REGULATIONS, COURSE STRUCTURE AND SYLLABUS

(Aligned with AICTE Model Curriculum)

SITE 2018M REGULATIONS

For

B.Tech.

in

Electronics and Communication Engineering

With effective from the Academic Year

2020-2021

...Values We Live...
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

Chapter – I

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 to cover the depth and breadth required for the program and for the attainment of program outcomes of the corresponding program. Each Programme 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 1**.

Table:1 Credits distribution (Category wise)

Sem(Year)	Category									Sem Credits	Remarks
	BS	ES	HSS	PC	PE	OE	MC	SAC	SI		
I (1)	9.5	9.5	-	-	-	-	1	-	-	19	
II (1)	9.5	5.5	4	-	-	-	1	-	-	19	
III (2)	4	3	-	12	-	-	1	-	-	19	
IV (2)	-	4	-	16.5	-	-	-	-	-	20.5	
V (3)	-	3	3	13	3	0	1	2	-	24	
VI (3)	-	-	-	9.5	6	6	-	2	-	23.5	
VII (4)	-	-	3	3	6	6	-	2	3	23	
VIII (4)	Major Project (6 months Internship)									12	
Category Credits	23	25	10	54	15	12	0	6	3	160	

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

1.4 Admission 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.

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:

Table2: Distribution and Weightage of marks

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
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 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.

Table 3: Allocation of grades

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:

Table 4: Award of class

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:

Table 5: Award of class

Class Awarded	CGPA to be secured	Remarks
First Class with Distinction	≥ 7.75 (Without any supplementary appearance)	From the CGPA secured from 122 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.

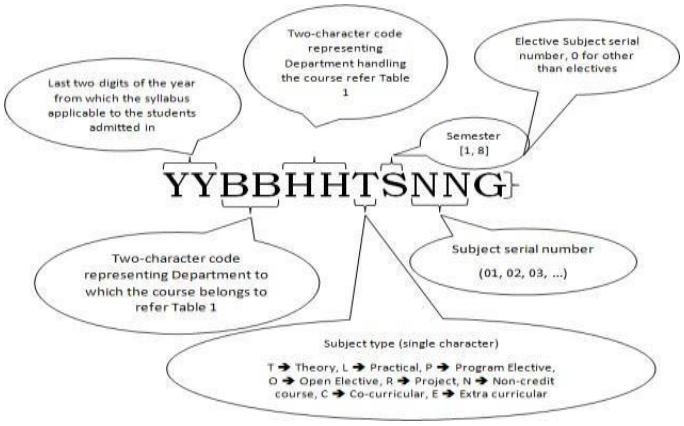


Figure 1: Course Numbering Scheme

The department codes are in given in following Table 6.

Table 6: 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: Signals & Systems in 3rd semester for ECE with S. No 4

Course Code: 18ECECT3040

Table 7: Comparison of Number of credits given by AICTE and Approved credits

S. No.	Category	No. of Credits									
		ECE/ ECT		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 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.	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.
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	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.

	the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	
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. 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.	

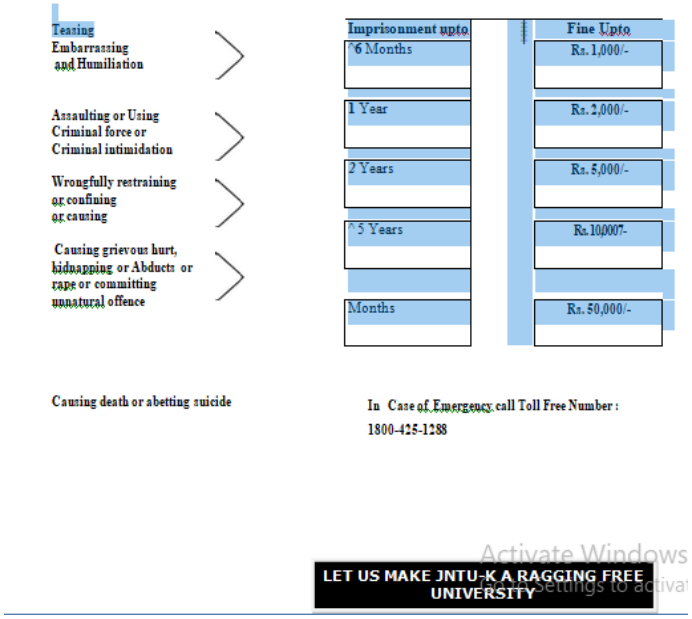
MALPRACTICES

- 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.



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.

Course Structure for

B. Tech (Electronics and Communication Engineering)

Semester I (First year)

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	18CMMAT1010	Engineering Mathematics – 1	3	1	0	4
2	18ECPHT1020	Engineering Physics	3	1	0	4
3	18CMCST1030	Programming for Problem Solving	3	0	0	3
4	18CMMEL1040	Engineering Graphics	1	0	4	3
5	18ECPHL1050	Engineering Physics Lab	0	0	3	1.5
6	18CMCSL1060	Programming for Problem Solving Lab	0	0	4	2
7	18CMMEL1070	Workshop/Manufacturing practice	0	0	3	1.5
8	18CMCHN1080	Environmental Science	3	0	0	0
Total						**19**

Semester II (First year)

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	18CMEGT2010	Technical English	3	0	0	3
2	18CMMAT2020	Engineering Mathematics - II	3	1	0	4
3	18CMCHT2030	Engineering Chemistry	3	1	0	4
4	18CMEET2040	Basic Electrical Engineering	3	1	0	4
5	18CMEGL2050	English Communication Skills Lab	0	0	2	1
6	18CMCHL2060	Engineering Chemistry Lab	0	0	3	1.5
7	18CMEEL2070	Basic Electrical Engineering Lab	0	0	3	1.5
8	18CMMSN2080	Constitution of India, PE&HR	3	0	0	0
Total						**19**

Course Structure for

B. Tech (Electronics and Communication Engineering)

Semester III (Second year**)**

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	18CMMAT3010	Engineering Mathematics – III	3	1	0	4
2	18ECECT3020	Electronic Devices	3	0	0	3
3	18ECECT3030	Network Analysis	3	0	0	3
4	18ECECT3040	Signals & Systems	3	0	0	3
5	18ECECT3050	Probability & Stochastic Processes	3	0	0	3
6	18ECECL3060	Electronic Devices Lab	0	0	3	1.5
7	18ECECL3070	Network Analysis Lab	0	0	3	1.5
8	18ECECN3080	Pulse & Digital Circuits	3	0	0	0
Total						**19**

Semester IV (Second year**)**

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	18ECECT4010	Digital System Design	3	0	0	3
2	18CMMET4020	Engineering Mechanics	3	1	0	4
3	18ECECT4030	EM Waves & Transmission Lines	3	0	0	3
4	18ECECT4040	Analog Circuits	3	0	0	3
5	18ECECT4050	Analog & Digital Communications	3	0	0	3
6	18ECECL4060	Digital System Design Lab	0	0	3	1.5
7	18ECECL4070	Analog Circuits Lab	0	0	3	1.5
8	18ECECL4080	Analog & Digital Communications Lab	0	0	3	1.5
Total						**20.5**

Course Structure for

B. Tech (Electronics and Communication Engineering)

Semester V (Third year**)**

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	18CMMST5010	Management Science	3	0	0	3
2	18ECECT5020	Control Systems	3	1	0	4
3	18ECECT5030	Computer Architecture & Organization	3	0	0	3
4	18ECECT5040	Microprocessor and Microcontrollers	3	0	0	3
5	18ECECT5050	Digital Signal Processing	3	0	0	3
6	18ECECP506X	Professional Elective - I	3	0	0	3
7	18ECECL5070	Microprocessor and Microcontrollers Lab	0	0	3	1.5
8	18ECECL5080	Digital Signal Processing Lab	0	0	3	1.5
9	18CMAHS5090	Soft Skills & Aptitude Builder-1 (Skill Oriented Course-I)	1	0	2	2
10	18CMMSN50A0	Biology for Engineers	2	0	0	0
Total						**24**

Professional Elective-I

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	18ECECP506A	Antennas and Wave Propagation	3	0	0	3
2	18ECECP506B	Information Theory & Coding	3	0	0	3
3	18ECECP506C	System Design through Verilog	3	0	0	3

Course Structure for

B. Tech (Electronics and Communication Engineering)

Semester VI (Third year**)**

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	18ECECT6010	VLSI Design	3	0	0	3
2	18ECECT6020	Computer Networks	3	0	0	3
3	18ECECP703X	Professional Elective – II	3	0	0	3
4	18ECECP604X	Professional Elective – III	3	0	0	3
5	18ECXXO605X	Open Elective – I	3	0	0	3
6	18ECXXO606X	Open Elective - II	3	0	0	3
7	18ECECL6070	VLSI Design Lab	0	0	4	2
8	18ECECL6080	Computer Networks Lab	0	0	3	1.5
9	18CMAHS6090	Soft Skills and Aptitude Builder-2 (Skill Oriented Course-II)	1	0	2	2
Total						**23.5**

Professional Elective-II

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	18ECECP603A	Embedded System Design	3	0	0	3
2	18ECECP603B	Design for Testability	3	0	0	3
3	18ECECP603C	Advanced Digital Signal Processing	3	0	0	3

Professional Elective-III

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	18ECECP604A	Microwave Engineering	3	0	0	3
2	18ECECP604B	Internet Protocols	3	0	0	3
3	18ECECP604C	Digital Image Processing	3	0	0	3

OE-I & OE-II
Candidate should select the subject from list of subjects offered by other departments

Course Structure for

B. Tech (Electronics and Communication Engineering)

Semester VII (Fourth year**)**

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	18CMMST7010	Engineering Economics & Financial Management	3	0	0	3
2	18ECECT7020	Electronic Measurements & Instrumentation	3	0	0	3
3	18ECECP703X	Professional Elective – IV	3	0	0	3
4	18ECECP704X	Professional Elective – V	3	0	0	3
5	18ECXXO705X	Open Elective – III	3	0	0	3
6	18ECXXO706X	Open Elective - IV	3	0	0	3
7	18ECECS7070	IOT and its Applications / Microwave Circuits and Antenna Design using HFSS (Skill Oriented Course-III)	1	0	2	2
8	18ECECR7080	Industrial/Research Internship 2 Months (Mandatory) after third year (to be evaluated during VII semester	0	0	6	3
Total						**23**

Professional Elective-IV

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	18ECECP703A	Embedded and Real Time Concepts	3	0	0	3
2	18ECECP703B	Low Power VLSI	3	0	0	3
3	18ECECP703C	Cellular and Mobile Communications	3	0	0	3

Professional Elective-V

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	18ECECP704A	Radar Systems	3	0	0	3
2	18ECECP704B	Wireless Sensor Networks.	3	0	0	3
3	18ECECP704C	Computer vision and Image Processing	3	0	0	3

OE-III & OE-IV
Candidate should select the subject from list of subjects offered by other departments

Course Structure for

B. Tech (Electronics and Communication Engineering)

Semester VIII (Fourth year**)**

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	18ECECR8010	Project Project work, seminar and internship in industry	0	0	24	12
Total						**12**

Open Elective Courses offered by ECE Department to the 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

ENGINEERING MATHEMATICS-I

Common to all the branches

SEMESTER - I

Subject Code	18CMMAT1010	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	**Hours**
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.	**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	**8**
Unit – 3	
Partial derivatives –Definition and Euler's theorem (without proof), total derivatives, partial differentiation of composite functions. Jacobian - Functional dependence.	**10**
Taylor's and Maclaurin's theorems for function of two variables (statement only). Maxima and minima- Lag ranges method of undetermined multipliers	
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 nonlinear (standard type) equations **Higher order Partial differential equations:** Solutions of Homogeneous and Non Homogeneous partial differential equations with constant coefficients – Classification of partial differential equations.	**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 **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.	**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, 44th edition 2016.
2. Erwin Kreyszig, "Advanced Engineering Mathematics, Wiley, 9th 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. Rajnish Verma, "Higher Engineering Mathematics", S. Chand publishing, 1st edition, 2011.

COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	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**	-	-	-	-	-	-	-	-	-	-	-	-	-

Common to ECE & ECT

ENGINEERING PHYSICS
(Introduction to Electromagnetic Theory)

Subject Code	18ECPHT1020	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	**Hours**
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.	**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.	**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.	**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. **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.	**10**
Unit – 5	
Maxwell's equations: Maxwell's equation in vacuum and non-conducting medium; Energy in an electromagnetic field; Flow of energy and Pointing vector with examples, Qualitative discussion of momentum in electromagnetic fields. **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.	**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:

1. Saroj K. Dash, Smaruti R. Khuntia, Fundamentals of Electromagnetic theory.
2. 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)			
Subject Code:	18CMCST1030	IA Marks	30
Number of Lecture Hours/Week	3+1(T)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 03			

Unit-I: Introduction to computer systems and programming	**Hours**
History & Hardware: Computer Hardware, components, Types of Software, Memory units. **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. **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.	**08**
Unit-II: C Expressions, evaluation and control statements	
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. **Conditional Branching:** if statement, if...else statement, Nested if...else statement, if…else…if ladder, switch statement. **Unconditional Branching:** goto. **Control flow statements:** break, continue. **Looping Constructs:** do-while statement, while statement, for statement.	**12**
Unit-III: Arrays and Functions	
Arrays: Introduction, 1-D Arrays, Character arrays and string representation, 2-D Arrays (Matrix), Multi- Dimensional Arrays. **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. **Strings:** Working with strings, String Handling Functions(both library and user defined).	**10**
Unit-IV: Derived and User Defined Data types	
Pointers: Understanding Pointers, Pointer expressions, Pointer and Arrays, Pointers and Strings, Pointers to Functions. **Dynamic Memory Allocation:** Introduction to Dynamic Memory Allocation malloc, calloc, realloc, free. **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.	**12**
Unit-V: Preprocessing and File Handling	
Preprocessing Directives: Macro Substitution, File Inclusion, conditional compilation and other directives **File Management in C:** Introduction to File Management, Modes and Operations on Files, Types of files, Error Handling During I/O Operations.	**8**

Text Books:

1. Computer Programming ANSIC, E Balagurusamy, McGraw Hill Education(Private), Limited(TB1)
2. Programming in C, Reema Thareja, Second Edition, Oxford Higher Education (TB2)

Reference Books:

1. Computer Basics and C Programming, V Raja Raman, Second Edition, PHI(RB1)

Course Outcomes: Student can able to

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	PO1 0	PO1 1	PO1 2	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 SEMESTER - I			
Subject Code	**18CMMEL1040**	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	**Hours**
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;	**10**
Unit -2	
Projections of Points and lines inclined to both planes; Projections of planes inclined to one plane	**08**
Unit – 3	
Projections of Solids – Prisms, Pyramids, Cones and Cylinders with the axis inclined to one of the planes	**10**
Unit – 4	
Sections and Sectional Views of Right Angular Solids covering, Prism, Cylinder, Pyramid, Cone	**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 **Introduction to AUTOCAD**-The Menu System, Toolbars(Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows	**– 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

6. Student will be able to draw objects using draw and modify toolbars of AutoCAD

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/Reference Books:

1. Engineering Drawing by N.D. Bhatt, Chariot Publications
2. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers
3. Engineering Drawing by K.L.Narayana & P.Kannaiah, Scitech Publishers
4. Engineering Graphics for Degree by K.C. John, PHI Publishers

COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:

PO\CO	PO1	PO 2	PO3	PO 4	PO5	PO6	PO7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
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 SEMESTER - I			
Subject Code	18ECPHL1050	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 strengthand 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	18CMCSL1060	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
d) Area= $\sqrt{s(s-a)(s-b)(s-c)}$ where $s = \frac{a+b+c}{2}$
e) Write a C program to find the largest of three numbers using ternary operator.
f) 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 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.

