NATIONAL ENGINEERING COLLEGE

(An Autonomous Institution Affiliated to Anna University Chennai & Accredited by NAAC)

K.R.NAGAR, KOVILPATTI – 628 503

www.nec.edu.in

REGULATIONS – 2015

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CURRICULUM & SYLLABUS

B. E. – ELECTRONICS AND COMMUNICATION ENGINEERING

Accredited by NBA

REGULATIONS – 2015

B.E. / B.Tech. DEGREE PROGRAMMES

VISION

- Transforming lives through quality Education and research with human values.

MISSION

- To maintain excellent infrastructure and highly qualified and dedicated faculty.
- To provide a conducive learning environment with an ambience of humanity, wisdom, creativity and team spirit.
- To promote the values of ethical behavior and commitment to the society.
- To partner with academic, industrial and government entities to attain collaborative research.

REGULATIONS – 2015

OUTCOME BASED EDUCATION & CHOICE BASED CREDIT SYSTEM

Common to all B.E. / B.Tech. Degree Programmes (8 – Semester)

The following Regulations shall be applicable for all the U.G. Degree Programmes offered at National Engineering College, K.R. Nagar, Kovilpatti from the academic year ***2015 – 2016*** onwards.

1.0 PRELIMINARY DEFINITIONS AND NOMENCLATURE

1. "***Programme***" means under graduate degree programme. i.e., B.E. / B.Tech. Degree Programme.

2. "***Specialization***" means a discipline of B.E. / B.Tech. Degree Programme, like Mechanical Engineering, Information Technology, etc.,

3. "***Course***" means a Theory / Integrated or Practical course that is normally studied in a semester, like Engineering Graphics, Fundamentals of Computing and Programming, etc.,

4. "***Controller of Examinations***" means the authority of the Institution who is responsible for all the activities of the End Semester Examinations of this Institute.

5. "***Dean (Academic)***" means the authority of the Institution who is responsible for initiating all the academic activities for the implementation of relevant rules and regulations.

6. "***Head of the Institution***" means the Principal of the College / Institution.

7. "***Head of the Department***" means Head of the Department concerned.

8. "***University***" means **ANNA UNIVERSITY, CHENNAI**.

2.0 QUALIFICATIONS FOR ADMISSION

2.1 Admission to First Semester

The candidates seeking admission for the first semester of the eight semester B.E. / B.Tech. degree programme:

i. Shall be required to have a pass in Higher Secondary Examinations of (10+2) in the academic stream with Mathematics, Physics and Chemistry as main courses of study conducted by the Government of Tamilnadu or an examination accepted by the syndicate of Anna University as equivalent there to.

(*OR*)

ii. Shall be required to have a pass in Higher Secondary Examination of Vocational Stream (Vocational groups in Engineering / Technology) as prescribed by the Government of Tamil Nadu.

2.2 Lateral Entry Admission

i. The candidates who possess the Diploma in Engineering / Technology awarded by the State Board of Technical Education, Tamil Nadu or its equivalent are eligible to apply for admission to the third semester of B.E. / B.Tech. programme corresponding to the branch of study.

(*OR*)

ii. The candidates who possess the Degree in Science (B.Sc.) (10+2+3 stream) with mathematics as a course at the B.Sc. level are eligible to apply for admission to the third semester of B.E. / B.Tech. Such candidates shall undergo two additional Engineering courses in the third or fifth and fourth or sixth semesters respectively as prescribed by the respective Chairman of Board of Studies.

2.3 They should also satisfy other eligibility rules as prescribed by the Anna University and Director of Technical Education, Government of Tamil Nadu, Chennai, from time to time.

3.0 UG PROGRAMMES OFFERED

1. B.E. - Mechanical Engineering
2. B.E. - Electronics and Communication Engineering
3. B.E. - Computer Science and Engineering

4. B.E. - Electrical and Electronics Engineering
5. B.E. - Electronics and Instrumentation Engineering
6. B.E. - Civil Engineering
7. B.Tech. - Information Technology

4.0 STRUCTURE OF THE PROGRAMME

The Curriculum and Syllabi under Regulations 2015 is designed keeping in mind the Outcome Based Education (OBE) and Choice Based Credit System (CBCS). The course content of each course shall be fixed in accordance with the Program Educational Objectives (PEOs), Program Outcomes (POs) and Course Outcomes (COs).

The CBCS enables the students to earn credits across programmes and provides flexibility for slow and fast learners in registering the required number of credits in a semester. The CBCS facilitates transfer of credits earned in different departments / Centers of other recognized / accredited universities or institutions of higher education in India and abroad either by studying directly or by online method.

The curriculum of every programme is designed with total number of credits ranging from ***168 to176 (125 to 133*** for Lateral entry) [Refer **Annexure-I**].

4.1 Categorization of Courses

Every B.E./B.Tech Degree Programme will have a curriculum with Syllabi consisting of theory and Practical courses that shall be categorized as given in **Table-1.**

TABLE-1 CATEGORY OF COURSES

Course Category	Range of Total credits (%) as per AICTE
Foundation Courses	30 – 40%
Programme Core	40 – 55%
Programme Elective	10 -15%
Open Elective	05 -10%
Mandatory	05 -10%

i. **Foundation courses** are classified into Common and Specific courses.

Common Foundation Courses (CFC) include Mathematics, Basic Sciences, Engineering Sciences and Skill Based Courses.

Specific Foundation Courses (SFC) include the basic courses specific to a programme of study.

ii. **Programme Core Courses (PCC)** include the core courses relevant to the chosen programme of study and the Employability Enhancement courses such as Project, Seminar and Inplant training/ Internship.

iii. **Programme Elective Courses (PEC)** include the elective courses relevant to the chosen programme of study.

iv. **Open Elective Courses (OEC)** include Inter-disciplinary and Trans-disciplinary courses. The students shall study Inter-disciplinary courses offered in other Engineering/Technology Programmes through regular mode and Trans-disciplinary courses through self study mode.

v. **Mandatory courses (MAC)** include the courses recommended by the regulatory bodies such as AICTE, UGC etc as given in **Table-2**.

TABLE-2 MANDATORY COURSES

Course Title	L	T	P	C
Technical English / Professional English	3	0	0	3
Professional Ethics and Human Values	3	0	0	3
Environmental Science and Engineering	3	0	0	3
Communication Skills Laboratory	0	0	2	1

vi. Every student shall undergo one Interdisciplinary and one Transdisciplinary course.

4.2 One Credit Non CGPA Courses

In addition, the students shall enroll, in any one of the one credit Non CGPA courses in each category listed in **Table-3** and earn a minimum of two credits (one from each category) for the award of the degree. The details for assessing these activities are given in **Annexure-II**.

TABLE – 3

CATEGORY OF ONE CREDIT NON – CGPA COURSES

Category	Code	Courses	Credit
Personality and Character Development	NCG11	Sports	1
	NCG12	Yoga for youth empowerment	
	NCG13	National Cadet Corps	
	NCG14	National Service Scheme	
	NCG15	YRC	
Allied Skills	NCG21	CO/Extra Curricular Activities	1
	NCG22	English Proficiency Certification	
	NCG23	Soft Skills	
	NCG24	Foreign / Vernacular Languages	
	NCG25	Aptitude Proficiency Certification	
	NCG26	Globally accepted Certification Courses	
	NCG27	Socially Responsible Activities	

4.3 Number of Courses per Semester

Curriculum of semester (vide **Clause 5.2)** shall normally have a blend of 2 to 7 theory / integrated courses and laboratory courses not exceeding 5. Each course may have credits as per **Clause 4.4**.

4.4 Credit System

In credit system, one credit refers to

- One period of lecturing per week for a theory course.
- Two periods per week for *Tutorial / Drawing / Lab / Workshop practice / project*.
- The contact periods per week for Tutorials and Practical can only be in multiples of 2.

The length of the semesters shall be 18 to 20 weeks. Credit for a course shall vary from 1 to 4. The L:T:P pattern that shall be followed for various courses is given in **Table-4**.

TABLE – 4

Type of course	Lectures (Periods/ week)	Tutorials (Periods/ week)	Practical work (Periods/ week)	Credits (L:T:P)	Total credits	Total (Periods/ week)
1 Credit	1	0	0	1:0:0	1	1
	0	0	2	0:0:1	1	2

Type of course	Lectures (Periods/ week)	Tutorials (Periods/ week)	Practical work (Periods/ week)	Credits (L:T:P)	Total credits	Total (Periods/ week)
2 Credit	2	0	0	2:0:0	2	2
	1	0	2	1:0:1	2	3
3 Credit	3	0	0	3:0:0	3	3
	2	2	0	2:1:0	3	4
	2	0	2	2:0:1	3	4
	0	0	6	0:0:3	3	6
4 Credit	2	2	2	2:1:1	4	6
	3	2	0	3:1:0	4	5
	3	0	2	3:0:1	4	5

4.5 Industrial Training/Internship

The students may undergo Industrial Training for a period as specified in the curriculum during summer / winter vacation. The number of credits shall be assigned as detailed in **Table-5**.

The students may undergo internship at research organization / university for the period prescribed in the curriculum. The number of credits shall be assigned as detailed in **Table-5**.

In such cases Industrial Training / Internship needs to be undergone continuously from one organization only. The student is allowed to undergo maximum of 3 months during the entire duration of study.

TABLE – 5

Duration of Training / Internship	Credits
2 Weeks	1
4 Weeks	2
6 Weeks	3
8 or more Weeks	4

4.6 Online Courses/Self Study Courses

4.6.1 Students may be permitted to earn credit through online courses (which are provided with certificate) with the approval of Head of the Department and Dean academic subject to a maximum of three credits. The Student needs to obtain certification to become eligible for writing end semester examination to be conducted by the Institution under autonomous status. In case of credits earned through on line mode from a university with approval of Head of the Department and Dean Academic, the credit may be transferred with the due approval procedures from the **Performance Analysis Committee**.

4.6.2 The student shall study Transdisciplinary courses prescribed in the curriculum through self study mode with the approval of Head of the Department. The student shall study on their own under the guidance of a faculty member nominated by the Head of the Department. No formal lectures need to be delivered. The evaluation methodology shall be the same as that of a theory course.

4.6.3 If a student has a publication in SCI listed journals as first author, he / she shall be exempted from one elective course.

4.7 One Credit Courses

One credit elective course shall be offered by the department itself or in collaboration with the industry / research organizations / higher learning institutions. If more number of such one credit courses is offered by any department, three elective courses of 1 credit shall replace a 3 credit elective course **as given below.**

Number of one credits earned		**Eligible to replace**	
Core Electives	Interdisciplinary Electives	PEC	OEC
3	0	1	-
2	1	1	-
1	2	-	1
0	3	-	1

4.8 Industrial Visit

Every student is required to go for one Industrial visit every year starting from the second year of the programme. The Heads of the Departments shall ensure that the necessary arrangements made in this regard.

4.9 Medium of Instruction

The medium of instruction shall be English for all the courses, examinations, seminar, presentations and project / thesis / dissertations reports.

5.0 DURATION OF THE PROGRAMMES

5.1 The minimum and maximum periods for completion of the UG programmes are given below.

TABLE – 6

Programme	Minimum No. of semesters	Maximum No. of semesters
B.E. / B.Tech.	8	16
B.E. / B.Tech. Lateral Entry	6	14

Each semester normally consists of 90 working days. In any contingent situation, the number of working days per semester shall not be less than 65 days. The Principal is given the discretionary powers to decide the number of working days in such contingencies. The Principal shall ensure that every teacher imparts instruction as per the number of periods specified in the syllabus and that the teacher teaches the full content of the specified syllabus for the course being taught.

5.2 For the purpose of regulations, the academic year has been divided into two semesters, the Odd semester normally spanning from June to November and the Even semester from December to May.

5.3 The First semester of B.E. / B.Tech. Degree Programme normally spans from August to December and Second semester from January to May.

5.4 The total duration of the programme reckoned from the commencement of the first semester to which the student was admitted, shall not exceed the maximum duration specified in **clause 5.1** irrespective of the period of break of study (**vide clause 20.1)** or prevention (**vide clause 7.4**) in order that the student may be eligible for the award of the degree (**vide clause 17.0**)

6.0 REGISTRATION

6.1 Each student, on admission shall be assigned to a Faculty Advisor / Tutor (vide **clause 8**) who shall advise her/him about the academic programs and counsel on the choice of courses considering the academic background and student's career objectives. With the advice and consent of the Faculty Advisor the student shall register for a set of courses he/she plans to take up for the Semester.

6.2 Every student shall enroll for the courses of the succeeding semester during the last week of the current semester. However, the student shall confirm the enrollment by registering for the courses within first five working days after the commencement of the concerned semester.

6.3 If a student is prevented from writing end semester examination (ESE) of a course due to lack of attendance, the student has to register for that course again, when offered next, attend the classes and fulfill the attendance requirements as per **clause 7**.

6.4 If the theory course in which the student has failed / has been prevented from writing end semester examination due to lack of attendance is a programme elective course or an open elective, then the student may register for the same or any other professional elective or open elective course respectively in the subsequent semesters.

6.5 If a student finds that he/she has registered for more courses than his/her capability to study in a semester, he/she can withdraw one or more of courses before the end of 2nd week of the semester.

6.6 The information on the list of all the courses offered in every department specifying the credits, the prerequisites, a brief description of syllabus or list of topics, the instructor who is offering the course and the time slot shall be made available in the college website.

6.7 In any department, the preference for registration shall be given to the students of that department for whom the course is a programme core course.

6.8 The registration for any course shall be on first come first served basis, provided the student fulfills prerequisites for that course, if any. Every effort shall be made by the Department / Centre to accommodate as many students as possible.

6.9 No course shall be offered by a department unless a minimum of **5** students are registered for that course.

6.10 Flexibility to Add or Drop Courses

6.10.1 A student has to earn the total number of credits specified in the curriculum of the respective programme of study in order to be eligible to obtain the degree. However, if the student wishes, the student is permitted to earn more than the total number of credits prescribed in the curriculum of the student's programme.

6.10.2 From the third to eighth semester, the student has the option of registering for additional courses or dropping existing courses. Total number of credits of such courses cannot exceed 6. However, the student

shall register for a minimum of 16 credits and a **maximum of 30 credits in a semester**.

6.10.3 The student shall register for the Project work in the VIII semester only.

6.10.4 The student shall register for the Product Development Laboratory in the **V / VI semester**. The evaluation methodology shall be the same as that of a **Project work**.

6.10.5 A student can earn maximum of 2 one credit courses per semester.

7.0 REQUIREMENTS FOR APPEARING FOR THE END SEMESTER EXAMINATION OF A COURSE

A student who has fulfilled the following conditions (**vide Clauses 7.1 - 7.2**) shall be deemed to have satisfied the requirements for appearing for End semester examination of a particular course.

7.1 Ideally every student is expected to attend all periods and earn 100% attendance in all the courses. However, he/she shall secure not less than 75% attendance in each course in that semester.

7.2 If student secures attendance of 65% and above but less than 75% in any course in the current semester due to medical reasons (hospitalization / accident / specific illness) or due to participation in the College / University / State / National / International level Sports events with prior permission from the Principal / competent authority, the student shall be given exemption from the prescribed attendance requirement and he/she shall be permitted to appear for the semester examinations of that course.

7.3 A candidate shall normally be permitted to appear for the End Semester Examination of the course if he/she has satisfied the attendance requirements (**subject to clause 7.1 - 7.2**) and has registered for examination in those courses of that semester. A candidate who has already appeared for a course in a semester and passed the examination is not entitled to reappear in the same course for improvement of letter grades.

7.4 Those students who have not satisfied the conditions specified in **clauses 7.1 - 7.2** and who secure **less than 65%** attendance in a course will not be permitted to write the End Semester Examination of that course. The student has to register and repeat this course in a subsequent semester when it is offered next subject to provisions under **clause 6.10.2**

8.0 FACULTY ADVISER (TUTOR)

Facilitating the students in choosing their courses of study and for general advice on the academic programme, the Head of the Department will allocate a fixed number of students to a teaching faculty of the department who shall function as Tutor for them throughout their period of study. Tutors shall advise the students in registering of courses, monitor their attendance and progress and counsel them periodically. If necessary, the tutor may also discuss with or inform the parents about the progress of the students through concerned Head of the Department.

8.1 Every student will be under the care and guidance of a faculty who is appointed as his / her tutor. About 20 students will be assigned to each tutor who will also act as their local guardian and assist them in all matters of academic as well as other activities.

8.2 Student counseling plays a vital role in a student's life. Hence, the students are advised to meet their tutor frequently and discuss their problems freely with them. They should also take care to see that all information concerning their progress and achievements in the college is duly entered in the record sheet.

8.3 The tutor will maintain a Record Sheet for each of his/her wards. The record sheet will contain all information concerning the students' attendance, grades obtained in the End Semester Examinations, monthly tests, achievements if any in Curricular, Co-curricular and Extra-curricular activities and disciplinary proceedings if any taken against the student.

9.0 CLASS COMMITTEE

9.1 A Class Committee consists of all teachers handling courses of the concerned class, student representatives - cross section of students (academically good, average, poor) and a chairperson who is a faculty not handling any course for the class. The overall goal of the Class Committee is to improve the teaching-learning process. The functions of the Class Committee include:

- Solving problems experienced by students in the classroom and in the laboratories.
- Clarifying the regulations of the degree programme and the details of rules therein.
- Informing the student representatives about the academic schedule including the date of assessments (Tests & Assignments) and the

syllabus coverage for each assessment.

- Analyzing the performance of the students of the class after each test and finding the ways and means of solving problems, if any
- Identifying the weak students, if any, and requesting the teachers concerned to provide some additional help or guidance or coaching to such weak students.

9.2 The class committee for a class under a particular programme is normally constituted by the Head of the department. However, if the students of different programmes are mixed in a class (like the first semester which is generally common to all programmes), the class committee is to be constituted by the Head of the Department concerned.

9.3 The class committee shall be constituted in the first week of commencement of any semester.

9.4 At least 6 student representatives (usually 3 boys and 3 girls) shall be included in the class committee.

9.5 The chairperson of the class committee may invite the Tutor(s) and the Head of the Department to the meeting of the class committee.

9.6 The Principal may participate in any class committee meeting.

9.7 The chairperson is required to prepare the minutes of every meeting, submit the same to HOD within two working days after the meeting and arrange to circulate among the concerned students and teachers. If there are some points in the minutes requiring action by the management, the same shall be brought to the notice of the management by the head of the institution.

9.8 The class committee shall meet at least twice in a semester:

- The first meeting, a week after the first test results.
- The second meeting, a week after the third test results.

9.9 During these meetings, the student members representing the entire class, shall meaningfully interact and express the opinions and suggestions of other students of the class to improve the effectiveness of the teaching-learning process.

10.0 COURSE COMMITTEE FOR COMMON COURSES

Each common theory course offered to more than one group of students shall have a “Course Committee” comprising all the teachers teaching the

common course with one of them nominated as Course Coordinator. The nomination of the course Coordinator shall be made by the Head of the Department/Head of the Institution depending upon whether all the teachers teaching the common course belong to a single department or to several departments. The 'Course committee' shall meet as often as possible and ensure uniform evaluation of the tests and arrive at a common scheme of evaluation for the tests. Wherever it is feasible, the course committee may also prepare a common question paper for the assessment test(s). Guidelines for the evaluation of CO attainment and continuous assessment shall be given by the Coordinator of common course committee.

11.0 SYSTEM OF EXAMINATION AND ASSESSMENT PROCEDURE

11.1 Performance in each course of study shall be evaluated based on (i) continuous internal assessment throughout the semester and (ii) End Semester Examinations (ESE) at the end of the semester.

11.2 Each course, both theory / integrated and practical including project work shall be evaluated for a maximum of 100 marks. For all theory / integrated and practical courses including the project work, the continuous internal assessment shall carry 40% and 50% marks respectively while the End Semester Examinations shall carry 60% and 50% marks respectively. **i.e.** Each course shall be evaluated for a maximum of 100 marks as detailed in **Table-7**.

TABLE – 7

S. No	Category of Course	Continuous Assessment	End Semester Examinations
1.	Theory / Integrated Courses	40 marks	60 Marks
2.	Laboratory Courses	50 Marks	50 Marks
3.	Project work	50 Marks	50 Marks

11.3 The End Semester Examination (Theory / Integrated & Practical) of 3 hours duration shall ordinarily be conducted between November and January during the odd semesters and between April and June during the even semesters. **The end semester question pattern shall mention Blooms Taxonomy levels and pattern type.** Further, in line with Course outcomes (COs), the end semester question pattern can be of different types as detailed in **Table-8** and it shall be mentioned in the curriculum itself.

TABLE – 8

Question pattern	1 mark	2 marks	4 marks	10 marks	12 marks	16 marks	20 marks	Total
A	--	--	--	--	--	--	1 Qn Compulsory & 4 Qns (either or type)	100
B	--	10	--	--	--	1 Qn Compulsory & 4 Qns (either or type)	--	100
C	10	--	10 out of 12	1 Qn Compulsory & 4 Qns (either or type)	--	--	--	100
D	10	10	5 out of 6	1 Qn Compulsory & 4 Qns (either or type)	--	--	--	100
E	--	10	5 out of 6	--	1 Qn Compulsory & 4 Qns (either or type)	--	--	100
F	--	--	--	--	--	--	5 out of 8	100
G	--	5	--	2 Qns (either or type)	--	--	--	30

11.3.1 For one credit courses, the End Semester Examination of 1 hour duration shall be conducted as and when the course is completed (if necessary). Further, the end semester question pattern shall be **G type** as detailed in **Table – 8**.

11.4 Integrated Courses (Theory Courses with Laboratory Component)

The End Semester Examination for the integrated courses shall be evaluated only based on the theory component. The practical component shall be evaluated as one of the continuous assessments based on the weightage assigned to the practical component in the course outcome.

11.5 The End Semester Examination for the project work shall consist of evaluation of the final report submitted by the student or students of the project group (of not exceeding 4 students) by an external examiner followed by a viva-voce examination conducted separately for each student by a committee consisting of the **External examiner, Internal examiner and Guide**.

11.6 The End Semester Examinations of practical courses shall be evaluated by *Internal Examiners*.

11.7 The End Semester Theory Examinations shall be conducted by Chief Superintendent appointed by the Principal. The Hall Superintendents from the college shall invigilate the halls during theory examinations.

11.8 Students involved in malpractice during end semester examinations shall appear before the enquiry committee and the punishment will be given by the committee as per the college norms.

11.9 Scribes may be appointed for conducting examination for a student with disabilities on request to Principal through Head of the department concerned with necessary documents. Based on the request and genuinity, the Principal may appoint the scribe for the disabled student as per the norms.

11.10 Product Development Laboratory

The End Semester Examination for the Product Development Laboratory shall consist of evaluation of the final report submitted by the student or students of the group (of not exceeding 4 students) by the panel of examiners consisting of faculty coordinator, Guide and a common examiner from other programme nominated by the COE.

12.0 PROCEDURE FOR AWARDING MARKS FOR INTERNAL ASSESSMENT

For all the courses, the continuous assessment (CA) shall be made through CO attainment of the individual student. Each course shall have a set of Course Outcomes (COs) ranging from 3 to 8. For each course, the continuous assessment shall be carried out based on the attainment of all COs by the students (either absolute or relative basis). The evaluation of each CO attainment by the student shall be carried out by the faculty based on the predefined assessment procedure approved by the domain expert and Head of the department. Continuous assessment shall be evaluated based on the attainment of all COs by the student assigning appropriate weightage to each CO and the total attainment by the student shall be reduced to 40 marks for theory / integrated courses and 50 marks for practical courses including project work.

12.1 Theory / Integrated Courses

Continuous assessment for each theory / integrated course shall be evaluated through tests and other appropriate assessment tools like Quiz, Seminar, Open book test etc as per the discretion of the course instructor /

course co-ordinator to evaluate the attainment of Course Outcomes by the student. The guidelines for the evaluation of continuous assessment marks in theory / integrated courses shall be implemented as given in **Table-9.**

TABLE – 9

CO	Test		Too1 1		Tool 2		Course End survey		Attainment		Total Attainment for CO
	Marks	Wtg.	Marks	Wtg.	Marks	Wtg.	Marks	Wtg.	Marks	Wtg.	Marks
1.											
2.											
:											
N.											
TOTAL ATTAINMENT OF ALL COS											

Wtg. – weightage;
Tools: Assignment / Open book test / Quiz / Seminar/etc.

12.2 Practical Courses

Continuous assessment for practical course shall be evaluated through CO attainment of the student by assessing the student performance during the laboratory class, student's records maintained, model examination and oral examination. The appropriate weightages shall be given to each assessment tool based on the importance of the tool being used to assess actual attainment of COs. Broad guidelines for the evaluation of COs is given in **Table – 10.**

TABLE – 10

CO	Experiment work		Model Exam		Rubrics for oral		Attainment		Total Attainment for CO
	Marks	Wtg.	Marks	Wtg.	Marks	Wtg.	Marks	Wtg.	Marks
1.									
2.									
:									
N.									
TOTAL ATTAINMENT OF ALL COS									

Wtg. – weightage

12.3 Project Work

Project work may be assigned to a single / group of students not exceeding 4 per group. The Head of the Department concerned shall constitute a review committee for each programme. The review committee shall conduct three review meetings per semester. The student shall make

presentation on the progress made to a three member review committee. The project Guide will be one of the members of the review committee.

12.3.1 The continuous assessment for the project shall be evaluated through CO attainment of the student by assessing presentation made by the students in the review meetings. For assessing the CO attainment, the review committee shall frame the rubrics with the approval of Head of the Department. The CO attainment of the student shall be reduced to 50 marks and rounded to the nearest integer. The continuous assessment and End semester examination marks for project work and the viva voce examination will be distributed as indicated below.

TABLE – 11

Internal (50 Marks)			**External (50 Marks)**			
Review I	Review II	Review III	Project Report (25)	Viva-voce (25)		
			External	Internal	External	Guide
15	15	20	25	10	10	5

12.3.2 The Project Report prepared by the student according to the approved guidelines and duly signed by the Guide and Head of the Department shall be submitted to the Head of the Department.

12.3.3 The End semester examination of the project work will be based on the evaluation of the project report submitted by the student(s) followed by a Viva-Voce Examination by a team consisting of a common internal examiner (other than the guide), External Examiner and Guide. The common internal examiner and the external examiner shall be appointed by the Controller of Examinations for evaluation from the panel of examiners submitted by the Head of the Department concerned **with the approval of the Board of Studies.**

12.3.4 If a student fails to submit the project report on or before the specified deadline, he/she is deemed to have failed in the project work and shall re-enroll for the same in a subsequent semester. If he/she fails in the viva-voce examination of Project work, he/she shall resubmit the project report within 30 days from the date of declaration of the results. For this purpose, the same Internal and External examiner shall evaluate the re-submitted report.

12.4 Open Elective Courses (Trans Disciplinary / Inter Disciplinary Elective)

The student shall undergo one Open Elective Course (Trans disciplinary elective) from the courses given in **curriculum** through self study mode / online in any semester during 5^{th} – 8^{th} semesters in addition to the other electives. The continuous assessments and End Semester Examination will be conducted as per the procedure stipulated for theory courses.

12.4.1 Students shall undergo online courses (which are provided with Certificate) with the approval of Department & Dean (Academic) subject to a maximum of 3 credits. This online course of 3 credits / three one credit courses can be considered instead of one elective course (Inter disciplinary / Programme Core Elective). The departmental committee constituted by the Principal consisting of HOD and two senior faculties will take a decision on the evaluation methodology for the online courses. The committee can decide whether to evaluate the online course through continuous assessment and End semester Examination or only by End semester Examination.

12.5 Comprehension

Comprehensive examination shall be conducted to evaluate the analytical ability and the comprehensive knowledge gained by the students in all the courses he/she had undergone till then. Comprehension of a student shall be evaluated in the form of a written test or viva voce or online exam as decided by the class committee.

12.6 Seminar/Research Paper/Patent Review

The seminar/case study is to be considered as purely Internal (with 100% Internal marks only). Every student is expected to present seminar on a research paper/patent in their specialization. A three member committee appointed by **Head of the Department** will evaluate the seminar. The evaluation shall be based on the seminar paper (40%), presentation (40%) and response to the questions asked during presentation (20%).

12.7 Internship / Industrial Training / Mini Project

The Industrial/Practical Training, Internship shall carry 100 marks and shall be evaluated through Internal assessment only. At the end of Industrial / Practical training/ Internship, the candidate shall submit a certificate from the organization where he/she has undergone training and a brief report. The evaluation will be made based on the report and a viva-voce

examination conducted internally by a three member Departmental Committee constituted by the **Head of the Department.** The certificate (issued by the organization) submitted by the students shall be attached to the mark list and sent to the Controller of Examinations. The details for assessing those courses are given in **Annexure – III**.

12.8 One Credit Courses

The one credit course shall carry 100 marks (40% of continuous assessment & 60% of End semester Examination) and shall be evaluated through continuous assessment and End Semester Examination. Two continuous assessments shall be conducted during the semester by the department. The continuous assessment shall be evaluated through CO attainment of the student for that course as detailed for the theory courses. The end semester examination shall be conducted for 1 hour duration for 30 marks.

13.0 ACADEMIC AUDIT

Each Staff member shall maintain an "*ATTENDANCE AND ASSESSMENT RECORD*" for every semester which consists of attendance marked in each Lecture / Practical / Project work class, the assesment marks and the record of class work (topic covered), separately for each course. This should be submitted to the Head of the Department periodically (at least three times in a semester). The Head of the Department will verify the details given by the Staff member. At the end of the semester, the record should be verified by the Principal who will keep this document in safe custody (for five years). The Academic Audit Committee appointed by the Principal may inspect the records of attendance and assessment for both current and previous semesters.

14.0 PASSING REQUIREMENTS

i. A student shall be deemed to have passed a theory course, if the total marks secured by him/her (CA+ESE put together) is at least ($\mu - 1.8\ \sigma$) or 50%, whichever is lower, where μ is the average mark of the students registered for the course and σ is the corresponding standard deviation. However, the student has to secure a minimum of 60% of μ in the End Semester Examination (ESE).

ii. A student is deemed to have passed a Laboratory Course, Industrial Training, In-plant Training, Internship, Mini Project and Project Work, if the

total mark secured by him/her is at least 50%.However, the student has to secure a minimum of 50% in the End semester Examination.

iii. A student is deemed to have passed a laboratory course consisting of two parts (Part A & Part B), if he/she secures 50% of marks in each part in the End Semester Examination.

iv. If a student appears in a course conducted exclusively as arrear examination, then his / her grade in that course will be based on the grade range allotted for the same score in that course in the immediate preceding regular examination.

v. If a student appears in a course as arrear examination which is being conducted as a regular examination for other batch of regular students, then his / her grade in that course will be based on the grade range allotted to the same score in that course applicable to the above batch of regular students.

vi. A student, who is absent for the end semester examination or withdraws from final examination or secures a letter grade RA in any course, has to register for arrear examinations for all such courses at the next available opportunity and complete them. Grades for the arrear examinations will be decided based on the original grade ranges of the class to which he/she belongs.

vii. The internal assessment marks obtained by the candidate in the first appearance shall be retained and considered valid for all subsequent attempts till the candidate secures a pass. However, from the third attempt onwards if a candidate fails to obtain pass marks (Internal Assessment + End Semester Examination) as per **clause 14.1**, then the candidate shall be declared to have passed the examination if he/she secures at least (μ – 1.8 σ) or 50 marks whichever is less in the end semester examination.

15.0 AWARD OF LETTER GRADES

15.1 All assessments of a course will be done on absolute mark basis. Each student based on his/her performance will be awarded a final letter grade and grade point, based on the performance of the student relative to others who have registered for that particular course **if the class strength is greater than or equal to 30.** However, if the class strength is less than 30, then the grading system shown in **Table-13** of clause 15.1 (ii) will be followed.

i. The letter grade and the grade point to each student studying theory / integrated courses (Internal and End semester examinations) are generally

awarded based on the statistical parameters, Mean (μ) and Standard Deviation (σ) of the distribution of marks as detailed in **Table-12**.

TABLE – 12

Range of Marks in % (CA+ESE)	Letter Grade	Relative Grade Point
$M \geq [(\mu + 1.65\sigma)]$	O	10
$\mu + 1.65\sigma > M \geq \mu + 0.85\sigma$	A^+	9
$\mu + 0.85\sigma > M \geq \mu$	A	8
$\mu > M \geq \mu - 0.9\sigma$	B^+	7
$\mu - 0.9\sigma > M \geq \mu - 1.8\sigma$	B	6
$M < \mu - 1.8\sigma$ (or) $M < 50$ Whichever is less	RA	0
Shortage of Attendance	SA	0
Absent	AB	0
Withdrawal from examination	W	0

RA - Reappearance in a Course

Where,

- M – Marks secured (CA+ESE)
- $\mu = \frac{1}{n}\sum_{j=1}^{n} M_i$ and

$$\sigma = \sqrt{\frac{\sum_{j=1}^{n}(M_i - \mu)^2}{n}}$$

M_i - total mark secured (CA+ESE) by the 'i' th student in the course

n – no. of students who appeared for the examination in that particular course

ii. The letter grade and grade point for all the courses other than theory / integrated courses including Elective courses (having strength less than 30) Laboratory courses, Industrial Training, Internship**,** In Plant Training, One credit courses, Mini Project and Project work shall be awarded by converting the marks obtained in that course in to a grade based on the guidelines detailed in clause 14 (ii) & Table-13.

TABLE – 13

Range of Marks in %	Letter Grade	Relative Grade Point
$M > (X - k)$	O	10
$(X - k) \geq M > (X - 2k)$	A^+	9
$(X - 2k) \geq M > (X - 3k)$	A	8
$(X - 3k) \geq M > (X - 4k)$	B^+	7
$(X - 4k) \geq M \geq (X - 5k)$	B	6
$M < 50$	RA	0
Shortage of Attendance	SA	0
Absent	AB	0
Withdrawal from examination	W	0

RA - Reappearance in a Course

Where,

- M – Marks secured (CA+ESE)
- X – maximum marks secured in a class
- k – class interval

The class intervals (k) shall be evaluated for the purpose of awarding the grades by dividing the difference between highest mark secured (X) in a Course and the minimum pass mark by the total number of grades (O, A^+, A, B^+ and B).

$$k = \frac{X - 50}{5}$$

iii. The **Performance Analysis Committee** chaired by the Principal consisting of the Dean (Academic), Controller of Examinations and all the Heads of the Departments will by collective wisdom, normalize the marks secured by the students in each course and finalize the grade range for that course so as to ensure that the clustering and grading decisions have been made in a reasonably balanced manner.

15.2 Grade Sheet

After the results are declared, Grade Sheets will be issued to each student which will contain the following details:

- The College Name and Affiliated University.
- The list of courses enrolled during the semester and the grades scored.

- The Grade Point Average (GPA) for the semester.
- The Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards.

GPA for a semester is the ratio of the sum of the products of the credits assigned to each course and the grade point obtained for that course to the sum of the total number of credits acquired in the semester.

CGPA will be calculated in a similar manner, considering all the courses enrolled from first semester to last semester rounded up to 2 decimal points. "RA", "SA" and “AB” grades will be excluded for calculating GPA and CGPA.

$$GPA \quad / CGPA \quad = \frac{\sum_{i=1}^{n} C_i \; GP_i}{\sum_{i=1}^{n} C_i}$$

where C_i - is the Credits assigned to the course

GP_i - is the point corresponding to the grade obtained for each Course

n - is number of all Courses successfully cleared during the particular semester in the case of GPA and during all the semesters in the case of CGPA

16.0 REVALUATION AND REVIEW

16.1 Revaluation

A candidate can apply for revaluation of his/her semester examination answer script in a theory course, within 2 weeks from the declaration of results, on payment of a prescribed fee through proper application to the Controller of Examinations through the Head of the Department.

A candidate can apply for Revaluation of answer scripts for not exceeding 5 courses at a time either directly or by getting Xerox copy of the answer scripts.

The revaluation results will be intimated to the candidate concerned through the Head of the Department. Revaluation is not permitted for practical courses, seminars, practical training and for project work.

16.2 Review

Candidates not satisfied with Revaluation can apply for Review of his/her examination answer paper in a theory course, within the prescribed date on payment of a prescribed fee through proper application to Controller of Examination through the Head of the Institution.

Candidates applying for Revaluation are alone eligible to apply for Review.

16.3 Examination Reforms for Transparency

A candidate can verify the end semester answer script for randomly chosen subjects. Before the publication of End Semester results, the students are allowed to verify the answer script of a subject which is randomly selected by Performance Analysis Committee. Consequently, the application for revaluation of those subjects are not permitted.

17.0 ELIGIBILITY FOR THE AWARD OF THE DEGREE

A student shall be declared to be eligible for the award of the Degree only when he/she has

i. Successfully gained the required number of total credits ***168 to 176 credits (125 to 133 credits for Lateral entry***) as specified in the curriculum corresponding to his/her Programme within the stipulated time.

ii. Successfully completed the B.E./B.Tech. Degree programme within 8 (EIGHT) years (SIXTEEN consecutive semesters) from the date of admission to the first semester of the programme and 7 (SEVEN) years (FOURTEEN consecutive semesters) for the lateral entry candidates from the date of admission to the third semester of the programme.

iii. Successfully completed any additional courses prescribed by the Dean (Academic), whenever any candidate is readmitted under Regulations other than R – 2015.

iv. Successfully undergone Two Non-CGPA courses.

v. Successfully completed the field visit / industrial training, if any, as prescribed in the curriculum.

vi. No disciplinary action is pending against him/her.

vii. The award of the Degree must have been approved by the syndicate of the University.

18.0 CLASSIFICATION OF THE DEGREE AWARDED

18.1 First Class with Distinction

A candidate who satisfies the following conditions shall be declared to have passed the examination in First Class with Distinction.

