Programme Ordinance, POs, PSOs & Course Outcomes (COs)

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING
FACULTY OF ENGINEERING & TECHNOLOGY
UNIVERSITY OF LUCKNOW

PROGRAMME ORDINANCE

1. GENERAL INFORMATION:

The degree of Bachelor of Technology (B. Tech.) of University of Lucknow, Lucknow shall be conferred on the candidates who have pursued the prescribed course of study and have passed the examinations as prescribed in the ordinances. The course will be conducted on full time basis.

2. ELIGIBILITY FOR ADMISSION:

2.1 Admission to B. Tech. First year in First Semester (from 2017-18 and onwards) and lateral entry to B. Tech. Second year in Third Semester (from 2018-19 and onwards) will be made through U. P. State Entrance Examination conducted by AKTU, Lucknow, or as decided by Executive Council of the University.

2.2 The minimum academic qualification for appearing in the Entrance Examination will be a pass in the final examination of 10+2 system or its equivalent with Chemistry, Mathematics and Physics or as notified. The candidate should be domiciled of U.P.

2.3 For admission to B. Tech. Second year (lateral entry) in third semester, candidate who have passed 3/4 Year Diploma (with minimum 60% marks) from institutions recognized by the U.P. Board of Technical Education in any branch of Engineering /Technology except Agriculture Engineering are eligible.

2.4 Up to 5% of the seats may be filled by NRI / direct / sponsored admission. These shall be supernumerary seats. They shall be admitted without any entrance examination on the basis of past academic record as notified. The fee structure for such students will be as notified.

2.5 In all cases, the admission of an applicant to the B. Tech, program requires that the applicant has:

1. The minimum academic qualification as notified,
2. Fulfilled the prescribed admission procedure and paid the prescribed fees.

3. ATTENDANCE:

3.1 Students are required to attend 100% classes. Any relaxations in attendance are subject to the satisfaction of concerned HOD/Dean. Normally student shall not be allowed to appear in a semester examination unless he / she has an overall average 75% attendance and 60% attendance in each of the theory / practical subjects in that semester. Attendance for dissertation work shall be verified by the supervisor / guide. However, an additional shortage by an amount not exceeding 15% of the total number of lectures delivered or practical work done in each subject may be condoned for special reasons as given below.

(a) A shortage up-to 5% of the total number of lectures delivered or practical work done in each subject may be condoned by the Head of the Department.

(b) A further shortage upto 10% may be condoned by the Dean of the Faculty on the specific recommendation of the concerned Head of Department.

3.2 No student will be allowed to appear in the end semester examination if he/she does not satisfy the overall average attendance requirements of Clause Nos. 3.1 and such candidate(s) shall be treated as having failed and will be further governed by clause no. 4.2 & 4.3.

3.3 The attendance shall be counted from the date of admission in the Faculty or start of academic session whichever is later.

(Note: For the purpose of the attendance not more than three periods including lecture and tutorial in the same subject shall be counted on any one day).

4. DURATION OF COURSES:

4.1 Total duration of the B. Tech. Course shall be 4 years, each year comprising of two semesters. Each semester shall normally have teaching for the 90 working days or as prescribed by A.I.C.T.E. from time to time.

4.2 A candidate, who has failed twice in first year due to any reason, including due to his/her non-appearance or he/she being not permitted to appear in semester examinations, shall not be allowed to continue his/her studies further subject to clause 8.
Provided further that if a student wishes to continue third time in first year he/she may be allowed on the recommendation of a committee constituted by the Vice Chancellor. However, the maximum time allowed for completing the course shall remain the same as in clause 4.3.

4.3 The maximum time allowed for a candidate admitted in 1st /3rd semester (for lateral entry) for completing the B. Tech. course shall be 7 (seven)/ 6 (Six) years respectively, failing which he/she shall not be allowed to continue for his/her B. Tech. degree.

4.4 The minimum credit requirement for B. Tech. degree is 192. The lower and upper limit for course credit registered in a semester by a full time student are :
Lower limit - 16 credits & Upper limit - 28 credits

5. CHANGE OF BRANCH:

5.1 Change of branch may be allowed against the vacant seats at the following two stages, provided criteria in the following sub clauses are satisfied.

(i) In first year, after the last date of admission to the B. Tech. 1st semester, on the basis of merit of entrance examination on vacant seats subject to clause 5.2

(ii) In the second year, on the basis of merit at the B. Tech. first year examination for those who are passed without any carry over papers subject to clause 5.2

5.2 After change of branch, number of students in branch (s) shall neither increase over the approved intake nor will it decrease below 75% of approved intake.

5.3 Change of branch is not applicable to the candidates admitted in Second Year of B. Tech. courses (lateral entry) as per clause 2.

5.4 The change of branch if allowed will become effective from B. Tech. 3rd semester.

5.5 Further change of branch shall not be permitted.

6. CURRICULUM:

6.1 The 4 year curriculum has been divided into 8 semester and shall include lectures, tutorials, practicals, seminars and projects etc. in addition to industrial training and educational tour etc. as defined in the scheme and executive instructions issued by the Institute from time to time.

6.2 The curriculum shall also include such other curricular, co-curricular and extracurricular activities as may be prescribed by the Faculty from time to time.

7. CURRICULUM STRUCTURE OF THE PROGRAMME:

The Faculty shall follow credit-based semester system. Every programme will have a specific curriculum for all semesters (semester I to semester VIII) with a syllabi consisting of theory, practical, project work, etc. and shall be in accordance with the prescribed syllabus. The courses

shall be covered through lectures, tutorials, laboratory classes, seminar, industrial and practical training, project, tours etc.

7.1 Course Coverage

The course coverage for all the B. Tech. Programmes shall have the following categories:

(i) Humanities and Social Sciences (HS)
(ii) Management (M)
(iii) Basic Applied Sciences (BAS)
(iv) Basic Engineering Sciences (BES)
(v) Departmental Core (DC)
(vi) Departmental Electives (DE)
(vii) Open Electives (OE)
(viii) Project Work, Seminar and Industrial Training (PST)
(ix) Mandatory Audit Courses (MAC)
(x) Few audit courses as per demand and requirement of students may be offered.

Each course is assigned a certain number of credits as follows.

(a) 1 credit per lecture hour per week
(b) 1 credit per tutorial hour per week
(c) 1 credit per 2 hours laboratory/practice/project per week.
(d) 2 credits per 3 hours laboratory/practice/project per week.

7.2 Grading System and Assessment Procedure:

An **Absolute Grading System** wherein the marks shall be converted into grades and the result of each semester will be declared with **Semester Grade Point Average** (SGPA) and **Cumulative Grade Point Average** (CGPA). The CGPA will be calculated for every semester, except the first semester. The grading system to be adopted with Letter Grades and Grade Points Scale shall be as given below:

Letter Grade	**Description**	**Grade Point**	**% (Marks Range)**
O	Outstanding	10	Greater than or equal to 90
A^+	Excellent	09	Less than 90 but greater than or equal to 80
A	Very Good	08	Less than 80 but greater than or equal to 70
B^+	Good	07	Less than 70 but greater than or equal to 60
B	Above Average	06	Less than 60 but greater than or equal to 50
C	Average	05	Less than 50 but greater than or equal to 45
P	Poor	04	Less than 45 but greater than or equal to 40
F	Fail	00	Less than 40
U	Short Attendance	-	-
W	Withdrawal	-	-
I	Incomplete	-	-
UFM	Unfair Means	-	-
AP	Audit Pass	-	-
AF	Audit Fail	-	-
S	Satisfactory Completion	-	-
Z	Course Continuation	-	-

Rounding of the numeric value of grades obtained will be done till two places of decimal.

7.3 Tests & Examinations

The theory and practical examinations shall consist of continuous assessment throughout the semester in all subjects. The End Semester Examination (ESE) will be conducted by University at the end of the semester. The assessment of courses will be done on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain points, will be awarded as per the range of total marks obtained by the candidate as detailed below.

7.4 Marks Distribution:

S. No.	Exam Category	Evaluation									
		Sessional								ESE	Grand Total
		CT		TA					Total		
		CT 1	CT 2	V	V	W	R	CP			
01	Theory Subject	10	10					10	30	70	100
02	Lab			05	05			10	20	30	50
03	Industrial Training				10	20	20		50		50
04	Seminar				10	20	20		50		50
05	Project 1			20	20	40	20		100		100
06	Project 2			25	25	50	50		150	100	250
07	MAC	10	10						20	30	50

CT: Class Test; TA: Teacher's Assessment; ESE: End Semester Examination; V 1: Viva-Voce 1; V 2: Viva-Voce 2; W: work; R: Report; CP: Class Performance (Tutorial + Attendance)

Notes:

A. The course coverage for Class Test-I, Class Test-II and End Semester Exam (ESE) will be respectively 40%, 80% and 100% of the syllabus.

B. Students who remain absent in either of the class tests on genuine grounds such as medical reasons. Institute representation in academic/extra-curricular activities with prior permission of the concerned Head of Department may be permitted for a special test. Students, who remain absent in both the class tests with prior permission will be allowed one special test covering 80% of the syllabus.

C. Class Performance will be based on assignments/tutorials, quizzes/viva-voce and attendance.

7.5 General Proficiency:

A **qualitative Assessment Remark** for General Proficiency as detailed in the table below will be given in the transcript on the basis of cumulative percentages of marks scored by the student during each semester through various components. Distribution / Weightage for award of marks in each component is prescribed in the subsequent table.

S.N.	Assessment	Weightage of Marks	Marks
1.	Discipline/Behavior of Students Inside/Outside Institute campus by DSW	40%	20
2.	Games/Sports/Cultural/Literary/PFAC/Hobby Events by Chairman, CSA	40%	20
3.	Academic Activities/Special Lecture/ Industrial Visits by HOD	20%	10

S.N.	Marks Secured	Remark
1.	80-100%	Excellent
2.	60-79%	Very Good
3.	40-59%	Good
4.	20-39%	Satisfactory
5.	<20%	Poor

8. CRITERIA FOR PASSING:

The performance of a student in a semester shall be evaluated through continuous class assessment and end semester examination. The continuous assessment shall be based on class tests, assignments/tutorials, quizzes/viva-voce and attendance. The marks for continuous assessment (sessional marks) shall be awarded at the end of the semester. The end semester examination shall comprise of written papers, practical and viva-voce, inspection of certified course work in classes and laboratories, project work, design reports or by means of any combination of these methods.

The distribution of marks for sessional, end semester theory papers, practical and other examinations, seminar, project and industrial training shall be as prescribed in the course structure. The practical, viva-voce, projects and reports shall be examined/evaluated through internal and external examiners as and when required.

The marks obtained in a subject shall consist of marks allotted in end semester theory paper and sessional work.

8.1 A Student who secures Grade O to P shall be considered as passed. If a student secures "F" grade, he /she has to reappear for the concerned subject examination. It is mandatory for a student to earn the required credits as mentioned in each semester.

(a) To pass in a Theory Subject, a student shall have to secure minimum 30% of the maximum marks prescribed for the End Semester Examination (ESE) and 40% of marks in the aggregate of End Semester Examination (ESE) and sessional marks assigned for that particular subject, i.e. **Minimum Passing Grade** shall be **"P".**

(b) For passing a Practical/Internship/Project/Viva-voce examination, a student shall have to secure a minimum of 50% of the prescribed maximum marks in the End Semester Examination of Practical/Internship/Project/Viva-voce and 50% of marks in the aggregate of Practical/Internship/Project/Viva-voce ESE and assigned sessional marks i.e. Minimum Passing Grade shall be "B".

(c) To pass in Seminar, a student shall require to secure a minimum of 50% of the maximum marks prescribed, i.e. Minimum Passing Grade shall be "B".

8.2 The student who do not satisfy the condition 8.1 or the student who remains absent shall be deemed to have failed in that subject and may appear for the University examination in the subsequent examinations the sessional marks awarded to the student/s at previous attempt in the concerned subject will be carried forward. However, if the student has secured less than 40% marks in the sessional, he/she will also be required to complete the sessional work of the concerned subject by way of assignments, quizzes and both class tests. The SGPA of the concerned semester will be calculated on the basis of the new grade secured by the student in the repeat examination of the subject (with new or old sessional marks as the case may be). Number of attempts taken to pass a subject/s shall be recorded in the transcript.

8.3 A student may, at his/her desire, opt to abandon his/her performance of a semester in following manner.

(a) A student may opt to abandon his/her performance only in University Examination of the Semester.

(b) A student may opt to abandon his/her total performance of the Semester which includes performance in University Examination and Sessional Marks.

(c) A student may opt of abandon his/her performance in University Examination of any or both semester of the same academic year only.

(d) A student shall be allowed to abandon the performance maximum twice during the entire course of study.

(e) Performance of a semester, once abandoned, cannot be claimed again.

8.4 The student, who opts to abandon the performance of a semester as per clause 8.3, shall abandon performance in all the courses of that semester, irrespective of fact whether the student has passed or failed in any subject of that semester.

8.5 A student, who opt to abandon the total performance of the semester including sessional marks, has to take readmission for the relevant semester. Readmission to the First semester in such cases shall not be considered as fresh admission i.e., the student will continue to have the same University Roll Number, which was allotted earlier.

8.6 The Student, who opted to abandon his/her performance only in the University examination of a semester and does not desire readmission, shall be permitted to re-appear for examinations of all the subjects of the semester in the subsequent examinations as an Ex-Student, However, the sessional marks obtained by the student in the abandoned semester shall be retained as per clause 8.2.

8.7 Such students who opted to abandon the performance at final year are eligible for the award of Class and Distinction at the B. Tech. degree level.

8.8 A student shall be declared to have completed the programme of B. Tech. degree, provided the student has undergone the stipulated course work as per the regulations and has earned atleast 192 Credits.

8.9 A student can avail one chance to improve his/her grade in one subject of just preceding semester in the next corresponding End Semester Examination, provided that he/she has secured P or higher grade in that subject. The grade secured in **"Improvement Attempt"** will be used for calculation of SGPA of the concerned semester and old grade secured in that particular subject will stand nullified.

8.10 For Audit Courses, Grade AP (Audit Pass) or AF (Audit Fail) shall be awarded and this will not be counted for the computation of SGPA/CGPA. Audit Fail students have to pass the course as per clause 8.2.

9. ELIGIBILITY FOR PROMOTION:

9.1 There shall not be any restriction for promotion from an odd semester to the next even semester.

9.2 For promotion from even semester to the next odd semester (i.e. of the next academic year) the student has to secured 24 credits in the immediately preceding two semesters including theory and practical credits.

Minimum Credit Threshold for Promotion

Check Point	Credit Threshold
First Year to Second Year	24 Credits in First Year
Second Year to Third Year	24 Credits in Second year
Third Year to Fourth Year	24 Credits in Third year

9.3 The result of the semester shall be declared pass only on securing P or above grades in all subjects and minimum semester Grade Point Average (SGPA) is 5.0.

9.4 Student himself can decide to abandon the performance of any or both the semesters of same academic year as per clause 8.3 and reappear in abandoned semester examination as per clauses 8.4, 8.5, & 8.6.

10. COMPUTATION OF SGPA AND CGPA :

(i) The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.

$$\boldsymbol{SGPA(S_i)} = \sum(\boldsymbol{C_i} \times \boldsymbol{G_i}) / \sum \boldsymbol{C_i}$$

Where $\boldsymbol{C_i}$ is the number of credits of the ith course and $\boldsymbol{G_i}$ is the grade point scored by the student in the ith course.

(i) The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

$$\boldsymbol{CGPA} = \sum(\boldsymbol{C_i} \times \boldsymbol{S_i}) / \sum \boldsymbol{C_i}$$

Where $\boldsymbol{S_i}$ is the SGPA of the ith semester and $\boldsymbol{C_i}$ is the total number of credits in that semester.

(ii) The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

(iii) Formula for the conversion of CGPA into percent marks is CGPA x 10 = (% Marks)

11. AWARD OF DIVISION & RANK:

Division shall be awarded only after the eighth and final semester examination based on integrated performance of the candidate for all the eight semesters (six semesters for lateral entry) as per following details:

11.1 A candidate who qualifies for the award of the degree securing P or above grades in all subjects pertaining to all semesters in first attempt within eight consecutive semesters (four academic years)/ six consecutive semesters (three academic years) as applicable, and in addition secures a CGPA of 7.5 and above for the semesters I to VIII or IE to VIE shall be

declared to have passed the examination in **FIRST DIVISION WITH HONOURS.**

11.2 A candidate who qualifies for the award of the degree by securing P or above grades in all subjects of all the semesters within maximum permissible period and secures CGPA not less than 6.5 shall be declared to have passed the examination in **FIRST DIVISION.**

11.3 All other candidates who qualify for the award of degree by securing P or above grades in all subjects of all semesters and secures CGPA not less than 5.0 shall be declared to have passed the examination in **SECOND DIVISION.**

11.4 For award of ranks in a branch, the first **Three** students will be awarded ranks, provided they have secured Grade P or above in all subjects pertaining to all semesters in first attempt within eight consecutive semesters (four academic years)/ six consecutive semesters (three academic years) as applicable.

12. SCRUTINY AND RE-EVALUATION:

12.1 Scrutiny shall be permitted within two weeks after declaration of result and will only be allowed in theory papers on the request of a student after deposition of prescribed fee for each subject decided by the University.

12.2 Re-evaluation of theory/practical papers is not permitted.

13. UNFAIR MEANS:

Cases of unfair means in the End Semester Examinations and Mid-Term Tests shall be dealt as per the rules of the University of Lucknow.

14. EX-STUDENTSHIP:

14.1 A candidate opting for ex-studentship shall be required to fulfill the conditions 8.3, 8.4, 8.5 & 8.6 and to appear in all the theory & practical subjects in the End Semester Examinations of both semesters of the same Academic Year. However, the marks of Sessional, Industrial Training, Seminar and General Proficiency shall remain the same as those secured by him/her in the previous Academic Year(s) as per clause 8.2.

14.2 A candidate opting for ex-studentship shall be required to apply to the Dean's office by paying only examination fee within 15 days from the start of new session.

15. RE-ADMISSION:

A candidate may be allowed for re-admission provided he/she satisfies one of the following conditions:

15.1 A candidate is declared failed.

15.2 A candidate did not appear in a semester examination/or he/she was not granted permission to appear in the examination.

15.3 A candidate has been detained by the University and subsequently has been permitted to take re-admission.

15.4 A candidate promoted with carry over subjects and he/she opted for readmission.

16. CANCELLATION OF ADMISSION:

The admission of a student at any stage of study shall stand cancelled if:

(i) He/she is not found qualified as per AICTE/State Government norms and guidelines or the eligibility criteria prescribed by the University.

or

(ii) If he/she fails to submit qualifying examination result/mark sheet after getting admission to B. Tech. First Semester/Third Semester (lateral entry) within a prescribed time.

or

(iii) He/she is found unable to complete the course within the stipulated time as prescribed in clause 4.2.

or

(iv) He/she is found involved in creating indiscipline in the University.

17. INTERPRETATION CLAUSE:

In case of any difficulty arising during the course of implementation of these ordinances or in case of any unforeseen circumstance, the interpretation/decision of the Vice-Chancellor shall be final.

18. The Academic Council shall have the power to relax/change any provision provided in the ordinance in any specific matter/situation.

19. Any legal issues arising out of the rules/provisions contained in the ordinances shall fall under the jurisdiction of District Lucknow.

PROGRAMME OUTCOMES (POs)

1. **Engineering Knowledge**: Ability of applying knowledge of mathematics, and basic engineering sciences to solve Electronics engineering related problems.
2. **Problem Analysis**: Formulation and analysis of engineering problems using concepts of mathematics and electronics and communication engineering.
3. **Design/Development of Solutions**: Ability to provide design solutions for complex engineering problems suited to the needs of society.
4. **Conduct Investigations of Complex Problems**: Ability to use research-based knowledge and methods to illustrate conclusions for complex problems through the design of experiments, analysis, and interpretation of data.
5. **Modern Tool Usage:** Ability to handle various modern EDA tools to analysis and designs of analogue, digital and mixed circuits.
6. **The Engineer and Society:** With this background, electronics and communication engineers are capable to contribute to solve a variety of key engineering challenges facing by the society
7. **Environment and Sustainability**: Understanding the effect of engineering solutions on society and the environment for sustainable growth.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work**: Capability to work independently as well as with multidisciplinary teams.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

1. Ability to use the basic concept of electronic circuits, Communication and Information Processing in the analysis and design of application based systems.
2. Ability to use standard tools and develop intelligent programming techniques for the solutions of Electronics and Communication Engineering problems.

Course Structure and Evaluation Scheme for B.Tech.

SEMESTER-I

S. No.	Subject Code	Subject Name	L – T - P	Evaluation					Credit
				Sessional			ESE	Grand Total	
				CT	TA	Total			
	Theory								
01.	AS 103	Engineering Mathematics-I	**3-1-0**	**20**	**10**	**30**	**70**	**100**	**4**
02.	AS 101	Engineering Physics-I	**3-1-0**	**20**	**10**	**30**	**70**	**100**	**4**
03.	EE 101/ ME 101	Basic Electrical Engineering/ Elements of Mechanical Engineering	**3-1-0**	**20**	**10**	**30**	**70**	**100**	**4**
04.	AS 104 CS 101	Professional Communication/ Computer System & Programming in	**3-0-0**	**20**	**10**	**30**	**70**	**100**	**3**
05.	EC 101/ AS 102	Basic Electronics/Engineering Chemistry	**3-1-0**	**20**	**10**	**30**	**70**	**100**	**4**
	Practical								
06.	AS 151/ AS 152	Engineering Physics Lab/ Engineering Chemistry Lab	**0-0-2**	**-**	**20**	**20**	**30**	**50**	**1**
07.	EE151/ ME 151	Basic Electrical Engineering Lab Elements of Mechanical Engineering Lab	**0-0-2**	**-**	**20**	**20**	**30**	**50**	**1**
08.	AS 154/ CS 151	Professional Communication Lab/ Computer Programming . Lab	**0-0-2**	**-**	**20**	**20**	**30**	**50**	**1**
09.	ME 152/ CE 151	Workshop Practice/Computer Aided Engineering Graphics	**0-0-3**	**-**	**20**	**20**	**30**	**50**	**2**
10.	GP	General Proficiency	**-**	**-**	**-**	**50**	**-**	**50**	**-**
Total								**700**	**24**

Abbreviations: CT - Class Test TA - Teacher's Assessment
ESE - End Semester Examination

SEMESTER-II

S. No.	Subject Code	Subject Name	L - T - P	Evaluation					Credit
				Sessional			ESE	Grand Total	
				CT	TA	Total			
	Theory								
01.	AS 203	Engineering Mathematics-II	**3-1-0**	**20**	**10**	**30**	**70**	**100**	**4**
02.	AS 201	Engineering Physics-II	**3-1-0**	**20**	**10**	**30**	**70**	**100**	**4**
03.	ME 201/ EE 201	Elements of Mechanical Engineering/ Basic Electrical Engineering	**3-1-0**	**20**	**10**	**30**	**70**	**100**	**4**
04.	CS 201/ AS 204	Computer System & Programming in C/ Professional Communication	**3-0-0**	**20**	**10**	**30**	**70**	**100**	**3**
05.	AS 202/ EC 201	Engineering Chemistry/ Basic Electronics	**3-1-0**	**20**	**10**	**30**	**70**	**100**	**4**
	Practical								
06.	AS 252/ AS 251	Engineering Chemistry Lab/ Engineering Physics Lab	**0-0-2**	**-**	**20**	**20**	**30**	**50**	**1**
07.	ME 251/ EE 251	Elements of Mechanical Engineering Lab/ Basic Electrical Engineering Lab	**0-0-2**	**—**	**20**	**20**	**30**	**50**	**1**
08.	CS 251/ AS254	Computer Programming. Lab/ Professional Communication Lab	**0-0-2**	**-**	**20**	**20**	**30**	**50**	**1**
09.	CE 251/ ME 252	Computer Aided Engineering Graphics/Workshop Practice	**0-0-3**	**-**	**20**	**20**	**30**	**50**	**2**
10.	GP	**General Proficiency**				**50**		**50**	
Total								**700**	**24**

SEMESTER-III

S. No.	Subject Code	Subject Name	L-T-P	Evaluation					Credit
				Sessional			ESE	Grand Total	
				CT	TA	Total			
	Theory								
1.	AS – 301	Mathematics – III	3--1--0	20	10	30	70	100	4
2.	CS – 301	Data Structure Primer using C	3--0--0	20	10	30	70	100	3
3.	EC -301	Digital Circuits & Logic Design	3--0--0	20	10	30	70	100	3
4.	EC – 302	Solid State Devices & Circuits	3--0--0	20	10	30	70	100	3
5.	EC – 303	Signals and Systems	3--1--0	20	10	30	70	100	4
6.	AS – 302/ AS - 303	Human Values & Ethics / Environment & Ecology	3—0--0	20	10	30	70	100	3
	Practical								
7.	CS - 351	Data Structure Lab	0--0--2	-	20	20	30	50	1
8.	EC - 351	Digital Circuits &Logic Design Lab	0--0--2	-	20	20	30	50	1
9.	EC - 352	Solid State Devices Lab	0--0--2	-	20	20	30	50	1
10.	EC - 353	Signals and Systems Lab	0--0--2	-	20	20	30	50	1
11.	GP - 301	General Proficiency				**50**		**50**	
Total			**18-2-8**					**800**	**24**

SEMESTER - IV

S. No.	Subject Code	Subject Name	L-T-P	Evaluation					Credit
				Sessional			ESE	Grand Total	
				CT	TA	Total			
	Theory								
1.	AS – 401	Computer Oriented Numerical Techniques	3--1--0	20	10	30	70	100	4
2.	EC – 401	Electronics Instrumentation and Measurements	3--0--0	20	10	30	70	100	3
3.	EC – 402	Electromagnetic Field Theory	3--0--0	20	10	30	70	100	3
4.	EC– 403	Computer Architecture & Organization	3--0--0	20	10	30	70	100	3
5.	EE – 401	Network Analysis and Synthesis	3--1--0	20	10	30	70	100	4
6.	AS – 402/ AS - 403	Human Values & Ethics/ Environment & Ecology	3—0--0	20	10	30	70	100	3
	Practical								
7.	EC – 451	Electronics Workshop & PCB Design Lab	0--0--2	-	20	20	30	50	1
8.	EC - 452	Electronics Instrumentation and Measurements Lab	0--0--2	-	20	20	30	50	1
9.	EC - 453	Numerical Technique Lab	0--0--2	-	20	20	30	50	1
10.	EE - 451	Network Analysis and Synthesis Lab	0--0--2	-	20	20	30	50	1
11.	GP - 401	General Proficiency				**50**		**50**	
Total			**18-2-8**					**800**	**24**

SEMESTER - V

S. No.	Subject Code	Subject Name	L-T-P	Evaluation					Credit
				Sessional			ESE	Grand Total	
				CT	TA	Total			
	Theory								
01.	EC - 501	Principles of Communication Engineering	3--1--0	20	10	30	70	100	4
02.	EC – 502	Microprocessors and Microcontrollers	3--1--0	20	10	30	70	100	4
03.	EC – 503	Integrated Circuits	3--1--0	20	10	30	70	100	4
04.	EC - 504	Antenna & Wave Propagation	3--0--0	20	10	30	70	100	3
05.	EC - 505	Analog Signal Processing	3--0--0	20	10	30	70	100	3
	Practical								
06.	EC - 551	Communication Engineering Lab – I	0--0--3	-	40	40	60	100	2
07.	EC – 552	Microprocessors and Microcontrollers Lab	0--0--3	-	40	40	60	100	2
08.	EC – 553	Integrated Circuits Lab	0--0--2	-	20	20	30	50	1
09.	EC – 554	Advance Electronics Design Lab	0--0--2	-	20	20	30	50	1
10.	GP - 501	General Proficiency				**50**		**50**	--
Total			**15-3-10**					**800**	**24**

Abbreviations : CT - Class Test TA - Teacher's Assessment
ESE - End Semester Examination

SEMESTER-VI

S. No.	Subject Code	Subject Name	L-T-P	Evaluation					Credit
				Sessional			ESE	Grand Total	
				CT	TA	Total			
	Theory								
01.	EC - 601	Microwave Engineering	3--1--0	20	10	30	70	100	4
02.	EC – 602	Digital Communication	3--1--0	20	10	30	70	100	4
03.	EC – 603	Control System	3--1--0	20	10	30	70	100	4
04.	EC - 604	Digital Signal Processing	3--0--0	20	10	30	70	100	3
05.	EC - 605	Any one from the list (DE –1)	3--0--0	20	10	30	70	100	3
	Practical								
06.	EC – 651	Microwave Engineering Lab	0--0--2	-	20	20	30	50	1
07.	EC – 652	Communication Engineering Lab - II	0--0--2	-	20	20	30	50	1
08.	EC – 653	Mini Project	0--0--3	-	40	40	60	100	2
09.	EC – 654	Seminar	0--0--3	-	40	40	60	100	2
10.	GP - 601	General Proficiency				**50**		**50**	
Total			**15-3-10**					**800**	**24**

Note : The students have to go for Industrial Training for a duration of six week during summer vacation. The report of Industrial Training will be submitted to the Head of Department in the beginning of seventh semester for evaluation.

