, Design of STUMPS, RTS and STUMPS results | **10** |
| **Unit-V** | |
| **Standard IEEE Test Access Methods**: Boundary Scan Basics, Boundary scan | **08** |

| | |
|---|---|
| architecture- Test access port, Boundary scan registers, TAP controller, the decoder unit, select and other units, Boundary scan Test Instructions-Mandatory instructions, Board level scan chain structure-One serial scan chain, multiple-scan chain with one control test port, multiple-scan chains with one TDI,TDO but multiple TMS, Multiplescan chain, multiple access port, RT Level boundary scan-inserting boundary scan test hardware for CUT, Two module test case, virtual boundary scan tester, Boundary Scan Description language. | |

**Course outcomes:**

On completion of the course student will be able to:

1. To acquire the knowledge of fundamental concepts in fault tolerant design.
2. Design requirements of self check-in circuits
3. Test pattern generation using LFSR
4. Design for testability rules and techniques for combinational circuits
5. Introducing scan architectures.
6. Design of built-in-self test and scan chain testings.

**Text Books:**

1. Fault Tolerant & Fault Testable Hardware Design- Parag K.Lala, 1984,PHI
2. Digital System Test and Testable Design using HDL models and Architectures - Zainalabedin Navabi, Springer International Edition.

**Reference Books:**

1. Digital Systems Testing and Testable Design-Miron Abramovici, Melvin A.Breuer and Arthur D. Friedman, Jaico Books
2. Essentials of Electronic Testing- Bushnell & Vishwani D.Agarwal, Springers.
3. Design for Test for Digital IC’s and Embedded Core Systems- Alfred L. Crouch, 2008, Pearson Education

# Embedded System Design

**(Professional Elective –II)**

SEMESTER VII

| | | | |
|---|---|---|---|
| Subject Code | 18ETETP604C | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |

Credits – 03

**Course objectives:**

This course will enable the students to

- To provide an overview of Design Principles of Embedded System.
- To provide clear understanding about the role of firmware.
- To understand the necessity of operating systems in correlation with hardware systems.
- To learn the methods of interfacing and synchronization for tasking.

| Unit -I | Hours |
|---|---|
| **Introduction to Embedded Systems**: 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. | **8** |
| **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. | **10** |
| **Unit-III** | |
| **Communication Interface:** block diagram of Onboard and External Communication Interfaces.<br>**Embedded Firmware**: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages. | **12** |
| **Unit –IV** | |
| **RTOS Based Embedded System Design**: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling. | **10** |
| **Unit-V** | |
| **Task Communication**: Shared Memory, Message Passing, Remote Procedure Call and Sockets,<br>**Task Synchronization**: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, Methods to Choose an RTOS. | **08** |

**Course outcomes:** Students will be able to

1. Understand the selection procedure of Processors in the embedded domain.
2. Understand core of the embedded system and design of memories.
3. Explain the design and operation of communication interface.
4. Design Procedure for Embedded Firmware.
5. To visualize the role of Real time Operating Systems in Embedded Systems.
6. To evaluate the Correlation between task synchronization and latency issues

**TEXT BOOK:**

1. Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill.

2. Embedded Systems - Raj Kamal, TMH

**REFERENCE BOOKS:**


1. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
2. Embedded Systems – Lyla, Pearson, 2013
3. An Embedded Software Primer - David E. Simon, Pearson Education.

<table>
<tr><td colspan="4">Digital Image and Video Processing<br>Professional Elective -II<br>SEMESTER VII</td></tr>
<tr><td>Subject Code</td><td>18ETETP604D</td><td>Internal Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>03</td><td>External Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>48</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">Credits – 03</td></tr>
<tr><td colspan="4">Course objectives:<br>This course will enable the students to<ul><li>To study the image fundamentals and mathematical transforms necessary for image Processing.</li><li>To familiarize with image enhancement techniques in spatial and frequency domain, to study the need for image restoration and different restoration models/techniques.</li><li>To learn the fundamentals of image segmentation and compression procedures, to study different segmentation and compression models.</li><li>To understand the basics of image morphologies and different color models.</li><li>To learn the basic steps of video processing.</li></ul></td></tr>
<tr><td colspan="3">Unit -I</td><td>Hours</td></tr>
<tr><td colspan="3">Fundamentals of Image Processing: Introduction, Image sampling, Quantization, Resolution, Image file formats, Elements of image processing system, Applications of Digital image processing<br>Image Transforms: Introduction, Need for transform, image transforms, Fourier transform, 2 D Discrete Fourier transform and its transforms, Importance of phase, Walsh transform, Hadamard transform, Haar transform, slant transform Discrete cosine transform, KL transform, singular value decomposition, Radon transform, comparison of different image transforms.</td><td>10</td></tr>
<tr><td colspan="4">Unit –II</td></tr>
<tr><td colspan="3">Image Enhancement: Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters. Frequency domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, Selective filtering.<br>Image Restoration: Introduction to Image restoration, Image degradation, Types of image blur, Classification of image restoration techniques, Image restoration model, Linear and Nonlinear image restoration techniques, Blind de convolution.</td><td>9</td></tr>
<tr><td colspan="4">Unit-III</td></tr>
<tr><td colspan="3">Image Segmentation: Introduction to image segmentation, Point, Line and Edge Detection, Region based segmentation., Classification of segmentation techniques, Region approach to image segmentation, clustering techniques, Image segmentation based on thresholding, Edge based segmentation, Edge detection and linking, Hough transform, Active contour<br>Image Compression: Introduction, Need for image compression, Redundancy in images, Classification of redundancy in images, image compression scheme, Classification of image compression schemes, Fundamentals of information theory, Run length coding, Shannon – Fano coding, Huffman coding, Arithmetic coding, Predictive coding, Transformed based compression, Image compression standard, Wavelet-based image compression, JPEG Standards.</td><td>10</td></tr>
<tr><td colspan="4">Unit –IV</td></tr>
<tr><td colspan="3">Morphological Image Processing: Preliminaries, Erosion and dilation, opening</td><td>10</td></tr>
</table>

| | |
|---|---|
| and closing, basic morphological algorithms for boundary extraction, thinning, grayscale morphology, Segmentation using morphological watersheds.<br>**Colour image processing:** color fundamentals, color models, pseudo color image processing, and basics of full colour image processing, colour transformations, smoothing and sharpening. Image segmentation based on colour, noise in colour images, color image compression. | |
| **Unit-V** | |
| **Basic Steps of Video Processing:** Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Video signals, filtering operations.<br>**2-D Motion Estimation:** Optical flow, General Methodologies, different motion estimation models.. | **9** |

**Course outcomes:**

1. Perform the basic operations on images and can compute different image transforms.
2. Perform image enhancement in spatial and frequency domain, be able to restore the given degraded image.
3. Segment and compress the given image using different techniques.
4. Perform different morphological operations on images and image color inter conversions.
5. Differentiate analog and digital video, perform sampling and filtering of video signals using different models.
6. Understand optical flow and different motion estimation models.

**TEXT BOOK:**

1. Digital Image Processing – Gonzaleze and Woods, 4th Ed., Pearson.
2. S.Jayaraman, S.Esakkirajan and T.VeeraKumar, "Digital Image processing, TataMcGraw Hill publishers, 2009
3. Digital Video Processing – M. Tekalp, Prentice Hall International.

**REFERENCE BOOKS:**

1. Anil K.Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 9thEdition, Indian Reprint, 2002.
2. Multidimensional Signal, Image and Video Processing and Coding – John Woods, 2ndEd, Elsevier.
3. Digital Image Processing with MATLAB and Lab view – Vipula Singh, Elsevier.
4. Video Processing and Communication – Yao Wang, JoemOstermann and Ya–quin Zhang.1st Ed., PH Int. https://nptel.ac.in/courses/117/105/117105135/.

**IV B. Tech I Sem Course Structure for**

**(Electronics and Communication Technology)**

**Semester VII (Fourth year)**

| S.No | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | 18ETETT7010 | RF System Design | 3 | 0 | 0 | 3 |
| 2 | 18ETETP7020 | Professional Elective – III* | 3 | 0 | 0 | 3 |
| 3 | 18ETETP7030 | Professional Elective – IV* | 3 | 0 | 0 | 3 |
| 4 | 18ETETP7040 | Professional Elective – V* | 3 | 0 | 0 | 3 |
| 5 | 18ETXXO705X | Open Elective – III** | 3 | 0 | 0 | 3 |
| 6 | 18ETXXO706X | Open Elective – IV** | 3 | 0 | 0 | 3 |
| 7 | 18ETETL7070 | RF System Design Lab | 0 | 0 | 3 | 1.5 |
| 8 | 18ETETI7080 | Research Internship | 0 | 0 | 3 | 3 |
| 9 | 18ETETS7090 | Skill Oriented Course – III<br>( Image Processing With Open CV) **OR** (Electromagnetic Simulation Tools (HFSS, CST & FEKO)) | 1 | 0 | 2 | 2 |
| 10 | 18ETETN70A0 | Electronics Measurements & Instrumentation | 3 | 0 | 0 | 0 |
| | | **Total Credits** | | | | 24.5 |

## Professional Elective -III

| S.No | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | 18ETETP702A | Radar and Satellite Communications | 3 | 0 | 0 | 3 |
| 2 | 18ETETP702B | Low Power VLSI Design | 3 | 0 | 0 | 3 |
| 3 | 18ETETP702C | System On Chip Architectures | 3 | 0 | 0 | 3 |
| 4 | 18ETETP702D | Bio-Medical Signal Processing | 3 | 0 | 0 | 3 |

## Professional Elective -IV

| S.No | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | 18ETETP703A | Software Defined Radio | 3 | 0 | 0 | 3 |
| 2 | 18ETETP703B | CPLD and FPGA Architectures & Applications | 3 | 0 | 0 | 3 |
| 3 | 18ETETP703C | Wireless Technologies for IOT | 3 | 0 | 0 | 3 |
| 4 | 18ETETP703D | Artificial Neural Networks | 3 | 0 | 0 | 3 |

## Professional Elective -V

| S.No | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | 18ETETP704A | Global Positioning Systems | 3 | 0 | 0 | 3 |
| 2 | 18ETETP704B | CAD Tools for VLSI | 3 | 0 | 0 | 3 |
| 3 | 18ETETP704C | Big Data Analytics for IoT | 3 | 0 | 0 | 3 |
| 4 | 18ETETP704D | Fuzzy Logic Systems | 3 | 0 | 0 | 3 |

## RF System Design

SEMESTER VII

| | | | |
|---|---|---|---|
| Subject Code | 18ETETT7010 | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |

Credits – 03

**Course objectives:**

This course will enable the students to

- Acquire the importance of RF Issues and various considerations for design
- Understand the filter design in RF range
- Understand the active components and applications
- Design RF Amplifiers
- Analyze the characteristics of RF Amplifiers
- Analyze High frequency models using oscillators and mixers

| Unit | Hours |
|---|---|
| **Unit -I** | |
| **RF ISSUES**<br>Importance of RF design Electromagnetic spectrum, RF behavior of passive components, chip components and circuit board considerations, scattering parameters, smith chart and applications. | **9** |
| **Unit –II** | |
| **RF FILTER DESIGN**<br>Overview, Basic resonator and filter configuration, special filter realizations, smith chart based filter design, coupled filter. | **9** |
| **Unit-III** | |
| **ACTIVE RF COMPONENTS AND APPLICATIONS**<br>RF diodes, BJT, RF FET'S, High electron mobility transistors<br>**Matching And Biasing Networks -**impedance matching using discrete components, microstrip line matching networks, amplifier classes of operation and biasing networks | **12** |
| **Unit –IV** | |
| **RF AMPLIFIER DESIGNS**<br>Characteristics, amplifier power relations, stability considerations, constant g ain circles, constant VSWR circles, low noise circles broadband, high power and multistage amplifiers. | **10** |
| **Unit-V** | |
| **OSCILLATORS**<br>Basic oscillator model, High Frequency oscillator configuration, Applications and analysis, qualitative treatment<br>**MIXERS & APPLICATIONS**<br>Basic characteristic of mixers, wireless synthesizers, phase locked loops, detector and demodulator circuits | **08** |

**Course outcomes:**

On completion of the course student will be able to:

1. To acquire the importance of RF Issues and various considerations for design
2. To understand the filter design in RF range
3. To understand the active components and applications
4. To design RF Amplifiers
5. To analyze the characteristics of RF Amplifiers
6. To analyze High frequency models using oscillators and mixers

**Text Books:**

1. Reinhold Ludwig and Powel Bretchko, RF Circuit Design – Theory and Applications, Pearson Education Asia, First Edition, 2001.
2. Joseph.J. Carr, Secrets of RF Circuit Design , McGraw Hill Publishers, Third Edition,2000.

**Reference Books:**

1. MathewM. Radmanesh, Radio Frequency & Microwave Electronics, Pearson Education Asia, Second Edition, 2002.
2. Ulrich L. Rohde and David P. NewKirk, RF / Microwave Circuit Design, John Wiley & Sons USA 2000.
3. RolandE. Best,Phase Locked Loops: Design, simulation and applications, Mc Graw Hill Publishers 5$^{TH}$ edition 2003

| RF System Design Lab<br>SEMESTER VII | | | |
|---|---|---|---|
| Subject Code | 18ETETL7070 | Internal Marks | 15 |
| Number of Practical Hours/Week | 02 | External Marks | 35 |
| Total Number of Practical Hours | 36 | Exam Hours | 03 |
| Credits – 1.5 | | | |

**Course Objectives:**

This course will enable students to

- Create a design for filter and analyze low power with example
- Characterize Diode and mixer circuits
- Understand simulation of QAM and ability to create amplifier
- Design oscillator and BJT amplifiers
- Analyze Multiplier and VCO
- Characterize FET and Lumped Element Diplexer

| | **Hours** |
|---|---|
| 1. BJT Feedback Oscillator Design<br>2. BJT amplifiers<br>3. Diode Characterization<br>4. Diode Mixer with Nonlinear and Phase Noise Simulations<br>5. Low-Power Mixer Design Example<br>6. 500 MHz LUMPED ELEMENT FILTER<br>7. Simulation of QAM<br>8. Distributed amplifier<br>9. Passive FET Mixer with Lumped Element Diplexer<br>10. Nonlinear FET Characterization<br>11. FET Multiplier<br>12. Feedback Voltage Controlled Oscillator | **36** |

**Course outcomes:**

Upon completion of the course, students will be able to

1. To design oscillator and BJT amplifiers
2. To characterize Diode and mixer circuits
3. To create a design for filter and analyze low power with example
4. To understand simulation of QAM and ability to create amplifier
5. To characterize FET and Lumped Element Diplexer
6. To analyze Multiplier and VCO

| Research Internship<br>SEMESTER VII | | | |
|---|---|---|---|
| Subject Code | 18ETETRI7080 | Internal Marks | 0 |
| Number of Practical Hours/Week | | External Marks | 50 |
| Total Number of Practical Hours | 36 | Exam Hours | 03 |
| Credits – 3 | | | |

**Note:** Evaluation of the summer internships: It shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Industries, Hydel and thermal power projects and also in software MNCs in the area of concerned specialization of the UG programme. Students shall pursue this internship during summer vacation just before its offering as per course structure. The minimum duration of this course shall be at least 6 weeks. The student shall register for the internship as per course structure after commencement of academic year. A supervisor/mentor/advisor has to be allotted to guide the students for taking up the summer internship. The supervisor shall monitor the attendance of the students while taking up the internship. Attendance requirements are as per the norms of the University. After successful completion, students shall submit a summer internship technical report to the concerned department and appear for an oral presentation before the departmental committee consists of an external examiner appointed by the University; Head of the Department, supervisor of the internship and a senior faculty member of the department. A certificate from industry/skill development center shall be included in the report. The report and the oral presentation shall carry 40% and 60% weightages respectively. **It shall be evaluated for 50 external marks at the end of the semester. There shall be no internal marks for Summer Internship. A student shall secure minimum 40% of marks for successful completion. In case, if a student fails, he/she shall reappear as and when semester supplementary examinations are conducted by the University**

Skill Oriented Course – III

**(Image Processing with OpenCV)**

SEMESTER VII

| | | | |
|---|---|---|---|
| Subject Code | 18ETETS7090 | Internal Marks | 0 |
| L-T-P | 1-0-2 | External Marks | 50 |
| Total Number of Lecture Hours | 36 | Exam Hours | 03 |

Credits – 02

**Course objectives:**

This course will enable the students to

- Demonstrate Open CV data types, operators, performance primitives
- Understand OpenCV high GUI
- Understand Threshold versus adaptive threshold Compare thresholding with adaptive thresholding
- Understand histogram, Image Parts and Segmentation

| Unit -I | Hours |
|---|---|
| **Overview:** What Is OpenCV?, Who Uses OpenCV?, What Is Computer Vision?, The Origin of OpenCV, Downloading and Installing OpenCV 8,Getting the Latest OpenCV via CVS 10,More OpenCV Documentation, OpenCV Structure and Content<br>**Introduction to Open CV**: Getting Started ,First Program—Display a Picture ,Second Program—AVI Video ,Moving Around ,A Simple Transformation ,A Not-So-Simple Transformation ,Input from a Camera ,Writing to an AVI File | **7** |
| **Unit –II** | |
| **Getting to Know OpenCV**: OpenCV Primitive Data Types ,CvMat Matrix Structure ,Ipl Image Data Structure ,Matrix and Image Operators ,Drawing Things ,Data Persistence ,Integrated Performance Primitives<br>• CvMat structure: the matrix "header"<br>• Matrix creation and release<br>• Pointer access to matrix structures<br>Set element functions for CvMat or IplImage | **7** |
| **Unit-III** | |
| **High GUI:** A Portable Graphics Toolkit ,Creating a Window ,Loading an Image ,Displaying Images ,Working with Video, Convert Image<br>draw boxes on the screen.(Define our call back which we will install for mouse events, Using a track bar to create a "switch" that the user can turn on and off, Adding something to open a video so that we can read its properties | **7** |
| **Unit –IV** | |
| **Image Processing:** Overview ,Smoothing ,Image Morphology ,Flood Fill ,Resize ,Image Pyramids, Threshold<br>• Doing something with each element in the sequence of connected components returned by CVPyr Segmentation(<br>• Example code making use of CV Threshold()<br>• Alternative method to combine and threshold image planes<br>Threshold versus adaptive threshold Compare thresholding with adaptive thresholding | **7** |
| **Unit-V** | |
| **Image Transforms:** Overview ,Convolution ,Gradients and Sobel Derivatives ,Laplace, Canny, Hough Transforms ,Remap ,Stretch, Shrink, Warp, and Rotate , | **8** |

| | |
|---|---|
| Cart To Polar and PolarTo Cart ,LogPolar ,Discrete Fourier Transform (DFT) ,Discrete Cosine Transform (DCT) ,Integral Images ,Distance Transform ,Histogram Equalization<br>• Hough circles<br>• An affine transformation<br>• Code for perspective transformation<br>• Log-polar transform example<br>Use of cvDFT() to accelerate the computation of convolutions<br>**Histograms and Matching:** Basic Histogram Data Structure ,Accessing Histograms ,Basic Manipulations with Histograms ,Some More Complicated Stuff ,<br>**Image Parts and Segmentation**: Parts and Segments ,Background Subtraction ,Watershed Algorithm ,Image Repair by Inpainting ,Mean-Shift Segmentation ,Delaunay Triangulation, Voronoi Tesselation<br>• Histogram computation and display<br>• Simple EMD interface<br>• Template matching<br>• Reading out the RGB values of all pixels in one row of a video and accumulating those values into three separate files<br>watershed image | |

**Course outcomes:**

On completion of the course student will be able to:

1. Understand Open CV , structure and content
2. Demonstrate Open CV data types, operators, performance primitives
3. Understand OpenCV high GUI
4. Understand Threshold versus adaptive threshold Compare thresholding with adaptive thresholding
5. Understand various types of Image transforms and analyze
6. Understand histogram, Image Parts and Segmentation.

**Text Books:**


1. David MillánEscrivá , Vinícius G. Mendonça , Prateek Joshi ,’Learn OpenCV 4 by Building Projects: Build real-world computer vision and image processing applications with OpenCV and C++, 2nd Edition,’Packt Publishing Limited
2. Gary Bradski and Adrian Kaehler,’Learning OpenCV,’O’Reilly Media, Inc


**REFERENCE BOOKS**


1. Alberto FernándezVillán, ’Mastering OpenCV 4 with Python,’ Packt Publishing Limited
2. Gloria Bueno García ,’ Learning Image Processing with OpenCV,’ Packt Publishing

Skill Oriented Course – III

## (Electromagnetic Simulation Tools (HFSS, CST & FEKO))

(SEMESTER VII

| Subject Code | 18ETETS7090 | Internal Marks | 0 |
|---|---|---|---|
| L-T-P | 1-0-2 | External Marks | 50 |
| Total Number of Lecture Hours | 36 | Exam Hours | 03 |

Credits – 02

**Course objectives:**

This course will enable the students to

- Demonstrate working with geometries, drawing models, assigning materials, assigning boundaries, creating the ports, Creating solution setup
- Design of probe fed micro strip antenna,
- Design of Triangular antenna, slot antenna
- Design of Microwave Communication Modules

| Unit | Hours |
|---|---|
| **Unit -I** | |
| **Introduction to Electromagnetic Simulation Tools & HFSS:** Conventional modeling Vs EM-Tools, Method of analysis for various EM-Tools, Introduction about Getting started with HFSS tool, Creating a project,<br>• Dipole Antenna Full-Wave Simulation<br>• Monopole Antennas and Full-Wave Simulations | **7** |
| **Unit –II** | |
| Working with geometries, drawing models, assigning materials, assigning boundaries, creating the ports, Creating solution setup<br>• Circular Loop Antennas<br>• Square Loop Antennas | **7** |
| **Unit-III** | |
| **Optimization and Post Processing:** Generation of the results (S-parameters, VSWR, Impedance, Smith Chart, Radiation Patterns, Field Distributions etc), Parametric analysis, Tuning of the dimensions, exporting the models and results, Importing the models and results.<br>• Circularly Polarized Patch Antennas<br>• Wilkinson Power Dividers | **7** |
| **Unit –IV** | |
| **Design of Antennas with HFSS – I :** Design of dipole antenna, Design of microstrip line fed patch antenna,<br>• Biconical Antennas<br>• Folded Dipole Antennas<br>**Design of Antennas with HFSS-II :** Design of probe fed microstrip antenna, Design of Triangular antenna, Design of slot antenna<br>• Helical Antennas<br>• Yagi-Uda Antennas | **7** |
| **Unit-V** | |
| **Design of Microwave Communication Modules:** Design and analysis of microstrip low pass filter, Design and analysis of microstrip High pass filter, Design and analysis of microstrip Band pass filter, Design and analysis of Coaxial Tee<br>• Sectoral Horn Antennas | **8** |

| | |
|---|---|
| • Pyramidal Horn Antennas | |

**Course outcomes:**

On completion of the course student will be able to:

1. Understand Electromagnetic simulation tools and HFSS
2. Demonstrate working with geometries, drawing models, assigning materials, assigning boundaries, creating the ports, Creating solution setup
3. Analyze optimization, post processing and parameter evaluation
4. Design of Antennas with HFSS
5. Design of probe fed micro strip antenna, Design of Triangular antenna, Design of slot antenna
6. Design of Microwave Communication Modules

**Text Books:**

1. Atef Z. Elsherbeni,' Antenna analysis and design using FEKO electromagnetic simulation software,' SciTech Publishing

2. Microwave filters, impedance-matching networks, and coupling structures by Leo Young, Artech House Publishing,

**REFERENCE BOOKS**

1. Antenna Theory Analysis and Design by Constantine A Balanis, John Wiley Publishing, 2011

2. Microstrip Antenna Design Handbook by Ramesh Garg, Artech House,

| Electronic Measurements and Instrumentation<br>SEMESTER VII | | | |
|---|---|---|---|
| Subject Code | 18ETETN70A0 | Internal Marks | 30 |
| Number of Lecture Hours/Week | 3 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| Credits – 0 | | | |

**Course Objectives:**

This course will enable the students to:

- Understand the performance characteristics and working of various meters in Electronic Measuring Instruments
- Familiarize with different signal generators & wave analyzers.
- Analyze the functioning of various types of oscilloscopes.
- Design AC bridges which can measure Inductance, Capacitance, Resistance
- Recognize and describe significance and working of different types of transducers.

| Unit -1 | Hours |
|---|---|
| **Measurement and Error:** Performance characteristics of instruments, Static characteristics, Accuracy, Resolution, Precision, Expected value, Error, Sensitivity. Errors in Measurement, Dynamic Characteristics, speed of response, Fidelity, Lag and Dynamic error.<br>**Voltmeters, Ammeters:** DC Voltmeters, Multi-range voltmeters, AC voltmeters, True RMS responding voltmeter. Ammeter, Ohmmeters, series type, shunt type. | **10** |
| **Unit -2** | |
| **Signal Generator**- Fixed and variable, AF oscillators, Standard and AF sine and square wave signal generators, Function Generators, Square pulse, Random noise, sweep, Wave Analyzers, Harmonic Distortion Analyzers, Spectrum Analyzers. | **9** |
| **Unit – 3** | |
| **Oscilloscopes** CRT features, vertical amplifiers, horizontal deflection system, sweep, trigger pulse, delay line, sync selector circuits, Dual beam CRO, Dual trace oscilloscope, sampling oscilloscope, digital storage oscilloscope, Lissajous method of frequency measurement. | **10** |
| **Unit – 4** | |
| **AC Bridges** Measurement of inductance- Maxwell's bridge, Hay's bridge Anderson bridge, Owen's bridge. Measurement of capacitance -Schering Bridge, De Sauty bridge. Wheat stone bridge. Wien Bridge, Sources of errors in bridge circuits, Precautions and techniques used for reducing errors in bridges. | **10** |
| **Unit – 5** | |
| **Transducers**: Active & passive transducers, Resistance, Capacitance, inductance; Strain gauges, LVDT, Piezo Electric transducers, Thermocouples, Thermistors. | **9** |

**Course outcomes:**

On completion of the course student will be able to

1. Interpret the performance characteristics and principle of various meters in Electronic Measuring Instruments.
2. Use different types of Electronic equipment for generating and analysing various signals.
3. Discriminate a signal / waveform with various types of oscilloscopes.
4. Construct AC bridges which can measure Inductance, Capacitance, Resistance

5. Summarize the working of active & passive transducers
6. Distinguish various transducers for measurement of different parameters.

**Text Books:**

1. Electronic instrumentation, second edition - H.S.Kalsi, Tata McGraw Hill, 2004.
2. A. K. Sawhney, Electronics and Electrical Measurements, Dhanpat Rai &Sons. ISBN -81-7700-016-0

**Reference Books**:

1. Modern Electronic Instrumentation and Measurement Techniques – A.D. Helfrick and W.D. Cooper, PHI, 5th Edition, 2002.
2. Electronic Test Instruments, Analog and Digital Measurements - Robert A.Witte, Pearson Education, 2nd Ed., 2004.
3. Electronic Instrumentation & Measurements - David A. Bell, PHI, 2nd Edition, 2003.

## Professional Elective -III

| S.No | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | 18ETETP702A | Radar and Satellite Communications | 3 | 0 | 0 | 3 |
| 2 | 18ETETP702B | Low Power VLSI Design | 3 | 0 | 0 | 3 |
| 3 | 18ETETP702C | System On Chip Architectures | 3 | 0 | 0 | 3 |
| 4 | 18ETETP702D | Bio-Medical Signal Processing | 3 | 0 | 0 | 3 |

## Radar and Satellite Communications
### (Professional Elective –III)
SEMESTER VII

| | | | |
|---|---|---|---|
| Subject Code | 18ETETP702A | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |

Credits – 3

**Course Objectives:**
This course will enable the students to:

- The goal of the course is to introduce students to the fundamentals of radar and satellite communication.
- To expose them to examples of applications and trade-offs that typically occur in engineering system design, and to ask them to apply the knowledge in design problems
- This course contributes to the educational objectives - Fundamental knowledge, specialization, design skills, and self – learning.

| Unit -1 | Hours |
|---|---|
| **Introduction to Radar**<br>Introduction to radar, Radar block diagram and operation, Radar frequencies, Applications of radar, Prediction of range performance, Minimum detectable signal, Receiver noise, Probability density function, SNR, Integration of radar pulses, Radar cross-section of targets, PRF and range ambiguities, Transmitter power, System losses. | **10** |
| **Unit -2** | |
| **Radar Technology**<br>Doppler Effect, CW radar, FM CW radar, multiple frequency CW radar. MTI radar, Delay line canceller, Range gated MTI radar, Blind speeds, Staggered PRF, Limitations to the performance of MTI radar, Non-coherent MTI radar. Tracking radar: sequential lobbing, conical scan, Monopulse: amplitude comparison and phase comparison methods, Radar antennas. Radar displays. | **9** |
| **Unit – 3** | |
| **Introduction to Satellite Communication**<br>Orbital aspects of Satellite Communication: Introduction to geo-synchronous and geostationary satellites, Kepler's laws, locating the satellite with respect to the earth, Subsatellite point, Look angles, Mechanics of launching a synchronous satellite, Orbital effects, Indian scenario in communication satellites | **10** |
| **Unit – 4** | |
| **Spacecraft and Earth station**<br>Satellite sub-systems: Attitude and Orbit control systems, Telemetry, Tracking and command control system, Power supply system, Space craft antennas, and multiple access techniques, comparison of FDMA, TDMA, and CDMA. Earth station equipments, tracking systems | **10** |
| **Unit – 5** | |
| **Satellite Link Design**<br>Introduction to satellite link design, basic transmission theory, system noise temperature and G/T ratio, design of down link and uplink, design of satellite links for specified C/N, satellite data communication protocols. | **9** |

**Course outcomes:**
On completion of the course student will be able to

1. Analyze the RADAR equation and required parameters

2. Understand various RADAR technologies and concept of radar tracking.
3. Learn the communication satellite mechanics and keplers laws.
4. Analyze various orbital parameters and orbital effects.
5. Explain AOCS and various types of access techniques.
6. Analyze satellite link design and calculate C/N

**Text Books:**

1. Merril. I. Skolnik, “Introduction to Radar Systems”, 2/e, MGH, 1981.
2. Mark A. Richards, James A. Scheer and William A. Holm, “Principles of Modern Radar: Basic Principles,” YesDee Publishing Pvt. Ltd., India, 2012.