- Should have passed the End Semester Examination in all the courses of all the eight semesters (six semesters in the case of lateral entry) in his/her First Appearance within five years (four years in the case of lateral entry) which includes authorized break of study of one year. Withdrawal from examination (vide **clause 19.0**) will not be considered as an appearance.
- Should have secured a CGPA of not less than 8.50
- Should not have been prevented from writing end semester examination due to lack of attendance in any of the courses

18.2 First Class

A candidate who satisfies the following conditions shall be declared to have passed the examination in First Class.

- Should have passed the End Semester Examination in all the courses of all the eight semesters (six semesters in the case of lateral entry) within five years (four years in the case of lateral entry). One year authorized break of study (if availed of) or prevention from writing the End Semester examination due to lack of attendance (if applicable) is included in the duration of five years (four years in the case of lateral entry) for award of First Class.
- Should have secured a CGPA of not less than **7.00.**

18.3 Second Class

All other candidates (not covered in **clauses 18.1 and 18.2**) who qualify for the award of degree (**vide clause 17.0**) shall be declared to have passed the examination in second class.

18.4 A candidate who is absent in semester examination in a course/project work after having registered for the same shall be considered to have appeared in that examination for the purpose of classification. (Subject to **clause 19.0 & 20.0**)

19.0 PROVISION FOR WITHDRAWAL FROM END-SEMESTER EXAMINATION

19.1 A candidate may be granted permission to withdraw from appearing for the examination of any one course or consecutive examinations of more than one course in a semester examination for valid reasons and on prior application.

19.2 Such withdrawal shall be permitted only once during the entire period of study.

19.3 Withdrawal application is valid only if the student is otherwise eligible to write the examination (**clause 7**) and if it is made within TEN working days prior to the commencement of the end semester examination in that course or courses and also recommended by the HOD and approved by the Principal.

19.4 Notwithstanding the requirement of mandatory TEN working days notice, applications for withdrawal for special cases under extraordinary conditions will be considered on the merit of the case.

19.5 Withdrawal shall not be construed as an appearance for the eligibility of a candidate for First Class with Distinction.

19.6 Withdrawal from the End semester examination is NOT applicable to arrear courses of previous semesters.

19.7 The candidate shall reappear for the withdrawn courses during the examination conducted in the subsequent semester.

19.8 Withdrawal is permitted for the end semester examinations in the final semester, only if, the period of study of the student concerned does not exceed five years as per **clause 18.1.**

20.0 PROVISION FOR AUTHORISED BREAK OF STUDY

20.1 Break of Study shall be granted only once for valid reasons for a maximum of one year during the entire period of study of the degree programme. However, in extraordinary situation the candidate may apply for additional break of study not exceeding another one year by paying prescribed fee for break of study. If a candidate intends to temporarily discontinue the programme in the middle of the semester for valid reasons, and to rejoin the programme in a subsequent year, permission may be granted based

on the merits of the case provided he / she applies to the Director, Academic Courses, Anna University, Chennai, in advance, but not later than the last date for registering for the end semester examination of the semester in question, through the Principal stating the reasons therefore and the probable date of rejoining the programme.

20.2 The student is permitted to rejoin the programme after the break of study shall be governed by the Curriculum and Regulations in force at the time of rejoining. If the Regulation is changed, then, those candidates may have to do additional courses as prescribed by the Dean (Academic).

20.3 The authorized break of study (for a maximum of one year) will not be counted for the duration specified for passing all the courses for the purpose of classification. However, additional break of study granted will be counted for the purpose of classification.

20.4 The total period for completion of the programme reckoned from the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specified in **clause 5.1** irrespective of the period of break of study in order that he/she may be eligible for the award of the degree.

20.5 If any student is detained for want of requisite attendance, progress and good conduct, the period spent in that semester shall not be considered as permitted “Break of Study” or “Withdrawal” is not applicable for this case.

21.0 DISCIPLINE

Every student is required to decently dress to observe discipline and decorum both inside and outside the college and not to indulge in any activity which affects the prestige of the college/university.

22.0 REVISION OF REGULATIONS AND CURRICULUM

The curriculum and syllabi under this regulation will be for **four years**. However, the Academic Council of the College reserves the right to revise or change or amend the regulations, the scheme of examinations, the curriculum and the syllabi from time to time if found necessary.

23.0 SPECIAL CASES

In the event of any clarification in the interpretation of the above rules and regulations, they shall be referred to the Standing Committee. The Standing Committee will offer suitable interpretations / clarifications /

amendments required for special case on such references and get them ratified in the next meeting of the Academic Council. The decision of the Academic Council will be final.

ANNEXURE - I

MINIMUM TOTAL CREDITS FOR B.E. / B.Tech. DEGREE PROGRAMMES OFFERED IN THE INSTITUTION

Sl. No.	Name of the Programme	Minimum Total Credits*
1.	B.E. Mechanical Engineering	171
2.	B.E. Electronics and Communication Engineering	173
3.	B.E. Computer Science and Engineering	169
4.	B.E. Electrical and Electronics Engineering	173
5.	B.E. Electronics and Instrumentation Engineering	171
6.	B.E. Civil Engineering	176
7.	B.Tech. Information Technology	168

* Minimum Total Credits to be earned by the student admitted to the particular UG Programme to become eligible for the award of Degree under **Clause 4.0** of Regulations 2015 (UG).

ANNEXURE – II

NCG11 SPORTS CREDIT: 1

1.	Pre – requisites / Eligibility Conditions	-
2.	Detail of Course Content / Syllabus	As prescribed by the Physical Education department
3.	Duration of the Course	50 Hours per Year Minimum contact hours required – 38 Hours per Year
4.	Assessment Procedure	As decided by the Physical Education department
5.	Criteria for allocation of credit	Participation in Ties /Zone/Inter Zone / Open Tournament or representation in intramural Sports & Games with 75% attendance in ground practice / Pass on Examination conducted by Physical Education department.
6.	In case of failure	(If the student score less than 50 marks in the above criteria) Repeat the course

NCG12 YOGA FOR EMPOWERMENT CREDIT: 1

1.	Pre – requisites / Eligibility Conditions	As prescribed by Yoga class practitioners
2.	Detail of Course Content / Syllabus	
3.	Duration of the Course	60 Hours per Year. Minimum contact hours required – 45 Hours per Year
4.	Assessment Procedure	-
5.	Criteria for allocation of credit	Completion certificate issued by the NEC Yoga Club / Yoga class practitioners
6.	In case of failure	-

NCG13 NATIONAL CADET CORPS (NCC) CREDIT: 1

1.	Pre – requisites / Eligibility Conditions	Student should be a citizen of India. He / She should have the minimum physical fitness as per NCC wing requirement

2.	Detail of Course Content / Syllabus	Norms as prescribed by NCC wing
3.	Duration of the Course	
4.	Assessment Procedure	
5.	Criteria for allocation of credit	80% parade attendance in both I & II year NCC training period
6.	In case of failure	-

NCG14 NATIONAL SERVICE SCHEME (NSS) CREDIT: 1

1.	Pre – requisites / Eligibility Conditions	-
2.	Detail of Course Content / Syllabus	
3.	Duration of the Course	2 years
4.	Assessment Procedure	-
5.	Criteria for allocation of credit	Attend one orientation programme and active participation certificate for 120 contact hours / year or active participation certificate in 5 activities
6.	In case of failure	-

NCG15 YRC CREDIT: 1

1.	Pre – requisites / Eligibility Conditions	-
2.	Detail of Course Content / Syllabus	Periodical meetings, Blood Donation Camp, Orphanage visit, Awareness Programmes, Test related to YRC (Multiple Choice Questions)
3.	Duration of the Course	One year
4.	Assessment Procedure	Evaluation will be based on attending periodical meetings (Attendance) / Camp / Orphanage visit / Test / Awareness Programmes
5.	Criteria for allocation of credit	Active participation certificate with good conduct in YRC club activities
6.	In case of failure	-

NCG21 CO / EXTRA-CURRICULAR ACTIVITIES CREDIT: 1

1.	Pre – requisites / Eligibility Conditions	-
2.	Detail of Course Content / Syllabus	Activities as decided by the respective club convener / coordinator
3.	Duration of the Course	Minimum requirements as specified by the club convener / Coordinator
4.	Assessment Procedure	
5.	Criteria for allocation of credit	Active participation certificate with good conduct in Fine arts / Rotract / Junior JAYCEE / RRC / Youth welfare Association / Quiz / Science / Mathematics / Literary Associates / IAS academy and all other approved clubs.
6.	In case of failure	-

NCG22 ENGLISH PROFICIENCY CERTIFICATION CREDIT: 1

1.	Pre – requisites / Eligibility Conditions	As prescribed by the certifying authority
2.	Detail of Course Content / Syllabus	
3.	Duration of the Course	
4.	Assessment Procedure	
5.	Criteria for allocation of credit	A certificate for attending BEC course / Minimum score in TOFEL iBT / GRE / IELTS
6.	In case of failure	Repeat the course

NCG23 SOFT SKILLS CREDIT: 1

1.	Pre – requisites / Eligibility Conditions	Completion of 2nd semester
2.	Detail of Course Content / Syllabus	As prescribed by Placement Cell
3.	Duration of the Course	-
4.	Assessment Procedure	-
5.	Criteria for allocation of credit	Successful completion of Soft skill Training Certificate with minimum 20 contact hours
6.	In case of failure	-

NCG24 FOREIGN / VERNACULAR LANGUAGES CREDIT: 1

1.	Pre – requisites / Eligibility Conditions	-
2.	Detail of Course Content / Syllabus	As prescribed by the course conducting Universities / Schools
3.	Duration of the Course	
4.	Assessment Procedure	
5.	Criteria for allocation of credit	Pass certificate issued by the competing authority
6.	In case of failure	Repeat the course

NCG25 APTITUDE PROFICIENCY CERTIFICATION CREDIT: 1

1.	Pre – requisites / Eligibility Conditions	As prescribed by the course coordinator
2.	Detail of Course Content / Syllabus	
3.	Duration of the Course	40 periods with minimum 70% of attendance
4.	Assessment Procedure	As prescribed by the course coordinator
5.	Criteria for allocation of credit	Pass in End Examination / Minimum score in GMAT / CAT / NAC / MAT
6.	In case of failure	Repeat the course

NCG26 GLOBALLY ACCEPTED CERTIFICATION COURSES CREDIT: 1

1.	Pre – requisites / Eligibility Conditions	Prior permission from the HOD is must
2.	Detail of Course Content / Syllabus	As prescribed by the certifying authority
3.	Duration of the Course	
4.	Assessment Procedure	
5.	Criteria for allocation of credit	Proof for the successful completion of the course provided by the globally accepted certifying agencies like HPATA / Microsoft / National Instruments (Lab View) / Oracle / IBM / CISCO Networking Academy / ADOBE / REDHAT / Sun Micro systems / JAVA / Softwares related to Mechanical and Civil Engineering
6.	In case of failure	-

ANNEXURE – III

INDUSTRIAL TRAINING **CREDIT: 1**

1.	Pre – requisites / Eligibility Conditions	After completion of the third semester. The student may undergo Industrial training in reputed organization after getting prior permission from HOD
2.	Detail of Course Content / Syllabus	Inplant training in any organization like BSNL, TTPS, BHEL, NLC etc related to their programmes
3.	Duration of the Course	One to two weeks
4.	Assessment Procedure	1. Student has to submit a report. 2. Evaluation Committee will be constituted by the respective department HOD to assess the report based on the following criteria's. • Evaluation of report given by the student (40%) • Student's presentation (40%) • Oral Examination (20%)
5.	Criteria for allocation of credit	Satisfactory completion certificate issued by the respective department HOD based on the performance of the student and a certificate from the organization concerned.
6.	In case of failure	-

INTERNSHIP **CREDIT: 1**

1.	Pre – requisites / Eligibility Conditions	After completion of the third semester. The student may undergo intensive training after getting prior permission from HOD
2.	Detail of Course Content / Syllabus	Internship Training in R & D organization like CSIR, DRDO, IITs and IISC etc related to their programmes
3.	Duration of the Course	One to two weeks
4.	Assessment Procedure	1. Student has to submit a report for Internship 2. Evaluation Committee will be constituted by the respective department HOD to assess the report based on the following criteria's.

		• Internship Report (40%) • Student's presentation (40%) • Oral Examination (20%)
5.	Criteria for allocation of credit	Satisfactory completion certificate issued by respective department HOD based on the performance of the student and a certificate obtained from the organization concerned.
6.	In case of failure	-

B. E. – ELECTRONICS AND COMMUNICATION ENGINEERING

CURRICULUM AND SYLLABUS

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VISION

To produce communication engineers capable of generating a knowledge economy with social responsibility

MISSION

- To impart high quality education with ethical behavior.
- To equip the students compatible with recent trends in Electronic industries.
- To develop leadership qualities with humanity, wisdom, creativity and team spirit.
- To provide a passionate environment for continual learning.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

1. Graduate will have successful technical career in core and related fields.
2. Graduates will pursue higher education and work in Research and Development for solving real world problems.
3. Graduates will have leadership qualities with social consciousness and ethics.

PROGRAM OUTCOMES (POs)

1. An ability to apply knowledge of mathematics, science, engineering and technology to solve complex Electronics and communication Engineering problems.
2. An ability to identify, formulate and analyze engineering problems using knowledge of Basic Mathematics and Engineering sciences.
3. An ability to provide solution and to design Electronics and Communication systems that meets out the social needs.
4. An ability to investigate the problems in an Electronics and Communication systems and rectifying it.
5. An ability to use latest hardware and software tools to solve complex engineering problems.
6. An ability to gain knowledge on contemporary issues which influence engineering design.
7. Awareness on society and environment to have sustainable solution for Electronics and Communication engineering problems.
8. An ability to demonstrate understanding of professional and ethical responsibilities.
9. An ability to work efficiently as an individual and in multidisciplinary teams.
10. An ability to communicate effectively and efficiently both in verbal and written form.
11. An ability to develop confidence for self education and understanding the value for life-long learning.
12. Able to implement Electronic system projects for real world applications.

PREAMBLE OF THE CURRICULUM & SYLLABI

The Curriculum and Syllabi under Regulations 2015 is designed keeping in mind the Outcome Based Education (OBE) and Choice Based Credit System (CBCS). The course content of each course shall be fixed in accordance with the Program Educational Objectives (PEOs), Program Outcomes (POs) and Course Outcomes (COs).

The CBCS enables the students to earn credits across programmes and provides flexibility for slow and fast learners in registering the required number of credits in a semester. The CBCS facilitates transfer of credits earned in different departments / Centers of other recognized / accredited universities or institutions of higher education in India and abroad either by studying directly or by online method.

The curriculum of **ECE programme** is designed with total number of credits ***173 (130*** for Lateral entry) and shall have the following category of courses in the curriculum.

1. **Foundation courses**

a. **Common Foundation Courses (CFC)** include Mathematics, Basic Sciences, Engineering Sciences and Skill Based Courses.
b. **Specific Foundation Courses (SFC)** include the basic courses specific to a programme of study.

2. **Programme Core Courses (PCC)** include the core courses relevant to the chosen programme of study and the Employability Enhancement courses such as Project, Seminar and Inplant training/ Internship.

3. **Programme Elective Courses (PEC)** include the elective courses relevant to the chosen programme of study.
4. **Open Elective Courses (OEC)** include Inter-disciplinary and Trans-disciplinary courses. The students shall study Inter-disciplinary courses offered in other Engineering/Technology Programmes through regular mode and Trans-disciplinary courses through self study mode.

5. **Mandatory courses (MAC)** include the courses recommended by the regulatory bodies such as AICTE, UGC etc as given below:
   a. Technical English / Professional English
   b. Professional Ethics and Human Values
   c. Environmental Science and Engineering
   d. Communication Skills Laboratory

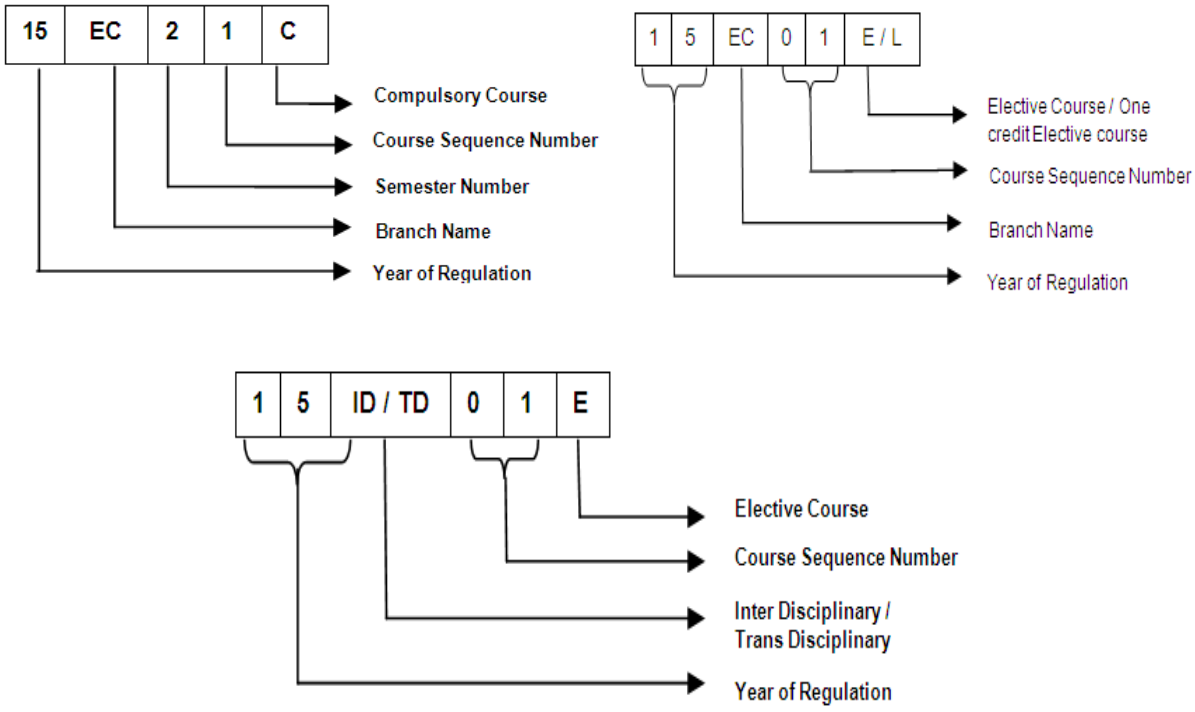
6. Every student shall undergo one Interdisciplinary and one Transdisciplinary course.

Performance in each course of study shall be evaluated based on Continuous Assessment throughout the semester and end semester examination at the end of the programme. Keeping in mind the content of the courses and delivery methods, different question paper patterns are suggested.

QP - Question Pattern

Question pattern	1 mark	2 marks	4 marks	10 marks	12 marks	16 marks	20 marks	Total
A	--	--	--	--	--	--	1 Qn Compulsory & 4 Qns (either or type)	100
B	--	10	--	--	--	1 Qn Compulsory & 4 Qns (either or type)	--	100
C	10	--	10 out of 12	1 Qn Compulsory & 4 Qns (either or type)	--	--	--	100
D	10	10	5 out of 6	1 Qn Compulsory & 4 Qns (either or type)	--	--	--	100
E	--	10	5 out of 6	--	1 Qn Compulsory & 4 Qns (either or type)	--	--	100
F	--	--	--	--	--	--	5 out of 8	100
G	--	5	--	2 Qns (either or type)	--	--	--	30

FORMAT FOR COURSE CODE



B.E. – ELECTRONICS AND COMMUNICATION ENGINEERING

REGULATIONS – 2015

CURRICULUM AND SYLLABUS

SEMESTER – I

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	QP
THEORY								
1.	MAC	15SH11C	Technical English*	3	0	0	3	B
2.	CFC	15SH12C	Mathematical Foundations for Engineers*	3	2	0	4	B
3.	CFC	15SH13C	Engineering Physics*	3	0	0	3	B
4.	CFC	15SH14C	Engineering Chemistry*	3	0	0	3	B
5.	CFC	15SH15C	Introduction to Engineering*	2	0	0	2	A
6.	CFC	15SH16C	Engineering Graphics*	2	0	2	3	A
PRACTICAL								
7.	CFC	15SH17C	Engineering Physics and Engineering Chemistry Laboratory*	0	0	2	1	-
8.	CFC	15SH18C	Engineering Practice Laboratory*	0	0	2	1	-
			TOTAL	**16**	**2**	**6**	**20**	

SEMESTER – II

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	QP
THEORY								
1.	MAC	15EC21C	Professional English*	3	0	0	3	B
2.	SFC	15EC22C	Calculus and Laplace Transforms	3	2	0	4	B
3.	SFC	15EC23C	Semiconductor Physics#	3	0	0	3	B
4.	SFC	15EC24C	Circuit Analysis	3	2	0	4	B
5.	CFC	15EC25C	C Programming for Engineers*	3	0	0	3	B
6.	MAC	15EC26C	Environmental Science and Engineering*	3	0	0	3	A
PRACTICAL								
7.	SFC	15EC27C	Semiconductor Physics and Environmental Chemistry Laboratory#	0	0	2	1	-
8.	CFC	15EC28C	C Programming Laboratory*	0	0	2	1	-
9.	SFC	15EC29C	Circuits and Devices Laboratory	0	0	2	1	-
			TOTAL	**18**	**4**	**6**	**23**	

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OEC – Open Elective Course) *Common to all B.E. / B.Tech., Programmes, #Common to ECE and EEE

SEMESTER – III

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	QP
THEORY								
1.	SFC	15EC31C	Transforms and Complex Integration	3	2	0	4	B
2.	PCC	15EC32C	Electronic Circuits – I	3	0	0	3	B
3.	PCC	15EC33C	Digital Electronics	3	0	0	3	B
4.	PCC	15EC34C	Signals and Systems	3	2	0	4	B
5.	PCC	15EC35C	Electromagnetic Fields	3	0	0	3	B
6.	SFC	15EC36C	C++ and Data Structures	3	0	0	3	B
PRACTICAL								
7.	PCC	15EC37C	Digital Electronics Laboratory	0	0	2	1	-
8.	SFC	15EC38C	C++ and Data Structures Laboratory	0	0	2	1	-
9.	PCC	15EC39C	Electronic Circuits laboratory	0	0	2	1	-
			TOTAL	**18**	**4**	**6**	**23**	

SEMESTER – IV

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	QP
THEORY								
1.	SFC	15EC41C	Probability and Random Processes	3	2	0	4	B
2.	PCC	15EC42C	Electronic Circuits – II	3	0	0	3	B
3.	PCC	15EC43C	Digital Signal Processing	3	2	0	4	B
4.	PCC	15EC44C	Communication Systems	3	0	0	3	B
5.	PCC	15EC45C	Transmission Lines and Waveguides	3	0	0	3	B
6.	MAC	15EC46C	Professional Ethics and Human Values*	3	0	0	3	A
PRACTICAL								
7.	PCC	15EC47C	Digital Signal Processing Laboratory	0	0	2	1	-
8.	PCC	15EC48C	Electronic Circuits and Simulation Laboratory	0	0	2	1	-
9.	MAC	15EC49C	Communication Skills Laboratory*	0	0	2	1	-
			TOTAL	**18**	**4**	**6**	**23**	

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SEMESTER – V

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	QP
THEORY								
1.	PCC	15EC51C	Advanced Communication Systems	3	2	0	4	B
2.	PCC	15EC52C	Linear Integrated Circuits	3	0	0	3	B
3.	PCC	15EC53C	Microprocessor and Microcontroller	3	2	0	4	B
4.	PCC	15EC54C	Antennas and Wave Propagation	3	0	0	3	B
5.	MAC	15EC55C	Project Management and Finance*	3	0	0	3	B
6.	PCC	15EC56C	Control Systems Analysis and Design	3	2	0	4	B
PRACTICAL								
7.	PCC	15EC57C	Analog and Digital Communication Laboratory	0	0	2	1	-
8.	PCC	15EC58C	Linear Integrated Circuits Laboratory	0	0	2	1	-
9.	PCC	15EC59C	Microprocessor and Microcontroller Laboratory	0	0	2	1	-
			TOTAL	**18**	**6**	**6**	**24**	

SEMESTER – VI

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	QP
THEORY								
1.	PCC	15EC61C	VLSI Technology and Design	3	2	0	4	E
2.	PCC	15EC62C	Computer Communication Networks	3	0	0	3	B
3.	PCC	15EC63C	Wireless Communication	3	0	0	3	B
4.	PCC	15EC64C	RF and Microwave Engineering	3	0	0	3	B
5.	*X*EC		Elective-I	3	0	0	3	-
6.	*X*EC		Elective–II	3	0	0	3	-
PRACTICAL								
7.	PCC	15EC65C	RF and Microwave Engineering Laboratory	0	0	2	1	-
8.	PCC	15EC66C	VLSI Design Laboratory	0	0	2	1	-
9.	PCC	15EC67C	Computer Communication Networks Laboratory	0	0	2	1	-
10.	PCC	15EC68C	Product Development Laboratory	0	0	4	2	-
			TOTAL	**18**	**2**	**10**	**24**	

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SEMESTER – VII

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	QP
THEORY								
1.	*X*EC		Elective-III	3	0	0	3	-
2.	*X*EC		Elective-IV	3	0	0	3	-
3.	*X*EC		Elective-V	3	0	0	3	-
4.	*X*EC		Elective-VI	3	0	0	3	-
5.	*X*EC		Elective-VII	3	0	0	3	-
PRACTICAL								
6.	PCC	15EC71C	Mini Project	0	0	8	4	-
7.	PCC	15EC72C	Research Paper and Patent Review - Seminar	0	0	2	1	-
8.	PCC	15EC73C	Comprehension	0	0	2	1	-
			TOTAL	**15**	**0**	**12**	**21**	

SEMESTER – VIII

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	QP
THEORY								
1.	*X*EC		Elective - VIII	3	0	0	3	-
PRACTICAL								
2.	PCC	15EC81C	Project Work	0	0	20	10	-
3.	PCC	15EC82C	a. Internship – 1 to 4 Credits (or) b. Inplant Training – 2 to 4 Credits	0	0	4	2	-
			TOTAL	**3**	**0**	**24**	**15**	

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PCC – Programme Core Course, *X*EC - *X* Stands for P or O (PEC – Programme Elective Course,
OEC – Open Elective Course) *****Common to all B.E. / B.Tech., Programmes, **#**Common to ECE and EEE

PROGRAMME ELECTIVE COURSES (PEC)

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	QP
SIGNAL and IMAGE PROCESSING								
1.	PEC	15EC01E	Fundamentals of Digital Image Processing	3	0	0	3	B
2.	PEC	15EC02E	Digital Signal Processors	3	0	0	3	B
3.	PEC	15EC03E	Biosignal Processing	3	0	0	3	B
RF and COMMUNICATION ENGINEERING								
4.	PEC	15EC07E	Radar and Navigational Aids	3	0	0	3	B
5.	PEC	15EC08E	Statistical Theory of Communication	3	0	0	3	B
6.	PEC	15EC09E	Multimedia Compression and Communication	3	0	0	3	B
7.	PEC	15EC10E	Global Navigation Satellite System	3	0	0	3	B
8.	PEC	15EC11E	Electromagnetic Interference and Compatibility	3	0	0	3	B
9.	PEC	15EC12E	Optical Communication and Networks	3	0	0	3	B
10.	PEC	15EC13E	RF MEMS Technologies and Components	3	0	0	3	B
11.	PEC	15EC14E	Microwave Theory and Techniques	3	0	0	3	B
VLSI and EMBEDDED SYSTEM								
12.	PEC	15EC18E	Advanced Microprocessors	3	0	0	3	B
13.	PEC	15EC19E	Fundamentals of Semiconductor Chip Testing	2	0	2	3	B
14.	PEC	15EC20E	ARM Processor Architecture and Programming	3	0	0	3	B
15.	PEC	15EC21E	Embedded and Real Time Systems	3	0	0	3	B
APPLIED ELECTRONICS								
16.	PEC	15EC25E	Medical Electronics	3	0	0	3	B
17.	PEC	15EC26E	Advanced Electronic System Design	3	0	0	3	B
NETWORKS								
18.	PEC	15EC31E	Mobile Adhoc Networks	3	0	0	3	B
19.	PEC	15EC32E	Wireless Sensor Networks	3	0	0	3	B
20.	PEC	15EC33E	Cryptography and Network Security	3	0	0	3	B
21.	PEC	15EC34E	Fundamentals of Cyber Security	3	0	0	3	B

ONE CREDIT ELECTIVE COURSES (PEC)

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	QP
1.	PEC	15EC01L	Basic Device Driver Programming Practice	0	0	2	1	-
2.	PEC	15EC02L	Introduction to Robotics and Machine Vision	1	0	0	1	G
3.	PEC	15EC03L	Automotive Embedded Systems	1	0	0	1	G
4.	PEC	15EC04L	Basics of GiT	0	0	2	1	-
5.	PEC	15EC05L	Image Processing Practice using Omap3530 and Opencv	0	0	2	1	-
6.	PEC	15EC06L	Application and Operations Security	1	0	0	1	G
7.	PEC	15EC07L	Security Engineering	1	0	0	1	G
8.	PEC	15EC08L	Security Management Practices	1	0	0	1	G
9.	PEC	15EC09L	Introduction to cybercrime analysis	1	0	0	1	G
10.	PEC	15EC10L	Introduction to OFDM	1	0	0	1	G
11.	PEC	15EC11L	Spreading codes in Spread Spectrum Modulation	1	0	0	1	G
12.	PEC	15EC12L	Practical Antenna Design: From Theory to Practice	1	0	0	1	G
13.	PEC	15EC13L	MIMO Antenna Engineering	1	0	0	1	G
14.	PEC	15EC14L	Advanced Multimedia Techniques	1	0	0	1	G
15.	PEC	15EC15L	Multimedia Processing and Coding Lab	0	0	2	1	-
16.	PEC	15EC16L	Broadcasting and Streaming Techniques	1	0	0	1	G
17.	PEC	15EC17L	Printed Circuit Board Design	1	0	0	1	G

Open Elective Course (OEC)

Group – I (Inter-disciplinary courses)

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	QP
Any one of the following course is compulsory								
1.	OEC	15ID01E	Product Design and Development	3	0	0	3	A
2.	OEC	15ID02E	Disaster Management	3	0	0	3	A
3.	OEC	15ID03E	Energy Engineering	3	0	0	3	A
4.	OEC	--	Other Programme Courses	3	0	0	3	As specified for the Chosen Course

Group-II (Trans-disciplinary courses) - Self Study Course

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	QP
Any one of the following course is compulsory								
1.	OEC	15TD01E	Indian Business Laws	0	0	0	3	F
2.	OEC	15TD02E	Leadership and Personality Development	0	0	0	3	F
3.	OEC	15TD03E	International Business Management	0	0	0	3	F
4.	OEC	15TD04E	Basics of Marketing	0	0	0	3	F
5.	OEC	15TD05E	Retailing and Distribution management	0	0	0	3	F
6.	OEC	15TD06E	International Economics	0	0	0	3	F
7.	OEC	15TD07E	Indian Economy	0	0	0	3	F
8.	OEC	15TD08E	Rural Economics	0	0	0	3	F
9.	OEC	15TD09E	International Trade	0	0	0	3	F
10.	OEC	15TD10E	Global Challenges and issues	0	0	0	3	F
11.	OEC	15TD11E	Indian Culture and Heritage	0	0	0	3	F
12.	OEC	15TD12E	Indian History	0	0	0	3	F
13.	OEC	15TD13E	Sustainable Development and Practices	0	0	0	3	F
14.	OEC	15TD14E	Women in Indian Society	0	0	0	3	F
15.	OEC	15TD15E	Indian Constitution	0	0	0	3	F
16.	OEC	15TD16E	Bio Mechanics in Sports	0	0	0	3	F

15SH11C	TECHNICAL ENGLISH	L T P C
	(Common to all B.E. / B.Tech. Degree Programmes)	**3 0 0 3**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: acquire the basics of English communication skills**.** (K3)

CO2: apply the basic language skills to understand various aspects of technical writing. (K3)

CO3: understand main ideas, specific details and implied meaning while listening and develop the factual & imaginative information. (K2, S4)

CO4: coordinate and communicate in a wide range of situation. (K3, S4)

CO5: integrate and apply the acquired skills in real life situation. (K2, S4)

UNIT I **9**

Parts of Speech - Sentence Structure (SV/SVO/SVC/SVIODO)- Identifying the kinds of sentences (Statement, Interrogative, Imperative, Exclamatory & Negative) - Informal writing (Diary writing & letter to friend / parent / siblings) - Self Introduction -Listening for general information.

UNIT II **9**

Transformation of words into different grammatical forms- Converting one kind of sentence into another sentence (Statement, Interrogative, Imperative, Exclamatory & Negative) - Technical Vocabulary - Tense Usage (Present tense- Past tense - Future tense - Writing passages in all tenses) -Letter writing (Permission letter & Requisition letter) - Listening for specific information.

UNIT III **9**

Personality Adjective - Concord - Letter Writing: Invitation / Acceptance letters - Itinerary Writing (with valued points/ situation) - Phonetics (Vowels - Consonants - Diphthongs) - Listening and filling up the information - Process Description (with valued points).

UNIT IV **9**

IF Conditionals - British & American Vocabulary - Letter Writing (Declining / Thanking letters) - Email writing (with valued points) - Instruction Writing - Listening and giving opinion on the pictures.

UNIT V **9**

Reading comprehension **-** Error Spotting (Article, Preposition, Modals and Concord) **-** Presenting article based on newspaper reading- Situational Conversation - Listening and writing dialogues – Checklists.

L: 45 TOTAL: 45 PERIODS

Suggested Activity: Each student should read the suggested fiction for oral assignment

TEXT BOOKS

1. Rizvi. M. Ashraf, "Effective Technical Communication", 1st Edition, The Mc Graw Hill Education Private Limited, New Delhi, 2005.
2. Dutt P. K., Rajeevan G. and Prakash C.L.N., "A Course in Communication Skills", 1st Edition, Cambridge University Press, India, 2007.

REFERENCES

1. John Sinclair, "Collins Cobuild English Grammar", 3rd Edition, Collins Publishers, London, 2011.
2. Jan Svartvik, Sidney Greenbaum, Geoffery Leech, Randolph Quirk "A Comprehensive Grammar of the English Language", 2nd Edition, Longman Inc., Newyork, 2014.
3. Micheael Vince, Peter Sunderland, "Advanced Language Practice with Key", 3rd Edition, Macmillan Publishers Limited, Italy, 2003.

Listening files: Audio files from net sources, Softwares: ODLL, Globerena.

15SH12C	MATHEMATICAL FOUNDATIONS FOR ENGINEERS	L T P C
	(Common to all B.E. / B.Tech. Degree Programmes)	**3 2 0 4**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: make use of orthogonal transformation. (K3)
CO 2: use the basic concepts of three dimensional geometry in engineering. (K2)
CO 3: obtain maxima and minima of real valued functions. (K3)
CO 4: solve ordinary differential equations. (K3)
CO 5: solve partial differential equations. (K3)

UNIT I MATRICES 15

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Independency and dependency of Eigen vectors – Properties of Eigen values and Eigen vectors (excluding proofs) - Diagonalisation of a matrix by orthogonal transformation- Quadratic forms – Reduction of quadratic form to canonical form by orthogonal transformation and its nature.

UNIT II THREE DIMENSIONAL ANALYTICAL GEOMETRY 15

Direction cosines and Direction ratios- Planes and Lines - Equations of plane and line - Intersection of two planes - Shortest distance between two lines - Equation of a sphere - Plane section of a sphere - Tangent Plane - Orthogonal spheres.

UNIT III FUNCTIONS OF SEVERAL VARIABLE 15

Euler's theorem on homogeneous functions of two variables - Taylor's Series - Jacobians - Maxima and Minima - Constrained Maxima and Minima by the method of Lagrange multipliers.

UNIT IV ORDINARY DIFFERENTIAL EQUATIONS 15

Solutions of higher order linear differential equations with constant coefficients - Cauchy's and Legendre's linear equations - Solutions of simultaneous first order linear equations with constant coefficients - Method of variation of parameters.

UNIT V PARTIAL DIFFERENTIAL EQUATIONS 15

Formation of partial differential equations - Lagrange's linear equations - Solutions of standard types of first order partial differential equations - Solutions of homogeneous linear partial differential equations of second and higher order with constant coefficients.

L: 45 T: 30 TOTAL: 75 PERIODS

TEXT BOOKS

1. Grewal.B.S. "Higher Engineering Mathematics", 42nd Edition, Khanna Publications, Delhi, 2012.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India, 2011.

REFERENCES

1. Bali.N.P. and Manish Goyal, "A Text book of Engineering Mathematics", 8th Edition, Laxmi Publications Private Limited, 2011.
2. George B.Thomas, Jr. Ross L.Finney, "Calculus and Analytic Geometry", 9th Edition, Dorling Kindersley Private Limited, 2010.
3. Sharma.G.S and Sarna.I.J.S, "Engineering Mathematics", 10th Edition, CBS Publishers and Distributors, New Delhi, 2005.
4. James C. Robinson, "An Introduction to Ordinary Differential Equations", Cambridge University Press, 2004.
5. Anthony Croft, Robert Davison, Martin Hargreaves James Flint, "Engineering Mathematics: A Foundation for Electronic, Electrical, Communications and System Engineers", 4th Edition, Pearson Education Private Limited, 2013.

15SH13C ENGINEERING PHYSICS L T P C

(Common to all B.E. / B.Tech. Degree Programmes) 3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: summarize the properties and structures of solids. (K2)

CO 2: define the principles of acoustics and ultrasonics and apply the ultrasonic methods for industrial and medical field. (K2)

CO 3: choose the appropriate Laser technique for industrial and medical applications. (K3)

CO 4: describe the different types, fabrication, losses of optical fibers and their applications in communication and instrumentation. (K2)

CO 5: explain the physical properties of photons & electrons and their applications in different electron microscopes. (K3)

UNIT I PROPERTIES OF MATTER AND CRYSTAL PHYSICS 9

Hooke's law - Types of moduli of elasticity - Determination of Rigidity modulus and Young's modulus - I shaped Girders.

Miller indices – d spacing - Characteristics of SC, BCC, FCC and HCP structures.