Departmental Elective – 1 :-

EC - 6051 Data Communication Networks
EC - 6052 Advance Semiconductor Devices
EC - 6053 Advance Digital Design Using Verilog
EC - 6054 Digital System Design using VHDL

SEMESTER-VII

S. No.	Subject Code	Subject Name	L-T-P	Evaluation					Credit
				Sessional			ESE	Grand Total	
				CT	TA	Total			
	Theory								
01.	EC-701	Mobile and Wireless Communications	3 – 1 – 0	20	10	30	70	100	4
02.	EC-702	VLSI Design	3 – 1 – 0	20	10	30	70	100	4
03.	EC-703	Optical Communication	3 – 1 – 0	20	10	30	70	100	4
04.	EC-704X	Any one from the list (DE-2)	3 – 1 – 0	20	10	30	70	100	4
05.	AS-701/ AS-702	Engineering Economics/ Industrial Management	3 – 0 – 0	20	10	30	70	100	3
	Practical								
06.	EC751	CAD Lab	0 – 0 – 2	-	20	20	30	50	1
07.	EC753	Optical Communication Lab	0 – 0 – 2	-	20	20	30	50	1
08.	EC752	Industrial Training	0 – 0 – 2	-	-	50	-	50	1
09.	EC754	Project	0 – 0 – 3	-	-	150	-	150	2
10.	GP	General Proficiency				50		50	
	Total		**15 – 4 – 9**					**800**	**24**

Departmental Elective – 2:

EC-7041 Information Theory and Coding

EC-7042 Radar & Satellite Communication

EC-7043 Integrated Circuit Technology

EC-7044 Biomedical Electronics

EC-7045 Electronic Switching

SEMESTER-VIII

S. No.	Subject Code	Subject Name	L-T-P	Evaluation					Credit
				Sessional			ESE	Grand Total	
				CT	TA	Total			
	Theory								
01.	OE-80XX	Any one from the Open Elective list	3 – 1 – 0	20	10	30	70	100	4
02.	EC-801	Digital Image Processing	3 – 1 – 0	20	10	30	70	100	4
03.	EC-802X	Any one from the list (DE-3)	3 – 1 – 0	20	10	30	70	100	4
04.	AS-801/ AS-802	Engineering Economics/ Industrial Management	3 – 0 – 0	20	10	30	70	100	3
	Practical								
05.	EC-851	Digital Image Processing Lab	0 – 0 – 2	-	20	20	30	50	1
06.	EC-852	Project	0 – 0 – 12	-		100	250	350	8
07.	GP-801	General Proficiency				50		50	
	Total		**12 – 3 – 14**					**800**	**24**

Departmental Elective – 3:

EC-8021 Optical Networks
EC-8022 Embedded System
EC-8023 Advance Instrumentation
EC-8024 Speech Processing
EC-8025 RF system
EC-8026 Real Time System

Open Electives: Refer list of Open Electives in APPENDIX.

AS 103
Engineering Mathematics - I

L	T	P
3	1	0

Course Outcomes (COs):

After the completion of the course, students are expected to have the ability to:

- Use matrices, determinants and techniques for solving systems of linear equations in the different areas of Linear Algebra, Understand the definitions of Vector Space and its linear Independence, Solve Eigen value problems and apply Cayley Hamilton Theorem.
- Study the functions of more than one independent variable and calculate partial derivatives along with their applications
- Explore the idea for finding the extreme values of functions and integrate a continuous function of two or three variables over a bounded region.
- Understand Curl, divergence and gradient with their applications and have the idea of directional derivatives and derive the equations of tangent planes and normal lines.
- Calculate line integral, surface integral and volume integral and correlate them with the application of Stokes, Green and Divergence theorem.

Unit - 1: Matrix Algebra

Types of Matrices, Inverse of a matrix by elementary transformations, Rank of a matrix (Echelon & Normal form). Linear dependence. Consistency of linear system of equations and their solution, Characteristic equation. Eigen values and Eigen vectors, Cayley-Hamilton Theorem, Diagonalization, Complex and Unitary Matrices and its properties

Unit -2: Differential Calculus -I

Successive Differentiation, Leibnitz's theorem, Limit , Continuity and Differentiability of functions of several variables. Partial derivatives, Euler's theorem for homogeneous functions, Total derivatives, Change of variables, Curve tracing: Cartesian and Polar coordinates.

Unit - 3: Differential Calculus – II

Taylor's and Maclaurin's Theorem, Expansion of function of several variables, Jacobian, Approximation of errors. Extrema of functions of several variables, Lagrange's method of multipliers (Simple applications).

Unit - 4: Vector Calculus

Point function. Gradient, Divergence and Curl of a vector and their physical interpretations. Vector identities. Tangent and Normal, Directional derivatives. Line, Surface and Volume integrals. Applications of Green's, Stake's and Gauss divergence theorems (without proof).

Unit - 5: Multiple Integrals

Double and triple integrals. Change of order of integration. Change of variables. Application of integration to lengths, Surface areas and Volumes - Cartesian and Polar coordinates. Beta and Gamma functions, Dirichiefs integral and its applications.

Text Books:

1. E. Kreyszig, Advanced Engineering Mathematics,John-Wiley & Sons
2. B. V. Ramana, Higher Engineering Mathematics, Tata Me Graw- Hill Publishing Company Ltd.
3. R.K.Jain & S.R.K. lyenger. Advance Engineering Mathematics, Narosa Publishing House.

Reference Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
2. Peter V. O' Neil, Advanced Engineering Mathematics, Thomas (Cengage) Learning.

3. Thomas & Finley, Calculus, Narosa Publishing House
4. Rukmangadachari, Engineering Mathematics -1, Pearson Education.
5. **A.C.Srivastava&P.K.Srivastava, Engineering Mathematics, Vol.l, PHI Learning Pvt. Limited, NewDelhi.**

AS 101

Engineering Physics - I

L	T	P
3	1	0

Course Outcomes (COs):

After the completion of the course, students are expected to have the ability to:

- To develop the concept of relativistic mechanics and to explain it in different domains.
- To develop the understanding of Modern Physics and their application in various micro and macro systems.
- To develop the understanding of Interference and Diffraction with different experimental results.
- To illustrate the nature of EM waves and to apply the ideas of production of different types of polarized light and to know about the components and types of laser i.e pulsed and continuous wave.
- To develop the understanding of components and types of optical fiber with light propagation mechanism and to illustrate construction and reconstruction of holograms.

Unit -1: Relativistic Mechanics **08 Hrs.**

Inertial & non-inertial frames of reference, Galilean transformations, Michelson-Morley experiment, Einstein's postulates, Lorentz transformation equations. Length contraction & Time dilation. Relativistic addition of velocities; Variation of mass with velocity. Mass energy equivalence. Mass less particle.

Unit-II: Modem Physics **10 Hrs.**

Black body radiation, Weins law and Rayleigh-Jeans law. Quantum theory of radiation, Planck's law. Wave-particle duality, de-Broglie matter waves, Bohr's quantization rule. Phase and Group velocities, Davisson-Germer experiment, Heisenberg uncertainty principle and its applications. Wave function and its significance, Time dependent and time independent Schrodinger's wave equations - particle in one dimensional potential box. Eigen values and Eigen function.

Unit - III: Wave Optics **10 Hrs.**

Interference: Coherent sources, condition for sustained Interference in thin films (parallel and wedge shaped film), Newton's rings and its applications.

Diffraction: Types of diffractions, Single, double and N- Slit Diffraction, Diffraction grating. Grating spectra, dispersive power, Rayleigh's criterion and resolving power of grating.

Unit - IV: Polarization and Laser **08 Hrs.**

Polarization: Phenomena of double refraction, Construction and working of Nicol prism. Production and analysis of plane, circular and elliptical polarized light. Retardation Plate, Optical Activity, Fresnel's theory. Specific rotation.

Laser: Spontaneous and stimulated emission of radiation, population inversion, Einstein's Coefficients, Coherence, Concept of 3 and 4 level Laser, Construction and working of Ruby, He-Ne lasers , Laser applications.

Unit - V: Fiber Optics and Holography **06 Hrs.**

Fiber Optics: Fundamental ideas about optical fiber. Propagation mechanism. Acceptance angle and cone. Normalized frequency, Numerical aperture. Single and Multi Mode Fibers, Dispersion and Attenuation.

Holography: Basic Principle of Holography, Construction and reconstruction of Image on hologram and applications of holography.

Reference Books:

1. Concepts of Modem Physics - AurthurBeiser (Mc-Graw Hill)
2. Introduction to Special Theory of Relativity- Robert Resnick (Wielly)
3. Optics -AjoyGhatak(Tata McGraw Hill Education Private Ltd. New Delhi)
4. Optics - Brijlal& Subramanian (S. Chand)
5. Engineering Physics- C. Mani Naidu(Pearson)
6. Lasers Principles, Types and Applications- K R Nambiar (New Age)
7. Applied Physics for Engineers- Neeraj Mehta (PHI Learning, New.

AS 102/AS 202

Engineering Chemistry

L	T	P
3	1	0

COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- The students will gain knowledge of basic theories of solid materials, nano-materials and liquid crystals.
- To demonstrate the knowledge of synthesis of polymeric material, which are required for engineering applications.
- Apply basic knowledge of Science and fundamental aspect of cell working, equations in solving electrochemistry problems, functioning of lubricants and the techniques controlling the corrosion.
- Analyze the water sample parameters & identify the impurities and its effects. Able to design process for purification of water that is concern with safety of public health & environment.
- Apply basic knowledge of fuels and experimental techniques used in identification of structure of organic/inorganic moieties.

Unit-1	Molecular orbital theory and its applications to homo-nuclear diatomic molecules. Band theory of solids. Liquid crystals and its applications. Point defects in Solids. Structure and applications of Graphite and Fullerenes. Concepts of nano-materials and its applications	**8**
Unit-2	Polymers: Basic concepts of polymer- blends and composites. Conducting and biodegradablepolymers. Preparations and applications of some industrially important polymers(Buna N, Buna S, Neoprene, Nylon 6, Nylon 6,6 , Terylene). General methods of synthesis of organometallic compound (Giignard Reagent) and their applications in polymerization.	**8**
Unit-3	Electrochemistry: Galvanic cell, electrode potential. Lead storage battery. Corrosion, causes and its prevention. Setting and hardening of cement, applications of cement. Plaster of paris. Lubricants- Classification, mechanism and applications..	**8**
Unit-4	Hardness of water. Disadvantage of hard water. Boiler troubles. Techniques for water softening; Lime-soda, Zeolite, Ion exchange resin. Reverse osmosis. Phase Rule and its application to water system.	**8**
Unit-5	Fuels; Classification of fuels. Analysis of Coal. Determination of Calorific values (bomb calorimeter & Dulong's method). Biogas. Elementary ideas and simple applications of UV, Visible, IR and H^NMR spectral Techniques.	**8**

Text Book :

1. Chemistry for Engineers, by S. Vairam and Suba Ramesh; Wiley India

Reference Books :

1. Textbook of Engineering Chemistry by Dr. Gopal Krishna Bhatt, Acme Publishers
2. Chemistry (9th ed), by Raymond Chang, Tata McGraw-Hill
3. Chemistry Concepts and Applications by Steven S. Zumdahl; Cengage Learning
4. Engineering Chemistry, Wiley India

5. Engineering Chemistry Author: Abhijit Mallick, Viva Books
6. Text Book of Engineering Chemistry by Harsh Malhotra; Sonali Publications
7. Concise Inorganic Chemistry by J.D. Lee; Wiley India
8. Organic Chemistry (6 ed) by Morrison & Boyd; Pearson Education
9. Physical Chemistry by Gordon M. Barrow; Mc-Graw Hill
10. Organic Chemistry, Volume 1(6 ed)& 2 (5ed) by I. L. Finar; Pearson Education
11. Atkins' Physical Chemistry by Peter Atkins & Julio De Paula; Oxford University Press.

EC101/EC 201

Basic Electronics Engineering

L	T	P
3	1	0

COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- Acquire basic knowledge on the working of various semi-conductor devices.
- Develop analysis capability in BJT and FET Amplifier Circuits.
- Identify functions of digital multimeter, voltmeter, Cathode ray oscilloscope and Digital storage oscilloscope in measurement of physical variables.
- Understand fundamentals of radio communication.

Unit-I

PN junction diode: **Introduction of Semiconductor Materials** Semiconductor Diode: Depletion layer, V-I characteristics, ideal and practical, diode resistance, capacitance. Diode Equivalent Circuits, Transition and Diffusion Capacitance, Diodes breakdown mechanism (Zener and avalanche) Diode Application: Series, Parallel and Series, Parallel Diode Configuration, Half and Full Wave rectification. Clippers, Clampers, Zener diode as shunt regulator. Voltage-Multiplier Circuits Special Purpose two terminal Devices: Light-Emitting Diodes, Liquid-Crystal Displays.

12 Lectures

Unit-II

Bipolar Junction Transistor and Field Effect Transistor: Bipolar Junction Transistor: Transistor Construction, Operation, Amplification action. Common Base, Common Emitter, Common Collector Configuration DC Biasing BJTs: Operating Point, Fixed-Bias, Emitter Bias, Voltage-Divider Bias Configuration.Emitter-Follower Configuration. Bias Stabilization. CE, CB, CC amplifiers and AC analysis of single stage CE amplifier (re Model). Field Effect Transistor: Construction and Characteristic of JFETs. AC analysis of CS amplifier, MOSFET (Depletion and Enhancement)Type, Transfer Characteristic.

10 Lectures

Unit-III

Operational Amplifiers: Introduction and Block diagram of Op Amp, Ideal & Practical characteristics of Op Amp, Differential amplifier circuits. Practical Op- Amp Circuits (Inverting Amplifier, Non inverting Amplifier, Unity Gain Amplifier, Summing Amplifier, Integrator, Differentiator). **OP AMP Parameters: Input offset voltage, Output** offset **voltage, Input biased current. Input offset current** Differential and Common-Mode Operation.

6 Lectures

Unit-IV

Electronic Instrumentation and Measurements: Digital Voltmeter : Introduction, RAMP Techniques, Analog and Digital Multimeters: Introduction Oscilloscope: Introduction, Basic Principle, Block Diagram of Oscilloscope, Simple CRO, Measurement of voltage, current phase and frequency using CRO, **Introduction of Digital Storage Oscilloscope and Comparison of DSO with Analog Oscilloscope.**

6 Lectures

Unit-V

Fundamentals of Communication Engineering: Elements of a Communication System, Need of Modulation, Electromagnetic spectrum and typical applications. Basics of Signal Representation and Analysis, **Introduction of various analog modulation techniques.** Fundamentals of amplitude and frequency modulation. Modulation and Demodulation Techniques of AM.

6 Lectures

Text Books:

1. Robert L. Boylestand / Louis Nashelsky*"Electronic Devices and Circuit Theory" Latest*Edition, Pearson Education.
2. H S Kalsi, "Electronic Instrumentation", Latest Edition, TMH Publication,.
3. George Kennedy, "Electronic Communication Systems", Latest Edition, TMH,

Reference Books:

1. David A. Bell, *""Electronic Devices and Circuits",* Latest Edition, Oxford University Press.
2. Jacob Millman, C.C. Halkias, StayabrataJit, *""Electronic Devices and Circuits'",* Latest Edition , TMH.
3. David A. Bell, Electronic Instrumentation and Measurements, Latest Edition, Oxford University Press India.

ME101/ME 201

Elements of Mechanical Engineering

L	T	P
3	1	0

COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- Problems by applying the fundamental principles of engineering mechanics and to proceed todesign and development of the mechanical systems.
- Understand the representation of forces and moments.
- Understand the concept of static equilibrium of particles and rigid bodies.
- Able to understand the concept of stress and strain.
- Understand the basic concepts of Thermodynamics

UNIT-I

Force System: Law of Parallelogram of forces, Lami's theorem. Principle of Transmissibility of forces. Moment of a force. Couple, Varignon's theorem. Resolution of a force into a force and a couple. Resultant and equilibrium of coplanar force system. Determination of reactions.Free body diagrams.

Concept of Centre of Gravity, Centroidand Area Moment of Inertia, Perpendicular axis theorem and Parallel axis theorem

9 Lectures

UNIT-II

Plane Trnss: Perfect Deficient and Redundant Truss. Assumptions and Analysis of Plane Truss by Method of joints and Method of section.

Beams: Types of beams., Shear force and bending moment in Statically Determinate Beams. Shear force and bending moment diagrams. Relationships between load, shear and bending moment.

8 **Lectures**

UNIT-III

Simple stress and strain: Normal and shear stresses. One Dimensional Loading; members of varying cross section, bars in series. Tensile Test diagram for ductile and brittle materials. Elastic constants. Strain energy.

Bending (Flexural) Stresses: theory of pure bending, neutral surface and neutral axis, stresses in beams .

Engineering Materials: Importance of engineering materials, classification, mechanical properties and applications of Ferrous, Nonferrous and composite materials.

8 **Lectures**

UNIT-IV

Basic Concepts and Definitions of Thermodynamics: Introduction and definition of thermodynamics. Microscopic and Macroscopic approaches. System, surrounding and universe. Concept of continuum. Thermodynamic equilibrium. Thermodynamic properties, path, process and cycle. Quasi static process. Energy and its forms. Work and heat.

Zeroth law of thermodynamics: Temperature and its' measurement.

First law of thermodynamics: First law of thermodynamics. Internal energy and enthalpy. First law analysis for non-flow processes. Steady flow energy equation; Boilers, Condensers, Turbine, Throttling process. Pumps etc.

8 **Lectures**

UNIT-V

Second law: Thermal reservoir, Kelvin Planck statement. Heat engines. Efficiency; Clausius' statement Heat pump, Refrigerator. Coefficient of Performance. Carnot cycle, Carnot theorem and it's corollaries.Clausius inequality. Concept of Entropy.

Properties of Pure Substances: P-v, T-s and h-s diagram, dryness fraction and steam tables. Rankine Cycle.

Internal Combustion Engines: Classification of I.C. Engines, working principle and comparison between 2 Stroke and 4 stroke engine , difference between SI and Cl engines. P- V and T-s diagramsof Otto and Diesel cycles, comparison of efficiency.

9 **Lectures**

Reference Books:

1. Engineering Mechanics: Statics by J.L Meriam , Wiley
2. Engineering Mechanics : Statics and Dynamics by R. C. Hibbler, Pearson
3. Strength of Materials by Thimoshenko& Young
4. Mechanics of Solid by R. C. Hibbler, Pearson
5. Introduction to Mechanical Engineering : Thermodynamics, Mechanics & strength of Material,Onkar Singh, New Age International (P) Ltd.
6. Engineering Thermodynamics by P.K.Nag, McGraw Hill
7. Thermodynamics An Engineering Approach by Cengel& Boles, McGraw Hill
8. Internal Combustion Engine by V Ganesan, McGraw Hill Pub .
9. Engineering Mechanics By S. S. Bhavikatti, K. G. Rajashekarappa, New Age International
10. Engineering Mechanics by R K Bansal, Laxmi Publications
11. Elements of Workshop Technology by Hajra Choudhary Media Promoter

EE101/EE 201

Basic Electrical Engineering

L	T	P
3	1	0

COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- To understand fundamentals of DC circuits and apply knowledge for Analyzing network theorems in DC circuits.
- To learn the fundamentals and analyze single phase AC circuits.
- To learn the fundamentals and analyze three phase AC circuits.
- To learn the basic operation and analyze the performance of single phase transformer.
- To understand the construction and basic operation of DC motors and generators.

Unit-I

Electrical Circuit Analysis:

Introduction, Circuit Concepts: Concepts of network. Active and passive elements. Voltage and current sources. Concept of linearity and linear network. Unilateral and bilateral elements. Source transformation, Kirchhoff's laws, Loop and nodal methods of analysis. Star-delta transformation,

AC fundamentals: Sinusoidal, square and triangular waveforms - Average and effective values. Form and peak factors, Concept of phasors, phasor representation of sinusoidally varying voltage and current.

Unit-II

Steady- State Analysis of Single Phase AC Circuits:

Analysis of series and parallel RLCCircuits, Concept of Resonance in series & parallel circuits, bandwidth and quality factor; Apparent, active & reactive powers. Power factor, Concept of power factor improvement and its improvement (Simple numerical problems)

Network theorems (AC & DC with independent sources): Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem (Simple numerical problems)

Unit-III

Three Phase AC Circuits:

Three phase system-its necessity and advantages, Star and delta connections, Balanced supply and balanced load, Line and phase voltage/current relations. Three-phase power and its measurement (simple numerical problems).

Measuring Instruments: Types of instruments, Construction and working principles of PMMC and moving iron type voltmeters & ammeters, Single phase dynamometer wattmeter, Use of shunts and multipliers (Simple numerical problems on shunts and multipliers), Single phase energy meter.

Power system: basic concept, power line diagram, concept of grid.

Unit-IV

Magnetic Circuits:

Magnetic circuit concepts, analogy between electric & magnetic circuits, B-H curve, Hysteresis and eddy current losses, Magnetic circuit calculations (Series & Parallel).

Single Phase Transformer: Principle of operation, Construction, EMF equation, Phaser diagram Equivalent circuit. Power losses, Efficiency (Simple numerical problems), Introduction to auto transformer.

Unit-V

Electrical Machines:

DC machines:Principle& Construction, Types, EMF equation of generator and torque equation of motor, applications of DC motors (simple numerical problems)

Three Phase Induction Motor:Principle& Construction, Types, Slip-torque characteristics. Applications (Numerical problems related to slip only)

Single Phase Induction motor: Principle of operation and introduction to methods of starting, applications.

Three Phase Synchronous Machines: Principle of operation of alternator and synchronous motor and their applications.

Text Books:

1 . Basic Electrical Engineering, S N Singh; Prentice Hall International
2. Basic Electrical Engineering, Kuldeep Sahay, New Age International Publishers
3. Fundamentals of Electrical Engineering, B Dwivedi, A Tripathi; Wiley India
4. Principles of Electrical Engineering, V. Del Toro,; Prentice Hall International
5. Electrical Engineering, J. B. Gupta, Kataria and Sons
6. Basic Electrical Engineering, T.K.Nagsarkar,M.S. Shukhija; Oxford University Press.

Reference Books:

1. Electrical and Electronics Technology, Edward Hughes; Pearson
2. Engineering Circuit Analysis, W.H. Hayt& J.E. Kimerly; Me GrawHill
3. Basic Electrical Engineering, C L Wadhwa; New Age International

CS 101/CS 201

Computer System and Programming in C

L	T	P
3	0	0

Course Outcomes (COs):

- This course will let students understand the basics of solving a problem using the computer system.
- Students will be able to solve simple and precise problems using the computer.
- Students can develop the attitude to solve the problems in hand in logical manner.
- To able to understand the basic concepts of digital computer, binary arithmetic.
- To be able to understand the importance of algorithm and flowcharts in programming.
- To be able to understand the basic concepts of writing a program in C language: write, compile, and run programs in C language.
- To understand role of constants, variables, identifiers, operators, type conversion and other building blocks of C Language
- To be able to write programs that involve decisions and iterations.
- To be able to understand how to use functions, arrays, pointers, preprocessor directives along with fare confidence in file handling.

Unit 1: (10 Lectures)

Basics of Computer: Introduction to digital computer, basic operations of computer, functional components of computer. Classification of computers.

Introduction to operating system: [DOS, Windows, Linux and Android] purpose, function, services and types.

Number system: Binary, octal and hexadecimal number systems, their mutual conversions. Binary arithmetic.

Basics of programming: Approaches to Problem Solving, Concept of algorithm and flow charts. Types of computer languages:- Machine Language, Assembly Language and High Level Language, Concept of Assembler, Compiler, Loader and Linker.

Unit2: (8 Lectures)

Standard I/O in "C", **Fundamental data types-** Character type, integer, short, long, unsigned, single and double floating point. Storage classes- automatic, register, static and external. Operators and expression using numeric and relational operators, mixed operands, type conversion, logical operators, bit operations, assignment operator, operator precedence and associatively.

Fundamentals of C programming: Structure of C program, writing and executing the first C program. Components of C language. Standard I/O in C.

Units3: (10 Lectures)

Conditional program execution: Applying if and switch statements, nesting if and else, use of break and default with switch, program loops and iterations: use of while, do while and for loops, multiple loop variables, use of break and continue statements.

Functions: Introduction, types of functions, functions with array, passing values to functions, recursive functions.

Unit 4: (6 Lectures)

Arrays: Array notation and representation, manipulating array elements, using multi dimensional arrays. Structure, union, enumerated data types

Unit 5: (8 Lectures)

Pointers: Introduction, declaration, applications File handling, standard C preprocessors, defining and calling macros, conditional compilation, passing values to the compiler.

Reference Books:

1. The C programming by Kemighan Brain W. and Ritchie Dennis M., Pearson Education .
2. Computer Basics and C Programming by V.Rajaraman, PHI Learning Pvt. Limited - 2015.
3. Programming in C by Kochan Stephen G. Pearson Education - 2015.
4. Computer Concepts and Programming in C by D.S. Yadav and Rajeev Khanna, New Age International Publication.
5. Computer Concepts and Programming in C by Vikas Gupta, Wiley India Publication
6. Computer Fundamentals and Programming in C. Reema Thareja, Oxford Publication
7. Computer Concepts and Programming in C, E Balaguruswami, McGraw Hill
8. Computer Science- A Structured Programming Approach Using C, by Behrouz A. Forouzan, Richard F. Gilberg, Thomson, Third Edition , Cengage Learning - 2007.
9. Problem Solving and Program Design in C, by Jeri R. Hanly, Elliot B. Koffman, Pearson Addison-Wesley, 2006.
10. Computer Concepts and Programming by Anami, Angadi and Manvi, PHI Publication
11. Computer Fundamental and C programming by K K Gupta, Acme Learning Publication

AS 104/AS 204

Professional Communication

L	T	P
3	0	0

Course Outcomes:
Students are able to demonstrate the following:

- Understand the communication system for specific purpose.
- Be able to communicate professionally.
- Be able to communicate across organizational levels and cultures effectively.
- Be able to negotiate with the odds and bring in best of the results with specific success.
- Be able to understand the human needs and adjust accordingly the set goals.

Unit-I: Fundamentals of Communications
Technical Communication: features: Distinction between General And Technical Communication; Language as a tool of communications; Levels of communication: Interpersonal, Organizational, Mass communication; The flow of communication: Downward, Upward, Lateral/Horizontal (Peer group)**:** Importance of technical communication; Barriers to Communication.

Unit-II: Written Communication
Words and Phrases: Word formation, Synonyms and Antonyms; Homophones; Select vocabulary of about 500-1000 New words; correct Usage: all Parts of Speech; Modals; Concord; Articles; Infinitives; Transformation of sentences; Requisites f Sentence Construction: Paragraph Development: Techniques and Methods- Inductive, Deductive, Spatial, Linear, Chronological etc.

Unit-III: Business Communication
Principles, Sales & Credit letters; Claim and Adjustment Letters; Job Application and Resumes. Reports: Types; Significance; Structure, Style & Writing of Reports.
Technical Proposal; Parts; Types; Writing of Proposal; Significance; Negotiation skills.

Unit-IV: Presentation Strategies and Soft Skills.
Nuances and Modes of Delivery; Body Language; Dimensions of Speech: Syllable; Accent; Pitch; Rhythm; Intonation; Paralinguistic features of voice; Interpersonal communication: Definition; Types; Team work; Attitude; Way to improve Attitude Listening Skills **:** Types; Methods for improving Listening Skills.

Unit –V: Value- Based Text Readings
Following essays from the prescribed text book with emphasis on Mechanics of writing.

1. Humanistic and Scientific Approaches to Human Activity by Moody E. Prior
2. The Language of Literature and Science by A. Huxley
3. Man and Nature by J. Bronowski
4. Science and Survival by Barry Commoner
5. The Mother of the Sciences by A.J. Bahm.

Text Book:

1. Improve your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi.
2. Technical Communication- Principles and Practices by Meenakshi Raman & Sangeeta

Sharma, Oxford Univ. Press, 2007, New Delhi.
3. Functional skills in Language and Literature, by R.P. Singh, Oxford Univ. Press, 2005, New Delhi.

Reference Books:

1. Communication Skills for Engineers and Scientists, Sangeeta Sharma et.al. PHI Learning Pvt. Ltd, 2011, New Delhi.
2. Business Correspondence and Report Writing by Prof R.C.,Sharma& Krishna Mohan, Tata McGraw Hill & Co. Ltd. ,2001, New Delhi.
3. **Word Power Made Easy by Norman Lewis, W.R. Goyal Pub. & Distributors, 2009, Delhi.**
4. Developing Communication skills by Krishna Mohan, MecraBannerji- Macmillan India Ltd. 1990, Delhi.
5. Manual of Practical Communication by L.U.B. Pandey: A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2013, Delhi.
6. English Grammar and Usage by R.P.Sinha, Oxford University Press, 2005, New Delhi.
7. Spoken English- A manual of Speech and Phonetics by R.K. Bansal & J.B. Harrison Orient Blackswan, 2013, New Delhi.

CE151/CE 251

Computer Aided Engineering Graphics

L	T	P
0	**0**	**3**

Course Outcomes (COs):

On successful completion of this course, a student would be able to:

- Produce geometric construction, Multiview, dimensioning and detail drawings of typical 3-D engineering objects.
- Apply the skill for preparing detail drawing of engineering objects.
- Understand and visualize the 3-D view of engineering objects.
- Understand and apply computer software to prepare engineering drawing.
- Able to visualize better and understand the various engineering problems.

Introduction

Drawing Instruments and their uses, BIS conventions. Lettering, Dimensioning line conventions and free hand practicing, AUTO CAD, layout of the software, standard tool bar/menus and description of most commonly used tool bars, navigational tools. Co-ordinate system and reference planes. Definitions of HP, VP, RPP & LPP. Creation of 2D/3D environment. Selection of drawing size and scale. Commands and creation of Lines,Co-ordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints.
2 - Sheets

Orthographic Projections Introduction, Definitions - Planes of projection, reference line and conventions employed, Projections of points in all the four quadrants, Projections of straight lines (located in First quadrant/first angle only), True and apparent lengths. True and apparent inclinations to reference planes.
2 - Sheets

Orthographic Projections of Plane Surfaces (First Angle Projection Only)Introduction, Definitions-projections of plane surfaces-triangle, square, rectangle, rhombus, pentagon, hexagon and circle, planes in different positions by change ofposition method only.
1 - Sheet

Projections of Solids (First Angle Projection Only) Introduction, Definitions - Projections of right regular tetrahedron, hexahedron (cube), prisms, pyramids, cylinders and cones in different positions.
2-Sheets

Sections And Development of Lateral Surfaces of Solids Introduction, Section planes. Sections, Section views, Sectional views, Apparent shapes and True shapes of Sections of right regular prisms, pyramids, cylinders and cones resting with base on HP.
1 - Sheet

Isometric Projection (Using Isometric Scale Only)

Introduction, Isometric scale, Isometric projection of simple plane figures. Isometric projection of tetrahedron, hexahedron(cube), right regular prisms , pyramids, cylinders, cones, spheres, cut spheres.
1-Sheet

Text Books:

1. Engineering Drawing - N.D. Bhatt & V.M. Panchal, 48thedition, 2005-Charotar Publishing House, Gujarat.
2. Computer Aided Engineering Drawing - S. Trymbaka Murthy, -I.K International Publishing House Pvt. Ltd., New Delhi, 3rdrevised edition- 2006.