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 SEMESTER - I			
Subject Code	18CMMEL 1070	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 moulding, 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 molding 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3														
2	3														
3	**2**				**1**				**1**						
Course	**3**				**1**				**1**						

ENVIRONMENTAL SCIENCE SEMESTER - I			
Subject Code	18CMCHN1080	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	**Hours**
MULTIDISCIPLINARYNATUREOF ENVIRONMENTALSTUDIES **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	**10**
Unit -2	
NATURAL RESOURCES 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. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. 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.	**12**
Unit -3	
BIODIVERSITY AND ITS CONSERVATION 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.	**6**
Unit -4	
ENVIRONMENTAL POLLUTION Definition, Cause, effects and control measures of: a. Air pollution f. Water pollution b. Soil pollution g. Marine pollution c. Noise pollution	**12**

d. Thermal pollution e. Nuclear hazards Solid waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution. - Pollution case studies.	
Unit -5	
SOCIAL ISSUES AND THE ENVIRONMENT 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. **Field work:** Visit to a local area to document environmental assets River /forest grassland/hill/mountain -Visit to a local polluted site Urban/Rural/industrial/ Agricultural Study of common plants, insects, birds. - Study of simple ecosystems - pond, river, hill slopes, etc.	**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. Udaya Bhaskar, 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**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

TECHNICAL ENGLISH Semester II			
Subject Code	18CMEGT2010	IA Marks	30
Number of Lecture Hours/Week	03	Exam Marks	70
Total Number of Lecture Hours	50	Exams Hours	03
Credits -03			

Course Objectives:

To enable the students to learn and apply fundamental principles in Technical English & Communication by focusing on:

- Technical English Vocabulary
- Writing Skills
- Common Errors in Writing
- Nature and Style of Sensible Technical Writing
- Writing Technical Reports and Letters
- Providing an inspiring reading experience from the biography of a renowned technocrat.

Unit I	**Hours**
Principles of Scientific Vocabulary • **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 • The role of roots in word building prefixes and suffixes, confusing words and expressions. • Non-detailed text-Karma yogi: 1-4 chapters, Page No 1-53	10
Unit II	
Writing Skills • Distinguishing between academic and personal styles of writing • Use of clauses in technical phrases and sentences • Techniques of Sentence and paragraph writing • Measuring the clarity of a text through Fog Index or Clarity Index Non-detailed text- Karma yogi: 5-8 chapters, Page No 54-100	10
Unit III	
Common Errors in Writing • Subject-verb agreement and concord of nouns, pronouns and possessive adjectives • Common errors in the use of articles, prepositions, adjectives and adverbs • Punctuation • Technical Guidelines for Communication • Avoiding the pitfalls Non-detailed text-Karma yogi: 9-12 chapters, Page No101- 151	10
Unit IV	
Nature and Style of Sensible Technical Writing • Academic Writing Process • Describing, processes and products • Defining, Classifying • Effective use of charts, graphs, and tables Non-detailed text- Karma yogi: 13-16 chapters, Page No 152-203	10
Unit V	
Report writing and Letter writing • Writing Technical Reports • Précis writing • Letter Writing • Essay writing	10

- Non-detailed text- Karma yogi: 13-16 chapters, Page No 204-250

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 & Pushpa Latha, 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	PO 2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	-	-	-	-	-	-	-	-	-	**2**	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	**2**	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	**2**	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	**2**	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	**2**	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	**2**	-	-	-	-	-

ENGINEERING MATHEMATICS-II

Common to all the branches

SEMESTER - II

Subject Code	18CMMAT2020	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	**Hours**
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**
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). Applications: Solving ordinary differential equations (initial value problems) using Laplace transforms	**10**
Unit – 3	
Numerical Methods: Numerical solution of algebraic and transcendental equations by Regula- Falsi Method and Newton-Raphson method. 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**
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**
Unit – 5	
Fourier Series: Periodic functions, Dirichlet's condition, Fourier Series of periodic functions with period 2π and with arbitrary period. Fourier series of even and odd functions, Half range Fourier Series. **Fourier Transforms**: Infinite Fourier transforms, Fourier sine and cosine transforms Inverse Fourier transforms.	**12**

Course outcomes:

On completion of this course, students are able to,

1. Solve system of linear equations
2. Find eigen values and eigen vectors of a matrix
3. Solve initial value problems by using Laplace transforms
4. Find the solution of algebraic/transcendental equations and also interpolate the functions.

5. Evaluate numerical integration and to solve ordinary differential equations by using numerical methods.
6. Find Fourier series of a periodic function and to determine the Fourier transform of a function

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, 44th Edition, 2016.
2. Kreyszig, "Advanced Engineering Mathematics"-Wiley, 9th Edition, 2013.

Reference Books:

1. B.V. Ramana "Higher Engineering Mathematics" TataMc Graw-Hill,2006
2. N P Baliand Manish Goyal," A text book of Engineering mathematics", Laxmi publications, 7th edition.
3. H. K Dass and Er. Rajnish Verma ,"Higher Engineering Mathematics", S. Chand publishing,1st edition,2011.
4. Dr.K.V. Nageswara Reddy and Dr.B. Rama Bhupal Reddy,"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**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

ENGINEERING CHEMISTRY SEMESTER - II			
Subject Code	18CMCHT2030	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	**Hours**
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 & 3andgeometries, hard soft acids and bases.	**10**
Unit -2	
USE OF FREE ENERGY IN CHEMICAL EQUILIBRIA **Thermodynamic functions:** State and Path functions, First and second laws of thermodynamics, Gibbs Helmholtz Equation, concept of entropy and enthalpy. **Electro chemistry:** Introduction, electrode potential, standard electrodes – Hydrogen and Calomel electrodes, Nernst equation and applications. **Water chemistry:** Surface and subsurface water quality parameters – turbidity, pH, total dissolved salts, chloride content, and break point chlorination. **Corrosion:** Wet chemical theory, control methods –Proper designing, cathodic protection- Sacrificial anodic and impressed current cathodic protection.	**10**
Unit -3	
STEREO CHEMISTRY Principles of stereochemistry, representations of 3 dimensional structures of organic compounds, geometrical and stereoisomer's, configuration and symmetry, enantiomers. **ORGANIC REACTIONS AND SYNTHESIS OF A DRUG MOLECULE** 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.	**10**
Unit -4	
ATOMIC, MOLECULAR STRUCTURE AND ADVANCED MATERIALS Schrodinger equation. Particle in a box solution and their applications for conjugated molecules. **Nano particles**: Introduction, preparation methods – Sol-gel method, Chemical reduction method – properties and applications. **Surface properties:** Determination of surface tension and viscosity of liquids. **Ceramics:** Classification, examples and applications. Crystal field theory and the energy level diagrams fortransition metal ions.	**10**
Unit -5	
SPECTROSCOPIC TECHNIQUES	

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.	**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. Able to synthesize organic molecules using different types 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-II			
Subject Code	18CMEET2040	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 -1	**Hours**
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, Thevenin's and Norton Theorems (Simple Numerical problems).Time-domain analysis of first-order RL and RC circuits.	**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.	**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.	**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. **DC machines-** Construction, working, torque-speed characteristics and speed control of dc shunt motor.	**10**
Unit – 5	
Power Converters and Electrical Installations DC – DC Buck and boost converters, duty ratio control, PWM techniques, single phase voltage source inverters. Classification of batteries and Low Voltage switch gear.	**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"*, 2nd 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. Bhavesh Bhalja, R.P., Maheshwari, Nilesh G. Chothani, *"Protection and Switchgear"*, Oxford University Press, 5th 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 SEMESTER-II			
Subject Code	18CMEGL2050	IA Marks	15
Number of Practical Hours/Week	02	Exam Marks	35
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 SEMESTER-II			
Subject Code	18CMCHL2060	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	PO1 0	PO11	PO12
1	-	3	-	-	-	-	-	-	-	-	-	-
2	-	3	-	-	-	-	-	-	-	-	-	-
3	-	3	-	-	-	-	-	-	-	-	-	-
4	3	-	-	-	-	-	-	-	-	-	-	-
5	-	3	-	-	-	-	-	-	-	-	-	-
6	-	3	-	-	-	-	-	-	-	-	-	-
Course	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

BASIC ELECTRICAL ENGINEERING LAB SEMESTER-II			
Subject Code	18CMEEL2070	IA Marks	15
Number of Practice Hours/Week	2P	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
12. Demonstration of Low Voltage Switchgear

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 branches

SEMESTER-II

Subject Code	18CMMSN2080	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 -1	**Hours**
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.	**10**
Unit -2	
Lesson: Directive Principles of State Policy & Relevance of Directive Principles State Policy Fundamental Duties. Union Executives – President, Prime Minister Parliament Supreme Court of India.	**10**
Unit – 3	
Lesson: State Executives – Governor, Chief Minister, State Legislature High Court of State. Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86th&91st Amendments.	**10**
Unit – 4	
Lesson: Special Provision for SC & ST Special Provision for Women, Children & Backward Classes Emergency Provisions. Human Rights –Meaning and Definitions, Legislation Specific Themes in Human Rights- Working of National Human Rights Commission in India Powers and functions of Municipalities, Panchayats and Co - Operative Societies.	**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.	**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.
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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	1	-		-	-	-	-	-	-	-
4	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-
5						3									
6	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-
Course	-	-	-	-	-	**3**	-	**5**	-		-	-	-	-	-

Course Structure for

B. Tech (Electronics and Communication Engineering)

Semester III (Second year**)**

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	18CMMAT3010	Engineering Mathematics – III	3	1	0	4
2	18ECECT3020	Electronic Devices	3	0	0	3
3	18ECECT3030	Network Analysis	3	0	0	3
4	18ECECT3040	Signals & Systems	3	0	0	3
5	18ECECT3050	Probability & Stochastic Processes	3	0	0	3
6	18ECECL3060	Electronic Devices Lab	0	0	3	1.5
7	18ECECL3070	Network Analysis Lab	0	0	3	1.5
8	18ECECN3080	Pulse & Digital Circuits	3	0	0	0
Total						**19**

Semester IV (Second year**)**

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	18ECECT4010	Digital System Design	3	0	0	3
2	18CMMET4020	Engineering Mechanics	3	1	0	4
3	18ECECT4030	EM Waves & Transmission Lines	3	0	0	3
4	18ECECT4040	Analog Circuits	3	0	0	3
5	18ECECT4050	Analog & Digital Communications	3	0	0	3
6	18ECECL4060	Digital System Design Lab	0	0	3	1.5
7	18ECECL4070	Analog Circuits Lab	0	0	3	1.5
8	18ECECL4080	Analog & Digital Communications Lab	0	0	3	1.5
Total						**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:

- Find the function of a complex variable
- Evaluate complex integration and expand functions using Taylor & Maclaurin's series
- Evaluate integrals using Residues
- Find the statistical parameters for distributions
- Test the hypothesis

Unit -1	**Hours**
Function of a complex variable 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 Complex integration: Line integral – Cauchy's integral theorem, Cauchy's in integral formula, generalized integral formula (all without proofs)Radius of convergence – expansion in Taylor's series, Maclaurin's series and Laurent series	**10**
Unit – 3	
Singularities and Residue Theorem 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**,**Integrationaroundsemicircle,Indentingthecontourshavingpolesonthereal axis.	**10**
Unit – 4	
Discrete Random variables and Distributions: Introduction-Random variables- Discrete Random Variable-Distribution function-Expectation. Discrete distributions: Binomial, Poisson and Geometric distributions and their fitting to data. **Continuous Random variable and distributions:** 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: Introduction - Population and samples- Sampling distribution of means (σ-known) t-distribution- Sampling distribution of means(σ-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 proportion,	**10**

two means- Proportions and their differences - ANOVA for one – way and two – way classified data	

Course outcomes:

On completion of this course, students are able to

1. Find the function of a complex variable
2. Evaluate complex integration and expand functions using Taylor & Maclaurin's series
3. Evaluate integrals using Residues
4. Find the statistical parameters for discrete distributions
5. Find the statistical parameters for continuous distributions
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,44thedition, 2016.
2. Erwin Kreyszig, "Advanced Engineering Mathematics, Wiley, 9thEdition, 2013.

Reference Books:

1. B.V. Ramana, "Higher Engineering Mathematics", Tata Mc Graw-Hill,2006
2. N.P.Bali and ManishGoyal,"A textbook of Engineering mathematics",Laxmi publications, 7thEdition.
3. H.K.Dassand, Er.RajnishVerma,"Higher Engineerig Mathematics", S.Chand publishing, 1st 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	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**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

ELECTRONIC DEVICES (Common for ECE & ECT) SEMESTER III			
Subject Code	18ECECT3020, 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, Semiconductors, and Metals classification using energy bands, mobility and conductivity, electrons and holes in intrinsic semiconductors and extrinsic semiconductors, 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: **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. **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:

2. Understand the basic concepts of semiconductor physics.
3. Understand the construction and operating principle of p-n junction diode and special semiconductor diodes
4. Apply diodes as rectifiers and analyze characteristics with and without filters
5. Understand the construction and principle of operation of BJT and FET w.r.t V-I characteristics.
6. Analyze various biasing techniques for BJT and FET.
7. 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. JacobMillman, C.Halkies, C.D.Parikh, "IntegratedElectronics",TataMc-Graw Hill, 2009.
2. G. Streetman and S. K. Banerjee, "Solid State Electronic Devices", 2nd edition, Pearson,2014.

Reference Books:

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

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO 3	PO4	PO 5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
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 and Thermal Stabilization	T1	9
		R2	5
5	Small Signal Low Frequency Transistor Amplifier Models	T1	8 & 10
		R4	9

NETWORK THEORY (Common for ECE & ECT) SEMESTER III			
Subject Code	18ECECT3030, 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. **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: **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 **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 Attenuators.

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, Valkenburg, "Network analysis", 3rd Edition, Prentice hall of India, 2000.
2. AWilliamHayt,"EngineeringCircuitAnalysis",8th Edition, McGraw-Hill Education
3. Sudhakar, A.,Shyammohan, "Circuits and Network", TataMcGraw-HillNew Delhi,1994

Reference Books:

1. John.D.Ryder, "Network lines and Fields",2nd edition, Asia publishing house.
2. D R Cunninghan, "Basic Circuit Analysis", Jaico Publishers.
3. Chadha, "Network Analysis and Filter Design", Umesh Publications.

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO 3	PO4	PO 5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
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	2 & 3
		T3	1&2
		R1	1
		R2	4
2	Network Theorems	T1	9
		T3	3
		R1	1
		R2	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 (Common for ECE & ECT) SEMESTER III			
Subject Code	18ECECT3040, 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. 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. 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. 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", 2nd Edition, PHI,2009.
2. B.P. Lathi, "Signal Processing & Linear Systems", 1st Edition, Oxford University Press,2006.

Reference Books

1. Simon Haykin and Van Veen, "Signals & Systems", 2nd Edition, John Wiley India,2011.
2. M.J.Roberts,"Analysis using Transform methods and MATLAB",1st Edition, TMH, 2005.
3. TKRawat, "Signals and Systems", 1stEdition, Oxford University press, 2014

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO 3	PO4	PO 5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
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

PROBABILITY & STOCHASTIC PROCESSES (Common for ECE & ECT) SEMESTER III			
Subject Code	18ECECT3050, 18ETETT3050	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Pre-requisite	---	Credits – 03	

Course Objectives:

This course will enable students to

- Understand the concept of distribution, density functions of different random variables
- Apply statistical operations on 1-d and multiple random variables.
- ClassifytherandomprocessesandanalyzetheLTIsystemswithrandomprocess

Unit -1	**Hours**
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. **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.	**12**
Unit -2	
Operation on One Random Variable – Expectations : Introduction, Expected Value of aRandom 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.	**10**
Unit – 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. **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.	**10**
Unit – 4	
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 Stationary, N^{th}-order and Strict-Sense Stationary, Time Averages and Ergodicity, Autocorrelation Function and its Properties, Cross-Correlation Function and its Properties, Covariance Functions, Gaussian Random Processes,	**8**

Poisson Random Process.	
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 Input and 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. Apply statistical operations and transformations on 1-D random variable
4. Extend the concept of 1-D random variable to multiple random variables
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", 4th Edition, TMH,2001.
2. Papoulis and S.Unnikrisha, "Probability, Random Variables and Stochastic Processes" 4th Edition, PHI,2002.

Reference Books:

1. Henry Stark and JohnW. Woods, "Probability and Random Processes with Applications to Signal Processing",3rd Edition, Pearson Education.
2. Gardener W.A, "Introduction to Random Processes with Applications to Signals and Systems", 2nd Edition, McGraw-Hill.

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO 3	PO4	PO 5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
1	3	2	-	-	-	-	-	-	-	-	-	-	-	3	-
2	3	2	-	-	-	-	-	-	-	-	-	-	-	1	-
3	3	2	-	-	-	-	-	-	-	-	-	-	-	1	-
4	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
5	3	2	-	-	-	-	-	-	-	-	-	-	-	3	-
6	3	1	-	-	-	-	-	-	-	-	-	-	-	2	-
Course	**3**	**2**	-	-	-	-	-	-	-	-	-	-	-	**2**	-

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	18ECECL3060, 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: 1. Identification, Specifications, Testing of R,L, C Components (Color-codes), Potentiometers, Coils, Gang Condensers, Relays, Bread Boards. 2. Identification, Specifications and Testing of active devices, Diodes, BJTs, JFETs, LEDs, LCDs, SCR, UJT. 3. Soldering Practice- Simple circuits using active and passive components. 4. Study and operation of Ammeters, Voltmeters, Transformers, Analog and Digital Multi-meter, Function Generator, Regulated Power Supply and CRO **List of Experiments:** 1. P-N Junction Diode Characteristics 2. Zener Diode Characteristics without and with Regulator 3. Half-wave Rectifier (without and with C-filter) 4. Full-wave Rectifier (without and with C-filter) 5. BJT Characteristics (CE Configuration) Part A: Input Characteristics Part B: Output Characteristics 6. FET Characteristics (CS Configuration) Part A: Drain Characteristics Part B: Transfer Characteristics 7. Transistor Biasing 8. BJT-CE Amplifier 9. Emitter Follower-CC Amplifier 10. FET-CS Amplifier	**36**

Course outcomes:

After completing this course, students will be able to:

1. Analyze the characteristics of Semiconductor devices.
2. Design and verify the biasing circuit for BJT
3. Design and analyze BJT and FET Amplifier Circuits

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.