UNIT II ACOUSTICS AND ULTRASONICS 9

Acoustics: Weber-Fechner law - Sabine's formula - Absorption Coefficient and its determination - factors affecting acoustics of buildings and their remedies.

Ultrasonics: Production - magnetostriction generator - piezoelectric generator, Properties - Cavitations - Velocity measurement - acoustic grating, Industrial applications - Medical application - Sonograms.

UNIT III LASER SYSTEM AND APPLICATIONS 9

Einstein's A and B coefficients – Types and working of Lasers - CO_2 Laser, Nd-YAG Laser, Semiconductor Laser (Homojunction), Determination of wavelength of Laser and Particle size - Industrial applications - Medical applications-Holography.

UNIT IV FIBER OPTICS AND ITS APPLICATIONS 9

Numerical aperture and Acceptance angle - Types of optical fibers - Double crucible technique – Splicing - Loss in optical fiber - Fiber optical communication system - Applications - Fiber optic sensors - Endoscope.

UNIT V QUANTUM PHYSICS 9

Photo electric effect - Matter Waves - Davisson and Germer experiment - Heisenberg's Uncertainty principle - Schrodinger's wave equation - particle in one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. David Halliday, Robert Resnick, Jearl Walker, "Fundamentals of Physics", 10th Edition, John Wiley & Sons Inc.USA, 2014.
2. Arthur Beiser, "Concepts of Modern Physics", 6th Edition, McGraw Hill Publications Private Limited, 2008.

REFERENCES

1. Richard P.Feynmann, Robert B Leighton and Mathew Sands, "Feynmann's Lectures on Physics", 4th Edition, Addison Wesley Publication USA, 2010.
2. Yoav Peleg, Reuven Pnini, Elvahu Zaarur, Eugene Hecht, "Schaum's Outline of Quantum Mechanics", 2nd Edition, McGraw Hill Companions Limited, USA, 2010.
3. William T.Silfvast, "Laser Fundamentals", 2nd Edition, Cambridge University Press, NewYork, 2008.

15SH14C **ENGINEERING CHEMISTRY** **L T P C**

(Common to all B.E. / B.Tech. Degree Programmes) **3 0 0 3**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: identify suitable water treatment techniques for industrial and domestic purpose.(K3)
CO 2: explain the type of corrosion and corrosion control methods. (K3)
CO 3: select the polymer for specific application. (K2)
CO 4: explain the preparation, properties and applications of nano materials. (K2)
CO 5: outline the principle and instrumentation of various analytical techniques. (K2)

UNIT I WATER TREATMENT 9

Types of water - hardness - estimation of hardness of water – disadvantages of using hard water in boiler – oils and silica in water; water softening – internal conditioning – external conditioning – domestic water treatment – desalination.

UNIT II CORROSION AND ITS CONTROL 9

Chemical corrosion – electrochemical corrosion – mechanism – different types of electrochemical corrosion – factors influencing corrosion – corrosion control methods.

UNIT III ENGINEERING POLYMERS 9

Polymers – polymerization – free radical mechanism – plastics – thermo plastics and thermosetting plastics – processing and moulding of plastics – special polymers: fire retardant, conducting, photonic and electro luminescent polymer; composites – polymer matrix composites.

UNIT IV NANO MATERIALS 9

Nanoparticles – synthesis of CNT – precipitation, thermolysis, hydrothermal, solvothermal, electrodeposition, chemical vapour deposition, laser ablation – toxic effect of nano materials- properties and applications.

UNIT V ANALYTICAL TECHNIQUES 9

Principle, instrumentation and applications of UV-Visible and IR spectroscopy; chromatography: instrumentation and working of gas chromatography and HPLC; conductivity measurements – pH measurements – applications.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Jain P.C. and Jain. M., “Engineering Chemistry”, 16th Edition, Dhanpat Rai Publishing Company, New Delhi, Reprint 2013.
2. Dara S.S. and Umare S.S., “A text book of Engineering Chemistry”, S.Chand and Company Limited, New Delhi, 2013.
3. Chawla.S, “A text book of Engineering Chemistry”, 16th Edition, Dhanpat Rai Publishing Company, New Delhi, Reprint 2015.

REFERENCES

1. Ahmed Z., "Principles of corrosion engineering and corrosion control", Butterworth Heinemann, 2006.
2. Ebewele R.O., "Polymer science and Technology", CFC Press, Newyork, 2000.
3. Charless P. P. and Frank O. J, ,"Introduction to nano technology" John Wiley & Sons, 2008
4. Skoog D.A., James H. F. and Crouch S.R., "Instrumental Analysis", Cengage Learning India Private Limited, New Delhi, 2011
5. Mc Cash E.M. and Banwell C.N., "Fundamentals of molecular spectroscopy", 5th Edition, McGraw Hill Education (India) Private Limited, 2013.

15SH15C	INTRODUCTION TO ENGINEERING	L T P C
	(Common to all B.E./B.Tech. Degree Programmes)	**2 0 0 2**

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO 1: recognize the history of engineering through various engineering wonders in past and identify the engineering profession. (K2)

CO 2: recognize and analyse various engineering career paths and preparing for an engineering career. (K3)

CO 3: understand the profile of engineers in various fields. (K3)

CO 4: understand the OBE concepts and its components. (K2)

CO 5: understand learning components and creativity. (K3)

UNIT I HISTORY OF ENGINEERING AND INTRODUCTION TO ENGINEERING PROFESSION **7**

History of Engineering: Definition of Engineering, The Beginnings of Engineering, Overview of ancient Engineering, Traveling through the Ages, A case study of two historic Engineers – Lionardo da Vincy, Gutenberg.

Introduction to Engineering Profession: Engineering work is all around you - Engineering as a profession and common traits of Good Engineers – History of Engineering Disciplines – Functions of Engineering.

UNIT II CAREER PATHS OF ENGINEER AND PREPARING FOR AN ENGINEERING CAREER **8**

Career Paths for Engineers: The corporate ladder, The independent entrepreneur, Employment Opportunities in Government, The military, Engineering and social service abroad, The Engineering Professor, Graduate work outside of engineering, A mix of two or more of the first six options.

Preparing for an Engineering Career: Making the Transition from High School to College - Budgeting Your Time - Daily Studying and Preparation - Getting Involved with an Engineering Organization - Your Graduation Plan - Other Considerations.

UNIT III PROFILES OF ENGINEERS 4

Initial Career Profiles of Civil, Mechanical, Electrical, Electronics, Instrumentation, Communication, Information Technology, Computer Engineering Graduates.

UNIT IV OVERVIEW OF OBE AND CBCS 4

Graduate attributes of Washington Accord – Programme Specific Criteria (PSC) – Programme Educational Objectives (PEOs) – Programme Outcomes (POs) – Course Outcomes (COs) – CBCS : Course categories - Scheme of instruction, Assessment and Evaluation.

UNIT V LEARNING AND CREATIVE THOUGHT 7

Introduction: The successful engineering student - the engineering curriculum - curriculum planning and management - adapting to the college classroom.

The learning process: the nature of learning - information processing and memory - determinants of efficient learning - practical suggestions for learning.

Differences in the way people think: The four-quadrant model of thinking - hindrances to problem solving.

On Creativity: What is creativity? - the nature of creativity - characteristics of creative people - the creative process - overcoming obstacles to creative thinking.

L: 30 TOTAL: 30 PERIODS

REFERENCES

1. Paul H. Wright, “Introduction to Engineering”, School of Civil and Environmental Engineering, 3rd Edition, John Wiley & Sons, Inc, 2002.
2. Saeed Moaveni, “Engineering Fundamentals an Introduction to Engineering”, 4th Edition, Cengage Learning, USA, 2011.
3. William C. Oakes, Les L. Leone and Craig J. Gunn, “Engineering Your Future – A Comprehensive Introduction to Engineering”, Oxford University Press, USA, 2010.
4. Philip Kosky, George Wise, Robert Balmer and William Keat, “Exploring Engineering An Introduction to Engineering and Design”, Academic Press, Elsevier, USA, 2010.

WEB RESOURCES

www.ieagreements.org/IEA-Grad-Attr-Prof-Competencies.pdf

15SH16C ENGINEERING GRAPHICS L T P C

(Common to all B.E./B.Tech. Degree Programmes) 2 0 2 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: use the drawing instruments effectively. (K2, S4, A3)

CO 2: draw the projections of points, straight lines, planes. (K2, S3, A3)

CO3: construct the projections of various solids in different positions. (K3, S3, A3)

CO 4: draw the sectional views of various solids and construct the true shape of the section. (K3, S3, A3)

CO 5: identify and draw the surface areas of simple solids. (K3, S3, A3)
CO 6: draw perspective views of simple solids and draw the orthographic views of simple objects. (K3, S3, A3)

UNIT I PROJECTION OF POINTS, LINES AND PLANE SURFACES 12

Drawing Instruments- IS specifications on lines- drawing sheets- Printing letters and dimensioning- scales - First angle projection. (Not for examination).
Projections of points and straight lines located in the first quadrant- Determination of true lengths and true inclinations. Projections of regular polygonal surfaces and circular lamina inclined to both reference planes

UNIT II PROJECTION OF SOLIDS 12

Projections of simple solids - axis inclined to one reference plane - change of position method.

UNIT III SECTION OF SOLIDS 12

Sectioning of simple solids - cutting planes inclined to one reference plane and perpendicular to the other.

UNIT IV DEVELOPMENT OF SURFACES AND ISOMETRIC PROJECTIONS 12

Development of lateral surfaces of simple and truncated solids - Principles of isometric projection and view of simple solids - truncated prism and pyramids.

UNIT V PERSPECTIVE PROJECTIONS AND ORTHOGRAPHIC PROJECTIONS 12

Perspective projection of cube, prisms and pyramids by visual ray method and vanishing point method. Orthographic projection – simple objects with straight and curved surfaces.

L: 30 P: 30 TOTAL: 60 PERIODS

TEXT BOOKS

1. Bhatt N.D, “Engineering Drawing”, 53rd Edition, Charotar Publishing House, 2014.
2. Natrajan K.V, “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.

REFERENCES

1. Kumar M.S, “Engineering Graphics”, D.D. Publications, 2007.
2. Venugopal K and Prabhu Raja V, “Engineering Graphics”, New Age International Private Limited, 2008.
3. Shah M.B and Rana B.C, “Engineering Drawing”, Pearson Education, 2005.
4. Gopalakrishna K.R, “Engineering Drawing”, 32nd Edition, Subhas Publications, 2005.
5. Dhananjay Jolhe A, “Engineering Drawing with an Introduction to AutoCAD”, Tata McGraw Hill Publishing Company Limited, 2008.
6. Basant Agarwal and Agarwal C.M, “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

15SH17C ENGINEERING PHYSICS AND ENGINEERING CHEMISTRY LABORATORY **L T P C**

(Common to all B.E./B.Tech. Degree Programmes) **0 0 2 1**

PART A – ENGINEERING PHYSICS LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: demonstrate the properties of light waves. (K3, S3)

CO2: interpret the production of ultrasounds and how the velocity of ultrasounds varies with respect to medium.(K3, S3)

CO3: illustrate the mechanical and electrical properties of materials. (K3, S3)

LIST OF EXPERIMENTS

1. Determination of thickness of a thin wire – Air wedge method.
2. Determination of velocity of sound and compressibility of the liquid – Ultrasonic Interferometer.
3. Determination of Dispersive power of a prism using Spectrometer.
4. Determination of Young's modulus – Uniform bending method.
5. Torsional pendulum – Determination of Moment of Inertia of the disc and Rigidity modulus of the material of the wire.
6. Determination of specific resistance of a given coil of wire – Carey Foster's Bridge.
7. Calibration of voltmeter / ammeter using potentiometer.
8. Determination of Frequency of A.C. mains using Sonometer.
9. Determination of the angular divergence of a laser beam using He-Ne laser or diode laser.
10. Determination of temperature coefficient of resistance.

P:15 TOTAL: 15 PERIODS

PART B - ENGINEERING CHEMISTRY LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: estimate the amount of hardness of the water sample (K5, S3)

CO 2: determine the rate of corrosion (K5, S3)

CO 3: synthesize a polymer and to determine molecular weight of the polymer (K6, S3)

CO 4: synthesize silver nano particles (K6,S3)

CO 5: quantify different ions by different analytical techniques (K5,S3)

LIST OF EXPERIMENTS

1. Estimation of hardness of water sample by EDTA method
2. Rate of corrosion- weight loss method
3. Synthesis of urea-formaldehyde resin

4. Determination of molecular weight of a polymer – Oswald's viscometer
5. Synthesis and characterization of silver nano particles.
6. Estimation of iron (Fe^{2+}) in water sample by dichrometry
7. Estimation of hydrochloric acid by conductometric method
8. Estimation of mixture of acids by conductometric method
9. Determination of purity of simple organic compounds using HPLC- (Demo).

P: 15 TOTAL: 15 PERIODS

- A minimum of FIVE experiments shall be offered.
- Laboratory classes on alternate weeks for Physics and Chemistry.

REFERENCES

1. Harris D.C., "Quantitative Chemical Analysis: International Edition", 8th Edition, W.H. Freeman, 2010.
2. Mendham J., "Vogel's Quantitative Chemical Analysis", 6th Edition, Pearson Publisher, 2009.
3. Vogel A.I., "Vogel's Textbook of Quantitative Chemical Analysis", 5th Edition, Longman Scientific & Technical, 1989.

15SH18C	**ENGINEERING PRACTICE LABORATORY**	**L T P C**
	(Common to all B.E./B.Tech. Degree Programmes)	**0 0 2 1**

PART A - MECHANICAL LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: prepare basic carpentry jobs (at least three joints). (K3,S2, A2)

CO 2: prepare the welded joint (minimum three) using arc and gas welding. (K3, S2, A2)

CO 3: Machine metals using lathe, shaper and drilling machine (each one job). (K3, S2, A2)

UNIT I CARPENTRY PRACTICES 5

Study of carpentry tools – preparation of joints like half lap, Tee and dove tail in wood.

UNIT II WELDING 5

Study of welding tools – Preparation of welded joints with Mild steel specimen like lap, butt and tee joints using ARC and Gas welding. (any one exercise should be given using Gas welding among three)

UNIT III BASIC MACHINING PRACTICES 5

Simple turning and taper turning using lathe – use of shaper and drilling machine for basic operations (Minimum three exercises should be given for students)

P: 15 TOTAL: 15 PERIODS

TEXT BOOK

1. Bawa H.S, "Workshop Practice", Tata McGraw Hill Publishing Company Limited, 2007.

REFERENCES

1. Ramesh Babu V, "Engineering Practices Laboratory Manual", Revised Edition, VRB Publishers Private Limited, Chennai, 2014.
2. Jeyachandran K, Natarajan S. and Balasubramanian S, "A Primer on Engineering Practices Laboratory", Anuradha Publications, 2007.
3. Jeyapoovan T, Saravanapandian M. and Pranitha S, "Engineering Practices Lab Manual", Vikas Publishing House Private Limited, 2006.
4. Rajendra Prasad A and Sarma PMMS, "Workshop Practice", Sree Sai Publication, 2002
5. Kannaiah P and Narayana KL, "Manual on Workshop Practice", Scitech Publications, 1999.

PART – B ELECTRICAL AND ELECTRONICS LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to,

CO 1: develop simple residential wiring circuits. (K6)
CO 2: calculate the basic electrical quantities. (K4)
CO 3: identify the value of resistance using appropriate methods. (K4, A4)
CO 4: realize the fundamentals of Boolean algebra using digital logic gates. (A4)
CO 5: practice soldering to design PCB for electronic circuits. (A5)

I. ELECTRICAL ENGINEERING PRACTICE **8**

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair-case wiring.
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of electrical equipment.

II. ELECTRONICS ENGINEERING PRACTICE **7**

1. Study of Electronic components and equipments – Resistor, colour coding, measurement of AC signal parameters (peak-peak, rms period, frequency) using CRO
2. Study of logic gates AND, OR, XOR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components, Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

P: 15 TOTAL: 15 PERIODS

REFERENCES

1. Jeyachandran K, Natarajan S and Balasubramanian S, “A Primer on Engineering Practices Laboratory”, Anuradha Publications, 2007.
2. Jeyapoovan T, Saravanapandian M and Pranitha S, “Engineering Practices Lab Manual”, Vikas Publishing House Private Limited, 2006.
3. Bawa H.S, “Workshop Practice”, Tata McGraw Hill Publishing Company Limited, 2007.
4. Rajendra Prasad A and Sarma P.M.M.S., “Workshop Practice”, Sree Sai Publication, 2002.
5. Kannaiah P and Narayana K.L, “Manual on Workshop Practice”, Scitech Publications, 1999.

15EC21C **PROFESSIONAL ENGLISH** **L T P C**

(Common to all B.E. / B.Tech. Degree Programmes) **3 0 0 3**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: contribute the lingual power to frame sentences in different context. (K2, A2)
CO 2: write effectively in any Professional context. (K3, A2)
CO 3: acquire the skills related to Group discussion. (K3, A2)
CO 4: communicate and respond in different social and professional contexts. (K3, A3)
CO 5: recall the acquired skills in solving competitive exam. (K2, S3)

UNIT I **9**

Phrasal Verbs (Based on root words: call, come, get, look, put, run, and take) - Foreign Words and Phrases (from the given list) - Listening to audio files and finding the technical words and framing different sentences - Channel conversion- Descriptive writing on various charts.

UNIT II **9**

Idioms and Phrases (with animal names from the given list) - Report writing (types- structure- stages in report writing- model report) - Job Application Letter with curriculum vitae.

UNIT III **9**

One word substitution (from the list given) Group Discussion (Why is GD a part of selection process? - Structure of GD – Strategies in GD – Team Work - Body Language - Video Samples-GD).

UNIT IV **9**

Choosing a suitable connotation (from the given list) - Note making – Preparing Circular and Minutes of meeting – Listening to TED Talks – Giving opinion on the given TED Talks and interviewing the TED talkers.

UNIT V **9**

Error Spotting (Tense, Relative Pronouns, Conjunctions, Sentence Structure, Adverb Placement) Sentence Completion - Reading comprehension.

L: 45 TOTAL: 45 PERIODS

Activity: Each student should read the suggested fiction for oral assignment.

TEXT BOOK

1. Tyagi Kavita and Padma Misra, "Advanced Technical Communication", 1st Edition, PHI Learning Private Limited, New Delhi, 2011.

REFERENCES

1. Smith-Worthington, Darlene & Sue Jefferson. "Technical Writing for Success", 1st Edition, Cengage Mason, USA, 2007.
2. Bovee, Courtland L., John V.Thill. "Business Communication Today", 12th Edition, Pearson Education, New Delhi, 2013.
3. Anderson, Paul V. "Technical Communication: A Reader - Centered Approach", 8th Edition, Cengage, New Delhi, 2013.

Listening files: Audio files from net sources and softwares: ODLL, Globerena.

15EC22C CALCULUS AND LAPLACE TRANSFORMS **L T P C**
3 2 0 4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: evaluate area and volume using double and triple integrals. (K3)
CO 2: analyze the concepts related to vector calculus and apply them in engineering field. (K3)
CO 3: grasp analytic functions and their properties and be introduced to the host of conformal mappings.(K2)
CO 4: perform the ideas of Laplace transform. (K3)

UNIT I MULTIPLE INTEGRALS **15**

Double integration – Cartesian and polar coordinates - Change of order of integration - Change of variables between Cartesian and polar coordinates - Triple integration in Cartesian coordinates - Area as double integral.

UNIT II VECTOR CALCULUS **15**

Gradient, Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields - Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

UNIT III ANALYTIC FUNCTIONS 15

Functions of a complex variable – Analytic functions – Necessary and Sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic functions – Harmonic conjugate – Construction of analytic functions – Conformal mapping: w=z+c, cz, 1/z and bilinear transformation.

UNIT IV LAPLACE TRANSFORMS 16

Definition of Laplace transform and its inverse – Transforms of elementary functions – Properties – Transforms of periodic functions – Initial and final value theorems – Convolution theorem.

UNIT V APPLICATIONS OF LAPLACE TRANSFORMS 14

Solutions of linear ordinary differential equations of second order with constant coefficients - Solutions of simultaneous differential equations of first order with constant coefficients – Solutions of Integro-differential equations.

L: 45 T: 30 TOTAL: 75 PERIODS

TEXT BOOKS

1. Grewal.B.S., “Higher Engineering Mathematics”, 42nd Edition, Khanna Publications, New Delhi, 2012.
2. Erwin Kreyszig, “Advanced Engineering Mathematics”, 10th Edition, Wiley India, 2011.

REFERENCES

1. Bali.N.P. and Manish Goyal, “A Text book of Engineering Mathematics”, 8th Edition, Laxmi Publications Private Limited, 2011.
2. Ramana.B.V., “Higher Engineering Mathematics”, Tata McGraw Hill Publishing Company, New Delhi, 2007.
3. Jain.R.K. and Iyengar.S.R.K., “Advanced Engineering Mathematics”, 3rd Edition, Narosa Publishing House Private Limited, 2007.

15EC22C CALCULUS AND LAPLACE TRANSFORMS L T P C

3 2 0 4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: evaluate area and volume using double and triple integrals. (K3)

CO 2: analyze the concepts related to vector calculus and apply them in engineering field. (K3)

CO 3: grasp analytic functions and their properties and be introduced to the host of conformal mappings.(K2)

CO 4: perform the ideas of Laplace transform. (K3)

UNIT I MULTIPLE INTEGRALS 15

Double integration – Cartesian and polar coordinates - Change of order of integration - Change of variables between Cartesian and polar coordinates - Triple integration in Cartesian coordinates - Area as double integral.

UNIT II VECTOR CALCULUS 15

Gradient, Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields - Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

UNIT III ANALYTIC FUNCTIONS 15

Functions of a complex variable – Analytic functions – Necessary and Sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic functions – Harmonic conjugate – Construction of analytic functions – Conformal mapping: w=z+c, cz, 1/z and bilinear transformation.

UNIT IV LAPLACE TRANSFORMS 16

Definition of Laplace transform and its inverse – Transforms of elementary functions – Properties – Transforms of periodic functions – Initial and final value theorems – Convolution theorem.

UNIT V APPLICATIONS OF LAPLACE TRANSFORMS 14

Solutions of linear ordinary differential equations of second order with constant coefficients - Solutions of simultaneous differential equations of first order with constant coefficients – Solutions of Integro-differential equations.

L: 45 T: 30 TOTAL: 75 PERIODS

TEXT BOOKS

1. Grewal.B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publications, New Delhi, 2012.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India, 2011.

REFERENCES

1. Bali.N.P. and Manish Goyal, "A Text book of Engineering Mathematics", 8th Edition, Laxmi Publications Private Limited, 2011.
2. Ramana.B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2007.
3. Jain.R.K. and Iyengar.S.R.K., "Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House Private Limited, 2007.

15EC23C SEMICONDUCTOR PHYSICS L T P C

(Common to ECE & EEE) 3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: explain the basics of semiconductors.(K2)

CO 2: discuss the V - I characteristics of diode and apply the diode concept in rectifiers. (K2)

CO 3: compare the characteristics of various transistors.(K3)

CO 4: describe the operation and characteristics of different types of semiconductor devices (K2)

CO 5: express the properties and applications of the optical materials.(K2)

UNIT I SEMICONDUCTORS 9

Intrinsic semiconductor – carrier concentration – determination of bandgap energy - Extrinsic semiconductors – carrier concentration - Hall effect.

UNIT II PN JUNCTION DIODE AND ITS APPLICATIONS 9

Theory of PN junction diode - Energy Band Structure - Biasing of PN Junction - Forward bias and Reverse bias - current equation - Space charge and diffusion capacitances – effect of temperature and breakdown mechanism, Zener diode and its characteristics, Applications – Half wave and Full wave rectifiers, Shunt Regulator.

UNIT III TRANSISTORS 9

BJT: Construction and Operation of NPN and PNP Transistors - Study of CE, CB and CC configurations and comparison of their characteristics – Breakdown in Transistors.

FET: Construction and Operation of N-Channel JFET – Expression for Drain Current, Comparison of JFET and BJT. **MOSFET:** Structure and Operation of N MOS and P MOS in Enhancement and Depletion nodes – characteristics of N type MOSFET – Comparison of MOSFET with JFET

UNIT IV SPECIAL SEMICONDUCTOR DEVICES 9

SCR – UJT – DIAC and TRIAC –Tunnel diode - PIN diode – Photodiode - Phototransistor – Varactor diode, LDR.

UNIT V OPTICAL MATERIALS 9

Optical properties of metals, insulators and semiconductors - Liquid Crystal Display – LED – Thermography - Solar cell.

L:45 TOTAL: 45 PERIODS

TEXT BOOKS

1. J. Millman and Halkins, Satyebranta Jit, “Electronic Devices and Circuits”, 2nd Edition, Tata McGraw Hill, 2008.
2. David A. Bell, “Fundamentals of Electronic Devices and Circuits”, 5th Edition, Oxford University Press, 2009.
3. Charles Kittel, “Introduction to Solid State Physics”, 7th Edition, John Wiley and Sons, Singapore, 2007.

REFERENCES

1. Salivahanan.S, Suresh kumar.N and Vallavaraj.A, "Electronic Devices and Circuits", 2nd Edition, Tata McGraw Hill, 2011.
2. Robert T. Paynter, "Introductory Electronic Devices and Circuits", 7th Edition, Pearson Education, 2008.
3. Donald A.Neamen "Semiconductor Physics and Devices", 4th Edition, Tata McGraw Hill Publication, New Delhi, 2012.
4. Thomas L. Floyd and David M. Buchla, "Electronics Fundamentals: Circuits, Devices and Applications", 8th Edition, Pearson College Div, 2010.

15EC24C CIRCUIT ANALYSIS L T P C
3 2 0 4

COURSE OUTCOMES

Upon completion of this course, students will be able to

CO 1: analyze the circuits using various network theorems and graph theory (K1-K4)

CO2: compute the transient response of RL, RC and RLC circuits for AC and DC inputs. (K1-K3)

CO 3: determine the resonance condition for series and parallel circuits. (K1-K3)

UNIT I CIRCUIT ANALYSIS TECHNIQUES FOR DC CIRCUITS 15

Ohm's law, Kirchhoff's Laws – Resistors in Series and Parallel Circuits – Mesh current and Node voltage method of analysis – Voltage and Current Division – Source Transformation – Star – Delta and Delta – Star Conversion.

Network Theorems: Thevenin's Theorem, Superposition Theorem, Norton's Theorem, Maximum Power Transfer Theorem.

UNIT II CIRCUIT ANALYSIS TECHNIQUES FOR AC CIRCUITS 15

Voltage and Current Relation in Pure Resistor, Inductor, Capacitor, Mesh current and Node voltage method of analysis – Thevenin's Theorem, Superposition Theorem, Norton's Theorem, Maximum Power Transfer Theorem.

UNIT III RESONANT CIRCUITS 15

RL, RC and RLC Circuits – Series and Parallel Circuits – Impedance Diagram and Phasor Diagram – Parallel and Series Resonances – their Frequency Response – Quality Factor and Bandwidth – Self and Mutual Inductance.

UNIT IV TRANSIENT RESPONSE FOR CIRCUITS 15

Transient Response of RL, RC and RLC Circuits using Laplace Transform for DC input and AC with sinusoidal input.

UNIT V CIRCUIT ANALYSIS USING GRAPH THEORY AND TWO PORT NETWORKS 15

Tree and Co-Tree, Twigs and Links, Incidence Matrix, Properties of Incidence Matrix, Incidence matrix and KCL, Link Currents: Tie-Set Matrix, Cut-Set and Tree Branch

Voltages, Two-port Network, Open Circuit Impedance (Z) Parameters, Short Circuit Impedance (Y) Parameters.

L: 45 T:30 TOTAL: 75 PERIODS

TEXT BOOKS

1. A.Sudhakar, Shyammohan S. Palli, "Circuits and Networks-Analysis and Synthesis", 4th Edition, Tata McGraw Hill, 2010.
2. William H. Hayt, Jack, E.Kemmerly and Steven M. Durbin, "Engineering Circuit Analysis", 8th Edition, Tata McGraw Hill, 2012.

REFERENCES

1. Joseph A. Edminister, Mahmood, Nahvi, "Electric Circuits", Schaum's Series, 5th Edition, Tata McGraw Hill, 2010.
2. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", 5th Edition, McGraw Hill, 2012.
3. John Bird, "Electrical Circuit Theory and Technology", 5th Edition, Newnes Publication, 2014.

15EC25C	**C PROGRAMMING FOR ENGINEERS**	**L T P C**
	(Common to all B.E. / B.Tech. Degree Programmes)	**3 0 0 3**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: recognize the system fundamentals and the role of hardware components of the Computer. (K3)

CO 2: apply the basic concepts and solve simple problems by analyzing the logics of conditional statements and looping constructs. (K3)

CO 3: handle similar types of data using array and utilize their functionality. (K3)

CO 4: appreciate the call by value and call by reference features in functions. (K5)

CO 5: design programs involving their own derived data types, pointers, memory allocation concepts. (K4)

CO 6: handle the file contents with access permissions. (K3)

UNIT I COMPUTER FUNDAMENTALS 10

Introduction – Characteristics of Computers – Evolution of Computers – Computer Generations – Classification of Computers – Basic Computer organization – Number Systems – Problem Analysis – Algorithms – Flow charts – Computer Software – Types of Software.

UNIT II BASIC C PROGRAMMING 9

Overview of C Program – Constants, Variables and Data Types – Operators and Expressions – Managing Input and Output operations – Decision Making and Branching – Decision making and Looping.

UNIT III ARRAYS AND FUNCTIONS 9

Arrays: One dimensional arrays – Two dimensional arrays – Multi dimensional arrays. Character arrays and Strings: Declaring and initializing String Variables – Comparison of two strings – String handling functions. User defined Functions: Definition – Declaration – Function calls – Category of Functions – Recursion - Storage Classes.

UNIT IV STRUCTURES AND POINTERS 9

Structures and Unions: Definition – Declaration – Accessing structures – Initialization of structures – Arrays of structures – Arrays within Structure – Structures within Structures - Structures and functions - Unions. Pointers: Initialization – Pointers and arrays- Array of pointers – Pointers as function arguments – Pointers to functions – Pointers and Structure.

UNIT V FILES AND DYNAMIC MEMORY ALLOCATION 8

File management in C – Defining and opening a file – closing a file - Input and Output operations on file – Error handling during IO operations – Random access to files – Command line Arguments. Dynamic memory allocation: Allocating a block of memory - Allocating a multiple block of memory – Releasing the used space – Altering the size of a block.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Ashok.N.Kamthane, “Computer Programming”, Pearson Education, India, 2008.
2. E. Balagurusamy, “Programming in ANSI C”, 6th Edition Multicolor, 2013.

REFERENCES

1. Pradip Dey, Manas Ghosh, “Fundamentals of Computing and Programming in C”, 1st Edition, Oxford University Press, 2009
2. Stephen G.Kochan, “Programming in C”, 3rd Edition, Pearson Education, India, 2005.
3. Brian W.Kernighan and Dennis M.Ritchie, “The C Programming Language”, Pearson Education Inc., 2005.

15EC26C ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C

(Common to all B.E. / B.Tech. Degree Programmes) **3 0 0 3**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: explain the structure and function of ecosystem. (K2)
CO 2: recognize the values of biodiversity and natural resources and the ways to protect the biodiversity of his /her locality. (K2)
CO 3: explain the causes and effects of pollution. (K2)
CO 4: describe social issues related to the environment and the environment act. (K2)
CO 5: identify the nutrients in food and impact of metals on human health. (K2)

UNIT I ENVIRONMENT AND ECOSYSTEMS 9

Scope and importance of environment – need for public awareness – ecosystem – structure and function of an ecosystem – energy flow in the ecosystem – forest and aquatic ecosystems – Field study of simple ecosystems – pond and forest.

UNIT II BIODIVERSITY AND NATURAL RESOURCES 9

Biodiversity: genetic, species and ecosystem diversity – threats to biodiversity – endangered and endemic species in India – conservation of biodiversity; forest resources: use and over-exploitation – deforestation - dams and their effects on forests and tribal people – water resources: use and overutilization of surface and ground water – role of an individual in conservation of natural resources.

UNIT III ENVIRONMENTAL POLLUTION 9

Causes, effects and control measures of air pollution, water pollution, soil pollution, noise pollution and nuclear hazards – solid waste management – e-waste – toxic substances in e-waste – risks related to toxic substances – role of an individual in prevention of pollution.

UNIT IV SOCIAL ISSUES, HUMAN POPULATION AND ENVIRONMENTAL LAW 9

Water conservation – rain water harvesting – climate change – global warming, acid rain, ozone layer depletion – population growth – population explosion – family welfare programme; environment laws: the water (prevention and control pollution) act, 1974-the air (prevention and control of pollution) act, 1981-environmental (protection) act,1986-the wild life (protection) act 1972.

UNIT V FOOD AND HUMAN HEALTH 9

Carbohydrates, amino acids, proteins, lipids and vitamins in balanced diet food; disease caused by deficiency of carbohydrates, amino acids, proteins, lipids and vitamins - food adulteration - simple test for food adulterants; environmental toxicology: metals in environment- impacts of lead, arsenic, cadmium, mercury and chromium on human health.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Miller G. and Spoolman S, “Environmental Science”, 14th Edition, Brooks/Cole Publishing Co., 2012.
2. Maczulak A.E., “Environmental Engineering”, Facts on file Inc., 2009
3. Han D, “Concise Environmental Engineering”, PhD & Ventus Publishing ApS, 2012

REFERENCES

1. Weller K. “Environmental Science and Biological Engineering”, 1st Edition, WIT Press, 2015
2. Strange C. “Environmental Science and production” Nason Trest Publisher, 2010

15EC27C SEMICONDUCTOR PHYSICS AND ENVIRONMENTAL CHEMISTRY LABORATORY **L T P C 0 0 2 1**

(Common to ECE and EEE)

PART A – SEMICONDUCTOR PHYSICS LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: demonstrate the properties of optical materials. (K2, S3)

CO 2: analyze the characteristics of semiconducting materials and devices. (K3,S3)

CO 3: design the rectifier using PN diode (K3,S3)

LIST OF EXPERIMENTS

1. (a) Determination of wave length of Laser source.
   (b) Particle size determination using Diode Laser.
   (c) Determination of Numerical aperture and acceptance angle of an optical fiber.
2. Determination of Band Gap of a semiconductor material.
3. V-I Characteristics of PN junction diode/ Zener diode.
4. Transistor Characteristics of BJT (CB & CE) and FET.
5. V-I Characteristics of UJT/Photo diode/ Photo Transistor.
6. V- I Characteristics of SCR.
7. Characteristics of LED/LCD/LDR.
8. Half Wave and Full Wave Rectifiers.

P:15 TOTAL: 15 PERIODS

PART - B ENVIRONMENTAL CHEMISTRY LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: quantify the amount of acidity, alkalinity, DO and COD present in water sample (K5,S3)

CO 2: analyse the ions present in the soil (K4,S3)

CO 3: quantify the amount of chloride ion in water sample (K5,S3)

CO 4: identify the adulteration in food samples (K1,S3)

CO 5: estimate the amount of metal ions in water sample (K5,S3)

LIST OF EXPERIMENTS

1. Estimation of acidity of Water sample.
2. Estimation of alkalinity of Water sample.
3. Determination of Dissolved Oxygen (DO) in water sample (Winkler's method).
4. Determination of COD in water sample.
5. Soil Analysis: Determinaton of colour, pH, nitrate, phosphate, chloride and sulphate ions.
6. Soil analysis: Estimation of Na/K/Ca in soil.
7. Estimation of chloride ion in water sample by argentometric method.

8. Simple adulteration test in food samples.
9. Estimation of copper in water sample by EDTA method.
10. Estimation of nickel in water sample.

P:15 TOTAL: 15 PERIODS

- A minimum of FIVE experiments shall be offered.
- Laboratory classes on alternate weeks for Physics and Chemistry.

REFERENCES

1. Harris D.C. "Quantitative Chemical Analysis: International Edition", 8th Edition, W.H.Freeman, 2010
2. Mendham J. "Vogel's Quantitative Chemical Analysis", 6th Edition, Pearson Publisher, 2009.
3. Vogel A.I., "Vogel's Textbook of Quantitative Chemical Analysis", 5th Edition, Longman scientific & Technical, 1989.

15EC28C	**C PROGRAMMING LABORATORY**	**L T P C**
	(Common to all B.E. / B.Tech. Degree Programmes)	**0 0 2 1**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: solve the given problem using the syntactical structures of C language. (K3)
CO 2: develop, execute and document computerized solution for various logic based problems using the flow control features of C language. (K3)
CO 3: enhance the programming skills in C by discriminating constants, variables and arrays and the functionality. (K3)
CO 4: learn about the connection between function return values and variables. (K5)
CO 5: develop programs using string manipulation and file manipulation functions. (K3)

Simple programs

1. Solve problems such as temperature conversion, student grading, interest calculation.
2. Solving the roots of a quadratic equation
3. Designing a simple arithmetic calculator. (Use switch statement)
4. Given distance traveled by a vehicle as d = ut + 1/2at2, where 'u' and 'a' are the initial velocity and acceleration. Calculate the distance traveled for different time intervals

Programs using different control structures

5. Performing the following operations:
   a. Generate Pascal's triangle.
   b. Construct a Pyramid of numbers.
6. Generation of the first 'n' terms of the Fibonacci sequence and prime sequence.
7. Computing Sine series and Cosine series.
8. Finding the 2's complement of a binary number.

Programs using arrays

9. Performing the following operations:
    a. Matrix addition.
    b. Transpose of a matrix.
    c. Matrix multiplication by checking compatibility.

Programs using string manipulation

10. Performing the following operations to a string:
    a. To insert a sub-string into main string at a given position.
    b. To delete 'n' characters from a given position in a string.
    c. To replace a character of string either from beginning or ending or at a specified location.

Programs using functions

11. Performing the following operations: (Use recursive functions)
    a. To find the factorial of a given integer.
    b. To find the GCD (Greatest Common Divisor) of two given integers.
    c. To solve Towers of Hanoi problem.