**Reference Books**:

1. Byron Edde, “Radar: Principles, Technology, Applications”, Pearson, 2008.
2. Timothy Pratt and Charles Bostian, “Satellite Communications”, John Wiley, 1986.
3. Dennis Roddy, “Satellite Communications”, MGraw Hill, Millan, 4th edition, 2013

# Low Power VLSI Design

**(Professional Elective –III)**

SEMESTER VII

| | | | |
|---|---|---|---|
| Subject Code | 18ETETP702B | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |

Credits – 3

**Course Objectives:**

This course will enable the students to:

- To study the fundamental concepts in low power CMOS VLSI design.
- To understand the design concepts of low power circuits.
- To realize the applications in low power design.
- To understand the design of low power low voltage ROM.
- To understand the designs of low power low voltage RAM.

| Unit -1 | Hours |
|---|---|
| **Low-Power CMOS VLSI Design**: Sources of power dissipation, static power dissipation, active power dissipation, designing of low power, circuit techniques for leakage power reduction. | **9** |
| **Unit -2** | |
| **Low-Voltage Low-Power Adders:** Standard adder cells, CMOS adder's architectures, Bi-CMOS Adder, low-voltage low-power design techniques, current-mode adder | **9** |
| **Unit – 3** | |
| **Low-Voltage Low-Power Adders:** Overview of multiplication, types of multiplier architectures, Braun multiplier, Baugh-Wooley multiplier, Booth multiplier, Wallace tree multiplier.<br>**Low-Voltage Low-Power Read-Only Memories**: Types of ROM, basic physics of floating gate non-volatile devices, floating gate memories, basics of ROM | **10** |
| **Unit – 4** | |
| **Low-Voltage Low-Power Read-Only Memories**: Low power ROM technology, future trend and development of ROMs. | **10** |
| **Unit – 5** | |
| **Low-Voltage Low-Power Random-Access Memories:** Basics of SRAM, memory cell, pre-charge and equalization circuit, decoder, sense amplifier, output latch, low power SRAM technologies, future trend and development of SRAM, types of DRAM, basics of DRAM, self-refresh circuit, future trend and development of DRAM. | **10** |

**Course outcomes:**

On completion of the course student will be able to

1. Understand fundamental concepts in low power CMOS VLSI design.
2. Design Basic cells with low power
3. Realize the applications in low power design
4. Understand the applications and developments in low power low voltage ROM
5. Understand the design of low power low voltage RAM.

**Text Books:**

1. Low-Voltage, Low-Power VLSI Subsystems – Kiat-Seng Yeo & Kaushik Roy - Tata McGraw-Hill Education Private Limited, 2009.
2. Low Power Design Methodologies - J. M. Rabaey and M. Pedram Boston – Springer Publications, 1996.

**Reference Books**:

1. CMOS Digital Integrated Circuits Analysis and Design- Sung-Mo Kang, Yusuf Leblebici, Tata McGraw-Hill Education, 2003.
2. Low-Voltage CMOS VLSI Circuits - J. B. Kuo and J.-H. Lou - New York: WileyInterscience Publications,1999.

## System on Chip Architectures

**(Professional Elective –III)**

SEMESTER VII

| | | | |
|---|---|---|---|
| Subject Code | 18ETETP702C | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |

Credits – 3

**Course Objectives:**

This course will enable the students to:

- Analyze different Design and Validation methodologies for logic cores such as memories, analog devices and SoC
- Understand and analyze different topologies of Networks on Chip.
- Analyze security issues of On chip Communication
- Understand on chip communication protocols, compliance verification
- Analyze security issues of On chip Communication

| Unit -1 | Hours |
|---|---|
| **SoC Design flow**: General guide lines for design reuse, design process for soft, firm and hard cores, system integration. Design Methodology for Memory Cores and Analog cores: Design methodology for embedded memories, specifications of analog circuits | **9** |
| **Unit -2** | |
| **Design Validation:** core level validation, core interface verification, SoC design validation. On-chip communication Architectures: A quick overlook | **9** |
| **Unit – 3** | |
| **Basic concepts of bus based communication Architectures:** Terminology, characteristics of Bus based communication architectures, data transfer modes, Bus topology types<br>**On chip Communication Architecture Standard:** standard on chip bus based communication architectures; socket based on chip interface standards | **10** |
| **Unit – 4** | |
| **Validation & Security in SOC:** verification of on chip communication protocols, compliance verification for IP block integration, basic concepts for SoC security, security support in standard bus protocols, | **10** |
| **Unit – 5** | |
| **Networks on chip:** network topology, switching strategies, routing algorithms, flow control, clocking schemes, NOC architectures. | **10** |

**Course outcomes:**

On completion of the course student will be able to

1. Able to understand and design methodologies for SOC
2. Able to understand On chip Communication Architecture Standards
3. Able to analyze security issues of On chip Communication Architecture standards
4. Able to understand and analyze different Topologies of Networks on Chip.
5. Verification of on chip communication protocols, compliance verification and analyze security issues of On chip Communication

**Text Books:**

1. System On a Chip Design and Test, By Rochit Rajsuman, Library of Congress Cataloging in- Publication Data,2000.
2. On chip communication Architectures? by Sudeep Pasricha and Nikil Dutt , Morgan Kaufmann Publishers,2008

**Reference Books**:

1. Computer System Design System-on-Chip by Michael J. Flynn and Wayne Luk, Wiely India Pvt. Ltd.
2. System on Chip Verification – Methodologies and Techniques –Prakash Rashinkar, Peter Paterson and Leena Singh L, 2001, Kluwer Academic Publishers.

# Biomedical Signal Processing
## (Professional Elective –III)
SEMESTER VII

| | | | |
|---|---|---|---|
| Subject Code | 18ETETP702D | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |

Credits – 3

**Course Objectives:**
This course will enable the students to:
- Describe the Detection of biomedical signals in noise
- Analyze the Spectral analysis of heart rate variability - interaction with other physiological signals
- Understand the categorization of EEG activity - recording techniques - EEG applications
- Analyze the stochastic models – Non-linear modeling of EEG

| **Unit -1** | **Hours** |
|---|---|
| **Introduction To Biomedical Signals** - Examples of Biomedical signals - ECG, EEG, EMG etc., Tasks in Biomedical Signal Processing - Computer Aided Diagnosis. Origin of bio potentials - Review of linear systems - Fourier Transform and Time Frequency Analysis (Wavelet) of biomedical signals- Processing of Random &Stochastic signals – spectral estimation – Properties and effects of noise in biomedical instruments - Filtering in biomedical instruments. | **10** |
| **Unit -2** | |
| **Concurrent, Coupled and Correlated Processes - Illustration with case studies** – Adaptive and optimal filtering - Modeling of Biomedical signals - Detection of biomedical signals in noise -removal of artifacts of one signal embedded in another -Maternal-Fetal ECG - Muscle-contraction interference. Event detection – case studies with ECG & EEG - Independent Component Analysis - Cocktail party problem applied to EEG signals -Classification of biomedical signals | **10** |
| **Unit – 3** | |
| **Cardio Vascular Applications:** Basic ECG - Electrical Activity of the heart- ECG data acquisition – ECG parameters & their estimation - Use of multi-scale analysis for ECG parameters estimation - Noise &Artifacts- **ECG Signal Processing:** Baseline Wandering, Power line interference, Muscle noise filtering – QRS detection -Arrhythmia analysis | **10** |
| **Unit – 4** | |
| **Data Compression: Lossless &Lossy- Heart Rate Variability** – Time Domain measures - Heart Rhythm representation - Spectral analysis of heart rate variability - interaction with other physiological signals | **9** |
| **Unit – 5** | |
| **Neurological Applications:** The electroencephalogram - EEG rhythms & waveform - categorization of EEG activity - recording techniques - EEG applications- Epilepsy, sleep disorders, brain computer interface. Modeling EEG- linear,<br>**Stochastic models** – Non-linear modeling of EEG - artifacts in EEG & their characteristics and processing – Model based spectral analysis - EEG segmentation - Joint Time-Frequency analysis – correlation analysis of EEG channels - coherence analysis of EEG channels. | **9** |

**Course outcomes:**

On completion of the course student will be able to

1. Understand the need of biomedical signals
2. Describe the Detection of biomedical signals in noise
3. Understand ECG, ECG parameters estimation
4. Analyze the Spectral analysis of heart rate variability - interaction with other physiological signals
5. Understand the categorization of EEG activity - recording techniques - EEG applications
6. Analyze the stochastic models – Non-linear modeling of EEG

**Text Books:**


1. D.C.Reddy ,"Biomedical Signal Processing: Principles and techniques" ,Tata McGraw Hill, New Delhi
2. Willis J Tompkins , Biomedical Signal Processing -, ED, Prentice – Hall


**Reference Books**:


1. Biomedical Signal Processing, MetinAkay, Academic Press
2. Biomedical Signal Processing: Volume 2: Compression and Automatic Recognition, ArnonCohen, CRC Press
3. Biomedical Signal Processing: Advances in Theory, Algorithms and Applications, Ganesh Naik, Springer

## Professional Elective -IV

| S.No | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | 18ETETP703A | Software Defined Radio | 3 | 0 | 0 | 3 |
| 2 | 18ETETP703B | CPLD and FPGA Architectures & Applications | 3 | 0 | 0 | 3 |
| 3 | 18ETETP703C | Wireless Technologies for IOT | 3 | 0 | 0 | 3 |
| 4 | 18ETETP703D | Artificial Neural Networks | 3 | 0 | 0 | 3 |

## Software Defined Radio

**(Professional Elective –IV)**

SEMESTER VII

| | | | |
|---|---|---|---|
| Subject Code | 18ETETP703A | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |

Credits – 3

**Course Objectives:**

This course will enable the students to:

- Student shall be able to understand the concepts involved in software radio
- Shall be able to understand the concepts of filters used in multirate signal processing
- Shall be able to understand the synthesization of signals
- Shall be able to understand the designs of smart antennas
- Shall be able to understand the design of software radio.

| Unit -1 | Hours |
|---|---|
| **INTRODUCTION TO SOFTWARE RADIO CONCEPTS**: The need for Software radios and its definition, Characteristics and benefits of Software radio, Design principles of a software radio. Radio Frequency Implementation Issues: Purpose of RF front – end, Dynamic range, RF receiver front – end topologies, Enhanced flexibility of the RF chain with software radios, Importance of the components to overall performance, Transmitter architectures and their issues, Noise and distortion in the RF chain, ADC & DAC distortion, Pre-distortion, Flexible RF systems using microelectro mechanical systems. | **10** |
| **Unit -2** | |
| **MULTIRATE SIGNAL PROCESSING IN SDR**: Sample rate conversion principles, Polyphase filters, Digital filter banks, Timing recovery in digital receivers using multirate digital filters. | **9** |
| **Unit – 3** | |
| **DIGITAL GENERATION OF SIGNALS**: Introduction, Comparison of direct digital synthesis with analog signal synthesis, Approaches to direct digital synthesis, Analysis of spurious signals, Spurious components due to periodic jitter, Band pass signal generation.<br>**Performance of direct digital synthesis systems**: Hybrid DDS – PLL Systems, Applications of direct digital synthesis, Generation of random sequences, ROM compression techniques. | **10** |
| **Unit – 4** | |
| **SMART ANTENNAS:** Introduction, Vector channel modelling, Benefits of smart antennas, Structures for beam forming systems, Smart antenna algorithms, Diversity and Space time adaptive signal processing, Algorithms for transmit STAP, Hardware implementation of smart antennas, Array calibration, Digital Hardware Choices-Key hardware elements, DSP processors, FPGAs, Power management issues | **10** |
| **Unit – 5** | |
| **OBJECT ORIENTED REPRESENTATION OF RADIOS AND NETWORK**: Networks, Object –oriented programming, Object brokers, Mobile application environments, Joint Tactical radio system. Case Studies in Software Radio Design: SPEAKeasy, JTRS, Wireless Information transfer system, SDR-3000 digital transceiver subsystem, Spectrum Ware, Brief introduction to Cognitive Networking. | **9** |

**Course outcomes:**

| |
|---|
| On completion of the course student will be able to<br>1. Understand the applications of software radio<br>2. Design filters used in multirate signal processing<br>3. Generate synthesized signals<br>4. Analyze the requirements for design of smart antennas<br>5. Understand the design of software radio and motivated towards cognitive radio application |
| **Text Books:**<br>1. Jeffrey Hugh Reed, “Software Radio: A Modern Approach to Radio Engineering,” Prentice Hall Professional, 2002.<br>2. Paul Burns, “Software Defined Radio for 3G,” Artech House, 2002. |
| **Reference Books**:<br>1. Tony J Rouphael, “RF and DSP for SDR,” Elsevier Newnes Press, 2008.<br>2. P. Kenington, “RF and Baseband Techniques for Software Defined Radio,” Artech House, 2005. |

# CPLD and FPGA Architectures & Applications

**Professional Elective -IV**

SEMESTER VII

| | | | |
|---|---|---|---|
| Subject Code | 18ETETP703B | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |

Credits – 3

**Course Objectives:**

This course will enable the students to:

- Understand the logic devices and need
- Gain knowledge on Programmable logic arrays and FPGAs
- Explain the significance of SRAM and fuse programming

| Unit -1 | Hours |
|---|---|
| **Introduction to Programmable Logic Devices**: Introduction, Simple Programmable Logic Devices – Read Only Memories, Programmable Logic Arrays, Programmable Array Logic, Programmable Logic Devices/Generic Array Logic; Complex Programmable Logic Devices – Architecture of Xilinx Cool Runner XCR3064XL CPLD, CPLD Implementation of a Parallel Adder with Accumulation. | **10** |
| **Unit -2** | |
| **Field Programmable Gate Arrays**: Organization of FPGAs, FPGA Programming Technologies, Programmable Logic Block Architectures, Programmable Interconnects, and Programmable I/O blocks in FPGAs. | **9** |
| **Unit – 3** | |
| **Field Programmable Gate Arrays**: Dedicated Specialized Components of FPGAs, and Applications of FPGAs.<br>**SRAM Programmable FPGAs**: Introduction, Programming Technology, Device Architecture, the Xilinx XC2000, XC3000 and XC4000 Architectures. | **10** |
| **Unit – 4** | |
| **Anti-Fuse Programmed FPGAs**: Introduction, Programming Technology, Device Architecture, the Actel ACT1, ACT2 and ACT3 Architectures. | **9** |
| **Unit – 5** | |
| **Design Applications**: General Design Issues, Counter Examples, A Fast Video Controller, and A Position Tracker for a Robot Manipulator, A Fast DMA Controller, Designing Counters with ACT devices, Designing Adders and Accumulators with the ACT Architecture. | **10** |

**Course outcomes:**

On completion of the course student will be able to

1. Understand the concept of PLDs
2. Explain the architectures of FPGAs and its operation.
3. Gain the knowledge on SRAM programming for FPGAs.
4. Design the programmed FPGA using programming technology for various applications.
5. Design adders and accumulators with ACT devices.

**Text Books:**

- Stephen M. Trimberger, “Field Programmable Gate Array Technology”, Springer International Edition.
- Charles H. Roth Jr, Lizy Kurian John, “Digital Systems Design”, Cengage Learning.

**Reference Books**:

- John V. Oldfield, Richard C. Dorf, “Field Programmable Gate Arrays”, Wiley India.
- Pak K. Chan/Samiha Mourad, “Digital Design Using Field Programmable Gate Arrays”, Pearson Low Price Edition.
- Ian Grout, “Digital Systems Design with FPGAs and CPLDs”, Elsevier, Newnes.
- Wayne Wolf, “FPGA based System Design”, Prentice Hall Modern Semiconductor Design Series.

## Wireless Technologies for IOT

**(Professional Elective –IV)**

SEMESTER VII

| | | | |
|---|---|---|---|
| Subject Code | 18ETETP703C | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |

Credits – 3

**Course Objectives:**

This course will enable the students to:

- Understand Radio Frequency (RF)Fundamentals
- Understand the Factors affecting network range
- Understand the basics of embedded wireless application development
- Understand Wireless Personal Area Networks

| Unit -1 | Hours |
|---|---|
| **Audio Frequency (RF) Fundamentals**: Introduction to RF & Wireless Communications Systems, RF and Microwave Spectral Analysis, Communication Standards, Understanding RF& Microwave Specifications. Spectrum Analysis of RF Environment | **10** |
| **Unit -2** | |
| **CCC & RF Measurements**: Factors affecting network range and speed, Environment, Line-of-sight, Interference, Defining differences between physical layers-OFDM. | **9** |
| **Unit – 3** | |
| **Cellular carriers and Frequencies**: Channel allocation, Cell coverage, Cell Splitting, Microcells, Pico cells, Handoff.<br>**Cellular Systems:** 1st, 2nd, 3rd and 4th Generation Cellular Systems(GSM, CDMA, GPRS, EDGE,UMTS), Mobile IP, WCDMA | **9** |
| **Unit – 4** | |
| **IEEE WLAN Standards:** Wi-Fi Alliance, WLAN Connectivity, WLAN QoS & Power-Save, IEEE 802.11 Standards,802.11- 2007,802.11a/b/g, 802.11e/h/I,802.11n<br>**WLAN Infrastructure :** Access Points, WLAN Routers, WLAN Bridges, WLAN Repeaters, Direct-connect Aps, Distributed connect Aps, PoE Infrastructure, Endpoint, Client hardware and software, Wi-Fi Applications. | **10** |
| **Unit – 5** | |
| **WPANs :** Wireless Personal Area Networks, Bluetooth, Bluetooth Standards, BlueTooth Protocol Architecture, UWB, IEEE 802.15 standards, ZigBee, Sub1GHz, Sensor Networks, coexistence strategies in Sensor Networks, Routing protocols in Wireless Sensor Networks | **10** |

**Course outcomes:**

On completion of the course student will be able to

1. Remember and understand Radio Frequency (RF)Fundamentals
2. Understand the Factors affecting network range
3. Illustrate the various cellular standards
4. Understand the different wireless technologies
5. Understand the basics of embedded wireless application development
6. Remember and understand Wireless Personal Area Networks

**Text Books:**

1. Wireless Communications – Principles and Practice; by Theodore S Rappaport, Pearson Education Pte. Ltd., Delhi

2. Wireless Communications and Networking; By: Stallings, William; Pearson Education Pte. Ltd., Delh
3. Wilson , "Sensor Technology hand book," Elsevier publications 2005

**Reference Books**:

1. Bluetooth Revealed; By: Miller, Brent A, Bisdikian, Chatschik; Addison Wesley Longman Pte Ltd., Delhi
2. Andrea Goldsmith, "Wireless Communications," Cambridge University Press, 2005
3. Mobile and Personal Communications Services and Systems; 1st Edition; By: Raj Pandya; PHI, New Delhi

## Artificial Neural Networks

**(Professional Elective –IV)** SEMESTER VII

| | | | |
|---|---|---|---|
| Subject Code | 18ETETP703D | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |

Credits – 3

**Course Objectives:**

This course will enable the students to:

- The main objective of this course is to provide the student with the basic Understanding of neural networks fundamentals,
- Program the related algorithms
- Design the required and related systems

| Unit -1 | Hours |
|---|---|
| **Introduction and ANN Structure**, Biological neurons and artificial neurons. Model of an ANN. Activation functions used in ANNs. Typical classes of network architectures. | **10** |
| **Unit -2** | |
| **Mathematical Foundations and Learning mechanisms**: Re-visiting vector and matrix algebra, State-space concepts, Concepts of optimization, Error-correction learning. Memory based learning, Hebbian learning. Competitive learning. | **10** |
| **Unit – 3** | |
| **Single layer perceptrons**, Structure and learning of perceptrons, Pattern classifier, introduction and Bayes' classifiers, Perceptron as a pattern classifier. **Perceptron convergence:** Need and Limitations of a perceptrons. | **9** |
| **Unit – 4** | |
| **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 | **10** |
| **Unit – 5** | |
| **Radial Basis Function Networks**, Pattern separability and interpolation, Regularization Theory Regularization and RBF networks.RBF network design and training. Approximation properties of RBF. | **9** |

**Course outcomes:**

On completion of the course student will be able to

1. Demonstrate ANN structure and activation Functions
2. Define foundations and learning mechanisms and state-space concepts
3. Identify structure and learning of perceptions
4. Explain Feed forward, multi-layer feed forward networks and Back propagationalgorithms
5. Analyze Radial Basis Function Networks, Theor Regularization and RBF networks

**Text Books:**

1. Simon Haykin, "Neural Networks: A comprehensive foundation", Second Edition, Pearson Education Asia.
2. Satish Kumar, "Neural Networks: A classroom approach", Tata McGraw Hill, 2004.

**Reference Books**:

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

## Professional Elective -V

| S.No | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | 18ETETP704A | Global Positioning Systems | 3 | 0 | 0 | 3 |
| 2 | 18ETETP704B | CAD Tools for VLSI | 3 | 0 | 0 | 3 |
| 3 | 18ETETP704C | Big Data Analytics for IoT | 3 | 0 | 0 | 3 |
| 4 | 18ETETP704D | Fuzzy Logic Systems | 3 | 0 | 0 | 3 |

## Global Positioning Systems
**(Professional Elective –V)**
SEMESTER VII

| | | | |
|---|---|---|---|
| Subject Code | 18ETETP704A | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |

Credits – 3

**Course Objectives:**
This course will enable the students to:
- To introduce fundamental blocks of global positioning system
- To analysis on signal characteristics of GPS
- Explore to the GPS Design analysis
- Illustrate about differential GPS
- Introduce about applications of GPS

| Unit -1 | Hours |
|---|---|
| **Introduction**: Basic concept, system architecture, GPS and GLONASS Overview, Satellite Navigation, Time and GPS, User position and velocity calculations, GPS, Satellite Constellation, Operation Segment, User receiving Equipment, Space Segment Phased development, GPS aided Geoaugmented navigation (GAGAN) architecture. | **10** |
| **Unit -2** | |
| **Signal Characteristics**: GPS signal components, purpose, properties and power level, signal acquisition and tracking , Navigation information extraction, pseudorange estimation, frequency estimation, GPS satellite position calculation, Signal structure, anti spoofing (AS), selective availability, Difference between GPS and GALILEO satellite construction. | **9** |
| **Unit – 3** | |
| **GPS Receivers & Data Errors:** Receiver Architecture, receiver design options, Antenna design, GPS error sources, SA errors, propagation errors, ionospheric error, tropospheric error, multipath, ionospheric error, estimation using dual frequency GPS receiver.<br>**Multipath Mitigation:** Methods of multipath mitigation, Ephemeris data errors, clock errors. | **10** |
| **Unit – 4** | |
| **Differential GPS**: Introduction, LADGPS, WADGPS, Wide Area Augmentation systems , GEO Uplink subsystem , GEO downlink systems , Geo Orbit determination , Geometric analysis , covariance analysis , GPS /INS Integration Architectures | **9** |
| **Unit – 5** | |
| **GPS Applications**: GPS in surveying, Mapping and Geographical Information System, Precision approach Aircraft landing system, Military and Space application, intelligent transportation system. GPS orbital parameters, description of receiver independent exchange format (RINEX) , Observation data and navigation message data parameters, GPS position determination, least squares method | **10** |

**Course outcomes:**
On completion of the course student will be able to
1. Explain about fundamental blocks of global positioning system
2. signal characteristics of GPS are analyzed
3. Explore to the GPS Design analysis.
4. Illustrate about differential GPS

| |
|---|
| 5. Explain and trained towards applications of GPS |
| **Text Books:**<br>1. Mohinder S.Grewal, Lawrence R.Weill, Angus P.Andrews, “Global positioning systems, Inertial Navigation and Integration”, Wiley 2007. |
| **Reference Books**:<br>1. E.D.Kaplan, Christopher J. Hegarty, “Understanding GPS Principles and Applications”, Artech House Boston 2005. |

# CAD Tools for VLSI

**(Professional Elective –V)** SEMESTER VII

| | | | |
|---|---|---|---|
| Subject Code | 18ETETP704B | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |

Credits – 0

**Course Objectives:**

This course will enable the students to:

- Hardware software co-design
- Synthesis tools and VHDL modelling for digital circuits
- Computational complexity issues in testing the circuits
- Simulation for various design circuits

| Unit -1 | Hours |
|---|---|
| **Introduction to VLSI design methodologies and supporting CAD environment Schematic editors: Parsing**: Reading files, describing data formats, Graphics & Plotting Layout. **Layout Editor:** Turning plotter into an editor. **Layout language:** Parameterized cells, PLA generators, Introduction to Silicon compiler, Data path. Compiler, Placement & routing, Floor planning. | **10** |
| **Unit -2** | |
| **Layout Analysis**: Design rules, Object based DRC, Edge based layout operations. Module generators. | **9** |
| **Unit – 3** | |
| **Simulation:** Types of simulation, Behavioral simulator, logic simulator, functional simulator & Circuit simulator. **Simulation Algorithms:** Introduction and significance of Compiled code and Event-driven simulation algorithms. | **10** |
| **Unit – 4** | |
| **Optimization Algorithms:** Greedy methods, simulated annealing, genetic algorithm and neural models. | **9** |
| **Unit – 5** | |
| **Testing ICs:** Fault simulation, Aids for test generation and testing. Computational complexity issues: Big Oh and big omega terms. **Recent topics in CAD-VLSI:** Array compilers, hardware software co-design, high-level synthesis tools and VHDL modeling. | **10** |

**Course outcomes:**

On completion of the course student will be able to

1. Explain VLSI design methodologies and supporting CAD environment
2. Understand the Plotting Layout, Layout Editor
3. Analyze the Placement & routing, Floor planning
4. Understand Simulation techniques for various design circuits
5. Explain Optimization Algorithms for the design circuits
6. Analyze the Computational complexity issues in testing the circuits

**Text Books:**

1. Stephen Trimberger," Introduction to CAD for VLSI", Kluwer Academic publisher, 2002
2. Naveed Shervani, "Algorithms for VLSI physical design Automation", Kluwer Academic Publisher, Second edition.

**Reference Books**: 1. Gaynor E. Taylor, G. Russell, "Algorithmic and Knowledge Based CAD for VLSI", Peter peregrinus ltd. London.

2. Gerez, "Algorithms VLSI Design Automation", John Wiley & Sons.

## Big Data Analytics for IoT

**(Professional Elective –V)**

SEMESTER VII

| | | | |
|---|---|---|---|
| Subject Code | 18ETETP704C | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| Credits – 3 | | | |

**Course Objectives:**

This course will enable the students to:

- Acquire the knowledge of FOG computing
- Describe Building a useful understanding of a social network
- Understand Toward Web Enhanced Building Automation Systems
- Understand RFID False Authentication
- Describe the Big Data Platforms for the Internet of Things
- Understand Sustainability Data and Analytics in Cloud-Based M2M Systems

| Unit -1 | Hours |
|---|---|
| **Big Data Platforms for the Internet of Things:** network protocol- data dissemination – current state of art- Improving Data and Service Interoperability with Structure, Compliance, Conformance and Context Awareness: interoperability problem in the IoT context- Big Data Management Systems for the Exploitation of Pervasive Environments - Big Data challenges and requirements coming from different Smart City applications | **10** |
| **Unit -2** | |
| **On RFID False Authentications:** YA TRAP – Necessary and sufficient condition for false authentication prevention - Adaptive Pipelined Neural Network Structure in Self aware Internet of Things: self-healing systems- Role of adaptive neural network- Spatial Dimensions of Big Data: Application of Geographical Concepts and Spatial Technology to the Internet of Things- Applying spatial relationships, functions, and models | **9** |
| **Unit – 3** | |
| **Fog Computing:** A Platform for Internet of Things and Analytics: a massively distributed number of sources .<br>**Big Data Metadata Management in Smart Grids:** semantic inconsistencies – role of metadata | **9** |
| **Unit – 4** | |
| **Toward Web Enhanced Building Automation Systems:** heterogeneity between existing installations and native IP devices - loosely-coupled Web protocol stack –energy saving in smart building- Intelligent Transportation Systems and Wireless Access in Vehicular Environment Technology for Developing Smart Cities: advantages and achievements- Emerging Technologies in Health Information Systems: Genomics Driven Wellness Tracking and Management System (GO-WELL) – predictive care – personalized medicine | **10** |
| **Unit – 5** | |
| **Sustainability Data and Analytics in Cloud-Based M2M Systems** – potential stakeholders and their complex relationships to data and analytics applications – Social Networking Analysis<br>**Building a useful understanding of a social network** – Leveraging social media and IoT to Bootstrap Smart Environments: lightweight Cyber Physical Social Systems - citizen actuation | **10** |

**Course outcomes:**

On completion of the course student will be able to

1. Describe the Big Data Platforms for the Internet of Things
2. Understand RFID False Authentication
3. Acquire the knowledge of FOG computing
4. Understand Toward Web Enhanced Building Automation Systems
5. Understand Sustainability Data and Analytics in Cloud-Based M2M Systems
6. Describe Building a useful understanding of a social network

**Text Books:**


1. Stackowiak, R., Licht, A., Mantha, V., Nagode, L.," Big Data and The Internet of Things Enterprise Information Architecture for A New Age", Apress
2. Dr. John Bates , "Thingalytics - Smart Big Data Analytics for the Internet of Things", john Bates


**Reference Books**:


1. Big Data Analytics for Internet of Things, Tausifa Jan Saleem, Mohammad Ahsan Chishti, Wiley Publications, 2021.

# FUZZY Logic Systems

**(Professional Elective –V)**

SEMESTER VII

| | | | |
|---|---|---|---|
| Subject Code | 18ETETP704D | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| Credits – 3 | | | |

**Course Objectives:**

This course will enable the students to:

- Understand Fuzzy Logic systems
- Describe properties of classical set and fuzzy sets
- Describe the applications of fuzzy logic
- Analyze the Fuzzy relations and aggregations –I& II
- Describe fuzzy logic for open source using python

| Unit -1 | Hours |
|---|---|
| **Introduction to Fuzzy Logic**: Classical and Fuzzy Sets, Membership Function, Membership Grade, Universe of Discourse, Linguistic Variables, Operations on Fuzzy Sets: Intersections, Unions,. | **9** |
| **Unit -2** | |
| Negation, Product, Difference, Properties of Classical set and Fuzzy sets, Fuzzy vs Probability, Fuzzy Arithmetic, Fuzzy Numbers | **9** |
| **Unit – 3** | |
| **Fuzzy Relations &Aggregations-I:** Essential Elements of Fuzzy Systems, Classical Inference Rule, Classical Implications and Fuzzy Implications.**Crisp Relation and Fuzzy Relations**: Introduction to relations and explanation, Composition of fuzzy relations | **10** |
| **Unit – 4** | |
| **Fuzzy Relations &Aggregations-II:** Cylindrical Extension and Projection. Fuzzy IF-THEN rules, Inference: Scaling and Clipping Method, Aggregation, Fuzzy rule based Model: Mamdani Model, TSK model, Fuzzy Propositions, Defuzzification: MOM, COA | **10** |
| **Unit – 5** | |
| **Fuzzy Optimization and Neuro Fuzzy Systems:** Fuzzy optimization – one-dimensional optimization. Introduction of Neuro-Fuzzy Systems, Architecture of Neuro Fuzzy Networks.<br>**Application of fuzzy logic:** Power plants, Industrial Control, AC Induction motor control, Traffic control, water treatment system, chilling systems, Washing machine Control, Fuzzy logic in DCS &PLC, Industrial Index motion control, Automatic generation control, power control, Automotive applications, Drying process control. Implement using an open source software such as python | **10** |

**Course outcomes:**

On completion of the course student will be able to

1. Understand Fuzzy Logic systems
2. Describe properties of classical set and fuzzy sets
3. Understand Fuzzy relations and aggregations –I
4. Understand Fuzzy relations and aggregations –II
5. Understand Fuzzy optimization
6. Describe the applications of fuzzy logic

**Text Books:**


1. Timothy J. Ross, " Fuzzy Logic With Engineering Applications", Tata McGraw-

| |
|---|
| Hill Inc.<br>2. Kwang Hyung Lee, First Course on Fuzzy Theory and Applications, Springer, |
| **Reference Books**:<br>1. Klir, J.G. – Bo Yuan: Fuzzy Sets and Fuzzy Logic, Prentice Hall<br>2. Nguyen, H. T. – Walker, E. A.: Fuzzy Logic, Chapman and Hall, NY |

**IV B. Tech II Sem Course Structure for**

**(Electronics and Communication Technology)**

**Semester VIII (Fourth year)**

| **S.No** | **Course Code** | **Course Title** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|---|
| 1 | 18ETETPR8010 | Project Work, Seminar & Internship in Industry | 0 | 0 | 0 | 12 |
| | | **Total Credits** | | | | 12 |
| **INTERNSHIP (6 MONTHS)** | | | | | | |

## Project Work

SEMESTER VIII

| | | | |
|---|---|---|---|
| Subject Code | 18ETETPR8010 | Internal Marks | 60 |
| Number of Lecture Hours/Week | 0 | External Marks | 140 |
| Total Number of Lecture Hours | 0 | Exam Hours | 03 |

Credits – 12

***Major Project (*****Project - Project work, seminar and internship in industry):**

In the final semester, the student should mandatorily register and undergo internship and in parallel 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.