NETWORK THEORY LAB

(Common for ECE & ECT)

SEMESTER - III

Subject Code	18ECECL3070, 18ETETL3070	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 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

List of Experiments	**Hours**
The students are required to design the electrical circuits to verify the laws, theorems, two port parameters, time response of AC circuits and has to Experimentally find the results. Experimental results should be verified with theoretical values. **Part-A: Computation of two port network parameters and transients** 1. Two port network parameters–Z-Y Parameters and analytical verification. 2. Two port network parameters – Hybrid& ABCD parameters, Analytical verification. 3. Transient response of RL & RC Networks for DC and AC Inputs 4. Transient response of RLC Circuit for DC and AC inputs FET-CS Amplifier **Part-B: Simulation of electrical networks using PSPICE** 1. Introduction to PSPICE and verification of Kirchhoff's laws for basic electrical networks. 2. Simulation of DC Electrical circuits and verification using Kirchhoff's laws 3. Simulation of AC Electrical circuits and verification using Kirchhoff's laws 4. Verification of Thevenin's and Norton's equivalent circuits using PSPICE. Verification on DC with Resistive loads 5. Verification of Thevenin's and Norton's equivalent circuits using PSPICE. Verification on AC with Reactive loads 6. Transient Response of RLC Circuits for DC and AC Inputs 7. Determination of Two port network parameters 8. Low pass and High Pass Filter characteristics	**36**

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.

PULSE & DIGITAL CIRCUITS

Common to ECE & ECT

SEMESTER III

Subject Code	18ECECN3080, 18ETETN3080	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Pre-requisite	Semiconductor Devices	**Credits - 0**	

Course Objectives:

This course will enable students to

- Understand Wave shaping circuits.
- Analyze switching characteristics of electronic devices.
- 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, clamping circuit theorem, practical clamping circuits, effect of diode 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. **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. **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
Total	**50**

Course outcomes:

On completion of the course, student will be able to

1. Analyze linear wave shaping circuits with different inputs.
2. Design Nonlinear wave shaping circuits.
3. Design switching circuits.
4. Analyze different Multivibrators
5. Design different multivibrators
6. Understand different types of time base generators

Text Books:

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

Reference Books:

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

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	PO1	PO2	PO 3	PO4	PO 5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
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	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	18ECECT4010, 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

- Introduce the concepts and techniques associated with the number systems and Boolean algebra.
- Design various combinational circuits, sequential circuits and memories using logic gates and PLDs
- Know various logic families
- 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, de-multiplexer, 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. **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. 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:

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

Reference Books:

1. W.H. Gothmann, "Digital Electronics- An introduction to theory and practice", 2nd Edition, PHI, 2006.
2. Charles H. RothJr, "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 McGraw Hill, 2012.
5. Stephen Brown and Zvonko Vramesic, "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	PO1	PO2	PO 3	PO4	PO 5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
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	TextBook/ 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 – 03

Course Objectives:

This course will enable students to

- Develop an understanding of the principles of statics and the ability to analyze problems using static equilibrium equations.
- Introduce the basic principles of mechanics applicable to rigid bodies in equilibrium.
- Teach the basic principles of mechanics applicable to the motion of particles and rigid bodies.
- Introduce with mathematical description of the plane motion of rigid bodies.
- Develop the fundamentals of engineering mechanics and problem solving skills essential for mechanical engineering

Unit -1	**Hours**
Introduction to Engg. Mechanics – Basic Concepts. **Systems of Forces:** Coplanar Concurrent Forces – Components in Space – Resultant – Moment of Force and its Application – Couples and Resultant of Force Systems. **Friction:** Introduction, limiting friction and impending motion, coulomb's laws of 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 Theorm, 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; **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. **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.,4thEdn-,McGrawHill publications.
2. Engineering Mechanics-Statics and Dynamics by A Nelson, TataMcGraw Hill Education Private Ltd, New Delhi,2009.

Reference Books:

1. EngineeringMechanicsstaticsanddynamics–R.C.Hibbeler,11thEdn–Pearson Publ.
2. Engineering Mechanics, statics – J.L.Meriam, 6th Edn – Wiley India PvtLtd.
3. Engineering Mechanics, statics and dynamics – I.H.Shames, – PearsonPubl.
4. Mechanic For Engineers, statics-F.P.Beer&E.R.Johnston–5thEdnMcGrawHill Publ.
5. Mechanics For Engineers, dynamics-F.P.Beer&E.R.Johnston–5thEdnMcGraw HillPubl.
6. Theory & Problems of engineering mechanics, statics & dynamics – E.W.Nelson, C.L.Best&W.G.McLean,5thEdn–Schaum'soutlineseries-McGrawHillPubl.
7. Singer's Engineering Mechanics: Statics And Dynamics, K.VijayKumarReddy,J. Suresh Kumar, BsPublications
8. Engineering Mechanics, Fedinand . L. Singer, Harper –Collins.

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO 3	PO4	PO 5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
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	18ECECT4030, 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

- Learn the concepts of transmission lines
- 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 and MinimumAttenuationlines,Loading-TypesofLoading.IllustrativeProblems.	**08**
Unit – 3	
Transmission Lines-II: Input Impedance Relations, SC and OC Lines, Reflection Coefficient, VSWR. UHF Lines as Circuit Elements; λ/4, λ /2, λ/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 Group Velocities, 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. **Microstrip Lines–** Introduction, Zo Relations, Effective Dielectric Constant, Losses, Q factor. **Cavity Resonators–** Introduction, Rectangular and Cylindrical Cavities, Dominant	**11**

Modes and Resonant Frequencies, Q factor and Coupling Coefficients. Related Problems.	

Course outcomes:

On completion of the course student will be able to

1. Analyze wave equations in different mediums
2. Understand the reflection and refraction mechanism of plane waves with normal and 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", 2nd Edition, PHI.
2. Matthew N.O.Sadiku, "Elements of Electromagnetics",3rdEdition, Oxford Univ. Press,2004

Reference Books:

1. R.K. Shevgaonkar, "Electromagnetic Waves", Tata McGraw Hill India,2005
2. UmeshSinha, SatyaPrakashan,"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	PO1	PO2	PO 3	PO4	PO 5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
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**	-

ANALOG CIRCUITS (Common for ECE & ECT) SEMESTER IV			
Subject Code	18ECECT4040, 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 students to

- Understand the working of single stage and multistage 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: **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. **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. **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. **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 **Operational Amplifier Characteristics**: DC Characteristics, AC Characteristics. **Operational Amplifier Applications:** 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 timers, functional diagram, applications of 555 timers. PLL: Basic principles, phase detector, VCO, Low pass filter, PLL applications **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**

On completion of the course student will be able to:

1. Analyze and design single and multi-stage amplifiers at low, mid and 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, "Micro electronic Circuits", 5thedition
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", 5th 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", 3rd 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	PO1	PO2	PO 3	PO4	PO 5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
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

ANALOG & DIGITAL COMMUNICATIONS (Common for ECE & ECT) SEMESTER IV			
Subject Code	18ECECT4050, 18ETETT4050	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Pre-requisite	Signals & Systems	Credits – 03	

Course Objectives:

This course will enable students to

- Understand the concept of modulation and learn continuous wave modulation and pulse modulation techniques.
- Measure the effect of noise in different modulation schemes.
- Study the Digital Modulation techniques.

Unit -1	**Hours**
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.	**12**
Unit -2	
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 AM Systems. Noise in amplitude modulated systems.	**08**
Unit – 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.	**12**
Unit – 4	
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. **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 drawbacks, adaptive delta modulation, comparison of PCM and DM systems, noise in PCM and DM systems	**08**

Unit – 5	
Digital Modulation Techniques: Introduction, ASK, FSK, PSK, DPSK, DEPSK, QPSK, M-array PSK, ASK, FSK. Calculation of error probability of ASK, BPSK, BFSK,QPSK.	**10**

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", 2nd Ed, JohnWiley.
2. Simon Haykin, "Digital communications", John Wiley,2005
3. H.TaubandD.Schilling,"Principles of CommunicationSystems",TMH, 2003

References Books:

1. B.P. Lathi, "Communication Systems", BS Publication,2006.
2. ProakisJ.G.andSalehiM.,"CommunicationSystemsEngineering",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	PO1	PO2	PO 3	PO4	PO 5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
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	3
		R2	3
2	DSB & SSB Modulation	T1	3
		R1	3
		R2	3
3	Angle Modulation	T1	4
		R1	4
4	Pulse Modulation	T1	7
	Pulse Digital Modulation	T3	7
		T4	5
		R1	5
5	Digital Modulation Techniques	T3	5
		T4	6
		R1	9

DIGITAL SYSTEM DESIGN LAB

(Common for ECE & ECT)

SEMESTER - IV

Subject Code	18ECECL4060, 18ETETL4060	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 course objective is make students to

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

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

Course outcomes:

Upon completion of the course, students will be able to

1. Design digital systems using combinational circuit's using VHDL.
2. Design digital systems using sequential circuit's 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.

ANALOG CIRCUITS LAB

(Common for ECE & ECT)

SEMESTER - IV

Subject Code	18ECECL4070, 18ETETL4070	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 course objective is make students to

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

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

Course outcomes:

After completing this course, students will be able to:

1. Design two stage amplifier 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	18ECECL4080, 18ETETL4080	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 course objective is make students to

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

List of Experiments	**Hours**
(Note: Each Experiment is verified using a) Hardware b) MATLAB program (or) MATLAB Simulink 14. Amplitude Modulation and demodulation 15. DSB-SC Modulation and demodulation and also verify using Spectrum Analyzer 16. Frequency Modulation and demodulation 17. Pre-emphasis and de-emphasis 18. Sampling Theorem 19. PWM, PPM Modulation and demodulation 20. Pulse Code Modulation 21. Delta Modulation 22. Amplitude Shift Keying 23. Frequency Shift Keying 24. Phase Shift Keying 25. Differential Phase Shift Keying	**36**

Course outcomes:

After completing 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.

Course Structure for

B. Tech (Electronics and Communication Engineering)

Semester V (Third year**)**

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	18CMMST5010	Management Science	3	0	0	3
2	18ECECT5020	Control Systems	3	1	0	4
3	18ECECT5030	Computer Architecture & Organization	3	0	0	3
4	18ECECT5040	Microprocessor and Microcontrollers	3	0	0	3
5	18ECECT5050	Digital Signal Processing	3	0	0	3
6	18ECECP506X	Professional Elective - I	3	0	0	3
7	18ECECL5070	Microprocessor and Microcontrollers Lab	0	0	3	1.5
8	18ECECL5080	Digital Signal Processing Lab	0	0	3	1.5
9	18ECECS5090	Soft Skills& Aptitude Builder-1 (Skill Oriented Course-I)	1	0	2	2
10	18CMMSN50A0	Biology for Engineers	2	0	0	0
Total						**24**

Professional Elective-I

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	18ECECP506A	Antennas and Wave Propagation	3	0	0	3
2	18ECECP506B	Information Theory & Coding	3	0	0	3
3	18ECECP506C	System Design through Verilog	3	0	0	3

MANAGEMENT SCIENCE
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 students to

1. To define the Basic Concepts of Management and organization
2. To summarize the different layouts for production, statistical quality control, methods of inspection importance of inventory management in operations
3. To identify the consumer behavior and Human Resource contribution in the development of organizations.
4. To apply the techniques of project management PERT, CPM to complete the project within optimal time and cost.
5. To identify various strategies used for organizational development

Unit -1	**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 -2	
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 -3	
Functional Management HRM& Marketing: Concept of HRM, HRD and PMIR- Functions of HRM - Marketing Management- Functions of Marketing, Marketing strategies based on product Life Cycle, Channels of distributions. **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 – 4	
Project Management: **(PERT/CPM):** Development of Network – Difference between PERT and CPM Identifying Critical Path- Probability- Project Crashing (Simple Problems).	10
Unit – 5	
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
Total	**48**

Course outcomes:

On completion of the course student will be able to

1. Define the Basic Concepts of Management and organization
2. Summarize the Statistical Quality Control Techniques, Methods of inspection, the concept of Inventory Management and Control
3. Identify the Customer Behavior and Employees Contribution towards success of Organization
4. Apply the techniques of project management to complete the project within the duration and cost.
5. Identify the various types of strategies for organizational development

Text Books:

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

Reference Books:

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

CONTROL SYSTEMS
Common to ECE & ECT
SEMESTER V

Subject Code	18ECECT5020	Internal Marks	30
Number of Lecture Hours/Week	04	External Marks	70
Total Number of Lecture Hours	64	Exam Hours	03
Pre-requisite	Engineering Mathematics	Credits – 04	

Course Objectives:
This course will enable students to

1. Understand concepts of the mathematical modelling of Control System.
2. Understand the 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 Time & Frequency response analysis
5. 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. **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.	14
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.	12
Unit -3	
Concepts of Stability and Algebraic Criteria: The concept of Stability, Necessary Conditions for Stability, Routh Hurwitz Stability Criterion. **The Root Locus Technique:** Introduction, The Root Locus concepts, Construction of Root Loci, Effect of adding poles and zeros to a system.	14
Unit – 4	
Frequency response analysis: Introduction, Correlation between time and frequency response, Polar Plots, Bode Plots, Nyquist Stability Criterion, Performance specifications in frequency-domain.	12
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.	12
Total	**64**

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. I.J. Nagarath and M. Gopal, Control Systems, New Age International Publishers, 5thEdition, 2014
2. Katsuhiko Ogata, Modern Control Engineering, Pearson, 4thEdition, 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

COMPUTER ARCHITECTURE & ORGANIZATION SEMESTER V			
Subject Code	18ECECT5030	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. Principles and the Implementation of Computer Arithmetic
2. Operation of CPUs including RTL, ALU, Instruction Cycle and Busses
3. Fundamentals of different Instruction Set Architectures and their relationship to the CPU Design
4. Memory System and I/O Organization
5. Principles of Operation of Multiprocessor Systems and Pipelining

Unit -1	**Hours**
Basic Structure of Computers: Functional unit, Basic Operational concepts, Bus structures, System Software, Performance, The history of computer development. Processor organization, Information representation, number formats. Multiplication & division, ALU design, Floating Point arithmetic, IEEE 754 floating point formats	10
Unit -2	
Machine Instruction and Programs: Instruction and Instruction Sequencing: Register Transfer Notation, Assembly Language Notation, Basic Instruction Types, Addressing Modes, Basic Input/output Operations, The role of Stacks and Queues in computer programming equation. Component of Instructions: Arithmetic Instructions, Logic Instructions, shift and Rotate Instructions, Branch Instructions.	10
Unit -3	
Input/ Output Organization: Accessing I/O Devices, Interrupts: Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Direct Memory Access, Buses: Synchronous Bus, Asynchronous Bus, Interface Circuits, Standard I/O Interface: Peripheral Component Interconnect (PCI) Bus, Universal Serial Bus (USB)	10
Unit – 4	
The Memory Systems: Basic memory circuits, Memory System Consideration, Read-Only Memory: ROM, PROM, EPROM, EEPROM, Flash Memory. Cache Memories: Mapping Functions, INTERLEAVING Secondary Storage: Magnetic Hard Disks, Optical Disks.	10
Unit – 5	
Multi Processors: Introduction, Characteristics of Multiprocessors, Interconnection Structures, Inter Processor Arbitration. Pipeline: Parallel Processing, Pipelining, Instruction Pipeline, RISC Pipeline, Array Processor.	8
Total	**48**

Course outcomes:

On completion of the course student will be able to

1. Understand about computer systems
2. Learn number systems, binary addition and subtraction, standard, floating-point, and micro operations
3. understanding of architecture and functionality of central processing unit
4. Know I/O and memory organization
5. Illustrate concepts of parallel processing, pipelining and inter processor communication

Text Books:

1. M. Morris Mano, Computer System Architecture, Third Edition, Pearson,2008.

2. Carl Hamacher, ZvonkoVranesic, SafwatZaky, Computer Organization, 5/e, McGraw Hill,2002.

Reference Books:

1. William Stallings, Computer Organization and Architecture, 6/e, Pearson,2006.
2. Andrew S. Tanenbaum, Structured Computer Organization, 4/e, Pearson,2005.