Reference Books:

1. Engineering Graphics - K.R. Gopalakrishna, 32”** edition, 2005- Subash Publishers Bangalore.

2. Fundamentals of Engineering Drawing with an Introduction to Interactive Computer Graphics for Design and Production-Luzadder Warren J., Duff John M., Eastern Economy Edition, 2005- Prentice-Hall of India Pvt. Ltd., New Delhi.
3. Engineering Drawing - M.B. Shah, B.C.Rana, 2nd Edition,2

AS 203

Engineering Mathematics - II

L	T	P
3	1	0

Course Outcomes (COs):
After the completion of the course, students are expected to have the ability to:

- Understand and implement the concept of differential equations and learn various methods to solve ordinary differential equation
- Extend the concept of series solutions to solve differential equations and learn orthogonality about the functions
- Implement the integral transformation using the concept of Laplace transformation and application to solve differential equations
- Learn Fourier series and Fourier transformations for initial and boundary values problems.
- Application of Partial differential equation as heatequation,wave equation and Laplace equation.

Unit - 1: Ordinary Differential Equations
Linear differential equations of order with constant coefficients. Complementary function and Particular integral. Simultaneous linear differential equations. Solution of second order differential equations by changing dependent & independent variables. Method of variation of parameters. Applications to engineering problems (without derivation).

Unit - 2: Series Solution and Special Functions
Series solution of second order ordinary differential equations with variable coefficient (Frobenius method), Bessel and Legendre equations and their series solutions. Properties of Bessel function and Legendre polynomials.

Unit - 3: Laplace Transform
Laplace transform. Existence theorem, Laplace transforms of derivatives and integrals. Initial and final value theorems. Unit step function, Dirac- delta function, Laplace transform of periodic function. Inverse Laplace transform. Convolution theorem. Application to solve simple linear and simultaneous differential equations.

Unit - 4: Fourier Series and Partial Differential Equations
Periodic functions, Dirichlet's Conditions, Fourier series of arbitrary periods, Euler's Formulae, Even and odd functions, Half range sine and cosine series, Gibbs Phenomena.
Solution of first order Lagrange's linear partial differential equations. Second order linear partial differential equations with constant coefficients.

Unit - 5: Applications of Partial Differential Equations
Classification of second order partial differential equations, Method of separation of variables for solving partial differential equations, Solution of one and two dimensional wave and heat conduction equations, Laplace equation in two dimension, Equation of transmission lines.

Text Books:

1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
2. B. V. Ramana, Higher Engineering Mathematics, Tata Me Graw- Hill Publishing Company Ltd.
3. R.K.Jain& S.R.K. lyenger, Advance Engineering Mathematics, Narosa Publishing House.

Reference Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
2. Peter V. O' Neil, Advanced Engineering Mathematics, Thomas (Cengage) Learning.
3. Chandrika Prasad, Advanced Mathematics for Engineers, Prasad Mudranalaya
4. A. C. Srivastava & P. K. Srivastava, Engineering Mathematics, Vol. - II, PHI Learning Pvt. Ltd.
5. **Rukmangadachari, Engineering Mathematics - II, Pearson Education.**

AS 201
ENGINEERING PHYSICS - II

L	T	P
3	1	0

Course Outcomes (COs):

After the completion of the course, students are expected to have the ability to:

- To know about the fundamentals of crystal physics and illustrations of Nacl and diamond structures.
- To understand the concepts of dielectrics and its polarization and different properties of magnetic materials with their hysteresis curve.
- To formulate and solve the engineering problems on electromagnetism with the help of Maxwell's equations.
- To understand the basics of band theory of solids and discuss the Fermi energy for semiconductors.
- To develop the understanding of superconductors and its types, superconductivity with BCS theory and to understand the various applications of nanotechnology with the help of nano materials.

Unit -1: Crystal Structures and X-ray Diffraction 10Hrs.

Space lattice, basis. Unit cell. Lattice parameter. Seven crystal systems and Fourteen Bravais lattices. Co-ordination number. Atomic radius and Packing factor of different cubic structures. Crystal structure of NaCl and diamond. Lattice planes and Miller Indices, Diffraction of X-rays by crystal, Laue's experiment, Bragg's Law, Bragg's spectrometer. Compton Effect.

Unit - II: Dielectric and Magnetic Properties of Materials 10 Hrs.

Dielectric Properties: Dielectric constant and Polarization of dielectric materials. Relation between E, D and P, Types of Polarization (Polarizability). Equation of internal fields in liquid and solid (One-Dimensional), Claussius-Mossotti equation. Frequency dependence of dielectric constant, Dielectric Losses, Important applications of dielectric material, Ferroelectricity, Piezoelectricity.

Magnetic Properties: Magnetization, Origin of magnetic moment, Dia, para and ferro magnetism, Langevin's theory for diamagnetic material. Phenomena of hysteresis and its applications.

Unit - III: Electromagnetic Theory 06 Hrs.

Equation of continuity, Maxwell's Equations (Integral and Differential Forms) and its derivations, Displacement Current, Poynting vector and Poynting theorem, EM - Wave equation and its propagation characteristics in free space, non-conducting and conducting media, energy density of electromagnetic wave, Skin depth.

Unit - IV: Band Theory of Solids 06 Hrs.

Free electron Theory, Formation of bands in Solids, Classification of solids on band theory. Density of states, Fermi-Dirac distribution, Concept of effective mass. Charge carrier density (electrons and holes), Conductivity of semiconductors, carrier concentrations Fermi energy. Position of Fermi level in intrinsic and in extrinsic semiconductors. Temperature dependence of conductivity in semiconductors.

Unit - V: Physics of some technologically important Materials 08Hrs.

Superconductors: Temperature dependence of resistivity in superconducting materials. Effect of magnetic field (Meissner effect), Temperature dependence of critical field, London equations, Josephson theory, persistent currents. Type I and Type II superconductors, BCS theory (Qualitative), High temperature superconductors and Applications of Super-conductors. **Nano-Materials:** Basic principle of nanoscience and technology, structure, properties and uses of Fullerene, Carbon nanotubes Single and double walled nanotubes, synthesis of nanotubes. Properties and Applications of nanotubes.

Reference books:

1. Concept of Modem Physics - by Beiser (Tata Mc-Graw Hill)
2. Solid State Physics - by C. Kittel, 7th edition (Wiley Eastern)
3. Materials Science and Engineering - by V. Raghavan (Prentice- Hall India)
4. Solid State Physics - by S.O. Pillai, 5th edition (New Age International).
5. Introduction to Electrodynamics - by David J. Griffith (PH I)
6. Engineering Physics- C. Mani Naidu(Pearson)
7. Applied Physics for Engineers- Neeraj Mehta (PHI Learning, New Delhi)

AS - 301
MATHEMATICS- III

L T P
3 1 0

Course Outcomes (COs):

After completion of the course student will be able to:

- Deal with sequences and various types of series and their convergence,
- Determine whether a given complex function isdifferentiable, and if so find its derivative. Express complex- differentiable functions as power series, find the Singularities, Zeroes and Poles, Residue.
- Identify of Integral Transforms Fourier integral, Applications of Fourier transform and Z-transform and its application to solve difference equations.
- Analyze of different Statistical Techniques–I Moments, Moment generating functions, Skewness, Kurtosis, Curve fitting, Correlation, Linear, nonlinear and multiple regression analysis,.
- Analysis of Statistical Techniques – II Binomial, Poisson and Normal distributions, Sampling theory, Tests of significations: Chi- square test, t-test, and Analysis of variance (one way), Application of. Time series and forecasting.

Unit- I: Sequences and Series **08**

Sequences, Limit of a sequence, Convergence, Divergence and Oscillation of a sequence, Infinite series, Necessary condition for convergence, Standard infinite series, Geometric series and Harmonic series. Tests for convergence and divergence, Comparison test (only for series with positive terms), Cauchy's integral test, D'alembert's ratio test, Cauchy's nth root test, Raabe's test (higher ratio test), Logarithmic test, Demorgan's and Bertrand's tests, Alternating series Leibnitz's theorem (without proof), Absolute convergence and Conditional convergence, Power series.

Unit-II: Function of Complex variable **08**

Analytic function, C-R equations, Harmonic functions, Cauchy's integral theorem, Cauchy's integral formula, Derivatives of analytic functions, Taylor's and Laurent's series, Singularities, Zeroes and Poles, Residue theorem, Evaluation of real integrals of the type $\int_0^{2\pi} f(cos\theta,\ sin\theta)d\theta$ and $\int_{-\infty}^{+\infty} f(x)dx$.

Unit- III: Integral Transforms **08**

Fourier integral, Complex Fourier transform, Inverse transform, Convolution theorem, Fourier sine and cosine transform, Applications of Fourier transform to simple one dimensional heat transfer equations, wave equations and Laplace equations, Z- transform and its application to solve difference equations.

Unit- IV: Statistical Techniques – I **08**

Moments, Moment generating functions, Skewness, Kurtosis, Curve fitting, Method of least squares, Fitting of straight lines, Polynomials, Exponential curves etc., Correlation, Linear, non-linear and multiple regression analysis, Probability theory.

Unit- V: Statistical Techniques – II **08**

Binomial, Poisson and Normal distributions, Sampling theory (small and large), Tets of significations: Chi- square test, t-test, Analysis of variance (one way), Application to engineering, medicine, agriculture etc. Time series and forecasting (moving and semi- averages), Statistical quality control methods, Control charts, $\bar{X}$, R, p, np and c charts.

Test Books:-

1. Peter V. O'Neil, Advance Engineering Mathematics Thomson (Cengage) Learning, 2007.
2. J.N. Kanpur, Mathematical Statistics, S. Chand & company Ttd., 2000

Reference Books:-

1. R.K. Jain & S.R.K. Iyenger, Advance Engineering Mathematics, Narosa Publication House, 2002.
2. Chandika Prasad, Advanced Mathematics for Engineers, Prasad Mudralaya, 1996.
3. B. V. Ramana, Higher Engineering Mathematics, Mc Gra Hill Education, 2016.
4. E. Kreysig, Advanced Engineering Mathematics, John Wiley & Sons, 2005.
5. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2005.
6. S.P. Gupta, Statistical Methods, Sultan and Sons, New Delhi, 2004.
7. Devore, Probability and Statistics, Thomson (Cengage) Learning, 2007.
8. Walpole, Myers, Myers & Ye, Probability and Statistics for Engineers & Scientists, Pearson Education, 2003.

CS - 301
DATA STRUCTURE PRIMER USING 'C'

Course Outcomes (COs): **L T P**
3 0 0

- Students will be able to learn how to represent arrays, linked lists, stacks, queues, trees, and graphs in memory using the algorithms and their common applications.
- Students will able to understanding the concept of recursion, application of recursion and its implementation and removal of recursion.
- Students will be able to learn the computational efficiency of the sorting and searching algorithms.
- Students will be able to learn implementation of Trees and Graphs, and various operations on these data structure.
- Students will capable to identify the alternative implementations of data structures with respect to its performance to solve a real world problem.

Unit –I **07**

Introduction: Basic Terminology, Elementary Data Organization, Built in Data Types, Abstract Data Types.

Arrays: Single and Multidimensional Arrays, Representation of Arrays, Derivation of Index Formulae for 1D, 2D, 3D & nD Array Application of arrays, Sparse Matrices and their representations.

Linked lists: Implementation of Singly Linked List using Array, and Pointer, Doubly Linked List, Circularly Linked List, Operations on a Linked List: Insertion, Deletion, Traversal, Polynomial Representation.

Unit – II **08**

Stacks: Basic operations: Push & Pop, Array and Linked List Implementation of Stack in C, Application of stack: Prefix and Postfix Expressions, Evaluation of postfix expression, Iteration and Recursion-Principles of recursion, Tail recursion, Removal of recursion Problem solving using iteration and recursion with examples such as binary search, Fibonacci numbers, and Hanoi towers. Trade-offs between iteration and recursion.

Queues: Basic operations: Create, Add, Delete, Circular queues, Array and linked list implementation of queues in C, Dequeue and Priority Queue.

Unit – III **09**

Trees: Basic terminology, Binary Trees, Binary Tree Representation: Array and Pointer (Linked List) Representation, Binary Search Tree, Strictly Binary Tree, Complete Binary Tree. Extended Binary Trees, Tree Traversal algorithms: In-order, Pre-order and Post-order, Constructing Binary Tree from given Tree Traversal, Insertion , Deletion, Searching & Modification of data in Binary Search. Threaded Binary trees, Traversing Threaded Binary trees. Huffman coding using Binary Tree. Concept & Basic Operations for AVL Tree, B Tree & Binary Heaps.

Unit – IV **08**

Searching: Sequential search, Index Sequential Search, Binary Search.

Hashing: Concept of Hashing & Collision resolution Techniques.

Sorting: Insertion Sort, Selection, Bubble Sort, Quick Sort, Merge Sort, Heap Sort, Radix Sort.

Unit – V **08**

Graphs: Basic terminology, Graph Representations: Adjacency Matrices, Adjacency List, Adjacency. Graph Traversal: Depth First Search and Breadth First Search, Connected Component, Spanning Trees, Minimum Cost Spanning Trees: Prims and Kruskal algorithm. Transitive Closure and Shortest Path algorithm: Warshal Algorithm and Dijikstra Algorithm.

Text Books:

1. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein "Data Structures Using C and C++" , PHI
2. R. Kruse etal, "Data Structures and Program Design in C", Pearson Education
3. Thareja, "Data Structure Using C" Oxford Higher Education.

Reference Books:

1. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publication
2. Lipschutz, "Data Structures" Schaum's Outline Series, TMH
3. Jean Paul Trembley and Paul G. Sorenson, "An Introduction to Data Structures with applications", McGraw Hill
4. R. Kruse etal, "Data Structures and Program Design in C", Pearson Education

EC-301
DIGITAL CIRCUITS & LOGIC DESIGN

L	T	P
3	0	0

Course Outcomes (COs):
The student will be able to

- Gain knowledge between different types of number systems, and their conversions.
- Design various logic gates and simplify Boolean equations.
- Design various flip flops, shift registers and determining outputs.
- Analyze, design and implement combinational logic circuits, e.g. design different types of counters.
- Classify different semiconductor memories.

Unit-I **09**

Digital system and binary numbers: Number System: Binary, Octal, Hexadecimal, Character Codes (BCD, ASCII, EBCDIC) and its arithmetic, Signed binary numbers, Cyclic codes, error detecting and correcting codes, Hamming Code.

Gate-level minimization: Boolean algebra: definition, axioms, basic theorems, and properties, Boolean functions, Canonical and standard forms, NAND and NOR implementation, K- map method up to five variable, don't care conditions, Quine Mc-Clusky method (tabular method).

Unit-II **07**

Combinational logic: Combinational circuits, analysis procedure, design procedure, binary adder-subtractor, decimal adder, magnitude comparator, decoders, encoders, multiplexers, Demultiplexers.

Unit-III **08**

Sequential logic: Sequential circuits, storage elements: latches, flip flops, analysis of clocked sequential circuits, state reduction and assignments, design procedure.

Registers and Counters: Shift registers, ripple counter, synchronous counter, other counters: Johnson & Ring Counter.

Unit-IV **08**

Synchronous and Asynchronous Sequential Circuits: Analysis of clocked sequential circuits with state machine designing, State reduction & assignments, Design procedure. Analysis procedure of Asynchronous sequential circuits, circuit with latches, design procedure, Reduction of state and flow table, Race-free state assignment.

Unit-V **08**

Memory and programmable logic: Introduction to Digital Logic families, RAM, ROM, PLA, PAL, Introduction to VHDL, Basics, Design of Combinational and Sequential circuits using VHDL.

Text Books:

1. M. Morris Mano and M. D. Ciletti, "Digital Design", Pearson Education.
2. David J. Comer, "Digital Logic & State Machine Design", Oxford University Press
3. RP Jain, "Modern Digital Electronics", Tata McGraw Hill Publication.

4. Donald P.Leach and Albert Paul Malvino, Digital Principles and Applications, 6th Edition, TMH.

Reference Books:

1. DP Kothari and J.S. Dhillon, "Digital Circuits and Design", Pearson Education
2. A. Anand Kumar, "Fundamentals of Digital Circuits", PHI Learning Pvt. Ltd.
3. Douglas L. Perry, "VHDL: Programming by Example", McGraw-Hill
4. Jairam Bhaskar, "A VHDL Primer", Prentice Hall PTR

EC - 302
Solid State Devices and Circuits

L	T	P
3	0	0

Course Outcomes (COs):

- Student will understand semiconductor fundamentals and applications to the electronic devices.
- Course creates the background in the classification of amplifiers and basic concepts of feedback.
- Student will able to understand the principal of operation of various basic oscillators and dc regulated power supplies.

UNIT I **08**

Diodes: Energy Band Theory of Crystals, Semiconductors, Mechanism of Conduction, Mass Action Law, Drift and Diffusion Currents, Semiconductor Equations, P-N Junction Diode, Depletion Region, Transition Capacitance, Junction Breakdown Diodes. Diffusion Capacitance, I-V Characteristics and Equation, Models: Piece-wise & Small Signal, Effect of Temperature, Switching Characteristics, Special Diodes: Schottky Barrier Diodes, Varactors, Photodiodes, Solar Cells.

UNIT II **08**

Transistors: Introduction to Bipolar Junction Transistors, Basic Transistor Operation, Transistor current components.
Field Effect Transistors: Theory and Operation of MOSFET, I-V Characteristics, Biasing, MOSFET circuits at DC, MOSFET as an amplifier and as a switch, Biasing in MOSFETs.

UNIT III **08**

Analysis of Single Stage MOS Amplifier: Small signal Operation and Model, Analysis of Single Stage CS, CG & CD (MOSFET Amplifiers) in Mid-band & High Frequency Region, Frequency Response of the CS Amplifier.

UNIT IV **08**

Classification of Amplifiers: Multistage Amplifiers, Power Amplifiers, Feedback Amplifiers, Basic Concept of Feedback, Effect of Negative Feedback, Simple Analysis, and Stability of Feedback Amplifier.

UNIT V **08**

Oscillators and Power Supplies: Condition for Oscillations, Generalized form of Hartley & Colpitts Oscillators, Op-Amp Based RC Phase Shift, Wein Bridge, Crystal Oscillators.
Power Supply: Unregulated Power Supply, Ripple Factor, Filters, Rectifier Efficiency. Regulated Power Supply, Regulation, Shunt Regulators, Series Regulators.

Text Books:

1. Millman, J. & Halkias, C. / "Integrated Electronics" / McGraw-Hill International.
2. Sedra, Adel S., Smith, Kenneth C. / "Microelectronic Circuits"/ Oxford University Press / 5th Edition
3. Shilling, D. H. & Belove, Ch. / "Electronic Circuit"/ McGraw-Hill International.

Reference Books:

1. Streetman, B.G. & Banerjee, Sanjay / "Solid State Electronic Devices" / Pearson Education, 5th Ed
2. Bell, David A. / "Electronic Devices & Circuits"/Pearson, 4th Ed.
3. Millman, J. and Grabel, A. / "Microelectronics"/ McGraw –Hill.

4. Nair, B. Somanathan /“Electronic Devices & Applications”/ Prentice-Hall (India)
5. Nagrath , I.J. / “Electronics, Analog & Digital”/ Prentice-Hall (India).
6. Neamen, Donald A. / “Electronic circuit Analysis & design” / Tata McGraw Hill

EC 303
SIGNALS & SYSTEMS

	L	T	P
Course Outcomes (COs):	**3**	**1**	**0**

- Understand the fundamental concept of signals and learn various operations on continuous-time and discrete signals.
- Compute Laplace transform for continuous time signals and Z-transform for discrete time signals
- Apply Fourier transforms and Comparison between continuous time FT and DTFT.
- Understand about the different types of systems and compute convolution sum, step response of discrete time system.
- Analyse continuous and discrete time systems in time domain and frequency domain.

Unit I **08**

Signals: Definition, types of signals and their representations: continuous-time/discrete-time, periodic/nonperiodic, even/odd, energy/power, deterministic / random, one-dimensional/multi-dimensional; commonly used signals (in continuous-time as well as in discrete-time): unit impulse, unit step, unit ramp (and their inter-relationships), exponential, rectangular pulse, sinusoidal; operations on continuous-time and discrete time signals (including transformations of independent variables).

Unit II **08**

Laplace-Transform (LT) and Z-transform (ZT): (i) One-sided LT of some common signals, important theorems and properties of LT, inverse LT, solutions of differential equations using LT, Bilateral LT, Regions of convergence (ROC) (ii) One sided and Bilateral Z-transforms, ZT of some common signals, ROC, Properties and theorems, solution of difference equations using one-sided ZT, s- to z-plane mapping

Unit III **08**

Fourier Transforms (FT): (i) Definition, conditions of existence of FT, properties, magnitude and phase spectra, Some important FT theorems, Parseval's theorem, Inverse FT, relation between LT and FT (ii) Discrete time Fourier transform (DTFT), inverse DTFT, convergence, properties and theorems, Comparison between continuous time FT and DTFT

Unit IV **08**

Systems: Classification, linearity, time-invariance and causality, impulse response, characterization of linear time-invariant (LTI) systems, unit sample response, convolution summation, step response of discrete time systems, stability. convolution integral, co-relations, signal energy and energy spectral density, signal power and power spectral density, properties of power spectral density,

Unit V **08**

Time and frequency domain analysis of systems: Analysis of first order and second order systems, continuous-time (CT) system analysis using LT, system functions of CT systems, poles and zeros, block diagram representations; discrete-time system functions, block diagram representation, illustration of the concepts of system bandwidth and rise time through the analysis of a first order CT low pass filter.

Text Books:

1. AV Oppenheim, A.S. Willsky and S. Hamid Nawab, 'Signals and Systems', Pearson Education,2016.
2. P. Ramakrishna Rao, `Signal and Systems'., Tata McGraw Hill, New Delhi,2013.
3. TK Rawat, "Signals and Systems", Oxford University Press.

Reference Books:

1. Chi-Tsong Chen, `Signals and Systems', 3rd Ed., Oxford University Press, 2004
2. BP Lathi, "Principals of Linear Systems and Signals", Oxford University Press.
3. Kishore S. Trivedi, "Probability & Statistics with Reliability Queuing and Computer Science Applications", Wiley Publication.

AS – 302/402
HUMAN VALUES AND ETHICS

L	T	P
3	0	0

Course Outcomes (COs):

- This course would help to assess ideas about ethics, self-exploration and happiness through reflective enquiry.
- It will aid in evaluating the prevailing problems in society due to differentiation and understanding the importance of human values in relationships.
- The course would lead to knowledge of the ideas of globalisation and the world as a nation, for a transformative world order.
- It will help in analysing ideas of leadership and creativity and using leadership qualities in day-to-day lives.
- It will augment an understanding of cross-cultural ethics and help students learn the art of resolving ethical dilemmas in business.

UNIT 1 **08**

Course Introduction

1. Understanding: Why humans are ethical, why they are not;
2. Understanding the need, basic guidelines, content and process for Value Education;
3. Self Exploration–what is it? – It's content and process;
4. 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration;
5. Right understanding of Relationship and Physical Facilities- the basic requirements for fulfilment of aspirations of every human being with their correct priority;
6. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario;
7. Method to fulfil the above human aspirations: understanding and living in harmony at various levels

UNIT 2 **08**

Understanding of Human Values and Ethics

1. Understanding the needs of Self ('I') and Body ('Me');
2. Understanding values in human-human relationship;
3. Meaning of Co-existence and Mutual Satisfaction;
4. Understanding Respect;
5. Understanding Comprehensive Human Goals;

UNIT 3 **08**

Effects of Holistic Harmony on Professional Ethics

1. World as a Nation;
2. Definitiveness of Ethical Human Conduct;
3. Basis for Humanistic Education and Humanistic Universal Order;
4. Competence in professional ethics:
    a) Ability to utilize the professional competence for augmenting universal human order;

b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,;
c) Ability to identify and develop appropriate technologies and management patterns for above production system;

5. Strategy for transition from the present state to Universal Human Order:
   a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers;
   b) At the level of society: as mutually enriching institutions and organizations;

UNIT 4 **08**

Effects of Holistic Personality for Success

1. Negotiation as a tool for success;
2. Leadership as an attribute of a successful Professional;
3. Managing Stress and Time;
4. Team Building--creating a harmonious environment with apathy to each other;
5. Understanding difference between evolution and revolution;

UNIT 5 **08**

Managing Relationship for Success

1. Understanding and valuing Cross-Cultural Ethics;
2. Managing Relationships (Networking), Personal Effectiveness and Self Leadership;
3. Theory of Constraints;
4. A Decision Making Model: Ethics as making decisions and choices;
5. Conflicts and Ethical Dilemmas;
6. Entrepreneurship and Ethics: A sense of business Ethics;
7. Pragmatic Behaviour of Business to its Colleagues/Competitors

Text Books:

1. Kazuo Ishiguro, 1989, *The Remains of the Day*, Faber and Faber
2. B. L. Bajpai, 2004, *Indian Ethos and Modern Management*. New Royal Book Co., Lucknow. Reprinted 2008;
3. Sussan George, 1976, *How the Other Half Dies*. Penguin Press, Reprint 1991;

Reference Books:

1. Amitabh Ghosh, 2008, *Sea of Poppies*. John Murray Publications.
2. R. K. Narayan, 1958, *The Guide*, Viking Press.
3. P. L. Dhar, R. R. Gour, 1990, *Science and Humanism*, Commonwealth Publishers;
4. R. R. Gaur, R. Sangal and G. P. Bagaria, 2010, A Foundation Course in Human Values and Professional Ethics, Excel Books.

Relevant movies and documentaries:

1. Story of Stuff (Documentary);
2. The Remains of the Day (Movie);
3. Pursuit of Happyness (Movie);
4. Fences (Movie);
5. Gifted (Movie)

AS – 303/ AS - 403
ENVIRONMENT AND ECOLOGY

L	T	P
3	0	0

Course Outcomes (COs):
After the completion of the course, students are expected to have the ability to:

- Get the information about environment, ecosystem and also about its functions like Food chain, Ecological pyramids etc.
- Get the complete information about EIA- Environmental Impact Assessment in which the student will get the knowledge about the projects and the process involved in getting the projects.
- Get the knowledge about the different types of resources like land, water, mineral and energy and also about the effects of environment by the usage of these resources. Also get the knowledge about the analysis of polluted water.
- Gain the knowledge about different types of pollution and their treatment techniques like waste water treatment, solid waste management etc.,
- Get the complete information about the all legal aspects of environment protection.

Unit I- Fundamentals of Environment & Ecology **08**
Definition, Scope & Importance and Need for public awareness.
Ecosystem- Definition, Energy flow in ecosystem, Ecological succession and Balanced ecosystem.
Effect of human activities on food, Shelter, Economic and social security.
Effect of human activities on environment - Agriculture, Housing, Industry, Mining and Transportation activities.
Basics of Environmental Impact, Assessment and Sustainable development.

Unit II- Natural Resources & Environmental Quality standard **09**
Water resources- Availability and quality aspects. Mineral resources, Material Cycle- Carbon, Nitrogen & Sulphur cycles, DO, BOD and COD.
Modern techniques used in analysis of Pollutants- Determination of disinfectants, Pesticides, Ambient Quality standards, Water quality parameters and standards, Turbidity, pH, Suspended solids and hardness,

Unit III- Environmental Pollution & Current Environmental issues **09**
Environmental Pollution-Definition, Causes, Effects and control measure of:

1. Air Pollution
2. Water Pollution
3. Soil pollution
4. Marine Pollution

Current environmental issues of importance: Population growth, Climate change & Global warming-effects, Urbanization, Cause of global warming, Acid rain. Ozone layer depletion- causes and effects on health, Control measures. Photochemical smog, Solid waste management, Waste water treatment.

Unit IV- Energy-Types , Sources and Uses **08**
Different types of energy, Conventional and nonconventional sources- Hydro-electric, Fossil fuel based, Nuclear, Solar, Biomass, Geothermal energy and Biogas. Hydrogen as alternative future source of energy.

Unit V- Environmental protection **06**
Role of Government, Legal aspects, Environment protection Act, Introduction to ISO 14000, Green building concept.

Text Books-

1. Environmental Studies- Dr. D. L. Manjunath, Pearson Education
2. Text book of Environment Science and Engineering- M. Anji Reddy- B S Publication
3. Elements of Environmental Science and Engineering- Dr. P. Meenakshi- Prentice-Hall of India Pvt Ltd, New Delhi, 2008.
4. Environment and Ecology- P.D. Sharma- Rastogi publication 2009.

Reference Books-

1. Principle of Environmental Science and Engineering- P. Venugopalan Rao, Prentice Hall of India.
2. Environmental studies- R. Rajagopalan- Oxford Publication-2005.

AS - 401
COMPUTER ORIENTED NUMERICAL TECHNIQUES

L	T	P
3	1	0

Course Outcomes (COs):

- Apply numerical methods to obtain the approximate solutions to the linear and non-linear transcendental and polynomial equations and find error.
- Identify numerical methods for various mathematical operations and tasks, such as interpolation formulae like forward, backward, and divided difference formulae.
- Apply the appropriate techniques for numerical differentiation and integration problems
- Design the numerical solution of initial value problems of the ordinary differential equations with implicit and explicit methods as appropriate
- Work numerically on the partial differential equations using different methods through of finite difference.