Programs using files

12. Performing the Student Information Processing using Structures and File handling concepts.

P: 30 TOTAL: 30 PERIODS

15EC29C	**CIRCUITS AND DEVICES LABORATORY**	**L T P C**
		0 0 2 1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: analyze the circuits using various network theorems and laws. (K2-K4, S1)

CO 2: determine the parameters from the characteristics of semiconductor devices. (K1-K3, S2, S3)

CO3: analyze the given circuit under transient and steady state conditions. (K2-K4, S2)

CO4: demonstrate the applications of Semiconductor devices. (K2, K3, S2, S3)

LIST OF EXPERIMENTS

1. Verification of KVL & KCL
2. Verification of Thevenin's Theorem.
3. Verification of Norton's Theorem.
4. Verification of Superposition Theorem.
5. Verification of Maximum Power Transfer Theorem.
6. Transient response of RC circuit.
7. Frequency response of series resonance circuit.
8. Characteristics of MOSFET.
9. Application of Zener Diode – Shunt regulator.

P: 30 TOTAL: 30 PERIODS

15EC31C	TRANSFORMS AND COMPLEX INTEGRATION	L	T	P	C
		3	2	0	4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: perform Fourier series analysis of the functions. (K2)
CO2: compute the Fourier transforms of various functions. (K2)
CO3: calculate the Fourier series solution of Wave and Heat equations. (K3)
CO4: solve difference equations using Z-Transforms. (K3)
CO5: evaluate complex integration over contour. (K3)

UNIT I FOURIER SERIES **15**

Dirichlet's conditions – General Fourier series– Half range series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

UNIT II FOURIER TRANSFORMS **15**

Fourier Integral theorem (without proof) – Fourier transform pair – Fourier Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS **15**

Classification of second order partial differential equations – Fourier series solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (Insulated edges excluded).

UNIT IV Z – TRANSFORMS **15**

Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Formation of difference equations – Solutions of difference equations using Z-transform

UNIT V COMPLEX INTEGRATION **15**

Cauchy's integral theorem and Cauchy's integral formula (excluding proofs) – Taylor's and Laurent's expansions – Singular points – Residues – Residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals – Unit circle and semi-circular contour(excluding poles on boundaries).

L: 45 T:30 TOTAL: 75 PERIODS

TEXT BOOKS

1 Grewal.B.S. "Higher Engineering Mathematics", 42nd Edition, Khanna Publications, Delhi, 2012.
2 Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India, 2011.

REFERENCES

1 Bali.N.P. and Manish Goyal, "A Text book of Engineering Mathematics", 8th Edition, Laxmi Publications Private Limited, 2011.
2 Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2007.

3 Jain.R.K. and Iyengar.S.R.K., "Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House Private Limited, 2007.

15EC32C ELECTRONIC CIRCUITS - I

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1:Describe various types of biasing circuits for BJT & FET.(K1- K2)
CO 2: Analyze the BJT amplifier using h-parameter model. (K1- K4)
CO 3: Analyze the FET amplifier using small-signal model. (K1 - K4)
CO 4: Analyze the frequency response of BJT and FET amplifiers. (K1-K4)
CO 5: Analyze various rectifier circuits, voltage regulators and filter circuits. (K1 – K4)

UNIT I TRANSISTOR BIASING AND STABILITY ANALYSIS 9

BJT biasing – DC Load line and AC Load line, Quiescent point – Different Types of biasing circuits: Fixed Bias Circuit, Collector to base bias, Voltage divider bias (Self Bias) – Stability Factors – Bias compensation: Diode, Thermistor and Sensistor compensations – Biasing circuits for JFET and MOSFET.

UNIT II BJT AMPLIFIERS 9

Small signal analysis of a Transistor Amplifier Circuit using ***h***-Parameters – Analysis of CE, CC and CB amplifiers using simplified ***h***-parameter Model – Multistage amplifiers: Analysis of Darlington amplifier – Miller's Theorem – Bootstrap Technique – Analysis of cascode amplifier.

UNIT III FET AMPLIFIERS 9

Small signal analysis of JFET and MOSFET amplifiers in CS, CG and CD configurations – BiMOS Cascode amplifier.

UNIT IV FREQUENCY RESPONSE OF AMPLIFIERS 9

High frequency equivalent circuits of single stage CE (Hybrid - Π model) and MOSFET CS amplifier – Determination of short circuit current gain, cutoff frequency and bandwidth – Bandwidth calculation of multistage amplifiers – Amplifier rise time, sag and their relation to cutoff frequencies.

UNIT V RECTIFIERS AND POWER SUPPLIES 9

Classification of power supplies – Rectifiers: Half-wave, full-wave and bridge rectifiers with resistive load – Analysis of rectifiers without filter and with C, L, LC and CLC filters. Voltage multipliers – Voltage regulators: Zener diode shunt regulator, Transistorized series and shunt regulators – SMPS - Controlled rectifier using SCR.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Donald .A. Neamen, "Electronic Circuit Analysis and Design", 2nd Edition, Tata Mc Graw Hill, 2009.
2. Millman.J and Halkias .C, "Electronic Devices and Circuits", TMH, 2008.

REFERENCES

1. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", 10th Edition, Prentice Hall, 2009.
2. Thomas L. Floyd and David M. Buchla, "Electronics Fundamentals: Circuits, Devices and Applications", 8th Edition, Pearson College Div, 2010.
3. David A. Bell, "Fundamentals of Electronic Devices and Circuits", Oxford University Press, 2009.
4. S.Salivahanan, N. Suresh Kumar and A.Vallavaraj, "Electronic Devices and Circuits", 3rd Edition, TMH, 2012.

15EC33C	DIGITAL ELECTRONICS	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Recall the different number systems and demonstrate the simplification of Boolean expressions using Boolean algebra & Karnaugh Map method. (K1-K2)
CO 2: Analyze the combinational building blocks. (K1-K3)
CO 3: Analyze the working of sequential circuit elements. (K1-K3)
CO 4: Develop a state diagram and simplify the given sequential logic.(K1-K4)
CO 5: Summarize the different programmable logic devices & digital logic families. (K1-K3)

UNIT I NUMBER SYSTEM AND BASIC LOGIC 9

Number systems-Binary, Octal, Hexadecimal, Number base conversions, arithmetic with binary numbers, number representations: signed, unsigned, fixed point numbers, arithmetic operations with signed binary numbers, codes-BCD,Gray,Excess-3, ASCII codes, code conversions. Logic gates-Basic gates, Universal gates, EXOR,EXNOR gates, Boolean algebra, Boolean postulates and laws –De-Morgan's Theorem- Principle of Duality, Simplification using Boolean algebra, Canonical forms - sum of product and product of sum forms. Realization using NAND and NOR gates, Karnaugh map Minimization, Tabulation method.

UNIT II COMBINATIONAL CIRCUITS 9

Design of combinational circuits : adder, subtractor, Parallel adder/Subtractor-Carry look ahead adder- Magnitude Comparator, parity generator & checker, encoder, decoder, Multiplexer, Demultiplexer, code converters, Function realization using multiplexers and decoders

UNIT III SEQUENTIAL CIRCUITS 9

Latches, Edge triggered Flip flops SR, JK, T, D and Master slave – Characteristic table

and equation, Flip flop timing analysis, Application table, Synchronous counters, Design of synchronous counters, up/down counter, Modulo–n counter, Decade counters, Register, shift registers, Universal shift register, Ring counters.

UNIT IV DESIGN OF SEQUENTIAL CIRCUITS 9

Classification of sequential circuits: Moore and Mealy, Design of synchronous sequential circuits, state diagram, State table, State minimization, State assignment. Asynchronous sequential logic: Race conditions and Cycles – Hazards in combinational circuits – Hazard free realization.

UNIT V PROGRAMMABLE LOGIC DEVICE AND DIGITAL LOGIC FAMILIES 9

Memories: ROM, PROM, EEPROM, RAM, Programmable Logic Devices: Programmable Logic Array (PLA), Programmable Array Logic (PAL), Implementation of combinational logic using PROM, PLA and PAL, Digital logic families: TTL, ECL, CMOS and FinFET.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. M. Morris Mano, “Digital Design”, 4th Edition, Pearson Education, 2007
2. Thomas L. Floyd, “Digital Fundamentals”, 10th Edition, Pearson Education Inc, New Delhi, 2009.

REFERENCES

1. S.Salivahanan and S.Arivazhagan,”Digital Circuits and Design”,3rd Edition, Vikas Publishing House Pvt. Ltd, New Delhi, 2007
2. Charles H.Roth, Larry L. Kinney. “Fundamentals of Logic Design”, 7th Edition, Nelson Education Ltd., 2013, ISBN no. 0495471690, 9780495471691
3. Donald P.Leach and Albert Paul Malvino, “Digital Principles and Applications”, 7th Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2010.
4. Donald D.Givone,”Digital Principles and Design”, Tata Mc-Graw Hill Publishing company limited, New Delhi, 2003.

15EC34C SIGNALS AND SYSTEMS L T P C
3 2 0 4

COURSE OUTCOMES

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

CO1: Classify and analyze the types of signals, their responses and properties. (K1- K2)

CO2: Analyze the continuous time signals using Fourier series, Fourier transform and Laplace transform and also understand their properties (K1-K3)

CO3: Analyze the continuous time systems using Fourier transform and Laplace transform and to solve the frequency response of LTI-CT systems. (K1-K4)

CO4: Explore the sampling concepts and the effects of aliasing. (K1-K2)

CO5: Analyze the discrete time signals using Fourier transform and Z transform and to

understand their properties. (K1-K2)

CO6: Analyze the discrete time systems using Fourier transform and Z- transform in order to solve the frequency response of LTI-DT systems.(K1-K4)

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS 15

Continuous time signals (CT signals), Discrete time signals (DT signals), Step, Ramp, Pulse, Impulse, Exponential, Classification of CT and DT signals, periodic and aperiodic, random signals, CT systems and DT systems, Basic properties of systems, Linear Time Invariant systems and properties.

UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS 15

Fourier series analysis- trigonometric, cosine and Exponential Fourier series, Spectrum of CT signals, Fourier Transform properties, Fourier transform signal analysis, Laplace Transform properties, Laplace transform Signal Analysis.

UNIT III LINEAR TIME INVARIANT - CONTINUOUS TIME SYSTEMS 15

Differential equation, Block diagram representation, Impulse response, Convolution integral, frequency response, LTI systems analysis using Fourier and Laplace transforms, State space representation.

UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS 15

Sampling of CT signals and aliasing, DTFT properties, DTFT signal analysis, Z transform properties, Z transform signal analysis, Inverse Z transform.

UNIT V LINEAR TIME INVARIANT - DISCRETE TIME SYSTEMS 15

Difference equation, Block diagram representation, Impulse response, Convolution sum, LTI systems analysis using DTFT and Z-transforms, State space representation.

L: 45 T: 30 TOTAL: 75 PERIODS

TEXT BOOKS

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, “Signals and Systems”, Pearson Education,2007.
2. Edward W Kamen and Bonnie's Heck, “Fundamentals of Signals and Systems using MATLAB”, Pearson Education, 2007.

REFERENCES

1. Rodger E.Ziemer, William H.Tranter and D.Ronald Fannin, “Signals & Systems-continuous and discrete”, Pearson Education, 4th Edition, 2001.
2. Simon Haykin and Barry Van Veen, “Signals and Systems”, 2nd Edition, Willey Publication, 2010.
3. Hwei P. Hsu, “Signals and Systems- Schaum's Outline Series”, Tata McGraw Hill, 2nd Edition, 2010.
4. John Alan Stuller, “An Introduction to Signals and Systems”, Cengage Learning India Private Limited, 2008.

15EC35C	ELECTROMAGNETIC FIELDS	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

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

CO1: Apply vector calculus to analyze the behavior of static electric fields and calculate electric fields from stationary charge distribution. (K1-K2)

CO2: Calculate magnetic fields from stationary and dynamic charge and current Distributions. (K1-K2)

CO3: Analyze various geometries of conductors, charge distribution and current to determine the terminal behavior of capacitors and inductors. (K1-K2)

CO4: Develop Maxwell's equation from fundamental laws. (K1-K3)

CO5: Analyze the propagation of plane waves in various materials. (K1-K2)

UNIT I STATIC ELECTRIC FIELDS 12

Introduction to Co-ordinate System - Rectangular, Cylindrical and Spherical Co- ordinate System, Introduction to line, Surface and Volume Integrals, Definition of Curl, Divergence and Gradient, Meaning of Stokes theorem and Divergence theorem.

Coulomb's Law in Vector Form, Definition of Electric Field Intensity, Principle of Superposition, Electric Field due to discrete charges, Electric field due to continuous charge distribution, Electric Field due to charges distributed uniformly on an infinite and finite line, Electric Field on the axis of a uniformly charged circular disc, Electric Field due to an infinite uniformly charged sheet.

Electric Scalar Potential, Relationship between potential and electric field, Potential due to electrical dipole, Electric Flux Density, Gauss Law, Gauss Law application

UNIT II STATIC MAGNETIC FIELD 9

The Biot-Savart Law in vector form, Magnetic Field intensity due to a finite and infinite wire carrying a current I, Magnetic field intensity on the axis of a circular and rectangular loop carrying a current I, Ampere's circuital law. Magnetic flux density, Magnetic moment, Magnetic Vector Potential.

UNIT III ELECTRIC AND MAGNETIC FIELDS IN MATERIALS 8

Poisson's and Laplace's equation, Electric Polarization, Nature of dielectric materials, Definition of Capacitance, Capacitance of various geometries using Laplace's equation, Electrostatic energy and energy density, Boundary conditions for electric fields, Electric current, Current density, point form of ohm's law. Definition of Inductance, Inductance of loops and solenoids, Definition of mutual inductance, simple examples. Energy density in magnetic fields, magnetization and permeability, magnetic boundary conditions.

UNIT IV TIME VARYING ELECTRIC AND MAGNETIC FIELDS 8

Faraday's law, Maxwell's Second Equation in integral form from Faraday's Law, Equation expressed in point form. Displacement current, Ampere's circuital law in integral form, Modified form of Ampere's circuital law as Maxwell's first equation in integral form, Equation expressed in point form. Poynting Vector and the flow of power, Power flow in a co-axial cable.

UNIT V ELECTRO MAGNETIC WAVES **8**

Derivation of Wave Equation, Uniform Plane Waves, Wave equation in Phasor form, Plane waves in free space and in a homogenous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect, Wave polarization.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. W H.Hayt & J A Buck, "Engineering Electromagnetics", TATA McGraw-Hill, 7th Edition, 2007.
2. E.C. Jordan & K.G. Balmain, "Electromagnetic Waves and Radiating Systems", Pearson Education, 4th Edition,2006.

REFERENCES

1. Matthew N. O. Sadiku, "Elements of Electromagnetics", Oxford University Press, USA, 3rd Edition, 2010.
2. Jian-Ming Jin, "Theory and Computation of Electromagnetic Fields", Wiley-IEEE Press, 2010.
3. John.D.Kraus and Fleisch, "Electromagnetics with Applications", Tata McGraw-Hill, 5th Edition, 2010
4. David k. Cheng, "Field and Wave Electromagnetics", Pearson Education, 2009.

15EC36C C++ AND DATA STRUCTURES **L T P C**
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, students will be able to

CO1: Recognize and apply the basic constructs to write programs (K3, S4)
CO2: Realize and apply the object oriented constructs to solve real life problems (K3, S4)
CO3: Comprehend and apply the concepts of file handling, templates, exception handling and string handling solving problems (K3, S4)
CO4: Appreciate and implement the linear data structures. (K2, S4)
CO5: Identify the suitable non linear data structures to solve real life problems.(K4,S4)

UNIT I BASIC CONSTRUCTS 9

Basic concepts of object oriented programming – Benefits and applications of OOP - Tokens – Keywords – Identifiers - Data types - Storage classes - Reference variable - Operators in C++ – Expressions - Control structures, C++ classes and objects – inline function – Static data member and static member function - Friend function, Constructors and destructors

UNIT II OBJECT ORIENTED PROGRAMMING CONSTRUCTS 9

Operator overloading and type conversions, Inheritance: Extending classes – Virtual Base

Classes – Abstract Classes, Pointers – this pointer, Virtual functions – Pure Virtual Functions - Polymorphism

UNIT III ADVANCED FEATURES IN OBJECT ORIENTED PROGRAMMING 9

File handling, Templates: Class Templates – Function Templates - Exception handling: Basics – Mechanism, Manipulating Strings: Creating String Objects – Manipulating String Objects.

UNIT IV LINEAR DATA STRUCTURES 9

Lists, Stacks and Queues: Array and linked list implementation of List, Stack, Queue – Applications of List: Polynomial addition – Sparse Matrix – Applications of stack: Infix to Postfix – Evaluation of Expression – Function calls.

UNIT V NONLINEAR DATA STRUCTURES 9

Trees: Binary tree – Expression tree - Binary search tree - AVL tree - Graphs: Basic Terminologies, Representations - Topological sort – Dijskstra's shortest path Algorithm - Prim's and Kruskal's Algorithms.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. E.Balagurusamy, "Object Oriented Programming with C++", McGraw Hill Company Limited, 2007.
2. M.A.Weiss, "Data Structures and Algorithm Analysis in C++", 3rd Edition, Addison - Wesley, 2007.
3. V.Aho, J.E.Hopcroft, and J.D.Ullman, "Data Structures and Algorithms", 1st Edition, Pearson Education, Reprint 2003.

REFERENCES

1. Bjarne Stroustrup, "Programming: Principles and Practice Using C++", Addison Wesley, 2008.
2. R. F. Gilberg, B. A. Forouzan, "Data Structures", 2nd Edition, Thomson India Edition, 2005.

15EC37C DIGITAL ELECTRONICS LABORATORY

L	T	P	C
0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Design, Analyze and troubleshoot the combinational and sequential circuits using logic gates and digital IC's. (K1-K3)

CO 2: Design and simulate combinational circuits using verilog HDL.(K1-K3)

LIST OF EXPERIMENTS

1. Design and implementation of Adder and Subtractor using logic gates.

2. Design and implementation of code converters using logic gates
   i) Gray to binary code converter
   ii) Binary to gray code converter.
3. Perform 4 bit binary Addition/ subtraction and BCD addition using IC 7483.
4. Design and implementation of Multiplexer and De-multiplexer using logic gates and study of IC74150 and IC 74154.
5. Design and implementation of encoder and decoder using logic gates and study of IC7445 and IC74147.
6. Construction and verification of 4 bit ripple counter and Mod-10 / Mod-12 Ripple counters.
7. Implementation of SISO, SIPO, PISO and PIPO shift registers using Flip- flops.
8. Design and simulation of Adder, Subtractor, Multiplexer, Demultiplexer, 4 bit ripple counter, Mod-10 ripple counter and Shift registers using Verilog Hardware Description Language.
9. Design and simulation of 4 bit magnitude comparator, 16 bit odd/even partity checker/generator using Gate level modeling of Verilog Hardware Description Language.

P:30 TOTAL: 30 PERIODS

15EC38C	**C++ AND DATA STRUCTURES LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: implement basic concepts of OOP (K3, S2)
CO 2: solve real world problems using advanced concepts of OOP. (K3,S4)
CO 3: develop programs using dynamic memory allocation and linked list ADT. (K3, S2)
CO 4: apply Stack ADT and Queue ADT to solve problems. (K3, S4)
CO 5: implement various trees ADT. (K3, S2)

LIST OF EXPERIMENTS

1. a. Design simple C++ classes using static members, methods, default arguments and friend functions.
   b. Design matrix and vector classes with static allocation and use friend function to do matrix vector multiplication.
2. Implement Matrix class with dynamic memory allocation and necessary methods. Give proper constructor, destructor, copy constructor and overloading of assignment operator to copy a matrix into another variable.
3. Assume a bank maintain two kinds of accounts savings account and current

account. The savings account provides compound interest and withdrawal facilities but no cheque book facility. The current account provides compound interest and withdrawal facilities but no cheque book facility but no interest. Current account holders should also maintain a minimum balance and if the balance falls below this level, a service charge is imposed. Create a class account that stores customer name, account number and type of account. From this derive the classes cur_acct and sav_acct to make them more specific to their requirements. Design a C++ class for the above scenario.

i. Include necessary member functions in order to achieve the following tasks: Don't use constructors to initialize
   a. Accept deposit from a customer and update the balance
   b. Display the balance
   c. Compute and deposit interest
   d. Permit withdrawal and update the balance
   e. Check for the minimum balance, impose penalty, necessary and update the balance
ii. Use constructors to initialize members for the three classes account, cur_acct and sav_acct

4. Create a base class shape. Use this class to store two double type values that could be used to compute the area of figures. Derive two specific classes called triangle and rectangle from the base shape. The member function get_data() of the base class is used to initialize base class data members and another member function display_area() to compute and display the area of figures. Make display_area() as a virtual function and redefine this function in the derived classes to suit their requirements. Design a C++ program that will accept dimensions of a triangle or a rectangle interactively and display the area.
   Note: The two values given as input will be treated as lengths of two sides in the case of rectangles and as base and height in the case of triangles.

5. Design stack and queue classes with necessary exception handling
6. a. Create a list. While creating, the new nodes should be added in the front of the list by default.
      i. Delete the specified node
      ii. Find the specified node and return it's position
      iii. Display the list and the number of nodes after each operation

   b. Create a list with n nodes. Each node contains data and time tick information.
      i. Insert the node based on the sorted order of time tick.
      ii. Display the list in the reverse order and number of nodes in the list.
      ii. Delete the specified node from the list and display the resultant list.
7. Represent a polynomial as a linked list and write functions to add the following polynomial and display the resultant polynomial. 4X4+3X3+X+5, 3X3+2X2+X+3.
8. Using Stack ADT, write a program to convert infix expression into postfix expression which includes '(',')','+','-','*' and '/'.
9. Write a program to implement an expression tree. Produce its pre-order, in-order,

and post-order traversals.

10. Implement binary search tree and AVL Tree

P:30 TOTAL: 30 PERIODS

15EC39C	**ELECTRONIC CIRCUITS LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Analyze various biasing circuits (K1-K4)

CO 2: Design a small signal BJT amplifier.(K1-K5)

CO 3: Design a small signal MOSFET amplifier.(K1-K5)

CO 4: Design a DC power supply circuits. (K1-K5)

LIST OF EXPERIMENTS

1. Study of Biasing Circuits
   - Fixed Bias
   - Self Bias
2. Design and construction of BJT Common Emitter Amplifier.
   - Measurement input and output impedances
   - Plot the frequency response & Determination of Gain Bandwidth Product
3. Design and construction BJT Common Collector Amplifier.
   - Measurement of input and output impedances.
   - Plot the frequency response & Determination of Gain Bandwidth Product
4. Design and construction Darlington Amplifier using BJT
5. Design and construction of MOSFET Amplifier.
   - Measurement of input and output impedances.
   - Plot the frequency response & Determination of Gain Bandwidth Product
6. Power Supply circuit - Full wave rectifier with simple capacitor filter and Zener Voltage Regulator
   - Measurement of DC output voltage under different loading conditions.
   - Plot the Load regulation characteristics and calculate the Load regulation.

P:30 TOTAL: 30 PERIODS

15EC41C PROBABILITY AND RANDOM PROCESSES

L	T	P	C
3	2	0	4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Grasp basic probability concepts and standard distributions. (K2)
CO 2: Perform the ideas related to two dimensional random variables.(K2)
CO 3: Understand various Random processes. (K3)
CO 4: Evaluate spectral densities of functions. (K2)
CO 5: Acquire the knowledge of linear systems. (K3)

UNIT I RANDOM VARIABLES 15

Discrete and continuous random variables – Moments - Moment generating function and their properties. Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions.

UNIT II TWO DIMENSIONAL RANDOM VARIABLE 15

Joint distributions - Marginal and conditional distributions - Covariance - Correlation and Regression – Transformation of random variables.

UNIT III CLASSIFICATION OF RANDOM PROCESSES 15

Classification of Random Processes - First order, second order, strictly stationary, wide-sense stationary and ergodic processes – Markov process - Poisson and Normal processes.

UNIT IV CORRELATION AND SPECTRAL DENSITIES 15

Auto correlation - Cross correlation - Power spectral density – Cross spectral density - Properties – Wiener-Khintchine theorem (without proof) – Relationship between cross power spectrum and cross correlation function.

UNIT V LINEAR SYSTEMS WITH RANDOM INPUTS 15

Linear time invariant system - System transfer function – Linear systems with random inputs–Auto correlation and cross correlation functions of input and output – White noise.

L: 45 T:30 TOTAL: 75 PERIODS

TEXT BOOKS

1 Oliver C. Ibe, “Fundamentals of Applied Probability and Random processes”, Elsevier, First Indian Reprint, 2007.
2 Peebles Jr. P.Z., “Probability Random Variables and Random Signal Principles”, Fourth Edition, Tata McGraw-Hill Publishers, New Delhi, 2002.

REFERENCES

1. Miller.S.L and Childers, S.L, “Probability and Random Processes with applications to Signal Processing and Communications”, Elsevier Inc., First Indian Reprint 2007.

2. Hwei Hsu, “Schaum’s Outline of Theory and Problems of Probability, Random Variables and Random Processes”, Tata McGraw-Hill edition, New Delhi, 2004.
3. Yates and D.J. Goodman, “Probability and Stochastic Processes”, Second edition, John Wiley and Sons, 2005.

15EC42C ELECTRONIC CIRCUITS – II

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Analyze various large signal amplifiers.(K1-K4)
CO 2: Identify and compare the various negative feedback topologies.(K1-K3)
CO 3: Design a sinusoidal oscillator.(K1-K5)
CO 4: Analyze different types of tuned amplifiers.(K1-K4)
CO 5: Simulate various electronic circuits using PSPICE.(K1-K5)

UNIT I LARGE SIGNAL AMPLIFIERS 9

Classification of amplifiers - Class A power amplifier, second order harmonic and higher order harmonic distortion in Class A amplifier – Analysis of Class A transformer coupled, Class B push-pull and Class C power amplifiers. Complementary – symmetry (class B) push-pull amplifier, Class D amplifier, MOSFET power amplifier - thermal stability and heat sink.

UNIT II FEEDBACK AMPLIFIERS 9

Block diagram, Loop gain, Gain with feedback, Effects of negative feedback on Cut-off frequencies, distortion, noise, input impedance and output impedance, Four types of negative feedback connections, voltage series feedback, voltage shunt feedback, current series feedback and current shunt feedback, Method of identifying feedback topology and feedback factor. Analysis of negative feedback amplifier circuits.

UNIT III OSCILLATORS 9

Classification - Barkhausen Criterion - Mechanism for start of oscillation and stabilization of amplitude - General form of an Oscillator - Analysis of LC oscillators - Hartley, Colpitts, Clapp, Franklin, Armstrong, Tuned collector oscillators. RC oscillators - phase shift, Wien bridge, Twin-T Oscillators. Quartz Crystal Construction, Electrical equivalent circuit of Crystal, Miller and Pierce Crystal oscillators, frequency stability of oscillators.

UNIT IV TUNED AMPLIFIERS 9

small signal tuned amplifiers - Analysis of capacitor coupled single tuned amplifier, double tuned amplifier(quantitative only), effect of cascading single tuned and double tuned amplifiers on bandwidth, Stagger tuned amplifiers. Large signal tuned amplifiers - Class C tuned amplifier, Efficiency and applications of Class C tuned amplifier. Stability of tuned amplifiers - Neutralization, Hazeltine neutralization method.

UNIT V WAVE SHAPING CIRCUITS AND PSPICE 9

Wave shaping circuits:RC and RL Low pass and High pass Circuits, Clipper and clamper circuits, PSPICE: Introduction to PSPICE software, file types, netlist commands, Basic analysis of DC,AC Transients, Analog Behavioural Model (ABM): equations setup, If statement, voltage/current/frequency dependent sources, Advanced analysis: noise, Monte carlo, Worse-case spectral description of signals (FFT), measuring the total harmonic distortion (THD), circuit optimization using PSPICE optimizer software, Simulation of various electronics circuits using PSPICE.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1 Millman and Halkias. C., "Integrated Electronics", Tata McGraw-Hill, 2010 (Re-print).
2 Schilling and Belove, "Electronic Circuits", TMH, 3rd Edition, 2002.
3. S. Salivahanan, N. Suresh Kumar and A. Vallavaraj, "Electronic Devices and Circuits", 2nd Edition, TMH, 2007.

REFERENCES

1. Chenming Hu , "Modern Semiconductor Devices for Integrated Circuits", Prentice Hall, 2009.
2. Jimmie J.Cathey, "Schaum's Outline of Electronic Devices and Circuits", McGraw-Hill, 2nd Edition, 2002.
3. David A. Bell, "Solid State Pulse Circuits", Prentice Hall of India, 1992.
4. Tuinega p.w.spice, "A guide to circuit simulation and analysis & PSPICE", Prentice Hall of India, 3rd edition,1995.
5. P.Antognetti and G.Mssobrio,"Semiconductor Device modeling with SPICE", McGraw Hall,2010(Re-print)

15EC43C	DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	2	0	4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Correlate the relationship between DTFT, DFT and FFT and compute DFT.(K1-K2)
CO 2: Design analog and digital IIR filters and realize them. (K1-K6)
CO 3: Design digital FIR filters and realize them. (K1-K6)
CO 4: Analyze the finite word length effects in signal processing.(K1-K4)
CO 5: Explain the concepts of Multi rate signal processing. (K1-K5)

UNIT I DISCRETE FOURIER TRANSFORM 15

DFT and its properties, Relation between DTFT, DFT and FFT, DFT computations using Decimation in time and Decimation in frequency algorithms, Inverse DFT using FFT algorithms, Use of FFT in linear filtering, Sectionalized convolution-overlap add and save

procedure.

UNIT II INFINITE IMPULSE RESPONSE DIGITAL FILTERS 15

Review of design of analog Butterworth and Chebyshev Filters, Frequency transformation in analog domain - Design of IIR digital filters using impulse invariance technique - Design of digital filters using bilinear transform - pre warping - Realization using direct, cascade and parallel forms.

UNIT III FINITE IMPULSE RESPONSE DIGITAL FILTERS 15

Symmetric and Antisymmetric FIR filters - Linear phase FIR filters - Design using Hamming, Hanning, Blackman and Kaiser Windows - Frequency sampling method, Optimal FIR filter design – Realization of FIR filters - Transversal, Linear phase and Polyphase structures.

UNIT IV FINITE WORD LENGTH EFFECTS 15

Fixed point and floating point number representations - Comparison - Truncation and Rounding errors - Quantization noise - derivation for quantization noise power - coefficient quantization error - Product quantization error - Overflow error, Saturation arithmetic - Roundoff noise power - limit cycle oscillations due to product round off and overflow errors - signal scaling.

UNIT V MULTIRATE SIGNAL PROCESSING 15

Introduction to Multirate signal processing-Decimation-Interpolation-Polyphase implementation of FIR filters for interpolator and decimator -Multistage implementation of sampling rate conversion- Design of narrow band filters – Applications: Sub band coding, Quadrature Mirror filter.

L: 45 T: 30 TOTAL: 75 PERIODS

TEXT BOOKS

1. John G Proakis and Manolakis, “Digital Signal Processing Principles, Algorithms and Applications”, Pearson Education, 4th Edition, 2007.
2. S.Salivahanan, C. Gnanapriya, “Digital Signal Processing”, Tata McGraw-Hill, 2nd Edition, 2011.

REFERENCES

1. E.C. Ifeachor and B.W. Jervis, “Digital signal processing - A practical approach”, Pearson, 2nd Edition, 2002.
2. S.K. Mitra, “Digital Signal Processing- A Computer Based approach”, Tata McGraw-Hill, 4th Edition, 2010.
3. P. Ramesh Babu, “Digital Signal Processing”, Scitech Publications, 4th Edition, 2011.
4. Johny R. Johnson, “Introduction to Digital Signal Processing”, PHI, 2006.

15EC44C	COMMUNICATION SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Compare the performance of different schemes of generation and detection of amplitude modulated signals.(K1-K4)

CO2: Describe and determine the performance of different schemes of generation and detection of angle modulated signals.(K1-K2)

CO3: Characterize and analyze the influence of noise in analog modulated signals. (K1-K4)

CO4: Represent a signal geometrical and convert AWGN channel to vector channel. (K1-K3)

CO5: Justify the need for source coding techniques.(K1-K5)

UNIT I AMPLITUDE MODULATION CONCEPTS AND METHODS 12

Introduction to communication system, Need for modulation, Types of modulation, Amplitude modulation, Time domain and Frequency domain description, Power relations in AM wave, Generation of AM wave using Class-C amplifier, Square law modulator, Detection of AM waves, Square law detector, Envelope detector. DSB-SC, and SSB-SC-modulation, generation, detection. Comparison of AM techniques, Applications of different AM waves.

UNIT II ANGLE MODULATION CONCEPTS AND METHODS 8

Frequency Modulation, Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave, Narrow band FM, Wide band FM, Constant Average Power, Transmission band width of FM wave, Generation of FM Waves-Direct and Indirect method, Detection of FM waves, Balanced frequency discriminator, Foster seely discriminator, ratio detector, FM transmitter block diagram, Comparison of AM & FM.

UNIT III NOISE PERFORMANCE IN CW SYSTEM AND RECEIVER 9

Noise in DSBSC systems using coherent detection, Noise in AM system using envelope detection, Noise in FM system, FM threshold effect, Pre-emphasis and De-emphasis in FM, Comparison of performances.

Super heterodyne receiver, RF section and characteristics, Frequency changing and Tracking, Intermediate frequency, AGC, FM receiver, Comparison with AM receiver, amplitude limiting.

UNIT IV FUNDAMENTALS OF DIGITAL COMMUNICATION SYSTEM 7

Digital Communication Systems – Functional description, Channel classification, Performance Measure; Geometric representation of Signals, Gram Schmidt Orthogonalization Procedure, Bandwidth ,Mathematical Models of Communication Channel, Conversion of the Continuous AWGN channel into a vector channel.

UNIT V SOURCE CODING TECHNIQUES 9

Discrete Messages and Information Content, Concept of Amount of Information, Average information, Entropy, Information rate, Source coding to increase average information per bit, Shannon-Fano coding, Huffman coding, Shannon's Theorem, Channel Capacity, Bandwidth- S/N trade-off, Mutual information and channel capacity, rate distortion theory.

L:45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Simon Haykin , "Communication Systems", Wiley Publications, 5th Edition, 2009.
2. Herbert Taub & Donald L Schilling, "Principles of Communication Systems", 3rd Edition, Tata McGraw Hill, 2008.
3. Amitabha Bhattacharya, "Digital Communications", Tata McGraw Hill, 2006.

REFERENCES

1. B.P.Lathi and Zhi Ding, "Modern Digital and Analog Communication Systems", Oxford University Press, 4th Edition, 2009.
2. A. Bruce Carlson, "Communication Systems", McGraw-Hill, 5th Edition, 2009

15EC45C TRANSMISSION LINES AND WAVEGUIDES L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Illustrate distributed circuit analysis using lumped circuit analysis concepts. (K1-K2)

CO2: Determine the voltage and current distribution in general transmission line and derive its parameters. (K1-K2)

CO3: Analyze the transmission line at Radio Frequency and perform impedance matching using Smith chart. (K1-K2)

CO4: Discuss the basic principles associated with parallel plate waveguides with TM, TE, and TEM mode and derive cutoff frequency, guide wavelength, and velocities. (K1-K3)

CO5: Discuss the basic principles associated with Rectangular, cylindrical waveguides and cavity resonator. (K1-K3)

UNIT I LUMPED FILTERS 9

The neper - the decibel - Characteristic impedance of Symmetrical Networks – Current and voltage ratios - Propagation constant, Properties of Symmetrical Networks - Filter fundamentals – Low pass, High pass, band pass, band elimination filters and Constant K Filters - Behaviour of the Characteristic impedance- m derived sections - Filter circuit design - Filter performance - Crystal Filters.

UNIT II TRANSMISSION LINE PARAMETERS 9

A line of cascaded T sections - Transmission lines - General Solution, Physical Significance of the equations, the infinite line, wavelength, velocity, propagation, Distortion line, coaxial cable, Reflection on a line not terminated in Z_o, Reflection Coefficient, Open and short circuited lines, Insertion loss.

UNIT III THE LINE AT RADIO FREQUENCY 9

Parameters of open wire line and Coaxial cable at RF - Line constants for dissipation - voltages and currents on the dissipation less line - standing waves - nodes - standing wave ratio - input impedance of open and short circuited lines - power and impedance measurement on lines –λ/4 line, Impedance matching - single and double-stub matching, circle diagram, smith chart and its applications - Problem solving using Smith chart

UNIT IV GUIDED WAVES BETWEEN PARALLEL PLANES 9

Application of the restrictions to Maxwell's equations - transmission of TM, TE and TEM waves between Parallel planes - wave propagation - Velocities of the waves - characteristic impedance – Attenuators.

UNIT V WAVEGUIDES 9

Application of Maxwell's equations to the Rectangular waveguide – TM and TE waves in Rectangular waveguide - Cylindrical waveguide - The TEM wave in coaxial lines - Excitation of wave guides - Guide termination and resonant cavities.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. John D.Ryder, “Networks, lines and fields”, Prentice Hall of India, 2nd Edition, 2006.
2. E.C.Jordan, K.G. Balmain, “E.M.Waves & Radiating System”, Pearson Education, 2006.

REFERENCES

1. Joseph Edminister, “Schaum's Series, Electromagnetics”, TMH, 2007
2. G S N Raju, “Electromagnetic Field Theory and Transmission Lines”, Pearson Education, 2006

15EC46C	PROFESSIONAL ETHICS AND HUMAN VALUES	L	T	P	C
	(Common to all Programmes)	**3**	**0**	**0**	**3**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Recognize the core human values that shape the ethical behavior of an engineer. (K2)
CO2: Expose awareness on professional ethics. (K2)
CO3: Analyze the engineering ethical breach from past study. (K2)
CO4: Distinguish and apply safety, responsibility and rights in workplaces. (K2)

CO5: Discuss about the global issues with regard to ethics. (K2)

UNIT I HUMAN VALUES 9

Morals, Values and Ethics - Integrity - Work Ethics - Service Learning - Civic Virtue - Respect for Others - Living Peacefully - Caring - Sharing - Honesty - Courage - Valuing Time - Co-operation - Commitment - Empathy - Self-Confidence - Character – Spirituality.