MICROPROCESSORS AND MICROCONTROLLERS
Common to ECE & ECT
SEMESTER V

Subject Code	18ECECT5040	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. **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, Rolin McKinlay Janice Gillispie Mazidi, 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
Common to ECE & ECT
SEMESTER V

Subject Code	18ECECT5050	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, Invertibility, 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. **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.

ANTENNAS AND WAVE PROPAGATION
(Professional Elective-I)
SEMESTER V

Subject Code	18ECECP506A	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Pre-requisite	EM Waves and Transmission Lines	Credits – 03	

Course Objectives:

This course will enable students to

1. Understand the radiation mechanism and antenna parameters and their limiting value
2. Study Retarded potentials and formulate Wire Antenna analysis
3. Analyse and compare the characteristics of various antenna arrays
4. Design various VHF, UHF and illustrate their working principles
5. Understand the various wave propagation modes

Unit -1	**Hours**
FUNDAMENTAL CONCEPTS: Introduction, Radiation Mechanism – single wire, 2 wire, dipoles, Current Distribution on a thin wire antenna. Antenna Parameters-Radiation Patterns, Patterns in Principal Planes, Main Lobe and Side Lobes, Beam widths, Polarization, Beam Area, Radiation Intensity, Beam Efficiency, Directivity, Gain and Resolution, Antenna Apertures, Aperture Efficiency, Effective Height, Friis Transmission Equation, illustrated Problems.	8
Unit -2	
RETARDED POTENTIALS AND WIRE ANTENNA ANALYSIS: Retarded Potentials, Fields of a short dipole, Radiation resistance of short dipole, Quarter wave Monopole and Half Wave Dipole-Evaluation of Field Components, Power Radiated, Radiation Resistance, Beam widths, Directivity, Effective Area and Effective Height. Natural current distributions, fields and patterns of Thin Linear Centre-fed Antennas of different lengths, Radiation Resistance at a point which is not current maximum.	10
Unit -3	
ANTENNA ARRAYS: Introduction, Two-Element Array, Principle of Pattern Multiplication, N element Uniform Linear Arrays – Broadside, End fire Arrays, Derivation of their characteristics and comparison; Concept of Scanning Arrays. Directivity Relations (no derivations). Binomial Arrays, Effects of Uniform and Non-Uniform Amplitude Distributions, Design Relations. Yagi-Uda Arrays, Folded Dipoles and their characteristics.	10
Unit – 4	
VHF AND UHF ANTENNAS: Broadband Antennas-Helical antenna, Practical design considerations, Principle of operation. Reflector antennas, parabolic reflector, corner reflector, Feed methods for parabolic reflectors, Horn Antennas – Types, Optimum Horns, Design Characteristics of Pyramidal Horns; Antenna. **MICRO STRIP ANTENNAS:** Microstrip Antennas-Introduction, Features, Advantages and Limitations, Rectangular Patch Antennas –Geometry and Parameters, Impact of different parameters on characteristics, Feeding methods, Design and Analysis using transmission line model.	10
Unit – 5	
RADIO WAVE PROPAGATION: Types of propagations. **Ground Wave Propagation:** Characteristics, Parameters, Wave Tilt, Flat and Spherical Earth Considerations. **Space Wave Propagation** – Mechanism, LOS and Radio Horizon. Tropospheric Wave Propagation – Radius of Curvature of path, Effective Earth's Radius, Effect of Earth's Curvature, Field Strength Calculations.	10

Sky Wave Propagation: Structural details of the Ionosphere, Wave propagation Mechanism, Refraction and Reflection of Sky waves by Ionosphere, Ray Path, Critical frequency, MUF, Skip Distance, Multi-Hop propagation.	
Total	**48**

Course outcomes:

On completion of the course student will be able to

1. To demonstrate the fundamentals and basics of Antennas with its working principle
2. To recognize the importance of Retarded potentials of antenna and Wire Antenna Analysis
3. Analyze the various antenna arrays with their design considerations
4. Design VHF and UHF Antennas and illustrate their working principle
5. Analysis wave propagation modes and their characteristics

Text Books:

1. C.A. Balanis, Antenna Theory and Design, Wiley,4nd Edition, 2016.
2. K.D. Prasad, Antennas and Wave Propagation, Satya Prakashan,2009

Reference Books:

1. E.C. Jordan and K.G. Balmain, Electromagnetic Waves and Radiating Systems, Pearson Education, 2015
2. John D. Kraus and Ronald J. Marhefka, Antennas for all Applications, Tata McGraw Hill Publishing, 2006

INFORMATION THEORY & CODING
(Professional Elective-I)
SEMESTER V

Subject Code	18ECECP506B	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Pre-requisite	Digital Communication	Credits – 03	

Course Objectives:
This course will enable students to

1. Learn measurement of information.
2. Analyze various source coding algorithms.
3. Model the continuous and discrete Information channels.
4. Implement the encoding and decoding circuits for Linear Block codes.
5. Implement the encoding and decoding circuits for cyclic and convolution codes.

Unit -1	**Hours**
Information Theory: Introduction, Measure of information, Information content of message, Average Information content of symbols in Long Independent sequences, Average Information content of symbols in Long dependent sequences, Markov Statistical Model for Information Sources, Entropy and Information rate of Mark off Sources	10
Unit -2	
Source Coding: Encoding of the Source Output, Shannon's Encoding Algorithm, Shannon-Fano Encoding Algorithm, Source coding theorem, Prefix Codes, Kraft McMillan Inequality property KMI, Huffman codes.	8
Unit -3	
Information Channels: Communication Channels, Discrete Communication Channels Channel Matrix, Joint probability Matrix, Binary Symmetric Channel, System Entropies. Mutual Information, Channel Capacity, Channel Capacity of Binary Symmetric Channel, Binary Erasure Channel, Muroga's Theorem	10
Unit – 4	
Error Control Coding: Introduction, Examples of Error control coding, methods of Controlling Errors, Types of Errors, types of Codes, Linear Block Codes: matrix description of Linear Block Codes, Error detection & Correction capabilities of Linear Block Codes, Single error correction Hamming code, Table lookup Decoding using Standard Array.	10
Unit – 5	
Binary Cyclic and Convolution Codes: Algebraic Structure of Cyclic Codes, Encoding using an (n-k) Bit Shift register, Syndrome Calculation, Error Detection and Correction. Convolution Encoder, Time domain approach, Transform domain approach, Code Tree, Trellis and State Diagram, The Viterbi Algorithm.	10
Total	**48**

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

1. Understand the concept of Information theory.
2. Analyze various source coding algorithms.
3. Model the continuous and discrete communication channels.
4. Construct the encoding and decoding circuits for Linear Block codes.
5. Construct the encoding and decoding circuits for cyclic and convolution codes.

Text Books:

1. K. Sam Shanmugam, Digital and Analog Communication Systems, Wiley India Pvt Ltd, 2006
2. Simon Haykin, Digital Communication Systems, Wiley, 2013

Reference Books:

1. Ranjan Bose, Information Theory, Coding and Cryptography, McGraw Hill Education India, 2nd Edition.
2. J. Das, S.K. Mullick, P. K. Chatterjee Principles of Digital Communication, Wiley Blackwell, 1986.
3. Bernard Sklar, Digital Communications: Fundamentals and Applications, 2/e, Pearson, 2008
4. Hari Bhat, Ganesh Rao, Information Theory and Coding, Cengage India Private Limited, 2017.
5. Todd K Moon, Error Correction Coding: Mathematical Methods and Algorithms, Wiley Interscience, 1st Edition, 2001

SYSTEM DESIGN THROUGH VERILOG

(Professional Elective-I)

SEMESTER V

Subject Code	18ECECP506C	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. 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. 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.	8
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 **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 **Tasks and Functions:** Difference between tasks and functions, declaration, invocation, automatic tasks and functions.	10
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, Prentice-Hall, 2nd Edition, 2003
2. T.R. Padmanabhan, B Bala Tripura Sundari, Design Through Verilog HDL, Wiley 2008

Reference Books:

1. Michael D Ciletti, Advanced Digital Design with the Verilog HDL (Prentice Hall Xilinx Design Series), Prentice-Hall, 2002
2. Stephen Brown, Zvonkoc Vranesic, Fundamentals of Digital Logic with Verilog Design (IRWIN ELEC&COMPUTER ENGINERING), McGraw Hill, 2013
3. Donald E. Thomas, Philip R. Moorby, The Verilog Hardware Description Language, Kluwer Academic Publishers, 2002

Simulation Books

1. J. Bhasker, "Verilog HDL Primer", 2nd Edition, BS Publications,2001
2. Sunggu Lee, "Advanced Digital Logic Design using Verilog, State Machines & Synthesis for FPGA", Cengage Learning,2012.

MICROPROCESSORS AND MICROCONTROLLERS LAB

Common to ECE & ECT

SEMESTER V

Subject Code	18ECECL5070	Internal Marks	15
Number of Lecture Hours/Week	03	External Marks	35
Total Number of Hours	36	Exam Hours	03
			Credits – 1.5

Course Objectives:

This course will enable students to

1. Performing hardware interfacing with 8086 microprocessor board.
2. Understand basic components interfacing with 8051 control board.
3. Analyze a real time clock with modern microcontroller boards.
4. Performing sensors and display module interfacing with 8051 board.
5. Understanding the interfacing concepts of ARM board.

List of Experiments:	**Hours**
PART- A: (Perform any three experiments) **8086 Assembly Language Programming using MASAM/TASM** 1. Signed and unsigned Arithmetic operation- (Multi byte Addition and Subtraction, Multiplication and Division) 2. Logical Operations- (Shift and rotate- Converting packed BCD to unpacked BCD, BCD to ASCII conversion) 3. Factorial of given n-numbers 4. String Operations - (Move Block, Reverse string, Sorting, Inserting, Deleting, Length of the string, String comparison). 5. DOS/BIOS programming: Reading keyboard (Buffered with and without echo) - Display characters, Strings. **PART- B: (Perform any three experiments)** **8086 Interfacing** 1. Hardware/Software Interrupt Application 2. A/D Interface through Intel 8255 3. Keyboard and Display Interface through Intel 8279 4. Generation of waveforms using Intel 8255 5. Stepper Motor interfacing **PART- C: (Perform any three experiments)** **8051 Embedded C Programming and Interfacing** 1. Different timer mode operations for LEDs Interfacing with 8051 2. Simple Calculator using 4 digits seven segment display and Hex Keyboard interface to 8051 3. Stepper motor interfacing with 8051 for clockwise and anticlockwise rotation. 4. External ADC and Temperature control interface to 8051 5. Serial Communication Implementation between system and 8051 **PART- D: (Perform any three experiments)** **LPC2148 with Embedded C Programming and Interfacing**	**36**

1. Switches and LEDs interfacing with the ARM- LPC 2148 controller board 2. Interfacing of 2*16 LCD display with the ARM- LPC 2148 controller board 3. Implement the developer board as a modem for data communication using serial port communication between two PC's. 4. Implement two digit 7-segment display with the ARM- LPC 2148 controller board.	

Course outcomes:

On completion of the course student will be able to

1. Perform the Arithmetic and logic operations with 8086 processors.
2. Learn the various interfacing concepts with 8086 processors.
3. Design a real time clock with modern microcontroller boards.
4. Learn the various interfacing mechanisms with modern microcontroller boards.
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	18ECECL5080	Internal Marks	15
Number of Lecture Hours/Week	03	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.

Unit -1	**Hours**
List of Experiments: 1. Generation of discrete time signals for discrete signals 2. To verify the Linear Convolution a. Using MATLAB b. Using Code Composer Studio (CCS) 3. To verify the Circular Convolution for discrete signals a. Using MATLAB b. Using Code Composer Studio (CCS) 4. To verify Discrete Fourier Transform (DFT) and Inverse Discrete Fourier Transform (IDFT) a. Using MATLAB b. Using Code Composer Studio (CCS) 5. Frequency Response of IIR low pass Butterworth Filter 6. Frequency Response of IIR high pass Butterworth Filter 7. Frequency Response of IIR low pass Chebyshev Filter 8. Frequency Response of IIR high pass Chebyshev Filter 9. Frequency Response of FIR low pass Filter using Rectangle Window 10. Frequency Response of FIR high pass Filter using Rectangle Window 11. Implementation of Decimation Process 12. Implementation of Interpolation Process	**36**

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

1. Illustrate the fundamental discrete time signals
2. Experiment with the properties of an LTI system
3. Construct a Digital IIR filter for the given specifications.
4. Construct a Digital FIR filter for the given specifications.
5. Apply basic building blocks of Multi-rate signal processing

SOFT SKILLS & APTITUDE BUILDER – 1 SEMESTER V			
Subject Code	18CMAHS5090	IA Marks	---
Number of Practice Hours/Week	4	Exam Marks	50
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 **Personal Effectiveness**: Who am I and What am I; My Strengths and Weaknesses; SWOT Analysis; SMART Goal Setting; Being Proactive **Principles of Personal Vision**: Beginning with the End in Mind; Time Management: Understanding Priorities; Put First-Things-First **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 **Emotional Intelligence**: Self-Awareness, Self-Regulation, Empathy, Assertiveness, Adoptability, Managing Emotions **Activity**: Resolving a Conflict with your Friend/Colleague/Family Member; Group Discussions & Debates			**11**
Unit – 3: 21st Century Skills			
What are 21st Century Skills? Learning Skills- Digital Literacy- Life Skills **Critical Thinking**: Active Listening, Observation, Introspection, Analytical Thinking, Open Mindedness **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 **Decision Making**: Managing Conflict, Conflict Resolution, Methods of Decision Making, Effective Decision Making in Teams – Methods & Styles **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. **Partnership:** Introduction, Relation between Capitals, Period of Investments and Shares **Number System:** Classification of Numbers, Divisibility Rules, Finding the Units Digit, Finding Remainders in Divisions Involving Higher Powers, LCM and HCF Models **Percentages:** Introduction, Converting a Percentage into Decimals, Converting a Decimal into Percentage, Percentage Equivalent of Fractions, Problems on Percentages			**16**

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 **Problems on Ages:** Introduction, Problems based on Ages **Averages:** Definition of Average, Rules of Average, Problems on Average , Problems on Weighted Average, Finding Average using Assumed Mean Method **Alligation and Mixture:** Problems on Mixtures, Alligation Rule, Problems on Alligation	
Unit – 5: Mental Ability	
Difference Series, Product Series, Squares Series, Cubes Series, Alternate Series Combination Series, Miscellaneous Series, Place Values of Letters **Number and Letter Analogies:** Definition of Analogy, Problems on Number Analogy, Problems on Letter Analogy, Problems on Verbal Analogy **Odd Man Out:** Problems on Number Odd Man Out, Problems on Letter Odd Man Out, Problems on Verbal Odd Man Out **Coding and Decoding:** Coding using Same Set of Letter, Coding using Different Set of Letters, Coding into a Number, Problems on R-Model **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 **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	21st 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

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 molecules of life and enzymes
4. Understand proteins and enzymology
5. Understand microbiology and metabolism

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. **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. **Proteins:** Proteins- structure and function. Hierarchy in protein structure. Primary secondary, tertiary and Quaternary structure. Proteins as enzymes, transporters, receptors and structural elements. **Information Transfer:** The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a 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	10
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 **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.