***Evaluation****:* The total marks for project work 200 marks and distribution shall be 60 marks for internal and 140 marks for external evaluation. The supervisor assesses the student for 30 marks (Report: 15 marks, Seminar: 15 marks). At the end of the semester, all projects shall be showcased at the department for the benefit of all students and staff and the same is to be evaluated by the departmental Project Review Committee consisting of supervisor, a senior faculty and HOD for 30 marks. The external evaluation of Project Work is a Viva-Voce Examination conducted in the presence of internal examiner and external examiner and is evaluated for 140 marks

# Open Elective
# Courses Offered by All the Departments

# Open Elective Courses Offered by Civil to other Departments

**Open Electives offered by Civil Department:**

| S.No | Subject Code | Subject |
|---|---|---|
| 1 | 18XXCEOXXXX | Civil Engineering-Societal & Global Impact |
| 2 | 18XXCEOXXXX | Introduction to Civil Engineering |
| 3 | 18XXCEOXXXX | Disaster Management |
| 4 | 18XXCEOXXXX | Environmental Pollution and control |
| 5 | 18XXCEOXXXX | Building Materials |
| 6 | 18XXCEOXXXX | Green Buildings and sustainability |

<table>
<tr><th colspan="4">CIVIL ENGINEERING -SOCIETAL & GLOBAL IMPACT</th></tr>
<tr><td>Subject Code</td><td>18XXCEOXXXX</td><td>Internal Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>03</td><td>External Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>48</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">Credits – 03</td></tr>
<tr><td colspan="4">Course Objectives:<br>❖ Awareness of the importance of Civil Engineering and the impact it has on the Society and at global levels<br>❖ Awareness of the impact of Civil Engineering for the various specific fields of human endeavour<br>❖ Need to think innovatively to ensure Sustainability</td></tr>
<tr><td colspan="3">Unit -1</td><td>Hours</td></tr>
<tr><td colspan="3">Understanding the importance of Civil Engineering in shaping and impacting the world; The ancient and modern Marvels and Wonders in the field of Civil Engineering; Future Vision for Civil Engineering</td><td>09</td></tr>
<tr><td colspan="4">Unit -2</td></tr>
<tr><td colspan="3">Infrastructure - Habitats, Megacities, Smart Cities, futuristic visions; Transportation (Roads, Railways & Metros, Airports, Seaports, River ways, Sea canals, Tunnels (below ground, under water); Futuristic systems (ex, Hyper Loop)); Energy generation (Hydro, Solar (Photovoltaic, Solar Chimney), Wind, Wave, Tidal, Geothermal, Thermal energy)</td><td>10</td></tr>
<tr><td colspan="4">Unit – 3</td></tr>
<tr><td colspan="3">Environment- Traditional & futuristic methods; Solid waste management, Water purification, Wastewater treatment & Recycling, Hazardous waste treatment; Flood control (Dams, Canals, River interlinking), Multi-purpose water projects, Atmospheric pollution; Global warming phenomena and Pollution Mitigation measures, Stationary and non- stationary; Environmental Metrics & Monitoring; Other Sustainability measures; Innovations and methodologies for ensuring Sustainability.</td><td>10</td></tr>
<tr><td colspan="4">Unit – 4</td></tr>
<tr><td colspan="3">Built environment – Facilities management, Climate control; Intelligent/ Smart Buildings; Aesthetics of built environment, Role of Urban Arts Commissions; Conservation, Repairs & Rehabilitation of Structures</td><td>09</td></tr>
<tr><td colspan="4">Unit-5</td></tr>
<tr><td colspan="3">Civil Engineering Projects – Environmental Impact Analysis procedures; Waste (materials, manpower, equipment) avoidance/ Efficiency increase; Advanced construction techniques for better sustainability; Techniques for reduction of Green House Gas emissions in various aspects of Civil Engineering Project</td><td>10</td></tr>
<tr><td colspan="4">Course outcomes:<br>On completion of this course, students are able to:<br>❖ Understand the role of Civil Engineering in Modern World<br>❖ Understand various constructional Infrastructure and their importance in present environment<br>❖ Interpret modern transportation systems and their advantages<br>❖ Effect of global Warming and mitigation measures<br>❖ Understand the importance of Sustainability and Reduction of Green House Gas Emissions</td></tr>
</table>

TEXT BOOKS


1. Žiga Turk (2014), Global Challenges and the Role of Civil Engineering, Chapter 3 in: Fischinger M. (eds) Performance-Based Seismic Engineering: Vision for an Earthquake Resilient Society. Geotechnical, Geological and Earthquake Engineering, Vol. 32. Springer, Dordrecht
2. Brito, Ciampi, Vasconcelos, Amarol, Barros (2013) Engineering impacting Social, Economical and Working Environment, 120th ASEE Annual Conference and Exposition
3. NAE Grand Challenges for Engineering (2006), Engineering for the Developing World, The Bridge, Vol 34, No.2, Summer 2004.


REFERENCES


1. Allen M. (2008) Cleansing the city. Ohio University Press. Athens Ohio.
2. Ashley R., Stovin V., Moore S., Hurley L., Lewis L., Saul A. (2010). London Tideway Tunnels Programme – Thames Tunnel Project Needs Report – Potential source control and SUDS applications: Land use and retrofit options
3. http://www.thamestunnelconsultation.co.uk/consultation-documents.aspx
4. Ashley R M., Nowell R., Gersonius B., Walker L. (2011). Surface Water Management and Urban Green Infrastructure. Review of Current Knowledge. Foundation for Water Research FR/R0014

## INTRODUCTION TO CIVIL ENGINEERING

| | | | |
|---|---|---|---|
| Subject Code | 18XXCEOXXXX | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| | | | **Credits – 03** |

**Course Objectives:**

- To give an understanding to the students of the vast breadth and numerous areas of engagement available in the overall field of Civil Engineering
- To motivate the student to pursue a career in one of the many areas of Civil Engineering with deep interest and keenness.
- To expose the students to the various avenues available for doing creative and
- Innovative work in this field by showcasing the many monuments and inspiring projects of public utility.

| **Unit -1 History of Civil engineering** | **Hours** |
|---|---|
| Early constructions and developments over time; Ancient monuments & Modern marvels; Development of various materials of construction and methods of construction; Works of Eminent civil engineers | **10** |
| **Unit -2 Fundamentals of Building Materials** | |
| Stones, bricks, mortars, Plain, Reinforced & Prestressed Concrete, Admixture; Structural Steel, High Tensile Steel, Recycling of Construction & Demolition wastes, Damp Proofing and water proofing materials and uses – Plastering Pointing, white washing and distempering. Paints: Constituents of a paint – Types of paints – Painting of new/old wood-Varnish. Form Works and Scaffoldings. | **10** |
| **Unit – 3 Basics of Construction Management & Contracts Management** | |
| Temporary Structures in Construction; Construction Methods for various types of Structures; Major Construction equipment; Modern Project management Systems; Advent of Lean Construction; Importance of Contracts Management-Terms in Contract-contract Types | **10** |
| **Unit – 4 Surveying & Geomatics** | |
| **Surveying & Geomatics**: Overview of Surveying, Traditional surveying techniques- , Total Stations; GPS & GIS Applications | **09** |
| **Unit-5 Geotechnical Engineering** | |
| Basics of soil mechanics, rock mechanics and geology; various types of foundations; basics of rock mechanics & tunneling | **09** |

**Course outcomes:**

On completion of this course, students are able to:

- Understand the role of Civil Engineering in Modern World
- Know the details and working of various building materials
- Understand the concept of various construction management Techniques
- Know basic surveying methods and their applications
- Understand the importance of soil mechanics and rock mechanics in various structural designs

**TEXT BOOKS**


1. Patil, B.S.(1974), Legal Aspects of Building and Engineering Contract
2. Soil dynamics and machine foundations by K.R. Arora

3. Surveying vol 1&2 by B.C.Punmia, Laxmi publications, 2005
4. Building Materials by P.C.Verghese, PHI learning pvt. Ltd., 2015
5. Meena Rao (2006), Fundamental concepts in Law of Contract, 3rd Edn. Professional Offset

**REFERENCES**


1. Chandiramani, Neelima (2000), The Law of Contract: An Outline, 2nd Edn. Avinash Publications Mumbai
2. Avtarsingh (2002), Law of Contract, Eastern Book Co.
3. Dutt (1994), Indian Contract Act, Eastern Law House
4. The National Building Code, BIS, (2017)

## DISASTER MANAGEMENT

| | | | |
|---|---|---|---|
| Subject Code | 18XXCEOXXXX | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |

**Credits – 03**

**Course Objectives:**

- Develop an understanding of why and how the modern disaster manager is involved with pre-disaster and post-disaster activities.
- Develop an awareness of the chronological phases of natural disaster response and refugee relief operations. Understand how the phases of each are parallel and how they differ.
- Understand the 'relief system' and the 'disaster victim.
- Describe the three planning strategies use full in mitigation.
- Identify the regulatory controls used in hazard management.
- Describe public awareness and economic incentive possibilities.

| **Unit -1 Natural Hazards And Disaster Management** | **Hours** |
|---|---|
| Introduction of DM–Inter Disciplinary –nature of the subject–Disaster Management cycle–Five priorities for action. Case study methods of the following: floods, draughts – Earthquakes – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast– landslides. | **10** |
| **Unit -2 Man Made Disaster And Their Management Along With Case Study Methods Of The Following** | |
| Fire hazards– transport hazard dynamics– solid waste management–post disaster–bio terrotirism- threat in mega cities, rail and aircraft's accidents, and Emerging in factious diseases &Aids and their management. | **09** |
| **Unit – 3 RiskAndVulnerability** | |
| Building codes and land use planning –social vulnerability–environmental vulnerability–Macroeconomic management and sustainable development, climate change risk rendition–financial management of disaster– related losses | **09** |
| **Unit – 4 Role Of Technology In Disaster Managements**: | |
| Disaster management for infrastructures, taxonomy of infrastructure–treatment plants and process facilities-electrical substations- roads and bridges- mitigation programme for earthquakes–flow chart, geospatial information in agriculture drought assessment-multimedia technology in disaster risk management and training- transformable indigenous knowledge in disaster reduction. | **10** |
| **Unit-5 Education And Community Preparedness:** | |
| Education in disaster risk reduction-Essentials of school disaster education-Community capacity and disaster resilience-Community based disaster recovery-Community based disaster management and social capital- Designing resilience-building community capacity for action. | **10** |

**Course outcomes:**

On completion of this course, students are able to

1. Affirm the usefulness of integrating management principles in disaster mitigation work.
2. Distinguish between the different approaches needed to manage pre- during and post-disaster periods.
3. Explain the process of risk management.
4. Relate to risk transfer.
5. Prepare community for risk reduction.

**TEXT BOOKS**

1. Disaster Management–Global Challenges and Local Solutions ’by Rajib shah & RKrishna murthy (2009), Universities press.
2. Disaster Science & Management ’by Tushar Bhattacharya, Tata Mc Graw Hill Education Pvt. Ltd., NewDelhi.
3. Disaster Management–Future Challenges and Opportunities ’by Jagbir Singh(2007),I K International Publishing House Pvt. Ltd.
4. http://ndma.gov.in/ (Home page of National Disaster Management Authority).

<table>
<tr><td colspan="4">ENVIONMENTAL POLLUTION AND CONTROL</td></tr>
<tr><td>Subject Code</td><td>18XXCEOXXXX</td><td>Internal Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>03</td><td>External Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>48</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">Credits – 03</td></tr>
</table>

**Course Objectives:**

- ❖ Impart knowledge on fundamental aspects of air pollution &control, noise pollution, and solid waste management.
- ❖ Provide basic knowledge on sustainable development.
- ❖ Introduces some basics of sanitation methods essential for protection of community health.
- ❖ Differentiate the solid and hazardous waste based on characterization.

| Unit -1 Introduction | Hours |
|---|---|
| **Air Pollution**: Air pollution Control Methods–Particulate control devices– Methods of Controlling Gaseous Emissions–Air quality standards.<br>**Noise Pollution**: Noise standards, Measurement and control methods–Reducing residential and industrial noise– ISO14000. | **10** |
| **Unit -2 Industrial wastewater Management** | |
| Strategies for pollution control- Volume and Strength reduction–Neutralization –Equalization– Proportioning –Common Effluent Treatment Plants-Recirculation of industrial wastes–Effluent standards. | **09** |
| **Unit – 3SolidWasteManagement** | |
| Solid waste characteristics –basics of on-site handling and collection –separation and processing-Incineration- Composting-Solid waste disposal methods– fundamentals of Land filling. | **09** |
| **Unit – 4 Environmental Sanitation** | |
| Environmental Sanitation Methods for Hostels and Hotels, Hospitals, Swimming pools and public bathing places, social gatherings (mela sand fares),Schools and Institutions, Rural Sanitation-low cost waste disposal methods. | **10** |
| **Unit-5 Hazardous Waste** | |
| Characterization – Nuclear waste– Biomedical wastes– Electronic wastes-Chemical wastes–Treatment and management of hazardous waste-Disposal and Control methods. | **10** |

**Course outcomes:**

On completion of this course, students are able to

- ❖ Identify the air pollutant control devices
- ❖ Have knowledge on the NAAQ standard sand air emission standards.
- ❖ Differentiate the treatment techniques used for sewage and industrial waste water treatment methods.
- ❖ Understand the fundamentals of solid waste management; practices adopted in his town/village and its importance in keeping the health of the city.
- ❖ Appreciate the methods o f environmental sanitation and the management of community facilities without spread of epidemics.

| TEXT BOOKS |
|---|
| 1. Environmental E n g i n e e r i n g , byRuth F. Weiner andRobin Matthews– 4thEditionElesevier, 2003.<br>2. Environmental Science and Engineering by J.G.HenryandG.W. Heinke–Pearson Education.<br>3. Environmental Engineering by Mackenzie L Davis &David A Cornwell.McGrawHillPublishing1. Air Pollution and Control by M.N.Rao & H.N.Rao |
| **REFERENCES** |
| 1. Air Pollution and Control by M.N.Rao & H.N.Rao<br>2. Solid Waste Management by K.Sasi Kumar, S.A.GopiKrishna. PHI New Delhi.<br>3. Environmental Engineering by Gerard Kiley, TataMcGrawHill.<br>4. Environmental Sanitation by KVSG Murali Krishna, Reem Publications, New Delhi. |

# BUILDING MATERIALS

| Subject Code | 18XXCEOXXXX | Internal Marks | 30 |
|---|---|---|---|
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |

**Credits – 03**

**Course Objectives:**

- Initiating the student with the knowledge of basic building materials and their properties
- Imparting the knowledge of course pattern in masonry construction and flat roofs and techniques of forming foundation, columns, beams, walls, sloped and flat roofs.
- The student is to be exposed to the various patterns of floors, walls, different types of paints and varnishes.
- Imparting the students with the techniques of formwork and scaffolding
- The students should be exposed to classification of aggregates, moisture content of the aggregate.

| Unit | Hours |
|---|---|
| **Unit -1 Introduction** | **Hours** |
| Stones, Bricks And Tiles Properties of building stones – relation to their structural requirements, classification of stones – stone quarrying – precautions in blasting, dressing of stone, composition of good brick earth, various methods of manufacturing of bricks. Characteristics of good tile - manufacturing methods, types of tiles. Uses of materials like Aluminium, Gypsum, Glass and Bituminous materials | **10** |
| **Unit -2 Masonry** | |
| Types of masonry, English and Flemish bonds, Rubble and Ashlars Masonry. Cavity and partition walls. Wood: Structure – Properties- Seasoning of timber- Classification of various types of woods used in buildings- Defects in timber. Alternative materials for wood – Galvanized Iron, Fiber Reinforced Plastics, Steel, Aluminium | **10** |
| **Unit – 3 Lime And Cement Lime** | |
| Various ingredients of lime – Constituents of lime stone – classification of lime – various methods of manufacture of lime. Cement: Portland cement- Chemical Composition – Hydration, setting and fineness of cement. Various types of cement and their properties. Various field and laboratory tests for Cement. Various ingredients of cement concrete and their importance – various tests for concrete. | **10** |
| **Unit – 4 Building Components** | |
| Lintels, arches, vaults, stair cases – types. Different types of floors – Concrete, Mosaic, and Terrazzo floors, Pitched, flat roofs. Lean to roof, Coupled Roofs. Trussed roofs – King and Queen post Trusses. R.C.C Roofs, Madras Terrace and Pre-fabricated roofs | **09** |
| **Unit-5 Finishing's** | |
| Damp Proofing and water proofing materials and uses – Plastering Pointing, white washing and distempering. Paints: Constituents of a paint – Types of paints – Painting of new/old wood- Varnish. Form Works and Scaffoldings. | **09** |

**Course outcomes:**

On completion of this course, students are able to

- Identify different building materials and their importance in building construction.
- Differentiate brick masonry, stone masonry construction and use of lime and cement in various constructions.

- ❖ Importance of building components and finishings.
- ❖ Classification of aggregates, sieve analysis and moisture content usually required in building construction.
- ❖ Understand the role of different floors, paints, Damp Proofing, structural elements

**TEXT BOOKS**

1. Building Materials, S. S. Bhavikatti, Vices publications House private ltd.
2. Building Construction, S. S. Bhavikatti, Vices publications House private ltd.
3. Building Materials, B. C. Punmia, Laxmi Publications private ltd.
4. Building Construction, B.C. Punmia, Laxmi Publications (p) ltd

**REFERENCES**


1. Building Materials, S. K. Duggal, New Age International Publications.
2. Building Materials, P. C. Verghese, PHI learning (P) ltd.
3. Building Materials, M. L. Gambhir, Tata McGraw Hill Publishing Co. Ltd. New Delhi.
4. Building construction, P. C. Verghese, PHI Learning (P) Ltd.

# GREEN BUILDINGS AND SUSTAINABILITY

| | | | |
|---|---|---|---|
| Subject Code | 18XXCEOXXXX | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |

**Credits –03**

**Course Objectives:**

Enable the students to

- Know the green building and green energy building materials.
- Familiarize with different rating agencies and features of green buildings.
- Understand the term sustainability and sustainable development.
- Learn sources of greenhouse gases and its impact on climate.
- Understand and Plan land use confirming to zonal regulations

| Unit | Hours |
|---|---|
| **Unit -1** | |
| **INTRODUCTION** What is Green Building, Why to go for Green Building, Benefits of Green Buildings, Green Building Materials and Equipment in India, What are key Requisites for Constructing a Green Building, Important Sustainable features for Green Building | **10** |
| **Unit -2** | |
| **GREEN BUILDING CONCEPTS AND PRACTICES** Indian Green Building Council, Green Building Moment in India, Benefits Experienced in Green Buildings, Launch of Green Building Rating Systems, Residential Sector, Market Transformation; Green Building Opportunities And Benefits: Opportunities of Green Building, Green Building Features, Material and Resources, Water Efficiency, Optimum Energy Efficiency, Typical Energy Saving Approach in Buildings, LEED India Rating System and Energy Efficiency, | **10** |
| **Unit – 3** | |
| **SUSTAINABILITY** Introduction, Human development index, Sustainable development and social ethics, definitions of sustainability, populations and consumptions | **09** |
| **Unit – 4** | |
| **THE CARBON CYCLE AND ENERGY BALANCES** Introduction, Climate science history, carbon sources and emissions, The carbon cycle, carbon flow pathways, and repositories, Global energy balance, Global energy balance and temperature model, Greenhouse gases and Effects, Climate change projections and impacts | **09** |
| **Unit-5** | |
| **SUSTAINABILITY AND BUILT ENVIRONMENT** Introduction, Land use and land cover change, Land use planning and its role in sustainable development-Zoning and land use planning, smart growth, Environmentally sensitive design- low impact development, green infrastructure and conservation design, Green buildings and land use planning, Energy use and buildings | **10** |

**Course outcomes:**

On completion of this course, students are able to:

- ❖ Describe green buildings and green building materials.
- ❖ Acquaint with different rating agencies and energy features of green buildings.
- ❖ Understand the term sustainability and sustainable development.
- ❖ Recognize sources of green house gases emissions and its impact on climate.
- ❖ Plan land use confirming to zonal regulations.

**TEXT BOOKS**

1. Standard for the Design of High-Performance Green Buildings by ASHRAE
2. Engineering Applications in Sustainable Design and Development By Bradley A.Striebig, Adebayo A.Ogundipe and Maria Papadakis. First edition, 2016, CENGAGE Learning.

**REFERENCES**


1. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air Conditioning Engineers, 2009. 2.
2. Green Building Hand Book by Tomwoolley and Samkimings, 2009.
3. IGBC - Smart Cities & Green Building Concept in India

# Open Elective Courses Offered by CSE,CST& IT to other Departments

**Open Elective Courses offered by CSE**

| S.No. | Subject Code | Name of the subject | L | T | P | Cr |
|---|---|---|---|---|---|---|
| 1. | 18XXCSOXXXX | Internet of Things | 3 | 0 | 0 | 3 |
| 2. | 18XXCSOXXXX | Block Chain | 3 | 0 | 0 | 3 |
| 3. | 18XXCSOXXXX | Quantum Computing | 3 | 0 | 0 | 3 |
| 4. | 18XXCSOXXXX | Virtual Reality | 3 | 0 | 0 | 3 |
| 5. | 18XXCSOXXXX | Data Structures through C | 3 | 0 | 0 | 3 |
| 6. | 18XXCSOXXXX | Designing Database Management Systems | 3 | 0 | 0 | 3 |
| 7. | 18XXCSOXXXX | Operating Systems Concepts | 3 | 0 | 0 | 3 |
| 8. | 18XXCSOXXXX | R Programming | 3 | 0 | 0 | 3 |
| 9. | 18XXCSOXXXX | Python Programming | 3 | 0 | 0 | 3 |
| 10. | 18XXCSOXXXX | Java Programming | 3 | 0 | 0 | 3 |
| 11. | 18XXCSOXXXX | App Technologies | 3 | 0 | 0 | 3 |
| 12. | 18XXCSOXXXX | Web Technologies | 3 | 0 | 0 | 3 |
| 13. | 18XXCSOXXXX | Artificial Intelligence | 3 | 0 | 0 | 3 |

**Open Electives Courses Offered by CST to other Departments**

| S.No | Subject Code | Name of the subject | L | T | P | Cr |
|---|---|---|---|---|---|---|
| 1 | 18XXCTOXXXX | Internet of Things | 3 | 0 | 0 | 3 |
| 2 | 18XXCTOXXXX | Block Chain | 3 | 0 | 0 | 3 |
| 3 | 18XXCTOXXXX | Quantum Computing | 3 | 0 | 0 | 3 |
| 4 | 18XXCTOXXXX | Virtual Reality | 3 | 0 | 0 | 3 |
| 5 | 18XXCTOXXXX | Data Structures Through C | 3 | 0 | 0 | 3 |
| 6 | 18XXCTOXXXX | Designing Database Management Systems | 3 | 0 | 0 | 3 |
| 7 | 18XXCTOXXXX | Operating Systems Concepts | 3 | 0 | 0 | 3 |
| 8 | 18XXCTOXXXX | R Programming | 3 | 0 | 0 | 3 |
| 9 | 18XXCTOXXXX | Python Programming | 3 | 0 | 0 | 3 |
| 10 | 18XXCTOXXXX | Java Programming | 3 | 0 | 0 | 3 |
| 11 | 18XXCTOXXXX | App Technologies | 3 | 0 | 0 | 3 |
| 12 | 18XXCTOXXXX | Web Technologies | 3 | 0 | 0 | 3 |
| 13 | 18XXCTOXXXX | Artificial Intelligence | 3 | 0 | 0 | 3 |

<table>
<tr><th colspan="4">INTERNET OF THINGS</th></tr>
<tr><td>Subject Code</td><td>18XXCSOXXXX</td><td>IA Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>03</td><td>Exam Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>48</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">Credits – 03</td></tr>
</table>

**Course Objectives:**

The learning objectives of this course are:

1. Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.
2. Formalize a given problem in the language/framework of different AI methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markov decision process, etc).
3. Implement basic AI algorithms (e.g., standard search algorithms or dynamic programming).
4. Design and carry out an empirical evaluation of different algorithms on problem formalization, and state the conclusions that the evaluation supports.