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy - Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the three mile island and chernobyl case studies. Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination.

UNIT V GLOBAL ISSUES 9

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers - consulting engineers - engineers as expert witnesses and advisors - Moral leadership - sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers (IETE),India, etc.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, “Ethics in Engineering”, McGraw-Hill, New York 1996.
2. GovindarajanM, Natarajan S andSenthil Kumar VS, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2004.

REFERENCES

1. Charles D and Fleddermann, “Engineering Ethics”, Pearson Education / Prentice Hall, New Jersey, 2004 (Indian Reprint)
2. Charles E Harris, Michael S Protchard and Michael J Rabins, “Engineering Ethics - Concepts and Cases”, Wadsworth Thompson Learning, United States, 2000 (Indian Reprint now available)
3. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford 2001.

15EC47C	DIGITAL SIGNAL PROCESSING LABORATORY	L	T	P	C
		0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Design digital IIR and FIR filters (K1-K3)
CO2: Generate continuous-time and discrete-time signals (K1-K3)
CO3: Analyze signals and systems. (K1-K3)
CO4: Compute convolution and correlation of a signal (K1-K2)
CO5: Analyze sampling rate and its effects (K1-K3)

LIST OF EXPERIMENTS

1. Generation of Signals.
2. Convolution and correlation
3. LTI system response
4. Impulse, step and ramp response of system
5. Single-rate and multi-rate sampling and analysis of the effects of aliasing.
6. Design of IIR and FIR filters.
7. Waveform generation using TMS320C6x Processor.
8. Convolution using TMS320C6x Processor
9. DFT computation of a signal using TMS320C6x Processor
10. Analysis of LTI filter using GUI
11. Mini Project-Application and Design oriented experiments

P:30 TOTAL: 30 PERIODS

15EC48C	ELECTRONIC CIRCUITS AND SIMULATION LABORATORY	L	T	P	C
		0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Design a negative feedback amplifier using BJT. (K1-K5)
CO 2: Design audio frequency and radio frequency oscillators. (K1-K5)
CO 3: Design a power amplifier for the given specification. (K1-K5)
CO 4: Design wave shaping and multivibrator circuits and measure their performance through simulation and experimental methods. (K1-K5)

LIST OF EXPERIMENTS

1. Design and Construction of negative feedback amplifiers with and without feedback.

- To plot the frequency response.
- To determine the input and output impedance.

2. Design and construction of oscillator
   - RF oscillator for a desired frequency.
   - AF oscillator for a desired frequency.
3. Design and construction of wave shaping circuits.
   - Diode wave shaping circuits
   - RC wave shaping circuits
4. Design and construction of power amplifier and to determine its efficiency.
   - Class A
   - Class B
5. Simulation of circuits using PSPICE.
   - Non sinusoidal oscillator.
   - Wave shaping circuits.

P:30 TOTAL: 30 PERIODS

Practice session: Giving opinions and suggestions, analyzing a social issue.

15EC49C	**COMMUNICATION SKILLS LABORATORY**	**L T P C**
	(Common to all B.E. / B.Tech., Programmes)	**0 0 2 1**

COURSE OUTCOMES:

Upon completion of this course, the students will be able to

CO 1: interpret any passage after listening and interact at different situations fluently (K2, S3)

CO2: excel appropriately in competitive and professional contexts. (K3, S3)

CO3: acquire the sub-skills required for paper presentations and group discussions which will help them to excel in their workplace. (K3, S3)

Unit I

Lab session:

i) Listening to audio files :
   - Conversations
   - Speech
   - TED Talks

ii) Listening and responding to any audio files:
   - Drawing the map
   - Picture completing task
   - Transferring data to Graph.

Practice session: On the spot Speaking activities: Just a minute speech, Picture description.

Unit II

Lab session: Read and understand the comprehension passages given in competitive examinations.

Unit III

Lab session: Listening to audio files related to soft skills.

Practice session: Practicing Power point presentation, Group discussion and Interview skills.

P: 30 TOTAL: 30 PERIODS

REFERENCES

1. Rizvi.M.Ashraf, “Effective Technical Communication”, First Edition, The MC Graw Hill Education Private Limited, Companies, New Delhi, 2010.
2. Sangeetha Sharma and Binod Mishra, “Communication Skills for Engineers and scientists”, PHI Learning Private Limited, Delhi, 2009.

15EC51C	ADVANCED COMMUNICATION SYSTEMS	L	T	P	C
		3	2	0	4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Analyze and compare the SNR of different PCM techniques.(K1-K4)
CO 2: Design an encoder and decoder for error control.(K1-K3)
CO 3: Analyze the effect of noise in baseband reception techniques.(K1-K4)
CO 4: Evaluate the error performance of coherent and non coherent modulation techniques systems.(K1-K5)
CO 5: Evaluate the error performance of M-ary and spread spectrum modulation techniques.(K1-K5)

UNIT I PULSE CODE MODULATION TECHNIQUES 15

Sampling – sampling theorem, Aliasing, Impulse sampling, Natural Sampling, Sampler Implementation; Quantization – Uniform and Non-uniform; Encoding Techniques – Temporal waveform encoding -PCM, Bandwidth of PCM system, Noise in a PCM system, SNR of PCM system with quantization noise, Adaptive PCM, DPCM, SNR improvement in DPCM, Delta modulation, SNR of DM system, Adaptive Delta modulation.

UNIT II CHANNEL CODING TECHNIQUES AND LINE CODES 15

Error Control Codes - Block Codes ,Convolutional Codes, Concept of Error Free Communication; Classification of line codes, desirable characteristics and power spectra of line codes.

UNIT III BASEBAND RECEPTION TECHNIQUES 15

Noise in Communication Systems; Receiving Filter – Correlator type, Matched Filter type;

Equalizing Filter - Signal and system design for ISI elimination, Implementation, Eye Pattern analysis; Synchronization; Detector – Maximum Likelihood Detector, Error Probability, Figure-of-Merit for Digital Detection.

UNIT IV DIGITAL MODULATION AND DEMODULATION TECHNIQUES 15

Pass band Transmission model – Modulation schemes: BPSK, BFSK, QPSK - Power spectrum and bandwidth efficiency of modulation schemes.

Demodulation - Coherent demodulation: BPSK, BFSK, Non-Coherent demodulation: BFSK - Comparison of binary and Quaternary modulation schemes.

UNIT V M-ARY MODULATION AND SPREAD SPECTRUM MODULATION TECHNIQUES 15

M-ary PSK, M-ary QAM, M-ary FSK, Power spectrum and bandwidth efficiency of M-ary signals, comparison of M-ary digital modulation techniques.

Spread-Spectrum Modulation-Pseudo noise sequences, Direct Sequence spread coherent BPSK- signal space dimensionality and processing gain, probability of error, Frequency-Hop spread spectrum-Slow and fast frequency hopping, Applications.

L:45 T:30 TOTAL: 75 PERIODS

TEXT BOOKS

1. Amitabha Bhattacharya, “Digital Communications”, Tata McGraw Hill, 2006.

2. Simon Haykins, “Communication Systems”, John Wiley, 5th Edition, 2009.

REFERENCES

1. Simon Haykin, “Digital Communications”, John Wiley, 5th Edition, 2006.
2. John.G. Proakis, “Fundamentals of Communication Systems”, Pearson Education, 5th Edition, 2006.
3. Michael. B. Purrsley, “Introduction to Digital Communication”, Pearson Education, 2006.
4. Bernard Sklar, “Digital Communication, Pearson Education”, 2nd Edition, 2006.

15EC52C LINEAR INTEGRATED CIRCUITS L T P C

3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Describe the construction of OP-AMP IC and also DC, AC characteristics of OP-AMP.(K1-K2)

CO2: Design a circuit using OP-AMP for various applications such as Inverting, Non-inverting, Logarithmic and anti-logarithmic amplifiers, Precision rectifier, active filters etc. (K1-K2)

CO3: Describe the construction of analog multipliers, PLL and its application. (K1-K3)

CO4: Design digital to analog and Analog to Digital converters. (K1-K4).

CO5: Design a function generator for various waveforms using timer or OP amp ICs

and the different types of regulator such as fixed and adjustable low voltage regulator and high voltage regulator. (K1-K4)

UNIT I IC FABRICATION AND CIRCUIT CONFIGURATION FOR LINEAR ICs **9**

Advantages of IC over discrete components, Manufacturing process of monolithic IC, Construction of Monolithic Bipolar transistor, Monolithic diodes, Integrated Resistors, Monolithic Capacitors, Inductors. General operational amplifier stages, Current mirror and current sources, Current sources as active loads, BJT Differential amplifier with active loads, DC and AC performance characteristics, slew rate, Open and closed loop configurations.

UNIT II APPLICATIONS OF OPERATIONAL AMPLIFIERS **9**

Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, Adder, Subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, Peak detector, Clipper and Clamper, Low-pass, High-pass and Band-pass Butterworth filters, Sine-wave generators, Triangular wave generator, Saw-tooth wave generator, Astable and Monostable Multivibrators.

UNIT III ANALOG MULTIPLIER AND PHASE LOCKED LOOP **9**

Analog Multiplier using Emitter Coupled Transistor Pair, Gilbert Multiplier cell, Variable transconductance technique, Analog multiplier ICs and their applications, Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, PLL phase noise, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing.

UNIT IV ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS **9**

Analog and Digital Data Conversions, D/A converter, specifications, weighted resistor type, R-2R Ladder type, Voltage Mode and Current Mode R-2R Ladder types, Switches for D/A converters, High speed sample and hold circuits, A/D Converters, specifications, Flash type, Counter type, Servo tracking type, Successive Approximation type, Dual Slope type, A/D converter, Figure of merit, Static Parameters: DNL, INL. Dynamic Parameters: SNR, ENOB, SFDR, THD, IMD.

UNIT V TIMER, VOLTAGE REGULATORS AND FUNCTION GENERATOR ICs **9**

Timer IC 555 - Description and Functional Diagram, Monostable operation, Astable operation, IC Voltage regulators, Three terminal fixed and adjustable voltage regulators, IC 723 General purpose regulator, IC L8038 function generator - Description and Functional Diagram, SMPS.

L:45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Sergio Franco, “Design with operational amplifiers and analog integrated circuits”, 3rd Edition, Tata McGraw Hill, 2007.

2. D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Private Limited, 4th Edition, 2010.

REFERENCES

1. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis and Robert G. Meyer, "Analysis and Design of Analog Integrated Circuits", John Wiley & Sons Inc, 5th Edition, 2009.
2. S.Salivahanan & V.S.Kanchana Bhaskaran,"Linear Integrated Circuits", TMH, 1st Edition, 2008.
3. Ramakant A. Gayakwad, "Op-amps and Linear Integrated Circuits", Prentice Hall, 4th Edition 2000.

15EC53C	MICROPROCESSOR AND MICROCONTROLLER	L	T	P	C
		3	2	0	4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Design and implement programs using 8085 microprocessor.(K1-K3)
CO 2: Describe the concepts of Memory management and paging mechanism relevant to 80286/80386/80486 microprocessor. (K1)
CO 3: Analyze the working principles and special features of Pentium processor family. (K1-K3)
CO 4: Write assembly language programs for microcontroller. (K1-K3)
CO 5: Design and implement 8051 microcontroller based systems.(K1-K3)

UNIT I BASIC MICROPROCESSOR 15

Introduction to 8085 microprocessor architecture-Memory Interfacing-I/O Data transfer concepts-Addressing modes-Timing diagram-Interrupts system-DMA-Instruction set-Simple programming in 8085, Architecture of 8086.

UNIT II 16 BIT MICROPROCESSORS 15

Introduction to 80286 and 80386 – 80386 Special registers – Memory Management – Memory paging mechanism – 80486 microprocessor architecture.

UNIT III PENTIUM PROCESSORS 15

Introduction to Pentium microprocessor – Special pentium registers – Pentium Memory Management – Pentium pro Microprocessor – Pentium pro features – Pentium II Microprocessor – Pentium II software changes – Pentium III processor.

UNIT IV 8051 MICROCONTROLLER 15

Architecture of 8051 – Special Function Registers(SFRs) – Timer – Serial port - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

UNIT V 8085/8051 PERIPHERAL INTERFACING AND APPLICATIONS 15

Introduction - Generation of I/O Ports, Programmable Peripheral Interface (PPI)- Intel 8255, Programmable Keyboard and display IC (8279), Programmable Interval timer IC (Intel 8253), UART (8251), USB interface.

Applications: Traffic light control – Washing machine - Stepper motor control – Serial Port Programming.

L: 45 T: 30 TOTAL: 75 PERIODS

TEXT BOOKS

1. Ramesh S Gaonkar, "Microprocessor Architecture, Programming and application with 8085", Penram International Publishing, New Delhi, 5th Edition, 2002.
2. Mohammed Ali Mazidi and Janice Gillispie Mazidi, "The 8051 Microcontroller and Embedded Systems", Pearson Education, New Delhi, 2nd Edition, 2008.
3. Barry. B. Berry, "The INTEL Microprocessor 8086/8088,80186/80188, 80286, 80386, 80486, Pentium II, Pentium III, Pentium 4", Pentice Hall, 6th Edition, 2004.

REFERENCE

1. Doughlas V.Hall, "Microprocessors and Interfacing, Programming and Hardware", TMH, 2012

15EC54C ANTENNAS AND WAVE PROPAGATION L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Distinguish the properties and parameters of antenna such as radiation pattern, radiation impedance, directivity, antenna gain, effective area. (K1- K2)

CO2: Describe an antenna system with the radiating elements in an array given the radiation parameters such as radiation pattern, gain, operating frequency, (K1-K2)

CO 3: Design aperture and special antennas for the given specification. (K1-K3)

CO 4: Analyze and classify the antennas for wireless applications. (K1-K3)

CO 5: Identify the mechanism of the atmospheric effects on radio wave propagation. (K1-K2)

UNIT I PHYSICAL CONCEPT OF RADIATION 9

Basic properties of transmitting and receiving antenna, Antenna parameters: Radiation pattern, Directivity, Gain, Radiation resistance, Mutual impedance, Input impedance, Polarization, Bandwidth, Beamwidth, Effective aperture, Vector effective length, Antenna temperature. Reciprocity principle and its applications, Friss transmission formula.

Wire antennas: Short dipole, Radiation resistance and Directivity, Half wave Dipole, Monopole, Small loop antennas.

UNIT II THEORY OF ARRAY ANTENNAS 9

Antenna Arrays: Two-element Array, Linear Array and Pattern Multiplication, Uniform Array, Array with non-uniform Excitation - Binomial Array, log-periodic dipole arrays and

Yagi-uda arrays.

UNIT III APERTURE ANTENNAS AND SPECIAL ANTENNAS 9

Aperture Antennas: Babinet's Principle, Slot antenna, Horn Antenna, Pyramidal Horn Antenna, Reflector Antenna-Flat reflector, Corner Reflector, Common curved reflector shapes, Lens Antenna.

Special Antennas: Long wire, V and Rhombic Antenna, Helical Antenna- Axial mode helix, Normal mode helix, Biconical Antenna.

UNIT IV ANTENNA MEASUREMENTS AND ANTENNAS FOR MOBILE APPLICATIONS 9

Microstrip Patch Antenna-Planar-Coplanar, Basic Concepts of Smart Antennas-Beamforming- Fixed weight beamforming - Adaptive beamforming

Antenna Measurements: Radiation Pattern measurement, Gain and Directivity Measurements, Anechoic Chamber.

UNIT V RADIO WAVE PROPAGATION 9

Ground Wave Propagation - Free-space Propagation - Ground Reflection, Tropospheric Propagation- Ionospheric propagation - Structure of ionosphere, skip distance, Virtual height, Critical frequency, MUF, Electrical properties of ionosphere, Faraday rotation, Whistlers.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. John D Kraus, Ronald J Marhefka and Ahmad S Khan, "Antennas for all Applications", Tata McGraw-Hill Book Company, 4th Edition, 2010.
2. K.D Prasad, "Antennas and Wave Propagation", Satya Prakashan Publications, 2nd Edition, 2008.

REFERENCES

1. Constantine A. Balanis, "Antenna Theory: Analysis and Design", John Wiley, 3rd Edition, 2005.
2. C.Rowell, E.Y.Lam," Mobile Phone Antenna Design", IEEE Antenna & Propagation Magazine, Vol 54, No.4, Pages (14-34), 2012.
3. A.R.Harish, M.Sachidananda, "Antennas and Wave propagation", Oxford University Press, 1st Edition, 2007.

15EC55C	PROJECT MANAGEMENT AND FINANCE (Common to all Programmes)	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Explain the concept of operational and project management. (K2)

CO2: Define the scope of a project and develop the project plan. (K2)

CO3: Evaluate the technical, business and social environment related to the project. (K3)
CO4: Formulate and manage project team successfully. (K5)
CO5: Monitor and control projects using tools and techniques. (K3)

UNIT I BASIC CONCEPT 9

Concept and categories of project - Project development cycle - Concept, tools and techniques of project management - Logistics and supply chain management - Forms of project organizations.

UNIT II PROJECT FORMULATION 9

Project identification, formulation and preparation. Market and demand estimation - Market survey techniques - Demand forecasting. Materials management - Analysis of materials input, technology, production, plant capacity, location and site, civil works, charts, layouts and work schedule. Cost of project - Means of financing, estimates of cost - Financial projections.

UNIT III PROCESS OF PROJECT APPRAISAL 9

Technical, Economic, Financial, Legal and Social appraisal of the Industrial Projects. Problems due to rate of discount, wage-rate, exchange rates, treatment of taxes, social cost-benefits - treatment of risk and uncertainty - sensitivity analysis and probability approach - Single as well as multiple projects - Big data analytics - PLM and SLM.

UNIT IV PROJECT TEAM FORMULATION AND MAXIMIZING PARTICIPATION 9

Project Team frame works - Project Team cultures - Barriers and challenges - Selecting Team Members - Key skills of effective project leaders - Giving / receiving feedback from different members of the project.

UNIT V IMPLEMENTATION, MONITORING AND CONTROL OF PROJECTS 9

Project scheduling, network techniques for resource, cost budgeting and scheduling - project management teams and coordination - Monitoring and post implementation, evaluation of the project - ERP - Project financing.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Gobalakrishnan P and Ramamoorthy VE “Textbook of Project Management”, Macmillan Publications, 2014.
2. Maylor “Project Management”, 3rd Edition, Pearson, 2010.

REFERENCES

1. Gido, “Effective project management”, 3rd Edition, Cengage Learning, 2008.
2. Gray and Larson, “Project Management: The Managerial Process”, 3rd Edition, TMH, 2010.
3. Choudhury S, “Project Management”, 1st Edition, Tata Mc Graw Hill Publishing Co., 2007.

15EC56C CONTROL SYSTEMS ANALYSIS AND DESIGN

L	T	P	C
3	2	0	4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Develop the mathematical model and describe the transfer function of electrical and electronic systems using block diagrams and signal flow graph. (K1-K5)

CO 2: Analyze the time response and steady state error of the first order and the second order control systems.(K1-K4)

CO 3: Investigate the control systems using frequency domain plots.(K1-K4)

CO 4: Determine the stability of the control systems in time, frequency and spatial domain representations. (K1-K3)

CO 5: Derive the state space representation of the control system and determine its controllability and observability. (K1-K5)

UNIT I CONTROL SYSTEM MODELING 15

Control systems – Terminology and Basic Structure, Open loop and Closed loop systems, Differential equation, Transfer function, Mathematical Modeling of Electrical and Op-amp based Electronic systems, Block diagram reduction Techniques, Signal flow graph

UNIT II TIME RESPONSE ANALYSIS 15

Standard test signals, First order systems, Impulse and Step Response analysis of second order systems, Time domain specification, Steady state errors and error constants

UNIT III FREQUENCY RESPONSE ANALYSIS 15

Frequency response analysis, Bode plot, Polar plot, Nyquist plot, Frequency Domain specifications from the plots, Lead Lag Compensator design and analysis

UNIT IV STABILITY ANALYSIS 15

Routh-Hurwitz Criterion, Root Locus Technique- Construction of Root Locus, Stability Analysis, Nyquist Stability Criterion, Relative Stability

UNIT V STATE VARIABLE ANALYSIS 15

State space representation of Continuous Time systems, State equations, Transfer function from State Variable Representation, Solutions of the state equations, Concepts of Controllability and Observability, State space representation for Discrete time systems.

L:45 T:30; TOTAL: 75 PERIODS

TEXT BOOKS

1. Nagrath and M.Gopal, “Control System Engineering”, New Age International Publishers, 5th Edition, 2007.
2. M.Gopal, “Control System – Principles and Design”, Tata McGraw Hill, 2nd Edition, 2002.

REFERENCES

1. Charles L. Phillips and John Parr, “Feedback Control Systems”, Prentice Hall, 5th

Edition, 2010.
2. Farid Golnaraghi and Benjamin C. Kuo, "Automatic Control Systems", Wiley Publications, 9th Edition, 2009.
3. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Prentice Hall, 12th Edition, 2010.

15EC57C	ANALOG AND DIGITAL COMMUNICATION LABORATORY	L	T	P	C
		0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Design and Construct various analog and digital communication circuits using discrete components. (K1-K3)

CO2: Calculate the BER in various digital modulation techniques using MATLAB Simulink. (K1-K2)

CO3: Study and Determine the transmission line and antenna parameters. (K1-K2)

LIST OF EXPERIMENTS

1. Generation & detection of AM signal.
2. Generation & detection of FM Signal.
3. Construction of Pre-emphasis and De-emphasis Circuit.
4. Generation & study of Analog TDM at least for 4 channels.
5. Generation and study of Pulse Amplitude Modulation.
6. Generation & study of amplitude shift keying modulator and demodulator.
7. Generation & study of frequency shift keying modulator and demodulator.
8. Digital link simulation: error introduction & error estimation in a digital link using MATLAB (SIMULINK)/ communication simulation packages.
9. To draw & study Polar plots & polarization of Yagi-uda & dipole Antenna & calculate Antenna gain, Antenna beam width, Element current & Front to back ratio of antenna.
10. To study a transmission line attenuation & frequency characteristics

P:30 TOTAL: 30 PERIODS

15EC58C	LINEAR INTEGRATED CIRCUITS LABORATORY	L	T	P	C
		0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Design oscillators and amplifiers using operational amplifiers. (K1-K6)

CO2: Evaluate the performance of the filters designed using opamp. (K1-K5)

CO3: Analyze the performance of amplifiers, oscillators and multivibrators using PSPICE (K1-K4)

LIST OF EXPERIMENTS

1. Inverting, Non inverting amplifiers using IC741
2. Integrator and Differentiator using IC741
3. Clipper and Clamper using IC741
4. Differential and Instrumentation amplifiers using IC741
5. Active lowpass, Highpass and bandpass filters using IC741
6. Astable and Monostable multivibrators using Op-amp and NE555 Timer
7. RC phase shift and Wein bridge oscillators using op-amp.
8. Study of PLL 565 characteristics and its use as Frequency Multiplier.
9. Design of Analog to Digital Converter circuit for Ramp and Sine input.
10. Design of Digital to Analog Converter using DAC0808
11. Design of regulated DC power supply using IC 7805, LM317 and LM723
12. Simulation of Differential amplifier, Instrumentation amplifier, Active lowpass, Highpass, Bandpass, Astable and Monostable multivibrators, RC phase shift oscillator,and Wein bridge oscillators using PSPICE.

P:30 TOTAL:30 PERIODS

15EC59C	**MICROPROCESSOR AND MICROCONTROLLER LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Write Assembly Language programs to perform given task using 8085 / 8051 instruction set. (K1-K3).

CO 2: Interface Microprocessor / Microcontroller with various peripherals. (K1-K4)

CO 3: Demonstrate the operations of Timer, Interrupts and UART in 8051 microcontroller. (K1-K3).

LIST OF EXPERIMENTS

1. Programs for Arithmetic and Logical Operations using 8085 Microprocessor
2. Programs for Sorting and searching using 8085 Microprocessor
3. Interfacing of 8255 with 8085 Microprocessor
4. Interfacing of 8253 with 8085 Microprocessor
5. Interfacing of 8279 with 8085 Microprocessor
6. Programs for Arithmetic and Logical Operations using 8051 Microcontroller
7. Interfacing of ADC with 8051 Microcontroller
8. Interfacing of DAC with 8051 Microcontroller
9. Demonstration of Timer, Interrupts operations in 8051 Microcontroller
10. Serial Communication between Microcontroller kit and PC
11. Interfacing of Stepper motor with 8051 Microcontroller
12. Interfacing of Traffic Light Controller with 8051 Microcontroller
13. Interfacing of LED and LCD with 8051 Microcontroller

P:30 TOTAL: 30 PERIODS

15EC61C	VLSI TECHNOLOGY AND DESIGN	L	T	P	C
		3	2	0	4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Explain the basic CMOS circuits and the CMOS process technology. (K1-K2)
CO 2: Design Combinational and Sequential circuits. (K1-K3)
CO 3: Estimate the delay, power dissipation of CMOS circuits. (K1)
CO 4: Analyze the performance of data path circuits. (K1-K4)
CO 5: Model the digital system using Verilog HDL (K1-K3)

UNIT I CMOS TECHNOLOGY **15**

MOS Transistor Theory - Ideal I-V and C-V Characteristics of MOS Transistor, Non-ideal I-V Effects, DC Transfer Characteristics of CMOS Inverter, n well, twin tub and SOI CMOS processes, Lambda based design Rules, CMOS Process Enhancements, Technology-related CAD Issues, Manufacturing Issues.

UNIT II CLASSIFICATION OF ICs AND CMOS CIRCUIT CHARACTERIZATION **15**

SSI, MSI, LSI, VLSI definitions, ASIC classification - Full Custom ASICs, Standard-Cell Based ASICs, Gate-Array-Based ASICs, Channeled, Channelless, Structured Gate Array and Architecture of Generic FPGA. Delay Estimation, Logical Effort and Transistor Sizing, Power Dissipation, Interconnect, Reliability, Scaling.

UNIT III COMBINATIONAL AND SEQUENTIAL CIRCUIT DESIGN 15

Combinational Circuit Design: Circuit Families – Static CMOS, Ratioed Circuits, Dynamic CMOS Circuits, Pass-transistor logic Circuits, Low power Logic Design, Comparison of CMOS Circuit Families Sequential Circuit Design: Sequencing Static Circuits, design of Latches and Flip-Flops.

UNIT IV DESIGNING ARITHMETIC BUILDING BLOCKS 15

Data path circuits: Architecture for ripple carry adder, carry look ahead adder, high speed adder, accumulator, Multiplier, divider, Barrel shifter, speed and area tradeoff.

UNIT V SPECIFICATION USING VERILOG HDL 15

Design Methodologies – Modules – Instances – Test bench – Operators – Number Specification – Identifiers and Keywords – Data Types – Modules and Ports – Gate-Level Modeling - Dataflow Modeling – Behavioral Modeling: Structured Procedures, Procedural Assignments, Timing Controls, Conditional Statements, Multiway Branching, Loops, Sequential and Parallel Blocks. Structural gate level description of decoder, equality detector, comparator, priority encoder, half adder, full adder, Ripple carry adder, Behavioral modeling of 'n' bit comparator, D flip-flop, T flip-flop, Structural modeling of Asynchronous counter, shift register, PRBS.

L: 45 T: 30 TOTAL: 75 PERIODS

TEXT BOOKS

1. Weste and Harris, "CMOS VLSI DESIGN: A Circuit and Systems Perspective", 3rd Edition, Pearson Education, 2007. (4th Reprint)
2. Samir Palnitkar, "Verilog HDL, A Guide to Digital Design and Synthesis" 2nd Edition, Pearson Education, 2005.

REFERENCES

1. M.J.S Smith, "Application Specific integrated circuits", Pearson Education, 2008. (5th reprint)
2. Jan Rabaey, Anantha Chandrakasan, B.Nikolic, "Digital Integrated Circuits: A Design Perspective", PHI, 2nd Edition, 2003.
3. D.A. Pucknell & K.Eshraghian, "Basic VLSI Design", PHI, 3rd Edition, 2003.
4. Wayne Wolf, "Modern VLSI design", Pearson Education, 3rd Edition, 2007.
5. Uyemura J.P, "Introduction to VLSI circuits and systems", Wiley, 2002.

15EC62C COMPUTER COMMUNICATION NETWORKS

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Describe and Discuss the concepts of networks, types and architectures.(K1-K2)

CO 2: Identify error free transmission of data and analyze data collision with various protocols.(K1-K2)

CO 3: Apply various routing algorithms over a network to provide optima path.(K1-K3)

CO 4: Examine the addressing entities of a network with implementation of TCP, UDP Protocols. (K1-K4)

CO 5: Illustrate the real time applications of networks. (K1-K3)

UNIT I INTRODUCTION TO COMPUTER COMMUNICATION NETWORKS AND PHYSICAL LAYER **9**

Data Communications – Networks - Networks models – OSI model – Layers in OSI model – Addressing – Guided and Unguided Transmission media, Line Coding, Switching: Circuit switched networks – Datagram Networks – Virtual circuit networks.

UNIT II DATA LINK LAYER **10**

Data link control: Framing – Flow and error control –Protocols for Noiseless and Noisy Channels. **Error Detection**: Parity, LRC, VRC, CRC – HDLC. **Multiple access**: Random access – Controlled access. **Wired LANS**: IEEE standards – standard Ethernet – changes in the standard – Fast Ethernet – Gigabit Ethernet. **Wireless LANS**: IEEE 802.11: Architecture, MAC Sub layer, Addressing Mechanism–Bluetooth.

UNIT III NETWORK LAYER **9**

Logical addressing: IPv4, IPv6 addresses - Internet Protocol: Internetworking – IPv4, IPv6 – Address mapping – ARP, RARP, BOOTP, DHCP, ICMP, IGMP, Delivery - Forwarding - Routing protocols – DSDV, OSPF.

UNIT IV TRANSPORT LAYER **7**

Process-to-Process delivery - User Datagram Protocol (UDP) – Transmission Control Protocol (TCP)/ Internet Protocol (IP) Suite – Congestion Control – Quality of services (QoS) – Techniques to improve QoS.

UNIT V APPLICATION LAYER **10**

Domain Name System (DNS) – E-mail – FTP – WWW – HTTP –Network Security: Cryptography –Data Encryption Standard, RSA - Digital signature – Management of Public keys.

L:45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Behrouz A. Forouzan, “Data communication and Networking”, Tata McGraw-Hill, 4th Edition, 2007.

2. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", 4th Edition, Morgan Kauffmann Publishers Inc., 2007.

REFERENCES

1. Andrew S. Tanenbaum, "Computer Networks", Pearson Education, 5th Edition, 2010.
2. Wayne Tomasi, "Introduction to Data Communication and Networking", 1st Edition, Pearson Education, 2005.
3. James.F.Kurose and Keith W.Ross, "Computer Networking: A Top down Approach", 6th Edition, Pearson Education, 2012.
4. William Stallings, "Data and Computer Communication", 9th Edition, Pearson Education, 2010.

15EC63C	WIRELESS COMMUNICATION	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Illustrate the cellular concept and Identify the suitable Modulation techniques (K1-K2)
CO 2: Analyze the propagation models to predict the received signal strength. (K1-K3)
CO 3: Categorize the various types of fading. (K1)
CO 4: Comprehend the techniques to improve the signal quality. (K1-K3)
CO 5: Discuss the various wireless systems and standards.(K1-K3)

UNIT I INTRODUCTION TO WIRELESS COMMUNICATION SYSTEMS 9

Introduction, Frequency Reuse, Channel Assignment Strategies, Handoff Strategies, Interference and System Capacity, Trunking and Grade of Service, Improving Coverage & Capacity in Cellular Systems, Multiple Access in cellular System- TDMA- FDMA-CDMA SDMA.

Modulation Techniques: QPSK – MSK – GMSK – Direct Sequence Spread Spectrum Frequency Hopped Spread Spectrum

UNIT II MOBILE RADIO WAVE PROPAGATION - LARGE SCALE FADING 9

Radio wave Propagation – Transmit and receive Signal Models – Free Space pathloss – Ray Tracing – Empirical Path loss models – Simplified path loss model – Shadow fading – Combine path loss and Shadowing – Outage Probability underpath loss & shadowing – Cell coverage area.

UNIT III MOBILE RADIO WAVE PROPAGATION - SMALL SCALE FADING AND MULTIPATH 9

Small Scale Multipath Propagation – Impulse response model of a Multipath Channel – Small Scale Multipath Measurements – Parameters of Mobile Multipath Channels – Types of fading (fading effects due to Multipath Time Delay Spread &Doppler spread) – Rayleigh

and Ricean Distribution.

UNIT IV CAPACITY, DIVERSITY AND EQUALIZATION IN WIRELESS SYSTEM **9**

Capacity in AWGN – Capacity of Flat Fading Channels – Channel and System Model Channel Distribution Information known – CSI at Receiver. Diversity Technique – Selection combining – Equal Gain Combining – Maximum Ratio Combining – Feedback – Time –Frequency – Rake Receiver – Interleaving. Equalization – Linear Equalization – Non linear (DFE & MLSE) – Algorithm of Adaptive Equalization – Zero Frequency algorithm – LMS algorithm – Recursive Least Square algorithm.

UNIT V WIRELESS SYSTEMS AND STANDARDS **9**

GSM System – Services and features – Architecture – Radio Subsystem – GSM Call – Frame Structure –Signal Processing. CDMA Digital Cellular Standard (IS-95) – Frequency &Channel Specification – Forward CDMA channel – Reverse CDMA channel. Introduction to OFDM system – Cyclic prefix – Matrix representation, Case study: IEEE 802.11a wireless LAN.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Rappaport T.S, “Wireless Communications: Principles and Practice”, Pearson education, 2nd Edition, 2009.
2. William Stallings, “Wireless Communication & Networking”, Pearson Education Asia, 2009.
3. Schiller, “Mobile Communication”, Pearson Education Asia Ltd, 2008.

REFERENCES

1. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press, Aug 2005.
2. Lee W.C.Y., “Mobile Communications Engineering: Theory & Applications”, McGraw Hill, New York 2nd Edition, 1998

15EC64C RF AND MICROWAVE ENGINEERING **L T P C**
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Distinguish different properties of S parameters for two port and N- Port networks. (K1-K3)
CO2: Analyze the design considerations of RF amplifier. (K1-K2)
CO3: Examine the S parameters for different types of Microwave components. (K1-K3)
CO4:Compare different types of Microwave semiconductor devices & its applications. (K1- K2)
CO5: Discuss the operation of various microwave oscillators and amplifires and discuss different microwave measurement techniques. (K1)

UNIT I TWO PORT RF NETWORKS-CIRCUIT REPRESENTATION 9

Low frequency parameters- impedance, admittance, hybrid and ABCD. High frequency parameters-Formulation of S parameters, properties of S parameters-Reciprocal and lossless networks, transmission matrix, Scattering matrix -Concept of N port scattering matrix representation-Properties of S matrix- S matrix formulation of two-port junction. Introduction to component basics - wire, resistor, capacitor and inductor - applications of RF.

UNIT II RF TRANSISTOR AMPLIFIER DESIGN 9

Amplifier power relation, stability considerations, gain considerations, noise figure, Parametric devices -Principles of operation - applications of parametric amplifier.

UNIT III MICROWAVE PASSIVE COMPONENTS 9

Microwave frequency range, significance of microwave frequency range -. Microwave junctions - Tee junctions- E plane tee- H plane Tee-Magic Tee - Rat race - Corners – bends and twists, Directional couplers -two hole directional couplers- Ferrites -Gyrator-Isolator Circulator - Attenuator - Phase changer.

UNIT IV MICROWAVE SEMICONDUCTOR DEVICES 9

Microwave semiconductor devices- operation - characteristics and application of BJTs and FETs- MESFET, HEMT -Principles of tunnel diodes , Varactor and Step recovery diodes, Transferred Electron Devices -Gunn diode- Avalanche Transit time devices- IMPATT and TRAPATT devices.

UNIT V MICROWAVE TUBES AND MEASUREMENTS 9

Microwave tubes- High frequency limitations – Principle of operation of two cavity and four cavity Klystron, Reflex Klystron, Traveling Wave Tube and Magnetron. Microwave measurements -power, wavelength, impedance, SWR, attenuation, Q factor and Phase shift.

L:45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Samuel Y Liao, “Microwave Devices & Circuits”, Pearson Education, 3rd Edition, 2003.
2. M.M.Radmanesh, “RF & Microwave Electronics Illustrated”, Pearson Education, 2007.

REFERENCES

1. Annapurna Das and Sisir K Das, “Microwave Engineering”, Tata McGraw Hill, 18th Reprint, 2004.
2. Reinhold.Ludwig and Pavel Bretshko, “RF Circuit Design”, Pearson Education, 2006.
3. Robert E.Colin, “Foundations for Microwave Engineering”, McGraw Hill, 2nd Edition, 2001.
4. David.M.Pozar, “Microwave Engineering.”, John Wiley & sons, 4th Edition, 2011.