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. andCox, 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

Course Structure for

B. Tech (Electronics and Communication Engineering)

Semester VI (Third year**)**

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	18ECECT6010	VLSI Design	3	0	0	3
2	18ECECT6020	Computer Networks	3	0	0	3
3	18ECECP703X	Professional Elective – II	3	0	0	3
4	18ECECP604X	Professional Elective – III	3	0	0	3
5	18ECXXO605X	Open Elective – I	3	0	0	3
6	18ECXXO606X	Open Elective - II	3	0	0	3
7	18ECECL6070	VLSI Design Lab	0	0	4	2
8	18ECECL6080	Computer Networks Lab	0	0	3	1.5
9	18CMAHS6090	Soft Skills and Aptitude Builder-2 (Skill Oriented Course-II)	1	0	2	2
Total						**23.5**

Professional Elective-II

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	18ECECP603A	Embedded System Design	3	0	0	3
2	18ECECP603B	Design for Testability	3	0	0	3
3	18ECECP603C	Advanced Digital Signal Processing	3	0	0	3

Professional Elective-III

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	18ECECP604A	Microwave Engineering	3	0	0	3
2	18ECECP604B	Internet Protocols	3	0	0	3
3	18ECECP604C	Digital Image Processing	3	0	0	3

OE-I & OE-II
Candidate should select the subject from list of subjects offered by other departments

VLSI DESIGN
Common to ECE & ECT
SEMESTER VI

Subject Code	18ECECT6010	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. **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 Subthreshold 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. **Design for Testability:** 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	18ECECT6020	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 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. **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, 8th Edition, 2006

EMBEDDED SYSTEM DESIGN
(Professional Elective-II)
SEMESTER VI

Subject Code	18ECECP603A	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Pre-requisite	Microprocessors and Microcontrollers	Credits – 03	

Course Objectives:
This course will enable students to

1. Understand the fundamentals of the embedded systems.
2. Know the hardware details of the embedded systems.
3. Learn concept of firmware design approaches, Interrupt concept.
4. Learn about the various embedded software development tools.
5. Understand the embedded system design life cycle and co-design issues

Unit -1	**Hours**
Introduction: Embedded System-Definition, History, Classification, application areas and purpose of embedded systems, Embedded Systems Vs General Computing Systems, Characteristics, Quality attributes of an Embedded systems, Application-specific and Domain-Specific examples of an embedded system.	8
Unit -2	
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 selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces, Wireless communication devices, Watchdog timer, Real time clock.	10
Unit -3	
Embedded Firmware Design: Embedded Firmware design approaches, Embedded Firmware development languages, Programming in Embedded C, ISR concept, Interrupt sources, Interrupt servicing mechanism, Multiple interrupts, DMA, Device driver programming, Concepts of C versus Embedded C and Compiler versus Cross-compiler.	10
Unit – 4	
Embedded System Development: The integrated development environment, Types of files generated on cross-compilation, Dissembler/Decompiler, Simulators, Emulators and Debugging, Target hardware debugging, Boundary Scan, Embedded Software development process and tools. Embedded System Implementation And Testing tools.	10
Unit – 5	
Hardware Software Co-Design: Fundamental Issues in Hardware Software Co-Design, Computational models in embedded design, Hardware software Trade-offs, Integration of Hardware and Firmware. **Case studies**: digital camera, Automatic Coffee Vending Machine.	10
Total	**48**

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

1. Understand the fundamentals of the embedded systems.
2. Know the hardware details of the embedded systems.
3. Learn concept of firmware design approaches, Interrupt concept.
4. Learn about the various embedded software development tools.
5. Understand the embedded system design life cycle and co-design issues

Text Books:

1. Shibu K.V, Introduction to Embedded Systems - Mc Graw Hill
2. Raj Kamal, Embedded Systems, Tata McGraw Hill Education Private Limited, Second Edition, 2008

Reference Books:

1. Frank Vahid, Tony Givargis, Embedded System Design, John Wiley Publications. 2005
2. David Simon, " An Embedded Software Primer" Addison Wesley, 2000
3. Lyla, Embedded Systems –Pearson, 2013

DESIGN FOR TESTABILITY
(Professional Elective-II)
SEMESTER VI

Subject Code	18ECECP603B	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 and VLSI Design	Credits – 03	

Course Objectives:

This course will enable students to

1. Learn different testing models for digital circuits and systems.
2. Familiarize simulation models and design rules for testability.
3. Construct various test generation methods for CMOS circuits.
4. Understand the construction of BIST architecture and response analysis.
5. Familiarize the different compression and memory models for Testing the VLSI circuits.

Unit -1	**Hours**
Introduction VLSI Testing: Introduction: Importance, Challenges, Levels of abstraction, Fault Models, Advanced issues **Design for Testability-I**: Introduction, Testability Analysis, DFT Basics, Scan cell design, Scan Architecture.	10
Unit -2	
Design for Testability-II: Scan design rules, Scan design flow Fault Simulation: Introduction, Simulation models **Fault Simulation**: Logic simulation, Fault simulation.	10
Unit -3	
Test Generation: Introduction, Exhaustive testing, Boolean difference, Basic ATPG algorithms, ATPG for non-stuck-at faults, Other issues in test generation.	10
Unit – 4	
Built in Self-Test: Introduction, BIST design rules, Test pattern generation, Output response analysis, Logic BIST architectures.	8
Unit – 5	
Test Compression: Introduction, Stimulus compression, Stimulus compression, Response compression. **Memory Testing:** Introduction, RAM fault models, RAM test generation, Memory BIST Power and Thermal Aware Test: Importance, Power models, Low power ATPG.	10
Total	**48**

Course outcomes:

On completion of the course student will be able to

1. Apply the concepts in testing which can help them design a better yield in IC design
2. Identify the design for testability methods for combinational & sequential CMOS circuits.
3. Analyze the various test generation methods for static & dynamic CMOS circuits.
4. Recognize the BIST techniques for improving testability.
5. Tackle the problems associated with testing of memory BIST and compression models

Text Books:

1. Michael L. Bushnell, Vishwani D. Agrawal, Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits: 17 (Frontiers in Electronic Testing), Springer, 2005
2. Santanu Chattopadhyay, Thermal-Aware Testing of Digital VLSI Circuits and Systems, 1st Edition, CRS Press, 2018.

Reference Books:

1. Stanley L. Hurst, VLSI Testing, VLSI Testing: Digital and mixed analogue/digital techniques (Materials, Circuits and Devices), Institution of Engineering and Technology, 1997
2. N Jha, S D Gupta, Testing of Digital Systems, Cambridge University Press, 2003
3. Laung-Terng Wang et al., VLSI Test Principles and Architectures: Design for Testability (The Morgan Kaufmann Series in Systems on Silicon), 1st Edition, 2006
4. P. K. Lala, Digital circuit Testing and Testability, Academic Press Inc, 1997

ADVANCED DIGITAL SIGNAL PROCESSING

(Professional Elective-II)

SEMESTER VI

Subject Code	18ECECP603C	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Pre-requisite	Digital Signal Processing	Credits – 03	

Course Objectives:

This course will enable students to

1. Understand the algorithms for signal processing applications.
2. Illustrate the fundamentals of Multirate DSP systems.
3. Summarize the methods to estimate power spectrum.
4. Construct various digital filters.
5. Explain the concept of Finite word length effects in Fixed point DSP Systems.

Unit -1	**Hours**
Discrete and Fast Fourier Transforms: Properties of DFT, Linear Filtering methods based on the DFT, Overlap save, Overlap -Add methods, frequency analysis of signals, Radix-2 FFT and Split-Radix FFT algorithms, The Goertzel and Chirp Z transform algorithms.	8
Unit -2	
Multirate Digital Signal Processing: Review of Decimation and Interpolation, Design of Phase Shifters, Interfacing of Digital Systems with Different Sampling Rates. Implementation of Narrow Band Low Pass Filters, Implementation of Digital Filter Banks, Sub-band Coding of Speech Signals, Quadrature Mirror Filters, Trans-multiplexers, Over Sampling A/D and D/A Conversion, application of Multirate systems.	10
Unit -3	
Power Spectral Estimation: Estimation of spectra from finite duration observation of signals, Non-parametric Methods: Bartlett, Welch & Blackman Tukey methods, Relation between autocorrelation &model parameters, AR Models-Yule-Walker & Burg Methods, MA&ARMA models for power spectrum estimation.	10
Unit – 4	
Implementation of Digital Filters: Introduction to filter structures (IIR & FIR), Frequency sampling structures of FIR, Lattice structures, Forward prediction error, Backward prediction error, Reflection coefficients for lattice realization, Implementation of lattice structures for IIR filters, Advantages of lattice Structures.	10
Unit – 5	
Analysis of Finite Word Length Effects in Fixed-Point DSP Systems: Fixed, Floating Point Arithmetic – ADC quantization noise & signal quality – Finite word length effect in IIR digital Filters –Finite word length effects in FFT Algorithms.	10
Total	**48**

Course outcomes:

On completion of the course student will be able to

1. Apply DFT and FFT on the given discrete time signal.
2. Outline the basics of multirate digital signal processing
3. Analyze the power spectrum estimation.
4. Construct the digital IIR and FIR filters.
5. Analyze the Finite word length effects in Fixed point DSP Systems.

Text Books:

1. J.G.Proakis & D.G.Manolokis,"Digital Signal Processing–Principles, Algorithms Applications", PHI.
2. Alan V Oppenheim & Ronald W Schaffer,"Discrete Time signal processing",PHI.
3. N.J.Fliege , John Wiley and Sons, Multirate Digital Signal Processing**.**

Reference Books:

1. S.M.Kay, "Modern Spectral Estimation Techniques",PHI,1997.
2. Emmanue lC. Ifeacher Barrie. W.Jervis,"DSP–A Practical Approach",Pearson Education.
3. P.P.Vaidyanathan, PTR Prentice Hall, Englewood Cliffs , New Jersey, Multirate System and Filter Banks.

MICROWAVE ENGINEERING
(Professional Elective-III)
SEMESTER VI

Subject Code	18ECECP604A	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Pre-requisite	EM Waves and Transmission Lines	Credits – 03	

Course Objectives:
This course will enable students to

1. Understand the concepts of circular waveguides, microstrip lines, and cavity resonators
2. Analyze the passive components for microwave systems and obtain the characteristics of these components
3. Analyze microwave O-type vacuum tubes
4. Understand the generation & amplification of the microwave signals and obtain the characteristics of O & M Type Tubes.
5. Understand the microwave measurement process

Unit -1	**Hours**
Introduction to microwaves: History, Microwave Spectrum and Bands, Applications of Microwaves. **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 Coupling Coefficients. Related Problems.	10
Unit -2	
Microwave Passive Components: Coupling Mechanisms – Probe, Loop, Aperture types. Waveguide Discontinuities – Waveguide irises, Tuning Screws and Posts, Matched Loads. Waveguide Attenuators – Resistive Card, Rotary Vane types; Waveguide Phase Shifters – Dielectric, Rotary Vane types, Scattering Matrix– Significance, Formulation and Properties, S-Matrix Calculations for – 2 port Junction, E-plane and H-plane Tees, Magic Tee, Hybrid Ring; Directional Couplers – 2Hole, Bethe Hole types, Ferrite Components– Faraday Rotation, S-Matrix Calculations for Gyrator, Isolator, Circulator, Related Problems.	10
Unit -3	
MICROWAVE TUBES: Limitations and Losses of conventional tubes at microwave frequencies, Re-entrant Cavities, Microwave tubes – O type and M type classifications, O-type tubes :2 Cavity Klystrons – Structure, Velocity Modulation Process and Applegate Diagram, Bunching Process and Small Signal Theory –, Applications, Reflex Klystrons – Structure, Applegate Diagram and Principle of working, Electronic Admittance; Oscillating Modes and output Characteristics, Electronic and Mechanical Tuning, Applications,	10
Unit – 4	
HELIX TWTS: Significance, Types and Characteristics of Slow Wave Structures; Structure of TWT and Suppression of Oscillations, **M-type Tubes** Introduction, Cross-field effects, Magnetrons – Different Types, 8-Cavity Cylindrical Travelling Wave Magnetron – Hull Cut-off Condition, Modes of Resonance and PI-Mode Operation, Separation of PI-Mode, o/p characteristics	8
Unit – 5	

MICROWAVE SOLID STATE DEVICES: Introduction, Classification, Applications. TEDs – Introduction, Gunn Diode – Principle, RWH Theory, Characteristics, Basic Modes of Operation, Oscillation Modes **MICROWAVE MEASUREMENTS:** Description of Microwave Bench – Different Blocks and their Features, Precautions; Microwave Power Measurement – Bolometer Method. Measurement of Attenuation, Frequency, Q- factor, Phase shift, VSWR, Impedance Measurement	10
Total	**48**

Course outcomes:

On completion of the course student will be able to

1. To understand microwave transmission lines
2. To analyze various microwave passive components with their working
3. To analyze various microwave O-type tubes
4. To analyze various M Type microwave vacuum tubes
5. To study the importance of microwave measurements

Text Books:

1. Samuel Y. Liao, Microwave Devices and Circuits, Pearson, 1990
2. M. Kulkarni, Microwave and Radar Engineering, Umesh Publications, 2009

Reference Books:

1. Annapurna Das and Sisir K. Das, "Microwave Engineering", 3rd Edition, Tata McGraw- Hill Education, 2000
2. G S N Raju, Microwave Engineering, I K International Publishing House Pvt. Ltd, 2013

INTERNET PROTOCOLS
(Professional Elective-III)
SEMESTER VI

Subject Code	18ECECP604B	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Pre-requisite	Computer Networks	Credits – 03	

Course Objectives:
This course will enable students to
1. Understand resolution protocol and IP
2. Understand ICMPV4 and ICMPV6
3. Understand TCP Protocol data flow and window management
4. Analyze simulation of network protocols using NS.
5. Understand different software's for simulation

Unit -1	**Hours**
Address Resolution Protocol (ARP), The Internet Protocol (IP), System Configuration: DHCP and Auto configuration, Fire walls and Network Address Translation (NAT)	8
Unit -2	
ICMPv4 and ICMPv6: Internet Control Message Protocol, Broadcasting and Local Multicasting (IGMP and MLD), User Datagram Protocol (UDP) and IP Fragmentation	10
Unit -3	
Name Resolution and the Domain Name System (DNS), TCP: The Transmission Control Protocol, TCP Connection Management, TCP Timeout and Retransmission	10
Unit – 4	
TCP Data Flow and Window Management: TCP Congestion Control, TCP Keep alive, Security, EAP, IPsec	10
Unit – 5	
TLS, DNSSEC, and DKIM, Case Study: Simulation of Network Protocols Using NS, **Case Study:** Simulation of Network Protocols Using NS and Packages	10
Total	**48**

Course outcomes:
On completion of the course student will be able to
1. Understand ARP and IP
2. Understand ICMPV4 and ICMPV6
3. Analyze DNS and Name Resolution
4. Describe TCP Data Flow and Window Management
5. Analyze Simulation of Network Protocols Using different software for simulation.

Text Books:

1. Richard Stevens W, TCP/IP Illustrated, Volume1: The Protocols (Addison-Wesley Professional Computing Series)3, Addison-Wesley Professional, 2nd Edition, 2011
2. Douglas E Comer, Internetworking with TCP/IP- Volume One;1, 6th Edition, Pearson, 2013
3. Behrouz A Forouzan, Local Area Networks, Tata McGraw Hill Publishing Company Limited, New Delhi, 2003

Reference Books:

1. Washburn K and Evans J, TCP/IP 2:Running A Successful Network, Addison Wesley, 2nd Edition, 1996

DIGITAL IMAGE PROCESSING
(Professional Elective-III)
SEMESTER VI

Subject Code	18ECECP604C	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Pre-requisite	SS and DSP	Credits – 03	

Course Objectives:
This course will enable students to

1. Familiarize with basic concepts of digital image processing and image transforms.
2. Make use of filtering in spatial and frequency domains.
3. Inference the images using wavelets and to discuss various compression models.
4. Outline the color models and explain the Morphological image processing concepts on gray scale images.
5. Choose various segmentation algorithms on digital images

Unit -1	**Hours**
Introduction: The origins of Digital Image Processing, Fundamental steps in Digital Image Processing, Components of an image processing system, Image sensing and acquisition, Image sampling and quantization, Some basic relationships between pixels. **Image Transforms:** Need for image transforms, 2-D Discrete Fourier transform (DFT) and its properties, Walsh transform, Hadamard transform, Haar transform, Discrete cosine transform.	10
Unit -2	
Intensity Transformations and Spatial Filtering: Background, some basic intensity transformation functions, Histogram processing, Fundamentals of spatial filtering, smoothing spatial filters, Sharpening spatial filters. **Filtering in the Frequency Domain:** The basics of filtering in the frequency domain, Image smoothing using frequency domain filters, Image Sharpening using frequency domain filters, Selective filtering.	10
Unit -3	
Wavelets and Multiresolution Processing: Image pyramids, Sub-band coding, Multiresolution expansions, Wavelet transforms in one dimensions & two dimensions, Wavelet coding. **Image Compression:** Fundamentals, Basic compression methods: Huffman coding, Arithmetic coding, LZW coding, Run-length coding, Block transform coding, Predictive coding.	10
Unit – 4	
Color Image Processing: Color fundamentals, Color models, Pseudo color Image Processing. **Morphological Image Processing:** Preliminaries, Erosion and Dilation, Opening and Closing, Basic morphological algorithms.	8
Unit – 5	
Image segmentation: Fundamentals, Point, Line and Edge detection, Thresholding, Region-based Segmentation. **Case studies on digital image processing:** Feature Detection, Face Recognition, Image Cryptography.	10
Total	**48**

Course outcomes:

On completion of the course student will be able to

1. Interpret the fundamentals of digital image processing and apply various transforms on digital images.
2. Apply filtering concepts in spatial and frequency domains
3. Analyze digital images using compression algorithms
4. Classify the color models and interpret the Morphological image processing concepts to gray scale images.
5. Apply various segmentation algorithms on digital images

Text Books:

1. R. C. Gonzalez and R. E. Woods, **"**Digital Image Processing", 3rd edition, Prentice Hall, 2008
2. Jayaraman, S. Esakkirajan, and T. Veerakumar," Digital Image Processing", Tata McGraw-Hill Education, 2011.