<table>
<tr><th>Unit -1: The Internet of Things</th><th>Hours</th></tr>
<tr><td>An Overview of Internet of things, Internet of Things Technology, behind IoTs Sources of the IoTs, M2M Communication, Examples OF IoTs, Design Principles for Connected Devices</td><td>09</td></tr>
<tr><td colspan="2">Unit -2 :Business Models</td></tr>
<tr><td>Business Processes in the Internet of Things ,IoT/M2M systems LAYERS AND designs standardizations ,Modified OSI Stack for the IoT/M2M Systems ,ETSI M2M domains and High-level capabilities ,Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway Ease of designing and affordability</td><td>10</td></tr>
<tr><td colspan="2">Unit – 3:Design Principles for the Web Connectivity</td></tr>
<tr><td>Design Principles for the Web Connectivity for connected-Devices, Web Communication protocols for Connected Devices, Message Communication protocols for Connected Devices, Web Connectivity for connected-Devices.</td><td>10</td></tr>
<tr><td colspan="2">Unit – 4:Internet Connectivity Principles</td></tr>
<tr><td>Internet Connectivity Principles, Internet connectivity, Application Layer Protocols: HTTP, HTTPS, FTP, Telnet. Data Acquiring, Organizing and Analytics in IoT/M2M, Applications/Services/Business Processes, IOT/M2M Data Acquiring and Storage, Business Models for Business Processes in the Internet of Things, Organizing Data, Transactions, Business Processes, Integration and Enterprise Systems.</td><td>10</td></tr>
<tr><td colspan="2">Unit – 5:Data Collection</td></tr>
<tr><td>Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services, Data Collection, Storage and Computing Using cloud platform Everything as a service and Cloud Service Models, IOT cloud-based services using the Xively (Pachube/COSM), Nimbits and other platforms Sensor, Participatory Sensing, Actuator, Radio Frequency Identification, and Wireless, Sensor Network Technology, Sensors Technology, Sensing the</td><td>09</td></tr>
</table>

| | | |
|---|---|---|
| World. | | |
| **Text(T) / Reference(R) Books:** | | |
| T1 | Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill Higher Education | |
| T2 | Internet of Things, A.Bahgya and V.Madisetti, Univesity Press, 2015 | |
| R1 | Designing the Internet of Things, Adrian McEwen and Hakim Cassimally, Wiley | |
| R2 | Getting Started with the Internet of Things CunoPfister , Oreilly | |
| W1 | https://www.coursera.org/specializations/internet-of-things | |
| W2 | https://alison.com/course/internet-of-things-and-the-cloud | |
| **Course Outcomes:** On completion of this course, students can | | |
| CO1 | Demonstrate knowledge and understanding of the security and ethical issues of the Internet of Things | |
| CO2 | Conceptually identify vulnerabilities in Internet of Things | |
| CO3 | Conceptually identify recent attacks, involving the Internet of Things | |
| CO4 | Develop critical thinking skills | |
| CO5 | Compare and contrast the threat environment based on industry and/or device type. | |

# BLOCK CHAIN TECHNOLOGY

| | | | |
|---|---|---|---|
| Subject Code | 18XXCSOXXXX | IA Marks | 30 |
| Number of Lecture Hours/Week | 03 | Exam Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| | | | **Credits – 03** |

**Course Objectives:**

The learning objectives of this course are:

1. To assess blockchain applications in a structured manner.
2. To impart knowledge in block chain techniques and able to present the concepts clearly and structured.
3. To get familiarity with future currencies and to create own crypto token.

| **Unit -1: Introduction** | **Hours** |
|---|---|
| Overview of Block chain, public ledgers, bitcoin, smart contracts, block in a block chain, transactions, distributed consensus, public vs private block chain, understanding crypto currency to block chain, permissioned model of block chain, overview of security aspects of block chain, cryptographic hash function, properties of a hash function, hash pointer and Merkle tree, digital signature, public key cryptography, a basic crypto currency. | **10** |
| **Unit -2 :Understanding block chain with crypto currency** | |
| Creation of coins, payments and double spending, bitcoin scripts, bitcoin P2P network, transaction in bitcoin network, block mining, block propagation and block relay, distributed consensus in open environments, consensus in a bitcoin network, Proof of Work (PoW)- Basic Introduction, hashcash PoW, Bitcoin PoW, Attacks on PoW and the monopoly problem, Proof of Stake, Proof of burn and proof of elapsed time, the life of a bitcoin miner, Mining- Difficulty, mining pool. | **10** |
| **Unit – 3:Permissioned Block Chain** | |
| Permissioned model and use cases, design issues for permissioned block chains, execute contracts, state machine replication, overview of consensus models for permissioned block chain, Distributed consensus in closed environment, paxos, RAFT consensus, Byzantine general problem, Byzantine fault tolerance system, Lamport-Shostak-Pease BFT algorithm, BFT over Asynchronous systems. | **10** |
| **Unit – 4:Enterprise application of Block chain** | |
| Cross border payments, Know Your Customer, Food security, Mortgage over block chain, Block chain enabled trade, trade finance network, supply chain financing, identity on block chain. | **09** |
| **Unit – 5:Block chain application development** | |
| Hyperledger fabric- architecture, identities and policies, membership and access control, channels, transaction validation, writing smart contract using Hyperledger fabric, writing smart contract using Ethereum, overview of Ripple and Corda. | **09** |

**Text(T) / Reference(R) Books:**

| | |
|---|---|
| T1 | Block Chain: Blueprint for a new economy, Melanie Swan, O'Reilly, 2015. |
| T2 | Block Chain: The Block Chain for Beginners- Guide to Block Chain Technology and Leveraging Block Chain Programming, Josh Thompsons |
| R1 | Block Chain Basics, Daniel Drescher, Apress; 1st edition, 2017 |

| | |
|---|---|
| R2 | Block Chain and Crypto Currencies, Anshul Kaushik, Khanna Publishing House, Delhi. |
| R3 | Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained, Imran Bhashir, Packt Publishing. |
| W1 | https://www.edx.org/learn/blockchain |
| W2 | https://www.coursera.org/courses?query=blockchain |

| **Course Outcomes:** On completion of this course, students can | |
|---|---|
| CO1 | Understand block chain technology. |
| CO2 | Develop block chain-based solutions |
| CO3 | Write smart contract using Hyperledger Fabric and Ethereum frameworks. |
| CO4 | Build and deploy block chain application for on premise and cloud-based architecture. |
| CO5 | Integrate ideas from various domains and implement them. |

| QUANTUM COMPUTING | | | |
|---|---|---|---|
| Subject Code | 18XXCSOXXXX | IA Marks | 30 |
| Number of Lecture Hours/Week | 03 | Exam Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| | | | **Credits – 03** |

**Course Objectives:**

The learning objectives of this course are:

- This course teaches the fundamentals of quantum information processing, including quantum computation, quantum cryptography, and quantum information theory.

| Unit -1:Introduction to Quantum computing | Hours |
|---|---|
| Motivation for studying Quantum computing,, Mojor players in industry, Origin of Quantum Computing, overview of major concepts in Quantum Computing. | **09** |
| **Unit -2 :Math Foundation for Quantum Computing** | |
| Matrix algebra- Basic vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, dirac notation, Eigen values and Eigen vector | **09** |
| **Unit – 3: Building Blocks for Quantum Program** | |
| Architectures of a Quantum Computing Platform, Details of q-bit system of information representation- Block sphere, Multi-qubits states, Quantum superposition of qubits, Quantum entanglement, Useful states from quantum algorithmic perceptive, Operations on qubits, Quantum Logic gates and circuits, Programming model for a Quantum Computing Program- Steps performed on classical computer, steps performed on Quantum computer, Moving data between bits and qubits. | **10** |
| **Unit – 4: Quantum Algorithms** | |
| Amplitude amplification, Quantum Fourier Transform, Phase Kick-back, Quantum Phase estimation, Quantum Walks | **10** |
| **Unit – 5: Algorithms** | |
| Shor's Algorithm, Grover's Algorithm, Deutsch's Algorithm, Deutsch-Jozsa Algorithm, IBM Quantum Experience, Microsoft Q, Rigetti PyQuil | **10** |

| **Text(T) / Reference(R) Books:** | |
|---|---|
| T1 | Quantum Computation and Quantum Information, Michael A. Nielsen, Cambridge University Press. |
| R1 | Quantum Computation Explained, David Mc Mahon, Wiley |
| W1 | https://quantumcurriculum.mit.edu/ |
| W2 | https://www.coursera.org/courses?query=quantum%20computing |

| **Course Outcomes:** On completion of this course, students can | |
|---|---|
| CO1 | To explain the working of Quantum computing program. |
| CO2 | To explain architecture and program model. |
| CO3 | Develop Quantum logic gate circuits |
| CO4 | Develop quantum algorithm |
| CO5 | Program Quantum algorithm on major toolkits. |

# VIRTUAL REALITY

| | | | |
|---|---|---|---|
| Subject Code | 18XXCSOXXXX | IA Marks | 30 |
| Number of Lecture Hours/Week | 03 | Exam Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| | | | **Credits – 03** |

**Course Objectives:**

The learning objectives of this course are:

1. Understand how the design of VR technology relates to human perception and cognition.
2. Discuss applications of VR to the conduct of scientific research, training, and industrial design.
3. Gain first-hand experience with using virtual environment technology, including 3D rendering software, tracking hardware, and input/output functions for capturing user data.
4. Learn the fundamental aspects of designing and implementing rigorous empirical experiments using VR.
5. Learn about multimodal virtual displays for conveying and presenting information and techniques for evaluating good and bad virtual interfaces.

| Unit -1:Virtual reality and Virtual Environment | Hours |
|---|---|
| Introduction, Computer graphics, Real time computer graphics, flight simulation, virtual environment requirement, benefits of virtual reality, historical development of VR, scientific landmark. 3D Commuter Graphics: Introduction, virtual world space, positioning the virtual observer, perspective projection, human vision, stereo perspective projection, 3D clipping, Colour theory, simple 3D modelling, Illumination models, reflection models, shading algorithms, radiosity, hidden surface removal, realism- stereographic image. | **10** |
| **Unit -2 :Geometric Modelling** | |
| Introduction, from 2D to 3D, 3D space curves, 3D boundary representation. Geometric transformation: Introduction, frames to reference, modelling transformations, instances, picking, flying, scaling the VE, Collision and detection. Generic VR system: Virtual environment, computer environment, VR technology- models of interaction, VR systems. | **10** |
| **Unit – 3:Animating the Virtual Environment** | |
| Introduction, the dynamics of numbers, linear and non-linear and non-linear interpolation, the animation of objects, linear and non-linear translation, shape & object in between, free from deformation, particle system. Physical Simulation: Objects falling in a gravitational field, rotating wheels, elastic collisions, projectiles, simple pendulum, springs, flight dynamics of an aircraft | **09** |
| **Unit – 4:Human Factors** | |
| the eye, the ear, the somatic senses. VR Hardware: Sensor hardware, head-coupled displays, acoustic hardware, integrated VR systems. VR Software: Modelling virtual world, physical simulation, VR toolkits, Introduction to VRML. | **09** |
| **Unit – 5:VR Applications** | |
| Shor's Algorithm, Grover's Algorithm, Deutsch's Algorithm, Deutsch-Jozsa Algorithm, IBM Quantum Experience, Microsoft Q, Rigetti PyQuil | **12** |

| **Text(T) / Reference(R) Books:** | |
|---|---|
| T1 | Virtual Reality Systems, John Vince, Pearson Education Asia, 2007. |
| T2 | Augmented and Virtual Reality, Anand R, Khanna Publishing House. Delhi |
| R1 | Visualizations of Virtual Reality, Adams, Tata Mc Graw Hill, 2000 |
| R2 | Virtual Reality Technology, Grigore C. Burdea, Philippe Coieffet, Wiley Inter Science, 2nd edition, 2006. |

| | |
|---|---|
| W1 | https://www.coursera.org/courses?query=virtual%20reality |
| W2 | https://www.classcentral.com/tag/virtual-reality |
| **Course Outcomes:** On completion of this course, students can | |
| CO1 | Understand geometric modelling |
| CO2 | Understand Virtual environment |
| CO3 | Study about Virtual Hardware and Software |
| CO4 | Study about Software needed for developing virtual reality environment. |
| CO5 | Develop Virtual Reality applications. |

| DATA STRUCTURES THROUGH C | | | |
|---|---|---|---|
| Subject Code | 18XXCSOXXXX | IA Marks | 30 |
| Number of Lecture Hours/Week | 03 | Exam Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| **Credits – 03** | | | |

**Course Objectives:**

The learning objectives of this course are:

1. Operations on linear data structures and their applications.
2. The various operations on linked lists.
3. The basic concepts of Trees, Traversal methods and operations.
4. Concepts of implementing graphs and its relevant algorithms.
5. Sorting and searching algorithms.

| **Unit -1: INTRODUCTION TO DATA STRUCTURE** | **Hours** |
|---|---|
| Data Management concepts, Data types – primitive and non-primitive, Performance Analysis and Measurement (Time and space analysis of algorithms-Average, best- and worst-case analysis), Types of Data Structures-Linear & Non-Linear Data Structures.<br>Sorting and Searching:<br>Sorting – Bubble Sort, Selection Sort, Quick Sort, Merge Sort<br>Searching –Sequential Search and Binary Search | **10** |
| **Unit -2 :LINEAR DATA STRUCTURE** | |
| Array: Representation of arrays, Applications of arrays, sparse matrix and its representation<br>Stack: Stack-Definitions & Concepts, Operations On Stacks, Applications of Stacks, Polish Expression, Reverse Polish Expression And Their Compilation, Recursion.<br>Queue: Representation Of Queue, Operations On Queue, Circular Queue, Double Ended Queue, Applications of Queue. | **10** |
| **Unit – 3: LINKED LIST** | |
| Linked List: Singly Linked List, Doubly Linked list, Circular linked list ,Linked implementation of Stack, Linked implementation of Queue, Applications of linked list. | **09** |
| **Unit – 4:NONLINEAR DATA STRUCTURE** | |
| Tree-Definitions and Concepts, Representation of binary tree, Binary tree traversal (Inorder, postorder, preorder), Binary search trees, Conversion of General Trees To Binary Trees, Applications of Trees. | **09** |
| **Unit – 5:GRAPH, HASHING AND FILE STRUCTURES** | |
| Graph-Matrix Representation Of Graphs, Elementary Graph operations, (Breadth First Search, Depth First Search, Spanning Trees, Shortest path, Minimal spanning tree)<br>Hashing: The symbol table, Hashing Functions, Collision Resolution Techniques, File Structure: Concepts of fields, records and files, Sequential, Indexed and Relative/Random File Organization, Indexing structure forindex files, hashing for direct files, Multi-Key file organization and accessmethods. | **10** |
| **Text(T) / Reference(R) Books:** | |

| | |
|---|---|
| T1 | Data Structures using C -By Reema Thareja - OXFORD Higher Publication |
| T2 | Data Structures using C & C++ -By Ten Baum Publisher – Prenctice-Hall International |
| R1 | Fundamentals of Computer Algorithms by Horowitz, Sahni,Galgotia Pub. 2001 ed |
| R2 | Fundamentals of Data Structures in C++-By Sartaj Sahani. |
| R3 | Data Structures: A Pseudo-code approach with C -By Gilberg & Forouzan Publisher Thomson Learning |
| W1 | https://www.coursera.org/specializations/data-structures-algorithms |
| W2 | https://online-learning.harvard.edu/course/data-structures-and-algorithms |
| **Course Outcomes:** On completion of this course, students can | |
| CO1 | Choose appropriate data structure as applied to specified problem definition. |
| CO2 | Handle operations like searching, insertion, deletion, traversing mechanism etc. on various data structures |
| CO3 | Apply concepts learned in various domains like DBMS |
| CO4 | Apply concepts learned in various domains like compiler construction |
| CO5 | Use linear and non-linear data structures like stacks, queues , linked list |

# DESIGNING DATABASE MANAGEMENT SYSTEMS

| | | | |
|---|---|---|---|
| Subject Code | 18XXCSOXXXX | IA Marks | 30 |
| Number of Lecture Hours/Week | 03 | Exam Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |

**Credits – 03**

**Course Objectives:**

The learning objectives of this course are:

1. To introduce about database management systems
2. To give a good formal foundation on the relational model of data and usage of Relational Algebra
3. To introduce the concepts of basic SQL as a universal Database language
4. To demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization
5. To provide an overview of database transactions and concurrency control.

| Unit -1: Database system architecture | Hours |
|---|---|
| Introduction to Databases: Characteristics of the Database Approach, Advantages of using the DBMS Approach, A Brief History of Database Applications. Overview of Database Languages and Architectures: Data Models, Schemas and Instances, Three-Schema Architecture and Data Independence, Database Users , Architecture for DBMS. | **10** |
| **Unit -2 : E-R Models** | |
| The E-R Models,TheRelationalModel,IntroductiontoDatabaseDesign,DatabaseDesign and Er Diagrams, Entities Attributes, and Entity Sets, Relationship and Relationship Sets, Conceptual Design with the Er Models, The Relational Model Integrity Constraints Over Relations, Key Constraints, Foreign Key Constraints, General Constraints. | **10** |
| **Unit - 3: Relational Algebra** | |
| Relational Algebra, Selection and Projection, Set Operation, Renaming, Joins, Division, More Examples of Queries, Relational Calculus: Tuple Relational Calculus, Domain Relational Calculus.<br>The Form of Basic SQL Query, Union, Intersect, and Except, Nested Queries, Aggregate Operators, Null Values, Complex Integrity Constraints in SQL, Triggers and Active Database. | **10** |
| **Unit - 4: Normalization** | |
| Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form (BCNF), Lossless join and dependency preserving decomposition, Fourth normal form(4NF). | **09** |
| **Unit - 5: Transaction Management** | |
| Transaction, properties of transactions, transaction log, and transaction management with SQL using commit rollback and save point. Concurrency control for lost updates, Uncommitted data, inconsistent retrievals and the Scheduler. Concurrency control with locking methods, lock granularity, lock types, two phase locking for ensuring serializability, deadlocks, Concurrency control with time | **09** |

| | |
|---|---|
| stamp ordering: Wait/Die and Wound/Wait Schemes, Database Recovery management. | |

| **Text(T) / Reference(R) Books:** | |
|---|---|
| T1 | In Introduction to Database Systems, CJDate, Pearson. |
| T2 | Database Management Systems,3rdEdition,Raghurama Krishnan, Johannes Gehrke, TATAMcGrawHill. |
| T3 | Database Systems-TheCompleteBook,H GMolina,J DUllman,J WidomPearson. |
| T4 | Database Management Systems,6/e Ramez Elmasri, Shamkant B. Navathe, PEA |
| R1 | DatabaseSystemsdesign,Implementation,andManagement,7thEdition,PeterRob&Carl osCoronel |
| R2 | Database System Concepts, 5th edition, Silberschatz, Korth, TMH |
| R3 | The Database Book Principles & Practice Using Oracle/MySQL, Narain Gehani, University Press. |
| W1 | https://onlinecourses.nptel.ac.in/noc18_cs15/preview |
| W2 | https://www.coursera.org/courses?query=database |

| **Course Outcomes:** On completion of this course, students can | |
|---|---|
| CO1 | Understand the basic elements of a relational database management system. |
| CO2 | Draw entity relationship and convert entity relationship diagrams into RDBMS. |
| CO3 | Create, maintain, and manipulate a relational database using SQL. |
| CO4 | Designs and applies normalization techniques for logical schema model. |
| CO5 | Solves concurrent issues and problems through locking mechanism. |

| OPERATING SYSTEMS CONCEPTS | | | |
|---|---|---|---|
| Subject Code | 18XXCSOXXXX | IA Marks | 30 |
| Number of Lecture Hours/Week | 03 | Exam Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| **Credits – 03** | | | |

**Course Objectives:**

The learning objectives of this course are:

1. Introduce the basic concepts of operating systems, its functions and services.
2. To provide the basic concepts of process management and synchronization.
3. Familiarize with deadlock issues.
4. Understand the various memory management skills.
5. Give exposure over I/O systems and mass storage structures.

| **Unit -1: Operating Systems Overview** | **Hours** |
|---|---|
| Computer system organization, Operating system structure, Process, memory, storage management, Protection and security, Distributed systems, Computing Environments, Open-source operating systems, OS services, User operating-system interface. | **09** |
| **Unit -2 :System Calls & IPC** | |
| System calls, Types, System programs, OS structure, OS generation, System Boot Process concept, scheduling (Operations on processes, Cooperating processes, Inter-process communication), Multi-threading models | **09** |
| **Unit - 3: Process Management** | |
| Basic concepts, Scheduling criteria, Scheduling algorithms, Thread scheduling, Multiple processor scheduling Operating system, Algorithm Evaluation, The critical section problem, Peterson’s solution, Synchronization hardware, Semaphores, Classic problems of synchronization, Critical regions, Monitors. | **10** |
| **Unit - 4:Memory Management & Dead lock** | |
| System model, Deadlock characterization, Methods for handling deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock detection, Recovery from deadlock.<br>Storage Management: Swapping, Contiguous memory allocation, Paging, Segmentation Virtual Memory Background, Demand paging, copy on write, Page replacement and various Page replacement algorithms, Allocation of frames, Thrashing. | **10** |
| **Unit - 5:I/O Systems** | |
| File concept, Access methods, Directory structure, Filesystem mounting, Protection, Directory implementation, Allocation methods, Free-space management, Disk scheduling, Disk management, Swap-space management, Protection. | **10** |

**Text(T) / Reference(R) Books:**


| | |
|---|---|
| T1 | Operating System Concepts Essentials, Abraham Silberschatz, Peter B. Galvin, Greg Gagne, John Wiley & Sons Inc., 2010. |
| T2 | Operating System Concepts, 9th Edition, Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, John Wiley and Sons Inc., 2012 |
| T3 | Operating Systems, Second Edition, S Halder, Alex A Aravind, Pearson Education, 2016 |

| | |
|---|---|
| T4 | Operating Systems – Internals and Design Principles, 7th Edition, William Stallings, Prentice Hall, 2011 |
| R1 | Modern Operating Systems, Second Edition, Andrew S. Tanenbaum, Addison Wesley, 2001. |
| R2 | Operating Systems: A Design-Oriented Approach, Charles Crowley, Tata McGraw Hill Education, 1996. |
| R3 | Operating Systems: A Concept-based Approach, Second Edition, D M Dhamdhere, Tata McGraw-Hill Education, 2007 |
| R4 | Operating Systems: Internals and Design Principles, Seventh Edition, William Stallings, Prentice Hall, 2011 |
| W1 | https://www.coursera.org/courses?query=operating%20system |
| W2 | https://onlinecourses.nptel.ac.in/noc16_cs10/preview |

| **Course Outcomes:** On completion of this course, students can | |
|---|---|
| CO1 | Demonstrate knowledge on Computer System organization and Operating system services. |
| CO2 | Design solutions for process synchronization problems by using System calls and Inter process communication. |
| CO3 | Identify the functionality involved in process management concepts like scheduling and synchronization. |
| CO4 | Design models for handling deadlock and perform memory management. |
| CO5 | Analyze services of I/O subsystems and mechanisms of security & protection. |

| R PROGRAMMING | | | |
|---|---|---|---|
| Subject Code | 18XXCSOXXXX | IA Marks | 30 |
| Number of Lecture Hours/Week | 03 | Exam Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| **Credits – 03** | | | |

**Course Objectives:**

The learning objectives of this course are:

1. Use R for statistical programming, computation, graphics, and modeling.
2. Write functions and use R in an efficient way.
3. Fit some basic types of statistical models.
4. Use R in their own research.
5. Be able to expand their knowledge of R on their own.

| **Unit -1:** Introduction | **Hours** |
|---|---|
| How to run R, R Sessions and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes**.** | **09** |
| **Unit -2 :** | |
| R Programming Structures, Control Statements, Loops,-Looping Over Nonvector Sets,- If-Else,Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return- Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion, A Quicksort Implementation-Extended Extended Example: A Binary Search Tree. | **10** |
| **Unit – 3:**Math and Simulation in R | |
| Doing Math and Simulation in R, Math Function, Extended Example Calculating Probability- Cumulative Sums and Products-Minima and Maxima- Calculus, Functions Fir Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Extended Example: Vector cross Product- Extended Example: Finding Stationary Distribution of Markov Chains, Set Operation, Input /out put, Accessing the Keyboard and Monitor, Reading and writer Files | **10** |
| **Unit – 4:**Graphics | |
| Creating Graphs, The Workhorse of R Base Graphics, the plot() Function – Customizing Graphs, Saving Graphs to Files, Probability Distributions, Normal Distribution- Binomial Distribution- Poisson Distributions Other Distribution, Basic Statistics, Correlation and Covariance, T-Tests,-ANOVA. | **10** |
| **Unit – 5:**Linear Models | |
| Simple Linear Regression, -Multiple Regression Generalized Linear Models, Logistic Regression, - Poisson Regression- other Generalized Linear Models-Survival Analysis, Nonlinear Models, Splines- Decision- Random Forests | **09** |

| **Text(T) / Reference(R) Books:** | |
|---|---|
| T1 | The Art of R Programming, Norman Matloff, Cengage Learning |
| T2 | R for Everyone, Lander, Pearson |
| R1 | R Cookbook, PaulTeetor, Oreilly |
| R2 | R in Action, Rob Kabacoff, Manning |
| W1 | https://www.edx.org/learn/r-programming |
| W2 | https://www.coursera.org/learn/r-programming |

| **Course Outcomes:** On completion of this course, students can | |
|---|---|
| CO1 | List motivation for learning a programming language |
| CO2 | Access online resources for R and import new function packages into the R workspace |
| CO3 | Import, review, manipulate and summarize data-sets in R |
| CO4 | Explore data-sets to create testable hypotheses and identify appropriate statistical tests |
| CO5 | Perform appropriate statistical tests using R Create and edit visualizations |

<table>
<tr><th colspan="5">PYTHON PROGRAMMING</th></tr>
<tr><td colspan="2">Subject Code</td><td>18XXCSOXXXX</td><td>IA Marks</td><td>30</td></tr>
<tr><td colspan="2">Number of Lecture Hours/Week</td><td>03</td><td>Exam Marks</td><td>70</td></tr>
<tr><td colspan="2">Total Number of Lecture Hours</td><td>48</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="5">Credits – 03</td></tr>
<tr><td colspan="5">Course Objectives:<br>The learning objectives of this course are:<br>1. Introduction to Scripting Language.<br>2. Exposure to various problems solving approaches of computer science.</td></tr>
<tr><td colspan="4">Unit -1: Introduction</td><td>Hours</td></tr>
<tr><td colspan="4">History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation</td><td>09</td></tr>
<tr><td colspan="5">Unit -2 : Types, Operators and Expressions</td></tr>
<tr><td colspan="4">Types - Integers, Strings, Booleans; Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations Control Flow- if, if-elif-else, for, while, break, continue, pass. Data Structures Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences. Comprehensions.</td><td>10</td></tr>
<tr><td colspan="5">Unit – 3: Functions</td></tr>
<tr><td colspan="4">Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions(Function Returning Values), Scope of the Variables in a Function - Global and Local Variables. Modules: Creating modules, import statement, from. Import statement, name spacing, Python packages, Introduction to PIP, Installing Packages via PIP, Using Python Packages</td><td>10</td></tr>
<tr><td colspan="5">Unit – 4: Object Oriented Programming in Python</td></tr>
<tr><td colspan="4">Classes, 'self variable', Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding, Error and Exceptions: Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions, User Defined Exceptions</td><td>10</td></tr>
<tr><td colspan="5">Unit – 5: Brief Tour of the Standard Library</td></tr>
<tr><td colspan="4">Operating System Interface - String Pattern Matching, Mathematics, Internet Access, Dates and Times, Data Compression, Multithreading, GUI Programming, Turtle Graphics Testing:Why testing is required?, Basic concepts of testing, Unit testing in Python, Writing Test cases, Running Tests.</td><td>09</td></tr>
<tr><td colspan="5">Text(T) / Reference(R) Books:</td></tr>
<tr><td>T1</td><td colspan="4">Python Programming: A Modern Approach, Vamsi Kurama, Pearson</td></tr>
<tr><td>T2</td><td colspan="4">Learning Python, Mark Lutz, Orielly</td></tr>
<tr><td>R1</td><td colspan="4">Think Python, Allen Downey, Green Tea Press</td></tr>
<tr><td>R2</td><td colspan="4">Core Python Programming, W.Chun, Pearson</td></tr>
<tr><td>R3</td><td colspan="4">Introduction to Python, Kenneth A. Lambert, Cengage</td></tr>
<tr><td>W1</td><td colspan="4">https://www.coursera.org/courses?query=python</td></tr>
<tr><td>W2</td><td colspan="4">https://www.edx.org/learn/python</td></tr>
</table>

| **Course Outcomes:** On completion of this course, students can | |
|---|---|
| CO1 | Making Software easily right out of the box |
| CO2 | Experience with an interpreted Language |
| CO3 | To build software for real needs. |
| CO4 | Prior Introduction to testing software |
| CO5 | Experience with implementation in current technologies |

<table>
<tr><th colspan="4">JAVA PROGRAMMING</th></tr>
<tr><td>Subject Code</td><td>18XXCSOXXXX</td><td>IA Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>03</td><td>Exam Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>48</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">Credits – 03</td></tr>
</table>

**Course Objectives:**

The learning objectives of this course are:

1. Understanding the OOP’s concepts, classes and objects, threads, files, applets, swings and act.
2. This course introduces computer programming using the JAVA programming language with object-oriented programming principles.
3. Emphasis is placed on event-driven programming methods, including creating and manipulating objects, classes, and using Java for network level programming and middleware development.