Unit I **08**

Problem solving on computer, Algorithms and flow charts.Introduction to numerical computing, approximations and errors in numerical computations, truncation and round off errors, propagation of errors.Root finding: Bisection method, regula-falsi method, iteration method, Newton Raphson method,Secant method, systems of nonlinear equations. Rate of convergence of iterative method.

Unit II **06**

Matrix algebra & solution of simultaneous linear algebraic equations: Gauss elimination, Gauss Jordan method, LU Decomposition, Jacobi method, Gauss Seidel method, SOR method, convergence of iterative methods. Tridiagonal systems and Thomas algorithm, Condition of a system and stability issues.

Unit III **10**

Interpolation and Extrapolation: Finite differences, Newton's forward and backward interpolation formula, Lagrange interpolation formula. Divided differences and Newton's formula.
Numerical differentiation. Numerical integration: Trapezoidal and Simpson's rules. Newton-Cotes integration formulas, Romberg integration, Gaussian quadrature.

Unit IV **08**

Numerical solution of O.D.E.: Taylor series method, Euler's method, Runge Kutta method.
Multistep method: Milne,s method, Adams method, accuracy, convergence criteria, stiffness.

Unit V **08**

Boundary Value problems: Finte difference method, solving eigenvalue problems, polynomial method and power method.
Numerical solution of Partial Differential equations. Elliptic, Parabolic and hyperbolic PDEs.

Text Books :

1. Jain, Iyengar and Jain, Numerical Methods for Scientific and Engineering Computation (2003), New Age International, New Delhi.
2. Grewal B.S., Numerical Methods in Engineering and Science, Khanna Publishers, Delhi.

3. E.Balagurusamy, Numerical Methods, Tata Mc Graw hill.

Reference Books :

1. Sastry, S.S. Introductory Methods of Numerical Analysis, 3rd ed. Prentice Hall of India, New Delhi (2002).
2. Schaum's Outlines: Numerical Analysis, 2nd ed. Tata Mc Graw Hill Publishing Co. Limited (1968).
3. Kandasamy, P. Thialagawathy, K. & Gumawathy, K. Numerical Method, S Chand & Company Ltd., New Delhi (1999)
4. Balaguruswanmy, E. Numerical Methods. Tata Mc Graw Hilll Publishing Co. Limited, New Delhi (2001)

EC 401
ELECTRONICS INSTRUMENTATION & MEASUREMENT

L	T	P
3	0	0

Course Outcomes (COs):

- Understand the basics of units, dimensions, standards, PMMC instrument and also various measurement errors.
- Analyze and design voltmeter circuits, AC electronic voltmeter, digital frequency meter and current measurement with electronic instruments.
- Understand various resistance and impedance measuring methods, Q-meter operation and will be able to evaluate balance condition in bridges.
- Understand and analyze fundamental operation of CRO and some special type of oscilloscopes like DSO, Sampling oscilloscope
- Apply calibration method to calibrate various instruments and will understand transducers.

Unit I **10**

Unit, dimensions and standards: Scientific notations and metric prefixes. SI electrical units, SI temperature scales, other unit systems, dimension and standards. Measurement Errors: Gross error, systematic error, absolute error and relative error, accuracy, precision, resolution and significant figures, Measurement error combination, basics of statistical analysis. PMMC instrument, galvanometer, DC ammeter, DC voltmeter, series ohm meter,

Unit II **08**

Transistor voltmeter circuits, AC electronic voltmeter, current measurement with electronic instruments, multimeter probes Digital voltmeter systems, digital multimeters and digital frequency meter system

Unit III **06**

Voltmeter and ammeter methods, Wheatstone bridge, low resistance measurements, low resistance measuring instruments AC bridge theory, capacitance bridges, Inductance bridges, Q meter

Unit IV **08**

CRO: CRT, wave form display, time base, dual trace oscilloscope, measurement of voltage, frequency and phase by CRO, Oscilloscope probes, Oscilloscope specifications and performance. Delay time based Oscilloscopes, Sampling Oscilloscope, DSO, DSO applications.

Unit V **08**

Instrument calibration: Comparison method, digital multimeters as standard instrument, calibration instrument Recorders: X-Y recorders, plotters and Transducers.

Text Books:

1. David A. Bell, “Electronic Instrumentation and Measurements”, Oxford University Press, New Delhi 2017.
2. H.S. Kalsi, “Electronic Instrumentation”,Mc Graw Hill Education, 2016.

Reference Books:

1. Oliver and Cage, “Electronic Measurements and Instrumentation”, TMH, 2009.
2. Alan S. Morris, “Measurement and Instrumentation Principles”, Elsevier (Buterworth Heinmann).
3. Banerjee, “Electrical and Electronics Measurements”, PHI Learning, 2017.
4. Oliver, “Electronic Measurements & Instrumentation”, McGraw Hill Education, 2017
5. Pukrait’ “Electrical & Electronics Measurements and Instrumentation”, McGraw Hill Education, 2017.
6. Joseph J.Carr, “Elements of Electronic Instrumentation and Measurement”, Pearson, 2017.

EC - 402
ELECTROMAGNETIC FIELD THEORY

L	T	P
3	0	0

Course Outcomes (COs):

- Apply different coordinate systems and their application in electromagnetic field theory, establish a relation between any two systems and also understand the vector calculus.
- Understand the concept of static electric field. Understand the concept of current and properties of conductors. Establish boundary conditions and to calculate capacitances of different types of capacitors
- Understand the forces due to magnetic field, magnetization, magnetic boundary conditions and inductors.
- Understand displacement current, time varying fields, propagation and reflection of EM waves and transmission lines.

Unit I: **08**

Coordinate systems and transformation: Cartesian coordinates, circular cylindrical coordinates, spherical coordinates. Vector calculus: Differential length, area and volume, line surface and volume integrals, del operator, gradient of a scalar, divergence of a vector and divergence theorem, curl of vector and Stake's theorem, Laplacian of a scalar.

Unit II: **10**

Electrostatics: Electrostatic fields, Coulombs law and field intensity, Electric field due to charge distribution, Electric flux density, Gausse's Law-Maxwell's equation, Electric dipole and flux lines, energy density in electrostatic fields.

Electric field in material space: Properties of materials, convection and conduction currents, conductors, polarization in dielectrics, dielectric constants, continuity equation and relaxation time, boundary condition. Electrostatic boundary value problems: Poisson's and Laplace's equations, general procedures for solving Poisson's or Laplace's equations, resistance and capacitance, method of images.

Unit III: **08**

Magnetostatics: Magneto-static fields, Biot-Savart's Law, Ampere's circuit law, Maxwell's equation, application of ampere's law, magnetic flux density-Maxwell's equation: Maxwell's equation for static fields, magnetic scalar and vector potential.

Magnetic forces, materials and devices: Forces due to magnetic field, magnetic torque and moment, a magnetic dipole, magnetization in materials, magnetic boundary conditions, inductors and inductances, magnetic energy.

Unit IV: **08**

Waves and applications: Maxwell's equation, Faraday's Law, transformer and motional electromotive forces, displacement current, Maxwell's equation in final form.

Electromagnetic wave propagation: Wave propagation in lossy dielectrics, plane waves in lossless dielectrics, plane wave in free spsce, plain waves in good conductors, power and the pointing vector, reflection of a plain wave in a normal incidence.

Unit V: **06**

Transmission lines: Transmission line parameters, Transmission line equations, input impedance, standing wave ratio and power The Smith chart, some applications of transmission lines.

Text Books:

1. M.N.O.Sadiku, "Elements of Electromagnetic" , 4th Ed, Oxford University Press.
2. Hayt, W.H. and Buck, J.A., "Electromagnetic Tata Mc. Graw Hill Publishing.

Reference Books:

3. Jordan E.C. and Balmain K.G., "Electromagnetic Wave and radiating Systems", Prentice Hall International, 2nd Edition.
4. Kraus, F. "Electromagnetic", Tata Mc. Graw Hill 5th Edition.
5. Ramo S, whinnery T.R. and Vanduzer T, "Field and Waves in Communication Electronics", John Wiely and Sons 3rd Edition.

COMPUTER ARCHITECTURE AND ORGANIZATION

L T P
3 0 0

Course Outcomes (COs):

- The student will conceptualize the basics of organizational and architectural issues of a digital computer.
- The student will learn and perform computer arithmetic operations on integer and real numbers.
- Student will analyze some of the design issues in terms of speed, technology, cost and performance.
- Student will get Exemplified in a better way the I/O and memory organization

Unit-I **09**

Functional units of digital system and their interconnections, buses, bus architecture and types of buses. Register, bus and memory transfer, Processor organization, general register organization and stack organization. Ripple carry adder/subtractor and look ahead carry adders. Multiplication: Signed operand multiplication, Booth's algorithm and array multiplier. Division and logic operations, , Arithmetic & logic unit design.

Unit-II **08**

Instruction types, formats, instruction cycles and sub cycles (fetch, execute etc), micro-operations, execution of a complete instruction, Hardwire and micro-programmed control: micro-programme sequencing, concept of horizontal and vertical microprogramming.

Unit-III **08**

Basic concept and hierarchy, semiconductor RAM memories, 2D & 2½ D memory organization. ROM memories, Cache memories: concept and design issues & performance, address mapping and replacement, Auxiliary memories: magnetic disks, magnetic tapes and optical disks, Virtual memory: concept & implementation.

Unit-IV **07**

Peripheral devices, I/O interface, I/O ports, Interrupts: interrupt hardware, types of interrupts and exceptions, Modes of Data Transfer: Programmed I/O, interrupt initiated I/O and Direct Memory Access., I/O channels and processors, Serial Communication: Synchronous & asynchronous communication, standard communication interfaces.

Unit-V **08**

Architectural Classification Schemes, Flynn's & Feng's Classification, Performance Metrics and Measures, Speedup Performance Laws, Pipelining and Memory Hierarchy Basic and Intermediate Concepts, Linear and Nonlinear Pipeline Processors, Optimization of Cache Performance.

Text Books:

1. William Stalling, "Computer Organization", PHI
2. M. Morris Mano, "Computer System Architecture", Pearson Learning
3. Vravice, Hamacher & Zaky, "Computer Organization", TMH

Reference Books:

1. Miles Murdocca, Vincent Heuring “Computer Architecture and Organisation: An Integrated Approch” 2nd Edition
2. Kai Hwang, “Advance Computer Architecture”, TMH
3. John P Hays, “Computer Organization”, McGraw Hill
4. Tannenbaum, “Structured Computer Organization”, PHI
5. P Pal Chaudhry, “Computer Organization & Design” PHI
6. Dezso and Sima, “Advanced Computer Architecture”, Pearson
7. Alan Clements “Computer Organization and Architecture” , Cengage Learning
8. Behrooz Parhami “Computer Architecture”, Oxford.
9. Patterson, “Computer Organization and Design” Elsevier Pub. 2009

NETWORK ANALYSIS AND SYNTHESIS

L	T	P
3	1	0

Course Outcomes (COs):

- Apply different network analysis and simplification theorems to dc and ac circuits and verify the solutions using modern tools for lifelong learning
- Solve network equations using classical methods and verify the solutions using modern tools for lifelong learning
- Apply Laplace Transformation technique for solution of network equations
- Calculate two port parameters and analyze network functions to decide stability of networks
- Define basic terms related with filters and design low pass/high pass passive filters
- Understand the method to find different type of network function and network function importance
- Understand different methods use foe network synthesis.

UNIT I **05**

Graph Theory:- Graph of a Network, definitions, tree, co tree , link, basic loop and basic cut set, Incidence matrix, cut set matrix, Tie set matrix Duality, Loop and Nodal methods of analysis.

UNIT II **07**

Network Theorems (Applications to AC networks):-Concept of linearity, and homogeneity Principle, Super-position theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem, Reciprocity theorem. Millman's theorem, compensation theorem, Tellegen's theorem.

UNIT III **07**

Network Functions:-Concept of Complex frequency, Transform Impedances, Network functions of one port and two ports networks, concept of poles and zeros, properties of driving point and transfer functions, time response and stability from pole zero plot.

UNIT IV **09**

Two Port Networks:-Characterization of LTI two port networks ZY, ABCD and h parameters, reciprocity and symmetry. Inter-relationships between the parameters, inter-connections of two port networks, Ladder and Lattice networks. T & Π Representation, Concepts of multi-port networks and their practical examples.

UNIT V **12**

Network Synthesis:-Positive real function; definition, properties and limitations; properties of LC, RC and RL driving point functions, synthesis of LC, RC and RL driving point immittance functions using Foster and Cauer first and second forms, similarities and dissimilarities between Foster's and Cauer's forms.

Filters: Image parameters and characteristics impedance, passive and active filter fundamentals, low-pass, high-pass, (constant K type) filters, and introduction to active filters.

Text Books:-

1. A.Chakrabarti, “Circuit Theory” Dhanpat Rai & Co.
2. C.L Wadhwa, “Network Analysis and Synthesis” New Age International Publishers.
3. N.C. Jagan and C. Lakshminarayana, “Newwork Analysis” B.S. Publications.

Reference Books:-

1. D.Roy Choudhary, “Networks and Systems” Wiley Eastern Ltd.
2. M.E. Van Valkenburg, “Network Analysis”, Prentice Hall of India
3. Donald E. Scott: “An Introduction to Circuit analysis: A System Approach” McGraw Hill.
4. M.E. Van Valkenburg, “An Introduction to Modern Network Synthesis”,Wiley Eastern Ltd.

EC - 501
PRINCIPLES OF COMMUNICATION ENGINEERING

L	T	P
3	1	0

Course Outcomes (COs):

- Basic concept of communication Systems, Amplitude Modulation (AM) and Demodulation Techniques.
- Angle Modulation (FM & PM), Generation and Reception Methods.
- Pulse modulation techniques, their generation and reception.
- Different multiplexing techniques
- Noise analysis in communication systems.

Unit-I

Introduction: Overview of Communication system, communication channels, need for modulation, base band and pass band signals. Amplitude Modulation : Double side band with carrier (DSB-C), double side band without carrier, single side band modulation, DSB-SC, DSB-C, SSB modulators and demodulators, vestigial side band (VSB), quadrature amplitude modulator. **08**

Unit-II

Angle modulation, modulation index, pre-emphasis & de-emphasis, tone modulated FM signal, arbitrary modulated FM signal, FM modulators, direct method & indirect method and demodulators, PLL, phase discriminator & ratio detector, PM modulator and demodulator, stereophonic FM broadcasting. **08**

Unit-III

Pulse Modulation Digital Transmission of Analog Signals: Sampling theorem and its applications, pulse amplitude modulation (PAM), pulse width modulation, pulse position modulation, their generation and demodulation, digital representation of analog signals. Pulse Code Modulation (PCM) and PCM system. Issues in Digital Transmission: Frequency division multiplexing, time division multiplexing ,line coding and their power spectral density. **08**

Unit-IV

Differential pulse code modulation, delta modulation. adaptive delta modulation, T1 digital system, TDM hierarchy, Noise in Amplitude Modulation: Analysis, signal to noise ratio, figure of merit, noise in frequency modulation. **08**

Unit-V

Noise: Types of noise and their sources, noise calculation, noise due to several amplifiers in cascade, noise in reactive circuits, noise figure & noise temperature calculation. **08**

Text Book:

1. H. Taub, D. Schilling, GoutomSaha, "Principles of Communication Systems", 4th Edition, TataMcGraw-Hill Publishing Company Ltd.
2. R.P. Singh, & S.D Sapre, "Communication Systems: Analog & Digital", 3rd Edition McGraw Hill Education.

3. B.P. Lathi, “Modern Digital and Analog communication Systems”, 3rd Edition, Oxford University Press,2009.

Reference Books:

1. G. Kennedy, B. Devis, S. R. M. Prasanna, “Electronic Communication Systems” 5th Edition, Tata McGraw-Hill Publishing Company Ltd.
2. Simon Haykin, “Communication Systems”,4th Edition, Wiley India.
3. H. Hsu & D. Mitra , “Analog and Digital Communications”, 2nd Edition, Tata McGraw-Hill Publishing Company Ltd.

EC - 502
MICROPROCESSORS AND MICROCONTROLLERS

L	T	P
3	1	0

Course Outcomes (COs):

The student will be able to

- Gain knowledge between different types of number systems, and their conversions.
- Design various logic gates and simplify Boolean equations.
- Design various flip flops, shift registers and determining outputs.
- Analyze, design and implement combinational logic circuits, e.g. design different types of counters.
- Classify different semiconductor memories.

UNIT I

8085 MICROPROCESSOR: Introduction to microprocessor, microprocessor architecture and its operations, address / data bus multiplexing and demultiplexing. Status and control signal generation, instruction set of 8085 microprocessor, classification of instructions, addressing modes, timing diagram of the instruction. **08**

UNIT II

Hardware Interfacing with 8085: Methods of data Transfer and Interrupts of 8085 microprocessor: Classification of interrupts, programming using interrupts, direct memory access, serial and parallel data transfer, interfacing of memory chips with 8085 microprocessor, interfacing of 8085 with 8155/8156 (RAM), 8355/8755 (ROM). Interfacing of programmable devices with 8085 microprocessor, 8279 programmable keyboard/display interface, 8255A programmable parallel interface, 8254 programmable interval timer, 8259A programmable interrupt controller, assembly language programming. **08**

UNIT III

16-bit low power MCU MSP430: Introduction to microcontrollers and embedded systems, Von Neumann (Princeton) and Harvard architecture, RISC and CISC machine. Introduction to MSP430: Architecture, programming techniques, addressing modes, programming system registers and configuration I/O ports pull up/down registers concepts. **08**

UNIT IV

Configuring Peripherals in MSP430: External interrupts and software interrupt, interrupt programming, watchdog timer, clock tree in MSP430, timer/ counter interrupt, programming MSP430 timer, counter programming, real time clock (RTC), PWM control, timing generation and measurements. **08**

UNIT V

Serial Communication Interfaces in MSP430: Basics of serial communication, mode of serial communication, RS232, serial communication issue, serial port programming. Implementing and programming UART, I2C, SPI interface using MSP430, interfacing external devices, external memory, keyboards, display devices, DAC/ADC, DC motor, stepper motor and servomotor.

08

Text Books:

1. Ramesh Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", Penram International Publication (India) Pvt. Ltd.
2. DV Hall, "Microprocessors Interfacing", Tata McGraw Hill Publication.
3. N. Senthil Kumar, M. Saravanan, S. Jeevananthan, "Microprocessors and Microcontrollers", Oxford University Press Publication.
4. A.Nagoor Kani, "Microprocessors and Microcontrollers", McGraw Hill Publication.

Reference Books:

1. AK Roy & KM Bhurchandi, "Advance Microprocessor and Peripherals (Architecture, Programming & Interfacing)", Tata McGraw Hill Publication.
2. http://processors.wiki.ti.com/index.php/MSP430_16-Bit_UltraLow_Power_MCU_Training
3. http://processors.wiki.ti.com/index.php/MSP430_LaunchPad_Low_Power_Mode.

EC - 503
INTEGRATED CIRCUITS

L	T	P
3	1	0

Course Outcomes (COs):

- Student will understand the concepts of current mirror and analyze the op-amp 741 circuit.
- Student will able to understand the operation of various linear and nonlinear op-amp base circuits.
- Student will get knowledge about working of IC 555 timer of PLL and its applications.
- Course create background in digital integrated circuit design.

Unit I

Analog Integrated Circuit Design: an overview : Current mirrors using BJT and MOSFETs, simple current mirror, base current compensated current mirror, Wilson and Improved Wilson current mirrors, Widlar current source and cascode current mirror .

The 741 IC Op-Amp : Bias circuit, short circuit protection circuitry, the input stage, the second stage, the output stage, and device parameters. DC Analysis of 741: Small signal analysis of input stage, the second stage, the output stage; gain, frequency response of 741. **08**

Unit II

Linear Applications of IC op-amps : An overview of Op-Amp (ideal and non ideal) based circuits V-I and I-V converters, generalized impedance converter, simulation of inductors filters, first and second order LP, HP, BP BS and all pass active filters and State Variable Biquad filters; Sinusoidal oscillators. **08**

Unit III

Non-Linear applications of IC Op-amps : Log–Anti Log amplifiers, precision rectifiers, peak detectors, sample and hold circuits, analog multipliers and their applications. Op-amp as a comparator, zero crossing detector, Schmitt Trigger, astable multivibrator, monostable multivibrator, generation of triangular waveforms, D/A & A/D converter. **08**

Unit IV

Integrated Circuit Timer : The 555 circuit, implementing a monostable multivibrator, astable multivibrator, VCO, Schmitt Trigger circuit using the 555 IC. Phase locked loops (PLL): Ex-OR gates and multipliers as phase detectors, block diagram of IC PLL, working of PLL and applications of PLL,D/A and A/D converters. **08**

Unit-V

Digital Integrated Circuit Design-An Overview : CMOS Logic Gate Circuits: Basic structure CMOS realization of inverters. AND, OR, NAND and NOR Gates Latches and Flip flops: The latch, the SR flipflop, CMOS implementation of SR flip-flops, a simpler CMOS implementation of the clocked SR flipflop, D flip-flop circuits. **08**

Text Book :

[1] Sedra and Smith, “Microelectronic Circuits”, 4th Edition, Oxford University Press.
[2] Michael Jacob, “Applications and Design with Analog Integrated Circuits”, PHI.
[3] D. Roy Choudhary, “ linear Integrated Circuit” PHI

Reference Books :

[1] Jacob Milliman and Arvin Grabel, “Microelectronics”, 2nd Edition, TMH.
[2] A. K. Maini, Analog Circuits, Khanna Publishing House, Delhi.

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EC – 504
ANTENNA & WAVE PROPAGATION

L	T	P
3	0	0

Course Outcomes (COs):

- Demonstrate the knowledge of antenna fundamentals.
- Radiation patterns of different antenna arrays.
- Express the basic concepts of ground, space, sky wave propagation mechanisms.
- Analyze and design rule of different types of basic antennas and their measurements.

Unit-I

Antennas Basics: Introduction, Basic antenna parameters, Patterns, Beam area (or beam solid angle) ΩA, Radiation intensity, Beam efficiency, Directivity D and gain G, Directivity and resolution, Antenna apertures, Effective height, The radio communication link, Fields from oscillating dipole, Single-to-noise ratio (SNR), Antenna temperature, Antenna impedance. **08**

Unit-II

Point sources and their arrays introduction, Point source, Power theorem and its application to an isotropic source, Radiation intensity, Arrays of two isotropic point sources, No isotropic but similar point sources and the principle of pattern multiplication, Pattern synthesis by pattern multiplication, Linear arrays of n isotropic point sources of equal amplitude and spacing, Linear broadside arrays with no uniform amplitude distributions. Electric dipoles, Thin liner antennas and arrays of dipoles and apertures the short electric dipole, The fields of a short dipole, Radiation resistance of short electric dipole, Thin linear antenna, Radiation resistance of λ/2 antenna, Array of two driven λ/2 elements: Broadside case and end-fire case, Horizontal antennas above a plane ground, Vertical antennas above a plane ground, Yagi-Uda antenna design, Long-wire antennas, Folded dipole antennas. **08**

Unit-III

The Loop Antenna: Design and its characteristic properties, Application of loop antennas, Far field patterns of circular loop antennas with uniform current, Slot antennas, Horn antennas, Helical antennas, The log-periodic antenna, Micro strip antennas. **08**

Unit-IV

Reflector Antennas: Flat sheet reflectors, Corner reflectors, The parabola-general properties, A comparison between parabolic and corner reflectors, The paraboloidal reflector, Patterns of large circular apertures with uniform illumination, Reflector types (summarized), Feed methods for Parabolic reflectors, Antenna measurements introduction, Antenna measurement ranges, Radiation pattern measurements, Gain and directivity measurements. **08**

Unit-V

Ground wave propagation plane earth reflection, Space wave and surface wave, Space wave propagation introduction, Field strength relation, Effects of imperfect earth, Effects of curvature of earth, Sky wave propagation introduction structural details of the ionosphere, Wave propagation mechanism, Refraction and reflection of sky waves by ionosphere, Ray path, Critical frequency, MUF, LUF, OF, Virtual height and skip distance, Relation between MUF and the skip distance, Multi-hop propagation. **08**

Text Book:

1. John D Krauss, Ronald J Marhefka and Ahmad S. Khan,"Antennas and Wave Propagation", FourthEdition, Tata McGraw Hill, 2010 Special Indian Edition.

2. A. Das, Sisir K. Das, “Microwave Engineering”, Tata McGraw Hill.

Reference Books:

1. A .R. Harish, M. Sachidananda, “Antennas and Wave Propagation”, Oxford University Press, 2009.
2. Jordan Edwards C. and Balmain, Keith G.“Electromagnetic Waves and Radiating Systems”, PHI.

EC – 505
ANALOG SIGNAL PROCESSING

L	T	P
3	0	0

Course Outcomes (COs):

- Student will get knowledge about various building blocks in analog circuits.
- Course create the background in analog filter design.
- Student will able to realize analog circuits that are suitable for integrated circuit implementation.

Unit-I

Introduction to domains and the analogue/digital trade off, Introduction to current conveyor, current feedback amplifier.

Analog signal filtering: introduction to bilinear transfer functions and active realizations. Second-order filter realization, filter design parameters (Q and ω_0), frequency response, Three op-amp biquad, effect of finite gain of op-amp over filters, Sallen-Key biquad. **08**

Unit-II

Ideal low-pass filter, Buttreworth and Chebyshev magnitude response, pole locations, low-pass filter specifications, comparison of Maximally flat and Equal ripple responses. **08**

Unit-III

Delay equalization: equalization procedures, equalization with first-order and second order modules, strategies for equalization design. Definition of Bode sensitivity. **08**

Unit-IV

The General Impedance Convertor (GIC), optimal design of the GIC, realization of simple ladders, Gorski-Popiel's Embedding Technique, Bruton's FDNR technique. **08**

Unit-V

Elementary transconductorbuilding blocks, resistors, integrators, amplifiers, summers, Gyrator, First and second order filters, Higher order filters. **08**

Text Books :

1. Ramon Pallas-Areny, John G. Webster, "Analog Signal Processing", John Wiley& Sons
2. R. Schaumann and M. E. Valkenberg, "Design of Analog Circuits", Oxford University Press.

Reference Books :

1. Alok Barua, "An Analog Signal Processing: Analysis & Synthesis", John Wiley& Sons.
2. Razavi, Behzad ,"Design of Analog CMOS integrated circuits", Tata McGraw-Hill

EC - 601
MICROWAVE ENGINEERING

L	T	P
3	1	0

Course Outcomes (COs):

- Explain different types of waveguides and their respective modes of propagation
- Explain working of microwave passive circuits such as isolator, circulator, Directional couplers, attenuators etc.
- Describe working of microwave tubes and solid state devices.
- Perform measurements on microwave devices and networks using power meter.

Unit-I

Rectangular Wave Guide: Field Components, TE, TM Modes, Dominant TE10 mode, Field Distribution, Power, Attenuation. Circular Waveguides: TE, TM modes. Wave Velocities, Micro strip Transmission line(TL), Coupled TL, Strip TL, Coupled Strip Line, Coplanar TL, Microwave Cavities. **08**

Unit-II

Passive microwave devices: Scattering Matrix, Microwave Hybrid Circuits, Terminations, Attenuators, Phase Shifters, Directional Couplers: Two Hole directional couplers, S-Matrix of a Directional coupler, Hybrid Couplers, Microwave Propagation in ferrites, Faraday Rotation, Isolators, Circulators, S-parameter analysis of all components. **08**

Unit-III

Microwave Tubes: Limitation of Conventional active devices at microwave frequency, Two Cavity Klystron, Reflex Klystron, Magnetron, Traveling wave tube, Backward wave oscillators, Gyro Devices: Their schematic, Principle of operation, Performance characteristic and their applications. **08**

Unit-IV

Solid state amplifiers and oscillators: Microwave Bipolar Transistor, Microwave tunnel diode, Microwave Field-effect Transistor, Transferred electron devices, Avalanche Transit –time devices: IMPATT diode, TRAPPAT diode, BARITT diode. **08**

Unit-V

Microwave Measurements: General set up of a microwave test bench, Slotted line carriage, VSWR Meter, microwave power measurements techniques, Crystal Detector, frequency measurement, wavelength measurements, Impedance and Refection coefficient, VSWR, Insertion and attenuation loss measurements, EM radiation & measurement. **08**

Text Books :

1. Samuel Y. Liao, "Microwave Devices and Circuits", 3rd Ed, Pearson Education.
2. A. Das and S. K. Das, "Microwave Engineering", TMH.3rd Edition.
3. G. S. Raghuvanshi, "Microwave Engineering", Cengage

Reference Books :

1. R.E Collin, "Foundation for Microwave Engineering ", 2nd Ed., John Wiley India.
2. Om P. Gandhi, Microwave Engineering and Applications; Pergamon Press.

EC - 602
DIGITAL COMMUNICATION

L	T	P
3	1	0

Course Outcomes (COs):

- To demonstrate the concepts involved in digital communication.
- To formulate basic statistics involved in communication theory.
- To explain the concepts of digital modulation schemes.
- To analyze the performance of digital communication systems.
- To apply the concept of information theory in digital systems.

Unit-I

Digital Data transmission, Line coding review, Pulse shaping, Scrambling, Digital receivers, Eye diagram, Digital carrier system, Method of generation and detection of coherent & non-coherent binary ASK, FSK &PSK, Differential phase shift keying, quadrature modulation techniques. (QPSK and MSK),M-ary Digital carrier Modulation. **08**

Unit-II

Concept of Probability, Random variable, Statistical averages, Correlation, Sum of Random Variables, Central Limit Theorem, Random Process, Classification of Random Processes, Power spectral density, Multiple random processes. **08**

Unit-III

Performance Analysis of Digital communication system: Optimum linear Detector for Binary polar signaling, General Binary Signaling, Coherent Receivers for Digital Carrier Modulations, Signal Space Analysis of Optimum Detection, Vector Decomposition of White Noise Random processes, General Expression for Error Probability of optimum receivers. **08**

Unit-IV

Spread spectrum Communications : Frequency Hopping Spread Spectrum (FHSS) systems, Direct Sequence Spread Spectrum, Code Division Multiple Access of DSSS, Multiuser Detection, OFDM Communications.