Reference Books:

1. Anil K.Jain, **"**Fundamentals of Digital Image Processing", Prentice Hall of India, 7th Edition, Indian Reprint, 1989
2. B.Chanda, D.Dutta Majumder, "Digital Image Processing and Analysis", PHI, 2009

VLSI DESIGN LAB
Common to ECE & ECT
SEMESTER VI

Subject Code	18ECECL6070	Internal Marks	15
Number of Lecture Hours/Week	03	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 2. Design and Implementation of a NAND Gate 3. Design and Implementation of an NOR Gate 4. Design and Implementation of Full Adder 5. Design and Implementation of 4-bit Ripple Carry Adder 6. Design and Implementation of Multiplexer using Transmission Gate 7. Design and Implementation of Decoder 8. Design and Implementation of D Flip-flop 9. Design and Implementation 4-bit Register 10. Design and Implementation asynchronous counter 11. Design and Implementation of static RAM cell 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 and Sequential CMOS.
3. Generation and verification of layouts for combinational CMOS Circuits.
4. Generation and verification of layouts for sequential CMOS Circuits.
5. Design and analysis of DRC and LVS for CMOS.

COMPUTER NETWORKS LAB

Common to ECE & ECT

SEMESTER VI

Subject Code	18ECECL6080	Internal Marks	15
Number of Lecture Hours/Week	03	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 and error control mechanism of DLL.
4. Understand routing algorithm for Network layer.
5. Understand transport layer applications.

List of Experiments	**Hours**
1. Study of linear data structures like stack, queue and linked list. 2. Implement stack (its operations) using arrays. 3. Use stack operations to convert infix expression into postfix expression. 4. Implement queue (its operations) using arrays. 5. Write functions to perform different operations i.e., insertion, deletion on a singly linked list. 6. Implement stack (its operations) using linked list. 7. Implement queue (its operations) using linked list. 8. Implement the data link layer framing methods such as character stuffing, bit stuffing. 9. Implement on a data set of characters the CRC polynomials – CRC 12, CRC 16 and CRC CCIP. 10. Implement Dijkstra's algorithm to compute the shortest path through a graph. 11. Take an example of subnet of hosts and obtain broadcast tree for it. 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 and error control mechanisms of Data link layer.
4. Develop routing algorithms of Network layer.
5. Construct transport layer applications.

SOFT SKILLS & APTITUDE BUILDER – 2 SEMESTER VI			
Subject Code	18CMAHS6090	IA Marks	--
Number of Practice Hours/Week	2	Exam Marks	50
Total Number of Practice Hours	64	Exam Hours	3
Credits - 2			
Section A **Soft Skills**			
Unit – 1: Communicative Competence			**Hours**
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 E-Mail Etiquette, Reporting News Activity: Completing Textual Exercises			**16**
Unit 2: Career and Employability Skills			
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 Activity: Resume Building, Interviews, Presentations, Digital Resumes			**16**
Section B **Aptitude Builder**			
Unit – 3: Time and Work			
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. **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 **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			**11**
Unit – 4: Logical and Analytical Reasoning			
Seating Arrangement: Linear Arrangement, Circular Arrangement, Tabler, Triangular Arrangement, Complex Arrangement**.** **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. **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			**11**

Syllogisms: Finding the Conclusions using Venn Diagram Method, Finding the Conclusions using Syllogism Method **Simple Interest:** Definitions, Problems on Interest and Amount, Problems when Rate of Interest and Time Period are Numerically Equal **Compound Interest:** Definition and Formula for Amount in Compound 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 **Probability:** Definition of Probability, Problems on Coins, Problems on Dice, Problems on Deck of Cards , Problems on Years **Mensuration - 2D:** Formulas for Areas, Formulas for Volumes of Different Solids, Problems on Areas **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	
CO 1	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 Structure for

B. Tech (Electronics and Communication Engineering)

Semester VII (Fourth year**)**

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	18CMMST7010	Engineering Economics & Financial Management	3	0	0	3
2	18ECECT7020	Electronic Measurements & Instrumentation	3	0	0	3
3	18ECECP703X	Professional Elective – IV	3	0	0	3
4	18ECECP704X	Professional Elective – V	3	0	0	3
5	18ECXXO705X	Open Elective – III	3	0	0	3
6	18ECXXO706X	Open Elective - IV	3	0	0	3
7	18ECECS7070	IOT and its Applications/Microwave Circuits and Antenna Design using HFSS (Skill Oriented Course-III)	1	0	2	2
8	18ECECR7080	Industrial/Research Internship 2 Months (Mandatory) after third year (to be evaluated during VII semester	0	0	6	3
Total						**23**

Professional Elective-IV

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	18ECECP703A	Embedded and Real Time Concepts	3	0	0	3
2	18ECECP703B	Low Power VLSI	3	0	0	3
3	18ECECP703C	Cellular and Mobile Communications	3	0	0	3

Professional Elective-V

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	18ECECP704A	Radar Systems	3	0	0	3
2	18ECECP704B	Wireless Sensor Networks.	3	0	0	3
3	18ECECP704C	Computer vision and Image Processing	3	0	0	3

OE-III & OE-IV
Candidate should select the subject from list of subjects offered by other departments

Semester VIII (Fourth year**)**

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	18ECECR8010	Project Project work, seminar and internship in industry	0	0	24	12
Total						**12**

ENGINEERING ECONOMICS & FINANCIAL MANAGEMENT
SEMESTER VII

Subject Code	18CMMST7010	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Pre-requisite	Management Science	Credits – 03	

Course Objectives:

This course will enable students to

1. Understand the basic concepts of Managerial economics, demand, demand forecasting techniques
2. Apply the techniques of production and able to analyze the cost concepts
3. Understand various market structures & pricing policies and analyze various formats of business-like sole trader, partnership, joint stock
4. apply the concepts of financial accounting to estimate the profit or loss of a firm
5. apply different techniques of capital budgeting to take investment decisions.

Unit -1	**Hours**
Introduction to Managerial Economics and demand Analysis: Definition of Managerial Economics and Scope-Managerial Economics and its relation with other subjects-Concept of Demand- Types-Determents-Law of Demand its Exception-Elasticity of Demand-Types and Measurement- Demand forecasting and its Methods.	8
Unit -2	
Production and Cost Analysis: Production function-Iso-quants and Iso-cost- Law of Variable proportions- Cobb-Douglas Production Function-Economics of Sale-Cost Concepts- Opportunity Cost- Fixed vs Variable Costs-Explicit Costs vs Implicit Costs-Cost Volume Profit analysis- Determination of Break-Even Point (Simple Problems).	10
Unit -3	
Introduction To Markets, Pricing Policies & forms Organizations and Business Cycles: Market Structures: Perfect Competition, Monopoly and Monopolistic and Oligopoly – Features Price Output Determination – Methods of Pricing: Market Skimming Pricing, And Internet Pricing: Flat Rate Pricing. **Introduction to forms of business:** Features and Evaluation of Sole Trader – Partnership – Joint Stock Company State/Public Enterprises and their forms – Business Cycles – Meaning and Features – Phases of Business Cycle	10
Unit – 4	
Introduction to Accounting & Financing Analysis: Introduction to Double Entry Systems – Preparation of Financial Statements- Analysis and Interpretation of Financial Statements-Ratio Analysis (Simple Problems)	10
Unit – 5	
Capital and Capital Budgeting: Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Need for Capital Budgeting-Techniques of Capital Budgeting-Traditional and Modern Methods.	10
Total	**48**

Course outcomes:

On completion of the course student will be able to

1. Define the basic concepts of managerial economics, demand, and demand forecasting techniques
2. Apply the techniques of production and able to analyze the cost concepts
3. Identify various market structures & pricing policies and Identify various formats of business-like sole trader, partnership, joint stock etc.,
4. Apply the concepts of financial accounting to estimate profit or loss of a firm CO5
5. Apply the different techniques of capital budgeting to take investment decisions

Text Books:

1. Dr. A. R. Aryasri, Managerial Economics and Financial Analysis, TMH, 2011.
2. B. Kuberudu and T. V. Ramana, Managerial Economics & Financial Analysis, Himalaya Publishing House,2011.

Reference Books:

1. P. Vijaya Kumar and N.Apparao, Management Science, Cengage, Delhi,2012.
2. S. A. Siddiqui &A. S. Siddiqui: Managerial Economics and Financial Analysis, New Age International Publishers,2012
3. Vanitha Agarwal, Managerial Economics, Pearson Publications2011.

ELECTRONICS MEASUREMENTS AND INSTRUMENTATION
SEMESTER VII

Subject Code	18ECECT7020	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Pre-requisite	Network Analysis.	Credits – 03	

Course Objectives:

This course will enable students to

1. Understand the performance characteristics of instruments
2. Know the working of various meters in Electronic Measuring Instruments
3. Familiarize with different signal generators & wave analyzers.
4. Design AC bridges which can measure Inductance, Capacitance, Resistance
5. 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.	10
Unit -2	
Voltmeters, Ammeters: DC Voltmeters, Multi-range voltmeters, AC voltmeters, True RMS responding voltmeter. Ammeter, Ohmmeters, series type, shunt type.	8
Unit -3	
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.	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.	10
Total	**48**

Course outcomes:

On completion of the course student will be able to

1. Understand the performance characteristic of instruments
2. Understand the functional characteristics of voltmeter and ammeter
3. Understand signal generator's features
4. Analyze the variants of AC Bridges
5. Understand the features and functionalities of transducers

Text Books:

1. H.S. Kalsi, Electronic Instrumentation, Tata McGraw Hill, 2nd Edition2004.
2. A. K. Sawhney, Electronics and Electrical Measurements, Dhanpat Rai & Sons, 2015

Reference Books:

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

EMBEDDED & REAL TIME CONCEPTS

(Professional Elective-IV)

SEMESTER VII

Subject Code	18ECECP703A	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Pre-requisite	Microprocessors and Microcontrollers	Credits – 03	

Course Objectives:

This course will enable students to

1. Understand the fundamentals of the Real Time Embedded Systems.
2. Demonstrate various communication protocols used in embedded systems.
3. Know the various state machine models of the embedded systems.
4. Learn the components of Real Time Operating Systems.
5. Learn about the operation of various embedded operating systems

Unit -1	**Hours**
Introduction: Introduction to Embedded Systems, Classification of Embedded Systems, An Embedded Real Time System- Definition, Examples, Applications, Embedded System Design Flow, Processors in Embedded Systems and other hardware units, Software Development Flow & Tools.	8
Unit -2	
Embedded Communication Units: Need for communication interfaces, RS232 / UART, RS422 / RS485, USB, Infrared, IEEE 1394 Firewire, Ethernet, IEEE 802.11, Blue tooth.	10
Unit -3	
State Machine and Concurrent Process Models Introduction, models Vs Languages, finite state machines with data path model(FSMD),using state machines, program state machine model(PSM, concurrent process model, concurrent processes, communication among processes, synchronization among processes, Implementation, data flow model.	10
Unit – 4	
Embedded/RTOS Concepts-I: Introduction to Embedded/RTOS, Types of Embedded/RTOS, Architecture of the Kernel, Tasks and task scheduler, interrupt service routines, Semaphores, Mutex, Mailboxes, Message Queues, Event Registers, Pipes-Signals. Timers-Memory Management-Priority inversion problem, real time operating system, Basic design using an RTOS, OS security issues.	10
Unit – 5	
Embedded/RTOS Concepts-II: Why Embedded Linux?, Embedded Linux Versus Desktop, Embedded Linux Distributions, Architecture of Embedded Linux, Linux Kernel Architecture, User Space, Linux Start-Up Sequence, GNU Cross-Platform Tool chain, - Embedded Linux Vs Real-time operating systems	10
Total	**48**

Course outcomes:

On completion of the course student will be able to

1. Review basic operation of the Real Time Embedded Systems.
2. Describe the various communication models used in Embedded application
3. Understand various Embedded System design computing models
4. Describe the concepts of Real Time Operating Systems.
5. Demonstrate the fundamentals of Embedded Linux concepts

Text Books:

1. KVKK Prasad, Embedded/Real Time Systems- Dreamtech press-2005.

2. Frank Vahid, Tony D.Givargis, Embedded System Design-A Unified Hardware/Software Introduction, John Wiley & Sons, Inc.2002.

Reference Books:

1. Jonathan W.Valvano, Embedded Microcomputer Systems- Books/Cole, Thomson Learning.
2. David E.Simon, An Embedded Software Primer- pearson Ed.2005
3. Shibu.K.V, Embedded Systems, Tata McGraw Hill Education Private Limited, 2013

LOW POWER VLSI
(Professional Elective-IV)
SEMESTER VII

Subject Code	18ECECP703B	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Pre-requisite	VLSI Design	Credits – 03	

Course Objectives:
This course will enable students to
1. Identify various sources of power consumption
2. Estimate the power consumption sing simulation and probabilistic approaches.
3. Discuss low power design issues at various levels of abstraction.
4. Understand low power design architecture and system.
5. Discuss clock distribution for low power dissipation.

Unit -1	**Hours**
Introduction: Need for low power VLSI chips, Sources of power dissipation. Emerging Low power approaches. Dynamic dissipation in CMOS, Transistor sizing & gate oxide thickness, Impact of technology Scaling, Technology & Device innovation.	10
Unit -2	
Power estimation Simulation Power analysis: SPICE circuit simulators, gate level logic simulation, capacitive power estimation, static state power, gate level capacitance estimation, architecture level analysis, data correlation analysis in DSP systems. Monte Carlo simulation. **Probabilistic power analysis**: Random logic signals, probability & frequency, probabilistic power analysis techniques, signal entropy	10
Unit -3	
Low Power Design Circuit level: Power consumption in circuits. Flip Flops & Latches design, high capacitance nodes, low power digital cells library **Logic level:** Gate reorganization, signal gating, logic encoding, state machine encoding, pre-computation logic.	10
Unit – 4	
Low power Architecture & Systems: Power & performance management, switching activity reduction, parallel architecture with voltage reduction, flow graph transformation, low power arithmetic components, low power memory design.	10
Unit – 5	
Low power Clock Distribution: Power dissipation in clock distribution, single driver Vs distributed buffers, Zero skew Vs tolerable skew, chip & package co design of clock network.	8
Total	**48**

Course outcomes:
On completion of the course student will be able to
1. Locate various power consumption sources in ICs.
2. Calculate various power consumption parameters using statistical methods.
3. Understand issue at various stages of low power design.
4. Develop architecture and system using low power design constraints.
5. Apply clock distribution network to applications targeting low power dissipation.

Text Books:

1. Gary K. Yeap, “Practical Low Power Digital VLSI Design”, KAP, 2002.
2. Rabaey, Pedram, “Low power design methodologies” Kluwer Academic, 1997.