<table>
<tr><th>Unit -1: Introduction to OOP</th><th>Hours</th></tr>
<tr><td>procedural programming language and object-oriented language, principles of OOP, applications of OOP, history of java, java features, JVM, program structure. Variables, primitive data types, identifiers, literals, operators, expressions, precedence rules and associativity, primitive type conversion and casting, flow of control.</td><td>10</td></tr>
<tr><td colspan="2">Unit -2 :Classes and objects</td></tr>
<tr><td>Classes and objects, class declaration, creating objects, methods, constructors and constructor overloading, garbage collector, importance of static keyword and examples, this keyword, arrays, command line arguments, nested classes.</td><td>09</td></tr>
<tr><td colspan="2">Unit – 3:Inheritance</td></tr>
<tr><td>Inheritance, types of inheritance, super keyword, final keyword, overriding and abstract class. Interfaces, creating the packages, using packages, importance of CLASSPATH and java.lang package. Exception handling, importance of try, catch, throw, throws and finally block, userdefined exceptions, Assertions</td><td>10</td></tr>
<tr><td colspan="2">Unit – 4:Multithreading</td></tr>
<tr><td>Introduction, thread life cycle, creation of threads, thread priorities, thread synchronization, communication between threads. Reading data from files and writing data to files, random access file.</td><td>09</td></tr>
<tr><td colspan="2">Unit – 5:Applet</td></tr>
<tr><td>Applet class, Applet structure, Applet life cycle, sample Applet programs. Event handling: event delegation model, sources of event, Event Listeners, adapter classes, inner classes. AWT: introduction, components and containers, Button, Label, Checkbox, Radio Buttons, List Boxes, Choice Boxes, Container class, Layouts, Menu and Scrollbar.</td><td>10</td></tr>
</table>

<table>
<tr><th colspan="2">Text(T) / Reference(R) Books:</th></tr>
<tr><td>T1</td><td>The complete Reference Java, 8th edition, Herbert Schildt, TMH</td></tr>
<tr><td>T2</td><td>Programming in JAVA, Sachin Malhotra, SaurabhChoudary, Oxford</td></tr>
<tr><td>R1</td><td>Introduction to java programming, 7th edition by Y Daniel Liang, Pearson</td></tr>
</table>

| | |
|---|---|
| W1 | https://www.coursera.org/courses?query=java |
| W2 | https://www.udemy.com/java-tutorial/ |
| **Course Outcomes:** On completion of this course, students can | |
| CO1 | Understand Java programming concepts and utilize Java Graphical User Interface in Program writing. |
| CO2 | Write, compile, execute and troubleshoot Java programming for networking concepts. |
| CO3 | Build Java Application for distributed environment. |
| CO4 | Design and Develop multi-tier applications. |
| CO5 | Identify and Analyze Enterprise applications. |

| APP TECHNOLOGIES | | | |
|---|---|---|---|
| Subject Code | 18XXCSOXXXX | IA Marks | 30 |
| Number of Lecture Hours/Week | 03 | Exam Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| **Credits – 03** | | | |

**Course Objectives:**

The learning objectives of this course are:

- To provide in depth knowledge and hands on experience in application development, the latest trends and features.

| **Unit -1: Android Programming Environment** | **Hours** |
|---|---|
| Android programming environment, linking activities using intents, calling built-in applications using intents. | **09** |
| **Unit -2:User Interface** | |
| Creating the user interface programmatically, Listening for UI notifications, build basic views, build picker views, build list views, Using image views, Using menus with views, Saving and loading user preferences | **10** |
| **Unit – 3:Data** | |
| Persisting data to files, Creating and using databases, Study Session, sharing data in android, Using a content provider, Creating a content provider | **10** |
| **Unit – 4: Networking** | |
| SMS messaging, sending emails, Networking, displaying maps, Getting location data | **10** |
| **Unit – 5: Services** | |
| Creating your own services, communicating between a service and an Activity, Binding Activities to Services, A complete lab work for Android service development, Deploy APK files. | **09** |

**Text(T) / Reference(R) Books:**

| | |
|---|---|
| T1 | Beginning Android Application Development, Wei-Meng Lee, 1st Ed, Wiley Publishing. |
| T2 | Android: A Programmers Guide, J. F. DiMarzio, McGraw Hill Education (India) Private Limited.1st Edition. |
| R1 | Android for Programmers: An App-Driven Approach, Paul Deitel, 1st Edition, Pearson India |
| R2 | Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India Pvt Ltd |
| W1 | https://www.coursera.org/browse/computer-science/mobile-and-web-development |
| W2 | https://in.udacity.com/course/new-android-fundamentals--ud851 |

**Course Outcomes:** On completion of this course, students can

| | |
|---|---|
| CO1 | Demonstrate their understanding of the fundamentals of Android operating systems |
| CO2 | Demonstrate their skills of using Android software development tools |
| CO3 | Demonstrate their ability to develop software with reasonable complexity on mobile platform |
| CO4 | Demonstrate their ability to deploy software to mobile devices |
| CO5 | Demonstrate their ability to debug programs running on mobile devices |

## WEB TECHNOLOGIES

| | | | |
|---|---|---|---|
| Subject Code | 18XXCSOXXXX | IA Marks | 30 |
| Number of Lecture Hours/Week | 03 | Exam Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |

**Credits – 03**

**Course Objectives:**

The learning objectives of this course are:

- This course is designed to introduce students with no programming experience to the programming languages and techniques associated with the World Wide Web. The course will introduce web-based media-rich programming tools for creating interactive web pages.

| Unit | Hours |
|---|---|
| **Unit-1: HTML** | |
| **HTML:** Basic Syntax, Standard HTML Document Structure, Basic Text Markup, Html styles, Elements, Attributes, Heading, Layouts, Html media, Iframes Images, Hypertext Links, Lists, Tables, Forms, GET and POST method, HTML 5, Dynamic HTML.<br>**CSS:** Cascading style sheets, Levels of Style Sheets, Style Specification Formats, Selector Forms, The Box Model, Conflict Resolution, CSS3. | **10** |
| **Unit -2: JSON** | |
| Introduction to JSON: JSON, Syntax, Data Types, Schema, Security Concerns, JSON Vs XML, the JavaScript XML Http Request and Web APIs, JSON and Client-Side Frameworks, JSON and NoSQL, JSON on the server side. | **09** |
| **Unit –3: YAML** | |
| Introduction to YAML: YAML, Syntax, Structure, indentation in YAML documents, YAML vs JSON and XML, data types, Using advanced features like anchors in a YAML. | **9** |
| **Unit -4: PHP** | |
| **PHP Programming:** Introduction to PHP, Creating PHP script, Running PHP script.<br>**Working with variables and constants:** Using variables, Using constants, Data types, Operators.<br>**Controlling program flow:** Conditional statements, Control statements, Arrays, functions. | **10** |
| **Unit – 5: Laravel** | |
| Introduction to Laravel, Features, routing, controllers, views, Blade template, migration, Laravel Database. | **10** |

**Text(T) / Reference(R) Books:**

| | |
|---|---|
| T1 | Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson, 2013 |
| T2 | Web Technologies, 1st Edition 7th impression, Uttam K Roy, Oxford, 2012. |
| T3 | Introduction to JavaScript by Lindsay Bassett, 2015. |
| T4 | Introduction to YAML: Demystifying YAML Data Serialization Format by Tarun Telang |
| T5 | Full-Stack Vue.Js 2 and Laravel 5: Bring the frontend and backend together with Vue, Vuex, and Laravel |
| R1 | Programming world wide web, Sebesta, Pearson |
| R2 | An Introduction to web Design and Programming, Wang, Thomson |

| | |
|---|---|
| W1 | https://www.edx.org/learn/web-development |
| W2 | https://www.javatpoint.com/what-is-json |
| W3 | https://www.javatpoint.com/yaml-scalars |
| W4 | https://www.javatpoint.com/laravel-blade-template |

| **Course Outcomes:** On completion of this course, students can | |
|---|---|
| CO1 | To develop a dynamic webpage by the use of HTML |
| CO2 | To develop a dynamic webpage by the use of CSS |
| CO3 | To develop a dynamic webpage by the use of JSON |
| CO4 | To develop a dynamic webpage by the use of YML |
| CO5 | Build web applications using PHP |
| CO6 | To develop a dynamic webpage by the use of Laravel |

| ARTIFICIAL INTELLIGENCE | | | |
|---|---|---|---|
| Subject Code | 18XXCSOXXXX | IA Marks | 30 |
| Number of Lecture Hours/Week | 03 | Exam Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| **Credits – 03** | | | |

**Course Objectives:**

The learning objectives of this course are:

1. To have a basic proficiency in a traditional AI language including an ability to write simple to intermediate programs and an ability to understand code written in that language
2. To have an understanding of the basic issues of knowledge representation and blind and heuristic search, as well as an understanding of other topics such as minimax, resolution, etc. that play an important role in AI programs
3. To have a basic understanding of some of the more advanced topics of AI such as learning, natural language processing, agents and robotics, expert systems, and planning.

| **Unit -1: Introduction to artificial intelligence** | **Hours** |
|---|---|
| Introduction, history, intelligent systems, foundations of AI, applications, tic-tac-tie game playing, development of AI languages, current trends in AI. | **09** |
| **Unit -2 : Problem solving: state-space search and control strategies** | |
| Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterative deepening a*, constraint satisfaction. | **10** |
| **Unit – 3:Problem reduction, Game playing** | |
| Problem Reduction: Introduction, Problem reduction using AO* algorithm, Towers of Hanoi problem, Matrix Multiplication problem game playing, alpha-beta pruning, two-player perfect information games. | **10** |
| **Unit – 4: Logic Concepts & Knowledge Representation Techniques** | |
| Logic Concepts: Introduction, propositional calculus, propositional logic, natural deduction system, axiomatic system, semantic tableau system in proportional logic, resolution refutation in proportional logic, predicate logic.<br>Introduction to KR techniques, conceptual dependency theory, script structure, cyc theory, case grammars, semantic web. | **10** |
| **Unit – 5: Expert systems and its applications** | |
| Introduction phases in building expert systems, expert system versus traditional systems, rule-based expert systems, blackboard systems, truth maintenance systems, application of expert systems, list of shells and tools. | **09** |

| **Text(T) / Reference(R) Books:** | |
|---|---|
| T1 | Artificial Intelligence- Saroj Kaushik, CENGAGE Learning |
| T2 | Artificial intelligence, A modern Approach, 2nded, Stuart Russel, Peter Norvig, PEA |
| T3 | Artificial Intelligence- Rich, Kevin Knight, Shiv Shankar B Nair, 3rded, TMH |
| T4 | Introduction to Artificial Intelligence, Patterson, PHI |
| R1 | Artificial intelligence, structures and Strategies for Complex problem solving, -George F Lugar, 5thed, PEA |
| R2 | Introduction to Artificial Intelligence, Ertel, Wolf Gang, Springer |
| R3 | Artificial Intelligence, A new Synthesis, Nils J Nilsson, Elsevier |
| R4 | AI: A Modern Approach, Stuart Russell and Peter Norvig, |

| | |
|---|---|
| | Additional Readings: Marr, Bishop, occasionally others |
| W1 | https://www.edx.org/learn/artificial-intelligence |
| W2 | https://www.coursera.org/courses?query=artificial%20intelligence |
| **Course Outcomes:** On completion of this course, students can | |
| CO1 | To introduce basic concepts of AI with its working principles. |
| CO2 | To understand different kinds of heuristic search algorithms to get feasible solution for AI problems. |
| CO3 | To understand problem reduction concepts using various problem reduction techniques. (Ex: Problem reduction using AO* algorithm, Towers of Hanoi problem, Matrix Multiplication problem) |
| CO4 | To understand various Knowledge Representation (KR) techniques |
| CO5 | To understand different kinds of Expert Systems. |

# Open Elective Courses Offered by ECE To other Departments

**Open Electives Courses Offered by the ECE to other Departments**

| S.No | Subject Code | Name of the subject | L | T | P | Cr |
|---|---|---|---|---|---|---|
| 1 | 18XXECOX0XA | VLSI Design | 3 | 0 | 0 | 3 |
| 2 | 18XXECOX0XB | HDL Programming for IC Design | 3 | 0 | 0 | 3 |
| 3 | 18XXECOX0XC | Principles of Communication Systems | 3 | 0 | 0 | 3 |
| 4 | 18XXECOX0XD | Transducers and Sensors | 3 | 0 | 0 | 3 |
| 5 | 18XXECOX0XE | Fundamentals of Microprocessors and Microcontrollers | 3 | 0 | 0 | 3 |
| 6 | 18XXECOX0XF | Fundaments of Internet of Things | 3 | 0 | 0 | 3 |
| 7 | 18XXECOX0XG | Fundamentals of Digital Image Processing | 3 | 0 | 0 | 3 |
| 8 | 18XXECOX0XH | Signals and Systems | 3 | 0 | 0 | 3 |

# VLSI DESIGN

(Open Elective)

| Subject Code | 18XXECOX0XA | Internal Marks | 30 |
|---|---|---|---|
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |

**Credits – 03**

**Course Objectives:**

This course will enable students to

1. To learn about various fabrication steps of IC and electrical properties of MOSFET.
2. To learn about specific rules to draw the stick diagrams and Layouts.
3. To analyze circuit concepts and to apply Scaling factors for Device parameters.
4. To learn concept of chip I/O and techniques of testability.
5. To learn about different FPGA designs and implementation

| Unit -1 | Hours |
|---|---|
| **Introduction and Basic Electrical Properties of MOS Circuits:** Introduction to IC technology, Fabrication process: nMOS, pMOS and CMOS. Ids versus Vds Relationships, Aspects of MOS transistor Threshold Voltage, MOS transistor Trans, Output Conductance and Figure of Merit. nMOS Inverter, Pull-up to Pull-down Ratio for nMOS inverter driven by another nMOS inverter, and through one or more pass transistors. Alternative forms of pull-up, The CMOS Inverter, Latch-up in CMOS circuits, Bi-CMOS Inverter, Comparison between CMOS and BiCMOS technology. | 10 |
| **Unit -2** | |
| **MOS and Bi-CMOS Circuit Design Processes:** MOS Layers, Stick Diagrams, Design Rules and Layout, General observations on the Design rules, 2μm Double Metal, Double Poly, CMOS/BiCMOS rules, 1.2μm Double Metal, Double Poly CMOS rules, Layout Diagrams of NAND and NOR gates and CMOS inverter, Symbolic Diagrams Translation to Mask Form. | 10 |
| **Unit -3** | |
| **Basic Circuit Concepts:** Sheet Resistance, Sheet Resistance concept applied to MOS transistors and Inverters, Area Capacitance of Layers, Standard unit of capacitance, some area Capacitance Calculations, The Delay Unit, Inverter Delays, driving large capacitive loads, Propagation Delays, Wiring Capacitances, Choice of layers.<br>**Scaling of MOS Circuits:** Scaling models and scaling factors, Scaling factors for device parameters, Limitations of scaling, Limits due to sub threshold currents, Limits on logic levels and supply voltage due to noise and current density. Switch logic, Gate logic. | 10 |
| **Unit – 4** | |
| **Chip Input and Output circuits:** ESD Protection, Input Circuits, Output Circuits and L(di/dt) Noise, On-Chip Clock Generation and Distribution.<br>**Design for Testability:** Fault types and Models, Controllability and Observability, Ad Hoc Testable Design Techniques, Scan Based Techniques and Built-In Self-Test techniques. | 10 |
| **Unit – 5** | |
| **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. | 8 |
| **Total** | **48** |

**Course outcomes:**

On completion of the course student will be able to

1. Elaborate the fabrication steps of IC and electrical properties of MOSFET.
2. Justify the concepts of design rules during the layout of a circuit.
3. Apply the circuit concepts and scaling factors for device parameters.
4. Analyze the concepts of chip I/O and techniques of testability.
5. Examine commercial architectures of FPGA.

**Text Books:**


1. Kamran Eshraghian, Douglas and A. Pucknell and Sholeh Eshraghian, Essentials of VLSI Circuits and Systems, Prentice-Hall of India Private Limited,2005 Edition.
2. Sung-Mo Kang, Yusuf Leblebici, CMOS Digital Integrated Circuits Analysis and Design, Tata McGrawHill Education, 2003.


**Reference Books**:


1. Michael D. Ciletti, Advanced Digital Design with the Verilog HDL, Xilinx Design Series, Pearson Education
2. Analysis and Design of Digital Integrated Circuits in Deep Submicron Technology, 3rd edition, David Hodges.
3. A. Shanthi and A. Kavita, VLSI Design, New Age International Private Limited, 2006 First Edition.

# HDL PROGRAMMING FOR IC DESIGN

(Open Elective)

| | | | |
|---|---|---|---|
| Subject Code | 18XXECOX0XB | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |

**Credits – 03**

**Course Objectives:**

This course will enable students to

1. Learn different Verilog programming constructs.
2. Familiarize the different levels of abstraction in Verilog HDL.
3. Construct digital circuits and corresponding RTL modeling using different styles along with test bench based verification.
4. Understand Verilog Tasks, Functions and Directives.
5. Understand timing and delay simulation.

| Unit -1 | Hours |
|---|---|
| **Introduction to Verilog HDL:** Verilog as HDL, Typical HDL flow, Top-Down and Bottom-up design methodology.<br>Levels of Design Description, Simulation and Synthesis, Function Verification, Module definition. Difference between module and module instances. | 10 |
| **Unit -2** | |
| **Language Constructs and Conventions**: Keywords, Identifiers, White Space, Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars and Vectors, Parameters, Operators. | 10 |
| **Unit -3** | |
| **Gate Level Modeling**: Modeling using basic Verilog gate primitives, Array of Instances of Primitives, Design of Flip-Flops with Gate Primitives, Delay, Strengths and Construction Resolution<br>**Modeling at Dataflow Level**: Continuous Assignment Structure, delay specification, expressions, vectors, operators, operands, operator types | 10 |
| **Unit – 4** | |
| **Behavioral Level Modeling:** Structured procedures, Initial and Always statements, blocking and non-blocking statements, delay control, generate statement, conditional statement, multiway branching, loops, sequential and parallel blocks. | 10 |
| **Unit – 5** | |
| **Switch Level Modeling:** Basic transistor switches, CMOS Switches, bi-directional gates, time delays with switch primitives<br>**Tasks and Functions:** Difference between tasks and functions, declaration, invocation, automatic tasks and functions. | 8 |
| **Total** | **48** |

**Course outcomes:**

On completion of the course student will be able to

1. Demonstrate knowledge on HDL design flow and identify the suitable abstraction level of a particular design
2. Memorizing the constructs and conventions used for Verilog programming
3. Design and develop the combinational and sequential circuits using dataflow modeling
4. Implement sequential logic circuits using behavioral modeling
5. Writing the programs more effectively using tasks and functions

**Text Books:**

1. Samir Palnitkar, “Verilog HDL: A Guide to Digital Design and Synthesis”, Pearson

| |
|---|
| Education, Second Edition<br>2. T.R.Padmanabhan, B Bala Tripura Sundari, “Design Through Verilog HDL”, Wiley 2009 |
| **Reference Books**:<br>1. Michael D Ciletti, “Advanced Digital Design with the Verilog HDL”, Xilinx Design Series, PearsonEducation.<br>2. Stephen Brown, Zvonkoc Vranesic, “Fundamentals of Digital Logic with Verilog Design”, TMH, 2nd Edition.<br>3. Donald E. Thomas, Philip R. Moorby, “The Verilog Hardware Description Language”, Springer Science + Business Media, LLC, Fifth edition |

# PRINCIPLES OF COMMUNICATION SYSTEMS

(Open Elective)

| | | | |
|---|---|---|---|
| Subject Code | 18XXECOX0XC | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |

**Credits – 03**

**Course Objectives:**

This course will enable students to

1. Analyze the performance of angle modulated signals.
2. Characterize analog signals in time domain as random processes and noise
3. Characterize the influence of channel on analog modulated signals
4. Determine the performance of analog communication systems in terms of SNR
5. Understand the concepts of noise and signal.

| Unit -1 | Hours |
|---|---|
| **Amplitude modulation:** Introduction, Amplitude Modulation: Time & Frequency – Domain description, switching modulator, Envelop detector. **Double side band-suppressed carrier modulation:** Time and Frequency – Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing. **Single side and vestigial side band methods of modulation**: SSB Modulation, VSB Modulation, Frequency Translation, Frequency-Division Multiplexing, Theme Example: VSB Transmission of Analog and Digital Television | 10 |
| **Unit -2** | |
| **Angle modulation**: Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, **Phase–Locked Loop:** Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems. The Super-heterodyne Receiver | 10 |
| **Unit -3** | |
| **Random variables & process**: Introduction, Probability, Conditional Probability, Random variables, Several Random Variables. Statistical Averages: Function of a random variable, Moments, Random Processes, Mean, Correlation and Covariance function: Properties of autocorrelation function, Cross–correlation functions. **Noise:** ShotNoise,Thermalnoise,WhiteNoise,NoiseEquivalentBandwidth,NoiseFigure | 10 |
| **Unit – 4** | |
| **Noise in analog modulation:** Introduction, Receiver Model, Noise in DSB-SC receivers, Noise in AM receivers, Threshold effect, Noise in FM receivers, Capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis and De-emphasis in FM. | 10 |
| **Unit – 5** | |
| **Digital representation of an analog signals**: Introduction, Why Digitize Analog Sources? The Sampling process, Pulse Amplitude Modulation, Time Division Multiplexing, Pulse-Position Modulation, Generation of PPM Waves, Detection of PPM Waves, The Quantization Process, Quantization Noise, **Pulse Code Modulation:** Sampling, Quantization, Encoding, Regeneration, Decoding, Filtering, Multiplexing | 8 |
| **Total** | **48** |

**Course outcomes:**

On completion of the course student will be able to

1. Analyze the performance of analog modulation schemes in time and frequency domains.
2. Analyze the performance of angle modulated signals.
3. Characterize analog signals in time domain as random processes and noise
4. Characterize the influence of channel on analog modulated signals
5. Determine the performance of analog communication systems in terms of SNR

**Text Books:**

1. H Taub& D. Schilling, Gautam Sahe, Principles of Communication Systems –TMH, 2007, 3rd Edition.
2. B.P. Lathi, Communication Systems–BSPublication,20062.
3. Simon Haykin, Principles of Communication Systems –John Wiley, 2 nd Edition

**Reference Books**:

1. George Kennedy and Bernard Davis, Electronics & Communication System –TMH 2004.
2. R.P. Singh, SPSapre, Communication Systems–SecondEditionTMH,2007

## TRANSDUCERS AND SENSORS

(Open Elective)

| | | | |
|---|---|---|---|
| Subject Code | 18XXECOX0XD | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |

**Credits – 03**

**Course Objectives:**

This course will enable students to

1. Choose proper sensor comparing different standards and guidelines to make sensitive measurements of physical parameters like pressure, flow, acceleration, etc
2. Predict correctly the expected performance of various sensors
3. Locate different type of sensors used in real life applications and paraphrase their importance
4. Understand and analyze the characteristics of temperature sensors
5. Set up testing strategies to evaluate performance characteristics of different types of sensors and transducers

| **Unit -1** | **Hours** |
|---|---|
| **Introduction**: functional elements of an instrument, generalized performance characteristics of instruments – static characteristics, dynamic characteristics. Zero order, first order, second order instruments – step response, ramp response and impulse response. Response of general form of instruments to periodic input and to transient input Experimental determination of measurement system parameters, loading effects under dynamic conditions | 10 |
| **Unit -2** | |
| **Transducers for motion and dimensional measurements:** Relative displacement, translation and rotational resistive potentiometers, resistance strain gauges, LVDT, synchros, capacitance pickups, Piezo-electric transducers, electro-optical devices, nozzle – flapper transducers, digital displacement transducers, ultrasonic transducers. Magnetic and photoelectric pulse counting methods, relative acceleration measurements, seismic acceleration pickups, calibration of vibration pickups. Gyroscopic sensors | 10 |
| **Unit -3** | |
| **TRANSDUCERS FOR FORCE MEASUREMENT**: Bonded strain guage transducers, Photo-electric transducers, variable reluctance pickup, torque measurement dynamometers.<br>**TRANSDUCERS FOR FLOW MEASUREMENT**: Hot wire and hot-film anemometers, Electro-magnetic flow meters, laser Doppler velocity meter TRANSDUCERS FOR PRESSURE MEASUREMENT: Manometers, elastic transducers, liquid systems, gas systems, very high pressure transducers. Thermal conductivity gauges, ionization gauges, microphone | 10 |
| **Unit – 4** | |
| **TRANSDUCERS FOR TEMPERATURE MEASUREMENT**: Thermal expansion methods, Thermometers (liquid in glass), pressure thermometers, Thermocouples, Materials configuration and techniques. Resistance thermometers, Thermistors, junction semiconductors, Sensors, Radiation methods, Optical pyrometers, Dynamic response of temperature sensors heat flux Sensors, Transducers for liquid level measurement, humidity, silicon and quartz sensors, fiber optic sensors. | 10 |
| **Unit – 5** | |
| **Smart sensors**: Introduction, primary sensors, converters, compensation. Recent trends in sensor technology – film sensors, semiconductor IC technology, | 8 |

| | |
|---|---|
| MEMS, Nano-sensors | |
| **Total** | **48** |

**Course outcomes:**

On completion of the course student will be able to

1. Use concepts in common methods for converting a physical parameter into an electrical quantity
2. Classify and explain with examples of transducers, including those for measurement of temperature, strain, motion, position and light
3. Choose proper sensor comparing different standards and guidelines to make sensitive measurements of physical parameters like pressure, flow, acceleration, etc
4. Predict correctly the expected performance of various sensors knowledge outside the classroom through design of a real-life instrumentation system
5. Locate different type of sensors used in real life applications and paraphrase their importance

**Text Books:**

1. Sensors and Transducers Hardcover – Import, 5 December 2000by Ian Sinclai , newness publication.
2. Sensors and Transducers , Author, Department of Cybernetics, University of Reading, UK , M. J. Usher, 1985, Springer

**Reference Books**:

1. Doebelin, E.O., “Measurement systems – Application and Design”, McGraw Hill.
2. D. Patranabis, “Sensors and Transducers”, PHI, 2nd Edition.

| FUNDAMENTALS OF MICROPROCESSORS AND MICROCONTROLLERS<br>(Open Elective) | | | |
|---|---|---|---|
| Subject Code | 18XXECOX0XE | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| | | | **Credits – 03** |

**Course Objectives:**

This course will enable students to

1. To Learn the architecture of microprocessor and microcontroller.
2. To know the programming of 8086
3. To understand the interfacing of the processors
4. To know Memory System and I/O Organization and its applications.
5. To develop Microcontroller programming for various applications

| **Unit -1** | **Hours** |
|---|---|
| 8085 PROCESSOR Hardware Architecture, pinouts — Functional Building Blocks of Processor — Memory organization — I/O ports and data transfer concepts, Interrupts. 8086 Architecture: Main features, pin diagram/description, 8086 microprocessor family, internal architecture, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration. | 10 |
| **Unit -2** | |
| 8086 Programming: Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools. | 10 |
| **Unit -3** | |
| 8086 Interfacing: Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDS, Interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers. | 10 |
| **Unit – 4** | |
| 8051 MICRO CONTROLLER Hardware Architecture, pinouts — Functional Building Blocks of Processor — Memory organization — I/O ports and data transfer concepts– Timing Diagram — Interrupts- Data Transfer, Manipulation, Control Algorithms& I/O instructions, Comparison to Programming concepts with 8085. | 10 |
| **Unit – 5** | |
| MICRO CONTROLLER PROGRAMMING & APPLICATIONS Simple programming exercises- key board and display interface –Control of servo motor stepper motor control- Application to automation systems. | 8 |
| **Total** | **48** |

**Course outcomes:**
On completion of the course student will be able to

1. Understand the architecture of microprocessor and their operation.
2. Demonstrate programming skills in assembly language for processors and controllers.
3. Analyze various interfacing techniques and apply them for the design of processor/Controller based systems.
4. Understand 8051 architecture.
5. Analyze Microcontroller programming & applications

**Text Books:**

1. R.S. Gaonkar, Microprocessor Architecture Programming and Application, with 8085, Wiley Eastern Ltd., New Delhi, 2013.

2. A.K Ray, K.M. Bhurchandhi," Advanced Microprocessor and Peripherals", Tata McGraw Hill Publications, 2000.

3. The 8051 Microcontrollers and Embedded systems Using Assembly and C, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D.McKinlay; Pearson 2-Edition, 2011

**Reference Books**:

1. Douglas V Hall, SSSP Rao, Microprocessors and Interfacing – Programming and Hardware, Tata Mc Graw Hill Education Private Limited,3rdEdition,1994

# FUNDAMENTALS OF INTERNET OF THINGS

(Open Elective)

| | | | |
|---|---|---|---|
| Subject Code | 18XXECOX0XF | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |

**Credits – 03**

**Course Objectives:**

This course will enable students to

1. To introduce IoT Fundamentals
2. To know about the IoT Characteristics.
3. To give the understanding of IoT Architecture overview
4. To understand the concepts of IoT Reference Architecture.
5. To know different case studies of IoT.

| **Unit -1** | **Hours** |
|---|---|
| **Introduction to IoT:** Sensing, Actuation, Networking basics, Communication Protocols, Sensor Networks, Machine-to-Machine Communications, IoT Definition, Characteristics. IoT Functional Blocks, Physical design of IoT, Logical design of IoT, Communication models &APis. | 10 |
| **Unit -2** | |
| M2M to IoT-The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics. Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT. | 10 |
| **Unit -3** | |
| M2M vs loT An Architectural Overview-Building architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. Reference Architecture and Reference Model of IoT. | 10 |
| **Unit – 4** | |
| IoT Reference Architecture-Getting Familiar with IoT Architecture, Various architectural views of IoT such as Functional, Information, Operational and Deployment. Constraints affecting design in IoT world-Introduction, Technical design Constraints. | 10 |
| **Unit – 5** | |
| Developing IoT solutions: Introduction to Python, Introduction to different IoT tools, Introduction to Arduino and Raspberry Pi, Introduction to Cloud Computing, Fog Computing, Connected Vehicles, Data Aggregation for the IoT in Smart Cities, Privacy and Security Issues in IoT. Case Studies: Home Automation, Smart Health care. | 8 |
| **Total** | **48** |

**Course outcomes:**

On completion of the course student will be able to

1. Understand general concepts of Internet of Things (IoT)
2. Understand general concepts of M2M
3. Know the design principals of IoT
4. Recognize the various architectural view IoT
5. Apply the different applications of IoT

**Text Books:**

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-onApproach)", $1^{st}$ Edition,VPT,2014
2. JanHoller, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of intelligence", 1stEdition, AcademicPress,2014.

**Reference Books**:

1. Francisda Costa, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything",$1^{st}$ Edition, A press Publications,2013
2. CunoPfister, Getting Started with the Internet of Things, O"ReillyMedia, 2011,ISBN:978-1-4493-9357-1

# FUNDAMENTALS OF DIGITAL SIGNAL PROCESSING

(Open Elective)

| | | | |
|---|---|---|---|
| Subject Code | 18XXECOX0XG | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| | | | **Credits – 03** |

**Course Objectives:**

This course will enable students to

1. Know digital signal processing concepts
2. Find the DFT of the given Discrete Time Sequences
3. Impose FFT concept for solving the DFT of a sequence
4. Design Digital filters for the given specifications
5. Know the concepts on Digital Signal Processors

| **Unit -1** | **Hours** |
|---|---|
| **Introduction:** Introduction to Digital Signal Processing: Discrete time signals & sequences, Classification of Discrete time systems, stability of LTI systems, Response of LTI systems to arbitrary inputs. Solution of Linear constant coefficient difference equations. Frequency domain representation of discrete time signals and systems. | 10 |
| **Unit -2** | |
| **Discrete Fourier Transforms:** Introduction, Discrete Fourier transforms of standard signals, Properties of DFT, Linear filtering methods based on DFT. | 10 |
| **Unit -3** | |
| **Fast Fourier transforms (FFT)**: Introduction, Radix-2 decimation in time FFT Algorithm (DIT-FFT), Radix-2 decimation in frequency FFT Algorithm (DIF-FFT), Inverse FFT. | 10 |
| **Unit – 4** | |
| **Design of IIR Digital Filters:** Analog filter approximations – Butter worth and Chebyshev, Design of IIR Digital filters from analog filters, Design Examples, Analog and Digital frequency transformations.<br><br>**Design of FIR Digital Filters:** Characteristics of FIR Digital Filters, frequency response. Design of FIR Digital Filters using Window Techniques, Comparison of IIR & FIR filters | 10 |
| **Unit – 5** | |
| **DSP Processors:** Introduction to programmable DSPs: Multiplier and Multiplier Accumulator, Modified bus structures and memory access schemes in P-DSPs, Multiple Access Memory, Multi-ported memory, VLIW architecture, Pipelining, Special addressing modes, On-Chip Peripherals. | 8 |
| **Total** | **48** |

**Course outcomes:**

On completion of the course student will be able to

1. Interpret digital signal processing concepts and solve difference equations for analyzing Discrete Time Systems
2. Apply DFT for Discrete Time Sequences
3. Construct FFT algorithm for solving the DFT of a sequence
4. Construct Digital filters for the given specifications
5. Apply the signal processing concepts on Digital Signal Processors.