15EC65C	RF AND MICROWAVE ENGINEERING LABORATORY	L	T	P	C
		0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Analyze the transmission line and waveguide structures and apply those structures in impedance matching and filter circuits. (K1)

CO 2: Discuss the microwave analysis methods. (K1)

CO 3: Apply analysis methods to determine RF characterization of passive/active microwave devices. (K1-K3)

CO4: Develop and analyze the performance of microwave devices and antennas using Computer Aided Design (CAD) tool. (K1-K3)

LIST OF EXPERIMENTS

1. Determination of Mode Characteristic of Reflex Klystron Oscillator
2. Gunn diode characteristics
3. S-Matrix characterization of Microwave Tees
4. Directional coupler – Directivity and Coupling factor – S – Parameters Measurement
5. Circulator – S – Parameter Measurement
6. Characteristics of Planar Transmission Lines
7. Design and Simulation of Single stub tuning
8. Design and Simulation of Microwave Low Pass Filters
9. Design and Simulation of Microwave Band Pass Filters
10. Design and Simulation of Branch Line Coupler
11. Design and Simulation of Patch Antenna
12. VSWR, Frequency and Wave Length Measurement using slotted section with tunable probe
13. Gain and Radiation Pattern Measurement of antennas

P:30 TOTAL: 30 PERIODS

15EC66C	VLSI DESIGN LABORATORY	L	T	P	C
		0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Write HDL code for given circuit specifications. (K1-K3)

CO2: Perform synthesis, Place and Route and implementation of digital Circuits in FPGAs. (K1-K3)

CO3: Design ICs for given specifications and implement it using CAD tools. (K1-K3)

LIST OF EXPERIMENTS

FPGA Based Experiments

1. Design entry and simulation of combinational logic circuits(8 bit adder, 4 bit

multiplier ,address decoders, multiplexers), test bench creation, functional verification, and concepts of concurrent and sequential execution to be highlighted

2. Design entry and simulation of counters, shift registers and state machines. Critical paths and static timing analysis to be identified.
3. Synthesis, Place and Route and Post Place and Route simulation of the components simulated in I and II.
4. Implementation of the digital circuits such as 8 bit adder, 4 bit multiplier, address decoder, multiplexer, counters and shift registers on FPGA.

IC Design Experiments
(Using Cadence /Microwind tool)

5. Design and simulation of a CMOS inverter. Perform layout simulation and parasitic extraction.
6. Layout generation, parasitic extraction and post layout simulation of the circuit designed in I and II.
7. Design of circuits using standard cell approach.

P:30 TOTAL: 30 PERIODS

15EC67C	COMPUTER COMMUNICATION NETWORKS LABORATORY	L	T	P	C
		0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Describe the fundamental concepts of computer networking and analyze the operations of various Error Detection algorithms. (K1-K2)

CO 2: Explain the role of protocols in network and transport Layer.(K1-K2)

CO 3: Exemplify the concepts of CIA and create network environment.(K1-K3)

LIST OF EXPERIMENTS

1. Topology orientation and building a small network
2. Analysis of logical link control layer protocols- Stop & wait, Sliding Window
3. Examining the protocols in the Network layer
4. Analysis of Network Data Traffic.
5. Observing TCP & UDP using Netstat and Wireshark.
6. Study and Configuration of Subnetting.
7. Implementation of Routing Protocols (RIP & OSPF).

8. Implementation of VLAN & NAT
9. Implementation of Data Encryption and Decryption
10. NS-2 based Simulation.

P:30 TOTAL: 30 PERIODS

15EC68C	PRODUCT DEVELOPMENT LABORATORY	L	T	P	C
		0	0	4	2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: understand the integration of customer requirements in product design.

CO 2: Apply structural approach to concept generation, selection and testing.

CO 3: Understand various aspects of design such as industrial design, design for manufacture.

The objective of this course is to make the students learn methodologies for identifying customer needs, developing new product concepts, prototype development, estimation of manufacturing costs, and developing business plans to support the development and marketing of these products. A student or a team of students shall develop their own products based on the users need, build simple prototypes of their design, and write development plans for the products.

P: 60 TOTAL: 60 PERIODS

15EC71C	MINI PROJECT	L	T	P	C
		0	0	8	4

MINI – PROJECTS (4 Credits)

A mini-project which is relevant to the branch of interest of the student or a simulation model developed by the student with the guidance of a faculty member.

An Evaluation committee formed by the HOD review the activities and the marks are awarded as follows:

- Report (40%),
- Presentation (30%) and
- Oral Examination (30%)

P:180 TOTAL:180 PERIODS

15EC72C	RESEARCH PAPER AND PATENT REVIEW – SEMINAR	L	T	P	C
		0	0	2	1

The Students will make a technical presentation on current topics related to the specialization. The same will be assessed by a committee appointed by the department. The students are expected to submit a report at the end of semester covering the various aspects of his/her presentation.

P:30 TOTAL:30 PERIODS

15EC73C	COMPREHENSION	L	T	P	C
		0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Plan and prepare for higher education.(K1-K3)

CO2: Illustrate the skills required for GATE like entrance exams.(K1-K4)

CO3: Demonstrate the comprehensive knowledge acquired by them in technical interviews. (K1- K4)

COURSE CONTENT AND LAYOUT

The students will select a particular group of subjects as mentioned below to review their competency level:

Group A

1. Circuit Theory
2. Signals and Systems
3. Control Systems
4. Analog and Digital Communication
5. Analog and Digital Circuits

Group B

6. Digital Circuits and Microprocessor
7. Computer Networks
8. VLSI Design
9. Data Structures and OOPS
10. Communication Skills

- The staff-coordinator per group is responsible for scheduling the session plans, monitoring the activities and recording the continual assessments.
- The technical seminars and group discussions will be assisted by subject experts in the department.
- Each student must participate in all the activities and their performance assessment must be recorded.

SUGGESTED ACTIVITIES

- Group Discussion
- Technical Seminars
- Test solving skills
- Mock GATE Examination
- Comprehensive Viva
- SIG activities

P:30 TOTAL: 30 PERIODS

REFERENCES

1. Dr.R.S.Aggarwal,"Quantitaive Aptitude for Compettitve Examinations", S Chand Publications, New Delhi, 20th edition (2013)
2. BARRON's GRE, Barron's Educational Series Inc.,U.S., 20th edition, 2013
3. Yashavant P. Kanetkar, "Let Us C", BPB Publications, 2011
4. E.Balagurusamy, "Object Oriented Programming with C++", McGraw Hill Company Ltd., 2007
5. Shakuntala Devi, "Puzzles To Puzzle To You" Orient Paperbacks, 1st Edition, 2001
6. www.indiabix.com

15EC81C	PROJECT WORK	L	T	P	C
		0	0	20	10

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Select a good project and able to work in a team leading to development of hardware / software product. (K1-K2)

CO2: Prepare a good technical report and able to present the ideas with clarity (K1-K2)

A Project topic must be selected either from published lists or the students themselves may propose suitable topics in consultation with their guides. The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.

The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report.

P: 300 TOTAL: 300 PERIODS

15EC01E FUNDAMENTALS OF DIGITAL IMAGE PROCESSING

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Describe the principles of image fundamentals and apply the mathematical knowledge to process the images. (K1-K2)

CO2: Apply different image enhancement techniques to gray scale and color images (K1-K3)

CO3: Choose the proper restoration techniques for a specific application. (K1-K3)

CO4: Analyze the segmentation methods for a specific application.(K1-K4)

CO5: Evaluate the compression ratio achieved for different techniques. (K1-K5)

UNIT I DIGITAL IMAGE FUNDAMENTALS 9

Elements of digital image processing systems, Elements of visual perception, brightness, contrast, hue, saturation, Mach band effect, Color image fundamentals - RGB, HSI models, Image sampling, Quantization, dither, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT, KLT, SVD.

UNIT II IMAGE ENHANCEMENT 9

Spatial filtering - Intensity Transformation- Histogram equalization and specification techniques, Noise distributions, Image Smoothing, Image sharpening, Median, Geometric mean, Harmonic mean - Contraharmonic mean filters - Homomorphic filtering - Color image enhancement.

UNIT III IMAGE RESTORATION 9

Image Restoration - degradation model, Inverse filtering- Wiener filtering, constrained least square filtering, Geometric transformations-spatial transformations.

UNIT IV IMAGE SEGMENTATION 9

Edge detection- Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and Merging – Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.

UNIT V IMAGE COMPRESSION 9

Need for data compression- Huffman, Run Length Encoding, Shift codes, Arithmetic coding, Vector Quantization, Transform coding, JPEG standard, MPEG.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Rafael C. Gonzalez, Richard E. Woods, “Digital Image Processing', Prentice Hall, 3rd Edition, 2009.
2. Anil K. Jain, “Fundamentals of Digital Image Processing”, Pearson Education, 2003.

REFERENCES

1. Kenneth R. Castleman, "Digital Image Processing", Pearson, 2006.
2. William K. Pratt, , "Digital Image Processing",John Wiley, New York, 4th Edition,2007
3. Milan Sonka et. al., "Image Processing, Analysis And Machine Vision", Brookes/Cole, Vikas Publishing House, 3rd edition, 2007

15EC02E	DIGITAL SIGNAL PROCESSORS	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Recognize the fundamentals of fixed and floating point architectures of various DSPs. (K1)

CO 2: Discuss the architecture details and instruction sets of fixed and floating point DSPs. (K2)

CO 3: Describe about the control instructions, interrupts, and pipeline operations. (K2)

CO 4: Illustrate and explore the FPGA based system design. (K2,K3)

CO 5: Analyze and learn to implement the signal processing algorithms in DSPs. (K3)

UNIT I COMPUTATIONAL ACCURACY IN DSP IMPLEMENTATIONS 9

Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter.

UNIT II ARCHITECTURES FOR PROGRAMMABLE DSP DEVICES

Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation unit, Programmability and Program Execution, Speed Issues, Features for External interfacing.

UNIT III PROGRAMMABLE DIGITAL SIGNAL PROCESSORS 9

Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX Processors, TMS320C54XX instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C54XX processors, Pipeline operation of TMS320C54XX Processors

UNIT IV ARCHITECTURE OF 'C6X PROCESSORS 9

Features of 'C6x Processors – Internal Architecture – General purpose register files – Functional units and its instructions – data paths – Fixed point instructions – Conditional operations – Parallel operation – Floating point instructions – Pipeline operations – Application Programs

UNIT V RECENT TRENDS IN DSP SYSTEM DESIGN 9

An overview of Open Multimedia Applications Platform(OMAP) – Evolution of FPGA based system design – Softcore Processors – FPGAs in Telecommunication Applications

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Venkataramani and M. Bhaskar, "Digital Signal Processors, Architecture, Programming and Applications", TMH, 2nd Edition, 2011.
2. S.Srinivasan&Avtar Singh, Digital Signal Processing, Implementations using DSP Microprocessors with Examples from TMS320C54X, Brooks/Cole, 2004

REFERENCES

1. K Padmanabhan, R. Vijayarajeswaran, Ananthi. S, "A Practical Approach to Digital Signal Processing", New Age International, 2nd edition 2013
2. Jonatham Stein, "Digital Signal Processing", John Wiley, 2005.
3. Lapsley,"DSP Processor Fundamentals, Architectures and Features", S.Chand & Co.,2000

15EC03E BIOSIGNAL PROCESSING L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Categorize and model the biomedical signals. (K1)
CO2: Analyze and process neurological signals. (K1-K3)
CO3: Develop a practical diagnosis system to analyze cardiological signals. (K1-K4)
CO4: Investigate optimal and adaptive filtering techniques for removing artifacts. (K1-K2)
CO5: Exploit the latest trends and their applications in biomedical signal processing. (K1- K3)

UNIT I INTRODUCTION TO BIOMEDICAL SIGNAL 9

Nature of Biomedical Signals, Typical Sources of Biomedical Signals, Biomedical Signal Analysis: Objectives and Difficulties-Computer Aided Diagnosis. Concurrent, Coupled and Correlated Processes: Illustration with case studies, Application-segmentation of PCG.

UNIT II NEUROLOGICAL SIGNAL PROCESSING 9

The Brain and its potentials, Electrophysiological origin of brain waves, EEG signal and its characteristics, EEG analysis, Linear prediction theory, AR Method for EEG, Recursive estimation of AR parameters, Spectral error measure, Adaptive segmentation, Transient detection and elimination, Overall Performance.

UNIT III CARDIOLOGICAL SIGNAL PROCESSING 9

Basic electrocardiography, ECG Data Acquisition, ECG lead systems, ECG parameters and their estimation, Use of multi scale analysis for parameter estimation, Arrhythmia analysis monitoring, Long-term continuous ECG recording.

UNIT IV FILTERING FOR REMOVAL OF ARTIFACTS 9

Time-domain Filters, Frequency-domain Filters, Optimal Filtering - Wiener Filter, Adaptive Filters for Removal of Interference, Selecting an Appropriate Filter, Application: Removal of Artifacts in the ECG, Maternal - Fetal ECG and Muscle-contraction Interference.

UNIT V BIOSIGNAL CLASSIFICATION AND DIAGNOSTIC DECISION 9

Diagnostic of bundle-branch block-Illustration, Pattern classification, Supervised and Unsupervised pattern classification, probabilistic models and statistical decision. Training test steps, Neural Networks and Applications.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. D.C. Reddy, “Biomedical Signal Processing Principles and Techniques”, Tata McGraw-Hill, 2nd reprint, 2006.
2. Rangaraj M. Rangayyan, “Biomedical Signal Analysis: A Case-Study Approach”, Wiley, 2002.

REFERENCES

1. Willis J Tompkins, “Bio Medical Digital Signal Processing”, Prentice Hall of India, New Delhi, 2003.
2. Eugene N. Bruce, “Biomedical Signal Processing and Signal Modeling”, John Wiley & Sons, 2001.
3. John L. Semmlow, “Biosignal And Biomedical Image processing Matlab Based Applications”, Marcel Dekker Inc., 2004.
4. Leif Sörnmo and Laguna, “Bioelectrical Signal Processing in Cardiac and Neurological Applications”, Elsevier, 1st Edition, 2005.
5. Metin Akay, “Biomedical Signal Processing”, Academic Press Inc., 1994.

15EC07E	RADAR AND NAVIGATIONAL AIDS	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Understand the fundamentals of Radars and its propagation. (K1)
CO2: Analyze the detection of signals in the presence of noise. (K1-K3)
CO3: Understand the concepts of Radar transmitter and receiver.(K1-K2)
CO4: Identifying various types of navigation system. (K1)

UNIT I RADAR EQUATIONS 9

Radar Block Diagram & operation - Radar Frequencies – The Radar Equation - Detection of Signals in Noise- Radar cross Section Fluctuations- Transmitter Power-Pulse Repetition Frequency- Antenna Parameters- System losses and propagation effects.

UNIT II MOVING TARGET INDICATOR AND PULSE DOPPLER RADAR 9

Introduction to Doppler and MTI Radar- Delay –Line Cancelers- Moving Target Detector – Limitations to MTI Performance - MTI from a Moving Platform (AMIT) - Pulse Doppler Radar –Non-Coherent MTI –CW conical Scan and sequential Lobing – Introduction of Synthetic Aperture Radar (SAR).

UNIT III RADAR SIGNAL DETECTION AND PROPAGATION ON WAVES 9

Detection Criteria – Detectors – Automatic Detector - Integrators – Constant False-Alarm Rate Receivers – Ambiguity Diagram– Pulse Compression– Introduction to Clutter– Surface clutter RADAR equation– anomalous propagation and diffraction – Radar Displays.

UNIT IV RADAR NAVIGATION 9

Adcock Direction Finders - Direction Finding at Very High Frequencies - Automatic Direction Finders - Decca Navigation System –Decca Receivers - Range and Accuracy of Decca -The Omega System - Tactical Air Navigation – Instrument landing System – Ground Controlled approach.

UNIT V RADAR TRANSMITTER AND RECEIVER 9

Beam Configurations -Doppler Frequency Equations - Track Stabilization - Doppler Spectrum - Components of the Doppler Navigation System - Doppler range Equation - Accuracy of Doppler Navigation Systems. Inertial Navigation - Principles of Operation - Navigation Over the Earth - Components of an Inertial Navigation System - Earth Coordinate Mechanization - Strapped-Down Systems - Accuracy of Inertial Navigation Systems. Satellite Navigation System - The Transit System - Navstar Global Positioning System (GPS) – RADAR Receiver – Receiver Noise Figure.

L:45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Merrill I. Skolnik, “Introduction to Radar Systems”, Tata McGraw-Hill, 3rd Edition, 2004.
2. Peyton Z. Peebles, “Radar principles”, John Wiley and Sons, 2009. (Reprint)
3. Mark A.Richards, James A. Scheer, William A.Holm, “Principles of Modern RADAR”, 2012. (Reprint)

REFERENCES

1. J.C Toomay, “Principles of Radar”, PHI, 3rd Edition, 2010.
2. Dr. AK Sen and Dr. AB Bhattacharya, “Radar Systems and Radio Aids to Navigation”, Khanna Publishers, 2010.
3. G.S.N.Raju, “Radar Engineering and fundamentals of navigational Aids”, I.K.International Publication, 2012

4. Byron Edpe, “Principles, Technology, Application of Radar”, Pearson Education, 2004.

15EC08E STATISTICAL THEORY OF COMMUNICATION

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Demonstrate the basic of classical detection and estimation theory. (K1-K3)

CO2: Estimate the signal parameters. (K1-K3)

CO3: Estimate continuous waveforms and Linear systems. (K1-K3)

UNIT I CLASSICAL DETECTION AND ESTIMATION THEORY **9**

Introduction – Simple binary hypothesis tests – M Hypothesis – Estimation theory – Composite hypothesis – General Gaussian problem – Performance bounds and approximations.

UNIT II REPRESENTATIONS OF RANDOM PROCESSES **9**

Deterministic functions: Orthogonal representations – Random process characterization – Homogeneous Integral equations and Eigen functions – Periodic processes – Infinite time interval: Spectral decomposition – Vector Random processes.

UNIT III DETECTION OF SIGNALS – ESTIMATION OF SIGNAL PARAMETERS **9**

Detection and Estimation in White Gaussian and Non-White Gaussian noise – Signals with unwanted parameters: The Composite hypothesis problem – Multiple channels – Multiple parameter estimation.

UNIT IV ESTIMATION OF CONTINUOUS WAVEFORMS **9**

Derivation of Estimator equations – A Lower bound on the mean square estimation error – Multidimensional waveform estimation – Non random waveform estimation.

UNIT V LINEAR ESTIMATION **9**

Properties of Optimum processors – Realizable Linear filters: Stationary processes, Infinite past: Wiener filters – Kalman-Bucy filters – Linear Modulation: Communications context - Fundamental role of the Optimum linear filter.

L:45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Harry L. Van Trees, “Detection, Estimation and Modulation theory”, Part I, John Wiley & Sons, NY, USA, 2nd Edition, 2013.
2. P. Eugene Xavier, “Statistical theory of Communication”, New Age International Ltd. Publishers, New Delhi, 2007.

REFERENCES

1. L. L. Scharf, “Statistical Signal Processing: Detection, Estimation, and Time Series Analysis”, Addison Wesley, 2012.
2. S. M. Kay, “Fundamentals of Statistical Signal Processing: Estimation Theory (Vol.-I), Detection Theory (Vol.-II)”, Prentice Hall, 1998.

15EC09E	MULTIMEDIA COMPRESSION AND COMMUNICATION	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Explain the characteristics of different multimedia components(K1,K2)
CO 2: Analyze the algorithms used for text and image compression.(K1-K4)
CO 3: Illustrate the different audio and video compression principles (K1-K3)
CO 4: Explain the basic concepts and the protocols of VoIP technology. (K1,K2)
CO 5: Illustrate the service requirements, protocols and mechanisms used for different multimedia applications. (K1-K3)

UNIT I MULTIMEDIA COMPONENTS 9

Introduction, Special features of multimedia, Multimedia components and their characteristics - Text, audio, images, graphics, animation, video.

UNIT II TEXT AND IMAGE COMPRESSION 9

Compression principles, text compression - static Huffman coding, dynamic Huffman coding, Arithmetic coding, Lempel Ziv-Welch Compression, Image compression – JPEG Standard, JPEG 2000 Standard, EZW, SPIHT.

UNIT III AUDIO AND VIDEO COMPRESSION 9

Audio compression - DPCM, Adaptive PCM, adaptive predictive coding, linear predictive coding, code excited LPC, perpetual coding. Video compression principles - H.261, H.263, MPEG 1, 2, 4.

UNIT IV VoIP TECHNOLOGY 9

Basics of IP transport, VoIP challenges, H.323 & SIP -Network Architecture – Protocols – Call establishment and release, VoIP and SS7, Quality of Service, CODEC Methods, VoIP applicability.

UNIT V MULTIMEDIA NETWORKING 9

Multimedia networking applications, Streaming stored audio and video, Making the best Effort service, Protocols for real time interactive Applications, Distributing multimedia, Beyond best effort service, Scheduling and policing mechanisms, Integrated services, Differentiated Services, RSVP.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Fred Halshall, “Multimedia communication - Applications, networks, protocols and standards”, Pearson Education, 1st Edition, 2011.
2. Khalid Sayood, “Introduction to Data Compression”, Morgan Kauffman, 4th Edition, 2012.

REFERENCES

1. Clint Smith, Daniel Collins, “3G Wireless Networks”, McGraw Hill, 2nd Edition, 2006.
2. Kurose and W.Ross, “Computer Networking - a Top down approach”, Pearson education, 6thEdition, 2012.
3. Ze-Nian Li, Mark S Drew, “Fundamentals of Multimedia”, Prentice Hall, 1st Edition, 2010.

15EC10E GLOBAL NAVIGATION SATELLITE SYSTEM

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Describe the working of GPS. (K1)
CO2: Discuss the satellite constellation, signal structure and errors in GPS. (K1-K3)
CO3: Illustrate the applications of GPS. (K1-K2)
CO4: Explain the principle of differential GPS. (K1-K2)
CO5: Compare different navigational satellite system.(K1-K4)

UNIT I OVERVIEW OF GPS **9**

Introduction to Global navigation satellite system, Kepler’s law and orbital dynamics, Satellite Orbital parameters, Orbital Perturbations, GPS observables, Basic Equations for finding user position, pseudorange measurement in receiver, user position determination from pseudoranges.

UNIT II GPS SATELLITE CONSTELLATION AND SIGNAL STRUCTURE **9**

GPS System segments - signals - signal generation – Signal characteristics – signal power levels, Determination of GPS satellite coordinates, GPS data formats: receiver independent exchange format (RINEX)

UNIT III DIFFERENTIAL GPS **9**

Basic concepts of DGPS, Local area DGPS, Extension of Range of Accurate DGPS, Real time and Post processing DGPS, Data link, RTCM format

UNIT IV GPS RECEIVERS AND ERRORS **9**

GPS receiver, Signal conditioning, Signal Acquisition, Carrier and code tracking, Converting tracking outputs to Navigation data, Subframe matching and Parity check, GNSS antennas, Weak signals and their Acquisition, GPS Error sources, Error correction models, Receiver noise, Ionospheric effects on GPS signals

UNIT V GLOBAL NAVIGATION SATELLITE SYSTEM 9

GLONASS components – Constellation details – Signal structure – Time and Co-ordinate systems, NAVSTAR GPS, GALILEO

L:45 TOTAL: 45 PERIODS

TEXT BOOKS

1. G S Rao, "Global Navigation Satellite Systems", McGraw-Hill publications, New Delhi, 2010.
2. B. Bhatta, "Global Navigation Satellite Systems", B.S publications, 2010

REFERENCES

1. B. Hoffman-Wellenhof, H. Liehtenegger and J. Collins, "GPS – Theory and Practice", Springer – Wien, New York, 2001.
2. James Ba – Yen Tsui, "Fundamentals of GPS receivers – A software approach", John Wiley & Sons, 2001.
3. Ahmed El-Rabbany, "Introduction to GPS: The Global Positioning System", 2nd Edition, 2006.
4. Gunter Seeber, "Satellite Geodesy", Walterde Gruyter Publisher, 2003.

15EC11E	**ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Understand EMI Sources and EMI problems. (K1)
CO2: Discuss the concepts of EMI coupling in cables and other equipments. (K1-K2)
CO3: Describe the mitigation techniques for EMI. (K1-K3)
CO4: Explain the standards and regulations for EMI/EMC. (K1-K4)
CO5: Discuss the various EMI test methods. (K1- K2)

UNIT I BASIC CONCEPTS 9

Definition of EMI and EMC, Intra and Inter system EMI, Sources and victims of EMI, Conducted and Radiated EMI emission and susceptibility, Transient & ESD, Case Histories, Radiation Hazards to humans.

UNIT II COUPLING MECHANISM 9

Common mode coupling, Differential mode coupling, Common impedance coupling, Ground loop coupling, Field to cable coupling, Cable to cable coupling, Power mains and Power supply coupling.

UNIT III EMI MITIGATION TECHNIQUES 9

Shielding - principle, choice of materials for H, E and free space fields, and thickness, EMI gaskets, Bonding, Grounding - circuits, system and cable grounding, Filtering, Transient EMI control devices and applications, PCB Zoning, Component selection, mounting, trace routing.

UNIT IV STANDARDS AND REGULATION 9

Units of EMI; National and International EMI Standardizing Organizations - IEC, ANSI, FCC, CISPR, British standard, EN Emission and Susceptibility standards and specifications; MIL461E Standards.

UNIT V EMI TEST METHODS AND INSTRUMENTATION 9

EMI test sites - Open area site, TEM cell, GTEM cell, Shielded chamber, Shielded Anechoic chamber, EMI test receivers, Spectrum Analyzer, Antennas and factors, Current probes and calibration factor; MIL-STD test methods, Civilian STD Test methods.

L:45 TOTAL: 45 PERIODS

TEXT BOOKS

1. V.P. Kodali, “Engineering EMC Principles, Measurements and Technologies”, IEEE Press, Newyork, 2001.
2. Henry W.Ott., “Noise Reduction Techniques in Electronic Systems”, A Wiley Inter Science Publications, John Wiley and Sons, Newyork, 1988.

REFERENCES

1. Don R.J.White Consultant Incorporate, “Handbook of EMI/EMC”, Vol I-V, 1988.
2. Bemhard Keiser, “Principles of Electromagnetic Compatibility”, 3rd Edition, Artech house, Norwood, 1987.
3. Henry Walter Ott, “Electromagnetic Compatibility Engineering”, Wiley, 1st Edition, 2009.
4. David Morgan, “ A Hand book for EMC Testing and Measurements”, IET, London.

15EC12E OPTICAL COMMUNICATION AND NETWORKS

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Analyze about light propagation through optical fiber.(K1-K4)
CO 2: Discuss about various losses and dispersion in optical fiber. (K1,K2)
CO 3: Describe about different optical sources and receivers.(K1,K2)
CO 4: Measure several fiber optic parameters.(K1-K4)
CO 5: Analyze different types of optical networks.(K1-K4)

UNIT I RAY THEORY IN FIBER OPTICS 9

Introduction**,** Ray theory transmission- Total internal reflection-Acceptance angle – Numerical aperture – Skew rays – Electromagnetic mode theory of optical propagation – EM waves – modes in Planar guide – phase and group velocity – cylindrical fibers – SM fibers.

UNIT II TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS 9

Attenuation – Material absorption losses in silica glass fibers – Linear and Nonlinear Scattering losses - Fiber Bend losses – Mid band and far band infra red transmission – Intra and Inter Modal Dispersion – Over all Fiber Dispersion – Polarization - Nonlinear effects –Overview - SPM,CPM,SBS,SRS.

UNIT III OPTICAL SOURCES AND RECEIVERS 9

Optical sources: Light Emitting Diodes - LED structures - surface and edge emitters, mono and hetero structures - quantum efficiency, injection laser diode - ILD structures - comparison of LED and ILD.

Optical Detectors: PIN Photo detectors, Avalanche photo diodes, construction, characteristics and properties, Comparison of performance - Fundamental receiver operation, Pre amplifiers, Error sources, Receiver Configuration.

UNIT IV FIBER OPTIC MEASUREMENTS AND DEVICES 9

Fiber Refractive index profile– Fiber alignment and Joint Losses – Fiber Splices – Fiber connectors – Expanded Beam Connectors – Fiber Couplers. Fiber cut- off Wavelength – Fiber Numerical Aperture– Fiber diameter, OTDR: OTDR Field application - OTDR Trace- OTDR Attenuation measurement - Fiber fault location.

UNIT V OPTICAL NETWORKS 9

Basic Networks – SONET / SDH – Broadcast and select WDM Networks –Wavelength Routed Networks – Performance of WDM - Solitons – Optical CDMA – Ultra High Capacity Networks.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1 John M. Senior, “Optical Fiber Communication”, Pearson Education, 2nd Edition, 2014.

2 Gerd Keiser, “Optical Fiber Communication”, Mc Graw Hill, 4th Edition, 2011.

REFERENCES

1. J.Gower, “Optical Communication System”, Prentice Hall of India, 2nd Edition. 2003.
2. Rajiv Ramaswami, “Optical Networks”, 3rd Edition, Elsevier, 2012.
3. Govind P. Agarwal, “Fiber-optic communication systems”, 3rd Edition, John Wiley & sons, 2004.
4. R.P. Khare, “Fiber Optics and Optoelectronics”, Oxford University Press, 1st Edition 2013.

15EC13E RF MEMS TECHNOLOGIES AND COMPONENTS L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Discuss the basics of micromachining / fabrication process used in MEMS (K1-K2)
CO2: Analyze the different MEMS Technologies (K1-K4)
CO3: Discuss the working principles of the state of art RF MEMS devices (K1-K2)
CO4: Evaluate the merits and drawbacks of an RF MEMS design (K1-K3)
CO5: Analyze the micromachined designs of reconfigurable antenna (K1- K4)
CO6: Design of an RF MEMS Devices or circuit with the help of CAD packages. (K1-K4)

UNIT I MICRO FABRICATION TECHNIQUES 9

Introduction to MEMS, Application areas of RF MEMS, Micromachining – Bulk and Surface, Microfabrication Techniques – Wafer Level Process – Substrate Selection, Wafer Cleaning, Oxidation, Doping, Thin-Film Deposition – PVD, CVD, Electro Deposition, Spin Casting, Pattern Transfer – Optical Lithography, Design Rules, Mask Making, Wet Etching – Isotropic, Anisotropic, Dry Etching – Vapor, Plasma-Assisted, DRIE, Additive Processes – Lift-Off process.

UNIT II RF MEMS SWITCHES AND CIRCUITS 9

Introduction, Switching Parameters, Types of RF MEMS switch, Actuation Mechanisms of MEMS Switches, Physical description, Circuit Model and Electromagnetic Modeling of RF MEMS switches.

UNIT III MEMS INDUCTORS AND CAPACITORS 9

MEMS Inductors, Micromachined Inductors – Meander, Spiral, Solenoid, Effect of Inductor layout, Modeling and design issues of planar inductors, Variable capacitors, Polymer based inductors, MEMS Capacitors, MEMS gap-tuning capacitors – Electrostatic, MEMS area-tuning capacitors, Dielectric tunable capacitors.

UNIT IV MEMS PHASE SHIFTERS AND FILTERS 9

Introduction, Types of phase shifters and limitations, MEMS phase shifters – Switched delay line, Reflection-type, DMTL, Micromechanical Filters – Electrostatic comb drive, Micromechanical filters using comb drives, Micromechanical filters using electrostatic coupled beam structures.

UNIT V MICROMACHINED ANTENNAS 9

Introduction, Overview of Microstrip antennas – Basic characteristics and Design parameters, Micromachining techniques to improve antenna performance, Reconfigurable antennas.

L:45 TOTAL:45 PERIODS

TEXT BOOKS

1. V.K. Varadan, K.J. Vinoy and K.A. Jose, “RF MEMS and their applications”, John Wiley & Sons Inc, 2002.

2. G.M. Rebeiz, “RF MEMS: Theory, Design and Technology”, John Wiley & Sons Inc., 2003.

REFERENCES

1. S. D. Senturia, “Microsystem Design”, Kluwer Academic Publishers, 2002.
2. S. Lucyszyn, “Advanced RF MEMS”, The Cambridge RF and Microwave Engineering series, 2010.
3. Hector J. De Los Santos, “RF MEMS circuit Design for Wireless Communications”, Artech House, 2002.

LAB EXPERIMENTS (Electrical Analysis)

1. Design of RF MEMS (Series and shunt) Switches
2. Design of RF MEMS capacitor, and Inductor
3. Design of RF MEMS filter and phase shifter

15EC14E	MICROWAVE THEORY AND TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Analyze the mathematical model and modes of RF and Microwave transmission line (K1-K4)

CO2: Analyze the networks of microwave components (K1-K4)

CO3: Apply the microwave design principles to develop the Cutting edge technological products. (K1-K5)

CO4: Describe the application based antenna system with measurements. (K1-K2)

CO5: Discuss the modern applications and impacts of Electromagnetic radiation with challenges.(K1-K2)

UNIT I RF AND MICROWAVE TRANSMISSION LINE 9

Introduction to Microwaves – History and Applications, Mathematical model of Microwave Transmission – Concept of mode, Characteristics of TEM, TE and TM modes, Losses associated with microwave transmission, Concept of impedance in microwave transmission, Analysis of RF and Microwave Transmission lines – Coaxial line, Rectangular waveguide, Circular waveguide, Microstrip line.

UNIT II MICROWAVE NETWORK ANALYSIS AND DEVICES 9

Equivalent voltages and currents for non-TEM lines, Network parameters for microwave circuits, Scattering Parameters, Microwave Passive Components – Power divider, Resonator, Microwave Active Components – Oscillators, Mixers.

UNIT III MICROWAVE DESIGN PRINCIPLES 9

Impedance transformation, Impedance matching, Microwave Filter design, RF and Microwave amplifier design, Microwave power amplifier design, Low noise amplifier design, Microwave Mixer and Oscillator design.

UNIT IV MICROWAVE ANTENNA AND MEASUREMENTS 9

Microwave antenna parameters, Microwave antenna – Ground based systems, Airborne based systems, Satellite borne systems, Microwave planar antenna. Measurements – Network Analyzer and Measurement of scattering parameters, Spectrum Analyzer and Measurement of spectrum of a microwave spectrum of a microwave signal.

UNIT V MICROWAVE SYSTEM AND MODERN TRENDS 9

Radar systems, Cellular phone, Satellite communication, RFID, GPS, Effect of Microwaves on human body, Medical and Civil applications of microwaves, EMI/EMC, MMIC, RF MEMS, Microwave Imaging.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. David M. Pozar, "Microwave Engineering", 3rd Edition, Wiley India.
2. S.Ramo, J.R.Whinnery and T.V.Duzer, "Fields and Waves in Communication Electronics", Third Edition, Wiley India.

REFERENCES

1. R.E.Collin, "Foundations for Microwave Engineering", 2nd Edition, IEEE Press.
2. Samuel Y Liao, “Microwave Devices and Circuits”, Pearson Education, 3rd Edition, 2003.
3. M. M. Radmanesh, “RF and Microwave Electronics illustrated”, Pearson Education, 2007.

15EC18E	ADVANCED MICROPROCESSORS	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Describe the background of ARM Cortex – M3.(K1-K2)

CO 2: Explain the essential knowledge for programming in Cortex- M3 (assembly directives, operands, data structures and instruction set). (K1-K2)

CO 3: Analyze the Instruction Set of CORTEX M3 (K1-K4)

CO4 : Write interrupts handling programs in CORTEX M3. (K1-K6)

CO 5: Develop assembly language source code with CORTEX M3 that allow modularity in programming (K1-K6)

UNIT I ARM CORTEX – M3 PROCESSOR 9

Overview of ARM Cortex-M3 Processor- Background of ARM and ARM Architecture-Architecture versions-ARM Nomenclature- Thumb and Jazelle Architecture- Cortex M3 Processor Applications- Registers- General Purpose Registers, Special purpose Registers-Operation Modes-Memory Map- Bus Interface-MPU-interrupts and Exceptions-Stack Memory Operations-Reset Sequence-Debugging Support.

UNIT II ASSEMBLY DIRECTIVES AND OPERANDS 9

Concept of the directive-Different directives: Directives for simple memory reservation, directive for memory reservation with initialization, directives for memory management, directive for project management, Special directive like CN, DCFSU,ENTRY,IMPORT,EXPORT-Operands of Instruction: Operands for Common instruction, immediate operand, memory access operands, initialization and use of operands, Addressing modes-Structure of program.

UNIT III ALGORITHMIC AND DATA STRUCTURES FOR CORTEX PROGRAMMING 9

Alternative Structures: Simple alternative, complete alternative, special case of alternative, multiple choice alternative-Iterative Structures: Repeat until loop, while do-loop, for loop-Compound condition: Alternative with AND, Iterative with AND, Alternative with OR, Iterative with OR-Data Structure: Table in one dimension, Tables in multiple dimensions, Registration, Non-dimensional table, Queue, stack- Cortex instruction set-Simple Assembly programming with CORTEX M3.

UNIT IV MANAGING EXCEPTIONS 9

Process after reset-possible exceptions: NMI, TRAPS like hard fault, memory management fault, bus fault, usage fault, SV Call trap, monitor, PENDSV service, Internal SYSTICK timer-Interrupts- Priority management: Priority levels and sublevels, nested mechanism- Entry and return in exception processing – NVIC registers for exception handling- Simple Assembly programming with CORTEX M3.

UNIT V INTERNAL MODULARITY AND EXTERNAL MODULARITY 9

Internal Modularity: Concepts of procedure-procedure arguments: Arguments by value and by reference, passing arguments by general registers, passing arguments by stack, passing arguments by system stack, local data & its reservation, chained list- Simple Assembly programming with CORTEX M3.

External Modularity: Different tools in ARM tool chain-Role of Assembler: Files produced by Assembler, placement counters, symbol table, translation, relocation table-Role of the linker: Functioning principle, product of the linker like map file and executable file image, scatter loading file-loader and debugging unit- Simple Assembly programming with CORTEX M3.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Vincent Mahout, “Assembly Language programming-ARM Cortex M3”, John Wiley & Sons, 2012

2. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", Elsevier, 2nd Edition, 2010

REFERENCES

1. Andrew N.Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide Designing and Optimizing System Software", Morgan Kaufmann, 1st Edition, 2004
2. Steave Furber, "ARM System-On-Chip Architecture", Addison Wesley, 2nd Edition, 2000
3. Daniel W. Lewis, "Fundamentals of Embedded Software with the ARM Cortex-M3", Prentice Hall, 1st Edition, 2012

15EC19E FUNDAMENTALS OF SEMICONDUCTOR CHIP TESTING

L	T	P	C
2	0	2	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Explain the need for IC testing. (K1-K2)
CO2: Explain various IC testing techniques. (K1-K2)
CO3: Calculate DC, AC parameters, Timing parameters from the testing.(K1)
CO4: Compare the various features of CAD tools used for IC testing. (K1)

UNIT I INTRODUCTION TO SEMICONDUCTOR IC TESTING 12

Design and manufacturing cycle of an IC – Manufacturing defects in an IC – Need for CHIP testing – Types of CHIP testing – Engineering testing, production testing, QA testing, Customer inspection testing. ATE – Automated Test Equipment and its components – digital subsystem analog subsystem – mixed signal subsystem – ATE subsystems – Test head, Main frame, Test computer, Manipulator. Common accessories of an ATE – Load boards, Probe cards.