Introduction to information theory : Measure of Information, Source Encoding, Error Free Communication over a Noisy Channel capacity of a discrete and Continuous Memory less channel. **08**

Unit-V

Error Correcting codes : Hamming sphere, hamming distance and Hamming bound, relation between minimum distance and error detecting and correcting capability.

Linear block codes : encoding & syndrome decoding; Cyclic codes, encoder and decoders for systematic cycle codes; convolution codes, code tree & Trellis diagram, Viterbi and sequential decoding. **08**

Text Book :

1. B.P. Lathi, "Modern Digital and Analog communication Systems", 4th Edition, Oxford University Press, 2010.
2. Simon Haykin, " Digital Communication" John Wiley & Sons.
3. John G. Proakis, "Digital Communications", 4th Edition, McGraw-Hill International

Reference Book :

1. R.N. Mutagi, “Digital Communication” Oxford University Press.
2. Dennis Roddy and John Coolen, “ Electronics Communication” PHI
3. Bernard Sklar and Pabitra Kumar Ray, “ Digital Communication” Pearson.

EC - 603
CONTROL SYSTEM

L	T	P
3	1	0

Course Outcomes (COs):

- Understand and differentiate the basics of linear time-invariant control system.
- Understand and analyze feedback characteristics of linear control system to reduce the disturbance.
- Understand and analyze time response of first and second order control systems for different standard test signals.
- Perform frequency domain analysis of linear control system using bode plot and nyquist stability criterion

Unit-I

Basic Components of a control system, Feedback and its effect, types of feedback control systems. Block diagrams Reduction and signal flow graphs. Modeling of Physical systems: electrical networks, mechanical systems elements, equations of mechanical systems, sensors and encoders in control systems, DC motors in control systems. **08**

Unit-II

Time domain Analysis of Control Systems: Time response of continuous data systems, typical test signals for the time response of control systems, the unit step response and time-domain specifications, Steady-State error, time response of a first order system, transient response of a prototype second order system. **08**

Unit-III

Stability of Linear Control Systems: Bounded-input bounded-output stability continuous data systems, zero-input and asymptotic stability of continuous data systems, Routh Hurwitz criterion. Root-Locus Technique: Introduction, Properties of the Root Loci, Design aspects of the Root Loci. **08**

Unit-IV

Frequency Domain Analysis: Mr (resonant peak) and ωr (resonant frequency) and bandwidth of the prototype Second order system, effects of adding a zero to the forward path, effects of adding a pole to the forward path, Polar Plot, Nyquist stability criterion, relative stability: gain margin and phase margin, stability analysis with the Bode plot. **08**

Unit-V

State-Variable Analysis: Vector matrix representation of state equation, state transition matrix, state-transition equation, relationship between state equations and high-order differential equations, relationship between state equations and transfer functions. Similarity Transformation, Decomposition of transfer functions, Controllability and Observability. **08**

Text Book :

1. B.C. Kuo & Farid Golnaraghi, "Automatic Control Systems", 8th Edition, John Wiley India, 2008.
2. I. J. Nagrath& M. Gopal, "Control System Engineering", New Age International Publishers.

Reference Books :

1. A. Ambikapathy, Control Systems, Khanna Publishing House, Delhi.

2. Joseph J. Distefano III, Allen R. Stubberud, Ivan J. Williams, “Control Systems” Schaums Outlines Series, 3rdEdition, Tata McGraw Hill, Special Indian Edition 2010.
3. William A. Wolovich, “Automatic Control Systems”, Oxford University Press, 2011.

EC – 604
DIGITAL SIGNAL PROCESSING

L	T	P
3	0	0

Course Outcomes (COs):

- Understand and realize different types of realizations of digital systems (IIR and FIR) and their utilities.
- Formulate the design parameters of analog IIR digital filters (Butterworth and Chebyshev filters) and various methods such as impulse invariant transformation and bilinear transformation of conversion of analog to digital filters.
- Analyze different types of window functions used for the design of FIR filters.
- Understand the principle of discrete Fourier transform & its various properties and concept of circular and linear convolution

Unit-I

Digital Signal & System: Introduction to DSP, Representation of Digital Signal, Basic Sequences, Representation of Arbitrary Sequences, Linear Shift Invariant System, stability & causuality, Sampling, Frequency Domain Concept of Digital Signal. **08**

Unit-II

Realization of Digital Systems : Introduction, direct form realization of IIR systems, cascade realization of an IIR systems, parallel form realization of an IIR systems, Ladder structures: continued fraction expansion of H(z), example of continued fraction, realization of a ladder structure, FIR Filter Realization: Direct & Cascade, FIR Linear Phase Realization. **08**

Unit-III

Design of Infinite Impulse Response Digital Filters : Introduction to Filters, Impulse Invariant Transformation, Bi-Linear Transformation, All- Pole Analog Filters: Butterworth and Chebyshev, Design of Digital Butterworth and Chebyshev Filters. **08**

Unit-IV

Finite Impulse Response Filter Design: Windowing and the Rectangular Window, Other Commonly Used Windows, Examples of Filter Designs Using Windows, The Kaiser Window. **08**

Unit-V

Discrete Fourier Transforms : Definitions, Properties of the DFT, Circular Convolution, Linear Convolution.

Fast Fourier Transform Algorithms: Introduction, Decimation–In Time(DIT) Algorithm, Computational Efficiency, Decimation in Frequency(DIF) Algorithm. **08**

Text Books :

1. Johnny R. Johnson, "Digital Signal Processing", PHI Learning Pvt Ltd.
2. S. Salivahanan, " Digital Signal Processing", Mc Graw Hill Education.
3. A.Anand Kumar, "Digital Signal Processing"PHI.

Reference Books :

1. John G Prokias, Dimitris G Manolakis, "Digital Signal Processing", Pearson Education.
2. Oppenheim & Schafer, " Digital Signal Processing" PHI.

EC - 6051
DATA COMMUNICATION NETWORKS

L	T	P
3	0	0

Course Outcomes (COs):

- Identify the issues and challenges in the architecture of a computer network.
- Understand the ISO/OSI seven layers in a network.
- Realize protocols at different layers of a network hierarchy.
- Recognize security issues in a network.

Unit-I

Introduction to Networks & Data Communications The Internet, Protocols & Standards, Layered Tasks, OSI Model, TCP / IP, Addressing, Line Coding Review, Transmission Media: Guided and unguided Media Review. **08**

Unit-II

Switching: Datagram Networks, Virtual Circuit Networks, Structure of a switch ,Ethernet Physical Layer, Data Link Layer: Error detection and Correction Data Link Control: Framing, Flow and Error Control Protocols, Noiseless Channel and Noisy Channel Protocol, HDLC, Point-to-Point Protocol. **08**

Unit-III

Multiple Access: RANDOH, CDMA, CSMA/CD, CSMA/CA, Controlled Access, Channelization Wired LANs: IEEE Standards, Standard Ethernet, Fast Ethernet, Gigabit Ethernet, Wireless LAN IEEE 802.11, Bluetooth IEEE 802.16. **08**

Unit-IV

Network Layer :Design Issues. Routing Algorithms. Congestion control Algorithms.IPV4 Addresses, Connecting Devices, Virtual LAN IPV6Addresses, Internet Protocol, Hardware Addressing versus IP Addressing,IP Data Gram. **08**

Unit-V

Transport Layer Protocol : UDP and TCP, ATM, Cryptography, Network Security.
Application Layer: File Transfer, Access and Management, Electronic mail, Virtual Terminals, Other application. **08**

Text Books :

1. B. A. Forouzan, "Data Communication and Networking", TMH.
2. W. Stallings, “Data and Computer Communication”, Macmillan Press.

Reference Books:

1. A.S. Tanenbaum, “Computer Networks”, PHI.
2. S. Keshav, “An Engineering Approach on Computer Networking”, Addison Wesley.

EC – 6052
ADVANCED SEMICONDUCTOR DEVICES

L	T	P
3	0	0

Course Outcomes (COs):

- Identify the issues and challenges in the architecture of a computer network.
- Understand the ISO/OSI seven layers in a network.
- Realize protocols at different layers of a network hierarchy.
- Recognize security issues in a network.

Unit-I

Physics of Semiconductors, P-N Junction Diode and BJT: Introduction, Crystal Structure, Phonon, Optical, and Thermal Properties, p-n Junctions–Junction Breakdown, Transient Behavior and Noise Terminal Functions.BJT: Static Characteristics, Microwave Characteristics, Related Device Structures, Heterojunction Bipolar Transistor. **08**

Unit-II

MOSFET, Hetero-Junctions and Basics of Nanostructures: MOSFET: Basic Device Characteristics, Nonuniform Doping and Buried Channel Device, Device Scaling and Short-Channel Effects, MOSFET Structures, Circuit Applications, Single Electron Transistor, JFETs.
Hetero-junctions: Metal-Semiconductor Contacts, Metal-Insulator-Semiconductor Capacitors, MESFETs. **08**

Unit-III

TUNNEL Devices and IMPATT Diodes: TUNNEL DEVICES: Tunnel Diode, Related Tunnel Devices, Resonant Tunneling Diode.

IMPATT Diodes: Static Characteristics, Dynamic Characteristics, Power and Efficiency Noise Behaviour, Device Design and Performance, BARITT Diode. **08**

Unit-IV

Power devices, Photonic devices: Transferred-Electron and Real-Space-Transfer Devices Thyristors, Power Devices.
Photonic Devices and Sensors: Radiative Transitions, Light-Emitting Diode (LED), Laser Physics, Laser Operating Characteristics. **08**

Unit-V

Photodetectors, Solar Cells and Sensors: Photodiodes, Avalanche Photodiode and Phototransistor, Charge-Coupled Device (CCD), Metal- Semiconductor-Metal Photo detector, Quantum-Well Infrared Photo detector, Solar Cell. Sensors: Thermal Sensor, Mechanical Sensors, Magnetic Sensors and Chemical Sensors. **08**

Text Book :

1. M.S. Tyagi, "Introduction To Semiconductor Materials And Devices", John Willy-India Pvt. Ltd.
2. S. M. Sze, "Physics of Semiconductor Devices", 2ndEdition, John Willy-India Pvt. Ltd.

Reference Books :

1. B. G. Streetman and S. Banerjee, "Solid state electronics devices", 5thEdition, PHI.
2. A.K. Maini, All in One Electronics Simplified, Khanna Publishing House, Delhi.

EC – 6053
ADVANCE DIGITAL DESIGN USING VERILOG

L	T	P
3	0	0

Course Outcomes (COs):

- Describe mixed logic circuits and their implementation.
- Implement combinational circuits using mixed logic and Verilog.
- Design sequential circuits using mixed logic and Verilog with mapping of Algorithm.
- Understand faults and its elimination in sequential and combinational circuits.
- Understand the working of programmable logic families.

Unit I

Introduction to Mixed Logic, Logic Representation and Minimization with cost, Multiple output minimization, Entered Variable K-Map including don't care handling, XOR Pattern Handling. **08**

Unit II

Combinational Circuit Design, Multiplexers, Decoders, Encoders, Code Comparators, Adders, Subtractors, Multipliers, Introduction to Verilog, Behavioral and Structural specification of logic circuits, Boolean function implementation using Verilog, Timing Analysis, Hazard Detection and Elimination. **08**

Unit III

Synchronous Sequential Circuits Design, Mapping Algorithm, Synchronous State Machines, ASM Charts, Asynchronous Sequential Circuit Design, Races, Multi-level minimization and optimization. **08**

Unit IV

Factoring, Decomposition, BDD, Ordered BDD, LPDD, Fault Detection and Analysis in combinational and sequential systems, Path Sensitization method, Boolean Difference Method, Initial State Method**.** **08**

Unit V

Study of programmable logic families, PLD, CPLD, FPGA, ASIC, PLA, Architectures, Design of Combinational and sequential circuits using CPLD and FPGA, Design Examples. **08**

Text Books:

1. Richard F. Tinder, "Engineering Digital Design", Academic Press.
2. Parag K. Lala, "Digital system Design Using PLDs", PHI India Ltd.
3. Stephen Brown and Zvonko Vranesiv, "Fundamental of Digital Logic with Verilog Design", Tata McGraw Hill.

Reference Books:

1. John Williams, "Digital VLSI Design with Verilog", Springer Publication.
2. Eugene Fabricius, "Modern Digital Design and Switching Theory", CRC Press.
3. Samuel C. Lee, "Digital Circuit and Logic Design", PHI India Ltd.

EC – 5054
DIGITAL SYSTEM DESIGN USING VHDL

L	T	P
3	0	0

Course Outcomes (COs):

- Write structural, behavioral and data flow models for digital circuits.
- Analyze combinational and sequential circuits and simulate using VHDL.
- Knowledge of VHDL operators, types and attributes.
- Characterization of VHDL signal models, sequential and concurrent assignments.
- Design of memories and its testing.

Unit I

Introduction to VHDL, reserve words, structures, modeling, objects, data type and operators, sequential statements and processes, sequential modeling and attributes, conditional assignment, concatenation and case array loops and assert statements, subprograms. **08**

Unit II

Digital System Design Automation– Abstraction Levels, System leveldesign flow, RTL design flow, VHDL. RTL Design with VHDL – Basic structures of VHDL, Combinational circuits, Sequential circuits, Writing Test benches, Synthesis issues, VHDL Essential Terminologies VHDL Constructs for Structures and Hierarchy Descriptions – Basic Components, Component Instantiations, Iterative networks, Binding Alternatives, Association methods, generic Parameters, Design Configuration. **08**

Unit III

Concurrent Constructs for RT level Descriptions – Concurrent Signal Assignments, Guarded signal assignment Sequential Constructs for RT level Descriptions – Process Statement, Sequential WAIT statement, VHDL Subprograms, VHDL library Structure, Packaging Utilities and Components, Sequential Statements. VHDL language Utilities - Type Declarations and Usage, VHDL Operators, Operator and Subprogram overloading, Other TYPES and TYPE–related issues, Predefined Attributes. **08**

Unit IV

VHDL Signal Model – Characterizing hardware languages, Signal Assignments, Concurrent and Sequential Assignments, Multiple Concurrent Drivers Standard Resolution. **08**

Unit V

Hardware Cores and Models - Synthesis rules and styles, Memory and Queue Structures, Arithmetic Cores, Components with Separate Control and Data parts.
Core Design Test and Testability - Issues Related to Design Test, Simple Test benches. **08**

Text Books:

1. Z. Navabi, “VHDL-Modular Design and Synthesis of cores and Systems”, TMH.
2. R.D.M. Hunter, T. T. Johnson, “Introduction to VHDL” Spriger Publication.

Reference Books:

1. Douglas Perry, “VHDL- Programming by examples”, McGraw Hill Publication.
2. C. H. Roth, “Digital System Design using VHDL”, PWS Publishing.

EC-701
MOBILE AND WIRELESS COMMUNICATION

L	T	P
3	1	0

Course Outcomes (COs):

- Familiarize with various generations of mobile communications.
- Understand the concept of cellular communication.
- Understand the basics of wireless communication.
- Understand GSM mobile communication standard, its architecture, logical channels, advantages and limitations.
- Gain knowledge of IS-95 CDMA mobile communication standard, its architecture, logical channels, advantages and limitations

Unit I: 08

Cellular System Fundamentals: Overview of Wireless Communication; Frequency Reuse and Cellular Concept; Co-Channel and Adjacent Channel Interferences; Cell Sectoring and Cell Splitting; Handoff Strategies; Channel Assignment Techniques.

Unit II: 08

Propagation Modelling: Propagation Path Loss; Shadowing; Path Loss Models; Multipath Fading; Narrowband Fading Models: Correlation and Power Spectral Density, Envelope and Power Distribution, Level Crossing Rate and Average Fade, Wideband Channel Models: Power Delay Profile, Coherence Bandwidth, Doppler Power Spectrum and Channel Coherence Time.

Unit III: 08

Modulation and Multiple Access Techniques: Performance of Digital Modulation over Wireless Channel; Diversity Techniques; Multiple Access Techniques: Frequency Division Multiple Access, Time Division Multiple Access, Code Division Multiple Access, Orthogonal Frequency Division Multiple Access, Hybrid Techniques

Unit IV: 08

Wireless Systems and Standards: Global System for Mobile Communications (GSM); CDMA Cellular System; Evolution of 2G, 3G, 4G Systems and Beyond; Wireless Local Area Network Technology; IEEE 802.11 Standards.

Unit V: 08

Introduction to Mobile Adhoc Networks, Mobile data networks, Introduction to Wireless Networks, Traffic Routing in wireless network, wireless data services, common channel signaling.

Text Books:

1. J. Schiller, , "Mobile Communication", Pearson Education, 2nd Ed.
2. T. S. Rappaport, *Wireless Communications: Principles and Practic*e, Pearson Education India, 2002.
3. R. Pandya, "Mobile and personal communication system", PHI.

Reference Books:

1. T. L. Singal, "Wireless Communications", McGraw Hill Publications.
2. A. S. Goldsmith, Wireless Communications, Cambridge University Press, 2005.
3. M. Richharia, , "Mobile Satellite communications", Pearson Education
4. W.C.Y. Lee, "Mobile Communication Engineering", McGraw-Hill

5. J.D. Gibson, “Mobile Communication”, IEEE Press Hand Book, 2008.
6. G. L. Stuber, “Principles of Mobile Communication”, Springer, 3rd Edition, 2011

EC-702
VLSI DESIGN

L	T	P
3	1	0

Course Outcomes (COs):

- Model the behavior of a MOS Transistor
- Design combinational and sequential circuits using CMOS gates
- Demonstrate an understanding of working principle of operation of different types of memories.
- Understand chip level issues and need of testability

Unit-I 08

Introduction: VLSI Design Flow, Design Hierarchy, Concepts of Regularity, Modularity and Locality. MOSFET Fabrication: Fabrication process flow, NMOS and CMOS fabrication, layout design rules, stick diagram and mask layout design. MOS Transistor : MOS Structure, The MOS System under external bias, Operation of MOSFET, MOSFET - Current /Voltage Characteristics, Scaling and Small geometry effects and capacitances

Unit-II 08

MOS Inverters: Introduction, Resistive Load Inverter, Inverters with n-type MOSFET load, CMOS Inverter. MOS Inverters - Switching Characteristics: Introduction, Delay – Time Definitions, Calculation of Delay Times, and Inverter Design with Delay Constraints.

Unit-III 08

Combinational MOS Logic Circuits: Introduction, MOS logic circuits with depletion NMOS Loads, CMOS logic circuits, complex logic circuits, CMOS transmission gates (pass gates) Sequential MOS Logic Circuits: Introduction, behavior bistable elements, SR latch circuits, clocked latch and FF circuits, CMOS D latch and edge triggered FF.

Unit-IV 08

Dynamic logic circuits: Introduction, basic principle of pass transistor circuits, synchronous dynamic circuit techniques, dynamic CMOS circuit techniques, domino CMOS logic. Semiconductor memories: Introduction, DRAM, SRAM, ROM, flash memory.

Unit-V 08

Low – Power CMOS Logic Circuits: Introduction, Overview of Power Consumption, Low – Power Design through voltage scaling, Estimation and Optimization of switching activity, Reduction of Switched Capacitance and Adiabatic Logic Circuits. Design for Testability: Introduction, Fault Types and Models, Controllability and Observability, Ad Hoc Testable Design Techniques, Scan Based and BIST Techniques

Text Book:

1. Sung-Mo Kang &Yosuf Leblebici, “CMOS Digital Integrated Circuits: Analysis & Design”, TMH, 3rd Edition.

Reference Books:

1. W. Wolf, “Modern VLSI Design: System on Chip”, Third Edition, Pearson, 2002.
2. N. H. E. Weste and K. Eshraghian, “Principles of CMOS VLSI Design”, Person
3. D. A. Pucknell and K. Eshraghian, “Basic VLSI Design: Systems and Circuits”, PHI, 3rd Ed., 1994.
4. D. A. Pucknell and K. Eshraghian, “Basic VLSI Design: Systems and Circuits”, PHI, 3rd Ed., 1994.

5. A. Albert Raj and T. Latha, “VLSI Design”, PHI.

EC-703

OPTICAL COMMUNICATION

L	T	P
3	1	0

Course Outcomes (COs):

- Study about optical fibers, their types, structures and applications
- Study about different materials used for the synthesis of optical fibers
- Learn about optical sources and detectors
- Review optical time division multiplexing, wavelength division multiplexing and coherent optical detection
- Discuss the channel impairments like losses and dispersion

Unit-1 Introduction to Optical Fibers 08

Introduction to optical fiber communication system and its advantages, **Optical fiber waveguides**: Ray theory transmission- Total internal reflection, acceptance angle, numerical aperture, skew rays, Optical fiber modes and configurations-Step index fibers, graded index fibers, Single mode fibers- Cut off wavelength, mode field diameter, effective refractive index, **Photonic crystal fibers**- Introduction and photonic band gap fibers, fiber materials and its fabrication.

Unit-2 Transmission Characteristics of Optical Fibers 08

Transmission characteristics of optical fibers: Attenuation, material absorption losses, Linear scattering losses- Rayleigh scattering, mie scattering, Nonlinear scattering losses- Stimulated brillouin scattering, stimulated raman scattering and fiber bend loss, **Dispersions**: Chromatic - Material dispersion, waveguide dispersion, Intermodal dispersions, Overall fiber dispersions- Multimode fibers, single-mode fibers, Polarization-polarization mode dispersion, Nonlinear effects-scattering effects and kerr effects.

Unit-3 Optical Sources and Detectors 08

Optical sources: Light emitting diodes(**LEDs**)- Structures, materials, quantum efficiency, power, modulation, power bandwidth product, **Laser diodes**- Basic concepts, classifications, Semiconductor injection laser- Modes, threshold conditions, external quantum efficiency, laser diode rate equations, resonant frequencies, reliability of LED and ILD. **Optical detectors**- PIN photo detectors, Avalanche photo detectors, detector response time, temperature effect on avalanche gain, comparison of photo detectors.

Unit-4 Optical Receiver, Measurement and Coupling 08

Optical receivers: Fundamental receiver operation, digital signal transmission, error sources, receiver configuration, digital receiver performance, probability of error, quantum limit, analog receivers. **Optical fiber measurements**- Fiber attenuation measurement, fiber dispersion measurement, fiber cut off wavelength measurement, fiber numerical aperture measurement, **Optical fiber connectors**- Joints, couplers and isolators.

Unit-5 System Transmission and Optical Networks 08

Link design- Point to point links, power penalties, error control, Multichannel transmission techniques, WDM concepts and components overview. Optical network concepts and topologies, SONET/SDH.

Text Books:

1. Gerd Keiser, "Optical Fiber Communication" Mc Graw -Hill International, 4th Edition., 2010
2. John M. Senior, “Optical Fiber Communication”, Second Edition, Pearson Education, 2007.

Reference Books:

1. Ramaswami, Sivarajan and Sasaki “Optical Networks”, Morgan Kaufmann, 2009.
2. J. Gower, "Optical Communication System", Prentice Hall of India, 2001.
3. Govind P. Agarwal, "Fiber Optic Communication Systems", John Wiley, 3rd Edition, 2004.
4. S.C. Gupta, "Text Book of Optical Fiber Communication & Its Applications", Prentice Hall(India).

EC-7041

INFORMATION THEORY AND CODING

L	T	P
3	1	0

Course Outcomes (COs):

- Describe fundamental of the Entropy, Joint Entropy and Conditional Entropy, and Mutual Information, and demonstrate source coding and solve problems on Huffman Coding.
- Design Optimal Codes, Bounds on the Optimal Code Length.
- Analyse Introduction to block codes, cyclic codes and convolution code.
- Describe the BCH code

Unit I 08

Source Coding: Introduction to Information Theory, Uncertainty and Information, Average Mutual Information and Entropy, Information Measures for Continuous Random Variables, Source Coding Theorem, Huffman Coding, The Lempel-Ziv Algorithm, Rate Distortion Function, Optimum Quantizer Design,

Channel Capacity and Coding: Introduction, Channel Models, Channel Capacity, Channel Coding, Information Capacity Theorem, The Shannon Limit, Random Selection of Codes.

Unit II 08

Linear Block Codes for Error Correction: Introduction to Error Correcting Codes, Basic Definitions, Matrix Description of Linear Block Codes, Equivalent Codes, Parity Check Matrix, Decoding of a Linear Block Code, Syndrome Decoding, Error Probability after Coding (Probability of Error Correction), Perfect Codes, Hamming Codes, Optimal Linear Codes, Cyclic Codes, Introduction to Cyclic Codes.

Unit III 08

Polynomials: The Division Algorithm for Polynomials, A Method for Generating Cyclic Codes, Matrix Description of Cyclic Codes, Fire Code, Golay Codes, Cyclic Redundancy Check (CRC) Codes
Introduction to BCH Codes, Primitive Elements, Minimal Polynomials, Generator Polynomials in Terms of Minimal Polynomials, Some Examples of BCH Codes, Decoding of BCH Codes Reed-Solomon Codes, Implementation of Reed-Solomon Encoders and Decoders Nested Codes,

Unit IV

Convolutional Codes: Introduction to Convolutional Codes, Tree Codes and Trellis Codes, Polynomial Description of Convolutional Codes (Analytical Representation), Notions for Convolutional Codes, The Generating Function, Matrix Description of Convolutional Codes, Viterbi Decoding of Convolutional Codes, Distance Bounds for Convolutional Codes, Performance Bounds, Known Good Convolutional Codes, Turbo Codes, Turbo Decoding.

Unit V

Trellis Codes Modulation: Introduction to TCM, The concept of Coded Modulation, Mapping by Set Partitioning, Ungerboeck's TCM Design Rules, TCM Decoder, Performance Evaluation for AWGN Channel, Computation of dfree, TCM for Fading Channel.

Text Books:

1. Ranjan Bose, "Information Theory, Coding & Cryptography", Tata McGraw Hill

Reference Books:

1. J. H. Van Lint**,** "Introduction to Coding Theory", Springer
2. John G. Proakis, "Digital Communications", McGraw Hill
3. P. S. Sathyanarayana, "Probability Information and Coding Theory", Dynaram Publications, Bangalore
4. Robert G. Gallager, "Information Theory and Reliable Communication", Wiley
5. Shu Lin and Daniel J. Costello, "Error Correcting Codes", Prentice Hall (India).

6. Herbert Taub and Donald L. Schilling, “Principles of Communication Systems”, Tata McGraw Hill
7. Lecturers of NPTEL.

EC-7042
RADAR AND SATELLITE COMMUNICATIONS

L	T	P
3	1	0

Course Outcomes (COs):

- Understand the orbital and functional principles of satellite communication systems
- Architect, interpret, and select appropriate technologies for implementation of specified satellite communication systems
- Analyse and evaluate a satellite link and suggest enhancements to improve the link performance.
- Select an appropriate modulation, multiplexing, coding and multiple access schemes for a given satellite communication link.
- Specify, design, prototype and test analog and digital satellite communication systems as per given specifications.

Unit-I 08

Elements of Satellite Communication look angle and orbit determination, launches & launch vehicle, orbital effects, Geostationary Orbit.

Unit-II 08

Satellite subsystems, attitude and orbit control systems, TTC&M, communication subsystem, satellite antenna Satellite link design: basic transmission theory, system noise temperature and G/T ratio, downlink design, uplink design, satellite systems using small earth station, design for specified C/N.

Unit-III 08

Propagation effects and their impact on satellite-earth links: attenuation and depolarization, atmospheric absorption, rain, cloud and ice effects etc. Introduction of various satellite systems: VSAT, low earth orbit and non geostationary,

Unit-IV 08

Introduction to Radar: Basic Radar, the Simply Form of the Radar Equations, Radar Block Diagram, Radar Frequencies, Applications of Radar. The Radar Equation: Detection of Signals in Noise, Receiver Noise and the Signal-to-Noise Ratio, Probabilities of Detection and False Alarm, Integration of Radar Pulses, Radar Cross Section of Targets, Radar Cross- Section of Targets, Radar Cross-Section Fluctuations, Transmitter Power, Pulse Repetition Frequency.

Unit-V 08

MTI and Pulse Doppler Radar: Introduction to Doppler and MTI Radar, Delay-Line Cancellers, Staggered Pulse Repetition Frequencies, Doppler Filter Banks, Digital MTI Processing, Moving Target Detector, Limitations to MTI Performance.
Tracking Radar: Tracking with Radar, Mono pulse Tracking, Conical Scan and Sequential Lobing, Limitations to tracking Accuracy, Low- Angle Tracking, Tracking in Range,

Text

1. B. Pratt, A. Bostian, “Satellite Communications”, Wiley India.
2. D. Roddy, “Satellite Communications”, TMH, 4th Ed.
3. Merrill I. Skolnik, “Introduction to Radar Systems” Third Edition.

Reference Books:

1. S. D. Ilcev, “Global Mobile Satellite Communication”, Springer
2. R. Pandya, “Mobile and Personal Communication Systems and Services”, PHI.

3. J.C. Toomay and Paul J. Hannen “Principles of Radar” Third Edition.

EC-7043
INTEGRATED CIRCUIT TECHNOLOGY

Course Outcomes (COs):

L	T	P
3	1	0

- Understand the material properties, crystalline structure of silicon and different crystal growth techniques.
- Kinetics of Silicon dioxide growth both for thick, thin and ultra thin films and oxidation modeling
- Techniques for introducing dopants into the bulk material , comparison of diffusion and ion implantation, modeling
- Deposition Techniques,Etching, photolithography and metallization methods

Unit-I 08

Introduction to IC Technology: SSI, MSI, LSI, VLSI Integrated Circuits Crystal Growth and Wafer Preparation: Electronic Grade Silicon, Czochralski Crystal Growth, Silicon Shaping, Processing Considerations.
Epitaxy: Vapor –Phase Epitaxy, Molecular Beam Epitaxy, Silicon on Insulators, Epitaxial Evaluation.