**Text Books:**

| |
|---|
| 1. John G. Proakis, Dimitris G.Manolakis, “Digital Signal Processing, Principles, Algorithms, and Applications”,Pearson Education / PHI, 2007.<br>2. A Anand Kumar, “Digital Signal Processing”, 2nd Edition, PHI Publications<br>3. B.Venkataramani, M.Bhaskar, “ Digital Signal Processors, Architecture, Programming and Applications”, TATA McGraw Hill, 2002 |
| 1. Andreas Antoniou, **“**Digital Signal Processing”, TATA McGraw Hill , 2006<br>2. Robert J. Schilling, Sandra L. Harris, “Fundamentals of Digital Signal Processing using Matlab”,Thomson, 2007. |

# SIGNALS AND SYSTEMS

(Open Elective)

| | | | |
|---|---|---|---|
| Subject Code | 18XXECOX0XH | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |

**Credits – 03**

**Course Objectives:**

This course will enable students to

1. Learn various signals, systems both in continuous time and discrete time.
2. Know the Fourier analysis of continuous-time periodic signals and finite energy signals.
3. Perform signal conversion by applying sampling theorem.
4. Make use of applying various signal and system properties to LTI systems
5. Extend the transform analysis to discrete time sequences

| **Unit -1** | **Hours** |
|---|---|
| **Introduction to Signals and Systems:** Definition of Signals and Systems, Singularity functions and related functions. Complex exponential and sinusoidal signals. Classification of Signals, Operations on signals. Classification of | 8 |
| **Unit -2** | |
| **Fourier Series:** Fourier series representation of continuous time periodic signals, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series.<br>**Fourier Transform:** Fourier transform of arbitrary signal, Fourier transform of standard signals, properties of Fourier transforms. | 10 |
| **Unit -3** | |
| **Sampling Theorem**: Representation of a CT signal by its samples: The Sampling theorem, impulse sampling, Natural and Flat-top Sampling, Reconstruction of signal from its samples, effect of under sampling–Aliasing.<br>Review of Laplace Transforms, Properties, Inverse Laplace Transform, Relation between L.T and F.T of a signal. | 10 |
| **Unit – 4** | |
| **Analysis of Linear Systems:** Linear Time Invariant systems, impulse response, Response of a linear system, Transfer function of a LTI system, Concept of convolution and graphical representation of convolution. Cross-correlation and auto-correlation of signals, Relation between convolution and correlation. | 10 |
| **Unit – 5** | |
| **Z–Transforms:** Concept of Z- Transform of a discrete sequence. Distinction between Laplace, Fourier and Z transforms. Region of convergence, constraints on ROC for various classes of signals, Properties of Z-transforms, Inverse Z-transform.<br>**Applications of signals and Systems:** Modulation for communication, Filtering of signals and Feedback control systems. | 10 |
| **Total** | **48** |

**Course outcomes:**

On completion of the course student will be able to

1. Understand various signals and systems and demonstrate their properties.
2. Develop Fourier analysis of continuous-time periodic signals and continuous-time finite energy signals.
3. Apply sampling theorem for signal conversion from continuous- time signals to discrete-time.
4. Illustrate various operations on LTI systems.
5. Apply z-transform to analyze discrete-time signals.

**Text Books:**

1. A.V. Oppenheim, A.S. Willsky and S.H. Nawab, “Signals and Systems”, 2nd Edition, PHI, 2009.
2. A Anand Kumar, “ Signals and Systems”, PHI Publications.

**Reference Books**

1. B.P. Lathi, “Signal Processing & Linear Systems”, 1st Edition, Oxford University Press, 2006
2. Simon Haykin and Van Veen, “Signals & Systems”, 2nd Edition, John Wiley India, 2011.

# Open Elective
# Courses Offered by ECT to other Departments

**Open Elective Courses offered by ECT Department**

| S.No | Subject Code | Name of the subject | L | T | P | Cr |
|---|---|---|---|---|---|---|
| 1 | 18XXETOXXXX | Signals and Systems | 3 | 0 | 0 | 3 |
| 2 | 18XXETOXXXX | Principles of Signal Processing | 3 | 0 | 0 | 3 |
| 3 | 18XXETOXXXX | Consumer Electronics | 3 | 0 | 0 | 3 |
| 4 | 18XXETOXXXX | Transducers and Sensors | 3 | 0 | 0 | 3 |
| 5 | 18XXETOXXXX | IOT and Applications | 3 | 0 | 0 | 3 |
| 6 | 18XXETOXXXX | IC Applications | 3 | 0 | 0 | 3 |
| 7 | 18XXETOXXXX | Principles of Communications | 3 | 0 | 0 | 3 |
| 8 | 18XXETOXXXX | Data Communications | 3 | 0 | 0 | 3 |
| 9 | 18XXETOXXXX | Digital Logic design | 3 | 0 | 0 | 3 |
| 10 | 18XXETOXXXX | Remote Sensing and GIS | 3 | 0 | 0 | 3 |

# SIGNALS AND SYSTEMS
**(Open Elective)**

| | | | |
|---|---|---|---|
| Subject Code | 18XXETOXXXX | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| Pre-requisite | Engineering Mathematics | Credits – 03 | |

**Course Objectives:**
This course will enable students to
1. Understand signals and systems classification
2. Explain convolution and representations of Systems
3. Understand frequency domain representation of systems
4. Explain the applications of Fourier representation

| Unit -1 | Hours |
|---|---|
| **Introduction:** Definitions of a signal and a system, classification of signals, basic Operations on signals, elementary signals, Systems viewed as Interconnections of operations, properties of systems | 10 |
| **Unit -2** | |
| **Time-domain representations for LTI systems:** Convolution, impulse response representation, Convolution Sum and Convolution Integral. Properties of impulse response representation, Differential and difference equation Representations, Block diagram representations. | 10 |
| **Unit -3** | |
| **Frequency-domain representation for signals:** Introduction, Discrete-time and continuous time Fourier series (derivation of series excluded) and their properties. **Discrete-time and continuous-time** Fourier transforms (derivations of transforms are excluded) and their properties. | 10 |
| **Unit – 4** | |
| **Applications of Fourier representations:** Introduction, Frequency response of LTI systems, Fourier transform representation of periodic signals, Fourier transform representation of discrete time signals. | 9 |
| **Unit – 5** | |
| **LAPLACE & Z-TRANSFORMS:** Introduction, Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals, Properties of L.T's, Inverse Laplace transform, Relation between L.T's, and F.T. of a signal. Z-Transforms: Introduction, Z-transform, properties of ROC, properties of Z – transforms, inversion Z-transforms. Z-Transform analysis of LTI Systems, unilateral Z-Transform and its application to solve difference equations | 9 |

**Course outcomes:** Students will be able to
1. Understand signal and its basic operations
2. Understand linear time invariant systems.
3. Apply the concepts of Fourier series representations to analyze continuous and discrete time periodic signals.
4. Understand and apply the continuous time Fourier transform, discrete time Fourier transform,
5. Apply the concepts of Laplace transform, and z-Transform to the analysis and description of LTI continuous and discrete-time systems

**Text Books:**

1. A.V. Oppenheim, A.S. Willsky and S.H. Nawab, "Signals and Systems", Pearson, 2 nd Edn.G. Streetman and S. K. Banerjee, "Solid State Electronic Devices", 2nd edition, Pearson, 2014.
2. B. P. Lathi, "Linear Systems and Signals", Second Edition, Oxford University Press

3. Simon Haykin and Van Veen, “Signals & Systems”, Wiley, 2nd Edition.

**Reference Books**:

1. Michel J. Robert, “Fundamentals of Signals and Systems”, MGH International Edition, 2008.
2. Ramakrishna Rao,“Signals and Systems”, 2008, TMH

# PRINCIPLES OF SIGNAL PROCESSING
**(Open Elective)**

| | | | |
|---|---|---|---|
| Subject Code | 18XXETOXXXX | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| Pre-requisite | Signals and Systems | Credits – 03 | |

**Course Objectives:**

This course will enable students to

1. Understand discrete signals and systems, DIT algorithms
2. Explain the structures of IIR filters by bilinear transformation
3. Explain the structures of FIR filters by window techniques
4. Explain the concept of multirate signal processing and adaptive filters

| **Unit -1** | **Hours** |
|---|---|
| **Discrete Signals and Systems-** A Review – Introduction to DFT – Properties of DFT – Circular Convolution – Filtering methods based on DFT – FFT Algorithms –Decimation in time Algorithms, Decimation in frequency Algorithms – Use of FFT in Linear Filtering. | 10 |
| **Unit -2** | |
| **Structures of IIR filters** – Analog filter design – Discrete time IIR filter from analog filter – IIR filter design by Impulse Invariance, Bilinear transformation. | 10 |
| **Unit -3** | |
| **Structures of FIR filters** – Linear phase FIR filter – Filter design.<br>**Design using windowingtechniques** (Rectangular Window, Hamming Window, Hanning Window), Frequency sampling techniques | 9 |
| **Unit – 4** | |
| **Multirate signal processing:** Basic building blocks of multirate DSP, Decimation, Interpolation, Sampling rate conversion by a rational factor, Multistage Sampling Rate Converters. | 10 |
| **Unit – 5** | |
| **Adaptive Filters:** Introduction, LMS and RLS Adaptation Algorithms, Applications of adaptive filtering to equalization, noise cancellation. | 9 |

**Course Outcomes:**

The student will be able to

1. Use the FFT algorithm for solving the DFT of a given signal
2. Design a Digital filter (FIR&IIR) from the given specifications
3. Realize the FIR and IIR structures from the designed digital filter.
4. Use the Multirate Processing concepts in various applications.
5. Apply the Adaptive signal processing concepts to various signal processing applications

**Text Books:**


1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G.Manolakis, Pearson Education / PHI, 2007.
2. Discrete Time Signal Processing – A.V.Oppenheim and R.W. Schaffer, PH


**Reference Books**:


1. Fundamentals of Digital Signal Processing using Matlab – Robert J. Schilling, Sandra L. Harris,Thomson, 2007.
2. Understanding Digital Signal Processing 2nd Edition by Richard G.Lyons

# CONSUMER ELECTRONICS
**(Open Elective)**

| | | | |
|---|---|---|---|
| Subject Code | 18XXETOXXXX | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| Pre-requisite | Analog Communications | Credits – 03 | |

**Course Objectives:**
This course will enable students to
1. Understand the significance of audio systems
2. Explain the digital audio fundamentals and operation
3. Explain the operation of digital transmission and reception
4. Understand the need for different type of appliances

| Unit -1 | Hours |
|---|---|
| **Audio Systems:** Microphones and Loudspeakers: Carbon, moving coil, cordless microphone, Direct radiating and horn loudspeaker, Multi-speaker system, Hi-Fi stereo and dolby system. Concept to fidelity, Noise and different types of distortion in audio system. | 10 |
| **Unit -2** | |
| **Digital Audio Fundamentals:** Audio as Data and Signal, Digital Audio Processes Outlined, Time Compression and Expansion. | 9 |
| **Unit -3** | |
| **SCR and Thyristor:** Principles of operation and characteristics of SCR, Triggering of Television: Basics of Television: Elements of TV communication system, Scanning and its need, Need of synchronizing and blanking pulses, VSB, Composite Video Signal. **Colour Television:** Primary, secondary colours, Concept of Mixing, Colour Triangle, Camera tube, PAL TV Receiver, NTSC, PAL, SECAM | 10 |
| **Unit – 4** | |
| **Digital Transmission and Reception:** Digital satellite television, Direct-To-Home(DTH) satellite television, Introduction to :Video on demand, CCTV, High Definition(HD)-TV. Introduction to Liquid Crystal and LED Screen Televisions Basic block diagram of LCD and LED Television and their comparison | 10 |
| **Unit – 5** | |
| **Introduction to different type of domestic/commercial appliances:** Operation of Micro-wave oven, Food Processors, Digital Electronic Lock, Vacuum cleaner, Xerox Machine, scanner . | 09 |

**Course Outcomes:** Student will be able to
1. Understand the various type of microphones and loud speakers.
2. To identify the various digital and analog signal.
3. Describe the basis of television and composite video signal.
4. Describe the various kind of colour TV standards and system.
5. Compare the various types of digital TV system.
6. Understand the various type of consumer goods.

**Text Books :**

1. Modern Television Practice by R. R. Gulai; New Age International Publishers.
2. Audio Video Systems by R. G. Gupta; McGraw Hill Education System.
3. Audio Video Systems Principles Practices and Troubleshooting by Bali & Bali; Khanna Publishing Company


**Reference Books**:

1. Consumer Electronics by S. P. Bali; Pearson Education, New Delhi

## TRANSDUCERS AND SENSORS
**(Open Elective)**

| | | | |
|---|---|---|---|
| Subject Code | 18XXETOXXXX | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| Pre-requisite | EMI | Credits – 03 | |

**Course Objectives:**

This course will enable students to

- Understand measurements and instrumentation and its need.
- Explain the Characteristics of Transducers.
- Explain the Characteristics of resistive, inductive and capacitive transducers

| Unit -1 | Hours |
|---|---|
| **Measurements and Instrumentation of Transducers:** Measurements – Basic method of measurement – Generalized scheme for measurement systems – Units and standards – Errors – Classification of errors, error analysis – Statistical methods – Sensor – Transducer – Classification of transducers – Basic requirement of transducers. | 10 |
| **Unit -2** | |
| **Characteristics of Transducers:** Static characteristics – Dynamic characteristics – Mathematical model of transducer – Zero, first order and second order transducers – Response to impulse, step, ramp and sinusoidal inputs | 10 |
| **Unit -3** | |
| **Resistive Transducers:** Potentiometer –Loading effect – Strain gauge – Theory, types, temperature compensation – Applications<br>**Torque measurement** – Proving Ring – Load Cell – Resistance thermometer – Thermistors materials – Constructions, Characteristics – Hot wire anemometer | 9 |
| **Unit – 4** | |
| **Inductive and Capacitive Transducer:** Self inductive transducer – Mutual inductive transducers – Linear Variable Differential Transformer – LVDT Accelerometer – RVDT – Synchros – Microsyn – Capacitive transducer – Variable Area Type – Variable Air Gap type – Variable Permittivity type – Capacitor microphone. | 10 |
| **Unit – 5** | |
| **Miscellaneous Transducers:** Piezoelectric transducer – Hall Effect transducers – Smart sensors – Fiber optic sensors – Film sensors – MEMS – Nano sensors, Digital transducers | 09 |

**Course Outcomes:**

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

1. Use concepts in common methods for converting a physical parameter into an electrical quantity
2. Classify and explain with examples of transducers, including those for measurement of temperature, strain, motion, position and light
3. Choose proper sensor comparing different standards and guidelines to make sensitive measurements of physical parameters like pressure, flow, acceleration, etc
4. Predict correctly the expected performance of various sensors
5. Locate different type of sensors used in real life applications and paraphrase their importance
6. Set up testing strategies to evaluate performance characteristics of different types of sensors and transducers

**Text Books:**


1. Sawhney. A.K, “A Course in Electrical and Electronics Measurements and

| |
|---|
| Instrumentation", 18th Edition, Dhanpat Rai & Company Private Limited, 2007.<br>2. Patranabis. D, "Sensors and Transducers", Prentice Hall of India, 2003. |
| **Reference Books**:<br>1. Renganathan. S, "Transducer Engineering", Allied Publishers, Chennai, 2003.<br>2. Doebelin. E.A, "Measurement Systems – Applications and Design", Tata McGraw Hill, New York, 2000<br>3. John. P, Bentley, "Principles of Measurement Systems", III Edition, Pearson Education, 2000.<br>4. Murthy. D. V. S, "Transducers and Instrumentation", Prentice Hall of India, 2001. 4. Sensor Technology Hand Book – Jon Wilson, Newne 2004.<br>5. Instrument Transducers – An Introduction to their Performance and design – by Herman K. P. Neubrat, Oxford University Press |

# IOT AND APPLICATIONS
## (Open Elective)

| | | | |
|---|---|---|---|
| Subject Code | 18XXETOXXXX | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| Pre-requisite | | Credits – 03 | |

**Course Objectives:**

This course will enable students to

1. Understand the IoT and its role in cloud computing.
2. Understand the elements and application development using IoT.
3. Explain the solution framework for IoT applications
4. Analyze the IoT Case Studies.

| Unit -1 | Hours |
|---|---|
| **Introduction to IoT:** Introduction to IoT, Architectural Overview, Design principles and needed capabilities, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Everything as a Service (XaaS), Role of Cloud in IoT, Security aspects in IoT. | 10 |
| **Unit -2** | |
| **Elements of IoT:** Hardware Components- Computing- Arduino, Raspberry Pi, ARM Cortex-A class processor, Embedded Devices – ARM Cortex-M class processor, Arm Cortex-M0 Processor Architecture, Block Diagram, Cortex-M0 Processor Instruction Set, ARM and Thumb Instruction Set. | 10 |
| **Unit -3** | |
| **IoT Application Development:** Communication, IoT Applications, Sensing, Actuation, I/O interfaces. Software Components- Programming API's (using Python/Node.js/Arduino) for Communication Protocols-MQTT, ZigBee, CoAP, UDP, TCP, Bluetooth.<br>**Bluetooth Smart Connectivity** Bluetooth overview, Bluetooth Key Versions, Bluetooth Low Energy (BLE) Protocol, Bluetooth, Low Energy Architecture, PSoC4 BLE architecture and Component Overview. | 9 |
| **Unit – 4** | |
| **Solution framework for IoT applications:** Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices. | 10 |
| **Unit – 5** | |
| **IoT Case Studies:** IoT case studies and mini projects based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation. Cloud Analytics for IoT Application: Introduction to cloud computing, Difference between Cloud Computing and Fog Computing: The Next Evolution of Cloud Computing, Role of Cloud Computing in IoT, Connecting IoT to cloud, Cloud Storage for IoT Challenge in integration of IoT with Cloud. | 9 |

**Course Outcomes:**

The student will be able to:

1. Understand internet of Things and its hardware and software components.
2. Interface I/O devices, sensors & communication modules.
3. Remotely monitor data and control devices.
4. Design real time IoT based applications.
5. Design the real case studies.

**Text Books:**

1. Raj Kamal, “Internet of Things: Architecture and Design Principles”, 1st Edition, McGraw Hill Education,2017.
2. The Definitive Guide to the ARM Cortex-M0 by JosephYiu,2011
3. Vijay Madisetti, Arshdeep Bahga, Internet of Things, “A Hands on Approach”, UniversityPress,2015

**Reference Books**:

1. CypressSemiconductor/PSoC4BLE(BluetoothLowEnergy)ProductTrainingModules.
2. PethuruRajandAnupamaC.Raman,“TheInternetofThings:EnablingTechnologies,Platforms,andUse Cases”,CRCPress,2017.

# IC APPLICATIONS
**(Open Elective)**

| | | | |
|---|---|---|---|
| Subject Code | 18XXETOXXXX | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| Pre-requisite | Analog Circuits, DSD | Credits – 03 | |

**Course Objectives:**
This course will enable students to
1. Understand the ideal op-amp and practical op-amp.
2. Understand 555 timer and IC565 VCO and its application.
3. Explain the DAC and ADC techniques and its specifications.
4. Explain the Use of TTL-74XX Series & CMOS 40XX Series ICs

| Unit -1 | Hours |
|---|---|
| **Ideal and Practical Op-Amp**, Op-amp characteristics-DC and AC Characteristics, General Linear Applications of Op-Amp: Adder, Subtractor, Differentiators and Integrators, Active Filters and Oscillators, Nonlinear Applications of OPAMP: Comparators, Schmitt Trigger, Multivibrators | 10 |
| **Unit -2** | |
| **Introduction to 555 Timer**, Functional Diagram, Monostable and Astable Operations and Applications, Schmitt Trigger, PLL- Introduction, Block Schematic, Principles and Description of individual Blocks of 565, VCO. | 10 |
| **Unit -3** | |
| **Introduction, Basic DAC Techniques** - Weighted Resistor Type. R-2R Ladder Type, inverted R-2R Type.<br>**Different types of ADCs** - Parallel Comparator Type. Counter Type. Successive Approximation Register Type and Dual Slope Type DAC and ADC Specifications. | 9 |
| **Unit – 4** | |
| **Use of TTL-74XX Series & CMOS 40XX Series ICs**, TTL ICs - Code Converters, Decoders, Demultiplexer, Encoders, Priority Encoders, multiplexers & their applications. Priority Generators, Arithmetic Circuit ICs-Parallel Binary Adder/Subtractor Using 2's Complement System, Magnitude Comparator Circuits. | 10 |
| **Unit – 5** | |
| **Commonly Available 74XX & 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 & applications | 09 |

**Course Outcomes:**
The student will be able to
1. Analyze the Differential Amplifier with Discrete components
2. Describe the Op-Amp and internal Circuitry: 555 Timer, PLL
3. Discuss the Applications of Operational amplifier: 555 Timer, PLL
4. Design the digital application using digital ICs
5. Use the Op-Amp in A to D & D to A Converters

**Text Books:**

1. Linear Integrated Circuits -D. Roy Chowdhury, New Age International (p)Ltd, 3" Ed., 2008.
2. Digital Fundamentals - Floyd and Jain, Pearson Education,8th Edition, 2005.


**Reference Books**:

1. Modern Digital Electronics - RP Jain - 4/e - TMH, 2010.
2. Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI, 1987

# PRINCIPLES OF COMMUNICATION SYSTEMS
**(Open Elective)**

| | | | |
|---|---|---|---|
| Subject Code | 18XXETOXXXX | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| Pre-requisite | Signals and Systems | Credits – 03 | |

**Course Objectives:**

This course will enable students to

1. Understand modulation techniques in time and frequency domain
2. Explain angle modulation and signal sampling.
3. Analyze noise in analog modulation systems
4. Understand Transmission of Binary Data in Communication Systems

| Unit -1 | Hours |
|---|---|
| **Amplitude modulation:** Introduction, Amplitude Modulation: Time & Frequency – Domain description, switching modulator, Envelop detector. Double side band-suppressed carrier modulation: Time and Frequency – Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing. Single side–band and vestigial sideband methods of modulation: SSB Modulation, VSB Modulation, Frequency Translation, Frequency- Division Multiplexing, Theme Example: VSB Transmission of Analog and Digital Television | 10 |
| **Unit -2** | |
| **Angle modulation:** Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, | 9 |
| **Unit -3** | |
| **Signal Sampling and Analog Pulse Communication:** Ideal Sampling, Pulse Amplitude Modulation, Pulse Width Modulation, Pulse Position Modulation. **Digital Communication Techniques:** Quantization, Digital Transmission of Data, Parallel and Serial Transmission, Data Conversion, Pulse Code Modulation, Delta Modulation. | 9 |
| **Unit – 4** | |
| **Noise in analog modulation:** Introduction, Receiver Model, Noise in DSB-SC receivers, Noise in AM receivers, Threshold effect, Noise in FM receivers, Capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis and De-emphasis in FM. | 10 |
| **Unit – 5** | |
| **Transmission of Binary Data in Communication Systems:** Digital Codes, Principles of Digital Transmission, Transmission Efficiency, Modem Concepts and Methods – FSK, BPSK, Error Detection and Correction | 10 |

**Course Outcomes**:

The student will be able to

1. Analyze the performance of analog modulation schemes in time and frequency domains.
2. Analyze the performance of angle modulated signals.
3. Characterize analog signals in time domain as random processes and noise
4. Characterize the influence of channel on analog modulated signals
5. Determine the performance of analog communication systems in terms of SNR
6. Analyze pulse amplitude modulation, pulse position modulation, pulse code modulation and TDM systems

**Text Books:**

1. Principles of Communication Systems – H Taub& D. Schilling, GautamSahe, TMH, 2007, 3rdEdition.

2. Communication Systems – B.P. Lathi, BS Publication,2006.

**Reference Books**:

1. Principles of Communication Systems - Simon Haykin, John Wiley,2ndEdition.
2. Electronics & Communication System – George Kennedy and Bernard Davis, TMH 2004.
3. Communication Systems– R.P. Singh, SP Sapre, Second Edition TMH,2007.

# DATA COMMUNICATIONS
## (Open Elective)

| | | | |
|---|---|---|---|
| Subject Code | 18XXETOXXXX | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| Pre-requisite | Communication | Credits – 03 | |

**Course Objectives:**
This course will enable students to
1. Understand the concept of data communications and network connection.
2. Explain the operation of data link layer and network layer.
3. Understand the operation of transport layer and IP.
4. Explain the application layer and Principles of Networking Applications.

| Unit -1 | Hours |
|---|---|
| **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, | 10 |
| **Unit -2** | |
| **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. | 10 |
| **Unit -3** | |
| **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.<br>**The Internet Protocol(IP):** Forwarding and Addressing in the Internet Datagram format, Ipv4 Addressing, Internet Control Message Protocol(ICMP), IPv6 | 9 |
| **Unit – 4** | |
| **Transport Layer:** Introduction 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, Go-Back-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 | 10 |
| **Unit – 5** | |
| **Application Layer:** Principles of Networking Applications – Network | 9 |

| | |
|---|---|
| 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 Internet's Directory Service – Service Provided by DNS, Overview of How DNS Works, DNS Records and messages. | |

**Course Outcomes:**

1. Know the Categories and functions of various Data Communication Networks
2. Design and analyze various error detection techniques.
3. Demonstrate the mechanism of routing the data in network layer
4. Know the significance of various Flow control and Congestion control Mechanisms

**Text Books:**


1. Computer Networking A Top-Down Approach – Kurose James F, Keith W, 6thEdition , Pearson,2017.
2. Data Communications and Networking Behrouz A.Forouzan4th Edition McGraw Hill Education,2017.


**Reference Books**:


1. Data communication and Networks - Bhusan Trivedi, Oxford university press, 2016
2. Computer Networks -- Andrew S Tanenbaum, 4th Edition, Pearson Education, 2003.
3. Understanding Communications and Networks, 3 rd Edition, W.A.Shay, Cengage Learning, 2003.

# DIGITAL LOGIC DESIGN
**(Open Elective)**

| | | | |
|---|---|---|---|
| Subject Code | 18XXETOXXXX | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| Pre-requisite | | Credits – 03 | |

**Course Objectives:**

This course will enable students to

1. Understand the number system and codes.
2. Explain the minimization techniques with four variables and single function.
3. Understand the logic circuits design using MSI and LSI
4. Explain the operation of sequential and combinational circuit design.

| Unit -1 | Hours |
|---|---|
| **REVIEW OF NUMBER SYSTEMS & CODES:** Representation of numbers of different radix, conversation from one radix to another radix, r-1's compliments and r's compliments of signed members, Gray code ,4 bit codes; BCD, Excess-3, 2421, 84-2-1 code etc. Error detection & correction codes: parity checking, even parity, odd parity, Hamming code. BOOLEAN **THEOREMS AND LOGIC OPERATIONS:** Boolean theorems, principle of complementation & duality, De-Morgan theorems, Logic operations; Basic logic operations -NOT, OR, AND, Universal Logic operations, EX-OR, EX- NOR operations. Standard SOP and POS Forms, NAND-NAND and NOR-NOR realizations, Realization of three level logic circuits. Study the pin diagram and obtain truth table for the following relevant ICs 7400,7402,7404,7408,7432,7486. | 9 |
| **Unit -2** | |
| **MINIMIZATION TECHNIQUES:** Minimization and realization of switching functions using Boolean theorems, K-Map (up to 6 variables)and tabular method(Quine-mccluskey method) with only four variables and single function. COMBINATIONAL LOGIC CIRCUITS DESIGN: Design of Half adder, full adder, half subtractor, full subtractor, applications of full adders; 4-bit adder-subtractor circuit, BCD adder circuit, Excess 3 adder circuit and carry look-a-head adder circuit, Design code converts using Karnaugh method and draw the complete circuit diagrams. | 10 |
| **Unit -3** | |
| **COMBINATIONAL LOGIC CIRCUITS DESIGN USING MSI &LSI :** Design of encoder ,decoder, multiplexer and de-multiplexers, Implementation of higher order circuits using lower order circuits . Realization of Boolean functions using decoders and multiplexers, Design of Priority encoder, 4-bit digital comparator and seven segment decoder. . Study the relevant ICs pin diagrams and their functions 7442,7447,7485,74154. **INTRODUCTION OF PLD's :** PLDs: PROM, PAL, PLA -Basics structures, realization of Boolean functions, Programming table. | 10 |
| **Unit – 4** | |
| **SEQUENTIAL CIRCUITS I**: Classification of sequential circuits (synchronous and asynchronous) , operation of NAND & NOR Latches and flip-flops; truth tables and excitation tables of RS flip-flop, JK flip-flop, T flip-flop, D flip-flop with reset and clear terminals. Conversion from one flip-flop to another flip- flop, Design of 5ripple counters, design of synchronous counters, Johnson counter, ring counter. Design of registers - Buffer register, control buffer register, shift register, bi-directional shift register, universal shift, register, Study the following relevant ICs and their relevant functions | 10 |

| | |
|---|---|
| 7474,7475,7476,7490,7493,74121. | |
| **Unit – 5** | |
| **SEQUENTIAL CIRCUITS II :**Finite state machine; state diagrams, state tables, reduction of state tables. Analysis of clocked sequential circuits Mealy to Moore conversion and vice-versa, Realization of sequence generator, Design of Clocked Sequential Circuit to detect the given sequence (with overlapping or without overlapping) | 9 |

**Course Outcomes**:

The student will be able to

1. Classify different number systems and apply to generate various codes.
2. Use the concept of Boolean algebra in minimization of switching functions
3. Design different types of combinational logic circuits.
4. Apply knowledge of flip-flops in designing of Registers and counters
5. The operation and design methodology for synchronous sequential circuits and algorithmic state machines
6. Produce innovative designs by modifying the traditional design techniques

**Text Books:**

1. Switching and finite automata theory Zvi.KOHAVI, Niraj.K. Jha 3rdEdition, Cambridge UniversityPress,2009
2. Digital Design by M.Morris Mano, Michael D Ciletti,4th edition PHIpublication,2008
3. Switching theory and logic design by Hill and Peterson, Mc-Graw Hill TMH edition, 2012.