Reference Books:

1. Kaushik Roy, Sharat Prasad, “Low-Power CMOS VLSI Circuit Design” Wiley, 2000.

CELLULAR & MOBILE COMMUNICATIONS

(Professional Elective-IV)

SEMESTER VII

Subject Code	18ECECP703C	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Pre-requisite	Communication Engineering	Credits – 03	

Course Objectives:

This course will enable students to

1. Understand the components of cellular systems
2. Analyze frequency reuse ratio and number of channels
3. Analyze Co-Channel measurement, Co-channel Interference Reduction Factor
4. Understand the different types of cell sites and Mobile Antennas
5. Understand the concept of cell drop rates

Unit -1	**Hours**
Cellular Mobile Radio Systems: Introduction to Cellular Mobile System, uniqueness of mobile radio environment, operation of cellular systems, consideration of the components of Cellular system, Hexagonal shaped cells, Analog and Digital Cellular systems.	8
Unit -2	
Cellular Concepts: Evolution of Cellular systems, Concept of frequency reuse, frequency reuse ratio, Number of channels in a cellular system, Cellular traffic: trunking and blocking, Grade of Service; Cellular structures: macro, micro, pico and fetor cells; Cell splitting, Cell sectoring.	10
Unit -3	
Cell Coverage for Signal and Traffic: signal reflections in flat and hilly terrain, effect of human made structures, phase difference between direct and reflected paths, straight line path loss slope, general formula for mobile propagation over water and flat open area, near and long-distance propagation, antenna height gain, form of a point-to-point model.	10
Unit – 4	
Cell Site and Mobile Antennas: Sum and difference patterns and their synthesis, Omni directional antennas, directional antennas for interference reduction, space diversity antennas, umbrella pattern antennas, minimum separation of cell site antennas, high gain antennas.	10
Unit – 5	
Handoff Strategies: Concept of Handoff, types of hand-off, handoff initiation, delaying handoff, forced handoff, mobile assigned handoff, intersystem handoff, vehicle locating methods, dropped call rates and their evaluation.	10
Total	**48**

Course outcomes:

On completion of the course student will be able to

1. Understand operation of cellular systems
2. Understand the concepts of cellular communication
3. Understand the cell coverage for signal and traffic
4. Acquire the knowledge of cell diversity in antennas.
5. Understand Concept of Handoff, types of hand-off

Text Books:

1. W.C.Y. Lee, Mobile Cellular Telecommunications, Tata McGraw Hill, 2006
2. Theodore. S. Rapport, Wireless Communications, Pearson Education India, 2nd Edition, 2010

Simulation Books:

1. Yong Soo Cho, MIMO-OFDM wireless communications with MATLAB, Wiley-IEEE Press, 2010
2. Houman Zarrinkoub, Understanding LTE with MATLAB: From Mathematical Modeling to Simulation and Prototyping, Wiley, 2014
3. Perez Fontan and P. Marin Espineira, Modelling the Wireless Propagation Channel: A simulation approach with MATLAB, Wiley, 1st Edition, 2008

RADAR SYSTEMS
(Professional Elective-V)
SEMESTER VII

Subject Code	18ECECP704A	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Pre-requisite	Antenna and Wave Propagation	Credits – 03	

Course Objectives:
This course will enable students to
1. Understand the basics of radar systems
2. Understand the concepts of radars and their losses
3. Understand the CW and FM radar and its applications
4. Gain knowledge on MTI pulse Doppler radar
5. To analyze the Tracking RADAR

Unit -1	**Hours**
Basics of Radar: Introduction, Maximum Unambiguous Range, simple Radar Range Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications. Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Illustrative Problems. Radar Equation: Modified Radar Range Equation.	8
Unit -2	
Introduction to RADAR: SNR, probability of detection, probability of False Alarm, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets - sphere, cone-sphere), Creeping Wave, Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Illustrative Problems.	10
Unit -3	
CW and Frequency Modulated Radar: Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar. Illustrative Problems **FM-CW Radar:** Range and Doppler Measurement, Block Diagram and Characteristics, FM-CW altimeter, Multiple Frequency CW Radar.	10
Unit – 4	
MTI and Pulse Doppler Radar: Introduction, Principle, MTI Radar with - Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, Nth Cancellation Staggered PRFs. Range Gated Doppler Filters. MTI Radar Parameters, Limitations to MTI Performance, MTI versus Pulse Doppler Radar.	10
Unit – 5	
Tracking Radar: Tracking with Radar, Sequential Lobing, Conical Scan, Mono pulse Tracking Radar – Amplitude Comparison Mono pulse (one- and two- coordinates), Phase Comparison Mono pulse, Tracking in Range, Acquisition and Scanning Patterns, Comparison of Trackers.	10
Total	**48**

Course outcomes:
On completion of the course student will be able to
1. Understand the basis for RADAR Systems
2. Understand various parameters associated with radars
3. To study the characteristics of CW and FM radar
4. To study the characteristics of MTI and pulse Doppler
5. To understand tracking of radars

Text Books: 1. Merrill I. Skolnik, Introduction to Radar Systems, McGraw Hill Education, 2017
Reference Books: 1. Bassem R. Mahafza, Radar Systems Analysis and Design Using MATLAB (Advances in Applied Mathematics), Chapman and Hall/CRC, 3rd Edition, 2013 2. B. Mahafza, MATLAB Simulations for Radar Systems Design, Chapman and Hall/CRC, 2003

WIRELESS SENSOR NETWORKS

(Professional Elective-V)

SEMESTER VII

Subject Code	18ECECP704B	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Pre-requisite	Computer Networks	Credits – 03	

Course Objectives:

This course will enable students to

1. Understand Cellular and Ad-Hoc networks in detail
2. Acquire the knowledge of design and principles of WSNs
3. Understand various MAC protocols for sensor networks
4. Able to understand and analyse various routing techniques of WSN and Ad-Hoc networks
5. Analyze the low duty cycle and wake up concepts of sensor networks

Unit -1	**Hours**
Cellular and Ad Hoc Wireless Networks: Concepts, Applications of Ad Hoc Wireless Networks, Issues in Ad Hoc Wireless Networks: Medium Access Scheme-Routing-Multicasting Transport Layer Protocols-Pricing Scheme-Quality of Service Provisioning-Self Organization-Security-Addressing and Service Discovery-Energy management Scalability-Deployment Considerations,	10
Unit -2	
Ad Hoc Wireless Internet: Comparison with Adhoc wireless networks-Challenges for WSNs – Difference between sensor networks and Traditional sensor networks, Types of Applications, Enabling Technologies for Wireless Sensor Networks –Single Node Architectures, Hardware Components	10
Unit -3	
Energy Consumption of Sensor Nodes: Issues in Designing a Multicast Routing Protocol. Data Dissemination-Flooding and Gossiping-Data gathering Sensor Network Scenarios –Optimization Goals and Figures of Merit – Design Principles for WSNs Gateway Concepts – Need for gateway	10
Unit – 4	
WSN to Internet Communication: Internet to WSN Communication –WSN Tunneling MAC Protocols for Sensor Networks-Location Discovery-Quality of Sensor Networks Evolving Standards-Other Issues	8
Unit – 5	
Low duty cycle and wake up concepts: The IEEE802.15.4 MAC Protocols- Energy Efficiency – Geographic Routing Mobile Nodes Gossiping and Agent based Unicast Forwarding-Energy Efficient Unicast	10
Total	**48**

Course outcomes:

On completion of the course student will be able to

1. Able to understand Cellular and Adhoc networks in detail
2. Able to understand wireless sensor networks design and principles
3. Able to understand various MAC protocols for sensor networks
4. Able to understand and analyze various routing techniques of WSN and ad hoc networks
5. Understand Low duty cycle and wake up concepts

Text Books:

1. Holger Karl and Andreas Willig, Protocols and Architectures for Wireless Sensor Networks,

Wiley-Interscience, 2007

2. Taieb Znati, Kazem Sohraby, Daniel Minoli,Wireless Sensor Networks: Technology, Protocols and Applications, Wiley, 2010

Reference Books:

1. Sabrie Solomon, Sensors Handbook, McGraw Hill, 2010
2. C.Siva Ram Murthy and B.S. Manoj Ad Hoc Wireless Networks, Pearson Education India 2006

COMPUTER VISION AND IMAGE PROCESSING

(Professional Elective-V)

SEMESTER VII

Subject Code	18ECECP704C	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Pre-requisite	SS and DSP	Credits – 03	

Course Objectives:

This course will enable students to

1. Familiarize with fundamentals of Computer Vision and image formation
2. Build feature detection and descriptors concepts of images
3. Understand fundamentals of pattern recognition
4. Make use of various networks related to the pattern classification
5. Conclude the computer vision concepts by applying it to various applications

Unit -1	**Hours**
Introduction to Computer Vision and Basic Concepts of Image Formation: Introduction and Goals of Computer Vision, Image Formation and Radiometry, Geometric Transformations, Geometric Camera Models, Image Reconstruction from a Series of Projections.	10
Unit -2	
Image Processing Concepts: Fundamentals of Image Processing, Image Transforms, Image Filtering, Colour Image Processing, Mathematical Morphology, Image Segmentation. **Image Descriptors and Features**: Texture Descriptors, Colour Features, Edge Detection, Object Boundary and Shape Representations, Interest or Corner Point Detectors, Histogram of Oriented Gradients, Scale Invariant Feature Transform, Speeded up Robust Features, Saliency.	10
Unit -3	
Fundamentals Pattern Recognition Concepts: Introduction to Pattern Recognition, Linear Regression, Basic Concepts of Decision Functions, Elementary Statistical Decision Theory, Gaussian Classifier, Parameter Estimation, Clustering for Knowledge Representation, Dimension Reduction.	10
Unit – 4	
Neural Networks for Pattern Classification: Artificial Neural Network for Pattern Classification, Convolutional Neural Networks, Auto encoders.	8
Unit – 5	
Applications of Computer Vision: Motion Estimation and Object Tracking, Face and Facial Expression Recognition, Gesture Recognition, Image Fusion.	10
Total	**48**

Course outcomes:

On completion of the course student will be able to

1. Interpret the basics of Computer Vision and image formation
2. Apply feature detection concepts on images.
3. Illustrate fundamentals of pattern recognition and parameter estimation
4. Construct neural networks related to pattern classification
5. Analyze applications of computer vision and pattern recognition

Text Books:

1. M.K. Bhuyan, “Computer Vision and Image Processing: Fundamentals and Applications”, CRC Press,

Reference Books:

1. Forsyth & Ponce, “Computer Vision-A Modern Approach”, Pearson Education.
2. Richard Szeliski, “Computer Vision- Algorithms & Applications”, Springer

INTERNET OF THINGS AND ITS APPLICATIONS
(Skill Oriented Course)
SEMESTER VII

Subject Code	18ECECS7070	Internal Marks	---
Number of Lecture Hours/Week	03	External Marks	50
Total Number of Hours	36	Exam Hours	03

Credits – 2

Course Objectives:
This course will enable students to

1. Understand the concepts of Arduino Uno, Raspberry Pi Board and different types of I/O Devices.
2. To develop Embedded C language program skills.
3. To develop Python language program skills.
4. Providing the basic knowledge of interfacing various peripherals to Raspberry Pi
5. To Develop Real Time Small Scale Embedded Applications using advanced IoT technologies.

List of Experiments:	**Hours**
Part-A (Perform all Experiments)	
1. Introduction and history of Arduino, types of Arduino boards, Install the Arduino Desktop IDE, Installing Libraries, functions and components of Arduino programming. 2. Introduction to Raspberry Pi Board, identification of components and software required, download and installation procedures of necessary software images in the memory card and booting of Raspberry Pi board.	**36**
Part-B (Perform any 6 Experiments)	
3. Write an Embedded C Program to control speed and direction of a stepper motor with Arduino Uno 4. Write an Embedded C Program to control speed and direction of a DC motor with Arduino Uno. 5. Write an Embedded C Program to implement real time clock using OLED and RTC modules with Arduino Uno. 6. Write a Python program to interface LED, Switch and buzzer with Raspbery Pi Board. 7. Write a Phyton code to interface camera with Raspberry Pi board and display image using VNC viewer. 8. Design a Web Controlled Surveillance Robot using Raspberry Pi. 9. Write a Python code to read following sensor data and display the data in TFT screen a) DHT11/22 b) Light Sensor(TEMT6000)	

10. Write a Phyton code to read soil moisture, air humidity and temperature and water temperature sensors data with raspberry Pi board and display in TFT screen.

Part- C (Perform all experiments)

11. Design a data logger for a smart home applications using DHT11/22, TEMT6000, BME680 sensors with Arduino, ESP8266 boards and thingspeak cloud.
12. Design a read and write operations from thing speak cloud of a temperature dependent auto-cooling system using DS18B20 sensor with Arduino, esp8266 WiFi module.
13. Design a Weather Monitoring System based on Raspberry Pi and Think Speak cloud.
14. Design remote patient monitoring system based on Raspberry Pi and think speak cloud.

Course outcomes:

On completion of the course student will be able to

1. Understand the concepts of Arduino Uno and different types of I/O Devices.
2. Develop Embedded C programs for different applications using Arduino Uno
3. Construct interfacing circuits for different Applications using Raspberry Pi
4. Develop Python codes for different applications using Raspberry Pi
5. Develop Real time Embedded System applications using IoT

REFERENCE BOOKS

1. Mike Cook, For Dummies, Raspberry Pi Projects for Dummies", 1st edition (2 October 2015), ISBN-10: 1118766695, ISBN-13: 978-1118766699
2. "Arduino Book for Beginners" Mike Cheich, Open Hardware Design Group LLC (1 July 2021), ISBN-10: 0988780615, ISBN-13: 978-0988780613
3. Simon Monk, "PROGRAMMING ARDUINO Getting started with sketches", McGraw Hill TAB; 2nd edition (16 July 2016), ISBN-10: 1259641635, ISBN-13: 978-1259641633
4. Neerparaj Rai, "Arduino Projects for Engineers", BPB Publications; First edition (15 July 2016), ISBN-10: 8183335977, ISBN-13: 978-8183335973

MICROWAVE CIRCUITS AND ANTENNA DESIGN USING HFSS
(Skill Oriented Course)
SEMESTER VII

Subject Code	18ECECS7070	Internal Marks	---
Number of Lecture Hours/Week	03	External Marks	50
Total Number of Hours	36	Exam Hours	03

Credits – 2

Course Objectives:
This course will enable students to

1. Design and simulate microstrip transmission lines and Rectangular Waveguide
2. Design and simulate power dividers and Magic Tee junction
3. Design and simulate wire antennas to understand the various antenna parameters
4. Design and simulate microstrip patch antennas using different feeding techniques
5. Design and simulate dual-band patch antenna and wideband/multiband monopole planar antennas

List of Experiments:	**Hours**
1. Design and analyze propagation characteristics of coaxial and microstrip transmission lines. 2. Design and simulate Rectangular Waveguide to analyze propagation modes and propagation characteristics 3. Design and simulate E-plane and H-palne Tee junctions to analyze their characteristics. 4. Design and simulate Magic Tee junction to analyze its characteristics. 5. Design and simulation of a half-wave dipole antenna. 6. Design and simulation of a quarter-wave monopole antenna. 7. Design and simulate pyramidal horn antenna to analyze its characteristics for the given specifications. 8. Design and simulation of rectangular microstrip patch antenna for the given specifications (operating frequency, dielectric constant and substrate thickness) 9. Design and simulation of circular microstrip patch antenna for for the given specifications (operating frequency, dielectric constant and substrate thickness) 10. Design and analysis of microstrip patch antenna using a coaxial feeding technique. 11. Design and simulation of dual-band rectangular patch antenna using the CPW feeding technique. 12. Design and simulation of frequency reconfigurable planar monopole antenna using microstrip line feeding.	**36**

Course outcomes:

On completion of the course student will be able to

1. Analyze various microstrip transmission lines
2. Design and Analyse half-wave and quarter-wave wire antennas.
3. Design and analyse microstrip patch antennas using different feeding techniques
4. Design and analyse dual band microstrip antennas
5. Design and analyse frequency reconfigurable antennas

Text Books

1. Samuel Y. Liao, Microwave Devices and Circuits, Pearson, 1990
2. C.A. Balanis, Antenna Theory and Design, , Wiley,4nd Edition, 2016.
3. K.D. Prasad, Antennas and Wave Propagation, Satya Prakashan,2009

REFERENCE BOOKS

1. E.C. Jordan and K.G. Balmain, Electromagnetic Waves and Radiating Systems, Pearson Education, 2015
2. John D. Kraus and Ronald J. Marhefka, Antennas for all Applications, Tata McGraw Hill Publishing, 2006

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

CIVIL ENGINEERING -SOCIETAL & GLOBAL IMPACT			
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:

1. Awareness of the importance of Civil Engineering and the impact it has on the Society and at global levels
2. Awareness of the impact of Civil Engineering for the various specific fields of human endeavour
3. Need to think innovatively to ensure Sustainability

Unit -1	Hours
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	09
Unit -2	
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)	10
Unit – 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.	10
Unit – 4	
Built environment – Facilities management, Climate control; Intelligent/ Smart Buildings; Aesthetics of built environment, Role of Urban Arts Commissions; Conservation, Repairs & Rehabilitation of Structures	09
Unit-5	
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	10

Course outcomes:

On completion of this course, students are able to:

1. Understand the role of Civil Engineering in Modern World
2. Understand various constructional Infrastructure and their importance in present environment
3. Interpret modern transportation systems and their advantages
4. Effect of global Warming and mitigation measures
5. Understand the importance of Sustainability and Reduction of Green House Gas Emissions

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:

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

Unit -1History 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 -2Fundamentals 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 – 3Basics 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:

1. Understand the role of Civil Engineering in Modern World
2. Know the details and working of various building materials
3. Understand the concept of various construction management Techniques
4. Know basic surveying methods and their applications
5. 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 byB.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:

1. Develop an understanding of why and how the modern disaster manager is involved with pre-disaster and post-disaster activities.
2. 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.
3. Understand the 'relief system' and the 'disaster victim.
4. Describe the three planning strategies use full in mitigation.
5. Identify the regulatory controls used in hazard management.
6. 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 – 3RiskAndVulnerability	
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 & RKrishnamurthy (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).