Unit-II 08

Oxidation: Growth Kinetics, Thin Oxides, Oxidation Techniques and Systems, Oxides Properties. Lithography: Optical Lithography. Photo masks, Wet Chemical Etching. Dielectric and Polysilicon Film Deposition: Deposition Processes, Polysilicon, Silicon Dioxide, Silicon Nitride.

Unit-III 08

Diffusion: Diffusion of Impurities in Silicon and Silicon Dioxide, Diffusion Equations, Diffusion Profiles, Diffusion Furnace, Solid, Liquid and Gaseous Sources, Sheet Resistance and its Measurement. Ion-Implantation: Ion-Implantation Technique, Range Theory, Implantation Equipment.

Unit-IV 08

Metallization: Metallization Application, Metallization Choices, Physical Vapor Deposition, Vacuum Deposition, Sputtering Apparatus. Packaging of VLSI devices: Package Types, Packaging Design Consideration, VLSI Assembly Technologies, Package Fabrication Technologies.

Unit-V 08

VLSI Process Integration: Fundamental Considerations for IC Processing, NMOS IC Technology, CMOS IC Technology, Bipolar IC Technology, Monolithic and Hybrid Integrated Circuits, IC Fabrication

Text Book:

1. S. M. Sze, “VLSI Technology”, 2ndEdition, McGraw –Hill Publication.
2. S.K. Ghandhi, “VLSI Fabrication Principles”, 2ndEdition, Willy-India Pvt. Ltd.

Reference Books:

1. Stephen A. Campbell, “The Science & Engineering of Microelectronic Fabrication” Oxford University Press.
2. Stephen A. Campbell, “Fabrication Engineering at the micro and nano scale”, Oxford Univ Press.
3. J. D. Plummer, M. D. Deal and Peter B. Griffin, “Silicon VLSI Technology: Fundamentals, practice and modelling”, Pearson Education.

EC-7044

BIOMEDICAL ELECTRONICS

L	T	P
3	1	0

Course Outcomes (COs):

- To have a basic understanding of medical terminology, relevant for biomedical instrumentation
- To understand and describe the physical and medical principles used as a basis for biomedical instrumentation
- Understand the elements of risk for different instrumentation methods and basic electrical safety
- Understand the position of biomedical instrumentation in modern hospital care.

Unit I 08

Introduction: The age of Biomedical Engineering, Development of Biomedical Instrumentation, Man–Instrumentation system, Components, Physiological system of the body, Problem encountered in measuring a living system.

Transducers: The Transducers & Transduction principles, Active transducers, Passive Transducers, Transducer for Biomedical Applications.

Unit II 08

Sources of Bioelectric potentials: Resting & Action potentials, propagation of active potential, The Bioelectric potentials-ECG, EEG, EMG, and Invoked responses.

Electrodes: Electrode theory, Biopotential Electrodes–Microelectrodes Body surface electrodes, Needle Electrodes, Biochemical Transducers, Reference electrodes, PH electrodes, Blood Gas electrodes.

Unit III 08

Cardiovascular Measurements: Electrocardiography – ECG amplifiers, Electrodes & leads, ECG recorders - Three channel, Vector Cardiographs, ECG system for stress testing, Continuous ECG recording (Holter recording), Blood pressure measurement, Blood flow measurement, Heart sound measurements.

Patient Care & Monitoring - Elements of Intensive Care monitoring, patient monitoring displays, Diagnosis, Calibration & Repairability of patient monitoring equipment, pacemakers & Defibrillators.

Unit IV 08

Measurements in Respiratory system: Physiology of respiratory system Measurement of breathing mechanics - Spiro meter, Respiratory Therapy equipments: Inhalators ventilators & Respirators, Humidifiers, Nebulizers & Aspirators.

Diagnostic Techniques: Ultrasonic Diagnosis Echocardiography, Echo Encephalography, Ophthalmic scans, X-Ray & Radio-isotope Instrumentation, Computerized Axial Tomography Scanners.

Unit V 08

Introduction to Bio-Medical Signals:

Classification, Acquisition and Difficulties during Acquisition, Electroencephalography, Electromyography, & electro-retinography, Role of Computers in the Analysis, Processing, Monitoring & Control and image reconstruction in bio-medical field.

Bio Telemetry: The components of Biotelemetry system Implantable units, Telemetry for ECG measurements during exercise, for Emergency patient monitoring. Physiological Effects of Electric Current Safety of Medical Electronic Equipments, Shock hazards from Electrical equipment and prevention against them.

Text Books:

1. Leslie Cromwell, Fred J. Welbell and Erich A. Pfeiffer, “Biomedical Instrumentation and Measurements”, Prentice Hall (India).

Reference Books:

1. R. S. Khandpur, “Biomedical Instrumentation”, Tata McGraw-Hill.
2. Willis J. Tompkins, “Biomedical DSP: C Language Examples and Laboratory Experiments for the IBM PC”, Prentice Hall (India).
3. D. C. Reddy, “Biomedical Signal Processing”, McGraw-Hill

EC-7045

ELECTRONIC SWITCHING

L	T	P
3	1	0

Course Outcomes (COs):

- Describe and apply fundamentals of telecommunication systems and associated technologies.
- Solve problems and design simple systems related to tele-traffic and trunking efficiency.
- Understand and explain the reasons for switching, and the relative merits of the possible switching modes, e.g. packet and circuit switching.
- Understand the principles of the internal design and operation of telecommunication switches, and the essence of the key signaling systems that are used in telecommunication networks

Unit-I 08

Evolution of Switching systems: Introduction: Message switching, circuits switching, functions of a switching system, register-translator-senders, distribution frames, crossbar switch, a general trunking, electronic switching, Reed electronic system, digital switching systems.

Unit-II 08

Digital switching: Switching functions, space division switching, Time division switching, two dimensional switching, Digital cross connect systems, digital switching in analog environment.

Unit-III 08

Telecom Traffic Engineering: Network traffic load and parameters, grade of service and blocking probability, modeling switching systems, incoming traffic and service time characterization, blocking models and loss estimates, Delay systems.

Unit-IV 08

Control of Switching Systems: Introduction, Call processing functions; common control, Reliability availability and security; Stored program control. Signalling: Introduction, Customer line signalling, AF junctions and trunk circuits, FDM carrier systems, PCM and inter register signalling, Common channel signalling principles, CCITT signalling system No. 6 and 7, Digital customer line signalling.

Unit-V 08

Packet Switching: Packets formats, statistical multiplexing, routing control, dynamic, virtual path circuit and fixed path routing, flow control, X.25 protocol, frame relay, TCP/IP, ATM cell, ATM service categories, ATM switching, ATM memory switch, space memory switch, memory-space, memory-space-memory switch, Banyan network switch.

Text Books:

1. Thiagarajan Viswanathan, “Telecommunication switching System and networks”, PHI.
2. J.E. Flood, “Telecommunication switching, Traffic and Networks”, Pearson education.
3. J.C. Bellamy, “Digital Telephony”, John Wiley, 3rdEd.

AS–701
ENGINEERING ECONOMICS

L	T	P
3	0	0

Course Outcomes (COs):
Students will be able to:

- Understand key economic analytical principles for decision-making among alternative courses of action in engineering
- Learn about the nature of economics and demand analysis.
- Understand about concept of supply, cost analysis and demand forecasting.
- Learn about market structure.
- Learn about nature and characteristics of Indian economy
- Using analytical techniques including benefit-cost ratio and breakeven analysis, solve economic problems involving comparison and selection of alternatives.

Unit-1 **08**

Introduction of Engineering Economics and Demand Analysis: Meaning and nature of economics, relation between science, engineering, technology and economics; Meaning of demand, determinants of demand, shifts in demand, law of demand, price elasticity of demand &types, income elasticity, cross price elasticity, determinants of elasticity and uses and importance of elasticity.

Unit-2 **08**

Concept of Supply: Law of supply, factors affecting supply, and elasticity of supply. Demand forecasting: introduction, meaning and forecasting, methods or techniques of demand forecasting, criteria for good demand forecasting and demand forecasting for a new product.

Unit-3 **08**

Cost Analysis: Introduction, types of costs, cost-output relationship: cost function, cost-output relationships in the short run, and cost-output relationships in the long run; Short run and long run, break-even analysis; Production functions: laws of variable proportions, law of returns and economies of scale: internal and external.

Unit-4 **08**

Market Structure: Market structure perfect competition, imperfect competition – monopolistic, oligopoly and duopoly sorbent features of price determination and various market conditions.

Unit-5 **08**

Nature and characteristics of Indian economy: Concepts of LPG, elementary concepts of national income, inflation and business cycles ,concept of N.I and measurement, meaning of inflation, types and causes and phases of business cycle investment decisions for boosting economy(national income and per capital income).

Text Books:

1. Premvir Kapoor, "Sociology and Economics for Engineers", Khanna Publishing.
2. D. Salvatore, “Principles of Microeconomics”, Oxford University Press.
3. A. Koutsoyiannis, “Modern Microeconomic”, Macmillan Education Ltd.

Reference Books:

1. D. N. Dwivedi, “Principles of Microeconomics”, Pearson Education.

2. F. A. Cowell, “Microeconomic Principles and Analysis”, Oxford University Press.
3. J. L. Riggs, “Engineering Economics”, McGraw Hills.

AS–702
INDUSTRIAL MANAGEMENT

L	T	P
3	0	0

Course Outcomes (COs):

- To understand the basic concept of Industrial management and its types and ownership.
- To know the functions of management with the help of scientific theory and human resource management.
- Able to know the objective and measurement in work study and use the different model of inventory control.
- To design the control chart for variable and attributes in statistical quality control and implementing sampling plan.
- Able to analyse the project management scheme in project network analysis

Unit-1 **08**

Introduction: Concept and scope of industrial management. **Productivity:** definition, measurement, productivity index, types of production system and industrial ownership.

Unit-2 **08**

Functions of Management: Taylor's scientific management theory, Fayol's principles of management, social responsibilities of management, introduction to human resources management: nature of HRM, functions and importance of HRM.

Unit-3 **08**

Work Study: Introduction, definition, objectives, steps in work study; **Method study:** Definition, objectives, steps of method study; **Work measurement:** Purpose, types of study: Stop watch methods steps: Allowances, standard time calculations, work sampling, production planning and control inventory control: inventory, cost, models of inventory control: EOQ, ABC, VED.

Unit-4 **08**

Quality Control: Statistical quality control, control charts for variables and attributes, acceptance sampling: single sampling- double sampling plans and introduction to TQM.

Unit-5 **08**

Project Management: Project network analysis, CPM, PERT and project crashing and resource leveling.

Text Books:

1. Gideon Halevi, "Industrial Management- Control and Profit: A Technical Approach" Springer.
2. A.P. Verma and N. Mohan "A Textbook of Industrial Management" S.K. Kataria & Sons.
3. S. K. Sharma, Savita Sharma "Industrial Engineering and Organization Management", Kataria and Sons.

Reference Books:

1. S.C. Sharma & T.R. Banga, "Engineering Management" (Industrial Engineering & Management), Khanna Book Publishing Co.
2. P. Khanna, "Industrial Engineering and Management", Dhanpatrai publications Ltd.
3. Paneer Selvam, "Production & Operation Management", PHI.

EC-801

DIGITAL IMAGE PROCESSING

L	T	P
3	1	0

Course Outcomes (COs):

- Describe Digital Image Fundamentals and applications of Digital Image Processing.
- Explain the various image transforms and need of the transforms.
- Describe Spatial Domain Methods, Frequency Domain Methods for image enhancement and learn the basics concept of Colour Image Enhancement.
- Understand causes for image degradation and apply image restoration methods.
- Explain the image compression methods in spatial and frequency domains.

Unit-I 08

Introduction and Digital Image Fundamentals: Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image processing Systems, Sampling and Quantization, Resolution, Human Visual System, Classification of Digital Images, Image Types, Applications of Digital Image Processing.

Unit-II 08

Image Transforms: Introduction, Need for Transform, Image Transforms, Fourier Transform 2D Discrete Fourier Transform, Discrete Cosine Transform, Hadamard Transform, Haar Transform, Slant Transform, Karhunen-Loeve Transform Transform (KL Transform) and Singular Value Decomposition.

Unit-III 08

Image Enhancement: Introduction, Point Operations, Spatial Domain Methods, Frequency Domain Methods, Spatial Filtering, Low Pass Filtering, High Pass Filtering, Homomorphic Filtering, Histogram Modeling and Equalization, Colour Image Enhancement.

Unit-IV 08

Image Restoration: Introduction, Image Observation Models, Degradation Models, Formulation of Discrete Linear Operators, Inverse & Wiener filtering,

Image Analysis: Spatial Features, Transform Features, Edge Detection, Boundary Detection, Sementation, Textures.

Unit-V 08

Image Compression: Introduction, Interpixel and Psycho visual redundancy. Pixel coding, Predictive coding, Transform coding, Image Compression Models, Error free Compression, Lossy Compression, Image Compression Standards.

Text Books:

1. S. Jayaraman, S. Esakkirajan and T. Veera Kumar, "Digital Image Processing", McGraw Hill Education, 2016.
2. Rafael C. Gonzalez and Richard E Woods, "Digital Image Processing", Pearson, 3rd Ed. 2009.
3. Anil K. Jain, "Fundamentals of Digital Image Processing", PHI.
4. J. S. Lim, "Two-dimensional Signal and Image Processing", PHI.

Reference Books:

1. Alasdair Mc Andrew, “Introduction to Digital Image Processing”, Cengage learning, 2009
2. W.K. Pratt, “Digital Image Processing”, PHI.
3. B. Chanda and Dwijesh Dutta Majumdar, “Digital Image Processing”, PHI.
4. Madhuri A. Joshi, “Digital Image Processing: An Algorithmic Approach” PHI.

EC-8021

OPTICAL NETWORKS

Course Outcomes (COs):

L	T	P
3	1	0

Student will be able to:

- Get a basic understanding of physical properties of optical networks.
- Get a profound understanding of optical switching methods and networking techniques, circuit, packet, hybrid, burst and flow.
- Get a basic understanding of optical components and optical node design
- Understand the basics of Multiplexing, SONET/SDH layers, SONET Frame structure
- To gain knowledge of Routing and wavelength assignment problems

Unit-I 08

Introduction to Optical Networks- Principles and Challenges and its Generation, Characteristics of Optical Fiber in nonlinear region ,Optical Packet Switching, Transmission Basics, Multiplexers & Filters,

Unit-II 08

Optical Amplifiers, Tunable Lasers, Switches, Wavelength Converters. Sub-Carrier Modulation and Multiplexing, Spectral efficiency, Crosstalk, Introduction of Soliton systems.

Unit-III 08

SONET/SDH: Multiplexing, SONET/ SDH Layers, Frame Structure, Physical Layer, Elements of aSONET/SDH Infrastructure, Ethernet. Optical Transport Network, Generic framing Procedure, IP routing and forwarding and QOS.WDM Network Elements Optical Line Terminals, Optical Line Amplifiers, Optical Add/ Drop Multiplexers, Optical Cross Connects.

Unit-IV 08

WDM Network Design Cost Trade-offs, Light path Topology Design, and Routing and wavelength assignment problems, Dimensioning Wavelength Routing Networks, Network Survivability Basic Concepts, Protection in SONET/SDH, Protection in client layer, Optical Layer Protection, Different Schemes, Interworking between Layers Access Networks Network Architecture Overview, Enhanced HFC, FTTC, PON evolution

Unit-V 08

Optical Switching OTDM, Synchronization, Header Processing, Buffering, Burst Switching. Deployment Considerations- SONET/SDH core Network

Text Books:

1. R. Ramaswami and K. N. Sivarajan, “Optical Networks a Practical perspective”, Morgan Kaufmann Publishers, 3rd Ed.
2. U. Black, “Optical Networks: Third Generation Transport Systems”, Pearson Educations

Reference Books:

1. Biswanath Mukherjee, “Optical WDM Networks”, Springer 2006

EC-8022

EMBEDDED SYSTEMS

L	T	P
3	1	0

Course Outcomes (COs):

The student will be able to

- Gain knowledge of embedded systems.
- Understand the concept, classification, characteristics, quality attributes and applications of Embedded Systems.
- Understand the architecture of embedded system and basics of real-time operating system.
- Write simple programs based on 8051 μC.
- Design simple applications using 8051 μC kit

Unit I 08

Introduction to Embedded system, Embedded System Project Management, ESD and Codesign issues in System development Process, Design cycle in the development phase for an embedded system, Use of target system or its emulator and In-circuit emulator, Use of software tools for development of an ES.

Unit II 08

8051 Microcontroller: Microprocessor V/s Micro-controller, 8051 Microcontroller: General architecture; Memory organization; I/O pins, ports & circuits; Counters and Timers; Serial data input/output; Interrupts. 8051 Instructions: Addressing Modes, Instruction set: Data Move Operations, Logical Operations, Arithmetic Operations, Jump and Call Subroutine, Advanced Instructions. 8051 Interfacing and Applications: Interfacing External Memory, Keyboard and Display Devices: LED, 7-segment LED display, LCD.

Unit III 08

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

Unit IV 08

Brief general architecture of AVR, PIC and ARM microcontrollers, JTAG: Concept and Boundary Scan Architecture. Organization of FPGAs, FPGA Programming Technologies, Programmable Logic Block Architectures, Programmable Interconnects, Programmable I/O blocks in FPGAs, Dedicated Specialized Components of FPGAs, Applications of FPGAs.

Unit V 08

Advanced Processor: (only architectures) 80386, 80486 and ARM (References)

RTOS: Tasks, states, Data, Semaphores and shared data, Operating system, services, Message queues, Mailboxes.

Communication basics: Microprocessor Interfacing, I/O Addressing, Direct memory access, Arbitration, multilevel bus architecture, Serial protocols, Parallel Protocols and wireless protocols.

Real world Interfacing: LCD, Stepping Motor, ADC, DAC, LED, Push Buttons, Keyboard, Latch Interconnection, PPI.

TEXT BOOKS:

1. K. V. Shibu, "Introduction to Embedded Systems", McGraw Hill.
2. E. Mazadi, "The 8051 Microcontroller And Embedded Systems Using Assembly And C", Pearson Education India, 2007

REFERENCE BOOKS:

1. Kenneth Hintz and Daniel Tabak, “Microcontrollers (Architecture, Implementation and Programming)”, TMH 2005.
2. Raj Kamal, “Embedded Systems”, TMH, 2006.
3. K. Ayala, “The 8051 Microcontroller”, 3rd Ed., Thomson Delmar Learning, 2007.
4. Frank Vahid and Tony Givargis, “Embedded System Design”, John Wiley.

EC-8023

ADVANCED INSTRUMENTATION

L	T	P
3	1	0

Course Outcomes (COs):

- Course create the background in industrial instruments and the methods to measure the various parameters.
- Student will able to understand principle of operation of various active and passive electrical transducers.
- Student will understand the telemetry and data acquisition system used in industry.
- Student will get knowledge about advance measuring instruments and roll of instrumentation engineer.

Unit-I 08

Measurement of Non Electrical Quantities: Measurement of Temperature: Absolute, Thermodynamic Scale, Bimetallic Element, Fluid Expansion Systems, Pressure: Manometers, Ring Balance Manometer & Bell Type Manometer, Bellows Element, Bourdon Tube Elements, Force: Helical Spiral Springs, Cantilever Beams, Loads Cells, Liquid Level: Float Element, Level to Pressure Converters, Level to force Converters Flow.

Unit-II 08

Passive Electrical Transducers: Resistive: Resistance Thermometers, Resistive Displacement Transducer, Resistive Strain Transducer, Resistive Pressure Transducer, Inductive: Inductive Thickness Transducers, Inductive Displacement Transducers, Eddy Current Type Inductive Transducers, Capacitive: Capacitive Thickness Transducers, Capacitive Displacement Transducer.

Unit-III 08

Active Electrical Transducers: Thermo Electric Transducers, Piezo-Electric Transducers: Force Transducers, Strain Transducers, Torque Transducers, Pressure Transducers, Photo Electric Transducers, Digital Transducers: Digital Displacement Transducers, Digital Tachometers.

Unit-IV 08

Telemetry and Data Acquisition System: Telemetry: Introduction & Characteristics, Land Line Telemetry, Radio Telemetry, Components of an Analog Data Acquisition System, Components of an Digital Data Acquisition System, Types of Multiplexing Systems, Uses of Data Acquisition Systems, Use of Recorders in Digital Systems, Modern Digital Data Acquisition System

Unit-V 08

Advanced Measuring Instruments: Data Loggers, Digital Read Out Systems, Digital Input Output devices, Digital Storage Oscilloscope, Spectrum Analyzer, Logic Analyzer, Microwave Instruments: Vector Network analyzer, power meter, Instrument Interfacing

Text Books:

1. Thomas E. Kissell, "Industrial Electronics Applications for Programmable Controllers, Instrumentation and Process Control and Electrical Machines and Motor Controls", PHI
2. A. K. Shawhney, "Electrical & Electronic Measurement & Measuring Instruments", Dhanpat Rai & Co.
3. E. O. Doebelin, "Measurement Systems", McGraw Hill.
4. D. B. S. Murty, "Transducers & Instrumentation", Prentice Hall (India).
5. M. M. S. Anand, "Electronic Instruments & Instrumentation Technology", Prentice Hall (India)

Reference Books:

1. W. D. Cooper, and A. D. Helfrick, "Modern Electronic Instrument & Measurement Techniques", Prentice Hall (India).
2. William C. Dunn, "Fundamentals of Industrial Instrumentation and Process Control", TMH

3. Douglas O. J. DeSá, “Applied Technology and Instrumentation for Process Control”, Taylor & Francis
4. J. Michael Jacob, “Industrial Control Electronics Applications and Design”, Prentice Hall
5. Bela G. Liptak, “Process Measurement and Analysis”, Butterworth Heinemann
6. William G Andrew and H. B. Williams, “Applied Instrumentation in the Process Industries Vol.: 1, 2 and 3”, Gulf Publishing.

EC-8024
SPEECH PROCESSING

L	T	P
3	1	0

Course Outcomes (COs):

The student will be able to

- Illustrate how the speech production is modeled
- Summarize the various techniques involved in collecting the features from the speech signal in both time and frequency domain
- Summarize the functional blocks of the ear
- Compare the various pattern recognition techniques involved in speech and speaker detection.
- Summarize the various speech compression techniques

Unit-I 08

Digital models for speech signals: Mechanism of speech production & acoustic phonetics, the acoustic theory of speech production, lossless tube models, and digital models for speech signals.

Unit-II 08

Time Domain methods of speech sampling: Time dependent processing of speech, short time energy and average magnitude, short time average zero crossing rate, discrimination between speech& silence, pitch period estimation using parallel processing, short time autocorrelation function & AMDF, pitch period estimation using auto correlation function.

Unit-III 08

Short time Fourier Analysis: Definition and properties, design of filter banks, implementation of filter bank summation method using FFT, spectrographic displays, pitch detection, analysis by synthesis phase, vocoder and channel vocoder.

Unit-IV 08

Homomorphic speech processing: Homomorphic system for convolution, complex cepstrum of speech, pitch detection using Homomorphic processing, formant estimation, Homomor phicvocoder.

Unit-V 08

predictive analysis, the autocorrelation method, computation of the gain for the model, solution of LPC equations for auto correlation method, prediction error and normalized mean square error, frequency domain interpretation of mean squared prediction error relation of linear predictive analysis to lossless tube models, relation between various speech parameters, synthesis of speech from linear predictive parameters, application of LPC parameters.

Text Books:

1. R. L. Rabiner and R.W. Schafer, “Digital Processing of speech signals”, Pearson Education.
2. B. Gold and Nelson Morgon, “Speech and audio signal processing”, Wiley India Edition

Reference Books:

1. Shūzō Saitō and Kazuo Nakata,“Fundamentals of speech signal processing”, Academic Press Inc
2. Sadoaki Furui,“Digital Speech Processing: Synthesis and Recognition”, CRC Press
3. A. R. Jayan, “Speech and Audio Signal Processing”, PHI
4. Vishnu Narayan Saxena, “Speech Signal Processing: Using MATLAB”, Create space Independent Pub
5. Ian Vince McLoughlin, “Speech and Audio Processing: A MATLAB-based Approach”, Cambridge University Press

EC-8025

RF SYSTEMS

L	T	P
3	1	0

Course Outcomes (COs):

Student will be able to:

- Analyze and design RF Filters
- Analyze the radiation mechanisms of antennas
- Demonstrate knowledge of antennas in communication systems. Ability to discriminate between antennas on the basis of their electrical performance.
- Discriminate various antennas on the basis of their electrical performance.

Unit-I 08

Introduction: Importance of RF and Microwave Concepts and Applications- and Units Frequency Spectrum, RF and Microwave Circuit Design, Dimensions - RF Behavior of Passive Components: High Frequency Resistors, High Frequency Capacitors, High Frequency Inductors, General Introduction, Types of Transmission Lines-Equivalent Circuit representation.

Unit-II 08

The Smith Chart: Introduction, Derivation of Smith Chart, Description of two types of smith chart, Z-Y Smith chart, Distributed Circuit Applications, Lumped Element Circuit Applications.

Unit-III 08

Single and Multiport Networks: Basic Definitions, Interconnecting Networks.
Scattering Parameters: Scattering Parameters: Definition, Meaning, Chain Scattering Matrix, Conversion between S- and Z-parameters, Signal Flow Chart Modelling.

Unit-IV 08

Stability and Gain Considerations – RF Design RF Source, Transducer Power Gain, Additional Power Relations-Stability Considerations: Stability Circles, Unconditional Stability, Stabilization Methods-Unilateral and Bilateral Design for Constant Gain, Noise Figure Circles, Constant VSWR Circles.

Unit-V 08

RF Filters, Amplifiers and Oscillators Design Generalization-Basic Resonator and Filter Configurations: Low Pass, High Pass, Band Pass and Band Stop type Filters, Filter Implementation using Unit Element and Kuroda's Identities Transformations. Small Signal Amplifiers, Design of different types of amplifiers (NBA, HGA, MGA, LNA, MNA, BBA), Design of Large Signal Amplifiers Oscillator vs Amplifier Design, Design procedure of Transistor Oscillators.

Text Books:

1. Mathew M. Radmanesh, “Radio Frequency & Microwave Electronics”, Pearson Education Asia, Second Edition,
2. Reinhold Ludwig and Powel Bretchko,” RF Circuit Design – Theory and Applications”, Pearson Education Asia, First Edition.

References Books:

1. Joseph J. Carr, “Secrets of RF Circuit Design”, McGraw Hill Publishers, Third Edition.
2. Ulrich L. Rohde and David P. New Kirk, “RF Microwave Circuit Design”, John Wiley & Sons USA, 2000.
3. Roland E. Best, “Phase - Locked Loops: Design, simulation and applications”, McGraw Hill Publishers.
4. Devendra K. Misra, “Radio Frequency and Microwave Communication Circuits - Analysis and Design” John Wiley & Sons, Inc.
5. Jon B. Hagen, "Radio Frequency Electronics", Cambridge university press.
6. James Hardy, "High Frequency Circuit Design", Resto Publishing Co., New York.

7. Ian Hickman, "RF Hand Book", Butter Worth Heinemann Ltd., Oxford.
8. Ulrich L. Rohde and T. T. N. Bucher, "Communication Receivers", Mc Graw-Hill, New York.

EC-8026

REAL TIME SYSTEM

L	T	P
3	1	0

Course Outcomes (COs):

The students will be able to

- Understand concepts of Real-Time systems and modeling
- Recognize the characteristics of a real-time system.
- Understand and develop document on an architectural design of a real-time system.
- Develop and document Task scheduling, resource management, real-time operating systems and fault tolerant applications of Real-Time Systems.

Unit-I 08

Introduction to Real Time System Introduction to Real time Embedded System, need for a real-time system, different kinds (reactive, time driven, deadline driven, etc.,) Embedded system Design cycle, Types of Real Time systems, Real Time Applications and features, Issues in real time computing, aspects of real-time systems (timeliness, responsiveness, concurrency, predictability, correctness, robustness, fault tolerance and safety, resource limitations, RTOS necessity), real-time requirement specifications, modeling/verifying design tools (UML, state charts, etc.,).

Unit-II 08

Embedded Hardware for Real Time System Selection criteria for Real time system - Hardware and Software perspective, need for partitioning, criteria for partitioning (performance, criticality, development ease, robustness, fault tolerance and safety, resource limitations, etc.,), System Considerations, Basic development environment-host vs target concept, CPU features, Architecture, I/O Ports, on-chip peripherals, Memory, Real time implementation considerations, bus architecture, Introduction to Interrupts, Interrupt vector table, interrupt programming, Pipeline and Parallelism concepts

Unit-III 08

Embedded Hardware – On chip Peripherals and Communication protocols Role of peripherals for Real time systems, On-Chip peripherals& hardware accelerators, Peripherals [Direct Memory Access, Timers, Analog to Digital Conversion (ADC), DAC, Comparator, Pulse Width Modulation (PWM)], Need of real time Communication, Communication Requirements, Timeliness, Dependability, Design Issues, Overview of Real time communication, Real time Communication Peripherals – I2C, SPI &UART. Introduction to the CCS IDE: its features, project options and basic examples Analog-to-Digital Converter Lab: Build a data acquisition system Control Peripherals Lab: Generate and graph a PWM waveform Direct Memory Access (DMA) Lab: Use DMA to buffer ADC results.

Unit-IV 08

Embedded Software and RTOS Software Architecture of real time System, Introduction to RTOS, role of RTOS, foreground Back ground system, pros and cons, Real time kernel, qualities of good RTOS, Functionalities of RTOS – Task Management, I/O management, Memory management, Inter Task Communication, Tasks, Task states, Task control block, attributes of TCB, Context switching, Interrupts handling, Multiprocessing and multitasking.