**Reference Books**:

1. Fundamentals of Logic Design by Charles H.RothJr,JaicoPublishers,2006
2. Digital electronics by R S Sedha.S.Chand&companylimited,2010
3. Switching Theory and Logic Design by A.Anand Kumar,PHILearningpvtltd,2016.
4. Digital logic applications and design by John M Yarbough,Cengagelearning,2006.
5. TTL74-Seriesdatabook.

## REMOTE SENSING AND GIS
**(Open Elective)**

| | | | |
|---|---|---|---|
| Subject Code | 18XXETOXXXX | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| Pre-requisite | | Credits – 03 | |

**Course Objectives:**

This course will enable students to

1. Understand the concept of photogrammetry and its significance.
2. Explain the basic concept of remote sensing and limitations.
3. Understand the vector data model and topology rules.
4. Explain the raster data model , elements and importance of source map and data editing

| Unit -1 | Hours |
|---|---|
| **Introduction to Photogrammetry:** Principles& types of aerial photograph, geometry of vertical aerial photograph, Scale & Height measurement on single vertical aerial photograph, Height measurement based on relief displacement, Fundamentals of stereoscopy, fiducial points, parallax measurement using fiducial line. | 09 |
| **Unit -2** | |
| **Remote Sensing:** Basic concept of remote sensing, Data and Information, Remote sensing data Collection, Remote sensing advantages & Limitations, Remote Sensing process. Electromagnetic Spectrum, Energy interactions with atmosphere and with earth surface features (soil, water, vegetation), Indian Satellites and Sensors characteristics, Resolution, Map and Image and False color composite, introduction to digital data, elements of visual interpretation techniques. | 10 |
| **Unit -3** | |
| **Remote Sensing:** Basic concept of remote sensing, Data and Information, Remote sensing data Collection, Remote sensing advantages & Limitations, Remote Sensing process.<br>**Electromagnetic Spectrum**, Energy interactions with atmosphere and with earth surface features (soil, water, vegetation), Indian Satellites and Sensors characteristics, Resolution, Map and Image and False color composite, introduction to digital data, elements of visual interpretation techniques. | 10 |
| **Unit – 4** | |
| **Vector Data Model:** Representation of simple features- Topology and its importance; coverage and its data structure, Shape file; Data models for composite features Object Based Vector Data Model; Classes and their Relationship; The geobase data model; Geometric representation of Spatial Feature and data structure, Topology rules | 10 |
| **Unit – 5** | |
| **Raster Data Model:** Elements of the Raster data model, Types of Raster Data, Raster Data Structure, Data Conversion, Integration of Raster and Vector data. Data Input: Metadata, Conversion of Existing data, creating new data; Remote Sensing data, Field data, Text data, Digitizing, Scanning, on screen digitizing, importance of source map, Data Editing | 09 |

**Course Outcomes:**

The student will be able to

1. Retrieve the information content of remotely sensed data
2. Analyze the energy interactions in the atmosphere and earth surface features
3. Interpret the images for preparation of thematic maps
4. Apply problem specific remote sensing data for engineering applications
5. Analyze spatial and attribute data for solving spatial problems
6. Create GIS and cartographic outputs for presentation

**Text Books:**

1. Remote Sensing and GIS Lillesand and Kiefer, John Willey 2008.
2. Remote Sensing and GIS B. Bhatta by Oxford Publishers 2015.
3. Introduction to Geographic Information System – Kang-Tsung Chang, McGraw-Hill 2015

**Reference Books**:

1. Concepts & Techniques of GIS by C. P. Lo Albert, K.W. Yonng, Prentice Hall (India) Publications.
2. Principals of Geo physical Information Systems – Peter A Burragh and Rachael A. Mc Donnell, Oxford Publishers 2004.
3. Basics of Remote sensing & GIS by S. Kumar, Laxmi Publications

# Open Elective
# Courses Offered by EEE to other Departments

**Open Electives offered by EEE department**

| S. No | Subject Code | Subject title |
|---|---|---|
| 1 | 18XXEEOM0XA | Control system design |
| 2 | 18XXEEOM0XB | Optimization techniques |
| 3 | 18XXEEOM0XC | Electrical Energy Conservation And Auditing |
| 4 | 18XXEEOM0XD | Electrical and Hybrid Vehicles |
| 5 | 18XXEEOM0XE | Intelligent control & its applications |
| 6 | 18XXEEOM0XF | Electrical materials |
| 7 | 18XXEEOM0XG | Industrial Electrical Systems |
| 8 | 18XXEEOM0XH | Advanced Control Systems |

# CONTROL SYSTEM DESIGN
**(Open Elective)**

| | | | |
|---|---|---|---|
| Subject Code | 18XXEEOM0XA | IA Marks | 30 |
| Number of Lecture Hours/week | 03 | Exam Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |

Credits – 03

**Course Objectives:**
This course will enable student to
1. Explain the concepts of design problem and various design specifications.
2. Discuss the design of compensator for both time and frequency domain specifications.
3. Explain the design of various controllers.
4. Understand the concept on feed-forward control.
5. Apply the knowledge of design using state space
6. Understand the methods of solving Non-linear system of equations.

| Unit | Hours |
|---|---|
| **Unit 1: Design Specifications** | |
| Introduction to design problem and philosophy. Introduction to time domain and frequency domain design specification and its physical relevance. Effect of gain on transient and steady state response. Effect of addition of pole on system performance. Effect of addition of zero on system response. | **10** |
| **Unit 2: Design of Classical Control System in the time domain and Frequency domain** | |
| Introduction to compensator. Design of Feedback and Feed forward compensators, Feedback compensation. Realization of compensators.<br>Compensator design in frequency domain to improve steady state and transient response. Feedback and Feed forward compensator design using Bode diagram. | **10** |
| **Unit 3: Design of PID controllers** | |
| Design of P, PI, PD and PID controllers in time domain and frequency domain for first, second and third order systems. Control loop with auxiliary feedback – Feed forward control. | **09** |
| **Unit 4: Control System Design in state space** | |
| Review of state space representation. Concept of controllability & observability, effect of pole zero cancellation on the controllability & observability of the system, pole placement design through state feedback. Ackerman's Formula for feedback gain design. Design of Observer. Full order, Reduced order observer. Separation Principle. | **10** |
| **Unit 5: Design of control for Non Linear Systems** | |
| Introduction, Methods of solving Non-linear systems of equations. Pseudo-composition, weight function procedure, Technique for extending scalar methods to the multidimensional case in a nontrivial way | **09** |

**Course outcomes:**
On completion of the course student will be able to:
1. Elaborate the concepts of various designing fundamentals.
2. Apply the basic design in both time and frequency domain
3. Understand the concepts of PID controllers
4. Apply the knowledge of design using state space
5. Illustrate the basic concepts of nonlinearities and their performance
6. Discuss the concepts of singular points and performance of system

**Text Books:**

1. N.Nise,“ControlsystemEngineering”,JohnWiley,2000.
2. I.J.NagrathandM.Gopal,“Controlsystemengineering”,Wiley,2000.
3. M.Gopal,“DigitalControlEngineering”,WileyEastern,1988.
4. K.Ogata,“ModernControlEngineering”,PrenticeHall,2010.

**Reference Books:**

1. B. C. Kuo, “ Automatic Control system”, PrenticeHall,1995.
2. J. J. D’Azzo and C. H. Houpis, “ Linear control system analysis anddesign (conventional and modern)” , McGrawHill,1995.
3. R. T. Stefani and G. H. Hostettler, “Design of feedback Control Systems”, Saunders CollegePub,1994.

# OPTIMIZATION TECHNIQUES

**Open Elective**

| | | | |
|---|---|---|---|
| Subject Code | 18XXEEOM0XB | IA Marks | 30 |
| Number of Lecture Hours/week | 03 | Exam Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |

Credits -3

**Course Objectives:**

This course will enable student to:

1. Explain the objective and constraint functions in terms of design variables, and then state the optimization problem.
2. Solve single variable and multi variable optimization problems with and without constraints.
3. Explain linear programming technique to an optimization problem, slack and surplus variables, by using Simplex method.
4. Explain nonlinear programming techniques, unconstrained or constrained, and define exterior and interior penalty functions for optimization problems.
5. Discuss evolutionary programming techniques.

| Unit 1: Introduction | Hours |
|---|---|
| Statement of an Optimization problem, design vector, design constraints, constraint surface, objective function, objective function surfaces, classification of Optimization problems. | **09** |
| **Unit 2: Classical Optimization Techniques** | |
| Single variable Optimization, multi variable Optimization without constraints, necessary and sufficient conditions for minimum/maximum, multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers, multivariableOptimizationwithinequalityconstraints,Kuhn,Tuckerconditions. | **10** |
| **Unit 3: Linear Programming** | |
| Standard form of a linear programming problem , geometry of linear programming problems, definitions and theorems, solution of a system of linear simultaneous equations, pivotal reduction of a general system of equations, motivation to the simplex method, simplex algorithm, Duality in Linear Programming, Dual Simplex method. | **09** |
| **Unit 4: Nonlinear Programming** | |
| Unconstrained cases, One, dimensional minimization methods: Classification, Fibonacci method and Quadratic interpolation method, Univariate method, Powell's method and steepest descent method.<br>Constrained cases, Characteristics of a constrained problem, Classification, Basic approach of Penalty Function method; Basic approaches of Interior and Exterior penalty function methods. Introduction to convex Programming Problem. | **10** |
| **Unit 5: Introduction to Evolutionary Methods** | |
| Evolutionary programming methods, Introduction to Genetic Algorithms (GA)– Control parameters, Number of generation, population size, selection, reproduction, crossover and mutation, Operator selection criteria , Simple mapping of objective function to fitness function, constraints, Genetic algorithm steps,<br>Stopping criteria –Simple examples. | **10** |

**Course outcomes:**

On completion of the course student will be able to:

1. State and formulate the optimization problem, without and with constraints, by using design variables from an engineering design problem.
2. Apply classical optimization techniques to minimize or maximize a multi-variable objective function, without or with constraints, and arrive at an optimal solution.
3. Formulate a mathematical model and apply linear programming technique by using Simplex method. Also extend the concept of dual Simplex method for optimal solutions.
4. Apply gradient and non-gradient methods to nonlinear optimization problems.
5. Apply interior or exterior penalty functions for the constraints to derive the optimal solutions.
6. Able to apply Genetic algorithms for simple electrical problems.

**Text Books:**

1. "Engineering optimization: Theory and practice"-by S. S.Rao, NewAge International (P) Limited, 3rd edition,1998.
2. Soft Computing with Matlab Programming by N.P.Padhy&S.P.Simson,Oxford University Press –2015

**Reference Books:**

1. "Optimization methods in operations Research and Systems Analysis" by K.V.Mitaland C.Mohan, New Age International (P) Limited, Publishers, 3rd edition,1996.
2. Genetic Algorithms in search, optimization, and Machine Learning by DaviE.Goldberg, ISBN:978-81-7758-829-3, Pearsonby Dorling Kindersley (India) PvtLtd.
3. "Operations Research: An Introduction" by H.A.Taha, PHI Pvt. Ltd., 6thedition.
4. Linear Programming byG.Hadley.

| ELECTRICAL ENERGY CONSERVATION AND AUDITING (Open Elective) | | | |
|---|---|---|---|
| Subject Code | 18XXEEOM0XC | IA Marks | 30 |
| Number of Lecture Hours/week | 03 | Exam Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| Credits-03 | | | |

**Course Objectives:**

This course enable student to:

1. Explain energy efficiency, scope, conservation and technologies.
2. Discuss energy efficient lighting systems.
3. Calculate power factor of systems and propose suitable compensation techniques.
4. Explain the working of energy instruments.
5. Discuss energy conservation in HVAC systems.
6. Calculate life cycle costing analysis and return on investment on energy efficient technologies.

| **Unit 1: Basic Principles of Energy Audit and International Acts on Energy** | **Hours** |
|---|---|
| Energy audit – Definitions – Concept – Types of audit – Energy index – Cost index – Pie charts –Sankey diagrams – Load profiles – Energy conservation schemes and energy saving potential – Numerical problems – Indian energy scenario and consumption, energy needs of growing economy, energy intensity, long term energy scenario, energy pricing, energy security, energy conservation and its importance, National action plan on climate change Energy and environment, air pollution, climate change United Nations Framework Convention on Climate Change (UNFCC), sustainable development, Kyoto Protocol, Conference of Parties | **10** |
| **Unit 2: Energy conservation opportunities in lighting** | |
| Modification of existing systems – Replacement of existing systems – Priorities Definition of terms and units – Luminous efficiency –Luminance or brightness – Types of lamps – Types of lighting – Electric lighting fittings (luminaries) – Flood lighting – White light LED and conducting Polymers –Energy conservation measures, lighting energy audit,case studies. | **10** |
| **Unit 3: Power Factor and energy instruments** | |
| Power factor – Methods of improvement – Location of capacitors – Power factor with nonlinear loads – Effect of harmonics on Power factor – Numerical problems Energy Instruments – Watt–hour meter – Data loggers –Thermocouples– Pyrometers – Lux meters – Tong testers – Power analyzer. | **09** |
| **Unit 4: HVAC Systems and ECBC** | |
| Heating, ventilation, air conditioning (HVAC), fenestrations Energy Conservation Building Codes (ECBC), building envelope, insulation, lighting, water pumping, inverter and energy storage/captive generation, elevators and escalators, star labeling for existing buildings, Energy Service Companies based case studies. | **09** |
| **Unit 5: Energy Efficient Motors and Financial Aspects of Conservation Technologies** | |
| Energy Efficient motors Design, construction, Gorilla fan case study(Additional practical topic) Understanding energy cost, Economics Analysis – Depreciation Methods – Time value of money – Rate of return – Present worth method – Replacement analysis – Life cycle costing analysis –– Economics of energy efficient motors and systems. Need of investment, appraisal and criteria, Calculation of simple payback period–Return on investment – Net present value – Internal rate of return – numerical examples Applications | **10** |

| | |
|---|---|
| of life cycle costing analysis – Return on investment –Numerical examples. | |

**Course outcomes:**

On completion of the course student will be able to:

1. Explain energy efficiency, conservation and various technologies
2. Design energy efficient lighting system
3. Calculate power factor of systems and propose suitable compensation techniques
4. Explain the working of Energy Instruments.
5. Explain energy conservation techniques in HVAC Systems
6. Calculate life cycle costing analysis and return on investment on energy efficiency technologies.

**Text Books:**


1. Hand Book of Energy Audit by Sonal Desai- Tata McGrawhill
2. Energy efficient electric motors by John .C. Andreas, Marcel Dekker Inc. Ltd– 2nd edition, 1995


**Reference Books:**


1. Energy management by W.R. Murphy & G. Mckay Butter worth, Elsevier publications.2012
2. Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill publishing company Ltd. NewDelhi.
3. Energy management by Paul o' Callaghan, Mc–Graw Hill Book company–1st edition, 1998.
4. Energy management hand book by W.C.Turner, John wileyandsons.
5. Energy management and conservation –k v Sharma and pvenkataseshaiah-I K International Publishing Housepvt.ltd,2011.
6. http://www.energymanagertraining.com/download/Gazette_of_IndiaPartIISecI-37_25-08- 2010.pdf

# ELECTRICAL AND HYBRID VEHICLES

**(Open Elective)**

| | | | |
|---|---|---|---|
| Subject Code | 18XXEEOM0XD | IA Marks | 30 |
| Number of Lecture Hours/week | 03 | Exam Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| Credits-03 | | | |

**Course Objectives:**

This course will enable student to:

1. Explain working of hybrid and electric vehicles, its performance and characteristics.
2. Discuss hybrid vehicle configuration and its components.
3. Explain electric vehicle drive systems.
4. Discuss the properties of energy storage systems.
5. Compare different Energy management strategies

| **Unit 1: Introduction** | **Hours** |
|---|---|
| Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, and mathematical models to describe vehicle performance.<br>Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles. | **10** |
| **Unit 2: Hybrid Electric Drive Trains** | |
| Architecture of Hybrid Electric Vehicles (HEV), analysis of drive trains, energy use in conventional vehicles, energy saving potential of hybrid drive trains, various HEV configurations and their operation model.<br>Power flow in HEV: Power flow control in series, parallel, series-parallel hybrid system. Torque and Speed coupling. | **10** |
| **Unit 3: Electric Drive Trains** | |
| Architecture of electric drive train, electric vehicle configuration, electric drive trains, EV power source configurations.<br>Single and Multi-Motor drives, In wheel drives, requirements of different electric motors used in EVs, Power-Torque-Speed characteristics, electric propulsion systems. | **09** |
| **Unit 4: Energy Storage** | |
| Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. | **09** |
| **Unit 5: Energy Management Strategies** | |
| Introduction to energy management strategies used in hybrid and electric vehicles, classification, comparison of different energy management strategies, implementation issues of energy management strategies. Functions of control system in HEVs & EVs, Elementary control theory, Electronic control unit, control area network, control variables, classifications of Hybrid electronic control unit, fuzzy logic based control system | **10** |

**Course outcomes:**

On completion of the course student will be able to:

1. Illustrate the working of hybrid and electric vehicles, its performance and characteristics.
2. Analyze hybrid vehicle configuration and its components.
3. Discuss electric vehicle drive systems.
4. Illustrate electric propulsion systems.
5. Infer the properties of energy storage systems.
6. Distinguish different energy management strategies.

**Question paper pattern:**

The question paper will have 10 questions.

1. Each full question carries 14marks.
2. Each full question will have sub question covering all topics under unit.

The student will have to answer 5 full questions selecting one full question from each unit.

**Text Books:**

1. C. Mi, M. A. Masrur and D. W. Gao, " Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons,2011.
2. S. Onori, L. Serrao and G. Rizzoni, " Hybrid Electric Vehicles: Energy Management Strategies" , Springer,2015.

**Reference Books:**

1. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric,HybridElectric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2004.
2. T. Denton, "Electric and Hybrid Vehicles", Routledge,2016.

# INTELLIGENT CONTROL & ITS APPLICATIONS
**(Open Elective)**

| | | | |
|---|---|---|---|
| Subject Code | 18XXEEOM0XE | IA Marks | 30 |
| Number of Lecture Hours/week | 03 | Exam Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| Credits – 03 | | | |

**Course Objectives:**

This course will enable student to:

1. Explain the basic intelligent controller concepts
2. Understand concepts of feed forward neural networks and learning and understanding of feedback neural networks.
3. Discuss the concept of genetic algorithm.
4. Understand the basic knowledge of fuzzy logic control.
5. Apply the knowledge of fuzzy logic control, genetic algorithm and neural network to the real problems.

| Unit | Hours |
|---|---|
| **Unit 1: Introduction to Intelligent Control** | **Hours** |
| Introduction and motivation. Approaches to intelligent control. Architecture for intelligent control. Symbolic reasoning system, rule-based systems, the AI approach. Knowledge representation, Expert systems. | **09** |
| **Unit 2: Artificial Neural Networks** | |
| Concept of Artificial Neural Networks, its basic mathematical model, McCulloch- Pitts neuron model, simple perception, Adeline and Madeline, Feed-forward Multilayer Perception. Learning and Training the neural network. Introduction, derivation, algorithm, flowchart, limitation-Error Back propagation, Hopfield, Radial bases function | **10** |
| **Unit 3: Genetic Algorithm** | |
| Basic concept of Genetic algorithm and detail algorithmic steps, adjustment of free parameters. Solution of typical control problems using genetic algorithm. Concept on some other search techniques like tab search and ant-colony search techniques for solving optimization problems | **10** |
| **Unit 4: Fuzzy Logic System** | |
| Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modeling and control. Fuzzification, inferencing and defuzzification. Fuzzy knowledge and rule bases. Fuzzy modeling and control schemes for nonlinear systems. Fuzzy logic control for nonlinear time- delay system. Implementation of fuzzy logic controller. | **10** |
| **Unit 5: Applications** | |
| Aerospace and data mining applications of Genetic Algorithm - Neural Network and Fuzzy Logic Control applications in Smart grid, Electric drives and Distributed generation. | **09** |

**Course outcomes:**

On completion of the course student will be able to :

1. Infer representations applied to artificial intelligence techniques
2. Illustrate the use of artificial neuron in perceptron models and back propagation algorithm to multilayer feed forward networks
3. Develop rule based and decision making with the use of classical and fuzzylogic systems
4. Analyze the concept of geneticalgorithm.
5. Analyze the fuzzy logic controller using MATLAB.
6. Discover various applications of neural and fuzzy logic systems inelectrical Engineering

**Text Books:**

1. Simon Haykins, Neural Networks: A comprehensive Foundation, Pearson Edition,2003.
2. T.J. Ross, Fuzzy logic with Fuzzy Applications, McGraw Hill Inc,1997.
3. David E Goldberg, Genetic Algorithms. Wesley PublishingCompany,1989
4. John Yen and Reza Langari, Fuzzy logic Intelligence, Control, and Information, Pearson Education, Indian Edition,2003.
5. Neural Network, Fuzzy Logic and Genetic Algorithm : Synthesis and Applications. Rajasekaran and G. A. VijayalakshmiPai (Prentice Hall India, 2010)

**Reference Books:**

1. M.T. Hagan, H. B. Demuth and M. Beale, Neural Network Design, Indian reprint,2008.
2. Fredric M. Ham and IvicaKostanic, Principles of Neuro computing for science and Engineering, McGraw Hill,2001.
3. N. K. Bose and P. Liang, Neural Network Fundamentals with Graphs, Algorithms, and Applications, Mc. Graw Hill, Inc.1996.
4. Yung C. Shin and ChengyingXu, Intelligent System, Modeling, Optimization and Control, CRC Press,2009.
5. N. K. Sinha and Madan M Gupta, Soft computing & Intelligent Systems, Theory &Applications, Indian Edition, Elsevier,2007.
6. WitoldPedrycz, Fuzzy Control and Fuzzy Systems, Overseas Press, Indian Edition,2008.

## ELECTRICAL MATERIALS
### (Open Elective)

| | | | |
|---|---|---|---|
| Subject Code | 18XXEEOM0XF | IA Marks | 30 |
| Number of Lecture Hours/week | 03 | Exam Marks | 70 |
| Total Number of Lecture Hours | 45 | Exam Hours | 03 |

Credits – 03

**Course Objectives:**

This course will enable student to:

1. Describe the formation and properties of conducting material.
2. Explain the formation and properties of Semiconductor Materials.
3. Infer the formation and properties of Dielectric Materials.
4. Explain the formation and properties of Magnetic Materials.
5. Describe the formation and properties of Special Purpose Materials.

| | Hours |
|---|---|
| **Unit 1: Conducting Materials** | **Hours** |
| Review of metallic conduction on the basis of free electron theory. Fermi-Dirac distribution – variation of conductivity with temperature and composition, materials for electric resistors- general electric properties; material for brushes of electrical machines, lamp filaments, fuses and solder. | **10** |
| **Unit 2: Semiconductor Materials** | |
| Mechanism of conduction in semiconductors, density of carriers in intrinsic semiconductors, the energy gap, types of semiconductors. Hall effect, compound semiconductors, basic ideas of amorphous and organic semiconductors. | **09** |
| **Unit 3: Dielectric Materials** | |
| Dielectric as Electric Field Medium, leakage currents, dielectric loss, dielectric strength, breakdown voltage, breakdown in solid dielectrics, flashover, liquid dielectrics, electric conductivity in solid, liquid and gaseous dielectrics, Ferromagnetic materials, properties of ferromagnetic materials in static fields, spontaneous, polarization, curie point, anti-ferromagnetic materials, piezoelectric materials, pyro electric materials. | **10** |
| **Unit 4: Magnetic Materials** | |
| Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, magnetic Anisotropy, Magnetostriction, diamagnetism, magnetically soft and hard materials, special purpose materials, feebly magnetic materials, Ferrites, cast and cermet permanent magnets, ageing of magnets. Factors effecting permeability and hysteresis | **10** |
| **Unit 5: Materials for Electrical Applications & Special Purpose Materials** | |
| Materials used for Resistors, rheostats, heaters, transmission line structures, stranded conductors, bimetals fuses, soft and hard solders, electric contact materials, electric carbon materials, thermocouple materials. Solid, Liquid and Gaseous insulating materials, Effect of moisture on insulation. Refractory Materials, Structural Materials, Radioactive Materials, Galvanization and Impregnation of materials, Processing of electronic materials, Insulating varnishes and coolants, Properties and applications of mineral oils, Testing of Transformer | **10** |

| | |
|---|---|
| oil as per ISI | |

**Course outcomes:**
On completion of the course student will be able to:

1. Understand various types of conducting, their properties in various conditions.
2. Evaluate semiconductor materials and technologies
3. Understand various types of dielectric materials, their properties in various conditions.
4. Evaluate magnetic materials and their behavior.
5. Acquire Knowledge on Materials used in electrical engineering and applications.
6. Able to test Transformer oil as per standard.

**Text Books:**

1. R K Rajput", " A course in Electrical Engineering Materials", Laxmi Publications, 2009
2. "T K Basak", " A course in Electrical Engineering Materials", New Age Science Publications 2009

**Reference Books:**

1. TTTI Madras, "Electrical Engineering Materials", McGraw Hill Education, 2004.
2. "AdrianusJ.Dekker", Electrical Engineering Materials, PHI Publication, 2006.
3. S. P. Seth, P. V. Gupta "A course in Electrical Engineering Materials", DhanpatRai& Sons, 2011.

# INDUSTRIAL ELECTRICAL SYSTEMS
**(Open Elective)**

| | | | |
|---|---|---|---|
| Subject Code | 18XXEEOM0XG | IA Marks | 30 |
| Number of Lecture Hours/week | 03 | Exam Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |

Credits – 03

**Course Objectives:**

This course will enable student to:

1. Explain Tariff structure and protection components.
2. Compare various types wiring systems and IE rules.
3. Describe the Illumination technology.
4. Compare various types of cables.
5. Discuss on PLC applications.
6. Explain the implementation of SCADA for various applications.

| | Hours |
|---|---|
| **Unit 1: Electrical System Components** | |
| LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and<br>Electrical safety practices | **10** |
| **Unit 2: Residential and Commercial Electrical Systems** | |
| Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components. | **10** |
| **Unit 3: Illumination Systems** | |
| Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting. | **10** |
| **Unit 4: Industrial Electrical Systems** | |
| HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components. DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks. | **10** |
| **Unit 5: Industrial Electrical System Automation** | |

Study of basic PLC, Role of in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation.

**Course outcomes:**

On completion of the course student will be able to:

1. Illustrate Tariff structure and protection components.
2. Discuss various types wiring systems and IE rules.
3. Explain the Illumination technology.
4. Distinguish various types of cables.
5. Discover PLC applications.
6. Choose various applications to implement SCADA.

**Text Books:**


1. S. L. Uppal and G. C. Garg, " Electrical Wiring, Estimating & Costing", Khannapublishers,2008.
2. K. B. Raina, "Electrical Design, Estimating & Costing", New age International,2007.
3. S. Singh and R. D. Singh, "Electrical estimating and costing",DhanpatRai and Co.,1997.


**Reference Books:**


1. Web site for IS Standards.
2. H. Joshi, "Residential Commercial and Industrial Systems", McGrawHill Education,2008.

| ADVANCED CONTROL SYSTEMS<br>**(Open Elective)** | | | |
|---|---|---|---|
| Subject Code | 18XXEEOM0XH | IA Marks | 30 |
| Number of Lecture Hours/week | 03 | Exam Marks | 70 |
| Total Number of Lecture Hours | 48 | Exam Hours | 03 |
| Credits -03 | | | |

**Course Objectives:**

The objectives of this course is to acquire knowledge on

1. formulation of different models using state space analysis
2. analysis of state feedback control through pole placement technique.
3. analysis of a nonlinear system using Lypanov's method of stability
4. formulation of Euler Lagrange equation to optimize typical functional and solutions.
5. optimal controller design using LQG framework

| **Unit 1: State Space Analysis** | **Hours** |
|---|---|
| State Space Representation –Solution of state equation –State transition matrix, –Canonical forms –Controllable canonical form –Observable canonical form, Jordan Canonical Form. | **09** |
| **Unit 2: 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. | **10** |
| **Unit 3: Describing Function and Stability Analysis** | |
| Introduction to nonlinear systems, Types of nonlinearities, describing functions, Introduction to phase–plane analysis. Stability in the sense of Lyapunov – Lyapunov's stability and Lypanov's instability theorems –Direct method of Lyapunov for the linear and nonlinear continuous time autonomous systems. | **10** |
| **Unit 4: 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 | **09** |
| **Unit 5: Optimal Control Design** | |
| Linear Quadratic Optimal Regulator (LQR) problem formulation –Optimal regulator Design by parameter adjustment (Lyapunov method) –Optimal regulator Design by Continuous Time Algebraic Riccatti equation (CARE) -Optimal controller Design using LQG framework. | **10** |

**Course outcomes:**

1. Able to design the state space model of control system and formulate different state models
2. Able to design of control system using the pole placement technique
3. Able to analyse of nonlinear system using the describing function technique and phase plane analysis.
4. Able to analysis the stability analysis using lypnov method.
5. Able to minimize the function using calculus of variation studied.
6. Able to design optimal controller using LQG framework.