ENVIONMENTAL POLLUTION AND CONTROL			
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:

1. Impart knowledge on fundamental aspects of air pollution & control, noise pollution, and solid waste management.
2. Provide basic knowledge on sustainable development.
3. Introduces some basics of sanitation methods essential for protection of community health.
4. 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. **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

1. Identify the air pollutant control devices
2. Have knowledge on the NAAQ standard sand air emission standards.
3. Differentiate the treatment techniques used for sewage and industrial waste water treatment methods.
4. Understand the fundamentals of solid waste management; practices adopted in his town/village and its importance in keeping the health of the city.
5. 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 , by Ruth F. Weiner and Robin Matthews– 4thEditionElesevier,2003.
2. Environmental Science and Engineering byJ.G.HenryandG.W. Heinke–Pearson Education.
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
2. Solid Waste Management by K.Sasi Kumar,S.A.GopiKrishna. PHI New Delhi.
3. Environmental Engineering by Gerard Kiley,TataMcGrawHill.
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:

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

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 -2Masonry	
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 – 3Lime 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

1. Identify different building materials and their importance in building construction.
2. Differentiate brick masonry, stone masonry construction and use of lime and cement in various constructions.
3. Importance of building components and finishings.

4. Classification of aggregates, sieve analysis and moisture content usually required in building construction.
5. 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

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

Unit -1	**Hours**
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:

1. Describe green buildings and green building materials.
2. Acquaint with different rating agencies and energy features of green buildings.
3. Understand the term sustainability and sustainable development.
4. Recognize sources of green house gases emissions and its impact on climate.

5. 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 to other Departments

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 Elective 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

INTERNET OF THINGS			
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. 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.

Unit -1: The Internet of Things	**Hours**
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	**09**
Unit -2 :Business Models	
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	**10**
Unit – 3:Design Principles for the Web Connectivity	
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.	**10**
Unit – 4:Internet Connectivity Principles	
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.	**10**
Unit – 5:Data Collection	
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 World.	**09**

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 usecases, 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,, Major 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. Sorting and Searching: Sorting – Bubble Sort, Selection Sort, Quick Sort, Merge Sort Searching – Sequential Search and Binary Search	**10**
Unit -2 :LINEAR DATA STRUCTURE	
Array: Representation of arrays, Applications of arrays, sparse matrix and its representation Stack: Stack-Definitions & Concepts, Operations On Stacks, Applications of Stacks, Polish Expression, Reverse Polish Expression And Their Compilation, Recursion. 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) 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 access methods.	**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. 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 stamp ordering: Wait/Die and Wound/Wait Schemes, Database Recovery management.	**09**

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&CarlosCoronel
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. 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

PYTHON 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. Introduction to Scripting Language.
2. Exposure to various problems solving approaches of computer science.

Unit -1: Introduction	**Hours**
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	**09**
Unit -2 : Types, Operators and Expressions	
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.	**10**
Unit – 3: Functions	
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	**10**
Unit – 4: Object Oriented Programming in Python	
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	**10**
Unit – 5: Brief Tour of the Standard Library	
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.	**09**

Text(T) / Reference(R) Books:	
T1	Python Programming: A Modern Approach, Vamsi Kurama, Pearson
T2	Learning Python, Mark Lutz, Orielly
R1	Think Python, Allen Downey, Green Tea Press
R2	Core Python Programming, W.Chun, Pearson
R3	Introduction to Python, Kenneth A. Lambert, Cengage
W1	https://www.coursera.org/courses?query=python
W2	https://www.edx.org/learn/python

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

JAVA 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. 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.

Unit -1: Introduction to OOP	**Hours**
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.	**10**
Unit -2 :Classes and objects	
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.	**09**
Unit – 3:Inheritance	
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, user defined exceptions, Assertions	**10**
Unit – 4:Multithreading	
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.	**09**
Unit – 5:Applet	
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.	**10**

Text(T) / Reference(R) Books:	
T1	The complete Reference Java, 8th edition, Herbert Schildt, TMH
T2	Programming in JAVA, Sachin Malhotra, SaurabhChoudary, Oxford
R1	Introduction to java programming, 7th edition by Y Daniel Liang, Pearson
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-1: HTML	**Hours**
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. **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. **Working with variables and constants:** Using variables, Using constants, Data types, Operators. **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. 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 Elective 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. **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. **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. 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 **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 **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

2. T.R.Padmanabhan, B Bala Tripura Sundari, “Design Through Verilog HDL”, Wiley 2009

Reference Books:

1. Michael D Ciletti, “Advanced Digital Design with the Verilog HDL”, Xilinx Design Series, PearsonEducation.
2. Stephen Brown, Zvonkoc Vranesic, “Fundamentals of Digital Logic with Verilog Design”, TMH, 2nd Edition.
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. **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, MEMS, Nano-sensors	8
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
(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)", 1st Edition,VPT,2014
2. JanHoller, Vlasios Tsiatsis, Catherine Mulligan,StefanAvesand, 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",1st 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 IMAGE 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. Familiarize with basic concepts of digital image processing
2. Experiment with various image related transforms.
3. Make use of filtering in spatial and frequency domains.
4. Utilize techniques for image restoration and reconstruction.
5. Explain various compression and segmentation algorithms to analyze digital images

Unit -1	**Hours**
Introduction: Introduction to image processing, Fundamental steps in digital image processing, Components of an image processing system, Image sensing and acquisition, Image sampling and quantization, Some basic relationships between pixels, An introduction to the mathematical tools used in digital image processing.	10
Unit -2	
Image Transforms: Need for image transforms, 2-D Discrete Fourier transform (DFT) and its properties, Walsh transform, Hadamard transform, Haar transform, Slant transform, Discrete cosine transform, KL transform, SVD, Comparison of different image transforms.	8
Unit -3	
Intensity Transformations and Spatial Filtering: Background, some basic intensity transformation functions, Histogram processing, Fundamentals of spatial filtering, smoothing spatial filters, Sharpening spatial filters. **Filtering in the Frequency Domain:** The basics of filtering in the frequency domain, Image smoothing using frequency domain filters, Image Sharpening using frequency domain filters, Selective filtering	10
Unit – 4	
Image Restoration and Reconstruction: A model of the image degradation / restoration process, Noise models, Restoration in the presence of noise only-Spatial Filtering, Periodic noise reduction by frequency domain filtering, Linear position-invariant degradations, Estimating the degradation function, Inverse filtering, Minimum mean square error (Wiener) filtering, Constrained least squares filtering, Geometric mean filter.	10
Unit – 5	
Image Compression: Fundamentals, Basic compression methods: Huffman coding, Golomb coding, Arithmetic coding, LZW coding, Run-length coding, Symbol-based coding, Bit-plane coding, Block transform coding, Predictive coding. **Image segmentation:** Fundamentals, Point, Line and Edge detection, Thresholding, Region-based Segmentation.	10
Total	**48**

Course outcomes:

On completion of the course student will be able to

1. Understand the fundamentals of digital image processing
2. Construct various transforms related to image processing including wavelets
3. Apply filtering concepts in spatial and frequency domains
4. Apply image restoration and reconstruction techniques
5. Analyze digital images using compression and segmentation algorithms

Text Books:

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, Pearson; 3rd Edition, 2007.
2. Jayaraman, S. Esakkirajan, and T. Veera Kumar, Digital Image Processing, McGraw Hill Education; 1st Edition, 2017B.

1. Anil K. Jain, Fundamentals of Digital Image Processing (Prentice Hall Information and System Sciences Series), Pearson, 1988
2. B. Chanda, D. Dutta Majumder, Digital Image Processing and Analysis, Prentice Hall of India, 2nd Edition, 2011

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 Systems.	8
Unit -2	
Fourier Series: Fourier series representation of continuous time periodic signals, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series. **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. 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. **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 Communication Systems	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. **Design using windowing techniques** (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

1. Understand measurements and instrumentation and its need.
2. Explain the Characteristics of Transducers.
3. 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 **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

7. develop professional skills in acquiring and applying the knowledge outside the classroom through design of a real-life instrumentation system

Text Books:

1. Sawhney. A.K, "A Course in Electrical and Electronics Measurements and Instrumentation", 18th Edition, Dhanpat Rai & Company Private Limited, 2007.
2. Patranabis. D, "Sensors and Transducers", Prentice Hall of India, 2003.

Reference Books:

1. Renganathan. S, "Transducer Engineering", Allied Publishers, Chennai, 2003.

2. Doebelin. E.A, “Measurement Systems – Applications and Design”, Tata McGraw Hill, New York, 2000
3. John. P, Bentley, “Principles of Measurement Systems”, III Edition, Pearson Education, 2000.
4. Murthy. D. V. S, “Transducers and Instrumentation”, Prentice Hall of India, 2001. 4. Sensor Technology Hand Book – Jon Wilson, Newne 2004.
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. **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. **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. **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 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.	9

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 7474,7475,7476,7490,7493,74121.	10
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. **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 Elective courses 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 1: Design Specifications	**Hours**
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	**10**
Introduction to compensator. Design of Feedback and Feed forward compensators, Feedback compensation. Realization of compensators. Compensator design in frequency domain to improve steady state and transient response. Feedback and Feed forward compensator design using Bode diagram.	
Unit 3: Design of PID controllers	**09**
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.	
Unit 4: Control System Design in state space	**10**
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.	
Unit 5: Design of control for Non Linear Systems	**09**
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	

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. 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, 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	**10**

present value – Internal rate of return – numerical examples Applications 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. 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. 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. 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 10questions.

1. Each full question carries 14marks.
2. Each full question will have sub question covering all topics under unit.
3. 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 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	**10**
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	
Unit 3: Genetic Algorithm	**10**
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	
Unit 4: Fuzzy Logic System	**10**
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.	
Unit 5: Applications	**09**
Aerospace and data mining applications of Genetic Algorithm - Neural Network and Fuzzy Logic Control applications in Smart grid, Electric drives and Distributed generation.	

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.

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 oil as per ISI	**10**

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.

Unit 1: Electrical System Components	**Hours**
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 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 (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

S.No.	Subject Code	Name of the subject	L	T	P	Cr
1.	18XXMEOXXXX	Operations Research	3	0	0	3
2.	18XXMEOXXXX	Fundamentals of Mechanical Engineering	3	0	0	3
3.	18XXMEOXXXX	Fundamentals of Robotics	3	0	0	3
4.	18XXMEOXXXX	Engineering Materials	3	0	0	3
5.	18XXMEOXXXX	Introduction to Material Handling	3	0	0	3
6.	18XXMEOXXXX	Production Planning and Control	3	0	0	3
7.	18XXMEOXXXX	Non-Conventional Sources of Energy	3	0	0	3
8.	18XXMEOXXXX	Fluid Mechanics and Fluid Machinery	3	0	0	3

OPERATIONS RESEARCH SEMESTER - XX			
Subject Code	18XXMEOX0XA	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 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.
2. Solve linear programming problems using various techniques based on the constraints
3. Understand about different application areas of operations research like transportation problem, assignment model, sequencing models.
4. Suggest optimal sequence and replacement policy and economic order quantities to be maintained for better and economic growth of the industry.
5. Suggest optimal game strategies and estimation of waiting times in waiting line problems in the competitive business world.

Unit -1	**Hours**
Introduction to Operations Research: Definition, Features, types of OR models, Methodology, Tools, Limitations and applications of Linear Programming. **Linear Programming-I:** Introduction, Formulation of Linear Programming Problem (LPP), Assumptions for solving LPP, Applications of LPP, Graphical method of solving LPP.	**10**
Unit -2	
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. **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.	**10**
Unit – 3	
Transportation Problem: Basics, Solution of Transportation problem with several methods, performing optimality test, degeneracy in transportation problem. **Assignment model:** Definition, Formulation, Different methods of solutions, Hungarian assignment method, unbalanced assignment problems, travelling salesman problems. **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.	**10**
Unit – 4	
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. **Inventory Control:** Introduction, Types of Inventories, Costs associated with inventories, the concept of EOQ, Deterministic inventory problems with no shortages, with shortage.	**10**
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]. **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 carry 14 marks each
3. Each full question will have sub question covering all topics under a course outcome

FUNDAMENTALS OF MECHANICAL ENGINEERING 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. **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, **Coupling:** Brief introduction of coupling, Rigid couplings - muff, split muff and flange couplings, flexible couplings - flange coupling	**10**

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 carry 14 marks each
3. Each full question will have sub question covering all topics under a course outcome

INDUSTRIAL ROBOTICS SEMESTER-XX			
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. 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 carry 14 marks each
3. Each full question will have sub question covering all topics under a course outcome

ENGINEERING MATERIALS 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 nonferrous 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 ceramic, 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, 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.	**12**

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 carry 14 marks each
3. Each full question will have sub question covering all topics under a course outcome

INTRODUCTION TO MATERIAL HANDLING SEMESTER - XX			
Subject Code	18XXMEOX0XE	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:

Students should be able

1. To understand the classification of material handling equipment
2. To explain the usage of different material handling equipment in industry
3. To know how to connect loading stations to the different discharge conditions.
4. To explain the usage of cranes at industries
5. To explain the usage of hoists and monorails at industries

Unit -1	**Hours**
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.	**10**
Unit -2	
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.	**10**
Unit – 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.	**10**
Unit – 4	
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,	**10**
Unit – 5	
Hoists and monorails Portal frames and slewing rings and bearings typical stability, calculations of portal cranes, types of hoists	**10**

Course outcomes:

1. Classify the material handling equipment
2. Explain the usage of different material handling equipment in industry
3. Discuss how to connect loading stations to the different discharge conditions
4. Associate the usage of cranes at industries
5. Associate the usage of hoists and monorails at industries

TEXT BOOKS

1. Material handling handbook, 2nd edition, ASME, 1985
2. Automation production systems and computer integrated manufacturing, Mikell P Groover, Prentice Hall of India, 2002.

REFERENCE BOOK

1. R.O. Bailey, “Bulk material handling by conveyor belt I and II” M.A. Al
2. Frutchbaum, “ Bulk solids handling

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 carry 14 marks each
3. Each full question will have sub question covering all topics under a course outcome

PRODUCTION PLANNING AND CONTROL SEMESTER - XX			
Subject Code	118XXMEOX0XF	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 production design concepts for production and service systems
2. Apply forecasting techniques for various firms, namely qualitative & quantitative methods to optimize/make best use of resources in achieving their objectives.
3. Identify different strategies employed in manufacturing and service industries to plan inventory
4. Apply different scheduling policies in planning and control and make best use of resources.
5. Measure the effectiveness, identify likely areas for improvement, develop and implement improved planning and control methods for production systems.

Unit -1	**Hours**
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.	**10**
Unit -2	
Forecasting – importance of forecasting – types of forecasting, their uses – general principles of forecasting – forecasting techniques – qualitative methods and quantitative methods.	**10**
Unit – 3	
Inventory management – functions of inventories – relevant inventory costs – ABC analysis – VED analysis – EOQ models – Inventory control systems – P–Systems and Q-Systems **Material Management Techniques:** Introduction to MRP I, MRP II, ERP, LOB (Line of Balance), JIT and KANBAN system.	**12**
Unit – 4	
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	**10**
Unit – 5	
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.	**8**

Course outcomes:

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

1. **Choose** the acceptable production planning and control system for designing and development of a product.
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. All questions carry 14 marks each
3. Each full question will have sub question covering all topics under a course outcome

NON-CONVENTIONAL SOURCES OF ENERGY SEMESTER-XX			
Subject code	18XXMEOX0XG	Internal marks	30
Number of lecture hours/Week	3(L)	External marks	70
Total No Of lecture hours	50	Exam hours	03

Credits-03

Course Objectives:

Enable the students to:

1. Understand the principles and working of solar and solar energy collection.
2. Apply the principles of solar energy storage, applications in generation of electric power.
3. Apply the knowledge of Wind energy and Biomass, in generation of electric power production.
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
5. Apply the principles of direct energy conversion systems like Thermoelectric generators, MHD generators and fuel cells, in generation of electric power production

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. **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 **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. **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 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.	**16**

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 questions carry 14 marks each
3. Each full question will have sub question covering all topics under a course outcome

FLUID MECHANICS AND FLUID MACHINERY 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. **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. **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 Tube. **Hydraulic Quantities:** Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.	**10**
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. 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 carry 14 marks each
3. Each full question will have sub question covering all topics under a course outcome