Unit-V 08

Introduction to TI C2000: Interface with actuators such as motor control enabling real time capabilities of C2000 Program to demonstrate the Task switching Simulation on CCS IDE To demonstrate the blink led application Using Hwi (Hardware Interrupt: periodically to produce an interrupt using Timers) of TI RTOS. Programming: demonstrate the Blink led application Using a Swi (Software interrupt) of TI RTOS to introduce two time-based SYS/BIOS services – Clock and Timestamp in TI RTOS; demonstrate the Task synchronization using Semaphores using TI RTOS; demonstrate Inter Task Communication Using

of Mailboxes and Queues using TI RTOS; demonstrate the Communication Protocols – I2C, SPI and USART using TI

Text:

1. Jane W. S. Liu, “Real-Time Systems”, Prentice Hall Publication
2. C. M. Krishna, “Real Time Systems” Mc-Graw Hill Publication.
3. Hamid A. Toliyat and Steven G. Campbell, “DSP based Electromechanical Motion Control” CRC Press Publication.
4. Jean J. Labrosse, “Embedded System Design blocks”, CMP books Publication
5. John H. Davies, “MSP430 Microcontroller Basics”, Newnes Publication.

Reference:

1. TMS320C28x CPU and Instruction Set Reference Guide, TI Literature Publication
2. TMS320x28xx, 28xxx DSP Peripheral Reference Guide, TI Literature Publication
3. C2000 Teaching CD ROM from Texas Instruments Publication

Introduction to the TI-RTOS Kernel Workshop Lab Manual, by Texas Instruments Publication

AS–801
ENGINEERING ECONOMICS

L	T	P
3	0	0

Course Outcomes (COs):

Students will be able to:

- Understand key economic analytical principles for decision-making among alternative courses of action in engineering
- Learn about the nature of economics and demand analysis.
- Understand about concept of supply, cost analysis and demand forecasting.
- Learn about market structure.
- Learn about nature and characteristics of Indian economy
- Using analytical techniques including benefit-cost ratio and breakeven analysis, solve economic problems involving comparison and selection of alternatives.

Unit-1 **08**

Introduction of Engineering Economics and Demand Analysis: Meaning and nature of economics, relation between science, engineering, technology and economics; Meaning of demand, determinants of demand, shifts in demand, law of demand, price elasticity of demand &types, income elasticity, cross price elasticity, determinants of elasticity and uses and importance of elasticity.

Unit-2 **08**

Concept of Supply: Law of supply, factors affecting supply, and elasticity of supply. Demand forecasting: introduction, meaning and forecasting, methods or techniques of demand forecasting, criteria for good demand forecasting and demand forecasting for a new product.

Unit-3 **08**

Cost Analysis: Introduction, types of costs, cost-output relationship: cost function, cost-output relationships in the short run, and cost-output relationships in the long run; Short run and long run, break-even analysis; Production functions: laws of variable proportions, law of returns and economies of scale: internal and external.

Unit-4 **08**

Market Structure: Market structure perfect competition, imperfect competition – monopolistic, oligopoly and duopoly sorbent features of price determination and various market conditions.

Unit-5 **08**

Nature and characteristics of Indian economy: Concepts of LPG, elementary concepts of national income, inflation and business cycles ,concept of N.I and measurement, meaning of inflation, types and causes and phases of business cycle investment decisions for boosting economy(national income and per capital income).

Text Books:

1. Premvir Kapoor, "Sociology and Economics for Engineers", Khanna Publishing.
2. Salvatore D, “Principles of Microeconomics”, Oxford University Press.
3. Koutsoyiannis A, “Modern Microeconomic”, Macmillan Education Ltd.

Reference Books:

1. Dwivedi DN, “Principles of Microeconomics”, Pearson Education.
2. Cowell, FA, “Microeconomic Principles and Analysis”, Oxford University Press.
3. Riggs J L, “Engineering Economics”, McGraw Hills.

AS–802
INDUSTRIAL MANAGEMENT

L	T	P
3	0	0

Course Outcomes (COs):

- To understand the basic concept of Industrial management and its types and ownership.
- To know the functions of management with the help of scientific theory and human resource management.
- Able to know the objective and measurement in work study and use the different model of inventory control.
- To design the control chart for variable and attributes in statistical quality control and implementing sampling plan.
- Able to analyse the project management scheme in project network analysis

Unit-1 **08**

Introduction: Concept and scope of industrial management. **Productivity:** definition, measurement, productivity index, types of production system and industrial ownership.

Unit-2 **08**

Functions of Management: Taylor's scientific management theory, Fayol's principles of management, social responsibilities of management, introduction to human resources management: nature of HRM, functions and importance of HRM.

Unit-3 **08**

Work Study: Introduction, definition, objectives, steps in work study; **Method study:** Definition, objectives, steps of method study; **Work measurement:** Purpose, types of study: Stop watch methods steps: Allowances, standard time calculations, work sampling, production planning and control inventory control: inventory, cost, models of inventory control: EOQ, ABC, VED.

Unit-4 **08**

Quality Control: Statistical quality control, control charts for variables and attributes, acceptance sampling: single sampling- double sampling plans and introduction to TQM.

Unit-5 **08**

Project Management: Project network analysis, CPM, PERT and project crashing and resource leveling.

Text Books:

4. Gideon Halevi, "Industrial Management- Control and Profit: A Technical Approach" Springer.
5. A.P. Verma and N. Mohan "A Textbook of Industrial Management" S.K. Kataria & Sons.
6. S. K. Sharma, Savita Sharma "Industrial Engineering and Organization Management", Kataria and Sons.

Reference Books:

4. S.C. Sharma & T.R. Banga, "Engineering Management" (Industrial Engineering & Management), Khanna Book Publishing Co.
5. P. Khanna, "Industrial Engineering and Management", Dhanpatrai publications Ltd.
6. Paneer Selvam, "Production & Operation Management", PHI.

APPENDIX

List of Open Electives

Note: Students may opt any one subject from the following list of open electives with restriction in some subjects as mentioned-

S.No.	Subject Code	Subject Name	Subject Offered by Department of	Remark
1.	OE-8011	Fuzzy logic and Neural Network	Computer Science &Engg.	--
2.	OE -8012	Mobile Application development	Computer Science &Engg.	--
3.	OE -8013	Automation & Robotics	Computer Science &Engg.	--
4.	OE -8014	Mobile Computing	Computer Science &Engg.	--
5.	OE -8015	Internet-of-Things	Computer Science &Engg.	--
6.	OE -8016	Cyber Law and Ethics	Computer Science &Engg.	--
7.	OE -8017	Data Analytics	Electrical Engg.	--
8.	OE -8018	Non-Conventional Energy Resources	Electrical Engg.	--
9.	OE -8019	Applied Operations Research	MechanicalEngg.	Not to be opted by students of MechanicalEngg.
10.	OE -8020	Six Sigma Methods & Application	MechanicalEngg.	--
11.	OE -8021	Mechatronics	MechanicalEngg.	--
12.	OE -8022	Biomedical Electronics	Electronics & Comm.Engg.	Not to be opted by students of Electronics & Comm.Engg.
13.	OE -8023	Embedded System	Electronics & Comm.Engg.	Not to be opted by students of Electronics & Comm.Engg.
14.	OE -8024	Advances in Polymer Science Technology	Applied Science& Humanities	--
15.	OE -8025	Mathematical Modeling and Simulation	Applied Science& Humanities	--
16.	OE -8026	Nanoscience and Quantum Computing	Applied Science& Humanities	--
17.	OE -8027	Entrepreneurship Development	Applied Science& Humanities	--
18.	OE -8028	Critical And Logical Thinking	Applied Science& Humanities	--
19.	OE -8029	Town Planning	CivilEngg.	--

20.	OE -8030	Disaster Management	CivilEngg.	--
21.	OE -8031	Environmental Pollution & Management	CivilEngg.	--

OE -8011

FUZZY LOGIC AND NEURAL NETWORK

L	T	P
3	1	0

Course Outcomes (COs):
After successful completion of this course, student will be able to:

- Understand basic knowledge of fuzzy sets and fuzzy logic.
- Apply basic fuzzy inference and approximate reasoning.
- Understand principles of neural networks.
- Apply basic fuzzy system modelling methods.

Unit-1 **08**

Introduction to Neural Networks: Introduction, humans and computers, organization of the brain, biological neuron, biological and artificial neuron models, Hodgkin-Huxley neuron model, integrate-and-fire neuron model, spiking neuron model, characteristics of ANN, Mcculloch-Pitts model, historical developments, and potential applications of ANN.

Unit-2 **08**

Essentials of Artificial Neural Networks: Artificial neuron model, operations of artificial neuron, types of neuron activation function, ANN architectures, classification taxonomy of ANN –connectivity, neural dynamics (activation and synaptic), learning strategy (supervised, unsupervised, reinforcement), learning rules, and types of application.

Unit-3 **08**

Single Layer Feed Forward Neural Networks: Introduction, **Perceptron models:** discrete, continuous and multi-category; **Training algorithms:** discrete and continuous perceptron networks, perceptron convergence theorem, limitations of the perceptron model, and applications.

Unit-4 **08**

Classical & Fuzzy Sets: Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, and membership functions.

Unit-5 **08**

Fuzzy Logic System Components: Fuzzification, membership value assignment, development of rule base and decision making system, defuzzification to crisp sets, and defuzzification methods.

Text Books:

1. Rajasekharan and Rai., "Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications", PHI Publication.
2. Bart Kosko, "Neural Networks and Fuzzy Logic System", PHI Publications.
3. S.N.Sivanandam, S.Sumathi, S.N.Deepa, "Introduction to Neural Networks using MATLAB 6.0", TMH.

Reference Books:

1. James A Freeman and Davis Skapura, “Neural Networks”, Pearson Education.
2. Simon Hakins, “Neural Networks”, Pearson Education.
3. C.Eliasmith and CH.Anderson, ”Neural Engineering”, PHI.

OE-8012
Mobile Application Development

L	T	P
3	1	0

Course Outcomes (COs):
After successful completion of this course, student will be able to:

- Ability to apply general programming knowledge in the field of developing mobile applications.
- Understanding of the specific requirements, possibilities and challenges when developing for a mobile context.
- Understanding of the interactions between user interface and underlying application infrastructure
- Understand the Android Software development.

Unit-1 **08**

Introduction: What is android, android versions and its feature to set the various android devices on the market, the android market application store, android development environment - system requirements, android SDK, installing java, and ADT bundle - eclipse integrated development environment (IDE), creating android virtual devices (AVDs), android architecture overview and creating an example. **Android Application:** The android software stack, the linux kernel and android runtime - Dalvik virtual machine

Unit-2 **08**

Android Software Development Platform: Understanding java SE and the Dalvik virtual machine, the directory structure of an android project, common default resources folders, the values folder, leveraging android XML, screen sizes. **Launching your application:** The android manifest.xml file, creating your first android application, android framework overview and android application components.

Unit-3 **10**

Understanding Android Views: View groups and layouts, designing for different android devices, views and view groups, android layout managers, the view hierarchy, designing an android user interface using the graphical layout tool. Graphical user interface screen with views, displaying text with text view, retrieving data from users, using buttons, check boxes and audio groups. Getting dates and times from users, using indicators to display data to users, adjusting progress with seek bar and working with menus using views.

Unit-4 **07**

Displaying Pictures: Gallery, image switcher, grid view, and image view, views to display images, creating animation files, content providers, and databases, saving and loading files, SQLite databases and android database design.

Unit-5 **07**

Intents and Intent Filters: Intent overview, implicit intents, creating the implicit intent example project, explicit intents, creating the explicit intent example application, intents with activities and intents with broadcast receivers. A basic overview of android threads and thread handlers.

Text Books:

1. S. Sydhani Begum, “Mobile App Development”, Notion press.
2. Pradeep Kothari, “Android Application Development”, Dream Tech press.
3. Bill Phillips, Chris Stewart and Kristin Marsicano, ”Android Programming”, Big Nerd Ranch.

Reference Books:

1. Jonathan McCallister, “Mobile Apps”, Create Space Independent Publishing platform.
2. Dan Hermes , “Xamarin Mobile Application Development”, Apress.
3. Dawn Griffiths, ”Head First Android Development”, O’Reilly.

OE-8013
AUTOMATION AND ROBOTICS

L	T	P
3	1	0

Course Outcomes (COs):
After successful completion of this course, student will be able to:

- Explain the fundamentals of robotics and its components
- Illustrate the Kinematics and Dynamics of robotics
- Explain sensors and instrumentation in robotics.

Unit-1 **08**

Introduction to Robotics: Types and components of a robot, classification of robots, closed-loop and open-loop control systems. Kinematics systems: Definition of mechanisms and manipulators, social issues and safety.

Unit-2 **09**

Robot Kinematics and Dynamics: Kinematic Modelling: Translation and rotation representation, co-ordinate transformation, DH parameters, Jacobian, singularity and statics, dynamic modelling, Equations of motion: Euler-Lagrange formulation.

Unit-3 **09**

Sensors and Vision System: Sensor: Contact and proximity, position, velocity, force and tactile etc., Introduction to Cameras: Camera calibration, geometry of image formation, Euclidean/similarity/affine/projective transformations and vision applications in robotics.

Unit-4 **08**

Robot Control: Basics of control: Transfer functions, control laws: P, PD, PID, non-linear and advanced controls, robot actuation systems: actuators: electric, hydraulic and pneumatic. Transmission: Gears, timing belts and bearings and parameters for selection of actuators.

Unit-5 **06**

Control Hardware and Interfacing: Embedded systems: Architecture and integration with sensors, actuators, components and programming for robot applications

Text Books:

1. Mittal R.K., NagrathI.J., "Robotics and Control", Tata McGraw Hill.
2. Mukherjee S., "Robotics and Automation", Khanna Publishing House, Delhi.
3. Craig, J.J., "Introduction to Robotics: Mechanics and Control", Pearson, New Delhi,

Reference Books:

1. Saha, S.K., "Introduction to Robotics", McGraw-Hill Higher Education", NewDelhi.
2. Ghosal, A., "Robotics", Oxford, New Delhi.
3. Niku Saeed B., "Introduction to Robotics: Analysis, Systems, Applications", PHI, New Delhi.

OE-8014
MOBILE COMPUTING

L	T	P
3	1	0

Course Outcomes (COs):
After successful completion of this course, student will be able to:

- Explain the principles and theories of mobile computing technologies.
- Describe infrastructures and technologies of mobile computing technologies.
- List applications in different domains that mobile computing offers to the public, employees, and businesses.
- Understand the Ad-hoc Network Routing Protocols.

Unit -1: **08**

Introduction: Challenges in mobile computing, coping with uncertainties, resource poorness and bandwidth, etc. cellular architecture, co-channel interference, frequency reuse and capacity increase by cell splitting. **Evolution of mobile system**: CDMA, FDMA, TDMA, and GSM.

Unit -2: **08**

Mobility Management: Cellular architecture, co-channel interference. **Mobility:** handoff, types of handoffs, location management, HLR-VLR scheme, hierarchical scheme, predictive location management schemes, Mobile IP and cellular IP.

Unit -3: **09**

Publishing & Accessing Data in Air: Pull and push based data delivery models, data dissemination by broadcast, broadcast disks, directory service in air and energy efficient indexing scheme for push based data delivery. **File System Support for Mobility**: Distributed file sharing for mobility support, CODA and other storage manager for mobility support.

Unit -4: **08**

Ad-hoc Network Routing Protocols: Ad-hoc network routing protocols, destination sequenced distance vector algorithm, cluster based gateway switch routing, global state routing, fish-eye state routing, dynamic source routing, ad-hoc on-demand routing, location aided routing and zonal routing algorithm.

Unit -5: **07**

Mobile Transaction and Commerce: Models for mobile transaction, Kangaroo and Joey transactions and team transaction, recovery model for mobile transactions, electronic payment and protocols for mobile commerce.

Text Books:

1. J. schiller , “Mobile Communication”, Addison Wesley.
2. Charlsperkins, “Ad-hoc Networks”, Addison Wesley.
3. Charlsperkins, “Mobile IP”, Addison Wesley.

Reference Books:

1. Willam Stallings, “Wireless Communications and Networking “, Pearson Education.
2. Sandeep Ks Gupta, “Fundamentals of Mobile & Pervasive Computing”, Frank Adelstein.
3. A. Mehrotra, “GSM System Engineering” Artech House.

OE- 8015
INTERNET OF THINGS

L	T	P
3	1	0

Course Outcomes (COs):
After successful completion of this course, student will be able to:

- Understand the application areas of IOT.
- Understand building blocks of Internet of Things and characteristics.
- Understand about radio frequency identification technology.

Unit-1 **08**

Introduction: Internet of thing, history of IoT, about IoT, overview and motivations, examples of applications, internet of things definitions and frameworks: IoT definitions, IoT architecture, general observations, ITU-T views, working definition, IoT frameworks and basic nodal capabilities.

Unit-2 **08**

Fundamentals of IoT Mechanisms and Key Technologies: Identification of IoT objects and services, structural aspects of the IoT, environment characteristics, traffic characteristics, scalability, interoperability, security and privacy, open architecture, key IoT technologies, device intelligence, communication capabilities, mobility support, device power, sensor technology, RFID technology and satellite technology.

Unit-3 **08**

Radio Frequency Identification Technology: RFID introduction, principle of RFID, components of an RFID system, Issues EPC global architecture framework- EPCIS & ONS, design issues, technological challenges, security challenges, IP for IoT, and web of things. **Wireless Sensor Networks:** History and context, WSN architecture, the node, connecting nodes, networking nodes, securing communication WSN specific IoT applications, challenges- security, QoS, configuration, various integration approaches, data link layer protocols, routing protocols and infrastructure establishment.

Unit-4 **08**

Resource Management in the Internet of Things: Clustering, software agents, clustering principles in an internet of things, architecture, design guidelines, and software agents for object representation, data synchronization, identity portrayal, identity management, various identity management models- local, network, federated and global web identity, user-centric identity management, device centric identity management and hybrid-identity management, identity and trust.

Unit-5 **08**

Internet of Things Privacy, Security and Governance: Vulnerabilities of IoT, security requirements, threat analysis, use cases and misuse cases, IoT security tomography and layered attacker model, identity establishment, access control, message integrity, non-repudiation, availability and security model for IoT.

Text Books:

1. A. Bahga and Vijay Madisetti, “Internet of Things - A Hands-on Approach”, Universities Press.
2. Matt Richardson, S. Wallace, “Getting Started with Raspberry Pi”, O'Reilly (SPD).
3. Olivier Hersent, D. Boswarthick, O.Elloumi, “The Internet of Things: Key Applications and Protocols”, 2nd Edition, Willy Publications.

Reference Books:

1. D. Uckelmann, M. Harrison, Michahelles, Florian , “Architecting the Internet of Things”, Springer.
2. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press.
3. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stamatis ,Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier.

OE-8016
CYBER LAW AND ETHICS

L	T	P
3	1	0

Course Outcomes (COs):
After successful completion of this course, student will be able to:

- Identify and analyze statutory, regulatory, constitutional, and organizational laws that affect the information technology professional.
- locate and apply case law and common law to current legal dilemmas in the technology field.
- Understand about internet security threats.

Unit-1 **08**

Fundamentals of Cyber Law: Jurisprudence of cyber law, object and scope of the IT Act2000, introduction to Indian cyber law, uncitral model law, ISP guideline. Intellectual property issues and cyber space, Indian perspective, overview of intellectual property related legislation in India, patent, copy right, trademark law, law related to semiconductor layout and design.

Unit-2 **08**

E-commerce Security: Security threats to e-commerce, virtual organization, business transactions on web, e-governance and EDI, concepts in electronic payment systems, e-cash, credit/debit cards, e-agreement, legal recognition of electronic and digital records, e-commerce issues of privacy, wireless computing-security challenges in mobile devices. **Digital Signatures** -Technical issues, legal issues, electronic records, digital contracts, and requirements of digital signature system.

Unit-3 **08**

Security Policies: Development of policies, www policies, email security policies, policy review process-corporate policies-sample security policies, publishing and notification requirement of the policies, **Evolving technology security:** mobile, cloud, outsourcing and SCM.

Unit-4 **09**

Internet Security Threats: Information systems and its importance, role of security in internet and web services, classification of threats and attacks, security challenges, security implication for organizations, security services-authentication, confidentiality, integrity, availability and other terms in information security, Introduction to cryptography, firewalls, basic concepts of network security, perimeters of network protection & network attack, need of intrusion monitoring and detection, hacking, cracking, sneaking, viruses, trojan horse, malicious code & logic bombs, Introduction to biometric security, its challenges, and finger prints.

Unit-5 **07**

Investigation and Ethics: Cyber-crime, cyber jurisdiction, cyber-crime and evidence act, treatment of different countries of cyber-crime, ethical issues in data and software privacy, plagiarism, pornography, tampering computer documents, data privacy and protection, domain name system, software piracy, issues in ethical hacking. **Cyber-crime forensic:** Case study in cyber-crime.

Text Books:

1. Charles P. Pfleeger, Shari LawerancePfleeger, "Analyzing Computer Security", Pearson Education India.
2. Harish Chander, "Cyber Law and IT Protection", PHI Publication, New Delhi.
3. Sarika Gupta & Gaurav Gupta, Information Security and Cyber Laws, Khanna Publishing House.

Reference Books:

1. Schou, Shoemaker, "Information Assurance for the Enterprise", Tata McGraw Hill.
2. Anshul Kaushik, "Cyber Security", Khanna Publishing House.
3. V.K. Jain, "Cryptography and Network Security", Khanna Publishing House, Delhi.

OE-8017
DATA ANALYTICS

L	T	P
3	1	0

Course Outcomes (COs):

After the completion of the course, students are expected to have the ability to:

- Identify appropriate data mining algorithms to solve real world problems.
- Compare and evaluate different data mining techniques like classification, prediction, clusteringand association rule mining.
- Describe complex data types with respect to spatial and web mining.

UNIT-I **10**

Introduction: Sources, modes of availability, inaccuracies and uses of data; Data Objects and Attributes; Descriptive Statistics: Visualization, Data Similarity and Dissimilarity, Pre-processing of Data: Cleaning for Missing and Noisy Data; Data Reduction: Discrete Wavelet Transform, Principal Component Analysis, Partial Least Square Method, Attribute Subset Selection, Data Transformation and Discretization.

UNIT-II **08**

Inferential Statistics: Probability density functions; Inferential statistics through hypothesis tests. **Business Analytics:** Predictive Analysis (Regression and Correlation, Logistic Regression, In-Sample and Out-of-Sample Predictions), Prescriptive Analytics (Optimization and Simulation with Multiple Objectives);

UNIT-III **08**

Mining Frequent Patterns: Concepts of support and confidence; Frequent Item sets Mining Methods; Pattern Evaluation. Classification: Decision Trees – Attribute Selection Measures and Tree Pruning; Bayesian and Rule-based Classification; Model Evaluation and Selection; Cross-Validation; Classification Accuracy; Bayesian Belief Networks; Classification by Back-propagation and Support Vector Machine.

UNIT-IV **06**

Clustering: Partitioning Methods – k-means Hierarchical Methods and Hierarchical Clustering using Feature Trees; Probabilistic Hierarchical Clustering; Introduction to Density, Grid and Fuzzy and Probabilistic Model-based Clustering Methods; and Evaluation of Clustering Methods.

UNIT-V08

Machine Learning: Introduction and Concepts: Ridge Regression; Lasso Regression; and *k*-Nearest Neighbours, Regression and Classification;

Supervised Learning with Regression and Classification Techniques: Bias-Variance Dichotomy, Linear and Quadratic Discriminant Analysis, Classification and Regression Trees; Ensemble Methods: Random Forest, Neural Networks, Deep Learning.

Text Books:

1. G. Shmueli, N. R. Patel, and P. C. Bruce, “Data Mining for Business Intelligence”, John Wiley & Sons, New York.
2. V. Kumar, and P.N. T. M. Steinbach, “Introduction to Data Mining”, Pearson.

Reference Books:

1. J. Han, M. Kamber and J. Pei, "Data Mining: Concepts and Techniques, Morgan Kaufmann.
2. G. James, D. Witten, T. Hastie, and R. Tibshirani, "An Introduction to Statistical learning with Applications in R", Springer, New York.
3. C. M. Bishop, "Pattern Recognition and Machine Learning", Springer.

OE-8018
NON-CONVENTIONAL ENERGY RESOURCES

L T P
3 1 0

Course Outcomes (COs):

After the completion of the course, students are expected to have the ability to:

- Identify renewable energy sources and their utilization.
- Understand basic concepts of solar radiation and analyze solar thermal systems for itsutilization.
- Understand working of solar cells and its modern manufacturing technologies.
- Understand concepts of Fuel cells and their applications.
- Compare energy utilization from wind energy, geothermal energy, biomass, biogas andhydrogen.

UNIT-I **09**

Introduction: Various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits; Solar Energy: Solar Radiation and its measurement, modes of utilization of solar energy; Solar Photovoltaic Technology: Theory of solar cells. Solar cell materials, voltage developed by solar cell, Solar cell performance, solar PV power plant.

UNIT-II **06**

Solar Thermal Energy: Flat plate collectors: materials used, applications and performance; Focusing type collectors: materials used, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling systems, limitations.

UNIT-III **10**

Geothermal Energy: Resources of geothermal energy, thermodynamics of geo-thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations; Magneto-hydrodynamics (MHD): Principle of working of MHD Power plant, performance and limitations; Fuel Cells: Principle of working of various types of fuel cells and their working, performance and limitations.

UNIT-IV **07**

Thermo-electric and Thermionic conversions: Principle of working, performance and limitations; Wind Energy: Wind power, site selection criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics, performance and limitations of energy conversion systems.

UNIT-V **08**

Bio-mass: Availability of bio-mass and its conversion theory; Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance and limitations; Wave energy and Tidal energy: Working principle, performance, limitations; waste recycling plants; Grid integration of RES.

Text Books:

1. M. V. R. Koteswara Rao, “Energy Resources: Conventional & Non-Conventional”, BS Publications.
2. D.S. Chauhan,”Non-conventional Energy Resources” New Age International.
3. C.S. Solanki, “Renewable Energy Technologies: A Practical Guide for Beginners”

PHI Learning.
4. G.D. Rai, “Non-Conventional Energy Sources”, Khanna Publishers.
5. R. D. Begamudre, “Energy Conversion Systems”, New Age International Publishers.

Reference Books:

1. Peter Auer, “Advances in Energy Systems and Technology”, Vol. 1 & II Edited by Academic Press.
2. Godfrey Boyle, “Renewable Energy Power for A Sustainable Future”, Oxford University Press.

OE-8019
APPLIED OPERATIONS RESEARCH

L T P
3 1 0

Course Outcomes (COs):

After the completion of the course, students are expected to have the ability to:

- To be able to understand the application of OR and frame a LP Problem with solution–graphical and through solver add in excel (software).
- To be able to build and solve Transportation and Assignment problems using appropriate method.
- To be able to design and solve simple models of CPM and queuing to improve decision
- making and develop critical thinking and objective analysis of decision problems.
- To be able to solve simple problems of replacement and implement practical cases of decision making under different business environments.
- Enables to take best course of action out of several alternative courses for the purpose of achieving objectives by applying game theory and sequencing models.

UNIT-I **10**

Introduction: Definition and scope of OR, Techniques and tools, model formulation, general methods for solution, Classification of Optimization problems, Optimization techniques.

Linear Optimization Models: Complex and revised Simplex algorithms, Degeneracy and duality, Post-optimum and Sensitivity analysis, Assignment, transportation and transhipment models, Travelling salesmanproblem, Integer and parametric programming.

UNIT-II **08**

Game Problems: Minimax criterion and optimal strategy, two persons zero sum game, Games by Simplex dominance rules.

UNIT-III **07**

Waiting Line Problems: Classification of queuing problems, M/M/1 & M/M/1/N queuing systems, Steady state analysis of M/M/m queues, Discrete and continuous time Markov models, Chapman-Kolmogorov equation, Birth & death processes in manufacturing, Open and Closed queuing networks.

UNIT-IV **07**

Inventory Management: ABC analysis, deterministic and Probabilistic models.

UNIT-V **08**

Dynamic Programming: Characteristics of dynamic programming problems, Bellman's principle of optimality, Problems with finite number of stages.

Stochastic Programming: Basic concepts of Probability theory, Stochastic linear programming.

Text Books:

1. L.Saaty, Elements of Queuing Theory,DoverPubns, New Ed edition
2. HadleyAddison&Wesley, Nonlinear and Dynamic Programming, Pearson Education(US)
3. Ackoff&Sasieni, Fundamentals of Operations Research,Wiley& Sons Inc.

References Books:

1. Wagner, Principles of OR with Applications to ManagerialDecisions, Prentice Hall
2. Taha, OperationsResearch, Pearson Education India
3. R PanneerselvamPrentice, OperationsResearch, Hall ofIndia
4. A P VermaS.K, OperationsResearch, Kataria&Sons
5. Hillier and Lieberman, Introduction to Operations Research, Prentice Hall

OE-8020
SIX SIGMA METHODS & APPLICATION

L	T	P
3	1	0

Course outcomes (COs)

- Ability to understand the concepts, implementation and objectives of sixsigma.
- Ability to use a structural approach to process improvement.
- Ability to develop a skill to predict, prevent and control defects in a process.
- Ability to achieve quality improvement through process improvement.
- Understand the tools of process discovery.

UNIT I **08**

Quality Perception; Quality in Manufacturing, Quality in Service Sector; Differences between Conventional and Six Sigma concept of quality; Six Sigma success stories. Statistical foundation and methods of quality improvement. Descriptive statistics: Data Type, Mean, Median, Mode, Range, Variation, Standard Deviation, Skewness, Kurtosis. Probability Distribution: Normal, Binomial, Poisson Distribution.