**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

**Reference Books:**

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 McGraw–Hill Companies, 1997

# Open Elective Courses Offered by ME to other Departments

## Open Elective Courses Offered by Mechanical Engineering to other Departments

| S. No. | Subject Code | Name of the subject | L | T | P | Cr |
|---|---|---|---|---|---|---|
| 1. | 18XXMEOX0XA | Operations Research | 3 | 0 | 0 | 3 |
| 2. | 18XXMEOX0XB | Fundamentals of Mechanical Engineering | 3 | 0 | 0 | 3 |
| 3. | 18XXMEOX0XC | Industrial Robotics | 3 | 0 | 0 | 3 |
| 4. | 18XXMEOX0XD | Engineering Materials | 3 | 0 | 0 | 3 |
| 5. | 18XXMEOX0XE | Introduction to Material Handling | 3 | 0 | 0 | 3 |
| 6. | 18XXMEOX0XF | Production Planning and Control | 3 | 0 | 0 | 3 |
| 7. | 18XXMEOX0XG | Non-Conventional Sources of Energy | 3 | 0 | 0 | 3 |
| 8. | 18XXMEOX0XH | Fluid Mechanics and Fluid Machinery | 3 | 0 | 0 | 3 |

<table>
<tr><td colspan="4" align="center">Operations Research<br>SEMESTER - XX</td></tr>
<tr><td>Subject Code</td><td>18XXMEOX0XA</td><td>Internal Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>3(L)</td><td>External Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4" align="center">Credits – 03</td></tr>
<tr><td colspan="4">Course Objectives:<br>Enable the students to<br>1. Understand the definition, scope, objectives, phases, models and limitations of operations research and developing the ability to formulate the linear programming problems for minimizing the project cost and maximizing its profit.<br>2. Solve linear programming problems using various techniques based on the constraints<br>3. Understand about different application areas of operations research like transportation problem, assignment model, sequencing models.<br>4. Suggest optimal sequence and replacement policy and economic order quantities to be maintained for better and economic growth of the industry.<br>5. Suggest optimal game strategies and estimation of waiting times in waiting line problems in the competitive business world.</td></tr>
<tr><td colspan="3">Unit -1</td><td>Hours</td></tr>
<tr><td colspan="3">Introduction to Operations Research: Definition, Features, types of OR models, Methodology, Tools, Limitations and applications of Linear Programming.<br>Linear Programming-I: Introduction, Formulation of Linear Programming Problem (LPP), Assumptions for solving LPP, Applications of LPP, Graphical method of solving LPP.</td><td>10</td></tr>
<tr><td colspan="4">Unit -2</td></tr>
<tr><td colspan="3">Linear Programming-II: Introduction, steps in solving problems using simplex method, Principle of simplex method- Maximization and minimization problems, solution by simplex method, limitations of LPP simplex method.<br>Linear Programming-III: Introduction, Concept of primal, dual relationship, formulation of the dual of the primal problem, solution of LP problems using dual simplex method.</td><td>10</td></tr>
<tr><td colspan="4">Unit – 3</td></tr>
<tr><td colspan="3">Transportation Problem: Basics, Solution of Transportation problem with several methods, performing optimality test, degeneracy in transportation problem.<br>Assignment model: Definition, Formulation, Different methods of solutions, Hungarian assignment method, unbalanced assignment problems, travelling salesman problems.<br>Sequencing problems: introduction, basics, types of sequencing problems, priority sequencing, sequencing n-jobs through two machines, n-jobs and m-machines, two jobs 3-machines case.</td><td>10</td></tr>
<tr><td colspan="4">Unit – 4</td></tr>
<tr><td colspan="3">Replacement: Introduction – replacement of items that deteriorate with time – when money value is not counted and counted – replacement of items that fail completely, group replacement.<br>Inventory Control: Introduction, Types of Inventories, Costs associated with</td><td>10</td></tr>
</table>

| | |
|---|---|
| inventories, the concept of EOQ, Deterministic inventory problems with no shortages, with shortage. | |
| **Unit – 5** | |
| **Queuing Theory**: Introduction, Queuing system, elements of Queuing system Operating characteristics of a Queuing system, Classification of queuing models: Model-I [M/M/1:∞ / FIFO], Model-III [M/M/1: N/FIFO].<br>**Game Theory**: Introduction, Two Person Zero sum games, Maximin - Minimax principle, Games without saddle points- mixed strategies, Graphical solution of 2Xn, mX2 games, and Dominance property, P-system, S-system, Q-system and Ss-system | **10** |

**Course outcomes:**

1. Formulate and solve mathematical model (linear programming problem) for real situations like production and distribution of goods using basic linear programming techniques li graphical methods
2. Apply the concepts of linear programming for decision making like simplex and dual simplex algorithms in production industries.
3. Calculate the optimal values of cost, job distribution and placement using transportation, assignment and sequencing methods
4. Select the best optimal inventory and replacement time for the goods produced in an industry for its better and economic growth using inventory and replacement techniques.
5. Select the best optimal time and strategy to be followed by any organization to identify the waiting times and strategies to be implemented using waiting lines and game theory techniques for a continuous and successful growth of an industry.

**TEXT BOOKS:**

1. Operation Research /Premkumar Gupta, D.S.Hira / S.Chand
2. Operations Research / S.D.Sharma-KedarnathRamnath(JNTU)

**REFERENCES:**

1. Operations Research / R. Pannerselvam / PHI Publications.
2. Operation Research /J.K.Sharma/MacMilan.
3. Operation Research An Introduction / Taha / Pearson
4. Operations Research / A.M.Natarajan, P. Balasubramani, A. Tamilarasi / Pearson Education.

**Question paper pattern:**

1. Question paper contains 10 Questions, 2 from each course outcome. The student must answer 5 full questions by selecting one question from each course outcome (Internal Choice)
2. All questions carries 14 marks each
3. Each full question will have sub question covering all topics under a course outcome

| Fundamentals of Mechanical Engineering<br>SEMESTER - XX | | | |
|---|---|---|---|
| Subject Code | 18XXMEOX0XB | Internal Marks | 30 |
| Number of Lecture Hours/Week | 3(L) | External Marks | 70 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |
| **Credits – 03** | | | |

**Course Objectives:**

Enable the students to

1. Understand the concepts of fluid properties like specific gravity, viscosity, density, surface tension
2. To study the classification of turbines and work done and efficiency of the different turbines and also study about draft tube theory and to determine the function efficiency.
3. To study about specific speed and performance characteristics of different types of turbines.
4. To study automobile engine working, valve timing and associated systems such as lubricating system, cooling system, fuel feed system, ignition system etc., their necessity, requirements, construction details, different types and their working
6. To study the construction, working principles and advantages of belt and rope drives, selection of belt drive- types of belt drives, V-belts, types of coupling.

| Unit -1 | Hours |
|---|---|
| **Fluid Mechanics:** Dimensions and units: physical properties of fluids- specific gravity, viscosity and its significance, surface tension, capillarity, and vapor pressure. Atmospheric gauge and vacuum pressure – Measurement of pressure. Manometers- Piezometer, U-tube, inverted and differential manometers. | **10** |
| **Unit -2** | |
| **Impact of jets:** hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes. | **10** |
| **Unit – 3** | |
| **Hydraulic Turbines and Governing systems:** Classification of turbines; Working principle, Efficiency calculation and Design principles for Pelton Wheel, Francis and for Kaplan turbines; Governing of turbines; Performance and characteristic curves.. | **10** |
| **Unit – 4** | |
| **I. C. Engines**: Classification, working principles – valve and port timing diagrams – air standard cycles –fuel injection system, carburetion, ignition, cooling and lubrication – Engine performance evaluation.<br>**Spark Ignition and Combustion Ignition engines** –Classification, working principles, Types of engines. | **10** |
| **Unit – 5** | |
| **Belt drives:** Introduction, Belt and rope drives, selection of belt drive- types of belt drives, V-belts, velocity ratio of belt drives, slip of belt, creep of belt, tensions for flat belt drive, angle of contact, centrifugal tension, maximum tension of belt,<br>**Coupling:** Brief introduction of coupling, Rigid couplings - muff, split muff and | **10** |

| | |
|---|---|
| flange couplings, flexible couplings - flange coupling | |

**Course outcomes:**

1. Understand the concepts of fluid properties like specific gravity, viscosity, density, surface tension.
2. To study the classification of turbines and work done and efficiency of the different turbines and also study about draft tube theory and to determine the function efficiency.
3. This study is also used for the estimation of efficiency and performance of the turbine with the study of characteristics curves.
4. To study automobile engine working, valve timing and associated systems such as lubricating system, cooling system, fuel feed system, ignition system etc., their necessity, requirements, construction details, different types and their working
5. To study the construction, working principles and advantages of belt and rope drives, selection of belt drive- types of belt drives, V-belts, types of coupling.

**TEXT BOOKS:**

1. Basic Mechanical Engineering / Pravin Kumar/ Pearson
2. Thermal Engineering-R.S Khurmi/JS Gupta/S.Chand.
3. Introduction to Engineering Materials / B.K. Agrawal/ McGraw Hill

**REFERENCES:**


1. Fundamental of Mechanical Engineering/ G.S. Sawhney/PHI
2. Thermal Science and Engineering / Dr. D.S. Kumar/ Kataria


**Question paper pattern:**

1. Question paper contains 10 Questions, 2 from each course outcome. The student must answer 5 full questions by selecting one question from each course outcome (Internal Choice)
2. All questions carries 14 marks each
3. Each full question will have sub question covering all topics under a course outcome

# Industrial Robotics

| Subject Code | 18XXMEOX0XC | Internal Marks | 30 |
|---|---|---|---|
| Number of Lecture Hours/Week | 3(L) | External Marks | 70 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |

**Credits – 03**

**Course Objectives:**
Enable the students to
1. Understand various applications of robotics and classification of coordinate system and control systems
2. Build the concepts of components of industrial robotics.
3. Determine kinematic analysis with D-H notation, forward and inverse kinematics
4. Model trajectory planning for a manipulator by avoiding obstacles
5. Understand different types of actuators and importance of application of robots in manufacturing

| Unit -1 | Hours |
|---|---|
| **Introduction:** Automation and Robotics, CAD/CAM and Robotics – An overview of Robotics –present and future applications – classification by coordinate system and control system. | 10 |
| **Unit -2** | |
| **Components of the Industrial Robotics:** Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, determination of the end effectors, comparison of Electric, Hydraulic and Pneumatic types of locomotion devices. | 10 |
| **Unit – 3** | |
| **Motion Analysis:** Homogeneous transformations as applicable to rotation and translation – problems. Manipulator Kinematics: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics – problems. | 10 |
| **Unit – 4** | |
| **Trajectory Planning:** General considerations in path description and generation. Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion –straight line motion – Robot programming, languages and software packages-description of paths with a robot programming language. | 10 |

| | |
|---|---|
| **Unit – 5** | |
| **Robot Actuators and Feed Back Components:** Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors. Feedback components: position sensors– potentiometers, resolvers, encoders – Velocity sensors.<br>Robot Applications in Manufacturing: Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection. | 10 |

**Course outcomes:**

1. Understand various applications of robotics and classification of coordinate system and control systems
2. Build the concepts of components of industrial robotics.
3. Apply kinematic analysis with D-H notation, forward and inverse kinematics
4. Model trajectory planning for a manipulator by avoiding obstacles.
5. Understand different types of actuators and various applications of robots in manufacturing

**TEXT BOOKS:**

1.Industrial Robotics / Groover M P /Mc Graw Hill
2.Introduction to Robotics / John J. Craig/ Pearson

**REFERENCES:**

1. Introduction to Robotics/ Saeed B Niku / Wiely Publications.

**Question paper pattern:**

1. Question paper contains 10 Questions, 2 from each course outcome. The student must answer 5 full questions by selecting one question from each course outcome (Internal Choice)
2. All questions carries 14 marks each
3. Each full question will have sub question covering all topics under a course outcome

| ENGINEERING MATERIALS<br>SEMESTER XX | | | |
|---|---|---|---|
| Subject Code | 18XXMEOX0XD | Internal Marks | 30 |
| Number of Lecture Hours/Week | 03 | External Marks | 70 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |
| **Credits - 03** | | | |

**Course objectives:**

This course will enable students to:

1. Classify different bonds in solids and understand crystallization of the metals, for the formation of the solid solutions and compounds.
2. Understand different phase diagrams .
3. Recorgnize the property requirements of a given application and suggest a suitable ferrous and non ferrous metal and their alloys.
4. Illustrate the property requirements of a given application and suggest appropriate heat treatment
5. Identify the property requirements of a given application and suggest a suitable ceramics, composite materials
6. Identify the relationships between structure, composition and properties of different engineering materials.

| Unit -1 | Hours |
|---|---|
| **Structure of Metals and Constitution of alloys:** Bonds in Solids – Metallic bond - crystallization of metals, grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys – determination of grain size. Necessity of alloying, types of solid solutions, Hume Rothery's rules, intermediate alloy phases, and electron compounds. Tensile, compression and torsion tests; Young's modulus, relations between true and engineering stress-strain curves, generalized Hooke's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery. | **10** |
| **Unit -2** | |
| **Equilibrium Diagrams:** Experimental methods of construction of equilibrium diagrams, Isomorpous alloy systems, equilibrium cooling and heating of alloys, lever rule, coring, miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. | **8** |
| **Unit - 3** | |
| **Ferrous & non-ferrous metals and their alloys** Structure and properties of white cast iron, malleable cast iron, grey cast iron, spheroid graphite cast iron, alloy cast irons. Classification of steels, structure and properties of plain carbon steels, low alloy steels, Hadfield manganese steels, tool and die steels. Structure and properties of copper and its alloys, Aluminum and its alloys, Titanium and its alloys | **12** |
| **Unit – 4** | |
| **Heat treatment of Alloys:** Annealing, normalizing, hardening, TTT diagrams, tempering, hardenability, surface-hardening methods (carburizing, carbo-nitriding, cyaniding, induction hardening and flame hardening), age hardening treatment, and cryogenic treatment of alloys. vacuum and plasma hardening | **8** |
| **Unit-5** | |
| **Ceramic and composite materials:** Crystalline ceramics, glasses, cermets, | **12** |

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| abrasive materials, nanomaterial's – definition, properties and applications of the above. Classification of composites, various methods of component manufacture of composites, particle – reinforced materials, fiber reinforced materials, metal ceramic mixtures, metal – matrix composites and C – C composites. | |

**Course outcomes:**

On completion of the course, student will be able to

1. Classify different bonds in solids and understand crystallization of the metals, for the formation of the solid solutions and compounds.
2. Different phase diagrams and study of binary phase diagrams
3. Recorgnize the property requirements of a given application and suggest suitable ferrous & non ferrous alloys
4. Analyze the property requirements of a given application and suggest appropriate heat treatment
5. Identified the property requirements of a given application and suggest a suitable ceramics, composite materials
6. Understand the relationships between structure, composition and properties of different engineering materials

**Text Books:**


1. Introduction to Physical Metallurgy - Sidney H. Avener - McGrawHill
2. Essential of Materials science and engineering - Donald R.Askeland –Thomson


**Reference Books:**


1. Material Science and Metallurgy – V.D.Kodgire and S.V.Kodgire
2. Materials Science and engineering - Callister & Baalasubrahmanyam
3. Material Science for Engineering students – Fischer – Elsevier Publishers.
4. Material science and Engineering - V. Rahghavan
5. Introduction to Material Science and Engineering – Yip-Wah Chung CRC Press.
6. Material Science and Metallurgy – A V K Suryanarayana – B S Publications.
7. Material Science and Metallurgy – U. C. Jindal – Pearson Publication


**Web Source References:**


1. https://www.iitm.ac.in/mmresearch
2. http://nptel.ac.in/courses/113106032/3
3. https://en.wikipedia.org/wiki/Materials_science


**Question paper pattern:**

1. Question paper contains 10 Questions, 2 from each course outcome. The student must answer 5 full questions by selecting one question from each course outcome (Internal Choice)
2. All questions carries 14 marks each
3. Each full question will have sub question covering all topics under a course outcome

<table>
<tr><td colspan="4">INTRODUCTION TO MATERIAL HANDLING<br>SEMESTER - XX</td></tr>
<tr><td>Subject Code</td><td>18XXMEOX0XE</td><td>Internal Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>3(L)</td><td>External Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">Credits – 03</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td colspan="4">COURSE OBJECTIVES:<br>Students should be able<br>1. To understand the classification of material handling equipment<br>2. To explain the usage of different material handling equipment in industry<br>3. To know how to connect loading stations to the different discharge conditions.<br>4. To explain the usage of cranes at industries<br>5. To explain the usage of hoists and monorails at industries</td></tr>
<tr><td colspan="3">Unit -1</td><td>Hours</td></tr>
<tr><td colspan="3">Introduction to materials handling, examples of materials equipment, examples of materials handling equipment, continuous conveying, intermittent conveying, examples, lifting, hoisting, handling of bulk goods and piece goods, cranes and conveyors, principles of calculation of conveying equipment, cycle time, bulk materials and bulk density, angle of repose, example for a belt conveyor and a simple hoist.</td><td>10</td></tr>
<tr><td colspan="4">Unit -2</td></tr>
<tr><td colspan="3">Belt conveyors, constructional details, toughing angle, idlers, belt specifications, chutes, skirt boards, ploughs, belt conveyor layouts, belt trippers and typical examples, roller conveyors, overhead conveyors, apron conveyors, component parts and operational details and applications with typical layouts.</td><td>10</td></tr>
<tr><td colspan="4">Unit – 3</td></tr>
<tr><td colspan="3">Unit materials handling and storage: Unit load concept (platform sheet industrial hand trucks, self contained unit load, palletless handling, introduction only), industrial hand trucks, powered industrial trucks, automated guided vehicles, basic storage and equipment system, Automated storage and retrieval systems (AS/RS), carosel storage system and its applications.</td><td>10</td></tr>
<tr><td colspan="4">Unit – 4</td></tr>
<tr><td colspan="3">Cranes Jib cranes like wall mounted and travelling type, stability criteria, wheel loads, wheel trucks and bogeys, number of mechanisms in jib cranes, jib construction. Harbour cranes, luffing and level luffing cranes, shipyard gantry cranes,</td><td>10</td></tr>
<tr><td colspan="4">Unit – 5</td></tr>
<tr><td colspan="3">Hoists and monorails Portal frames and slewing rings and bearings typical stability, calculations of portal cranes, types of hoists</td><td>10</td></tr>
<tr><td colspan="4">Course outcomes:<br>1. Classify the material handling equipment<br>2. Explain the usage of different material handling equipment in industry<br>3. Discuss how to connect loading stations to the different discharge conditions<br>4. Associate the usage of cranes at industries<br>5. Associate the usage of hoists and monorails at industries</td></tr>
</table>

| |
|---|
| **TEXT BOOKS**<br>1. Material handling handbook, 2nd edition, ASME, 1985<br>2. Automation production systems and computer integrated manufacturing, Mikell P Groover, Prentice Hall of India, 2002. |
| **REFERENCE BOOK**<br>1. R.O. Bailey, “Bulk material handling by conveyor belt I and II” M.A. Al<br>**2.** Frutchbaum, “ Bulk solids handling |
| **Question paper pattern:**<br>1. Question paper contains 12 Questions, 2 from each course outcome. The student must answer 6 full questions by selecting one question from each course outcome (Internal Choice)<br>2. CO1- CO5 questions carries 12 marks each<br>3. Each full question will have sub question covering all topics under a course outcome |

<table>
<tr><td colspan="4">PRODUCTION PLANNING AND CONTROL<br>SEMESTER - XX</td></tr>
<tr><td>Subject Code</td><td>118XXMEOX0XF</td><td>Internal Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>3(L)</td><td>External Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">Credits – 03</td></tr>
<tr><td colspan="4">Course Objectives:<br>Enable the students to<br>1. Understand the concepts of production design concepts for production and service systems<br>2. Apply forecasting techniques for various firms, namely qualitative & quantitative methods to optimize/make best use of resources in achieving their objectives.<br>3. Identify different strategies employed in manufacturing and service industries to plan inventory<br>4. Apply different scheduling policies in planning and control and make best use of resources.<br>5. Measure the effectiveness, identify likely areas for improvement, develop and implement improved planning and control methods for production systems.</td></tr>
<tr><td colspan="3">Unit -1</td><td>Hours</td></tr>
<tr><td colspan="3">Introduction: Definition – objectives and functions of production planning and control – elements of production control – types of production – organization of production planning and control department – internal organization of department.</td><td>10</td></tr>
<tr><td colspan="4">Unit -2</td></tr>
<tr><td colspan="3">Forecasting – importance of forecasting – types of forecasting, their uses – general principles of forecasting – forecasting techniques – qualitative methods and quantitative methods.</td><td>10</td></tr>
<tr><td colspan="4">Unit – 3</td></tr>
<tr><td colspan="3">Inventory management – functions of inventories – relevant inventory costs – ABC analysis – VED analysis – EOQ models – Inventory control systems – P–Systems and Q-Systems<br>Material Management Techniques:<br>Introduction to MRP I, MRP II, ERP, LOB (Line of Balance), JIT and KANBAN system.</td><td>12</td></tr>
<tr><td colspan="4">Unit – 4</td></tr>
<tr><td colspan="3">Routing & Scheduling– definition – routing procedure –route sheets – bill of material – factors affecting routing procedure, schedule –definition – difference with loading, Scheduling policies – techniques, standard scheduling methods, line balancing, aggregate planning</td><td>10</td></tr>
<tr><td colspan="4">Unit – 5</td></tr>
<tr><td colspan="3">Dispatching– activities of dispatcher – dispatching procedure – follow up– definition – reason for existence of functions – types of follow up, expediting, controlling aspects. Applications of computer in production planning and control.</td><td>8</td></tr>
<tr><td colspan="4">Course outcomes:<br>On completion of this course, students will be be able to:<br>1. Choose the acceptable production planning and control system for designing and development of a product.</td></tr>
</table>

2. **Examine** the forecasts made in the manufacturing and service sectors by using selected quantitative and qualitative techniques.
3. **Categorize** the production systems based on the inventory principles and techniques to optimize/make best use of resources.
4. **Select and use** an appropriate principles/methods/ techniques/ modern concept with reference to given application/situation in the preparation of route sheets with scheduling and loading in manufacturing systems
5. **Illustrate** the role of a dispatching and follow-up necessary at various stages of manufacturing in an industry.

**Text Books:**

1. Elements of Production Planning and Control / Samuel Eilon.
2. Manufacturing, Planning and Control, Partik Jonsson Stig-Arne Mattsson, Tata Mc Graw Hill.
3. MECHATRONICS Integrated Mechanical Electronics Systems/KP Ramachandran, GK Vijaya Raghavan & MS Balasundaram/WILEY India Edition

**Reference Books:**

1. Production Planning and Control, Mukhopadyay, PHI.
2. Inventory Control Theory and Practice / Martin K. Starr and David W. Miller/Prentice-Hall
3. Production Control A Quantitative Approach / John E. Biegel/Prentice-Hall

**Question paper pattern:**

1. Question paper contains 10 Questions, 2 from each course outcome. The student must answer 5 full questions by selecting one question from each course outcome (Internal Choice)
2. CO1- CO5 questions carries 14 marks each.
3. Each full question will have a sub question covering all topics under a course outcome.

<table>
<tr><td colspan="4">NON-CONVENTIONAL SOURCES OF ENERGY<br>SEMESTER-XX</td></tr>
<tr><td>Subject code</td><td>18XXMEOX0XG</td><td>Internal marks</td><td>30</td></tr>
<tr><td>Number of lecture hours/Week</td><td>3(L)</td><td>External marks</td><td>70</td></tr>
<tr><td>Total No Of lecture hours</td><td>50</td><td>Exam hours</td><td>03</td></tr>
<tr><td colspan="4">Credits-03</td></tr>
<tr><td colspan="4">Course Objectives:<br>Enable the students to:<br>1. Understand the principles and working of solar and solar energy collection.<br>2. Apply the principles of solar energy storage, applications in generation of electric power.<br>3. Apply the knowledge of Wind energy and Biomass, in generation of electric power production.<br>4. Apply the Principles and working of Geothermal energy power plant, OTEC plants, tidal, wave energy and Mini hydel power plants in generation of the electric power<br>5. Apply the principles of direct energy conversion systems like Thermoelectric generators, MHD generators and fuel cells, in generation of electric power production</td></tr>
</table>

| Unit-1 | Hours |
|---|---|
| **Principles of Solar Radiation:** Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power - the solar constant, extra-terrestrial and terrestrial solar radiation, Solar radiation on titled surface, Instruments for measuring solar radiation and sun shine, solar radiation data.<br>**Solar Energy Collection:** Flat plate and concentrating collectors, classification of concentrating collectors, advanced collectors.. | **8** |
| **Unit-2** | |
| **Solar Energy Storage and Applications:** Different methods, sensible, latent heat and stratified storage, solar ponds. Solar applications - solar heating/cooling techniques, solar distillation and drying, photovoltaic energy conversion. | **6** |
| **Unit-3** | |
| **Wind Energy:** Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria<br>**Bio-Mass:** Principles of Bio-Conversion, Anaerobic /aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of biogas, utilization for cooking, I.C. Engine operation, and economic aspects. | **10** |
| **Unit-4** | |
| **Geothermal Energy:** Resources, types of wells, methods of harnessing the energy, potential in India. Ocean Energy – OTEC, Principles, utilization, setting of OTEC plants, thermodynamic cycles.<br>**Tidal and Wave energy:** Potential and conversion techniques, mini-hydel power plants, their economics. | **10** |
| **Unit-5** | |
| **Direct Energy Conversion:** Need for DEC, Carnot cycle, limitations, Principles of DEC. Thermoelectric generators, Seebeck, Peltier and Joule Thompson effects, figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD | **16** |

| | |
|---|---|
| accelerator, MHD engine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cells, principle, faraday's laws, thermodynamic aspects, selection of fuels and operating conditions. | |

**Course outcomes:**

1. The student understands the principles and working of solar and solar energy collection.
2. The students apply the principles of solar energy storage, applications in power generation.
3. The students Apply the knowledge of Wind energy and Biomass, in generation of power
4. The students Apply the Principles and working of Geothermal energy power plant, OTEC plants, tidal, wave energy and Mini hydel power plants in generation of the electric power.
5. Apply the principles of direct energy conversion systems like Thermoelectric generators, MHD generators and fuel cells, in generation of electric power.

**Text books:**

1. Renewable Energy Resources / Tiwari and Ghosal / Narosa
2. Non- conventional Energy Sources / G.D. Rai/ Khanna Publishers
3. Biological Energy Resources/ Malcolm Fleischer & Chris Lawis/ E&FN Spon

**Reference books:**

1. Renewable Energy Sources / Twidell& Weir
2. Solar Power Engineering / B.S. Magal Frank Kreith& J.F. Kreith
3. Principles of Solar Energy / Frank Krieth& John F Kreider
4. Non-Conventional Energy / Ashok V Desai / Wiley Eastern

**Question paper pattern:**

1. Question paper contains 10 questions,2 from each course outcomes, the student must answer 5 full questions by selecting one question from each course outcome (Internal choice)
2. All question carries 14 marks each
3. Each full question will have sub question covering all topics under a course outcome

| FLUID MECHANICS AND FLUID MACHINERY<br>SEMESTER -XX | | | |
|---|---|---|---|
| Subject Code | 18XXMEOX0XH | Internal Marks | 30 |
| Number of Lecture Hours/Week | 3(L) | External Marks | 70 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |
| **Credits – 03** | | | |

1. Understand the fundamental properties of fluid and calculate fluid pressure using the manometer.
2. Apply the differential conservation equations of mass, momentum, and energy to fluid flow problems.
3. Evaluate major and minor losses in pipes and also discuss boundary layer concepts.
4. Solve problems on the turbo machines like turbines using analytical method and velocity triangles.
5. Discuss the Classification and working principles of pumps and evaluate the performance of hydraulic machines.

| **Unit -1** | **Hours** |
|---|---|
| **Fluids:** Definition of fluid, Fluid properties, Atmospheric gauge and vacuum pressure – measurement of pressure. Manometers- Piezometer, U-tube, inverted and differential manometers. Pascal's law, hydrostatic law. Buoyancy, forces on submerged bodies, stability of floating bodies. | **10** |
| **Unit -2** | |
| **Fluid Kinematics:** Introduction, flow types. Equation of continuity for one dimensional flow. Stream line, path line and streak lines and stream tube. Stream function and velocity potential function.<br>**Fluid Dynamics:** surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its applications, force on pipe bend. | **10** |
| **Unit – 3** | |
| **Closed Conduit Flow:** Reynold's experiment- Darcy Weisbach equation, Minor losses in pipes- pipes in series and pipes in parallel- total energy line hydraulic gradient line.<br>**Basics of Turbo Machinery:** Hydrodynamic force of jets on stationery and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes. | **10** |
| **Unit – 4** | |
| **Turbines:** Hydraulic Turbines: classification of turbines, Working and efficiencies of Pelton wheel, Francis and Kaplan turbines. Importance of Draft | **10** |

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| Tube.<br>**Hydraulic Quantities:** Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer. | |
| **Unit – 5** | |
| **Pumps: Centrifugal Pumps:** Classification, working, work done – manometric head losses and efficiencies- specific speed- pumps in series and parallel performance characteristic curves, cavitation & NPSH.<br>Reciprocating Pumps: Working, Discharge, slip, indicator diagrams. | **10** |

**Course outcomes:**

1. Demonstrate various properties of fluids, pressure measurement devices and their applications.
2. Identify the kinematics and dynamics properties of fluids flowing in different conditions and its effects on the bodies.
3. Estimate the effect of various losses in fluids due to flowing and obstructions and understand using the concepts of pipe losses and Boundary layer theory.
4. Analyze the performance of hydraulic turbines, units and specific quantities based on the design by applying the knowledge of turbomachinery using analytical methods and velocity triangles.
5. Analyze the performance of various hydraulic pumps based on workings and design.

**TEXT BOOKS**

1. Hydraulics, fluid mechanics and Hydraulic machinery Modi and Seth
2. Fluid Mechanics and Hydraulic Machines/ RK Bansal/Laxmi Publications (P) Ltd.

**REFERENCE BOOKS**

**1.** Fluid Mechanics and Hydraulic Machines by Rajput
2. Fluid Mechanics & Turbo machinery by Dixon, 7th Edn, Elesvier
3. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International
4. Fluid Mechanics- Fundementals and Applications by Y.A. Cengel, J.M.Cimbala, 6th Edn, McGrawHill
5. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria& Sons.

**Question paper pattern:**

1. Question paper contains 10 Questions, 2 from each course outcome. The student must answer 5 full
   questions by selecting one question from each course outcome (Internal Choice)
2. All questions carries 14 marks each
3. Each full question will have sub question covering all topics under a course outcome