UNIT II DIGITAL DOMAIN TESTING – CONCEPTS AND METHODS 12

Introduction to testing in digital domains – Functional Testing Basics – VIL/VIH, VOL/VOH, IIL, IIH, IOL, IOH – DC Parametric test, continuity test, leakage test, IDD static test, IDD dynamic test, Digital Functional Test – Pattern, Timing, Levels – IO Signals – Input Signal Generation, Output Signal Compare Test Vectors – BIST, MBIST, PBIST techniques. AC Parameters Test – AC Timing Tests – Setup Time, Hold Time, Propagation Delay, ATE Time Measurement subsystem.

UNIT III AUTOMATIC TEST EQUIPMENT ARCHITECTURE 12

Architecture of a mixed signal ATE – Digital subsystem, Pogo blocks, digitizers, Digital subsystem – Drivers, Comparators, PMU, Timing and formatting units, Sequence controller, Digital source memory, digital capture memory, ATE Pin Electronics.

UNIT IV TESTING OF SEMICONDUCTOR DEVICES 12

Project Plan, Specifications and Test Program. Test Plan Specifications – Design Test, Devices, Sample Test Program – Types, Considerations, Test Flow, Binning. Common Categories of Test for Semiconductor Devices – Continuity Test, leakage test, IDD test, AC tests, Specifications of Devices – Data Sheets.

UNIT V CAD TOOLS FOR TESTING 12

Debug Tools and data analysis, Characterization methods – Tools – Datalog, Histogram, Shmoo, pin margin, Pattern Debugger, Waveform Tool. Trouble Shooting Techniques – Statistical process control, process capability (CP), Process capability index (CPK), Standard deviation, mean, six sigma quality, gauge repeatability and reproducibility, guard banding, Gaussian statistics.

L:30; P:30; TOTAL: 60 PERIODS

TEXT BOOKS

1. Mark burns & Gordon W Roberts, “An Introduction to mixed signal IC testing and measurement”, Oxford University Press, 1st Edition, 2000.
2. Michael L. Bushnell & Vishwani D. Agrawal, “Essentials of electronic testing” Kluwer academic publishers, 2000.

REFERENCES

1. A Text book on semiconductor IC testing using Automatic Test Equipment, Tessolve Services – Private circulation manual.
2. William J. Greig, “Integrated Circuit Packaging, Assembly and Interconnections”, Springer, 2007.
3. Artur Balasinki, “Semiconductors: Integrated Circuit Design foe Manufacturability”, CRC Press, 1st Edition, 2011.

15EC20E	ARM PROCESSOR ARCHITECTURE AND PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Compare the different ARM processor families.(K1-K4)
CO 2: Explain different types of instructions used in ARM. (K1-K2)
CO 3: Develop ARM assembly programmes. (K1-K6)
CO 4: Distinguish exception and interrupts. (K1-K2)
CO 5: Design interfacing circuit with ARM processor (K1-K6)

UNIT I ARM PROCESSOR FUNDAMENTALS 9

Introduction to ARM Processors, ARM programmers model, ARM architecture Revisions, ARM Nomenclature, Functional block diagram of ARM Processor Families: ARM 9, ARM 11 and Cortex, Comparison of Cortex families.

UNIT II ARM INSTRUCTION SET 9

Data Processing Instructions, MOVE Instructions, Barrel Shifter Operations, Arithmetic Instructions, Logical Instructions, Comparison and Test Instructions, Multiply Instructions, Branch Instructions, Load – Store Instructions, Single Register Transfer, Single Register Load Store Addressing Modes, Multiple Register Transfer, Addressing Modes for Stack Operations, Swap Instruction, Software Interrupt Instruction, PSR, MRS and MSR Instructions.

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UNIT III ARM ASSEMBLY PROGRAMMING 9

Instruction Scheduling – Register Allocation – Conditional Execution – Looping Constructs – Bit manipulation – Efficient switches – Handling unaligned data-Simple ARM assembly program for calculating: Division, Square roots, Random Number Generation, Saturated and Rounded Arithmetic.

UNIT IV EXCEPTION AND INTERRUPT HANDLING 9

Definition: Exception, Interrupt, Interrupt handler, ARM Processor Exceptions and Modes-Exception Priorities - Link Register Offsets – Interrupts - Interrupt Latency - Vector table, Basic Interrupt Stack Design and Implementation - Nested Vector interrupt controller of Cortex M3 Processor.

UNIT V ARM INTERFACING APPLICATIONS 9

GSM Interfacing - ZigBee Interfacing - LCD Display Interfacing - Sensor Interfacing (Ultrasonic, Hall effect sensors) – Quadrature encoder interfacing.

L: 45 TOTAL: 45 PERIODS

TEXT BOOK

1. Steve Furber, “ARM System-on-chip architecture”, Pearson Education, 2nd Edition, 2005

REFERENCES

1. Andrew N. Sloss, Dominic Symes, Chris Wright, “ARM System Developer‘s Guide Designing and Optimizing System Software”, Morgan Kaufmann, 2004.
2. www.arm.com
3. Cortex M3: Technical Reference Manual(TRM)

15EC21E	EMBEDDED AND REAL TIME SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Explain the fundamental concept of design of embedded system.(K1)

CO2: Analyze the various platforms used for embedded computing and the performance of embedded systems design. (K1-K4)

CO3: Distinguish real time system and its characteristics. (K1-K2)

CO4: Summarize the basic properties of a real time operating system.(K1)

CO5: Describe the services of operating system.(K1)

UNIT I INTRODUCTION TO EMBEDDED COMPUTING 9

Definition: Embedded system, Intelligent system, Expert System – Embedded system - classification – Embedded system design process – Instruction sets Preliminaries – ARM Processor – CPU: Programming input and output – Supervisor mode, exception and traps. Embedded System design Example.

UNIT II COMPUTING PLATFORM AND DESIGN ANALYSIS 9

I/O devices – Component interfacing – Memory mapped I/O – I/O mapped I/O – Development and Debugging – Program design – Model of programs – Basic compilation techniques – Assembly and Linking, Analysis and optimization of execution time, power, energy, program size – Program validation and testing.

UNIT III REAL TIME SYSTEMS 9

Definition: Real time and real time systems – real time system Model - real time system characteristics – High reliability achievement ways in real time system - Hardware considerations for real time system – Examples for real time system .

UNIT IV PROCESS AND OPERATING SYSTEMS 9

Definition: Multi tasking and multi processing – Context Switching – Operating Systems Scheduling policies: Rate monotonic, EDF, Comparison example – Inter Process Communication mechanisms – Message Mailboxes – Message Queues – Evaluating operating system performance.

UNIT V TASK MANAGEMENT AND MEMORY MANAGEMENT WITH MICRO C II OS 9

Introduction to MICRO C OS II: Features, Services and variants.

Task Management: Task creation, task stacks, stack checking, task priority, task suspending, task deletion program example for Multitasking.

Memory management: Creating partition in memory, memory control block, obtaining and returning memory control block functions program example for memory management implementation.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Wayne Wolf, “Computers as Components - Principles of Embedded Computer System Design”, Morgan Kaufmann, 2nd Edition, 2008.
2. Philip A. Laplante “Real time systems design and analysis”, Wiley India Edition, 3rd Edition, 2006.

REFERENCES

1. Jean J. Labrosse, “Micro C/OS-II: The Real Time Kernal”, CMP Books, 2nd Edition 2002.
2. David E-Simon, “An Embedded Software Primer”, Pearson Education, 2007.
3. K.V.K.K.Prasad, “Embedded Real-Time Systems: Concepts, Design & Programming”, Dreamtech Press, 2005.
4. Tim Wilmshurst, “An Introduction to the Design of Small Scale Embedded

Systems", Pal grave Publisher, 2004.
5. Sriram V Iyer, Pankaj Gupta, "Embedded Real Time Systems Programming", Tata Mc-Graw Hill, 2004.
6. Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2006.

15EC25E MEDICAL ELECTRONICS

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Analyze the human functioning system and its instrumentations with respect to bioelectric potential and biochemical reactions (K1-K2)

CO 2: Define the quantities from diagnostic equipments and assist with Therapeutic equipments.(K1)

CO 3: Discuss and handle radiological and nuclear equipments for diagnosis. (K1)

CO 4: Explain the safety consequences in usage of recording instruments and avoiding electrical shock.(K1-K3)

CO 5: Explore the wireless communication technology for biotelemetry and telemedicine. (K1-K4)

UNIT I BIOPOTENTIAL AND BIO-CHEMICAL MEASUREMENTS 9

Sources of Bioelectric potentials, Electrode Theory, Biopotential Electrodes, Biochemical Transducers, Bioelectric amplifiers, Electrocardiograph – ECG waveform, standard lead systems and ECG Machine. Electroencephalograph. Blood Gas Analyzer - pH, pO2, pCO2 measurement, Colorimeter, Auto analyzer.

UNIT II CLINICAL DIAGNOSIS AND THERAPEUTIC EQUIPMENTS 9

Blood flow meter, Cardiac Output Measurement, Blood cell counters, Pacemakers, Defibrillators, Hemodialysis Machine, Heart-Lung machine.

UNIT III RADIOLOGY AND NUCLEAR EQUIPMENTS FOR DIAGNOSIS 9

Basis of Diagnostic Radiology, Nature of X-rays, Production of X-rays, X-ray Machine, Visualization of X-rays, X-ray Computed Tomography, Radio-isotopes in Medical Diagnosis, Physics of Radioactivity, Radiation Detectors, Single Photon Emission Computed Tomography, Positron Emission Tomography.

UNIT IV LATEST MEDICAL EQUIPMENTS AND ELECTRICAL SAFETY 9

Magnetic Resonance Imaging, Ultrasonic Imaging, Thermal Imaging, Laser in Medicine, Physiological Effects of Electrical Current, Shock Hazards from Electrical Equipment, Methods of Accident Prevention.

UNIT V BIO-TELEMETRY AND TELEMEDICINE 9

Introduction to Biotelemetry, Physiological Parameters Adaptable to Biotelemetry, Components of a Biotelemetry System, Single Channel and Multi-channel Wireless Telemetry Systems, Multi-patient Telemetry, Implantable Telemetry systems, Telemedicine.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Lesile Cromwell, “Biomedical instrumentation and measurement”, Prentice Hall of India, New Delhi, 2007.
2. Khandpur, R.S., “Handbook of Biomedical Instrumentation”, Tata McGraw-Hill, New Delhi, 2nd Edition, 2003.
3. Joseph.J, Carr and John M.Brown, “Introduction to Biomedical Equipment Technology”, Pearson Education Inc., 2004.

REFERENCES

1. A.P.F. Turner, I. Karube & G.S. Wilson, “Biosensors: Fundamentals & Applications”,Oxford University Press, Oxford, 1st Edition, 1995.
2. John G.Webster, “Medical Instrumentation Application and Design”, John Wiley and Sons,(Asia) Private Limited, 4th Edition, 2009.
3. B. H. Brown et. Al, “Medical Physics and Biomedical Engineering”, Overseas Press India Private Limited, 2005.

15EC26E ADVANCED ELECTRONIC SYSTEM DESIGN L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Explain the RF components such as resonator, filter, transmission lines, etc. (K1)
CO2: Apply optimization techniques to the design of RF amplifiers using transistors.(K1)
CO3: Discuss modern Power Supplies using SCR and SMPS technology (K1)
CO4: Explain about signal shielding, grounding techniques. (K1-K2)
CO5: Discuss PCB design. (K1)

UNIT I INTRODUCTION TO RF DESIGN 9

RF behaviour of passive components, Chip components and circuit board considerations, Review of transmission lines, Impedance and admittance transformation, Parallel and series connection of networks, ABCD and scattering parameters, Analysis of amplifier using scattering parameter. RF filter – Basic resonator and filter configurations – Butterworth and Chebyshev filters. Implementation of microstrip filters design. Band pass filter and cascading of band pass filter elements.

UNIT II RF TRANSISTOR AMPLIFIER DESIGN 9

Impedance matching using discrete components. Microstrip line matching networks. Amplifier classes of operation and biasing networks – Amplifier power gain, Unilateral design(S12 =0) –Simple input and output matching networks – Bilateral design - Stability circle and conditional stability, Simultaneous conjugate matching for unconditionally stable transistors. Broadband amplifiers, High power amplifiers and multistage amplifiers.

UNIT III DESIGN OF POWER SUPPLIES 9

DC power supply design using transistors and SCRs, Design of crowbar and fold back protection circuits, Switched mode power supplies, Forward, flyback, buck and boost converters, Design of transformers and control circuits for SMPS.

UNIT IV DESIGN OF DATA ACQUISITION SYSTEMS 9

Amplification of Low level signals, Grounding, Shielding and Guarding techniques, Dual slope, quad slope and high speed A/D converters, Microprocessors Compatible A/D converters, Multiplying A/D converters and Logarithmic A/D converters, Sample and Hold, Design of two and four wire transmitters.

UNIT V DESIGN OF PRINTED CIRCUIT BOARDS 9

Introduction to technology of printed circuit boards (PCB), General lay out and rules and parameters, PCB design rules for Digital, High Frequency, Analog, Power Electronics and Microwave circuits, Computer Aided design of PCBs.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Reinhold Luduig and Pavel Bretchko, “RF Circuit Design – Theory and Applications”, Pearson Education, 2nd Edition, 2009.
2. Sydney Soclof, “Applications of Analog Integrated Circuits”, Prentice Hall of India, 2004.
3. Walter C.Bosshart, “Printed circuit Boards – Design and Technology”, TATA McGraw- Hill, 31st reprint, 2008.

REFERENCES

1. Keith H.Billings, “Switchmode Power Supply Handbook”, McGraw-Hill Professional, 3rd Edition, 2010.
2. Ali Emadi, Alireza Khaligh, Zhong Nie and Young Joo Lee, “Integrated Power Electronic Converters and Digital Control”, CRC Press, 1st Edition, 2009.
3. Muhammad H.Rashid, “Power Electronics – Circuits, Devices and Applications”, Prentice Hall, 3rd Edition, 2003.

15EC31E	MOBILE ADHOC NETWORKS	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Summarize the challenges in the design of wireless adhoc networks. (K1)
CO2: Categorize and analyze the proposed protocols at MAC layers of Adhoc networks (K1-K3)
CO3: Analyze the challenges in routing layer of Adhoc Networks. (K1-K4)
CO4: Analyze the attacks pertaining to network layer. (K1-K4)
CO5: Elaborate the QoS requirements and Energy Management schemes. (K1-K3)

UNIT I INTRODUCTION 9

Introduction to adhoc networks – Definition - Characteristics features, applications. Characteristics of Wireless channel, adhoc Mobility Models: - Indoor and outdoor models. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.

UNIT II MEDIUM ACCESS PROTOCOLS 9

MAC Protocols: design issues, goals and classification. Contention based protocols- with reservation, scheduling algorithms, protocols using directional antennas.

UNIT III NETWORK PROTOCOLS 9

Routing Protocols: Design issues, goals and classification. Proactive Vs reactive routing, Unicast routing algorithms, Hybrid routing algorithm, Hierarchical Routing – Tree-Based and Mesh-Based Multicast routing algorithms.

UNIT IV END-END DELIVERY AND SECURITY 9

Transport layer: Issues in designing- Transport layer classification, adhoc transport protocols. Security issues in adhoc networks: issues and challenges, network security attacks, secure routing protocols.

UNIT V QUALITY OF SERVICE AND ENERGY MANAGEMENT SCHEMES 9

Introduction - Issues and Challenges in providing QoS in Adhoc Wireless Networks-Classifications of QoS Solutions. MAC Layer Solutions-Network Layer Solutions-QoS Frameworks-Need for Energy Management-Classification of Energy Management Schemes-Battery, Transmission Power, System Power Management Schemes.

L:45 TOTAL: 45 PERIODS

TEXT BOOKS

1. C.Siva Ram Murthy and B.S.Manoj, “Adhoc Wireless Networks Architectures and protocols”, Pearson Education, 2nd Edition, 2007.
2. Charles E. Perkins, “Adhoc Networking”, Addison - Wesley, 1st Edition, 2001.

REFERENCES

1. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan Stojmenovic, “Mobile Adhoc Networking”, Wiley India Edition, 2010.
2. Mohammad Ilyas, “The handbook of adhoc wireless networks”, CRC press, 2002.
3. Fekri M. Abduljalil and Shrikant K. Bodhe, “A survey of integrating IP mobility protocols and Mobile Adhoc networks”, IEEE communication Survey and tutorials, v9.no.1, 2007.
4. Jonathan Loo, Jaime Lloret Mauri, “Mobile Adhoc Networks: Current status and Future Trends”, CRC Press, 1st Edition, 2011.

15EC32E WIRELESS SENSOR NETWORKS

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Describe the basic concepts and architecture of Wireless Sensor Networks. (K1)

CO2: Develop the protocol stack for WSN. (K1-K4)

CO3: Design the simple Sensor Node for a specific application. (K1-K4)

UNIT I INTRODUCTION 9

Challenges for Wireless Sensor Networks, Enabling Technologies for WSN, Single node architecture – Energy consumption of sensor nodes - Network architecture – Sensor network scenarios - Optimization Goals and Figures of Merit - Design principles for WSN.

UNIT II PHYSICAL LAYER 9

Introduction, wireless channel and communication fundamentals – frequency allocation, modulation and demodulation, wave propagation effects and noise, channels models, spread spectrum communication, packet transmission and synchronization, quality of wireless channels and measures for improvement, Physical layer and transceiver design consideration in wireless sensor networks: Energy usage profile, choice of modulation schemes, Antenna Considerations.

UNIT III DATALINK LAYER 9

MAC protocols – fundamentals of wireless MAC protocols, Low duty cycle protocols: STEM, S-MAC - wakeup concepts, contention-based protocols: CSMA, PAMAS - Schedule-based protocols: SMACS - IEEE 802.15.4 low rate WPAN.

UNIT IV NETWORK LAYER 9

Geographic routing, Hierarchical Routing – LEACH, PEGASIS, Location Based Routing – GAF, GEAR, Data aggregation – Various aggregation techniques.

UNIT V INFRASTRUCTURE ESTABLISHMENT AND CASE STUDY 9

Topology Control - Localization and Positioning - Target detection tracking, Medicine and Health Care, Environmental disaster monitoring.

L:45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Holger Karl, Andreas willig, “Protocol and Architecture for Wireless Sensor Networks”, John Wiley Publication, 2006.
2. K.Akkaya and M.Younis, “A Survey of routing protocols in wireless sensor networks”, Elsevier Adhoc Network Journal, Vol.3, no.3, pp. 325-349, 2005.

REFERENCES

1. Kazem Sohraby, Daniel Minoli and Taieb Znati, “Wireless Sensor Networks Technology- Protocols and Applications”, John Wiley & Sons, 2007.
2. Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks: an information processing approach”, Elsevier Publication, 2004.
3. C.S.Raghavendra Krishna, M.Sivalingam and Tarib znati, “Wireless Sensor Networks”, Springer Publication, 2004.

4. C. Siva Ram Murthy and B. S. Manoj, “Adhoc Wireless Networks Architectures and Protocols”, Prentice Hall, PTR, 2004
5. Philip Levis, “Tiny OS Programming”, 2006 – www.tinyos.net.
6. Jamal N. Al-karaki, Ahmed E. Kamal, “Routing Techniques in Wireless sensor networks: A survey”, IEEE wireless communication, December 2004, 6 – 28.

15EC33E CRYPTOGRAPHY AND NETWORK SECURITY

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Describe the need for security and the various security techniques(K1)
CO2: Explain the various symmetric and asymmetric key algorithms. (K1-K2)
CO3: Apply suitable authentication functions to ensure authentication. (K1-K3)
CO4: Elaborate different types of security services used in various applications. (K1)
CO5: Provide solutions for security at the system level. (K1-K4)

UNIT I INTRODUCTION 9

OSI Security Architecture - Security Goals - Types of Attacks - Passive attack, active attack - Security services – Overview of Cryptography - Classical Encryption techniques – Substitutional Ciphers, Transposition Ciphers – Steganography

UNIT II SYMMETRIC AND ASYMMETRIC KEY ALGORITHMS 9

Block Ciphers - Data Encryption Standard - Block Cipher Design Principles and Modes of Operation – Advanced Encryption Standard – Triple DES, Stream Cipher-RC4. Public Key Cryptography and RSA – Diffie-Hellman key Exchange.

UNIT III AUTHENTICATION AND HASH FUNCTION 9

Authentication requirements – Authentication functions – Message Authentication Codes - Hash functions- SHA-1-Digital signatures: Digital signature standards - Entity Authentication: Biometrics, Key management Techniques.

UNIT IV NETWORK SECURITY 9

Authentication Applications: Kerberos – X.509 Authentication Service – Electronic Mail Security – PGP – S/MIME - IP Security – Web Security.

UNIT V SYSTEM LEVEL SECURITY 9

Intrusion detection – password management – Viruses and related Threats – Virus Counter measures – Firewall Design Principles – Trusted Systems**.**

L:45 TOTAL: 45 PERIODS

TEXT BOOKS

1. William Stallings, "Cryptography And Network Security – Principles and Practices", Pearson Education, 3rd Edition, 2003.
2. Behrouz A. Foruzan, "Cryptography and Network Security", Tata McGraw-Hill, 2007.

REFERENCES

1. Bruce Schneier, "Applied Cryptography", John Wiley & Sons Inc, 2nd Edition, 2001.
2. Charles B. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing", Pearson Education, 3rd Edition, 2003.
3. Wade Trappe and Lawrence C. Washington, " Introduction to Cryptography with coding theory", Pearson Education, 2nd Edition, 2007.
4. Wenbo Mao, "Modern Cryptography Theory and Practice", Pearson Education, 3rd reprint, 2008.
5. Thomas Calabrese, "Information Security Intelligence : Cryptographic Principles and Applications", Thomson Delmar Learning, 2006.
6. Atul Kahate, "Cryptography and Network Security", Tata McGraw-Hill, 8th reprint, 2006.

15EC34E	FUNDAMENTALS OF CYBER SECURITY	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Analyze the security threats and vulnerabilities(K1-K2)
CO 2: Explain the importance of Host, Data and Network Security. (K1-K3)
CO 3: Apply and implement secure network administration principles. (K1-K4)
CO 4: Develop access control and identity management (K1-K4)
CO 5: Exemplify the concepts of CIA and various cryptography Algorithms (K1-K3)

UNIT I SECURITY AND ATTACKS 9

Introduction to Security - Malware and Social Engineering Attacks - Application and Network Attacks - Vulnerability Assessment, Vulnerability Scanning vs. Penetration Testing and Mitigating Attacks

UNIT II APPLICATION, DATA AND NETWORK SECURITY 9

Securing the Host - Application Security - Securing Data - Security Through Network Devices - Security Through Network Technologies - Security Through Network Design Elements

UNIT III NETWORK ADMINISTRATION AND WIRELESS NETWORK SECURITY **9**

Network Protocols - Network Administration Principles - Securing Network Applications - Wireless Attacks - Vulnerabilities of IEEE 802.11 Security - Wireless Security Solutions

UNIT IV ACCESS CONTROL AND AUTHENTICATION **9**

Access Control - Implementing Access Control - Authentication Services - Authentication Credentials - Single Sign-On - Account Management - Trusted Operating Systems

UNIT V ADVANCED CRYPTOGRAPHY **9**

Cryptographic Algorithms - Digital Certificates - Public Key Infrastructure - Key Management - Transport Encryption Algorithms

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Mark Ciampa., "Security+ Guide to Network Security Fundamentals", Course Technology, Cengage Learning, 4th Edition, 2012.
2. EC-Council Press, "Investigating Network Intrusions and Cybercrime", , Course Technology, Cengage Learning, 1th Edition, 2010.

REFERENCES

1. Kimberly Graves, "CEH: Certified Ethical Hacker Study Guide", Wiley Publishing Inc., 2010.
2. Rafay Baloch, "Ethical Hacking and Penetration Testing Guide", CRC Press (Taylor & Francis Group), 2015.
3. Patrick Engebretson, "The Basics of Hacking and Penetration Testing - Ethical Hacking and Penetration Testing Made Easy", Syngress, 2011.
   EC-Council | Press, "Investigating Network Intrusions and Cybercrime", EC-Council, 2010.

B. E. – ELECTRONICS AND COMMUNICATION ENGINEERING

ONE CREDIT ELECTIVE COURSES

15EC01L BASIC DEVICE DRIVER PROGRAMMING PRACTICE

L	T	P	C
0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to,

CO 1: Write character type Device Driver programs for the given On chip peripherals.

Experiments

1. Theoretical introduction about the significance and different types of Device driver.
2. Device driver program to perform on-board LEDS glow using GPIO logic block
3. Device driver program to perform on-board LEDS glow using Timer0 logic block
4. Device driver program to perform LCD interface using SPI logic block
5. Device driver program to perform SPI communication using SPI logic blocks of two different lpc 2148 Boards
6. Device driver program to perform serial data communication using UART logic block
7. Device driver program to perform GSM interface using UART logic block
8. Device driver program to perform DC Motor interface using UART and SPI logic blocks.
9. Device driver program to perform ToF interface using I2C logic blocks of different processor families.

P: 30 TOTAL: 30 PERIODS

REFERENCES

1. Tammy Noergaard , “Embedded Systems Architecture”, Elsevier Inc, 2005
2. Sreekrishnan Venkateswaran, “Essential Device Driver”, Prentice Hall, 2008
3. www.arm.com
4. www.embeddedrelated.com
5. www.embeddedarm.com

15EC02L INTRODUCTION TO ROBOTICS AND MACHINE VISION

L	T	P	C
1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to,

CO 1: Understand the essential components of Industrial robot.

CO 2: Utilize the Quadrature Encoder and Stereo Vision camera in Robotic application.

Robot definitions-evaluation-robot anatomy-Coordinates frames-object description in space-robot modeling by Direct kinematic model-Trajectory planning-Architecture of robot vision system- Quadrature Encoder principles and interfacing- Camera types and Stereo

Vision camera interfacing

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. R.K.Mittal and I.J.Nagrath, "Robotics and Control", Tata McGraw-Hill, 9th Reprint, 2008
2. Ashitava Ghosal, "Robotics Fundamental Concepts and Analysis", Oxford University press, 2006.
3. www.ti.com

15EC03L	AUTOMOTIVE EMBEDDED SYSTEMS	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to,

CO1: Distinguish the different communication protocols for In_car Embedded networks

CO 2: Understand the essential functional domains of In_vehicle embedded system.

Different Functional domains of Vehicle-Standardized components for cooperative development process-Certification issues of safety critical In_vehicle embedded system – AUTOSAR architecture-main areas of AUTOSAR standardization-Examples of AUTOSAR in practice –Open issues for automotive communication protocols-In_car Embedded networks using CAN Protocol.

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Nicholasl Navart and Francoise Simonot lion, "Automotive Embedded System", CRC Press, 1st Reprint, 2014.
2. www.can-newsletter.com
3. www.autosar.org
4. Marco Di Natale, Haibo Zeng and Arkadeb Ghosal, "Understanding and Using the Controller Area Network Communication Protocol- Theory and Practice", Springer, 2012

15EC04L	BASICS OF GiT	L	T	P	C
		0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO 1: Understand how to coordinate with other programmers in code sharing environment under any Version control system.

LIST OF EXPERIMENTS

1. **A)Git Basics**
    1. Introduction to Version Control
    2. Introduction to Git
    3. Viewing History
    4. Track and Un track Files
    5. Creating a New Repository

2. B) **Git Internals**
    1. Building Git From Scratch
        - Simple Single File Model
        - SHA1 Single File Model
        - Ordered Single File Model
        - Detached Head Model
        - Multi-Branch Model
        - Merge Commit Model
        - Multi-File Model
    2. Exploring a Git Repo
    3. Staging
3. C) **Git Remotes**
    1. Merging
    2. Remote Repositories
        - Git Clone
        - Sharing Changes
        - Fetching Changes
        - Remote Tracking Branch
        - Managing Remotes
4. D) **Advanced Git**
    1. Rebase Interactive
    2. Interactive Add
    3. Stash

    Using GitHub

5. **Study experiments:**
    1. Concurrent version control system.(openCVS)
    2. PERFORCE HELIX

P:30 TOTAL: 30 PERIODS

15EC05L	**IMAGE PROCESSING PRACTICE USING OMAP3530 AND OPENCV**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Perform the Image Processing using OMAP3530 and OPENCV.

LIST OF EXPERIMENTS

1. Program to Read, Load and Display the given JPEG images.

2. Program to perform Negative Logarithmic transformation of different images.
3. Develop Histogram equalization algorithm and display the Histogram equalized image.
4. Program to perform filtering operation in spatial domain on noisy image corrupted by both Gaussian noise and Salt Pepper noise. Find signal to noise ratio in both cases.
5. Program to perform Gaussian noise removal using Filters.
6. Program to perform Sharpening of two different images using Filters.
7. Program to perform segmentation on bi-level images using histogram method.
8. Program to perform Erosion and Dilation.
9. Program to perform scaling and shearing.
10 Program to perform DISTANCE measurement using opencv and single camera

P:30 TOTAL: 30 PERIODS

15EC06L APPLICATION AND OPERATIONS SECURITY

L	T	P	C
1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Describe the Operations department responsibilities and investigate the threats to operations security.
CO2: Conduct incident management.
CO3: Analyze how to enhance security in software development.

Operations Security

Controlling and Monitoring Access, Security Assessment and Testing, Security Operations - Provisioning and Managing Resources, Configuration Management, Vulnerability Testing.

Incident Response

Preventing and Responding to Incidents, Disaster Recovery Planning, Incidents and Ethics.

Application Development Security

Software Development Security, Malicious Code and Application Attacks.

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Shon Harris, “All-in-One CISSP”, Tata Mc Graw Hill, 6th Edition, 2013.
2 James Michael Stewart, Ed Tittel, Mike Chapple, Sybex, “Certified Information Systems Security Professional”, A Wiley Brand, 7th Edition, 2015.

15EC07L	SECURITY ENGINEERING	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to,

CO1: Understand the fundamental concepts of security models.

CO2: Assess and mitigate the vulnerabilities of various systems.

CO3: Apply secure principles to communication channel and network components.

Security Models

Security models fundamental concepts, Security evaluation models, Security capabilities of information systems

Security Vulnerabilities

Security architectures, designs, and solution elements vulnerabilities, Web-based systems vulnerabilities, Mobile systems vulnerabilities, Embedded devices and cyber-physical systems vulnerabilities, Physical Security Requirements

.

Secure Network Architecture

Communication and Network Security, Secure network components, Secure communication channels, Prevent or mitigate network attacks

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Shon Harris, “All-in-One CISSP”, Tata Mc Graw Hill, 6th Edition, 2013.
2. James Michael Stewart, Ed Tittel, Mike Chapple, Sybex, “Certified Information Systems Security Professional”, A Wiley Brand, 7th Edition, 2015.

15EC08L	SECURITY MANAGEMENT PRACTICES	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand and apply security governance principles and risk management concepts.

CO2: Conduct business impact analysis business.

CO3: Classify information and supporting assets.

Security Governance and Risk Management

Concepts of Confidentiality, Integrity, and Availability, Security Governance Principles, Documented Security Policies, Threat Modeling, Personnel Security and Risk Management Concepts, Information Security Education.

Business Continuity Planning

Planning for Business Continuity, Business Impact Assessment, Continuity Planning, Laws, Regulations, and Compliance

Protecting Security of Assets

Classifying and Labeling Assets - Sensitive Data, Classifications, Data Security Requirements, Managing Sensitive Data , Data Roles, Protecting Privacy.

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Shon Harris, “All-in-One CISSP”, Tata Mc Graw Hill, 6th Edition, 2013.
2. James Michael Stewart, Ed Tittel, Mike Chapple, Sybex, “Certified Information Systems Security Professional”, A Wiley Brand, 7th Edition, 2015.

15EC09L	INTRODUCTION TO CYBERCRIME ANALYSIS	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO 1: Describe the types of Cybercrime and Cyber forensic.

CO 2: Analyze the methods of Cybercrime Investigation and Digital Evidence data against Cybercrime.

CO 3: Investigate cybercrimes in different scenarios.

Cybercrime and Cyber forensic

Introduction on Cybercrime, Types of Cybercrime, Cyber Forensics, Application of Law, Pre-Investigation Assessment.

Procedure for Cybercrime Investigations

Standard Operating Procedures, Crime Scene Investigation, Forensic Collection of Digital Evidence, Gathering and Analyzing the Data.

Investigation of Offences

Different Case Scenarios, Preserving the Digital Media, Preparing the Evidence.

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. “Cybercrime Investigation Manual”, Data Security Council of India.
2. “Investigating Network Intrusions and Cybercrime: EC-Council | Press”, Course Technology- Cengage Learning.

15EC10L	INTRODUCTION TO OFDM	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to,

CO1: Illustrate the basic need and concept of OFDM
CO2: Analyze the effects of symbol time offset in OFDM
CO3: Analyze the effect of carrier frequency offset in OFDM
CO4: Analyze the effect of PAPR in OFDM.

UNIT 1 OFDM BASICS

Multi-carrier generation, OFDM modulation and demodulation.

UNIT 2 OFDM TIMING SYNCHRONIZATION

Effect of symbol-time offset (STO), Estimation of STO, Compensation of STO, and Effect/compensation of sampling-clock offset (SCO).

UNIT 3 OFDM FREQUENCY SYNCHRONIZATION

Effect of carrier-frequency offset (CFO), Estimation of CFO, and Compensation of CFO.

UNIT 4 PEAK-TO-AVERAGE POWER RATIO REDUCTION (PAPRR)

Distribution of OFDM-signal amplitude; PAPR & oversampling; Mitigation methods: clipping & filtering, selective mapping (SLM), partial transmit sequence (PTS), tone reservation (TR), tone injection (TI), etc.

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Richard van Nee, Ramjee Prasad, “OFDM for Wireless multimedia communications”, Artech House, 2000.
2. Andrea Goldsmith, “ Wireless Communications”, Cambridge University Press, 2005

15EC11L	SPREADING CODES IN SPREAD SPECTRUM MODULATION	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to,

CO1: Identify the popular spreading codes in communication
CO2: Discuss the various code generation methods.
CO3: Analyze and select code for spreading.
CO4: Discuss the applications of spreading codes.

UNIT 1 DESCRIPTION OF POPULAR CODES

Maximal length sequences code, Gold code, and Kasami code

UNIT 2 CODES GENERATION

Binary Shift Register concept for generation of PN sequence: balance property, run length property, and Correlation Property, generation of Gold code set, generation of Kasami code set.

UNIT 3 CODE SELECTION FOR SPREADING

Comparison of auto correlation and cross correlation of various codes such as PN sequence code, M-Sequence code, Gold code, Kasami code.

UNIT 4 APPLICATIONS OF THE SPREADING CODES

Applications of spreading code to cellular communication systems, Second and third generation CDMA systems/ standards, Design examples of IS-95, GPRS, Bluetooth, W-CDMA, Wi-Fi.

L: 15 TOTAL: 15 PERIODS

REFERENCES

. 1. John Proakis and Masoud Salehi, Digital Communications, McGraw-Hill, 5th Edition, 2007.
. 2. T. S.Rappaport, Wireless Communications: Principles and Practice (2nd Edition), Prentice Hall, 2001.
3. R.L. Peterson, R. L Ziemer, D. E Borth, “Introduction to Spread Spectrum Communications”, Upper Saddle River: NJ, Prentice Hall, 1995.
4. E. H. Dinan ve B. Jabbari, "Spreading codes for direct sequence CDMA and wideband CDMA cellular networks", IEEE Communications Magazine, vol. 36, pp.48-54, September 1998.

15EC12L	PRACTICAL ANTENNA DESIGN: FROM THEORY TO PRACTICE	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to,

CO1: Discuss the practical consideration and techniques in designing antennas for wireless applications

CO2: Discuss the materials requirement for fabrication and parameters measurements.

CO3: Learn how to use the software packages to design various high frequency components.

Antenna parameters - field and circuit point of view, Practical consideration and techniques in designing antennas, Conducting and Dielectric materials for antenna fabrication.

Computational electromagnetic methodologies - time and frequency domain, Analytical method, **Numerical methods for EM modelling**(Principle)– Method of Moments (MoM), Finite Difference Time Domain (FDTD), Finite Element Method (FEM), Comparison of CEM methods(Advantages/Disadvantages)**, Applications of CAD software simulators.**

1. Design and simulation Planar antennas
2. S-parameter analysis on Transmission line and discontinuities
3. Modelling and simulation of microwave passive components

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Yi Huang and Kevin Boyle, “Antennas from theory to practise” John Wiley and sons, 2008.
2. M. N. Sadiku, “Numerical Techniques in Electromagnetics” CRC Press, 1992.
3. Joseph Carr, George Hippisley, “Practical Antenna Handbook, 5th Edition”, Mc.Graw Hill Professional, 2011.
4. Kyohei Fujimoto, HisashiMorishita, “Modern small antennas”, Cambridge university press, 2013.
5. A. Bondeson, T. Rylander, P. Ingelstrom, “Computational Electromagnetics” Springer 2005.
6. Daniel G. Swanson, Wolfgang J. R. Hoefer, “Microwave circuit modelling using electromagnetic field simulation”, Artech house, 2003.

15EC13L	MIMO ANTENNA ENGINEERING	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the MIMO concept for Wireless Communication Systems with parameters

CO2: Discuss the guidelines to design an antenna for gadgets applications.