UNIT II **08**

Basics of Six Sigma: Concept of Six Sigma, Defects, DPMO, DPU, Attacks on X'S,Customer focus, Six Sigma for manufacturing, Six Sigma for service. Z score,Understanding Six Sigma organization, Leadership council, Project sponsors and champions, Master Black Belt, Black Belt, Green Belts.

UNIT III **08**

Methodology of Six Sigma, DMAIC, DFSS, Models of Implementation of Six Sigma, Selection of Six Sigma Projects.

UNIT IV **08**

Six Sigma Tools: Project Charter, Process mapping, Measurement system analysis, Hypothesis Testing, Quality Function deployment, Failure mode effect analysis, Design of Experiments.

UNIT V **08**

Sustenance of Six Sigma, Communication plan, Company culture, Reinforcement and control, Introduction to software for Six Sigma, Understanding Minitab, Graphical analysis of Minitab plots.

Text Books:

1. Hillier and Lieberman,Six Sigma: SPC and TQM in manufacturing and service, Geoff Tennant, Gower PublishingCo.
2. Greg Brue, Six Sigma for managers, McGraw-Hill
3. Pete Pande, What is Six Sigma, McGraw-Hill

References Books:

1. Peter S. Pande, The Six Sigma Way, McGraw-Hill education
2. Peter S. Pande, The Six Sigma way, McGraw-Hill
3. Adam Vardy, Lean Six Sigma, Create space Independent Publishing Platform
4. Thomas Pyzdek and Paul Keller, Six Sigma,McGraw-Hill

OE-8021
MECHATRONICS

L	T	P
3	1	0

Course Outcomes (COs):

After the completion of the course, students are expected to have the ability to:

- Identify key elements of mechatronics and its representation by block diagram.
- Understand the concept of sensors and use of interfacing systems.
- Understand the concept and applications of different actuators.
- Illustrate various applications of mechatronic systems.
- Develop PLC ladder programming and implementation in real life problem.

UNIT-I **08**

Introduction: Introduction to mechatronics, systems, measurement systems, control systems, microprocessor based controllers, The mechatronics approach, Problems.

Review of Transducers: Sensors and transducers, performance terminology, Displacement position and proximity, velocity& motion, Force, Fluid pressure, Liquid flow, liquid level, Temperature, Light sensors, Selection of sensors, Inputting data by switches.

UNIT-II **09**

Signal Conditioning: Signal conditioning, The operational amplifier, Protection, Filtering, Wheatstone bridge, Digital signals, Multiplexers, Data acquisition, Digital signal processing, Pulse - modulation, Problems.

Data Presentation Systems: Displays, Data presentation elements, Magnetic recording, Displays, Data acquisition systems, Measurement systems, Measurement systems, Testing and calibration.

UNIT-III **09**

Pneumatic and Hydraulic Systems: Actuation systems, Pneumatic and hydraulic systems, Directional control valves, Pressure-control valves, Cylinders, Process control valves, rotary actuators, Problems.

Mechanical Actuation Systems: Mechanical systems, Types of motion, Kinematics chains, Cams, Gear trains, Ratchet and pawl, Belt and chain drives, Bearings, Mechanical aspects of motor selection problems.

UNIT-IV **07**

Electrical Actuation Systems: Electrical systems, Mechanical Switches, Solid-state switches, Solenoids, DC motors, AC motors, Stepper motors.

UNIT-V **07**

Basic System Models: Mathematical models, mechanical system building blocks, Electrical system building blocks, Thermal system building blocks.

Text Books:

1. W. Bolton, Mechatronics,. Addison Wesley Longman, Pub, 1999 (Delhi)
2. K.P Ramachandra, Mechatronics, Wiley Publication.
3. Dr. Rajesh Purohit, Industrial Engineering robotics and Mechatronics, Made Easy Publication

References Books:

1. William Bolton, Mechatronics, Pearson Education.
2. M.D.Singh and J.G Joshi, Mehatronics, PHI Publication
3. Richard A.Kolk, Mechatronics System design. Cengage Learning, Inc
4. AppuKuttan K.K, Introduction To Mechatronics, Oxford University Press

OE-8022
BIOMEDICAL ELECTRONICS

L	T	P
3	1	0

Course Outcomes (COs):

After the completion of the course, students are expected to have the ability to:

- To have a basic understanding of medical terminology, relevant for biomedical instrumentation.
- To understand and describe the physical and medical principles used as a basis for biomedical instrumentation.
- Understand the elements of risk for different instrumentation methods and basic electrical safety.
- Understand the position of biomedical instrumentation in modern hospital care.

Unit I **08**

Introduction: The age of Biomedical Engineering, Development of Biomedical Instrumentation, Man–Instrumentation system, Components, Physiological system of the body, Problem encountered in measuring a living system.

Transducers: The Transducers & Transduction principles, Active transducers, Passive Transducers, Transducer for Biomedical Applications.

Unit II **08**

Sources of Bioelectric potentials: Resting & Action potentials, propagation of active potential, The Bioelectric potentials-ECG, EEG, EMG, and Invoked responses.

Electrodes: Electrode theory, Biopotential Electrodes–Microelectrodes Body surface electrodes, Needle Electrodes, Biochemical Transducers, Reference electrodes, PH electrodes, Blood Gas electrodes.

Unit III **08**

Cardiovascular Measurements: Electrocardiography – ECG amplifiers, Electrodes & leads, ECG recorders - Three channel, Vector Cardiographs, ECG system for stress testing, Continuous ECG recording (Holter recording), Blood pressure measurement, Blood flow measurement, Heart sound measurements.

Patient Care & Monitoring - Elements of Intensive Care monitoring, patient monitoring displays, Diagnosis, Calibration & Repairability of patient monitoring equipment, pacemakers & Defibrillators.

Unit IV **08**

Measurements in Respiratory system: Physiology of respiratory system Measurement of breathing mechanics - Spiro meter, Respiratory Therapy equipments: Inhalators ventilators & Respirators, Humidifiers, Nebulizers & Aspirators.

Diagnostic Techniques: Ultrasonic Diagnosis Echocardiography, Echo Encephalography, Ophthalmic scans, X-Ray & Radio-isotope Instrumentation, Computerized Axial Tomography Scanners.

Unit V **08**

Introduction to Bio-Medical Signals:

Classification, Acquisition and Difficulties during Acquisition, Electroencephalography, Electromyography, & electro-retinography, Role of Computers in the Analysis, Processing, Monitoring & Control and image reconstruction in bio-medical field.

Bio Telemetry: The components of Biotelemetry system Implantable units, Telemetry for ECG measurements during exercise, for Emergency patient monitoring. Physiological Effects of Electric Current Safety of Medical Electronic Equipments, Shock hazards from Electrical equipment and prevention against them.

Text Books:

2. Leslie Cromwell, Fred J. Welbell and Erich A. Pfeiffer, "Biomedical Instrumentation and Measurements", Prentice Hall (India).

Reference Books:

4. R. S. Khandpur, "Biomedical Instrumentation", Tata McGraw-Hill.
5. Willis J. Tompkins, "Biomedical DSP: C Language Examples and Laboratory Experiments
   for the IBM PC", Prentice Hall (India).
6. D. C. Reddy, "Biomedical Signal Processing", McGraw-Hill

OE-8023
EMBEDDED SYSTEMS

L	T	P
3	1	0

Course Outcomes (COs):

After the completion of the course, students are expected to have the ability to:

- Gain knowledge of embedded systems.
- Understand the concept, classification, characteristics, quality attributes and applications of Embedded Systems.
- Understand the architecture of embedded system and basics of real-time operating system.
- Write simple programs based on 8051 μC.
- Design simple applications using 8051 μC kit.

Unit I **08**

Introduction to Embedded system, Embedded System Project Management, ESD and Codesign issues in System development Process, Design cycle in the development phase for an embedded system, Use of target system or its emulator and In-circuit emulator, Use of software tools for development of an ES.

Unit II **08**

8051 Microcontroller: Microprocessor V/s Micro-controller, 8051 Microcontroller: General architecture; Memory organization; I/O pins, ports & circuits; Counters and Timers; Serial data input/output; Interrupts. 8051 Instructions: Addressing Modes, Instruction set: Data Move Operations, Logical Operations, Arithmetic Operations, Jump and Call Subroutine, Advanced Instructions. 8051 Interfacing and Applications: Interfacing External Memory, Keyboard and Display Devices: LED, 7-segment LED display, LCD.

Unit III **08**

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

Unit IV **08**

Brief general architecture of AVR, PIC and ARM microcontrollers, JTAG: Concept and Boundary Scan Architecture. Organization of FPGAs, FPGA Programming Technologies, Programmable Logic Block Architectures, Programmable Interconnects, Programmable I/O blocks in FPGAs, Dedicated Specialized Components of FPGAs, Applications of FPGAs.

Unit V **08**

Advanced Processor: (only architectures) 80386, 80486 and ARM (References)

RTOS: Tasks, states, Data, Semaphores and shared data, Operating system, services, Message queues, Mailboxes.

Communication basics: Microprocessor Interfacing, I/O Addressing, Direct memory access, Arbitration, multilevel bus architecture, Serial protocols, Parallel Protocols and wireless protocols.

Real world Interfacing: LCD, Stepping Motor, ADC, DAC, LED, Push Buttons, Keyboard, Latch Interconnection, PPI.

Text Books:

3. K. V. Shibu, “Introduction to Embedded Systems”, McGraw Hill.
4. E. Mazadi, “The 8051 Microcontroller And Embedded Systems Using Assembly And C”, Pearson Education India, 2007

Reference Books:

5. Kenneth Hintz and Daniel Tabak, “Microcontrollers (Architecture, Implementation and Programming)”, TMH 2005.
6. Raj Kamal, “Embedded Systems”, TMH, 2006.
7. K. Ayala, “The 8051 Microcontroller”, 3rd Ed., Thomson Delmar Learning, 2007.
8. Frank Vahid and Tony Givargis, “Embedded System Design”, John Wiley.

OE-8024
ADVANCES IN POLYMER SCIENCE TECHNOLOGY

L	T	P
3	1	0

COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- Get knowledge of calculation of molecular weight of polymers.
- Get know about rate of different polymerization reactions
- Get know about morphology and deformation causes in polymers.
- Get know the use of composites and conducting in technology
- Get knowledge about various processing techniques of polymers like plastic, fibres and elastomers.

UNIT 1: **08**

Characteristics and Analysis of Polymers

Basic concept of Polymer Science, Measurement of molecular weight and size, Polymer degradation, Analysis and testing of polymers.

UNIT 2: **0**8

Mechanism and Kinetics of Polymerisation

Free radical, Cationic,Anionic, Coordination polymerization and their kinetics. Step Growth polymerization and their kinetics, Ring opening polymerization.

UNIT 3: **08**

Structure and Properties of Polymers

Morphology in crystalline polymers, Calculation of crystallinity, Polymer structure and physical properties, Deformation, flow and melt characteristics, Rheology and mechanical properties of polymers.

UNIT 4: **0**8

Composites, Conducting Polymers

Definition, types of composites, preparation methods, testing of composites, Applications of composites in technology. Conducting polymers- Definition, Synthesis and application in technology.

UNIT 5: **0**8

Processing of Polymers- Plastics, Fibers and Elastomers

Plastics-extrusion, injection molding, blow molding, compression and transfer molding; Spinning of fibers. Elastomers: Utility of Vulcanization and Reinforcement in Engineering.

Text Books:

- F.W. Billmeyer, "Text Book of Polymer Science", 3rdEdn., Wiley Inter Science.
- V. R. Gowarikar, N. V. Viswanathan, Jayadev Sreedhar, “Polymer Science” 3rd Edition, New Age International Publishers.

Reference Books:

- F. Rodriguez, "Principles of polymer systems",4thEdn., Taylor and Francis, Washington.
- Fried, J.R., “Polymer Science and Technology”, Prentice Hall, Inc.

OE-8025
Mathematical Modeling and Simulation

L	T	P
3	1	0

Course Outcome (COs):

After completion of the course student will be able to:

- Define, describe and apply basic concepts related to modeling and simulation.
- Importance of simulation, how to simulate real world problems.
- Simulation of real world problems like water reservoir, autopilot, servo system.
- Develop mathematical model for real world problems.
- Model and simulate mechanical and electrical systems using the computer tools Simulink.

UNIT I **08**

Introduction to Modeling and Simulation: System definition and components, stochastic activities, continuous and discrete systems, system modeling, types of models, static and dynamic physical models, static and dynamic mathematical models, full corporate model, types of system study. Introduction to Simulation, appropriate and not appropriate, advantages and disadvantage, application areas, history of simulation software, MATLAB as a Simulation tool.

UNIT II **08**

System simulation, why& when to simulate, nature and techniques of simulation, comparison of simulation and analytical methods, types of system simulation, real time simulation, hybrid simulation, simulation of pure-pursuit problem, single-server queuing system and an inventory problem, Monte-Carlo simulation, Distributed Lag models, Cobweb model.

UNIT III **08**

Simulation of continuous systems, analog vs. digital Simulation, Simulation of water reservoir system, Simulation of a servo system, simulation of an autopilot, Discrete system simulation, fixed time-step vs. even to even model, generation of random numbers, test for randomness, Monte-Carlo computation vs. stochastic simulation.

Unit IV **08**

System dynamics,exponential growth models, exponential decay models, modified exponential growth models, logistic curves, generalization of growth models, system dynamic diagrams.

Introduction to SIMSCRIPT: Program, system concepts, origination, and statements, defining the telephone system model.

UNIT V **08**

Simulation of PERT Networks, critical path computation, uncertainties in activity duration, resource allocation and consideration.Simulation languages and software, continuous and discrete simulation languages, expression based languages, object oriented simulation, general purpose vs. application - oriented simulation packages, CSMP-III, MODSIM-III.

Text Books:

1. Geoftrey Gordon, " System Simulation", PHI
2. Narsingh Deo, "System Simulation with digital computer"PHI

Reference Books

1.Jerry Banks, John S. C Barry L. Nelson David M. Nicol, "Discrete Event System Simulation", Pearson Education

2. V P Singh, "System Modeling and simulation", New Age International.
3. Averill M. Law, W. David Kelton, "System Modeling and simulation and Analysis", TMH

OE-8026
Nanoscience and Quantum Computing

L	T	P
3	1	0

Course Outcome:

After completion of the course student will be able to:

- To apply engineering and physics concepts to the nano-scale and non-continuum domain. Identify and compare state-of-the-art nanofabrication methods and perform a critical analysis of the research literature. Design processing conditions to engineer functional nanomaterials.
- To explain the fundamental science and quantum mechanics behind nanoelectronics. Explain the concepts of a quantum well, quantum transport and tunnelling effects. Differentiate between microelectronics and nanoelectronics and to understand basic and advanced concepts of nanoelectronic devices, sensors
- Understand the general concepts of photon trapping and plasmons in nanooptics, nano-photonics etc and to explain the basic functions, properties and different methods of Nanoholes and photons, solar energy, solar cells, optically used nanomaterials, Photoniccrystals.
- To impart knowledge on *Nanomaterials* for *biomedical* applications such as Proteins and applications, Drug delivery systems and to explain fabrication of nanoporous and nanofluidic devices and itsapplications.
- To provide a brief idea about quantum information and quantum Computing, Superposition, Measurement and working principle of quantum computers.

UNIT - I: Nanomaterials and Nano-structures **08**

Brief review of nanomaterials: Fullerenes, Nanotubes, Nanowires, Quantum Dots, Dendrites, Synthesis- Top Down, Bottom Up, Plasma arcing, Chemical vapour Deposition, sol-gel methods, Characterization using Electron Microscopy Techniques: Scanning Electron Microscopy, Transmission Electron Microscopy, Scanning Tunneling Microscopy, Atomic Force Microscopy, Scanning Probe Microscopy, X ray methods, Fluorescence, Properties of nanomaterials.

UNIT –II:Nanoelectronics **08**

Introduction – micro, and nano fabrication: Optical lithography, Electron beam lithography, Atomic lithography, Molecular beam epitaxy, Quantum electronic devices: High electron mobility transistors, Quantum interference Transistor, Single electron Transistor, MEMS, NEMS

UNIT - III: NanotechnologyinOptics **08**

Properties of light – interaction of light and nanomaterials: Photon trapping and Plasmons, Dielectric Constant and Polarisation, Refractive index, Nanoholes and photons, solar energy, solar cells, optically used nanomaterials, Photoniccrystals

UNIT – IV: NanotechnologyinBiomedicine **08**

Self assembled monolayers, Bio molecular motors: Function of Motor Proteins and applications, Drug delivery systems, Nanofluidics: Fluids at micro andNanometer scale, fabrication of nanoporous and nanofluidic devices and itsapplications.

UNIT – V: Quantum Computers **08**

Brief idea about quantum information and quantum Computing: Superposition, Measurement, Unitary evolution, qubits-single and multiple qubits, quantum memory, Elementary gates-quantum teleportation, working principle of quantum computers.

TextBooks:

1. Nanotechnology- Basic Science and Emerging Technologies, Mick Wilson, KamaliKannangara Geoff Smith, Michelle Simmons and Burkhard Raguse, I Edition – Overseas Press,2005
2. Introduction to Nanoscale Science & Technology, Ed. By Massimilano DiVentra – I Edition, Kluwer Academic - 2004
3. Nanotechnology, Gregory Timp – I Edition, Springer International –2005

Reference Books:

1. Nanotechnology, Michael Kohler – I Edition, Wiley VCH –2004
2. Nano-Engineering in Science & Technology, Michael Rieth – I Edition, World Scientific –2004
3. Nano, The NwextRevoliution, Mohan SundaraRajan – I Edition, National Book Trust – 2004
4. Nanotechnology, Gregory Timp-I Edition, Springer International - 2005

OE-8027
ENTREPRENEURSHIP DEVELOPMENT

L	T	P
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Course Outcome (COs):

After completion of the course student will be able to:

- Define, describe and apply basic concepts related to entrepreneurship.
- Understand the systematic process to analyze and evaluate project, prepare project report.
- Prepare balance sheet, financial report.
- Interpret their own business plan.
- Consider the legal and financial conditions for starting a business venture.

UNIT-I **08**

Entrepreneurship- definition. growth of small scale industries in developingcountries and their positions vis-a-vis large industries; role of small scale industries in the national economy; characteristics and types of small scale industries; demand based and resources based ancillaries and sub-control types.Government policy for small scale industry; stages in starting a small scale industry.

UNIT-II **08**

Project identification- assessment of viability, formulation, evaluation, financing, field-study and collection of information, preparation of project report, demand analysis, material balance and output methods, benefit cost analysis, discounted cash flow, internal rate of return and net present value methods.

UNIT-III **08**

Accountancy- Preparation of balance sheets and assessment of economic viability, decision making, expected costs, planning and production control, quality control, marketing, industrial relations, sales and purchases, advertisement, wages and incentive, inventory control, preparation of financial reports, accounts and stores studies.

UNIT-IV **08**

Project Planning and control: The financial functions cost of capital approach inproject planning and control. Economic evaluation, risk analysis, capital expenditures, policies and practices in public enterprises. Profit planning and programming, planning cash flow, capital expenditure and operations. control of financial flows, control and communication.

UNIT-V **08**

Laws concerning entrepreneur viz, partnership laws, business ownership, salesand income taxes and workman compensation act. Role of various national and state agencies which render assistance to small scale industries.

Text Books:

1.Khana.S.S., "Entrepreneurial Development" S.Chand &Co.Ltd.,Ram Nagar,New Delhi,2013.

2. Donald F Kuratko, "Entrepreneurship-Theory, Process and Practice",9th Edition, Cengage Learning 2014.

Reference Books:

1. Forbat, John, “Entrepreneurship” New Age International.
2. Havinal, Veerbhadrappa, “Management and Entrepreneurship” New Age International
3. Joseph, L. Massod, “Essential of Management", Prentice Hall of India

OE-8028
CRITICAL AND LOGICAL THINKING

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Course Outcome (COs):
After completion of the course student will be able to:

- Analyzing, reasoning, evaluating, decision-making and problem-solving attributes to play a vital role in organizational growth.
- Understand and comprehend the complexity of the professional domain and implement Interpersonal Skills.
- Negotiate with the odds and provide best opinions to the higher officials.
- Logical leadership with critical bent to produce positive results in unfavorable situations.

Unit I: Fundamentals of Critical Thinking **08**

Introduction to Critical Thinking, Recognizing Arguments, Key Concepts – Thinking Reflection and Creativity; Rhetorical Language; Principles of Interpretations; Process of Elimination; The Parts of an Argument – Claims and Propositions, Evidence, Reasoning; Argument and Critical thought; Communicating Arguments; Co-orientational, Cultural and Ethical View of Arguments

Unit II: Critical Thinking and Logical Communication **07**

Language and Critical Thinking; Citing and listing references – How to refer appropriately to the work of others; Putting your thinking into words; Writing about reflection - How to structure and report your thoughts; Editing and presenting your assignment – How to review your own work and follow academic conventions; Preparing for employment – How to transfer your thinking skills to a career.

Unit III: Logical Concepts and Philosophy of Science **08**

Truth and Validity; Hypothesis; Methods of Experimental Enquiry; Logic: Inductive and Deductive;Syllogism and Fallacies; Aristotle's conception of Virtue and Well-being; Kant's conception of Good Will, Duty and Categorical Imperative; Joseph Butler's Theory of Conscience and Self Love; J. S. Mill's Utiliterianism, Freedom and Responsibility, Chankya'sArthsashtra

Unit IV: Select School of Thought and Criticism **08**

Structuralism (Ferdinand de Saussure), Post Structuralism, Deconstruction (Jacques Derrida), Reader Response Theory (Roland Barthes), Gender Studies, Cultural Studies (Raymond Williams).

Unit V: Select School of Thought and Criticism **08**

1) ***Hind Swaraj***by Mahatma Gandhi
2) ***Tradition and Individual Talent***by T.S. Eliot
3) *"***Phenomenal Woman"***by *Maya* Angelou
4) **Heart of Darkness by Joseph Conrad**

Note: (*) denotes texts for detailed study.

Text Books:

1 Rangarajan, L.N. *Kautilya The Arthashashtra*. Penguin Classics, New Delhi, 2000.
2 Gandhi, M. K. *Hindi Swaraj*. Delhi Open Books, New Delhi, 2019.
3 Eliot, T. S. *Tradition and the Individual Talent*, The Sacred Wood, New York, 1921.
4 Conrad, Joseph. *Heart of Darkness*. Signet Classic Publishers, New York, 1997.
5 Angelou, Maya. *Phenomenal Woman: Four Poems Celebrating Women*. New York: Random House, 1994.
6 *Critical Thinking: A Student's Introduction* by Gregory Bassham and William Irwin and Henry Nardone and James Wallace, McGraw-Hill, Noida, 2019.
7 *How to Improve your Critical Thinking & Reflective Skills* by Jonathan Weyers, Pearson Education, New York, 2011.

Reference Books:

1 *Critical Thinking* by Brooke Noel Moore and Richard Parker, McGraw-Hill, Noida, 2019.
2 *Critical Thinking and Communication* by Edward S Inch, Pearson Education, New York, 2011.
3 *A glossary of literary terms* by M H Abrams& Geoffrey Galt Harpham, Cengage Learning, San Francisco, 1957.
4 *English Literary Criticism and Theory* by M.S. Nagarajan, Orient BlackSwan, Hyderabad, 2006.
5 *The Penguin Dictionary of Philosophy* by Thomas Mautner, Penguin Reference, New Delhi, 1997.
6 *Western Philosophy: An Anthology* by John Cottingham, Wiley-Blackwell, New Jersey, 1996.

CE-8029
TOWN PLANNING

L T P
3 1 0

Course Outcome (COs):
After completion of the course student will be able to

- To understand the concept of balanced town by ensuring that new and existing facilities are complimentary to each other.
- To provide sustainable buildings by considering the environmental, social and economic conditions.
- To provide diversity of accommodation.
- To provide leisure and cultural facilities for the town.
- To create awareness about the traffic management within the town.

UNIT-1 **08**

Introduction to Town Planning: Definitions of town planning, form of planning, Elements and planning principal of city plan, Shapes of plan in accordance to road networks.

UNIT-2 **08**

Planning Concepts and Evolution: Planning concepts related to City beautiful movement (Chicago, Chandigarh), Urban Utopia (Broadacre), Garden city (Letchworth), Radburn Theory (Radburn) and Neighbourhood planning.

UNIT-3 **08**

Planning Process & Standards: Understanding of planning process, Relevance of standards in planning as per URDPFI guidelines prepared by TCPO.

UNIT-4 **08**

Roads and traffic studies: Awareness of concepts related to various traffic problems in India, Understanding of PCU, Traffic volume, Road capacities, Road types; their sections and intersections, Traffic calming as per IRC guidelines.

UNIT-5 **08**

Modern Transportation systems: New concepts in mass and rapid transportation systems e.g. BRT, LRT and Metro rail. **Modern approach in Planning:** Introduction, Benefits and Planning components of Green City (e.g. Vancouver), Compact City (e.g. Sky city, China) and Smart City (e.g. Malta)

Text Books:

1 John Ratcliffe, "An Introduction to Town and Country Planning", Hutchinson 1981.
2 Arthur B. Gallion and Simon Eisner, "The Urban Pattern – City planning and Design", Van Nostrand Reinhold company.
3 Rangwala, "Town Planning", Charotar publishing house.
4 G.K.Hiraskar, "Town Planning".

Reference Books:

1 Rame Gowda, " Urban and Regional planning".
2 S.K. Khanna, C.E.G. Jhusto, "Highway Engineering", Nemchand& Bros. Roorkee 1997.
3 N.V.Modak, V.N. Ambedkar, "Town and country planning and Housing", orient longman, 1971.
4 URDPFI Guidelines for Planning by TCPO.
5 IRC Guidelines.

CE-8030

DISASTER MANAGEMENT

L T P
3 1 0

Course Outcome (COs):
After completion of the course student will be able to

- Capacity to integrate knowledge and to analyse, evaluate and manage the different publichealth aspects of disaster events at a local and global levels, even when limited information is available.
- Capacity to describe, analyse and evaluate the environmental, social, cultural, economic, legal and organisational aspects influencing vulnerabilities and capacities to face disasters.
- Capacity to work theoretically and practically in the processes of disaster management (disaster risk reduction, response, and recovery) and relate their interconnections, particularly in the field of the Public Health aspects of the disasters.
- Capacity to manage the Public Health aspects of the disasters.
- Capacity to obtain, analyse, and communicate information on risks, relief needs and lessons learned from earlier disasters in order to formulate strategies for mitigation in future scenarios with the ability to clearly present and discuss their conclusions and the knowledge and arguments behind them.
- Capacity to design and perform research on the different aspects of the emergencies anddisaster events while demonstrating insight into the potential and limitations of science, its role in society and people's responsibility for how it is used.
- Capacity to analyse and evaluate research work on the field of emergencies and disaster while demonstrating insight into the potential and limitations of science, its role in society andpeople's responsibility for how it is used.

UNIT-1 **08**

Introduction: Reasons, classifications-natural, based on violence, deterioration of environment and health and failures of industrial society; disaster risk, elements of risk Goals of disaster management, Assessment of disasters magnitude**.**

UNIT-2 **08**

Natural disasters: Earthquake, floods, cyclone, landslide, volcano, Tsunami, drought.

UNIT-3 **08**

Man-made disasters: Reasons, types, assessment methodologies, mitigation; community-based participation; government intervention.

UNIT-4 **08**

Phases / Elements of disaster management: Mitigation, Preparedness, response, recovery, Structural and non-structural measures for flood disasters, earthquake, cyclone, landslides

UNIT-5 **08**

Community based disaster preparedness, new paradigm for risk reduction, Government of India‘s initiatives, International bodies, Case studies of recent major disasters in India and Abroad.

Text Books:

1 R.B. Singh (Ed.), “Disaster management”, Rawat publications, New Delhi.
2 “National Disaster Response Plan”, A Document prepared by Department of Agriculture and Cooperation.

Reference Books:

1. Concept of Trigger Mechanism, Govt. Of India, Ministry of Home Affairs, February 2001, Publication.
2. Water and Climate related Disasters, Govt. of India, Ministry of Home affairs, Publication.

CE-8031
ENVIRONMENTAL POLLUTION AND MANAGEMENT

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Course Outcome (COs):
After completion of the course student will be able to

- Understand the relation, impact and dependency of human being on environment.
- Identify the sources of different types of pollutants, methods of reduction of these pollutants.
- Identify sources and effects of air, water and land pollution.
- Demonstrate the use of different uses and effectiveness of government policies related toreduction of pollution.

UNIT-1 **08**

Impact of man on environment, Consequence of population growth, Energy problem, Pollution of air, water & land, Global environmental issues

UNIT-2 **08**

Water pollution: Sources and classification of water pollutants, wastewater treatment, control strategies, Eutrophication of lakes, self purification capacity of streams,
Thermal pollution: Sources, effects and control measures.

UNIT-3 **08**

Air pollution: Sources and effects, meteorological aspects, control methods and equipments, Land pollution: Types of land pollution, solid waste management-generation, storage, collection, transport, processing and disposal
Noise pollution: Sources, effects, preventive and control measures.

UNIT-4 **08**

EIA: Planning and management of environmental impact studies;
Impact evaluation methodologies: baseline studies, screening, scooping, checklist, overlays, Environmental Impact Assessment of water resources and environmental projects, Case study of power plant.
EA: Meaning, audit items, audit procedure, safety audit.

UNIT-5 **08**

Contemporary issues: Emission trading, discharge permits, international resource sharing issues, climate change, international environmental treaties and protocol, Environmental legislation: Introduction to various legislations related to water, air, biodiversity, ozone depletion etc at National and International level; Institutions for governance.

Text Books:

1 C. Manoharachary and P. Jayarama Reddy, "Principles of environmental studies (Ecology, economics, management and law)", B.S. Publications.
2 P.V. Rao, "Text of Environmental Engineering", Prentice Hall Pvt ltd., Delhi.

Reference Books:

1 Y. Ananayulu and C.A. Sastry, “Environmental impact assessment methodologies”, B.S. Publications, Hyderabad.