CO3: Discuss the Isolation enhancement and measurement techniques.

Multiple-Input-Multiple-Output (MIMO) Technology, **MIMO Antenna Parameters** – Isolation, Mean effective gain, Diversity gain. **Design guidelines of Single and Multi band MIMO antenna** system for access points, mobile phones, tablets and USB dongle applications, **Isolation enhancement techniques** – antenna placement and orientation, defected ground structure, metamaterial, **MIMO antenna performance measurement techniques –** multiprobe OTA (Over The Air) method, Two stage OTA method, Reverberation chamber OTA testing method.

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Mohammad S. Sharawi "Printed MIMO antenna engineering", Artech house, 2014.
2. Franco De Flaviis, Llui Jofre, Jordi Romeu, Alfred Grau, "Multi antenna systems for MIMO communications", Morgan & Claypool, 2008.
3. AntonisKalis, Athanasios G Kanatas, Constantinos B. Papadias, "Parasitic Antenna arrays for Wireless MIMO systems", Springer, 2014.

15EC14L	ADVANCED MULTIMEDIA TECHNIQUES	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to,

CO 1: Understand the recent developments in Video and Audio compression
CO 2: Do projects on video and audio processing and compression
CO 3: Do projects to improve transcoding efficiency

Introduction to Video

Analog Vs Digital, Video Data, Video Timing, Video Resolution, Video Compression, Color Spaces

Digital Video Processing

Chroma Subsampling, Video Scaling, Scan rate conversion, Interlaced viz-a-viz Progressive conversion, DCT based Compression

Video Compression

H.264 Video Compression - Syntax, Prediction, Transform and Coding, H.264 Conformance, Transport

H.265 Video Compression, Architecture, Decoding Process, Parsing Process, Syntax and Semantics

Audio Processing

Digital Audio Interface, Equalizers, Loudness management, SRC, Level, Volume control

Audio Compression

MPEG Advanced Audio Coding, Dolby AC3, EAC3, AC5, ATMoS, H265+

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Video Demystified, Keith Jack, "A Handbook for the Digital Engineer", 3rd Edition, LLH Technology Publishing.
2. Iain E. Richardson, "The H.264 Advanced Video Compression Standard", 2nd Edition, Wiley Publications.
3. H265 Video Standard – Recommendation ITU-T H.265
4. Digital Audio Signal Processing – Udo Zolzer, John Wiley & Sons Ltd
5. Introduction to Data Compression – Khalid Sayood – Third Edition – ELSEVIER

15EC15L MULTIMEDIA PROCESSING AND CODING LAB

L	T	P	C
0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to,

CO 1: Understand state-of-the-art video and audio transcoding

CO 2: Add values to improve effectiveness in video and audio compression by projects

Experiments

1. Study resolution, fields/frame, Color spaces in YUV files
2. Change Chroma format, crop, apply DCT and IDCT
3. Analysis on Compressed audio using Audacity
4. FFMPEG based Video Compression and Decompression
5. X264 based H.264 encoding and streams analysis
6. X265 based H.265 encoding
7. VLC player based Video and Audio transcoding
8. Understand different video and audio compression using VLC player
9. Live video and audio encoding from Digital Video camera

P: 30 TOTAL: 30 PERIODS

15EC16L BROADCASTING AND STREAMING TECHNIQUES

L	T	P	C
1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to,

CO 1: Understand the present implementation of multimedia broadcasting and streaming techniques

CO 2: Add values by projects on efficiency improvement

Digital Modulation

Brief about SATCOM w.r.to DVB - Transmitting Digital Television Signals by Satellite – DVB-S/S2 - Broadband Cable Transmission according to DVB-C, DVB-C2, Terrestrial Transmission of Digital Television Signals (DVB-T), DVB-T2

Broadcasting Techniques

Digital Video Broadcasting for Handheld Devices, Digital Audio Broadcasting, DRM

Streaming Techniques

Overview of streaming and communication applications, Challenges in Video Streaming, Transport and Rate control for overcoming Time-varying Bandwidths, Playout Buffer for overcoming Delay Jitter - Error control for overcoming Channel losses, Error Resilient Video Coding, Media Streaming Protocols and Standards, Streaming media content delivery networks, Scalable audio DRM, Object based Video Transmission

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. W. Fischer , “Digital Video and Audio Broadcasting Technology”, 3rd Edition, Springer, Signals and Communication Technology
2. John C. Apostolopoulos, “Video Streaming: Concepts, Algorithms, and systems, Mobile and Media Systems Lab”.

15EC17L	PRINTED CIRCUIT BOARD DESIGN	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to,

CO 1: Involve in the various process of PCB design.

CO 2: Attain in-depth core knowledge in design, performance analysis and fabrication of Printed Circuit Boards.

CO 3: Predict the factors affecting PCB performance.

PCB DESIGN PROCESS AN OVERVIEW

Conception Level Introduction: Specifying Parts, Packages and Pin Names, The Partlist, The Netlist, Making Netlist Files, Placing Parts, Routing Traces, Adding Text, Plot and Drill Files, PCB Layout, Layer List and Selection Mask, Panning and Zooming, Projects, PCB Elements.

PCB DESIGN PROCESS

Board Outline; Parts-Anatomy of a Part, Partlist, Editing Parts, Reference Designator; Mounting Holes; Nets, Ratlines and Routing; Nets - Netlist; Ratlines; Vias; Modifying Traces, Swapping Pins; Importing Netlist; Copper Areas; Text ; Solder Mask Cutouts; Groups; Design Rule Checking; Exporting Drill and Gerber Files; Drills; Footprints and Libraries Adding and Editing Pins, Polylines.

APPLICATION ORIENTED DESIGN AND FABRICATION

Schematic Diagram, Creating the Project, Importing the Net list File, Drawing the Board Outline, Adding Mounting Holes, Placing Parts, Adding Parts and Editing Nets, Adding Copper Areas, Routing, Nets, Ratlines and Routings, Adding Text, Checking Design Rules, Fabrication Process and Methodology

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. R.S.Khandpur, “Printed Circuit Boards: Design, Fabrication, and Assembly”, McGraw-Hill, 2005
2. Bossart, "Printed Circuit Boards:Design and Technology", TMH, New Delhi 2008

B. E. – ELECTRONICS AND COMMUNICATION ENGINEERING

OPEN ELECTIVE COURSES

Open Elective Course (OEC)

Group - I (Inter-disciplinary courses)

		L	T	P	C
15ID01E	**PRODUCT DESIGN AND DEVELOPMENT**	**3**	**0**	**0**	**3**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: analyze various global trends and identify the scope of a new product (K4)
CO2: perform requirement analysis and convert the requirements into design specification (K4)
CO3: translate conceptual idea into detailed design (K6)
CO4: create prototype to demonstrate the product (K6)
CO5: perform sustenance engineering to improve the longevity of the product(K6)

UNIT I FUNDAMENTALS OF PRODUCT DEVELOPMENT 9

Global Trends Analysis and Product decision: Types of various trends affecting product decision - Social Trends-Technical Trends- Economical Trends- Environmental Trends- Political/ Policy Trends- PESTLE Analysis.

Introduction to Product Development Methodologies and Management: Overview of Products and Services- Types of Product Development- Overview of Product Development methodologies - Product Life Cycle and PLM - Product Development Planning and Management .

UNIT II REQUIREMENTS AND SYSTEM DESIGN 9

Requirement Engineering: Types of Requirements- Requirement Engineering- Analysis -Traceability Matrix and Analysis- Requirement Management

System Design and Modeling: Introduction to System Modeling- Introduction to System Optimization- System Specification-Sub-System Design- Interface Design.

UNIT III DESIGN AND TESTING 9

Conceptualization - Industrial Design and User Interface Design - Introduction to Concept generation Techniques - Concept Screening and Evaluation - Concept Design - S/W Architecture - Hardware Schematics and simulation

Detailed Design: Component Design and Verification - High Level Design/Low Level Design of S/W Programs - S/W Testing-Hardware Schematic - Component design - Layout and Hardware Testing.

UNIT IV IMPLEMENTATION AND INTEGRATION 9

Prototyping: Types of Prototypes -Introduction to Rapid Prototyping and Rapid Manufacturing.

System Integration- Testing- Certification and Documentation: Introduction to Manufacturing/Purchase and Assembly of Systems- Integration of Mechanical, Embedded and S/W systems- Introduction to Product verification and validation processes - Product Testing standards, Certification and Documentation.

UNIT V SUSTENANCE ENGINEERING AND BUSINESS DYNAMICS 9

Sustenance - Maintenance and Repair - Enhancements

Product End of Life (EoL): Obsolescence Management-Configuration Management - EoL Disposal.

The Industry - Engineering Services Industry overview - Product development in Industry versus Academia

The IPD Essentials - Introduction to vertical specific product development processes - Product development Trade-offs - Intellectual Property Rights and Confidentiality- Security and configuration management

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Anita Goyal, Karl T Ulrich, Steven D Eppinger, "Product Design and Development ", Tata McGraw-Hill Education, 4th Edition, 2009, ISBN-10-007-14679-9.
2. George E Dieter, Linda C Schmidt, "Engineering Design", McGraw-Hill International Edition,4th Edition, 2009, ISBN 978-007-127189-9

REFERENCES

1. Kevin Otto, Kristin Wood, "Product Design", Indian Reprint 2004, Pearson Education, ISBN 9788177588217
2. Yousef Haik, Shahin T M M, "Engineering Design Process", Cengage Learning,2nd Edition Reprint, 2010, ISBN 0495668141
3. Clive L Dym, Patrick Little, "Engineering Design: A Project-based Introduction", John Wiley & Sons, 3rd Edition, 2009, ISBN 978-0-470-22596-7
4. Kevin Otto & Kristin Wood, "Product Design Techniques in Reverse Engineering and New Product Development", Pearson Education (LPE), 2001.
5. James R Evens, William M Lindsay "The Management and control of Quality" Pub:son south-western(www.swlearning.com), 6th edition.
6. AmitavaMitra, "Fundamentals of Quality control and improvement" Pearson Education Asia, 2nd edition, 2002.
7. Montgomery D C, "Design and Analysis of experiments", John Wiley and Sons, 2003.
8. Phillip J Rose, "Taguchi techniques for quality engineering", McGraw Hill, 1996.
9. Reddy G B, "Intellectual Property Rights and the Law", Gogia Law Agency, 7th Edition Reprint, 2009.
10. Subbaram N R, "Demystifying Intellectual Property Rights", Lexisexis Butterworths Wadhwa, 1st Edition, 2009.

15ID02E DISASTER MANAGEMENT L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: classify the various types of disaster. (K2)

CO2: interpret various natural and manmade disasters. (K2)

CO3: choose a Hazard Assessment procedure. (K3)
CO4: construct the protection measures against Disaster. (K3)
CO5: apply Science and Technology in Disaster Management. (K3)

UNIT I INTRODUCTION TO DISASTER 8

Hazard, risk, vulnerability, disaster significance, nature, importance, dimensions and scope of disaster management - national disaster management frame work- financial arrangements- disaster- management cycle**.**

UNIT II SOURCES OF DISASTER 10

Natural disasters- significance, nature, types and effects - floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, heat and cold waves, climatic change - global warming - sea level rise - ozone depletion. Manmade disasters- nuclear , chemical, biological, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents and sea accidents.

UNIT III DISASTER MITIGATION AND HAZARDS ASSESMENT 10

Factors affecting damage – types, social status, habitation pattern, physiology and climate - Factors affecting mitigation measures - prediction – preparation - communication - area and accessibility - population - physiology and climate - Vulnerability Assessment and seismic strengthening of buildings - Vulnerability Assessment of Buildings procedure - Hazard Assessment-Visual Inspection and Study of Available Documents

UNIT IV DISASTER MANAGEMENT 9

Disaster management - efforts to mitigate natural disasters at national and global levels - international strategy for disaster reduction- Rescue ,relief And Rehabilitation, Role Of National And International Agencies In Disaster Management-National Disaster Policy Of India (Salient Features).

UNIT V APPLICATIONS OF SCIENCE AND TECHNOLOGY AND CASE STUDIES 8

Applications of Science and Technology (RS, GIS, GPS) - Early Warning And Prediction Systems- Earthquake, cyclone, landslides, fire accidents, accidents- case studies

L: 45; TOTAL: 45 PERIODS

TEXTBOOKS

1. S.K.Singh, S.C. Kundu, Shobha Singh A ,"Disaster management", William Publications, New Delhi, 1997.
2. Vinod K Sharma, "Disaster Management", IIPA, New Delhi, 1995

REFERENCE

1. Annual Report, 2009-10,Ministry of Home Affairs, GOI

15ID03E	ENERGY ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explain the operation of Solar Thermal application and Solar Photovoltaic. (K2)
CO2: explain the operation of wind energy systems. (K2)
CO3: describe the concepts of various Bio-Energy Conversion techniques. (K2)
CO4: illustrate the concepts of other conventional and nonconventional power plants. (K2)
CO5: explain the concepts of hydrogen and fuel cell technology. (K2)

UNIT I INTRODUCTION TO SOLAR ENERGY 9

Sun - Earth Geometry, solar radiation, Solar Collectors - Application of solar thermal systems. Direct Electricity Conversion - Types of Solar cell - Solar Photovoltaic system and types.

UNIT II WIND ENERGY 9

Wind energy potential, Principle of wind energy conversion; Basic components, types and their constructional features; design considerations: wind data and site selection.

UNIT III BIO-ENERGY 9

Biomass: sources, characterization, principles of energy transfer technologies. Biogas: Feedstock, types of Biogas plant- parameters affecting biogas production.

UNIT IV OTHER POWER PLANTS 9

Layout of Hydel - thermal - Nuclear - Gas turbine - Diesel - MHD- Geo thermal - OTEC - Tidal Power Plants.

UNIT V HYDROGEN AND FUEL CELLS 9

Energy carrier: Types - Hydrogen: generation, storage, transport and utilization - thermal energy storage: Principle and utilization - Fuel cells: Technologies, types and applications.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Soteris Kalogirou, “Solar Energy Engineering: Processes and Systems”, Academic Press, 2014.
2. Godfrey Boyle, “Renewable Energy, Power for a Sustainable Future”, Oxford University Press, U.K, 3rd Edition, 2012.

REFERENCES

1. Mukund R Patel, “Wind and Solar Power Systems”, CRC Press, 2nd Edition, 2006.
2. Hart A B and Womack, G J, “Fuel Cells: Theory & Applications”,Prentice Hall, 1997.
3. EI-Wakil M M,“Power Plant Technology”, Tata McGraw-Hill, 2010.
4. Khandelwal K C and Mahdi S S, “Biogas Technology” - A Practical Handbook, Tata McGraw Hill, 1986.
5. Duffie J A and Beckman W A, “Solar Engineering of Thermal Processes”, Wiley, 4th Edition, 2013.
6. Chetan Singh Solanki, “Solar Photovoltaics Fundamentals, Technologies and Applications”, Prentice Hall of India, 3rd Edition, 2015.

Group - II (Trans disciplinary courses)

15TD01E	INDIAN BUSINESS LAWS	L T P C 0 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: explain the elements of a valid contract.

CO 2: discuss main provisions relating to Sale of Goods Act and Negotiable Instruments Act.

CO 3: explain provisions relating to incorporation and functioning of company and partnership firm.

CO 4: understand the fundamentals of Consumer Protection Act and Foreign Exchange Management Act.

CO 5: understand the basic knowledge of Information Technology Act and RTI Act.

UNIT I THE INDIAN CONTRACT ACT, 1872

Definition of a Contract and its essentials - Formation of a valid Contract - Offer and Acceptance, Consideration - Capacity to Contract - Free consent - Legality of object - Discharge of a Contract by performance - Impossibility and Frustration - Breach, Damages for breach of a contract - Quasi contracts - Special Contracts - Contract of Indemnity and Guarantee - Contract of Bailment and Pledge - Contract of Agency.

UNIT II THE SALE OF GOODS ACT, 1930

Definition of a Contract of Sale - Conditions and Warranties - Passing of Property - Right of Unpaid Seller against the Goods - Remedies for Breach - The Negotiable Instrument Act, 1881

Definition and characteristics - Kinds of negotiable instruments - Promissory Note - Bill of Exchange and Cheques - Holder and Holder in due course - Negotiation, Presentment, Discharge from Liability - Noting and Protest – Presumption - Crossing of Cheques - Bouncing of Cheques.

UNIT III THE COMPANIES ACT, 1956

Nature and Definition of a Company - Registration and Incorporation - Memorandum of Association - Articles of Association – Prospectus - Kinds of Companies - Directors: Their powers and duties – Meetings - Winding up - The Indian Partnership Act, 1932 - Definition of Partnership and its essentials - Rights and Duties of Partners: Types of Partners - Minor as a partner - Doctrine of Implied Authority - Registration of Firms - Dissolution of firms - Limited Liability Partnership Act, 2000.

UNIT IV THE CONSUMER PROTECTION ACT, 1986

Aims and Objects of the Act - Redressal Machinery and Procedure for complaints under the Act – Remedies – Appeals - Enforcement of orders and Penalties - Foreign Exchange Management Act 2000 - Definition and Main Provisions.

UNIT V THE INFORMATION TECHNOLOGY ACT

Definition, Digital Signature - Electronic Governance – Attribution - Acknowledgment and Dispatch of Electronic Records - Sense Electronic Records and Sense Digital Signatures - Regulation of Certifying Authorities Digital Signature Certificates - Duties of Subscribers - Penalties and Offences - The Right to Information Act, 2005 - Right to know - Salient Features of the Act - Obligation of Public Authority - Designation of Public Information Officer - Request for obtaining information - Duties of a PIO - Exemption from Disclosure of Information - Partial Disclosure of Information - Information Commissions - Powers of

Information Commissions - Appellate Authorities – Penalties - Jurisdiction of Courts.

TEXT BOOKS

1. Kuchhal M.C, "Business and Industrial Laws", 3rd Edition, JBA Publishers, New Delhi, 2013.
2. Gulshan S.S, "Merchantile Law", 3rd Edition, JBA Publishers, New Delhi, 2007.

REFERENCES

1. Mulla D.F, "The Sale of Goods Act and the Indian Partnership Act", 10th Edition, LexisNexis Ltd., India, 2012.
2. Dabas J, "Negotiable Instruments Act", 2nd Edition, JBA Publishers, New Delhi, 2013.
3. Avtar S, "The Principles of Mercantile Law", 9th Edition, Eastern Book Company, India, 2011.

15TD02E LEADERSHIP AND PERSONALITY DEVELOPMENT L T P C
0 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: identify the various leadership skills.
CO 2: understand group dynamics and factors influencing the team performance.
CO 3: describe the personality dimensions based on personality theories.
CO 4: explain personality determinants and personality types.
CO 5: apply effective training program for personality development.

UNIT I INTRODUCTION

Leadership – Meaning, Concepts and Myths about Leadership, Components of Leadership- Leader, Followers and Situations - Leadership Skills – Basic Leadership Skills - Building Technical Competency - Advanced Leadership Skills - Team Building for Work Teams - Building High Performance Teams.

UNIT II TEAMS AND LEADERSHIP

Assessing Leadership & Measuring Its Effects - Group- Nature, Size, Roles, Norms, Cohesion, and Stages of Group Development - Teams and their Leadership – Effective Team Characteristics and Team Building - Ginnetts Team Effectiveness Leadership Model.

UNIT III PERSONALITY

Personality - Meaning, Concept, Personality Patterns, Symbols of Self, Moulding the Personality Pattern, Persistence & Change - Personality & Personal Effectiveness - Psychometric Theories – Cattele and Big Five - Psychodynamic Theories - Carl Jung and MBTI - Transactional Analysis - Johari – Window - Personal Effectiveness.

UNIT IV PERSONALITY DETERMINANTS

Personality Determinants – Heredity and Environment – Types of personality.

UNIT V PERSONALITY TRAINING

Concept, Role, Need, Importance and types of personality Training - Understanding Process of Learning - Developing an Integrated Approach of Learning in Training Programme - Training Needs Assessment.

TEXT BOOKS

1. Yukl G, "Leadership in Organisations", 8th Edition, Pearson Education Ltd., England, 2013.
2. Lall M, Sharma S, "Personal Growth Training & Development", Kindle Edition, USA, 2009.

REFERENCES

1. Janakiraman B, "Training and Development", Wiley Dream tech, Biztantra, 2005.
2. Pareek U, "Understanding Organizational Behaviour", 2nd Edition, Oxford University Press, USA, 2007.

15TD03E INTERNATIONAL BUSINESS MANAGEMENT L T P C
0 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: understand the global business environment.
CO 2: explain the impact of economic, legal, cultural, geographical and political factors on international business.
CO 3: discuss the issues and problems of Multinational Enterprises.
CO 4: discuss the role of various international financial institutions.
CO 5: discuss about important aspects of WTO and GATT agreement.

UNIT I INTERNATIONAL BUSINESS ENVIRONMENT

International Business Environment - Globalization - Forces, Meaning, Dimensions and Stages in Globalization - Trading Environment of International Trade - Tariff and Non-tariff Barriers - Trade Blocks.

UNIT II RISK ANALYSIS AND PRACTICES

Country Risk Analysis - Political, Social and Economic - Cultural and Ethical practices - Responsibilities of International Business - Economic crisis in foreign countries.

UNIT III MULTINATIONAL ENTERPRISES

Managing Multinational Enterprises - Problems and Potential - Multinational Service Organizations - Indian companies becoming multinationals - Potential, Need and Problems.

UNIT IV INTERNATIONAL FINANCIAL MANAGEMENT

Introduction to International Financial Management - Balance of Trade and Balance of Payment - International Monetary Fund, Asian Development Bank and World Bank - Financial Markets and Instruments - Introduction to Export and Import Finance - Methods of Payment in International Trade.

UNIT V INTERNATAIONAL AGREEMENT

General Agreement on Trade and Tariffs, (GATT) - World Trade Organization - Seattle and Doha Round of Talks - Dispute Settlement Mechanism under WTO - Problems of Patent Laws - International Convention on Competitiveness - Global Sourcing and its Impact on Indian Industry - Globalization and Internal Reform Process.

TEXT BOOKS

1. Bhalla V.K, Shivaramu S, "International Business Environment", 9th Edition, Anmol Publications Pvt. Ltd., Delhi, 2005.
2. Apte P.G, "International Financial Management", 5th Edition, Tata McGraw Hill, India, 2008.
3. Cherulinam F, "International Business", 5th Edition, Prentice Hall of India, New Delhi, 2010.

REFERENCES

1. Rao, Rangachari, "International Business", Himalaya Publishing House, New Delhi, 2010.
2. Hill C, "International Business", 10th Edition, Tata McGraw Hill Education, New Delhi, 2014.
3. Daniels J.D, "International Business Environment", 15th Edition, Prentice Hall of India, New Delhi, 2014.

15TD04E BASICS OF MARKETING L T P C
0 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: describe the basic concepts of marketing.
CO 2: discuss the significance of consumer behavior and market segmentation.
CO 3: discuss brand, trade mark, after- sales service and product life cycle concepts.
CO 4: formulate strategies for pricing and channels of distribution.
CO 5: analyze and selection of best promotional technique.

UNIT I INTRODUCTION

Nature and Scope of Marketing - Importance of Marketing – Concepts: Traditional and Modern - Selling Vs. Marketing - Marketing Mix - Marketing Environment.

UNIT II CONSUMER BEHAVIOR AND MARKET SEGMENTATION

Nature, Scope and Significance of Consumer Behavior - Market Segmentation - Concept and Importance - Bases for Market Segmentation.

UNIT III PRODUCT PLANNING

Concept of Product - Consumer and Industrial Goods - Product Planning and Development - Packaging - Role and Functions - Brand Name and Trade Mark - After-Sales Service - Product Life Cycle Concept.

UNIT IV PRICING AND PHYSICAL DISTRIBUTION

Price - Importance of Price in the Marketing Mix - Factors Affecting Price of a Product/Service - Discounts and Rebates - Distribution Channels - Concept and Role - Types of Distribution Channels - Factors Affecting Choice of a Distribution Channel - Retailer and Wholesaler - Distributions Channels and Physical Distribution.

UNIT V PROMOTION

Definition - Methods of Promotion - Optimum Promotion Mix - Advertising Media - Their Relative Merits and Limitations - Characteristics of an Effective Advertisement - Personal Selling - Selling as a Career - Classification of a Successful Sales Person - Functions of Salesman.

TEXT BOOKS

1. Etzel M.J, Walker B.J, Stanton W.J, "Fundamentals of Marketing", 13th Edition, McGraw Hill, New York, 2004.
2. Tanner J, Raymond M, "Principles of Marketing", University of Minnesota Libraries Publishing, New York, 2015.

REFERENCES

1. Rajan Nair N, Varma M.M, "Marketing Management", 2nd Edition, S.Chand & Sons, New Delhi, 2005.
2. Ramaswamy V.S, Namakumari S, "Marketing Management", 3rd Edition, Macmillan India Limited, London, 2002.

15TD05E RETAILING AND DISTRIBUTION MANAGEMENT L T P C
0 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: explain the concepts of retailing and distribution management.
CO 2: analyze and solve retailers' problems to make decisions in retail organizations.
CO 3: plan and formulate strategy for retail management process.
CO 4: discuss about various distribution technology and stores management.
CO 5: analyze the issues and challenges in Logistic Management

UNIT I INTRODUCTION

Meaning and Nature of Distribution and Retail Industry - Future of Retailing and Distribution in India - Distribution Channels – Concept, Role and Types - Factors Affecting Choice of Distribution Channel.

UNIT II TYPES OF RETAILING

Stores Classified by Owners - Stores Classified by Merchandising Categories - Wheel Of Retailing - Traditional Retail Formats Vs. Modern Retail Formats in India - Store and Non-Store Based Formats - Cash and Carry Business - Retailing Models – Franchiser Franchisee, Directly Owned - Wheel of Retailing and Retailing Life Cycle – Issues in Retailing.

UNIT III MANAGEMENT OF RETAILING OPERATIONS

Meaning - Functions of Retail Management - Strategic Retail Management Process - Retail Planning - Importance and Process - Developing Retailing Strategies.

UNIT IV TECHNOLOGY IN DISTRIBUTION

Bar-Coding – RFID – Electronic Payment Systems - Store Administration - Floor Space Management – Managing Store Inventories and Display Action Plans - Pricing Strategies and Location Strategies.

UNIT V LOGISTICS OF RETAIL MANAGEMENT

Components and Functions; Distribution Related Issues and Challenges - Gaining Competitive Advantage through Logistics Management.

TEXT BOOKS

1. Agrawal D. K., "Distribution & Logistics Management: A Strategic Marketing Approach", Macmillan Publishers India Limited, New Delhi, 2007.
2. Berman B, Evans J.R, "Retail Management – A Strategic approach", 12th Edition, Pearson Education Ltd., England, 2013.
3. Cox R, Brittan P, "Retailing an introduction, Financial Times Management", 5th Edition, Pearson Education Limited, England, 2004.

REFERENCES

1. Rushton A, Croucher P, Baker P, "The Handbook of Logistics & Distribution Management", Kogan Page Limited, London, 2006.
2. Coughlan A.T, Anderson E, Stern L.W, El-Ansary A.I, "Marketing Channels", 7th Edition, Prentice Hall, New Jersey, 2006.
3. Sinha P. K, Uniyal D.P, "Managing Retailing", Oxford University Press, India, 2007.

15TD06E **INTERNATIONAL ECONOMICS** **L T P C**
0 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: discuss the impact of globalization.
CO 2: identify and analyze different theoretical models of international economics in light of 'real world' situations.
CO 3: examine the consequences of trade policies.
CO 4: explain the importance of international financial markets.
CO 5: discuss the important aspects of international banking.

UNIT I INTRODUCTION

Background of International Business Economics - Globalization and International Business – The Emergence of Global Institutions – Drivers of Globalizations - The Globalization Debate.

UNIT II THE INTERNATIONAL TRADE THEORY

The Law of Comparative Advantage – The Demand and Supply, Offer Curves - The Terms of Trade – Factor Endowments and the Heckscher – Ohlin Theory – Implications of Trade Theories - Economics of Scale - Imperfect Competition.

UNIT III INTERNATIONAL TRADE POLICY

Trade Restrictions - Tariffs, Non –Tariff Trade Barriers - Tariff Vs. Quota - The New Protectionism – Economic Integration - Custom Unions and Free Trade Areas - Major Regional Trade Agreements - Foreign Exchange Market – Types of Foreign Exchange Transactions – Reading Foreign Exchange Quotations – Forward and Futures Market – Foreign - Currency Options – Exchange Rate Determination – Arbitrage – Speculation and Exchange - Market Stability.

UNIT IV WORLD FINANCIAL ENVIRONMENT

Global Foreign Exchange Markets – Economic Theories of Exchange - Rate Determination - International Regime for FDI and MNC - Consequences of Economic Globalization.

UNIT V INTERNATIONAL BANKING

Reserves, Debt and Risk - Nature of International Reserves – Demand for International Reserves – Supply of International Reserves – Gold Exchange Standard – Special Drawing Rights – International Lending Risk – The Problem of International Debt – Financial Crisis and The International Monetary Fund – Eurocurrency Market.

TEXT BOOKS

1. Krugman P.R, Obstfeld M, “International Economics Theory and Policy”, 8th Edition, Prentice Hall, Boston, 2008.
2. Carbaugh R.J, “International Economics”, 15th Edition, South Western College publication, USA, 2014.

REFERENCES

1. Daniels J, Radebaugh L, Sullivan D, Salwan P, “International Business”, 12th Edition, Pearson Education, New Delhi, 2010.
2. Suranovic S, “International Economics: Theory and Policy”, Flat World Knowledge, USA, 2010.

15TD07E	INDIAN ECONOMY	L T P C 0 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: discuss the current economic development in India
CO 2: describe the key indicators of estimation of national income
CO 3: explain elementary concepts of economic planning and development in India
CO 4: discuss the concept of public finance and preparation of budget
CO 5: discuss the influence of infrastructure growth on economic development

UNIT I ECONOMIC DEVELOPMENT

Meaning - Measurement of Economic Development - Characteristic of underdeveloped and developed economies - Causes for Indian economic underdevelopment - Major issues in development - Strategies for economic development Import substitution and Export oriented strategies - Determinants of economic development.

UNIT II NATIONAL INCOME

The National Income and its estimates in India - Limitations of National income estimation - Trends in National income of India: Growth and Structure - Inter-state variations in

National income - Income distribution - Measurement of poverty in India.

UNIT III ECONOMIC PLANNING

Planning and economic development in India - Planning models in India (Elementary concepts) - Capital formation - Growth of Public and Private sector in India – Industrial policies an assessment - Capital formation and domestic saving.

UNIT IV INDIAN PUBLIC FINANCE

Budgetary policies of the central government - Composition and trends in public revenue and expenditure - Expenditure control and government consumption expenditure - concepts of Budgetary deficits and implications - state budget.

UNIT V INFRASTRUCTURE AND ECONOMIC DEVELOPMENT

Power and energy - Transport system in India's economic development - Communication system in India - Urban infrastructure - Science and technology - Private investment in infrastructure - Outlook and prospects.

TEXT BOOKS

1. Dutt R, Sundaram K.P.M, "Indian Economy", S.Chand and Co., New Delhi, 2006.
2. Agarwal A.N, Agarwal M.K, "Indian Economy: Problems of Development and Planning", 41st Edition, New Age International Ltd., New Delhi, 2016.

REFERENCES

1. Arvind P, "India:The Emerging Giant", Oxford University Press, USA, 2008.
2. Government of India, Economic Survey, (2010 -11 to 2014 -15).

15TD08E RURAL ECONOMICS L T P C
0 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: discuss the role and importance of agriculture in economic development of India.
CO 2: describe the impact of agricultural forming in rural employment, wage policy, technological change and green revolution.
CO 3: analyze the relationship between rural and urban society.
CO 4: recognize the formation and system of rural social institutions.
CO 5: compare the social changes in the rural society after modernization and globalization.

UNIT I INTRODUCTION

Nature and Scope of Rural Economy - Importance of Agriculture in Economic Development of India - Nature of Land Problems - Evolution of Policy – Land Tenure System - Land Reform Measures.

UNIT II AGRICULTURE AND FARMING

Agricultural Holdings - Fragmentation and Sub-Division of Holdings, Cooperative Farming-Rural Labour Problems - Nature of Rural Unemployment - Employment and Wage Policy - Sources of Technological Change and Green Revolution.

UNIT III RURAL SOCIETY

Rural Society Structure and Change - Village and its Social Organization - Indian Village and its Types - Rural-Urban Continuum and Rural-Urban Relationships.

UNIT IV RURAL SOCIAL INSTITUTIONS

Rural Social Institutions - Family, Property, Caste, Class, Agrarian Structure - Indebtedness and Poverty - Jajmani System - Religion, Village, Panchayat Raj and Community Development Programmes – Problems.

UNIT V SOCIAL CHANGES

Social Change in Rural India-Impact of Westernization - Secularization, Urbanisation, Industrialisation, Migration, Transportation, Modernization of Indian Rural Society - Post Modernization and Globalization and Indian Villages.

TEXT BOOKS

1. Carver T.N, “The Principles of Rural Economics”, Ginn and company, USA, 1911.
2. Desai A.R, “Rural Sociology in India”, 5th Edition, Popular Prakashan Ltd., Mumbai, 2011.

REFERENCES

1. Dube S.C., “India’s changing villages”, Psychology Press, UK, 2003.
2. Datt R, Sundharam K.P.M, Datt G, Mahajan A, “Indian Economy”, 72nd Edition, S.Chand & Co., New Delhi, 2016.
3. Chaudhari, C.M., “Rural Economics”, Sublime Publication, Jaipur, 2009.

15TD09E INTERNATIONAL TRADE L T P C
0 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: discuss the importance of international trade in developing countries.
CO 2: describe the impact of Trade agreements in international Business environment.
CO 3: explain the role of foreign exchange and their impact on trade and investment flows.
CO 4: discuss the benefits of Multinational Corporation in Internal Trade
CO 5: analyze the key role of globalisation in Indian economy.

UNIT I INTRODUCTION

International Marketing - Trends in International Trade - Reasons - Global Sourcing and Production Sharing - International Orientations - Internationalization Stages and Orientations - Growing Economic Power of Developing Countries – International Business Decision.

UNIT II INTERNATIONAL BUSINESS ENVIRONMENT

Trading Environment - Commodity Agreements – State Trading - Trading Blocks and Growing Intra-Regional Trade - Regional Groupings – SAARC, BRICS, ECM, ASEAN - Trade Liberalization - The Uruguay Round-Evaluation – UNCTAD – GATT – WTO.

UNIT III INTERNATIONAL FINANCIAL ENVIRONMENT

International Money and Capital Markets - Foreign Investment Flows – Pattern, Structure and Effects - Movements in Foreign Exchange and Interest Rates and their Impact on Trade and Investment Flows - Exchange Rate Mechanism and Arrangement.

UNIT IV MULTINATIONAL CORPORATIONS

Definition - Organizational Structures - Dominance of MNC's - Recent Trends - Code of Conduct - Multinationals in India - Issue in Investment, Technology Transfer, Pricing and Regulations - International Collaborations and Strategic Alliances.

UNIT V INDIA IN THE GLOBAL SETTING

India an Emerging Market - India in the Global Trade - Liberalization and Integration with Global Economy - Factors Favouring and Resisting Globalization - Trade Policy and Regulation in India - Trade Strategies - Export-Import Policy - Regulation and Promotion of Foreign Trade in India.

TEXT BOOKS

1. Daniels J.D, Radebaugh L.H, Sullivan D.P, "International Business: Environment and Operations", 12th Edition, Prentice Hall, USA, 2009.
2. Ricky W.G, Michael W.P, "International Business: A Managerial Perspective", Prentice Hall, USA, 2009.

REFERENCES

1. Bhattacharya B, Varshney R.L, "International Marketing Management", 25th Revised Edition, S. Chand & Sons, New Delhi, 2015.
2. Verma M.L, "International Trade", Common wealth Publisher, New Delhi, 2010.

15TD10E GLOBAL CHALLENGES AND ISSUES L T P C
0 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: understand the various global issues.
CO 2: demonstrate a reasonable understanding of environmental debates and issues.
CO 3: explain the developmental issues relating to food, health and energy.
CO 4: demonstrate the economical issues in international trade.
CO 5: describe the civilization issues relating to human rights and social justice.

UNIT I SECURITY ISSUES

Nuclear Issues - Global and South Asian Context - Small Weapons Proliferation and Internal Arms Race - Chemical and Biological Weapons – Terrorism - Causes, Consequences And Trends - Cyber Terrorism – Counter Terrorism.

UNIT II ENVIRONMENTAL ISSUES

Global Warming and Climate Change - Threats to Bio-Sphere and Space - Pollutions, De-Forestation, Solid, Chemical and Nuclear Wastes and their Management - Preserving the Green Cover and Wild Life.

UNIT III DEVELOPMENTAL ISSUES

Food Security - Poverty and Hunger - Energy Security - Supply and Demand - Traditional and Alternative Sources of Energy – ITER - Health Security – Health for all - Development Vs. Environment - Sustainable Development.

UNIT IV ECONOMIC ISSUES ON INTERNATIONAL TRADE

International Trade - GATT, WTO - Regional Associations - ECM, ASEAN, OPEC, BRICS - Financial Crisis - ASEAN, Mexico and Greece - Global Issues in Trade and Commerce.

UNIT V CIVILIZATION ISSUES

Human Rights - Issues Relating to Freedom of Speech and Expression - Right to Self Determination - Preservation of Cultures and Cultural Diversities - Rights of Women and Children - Dividends of Globalization and Social Justice – Good Governance.

TEXT BOOKS

1. Payne R, “Global Issues”, 4th Edition, Pearson Education Ltd., New York, 2013.
2. Owens P, Baylis J, Smith S, “The Globalization of World Politics”, 3rd Edition, Oxford University Press, USA, 2013.

REFERENCE

1. Chirco J.A, “Globalization: Prospects and Problems”, Sage Publications, New Delhi, 2013.

15TD11E INDIAN CULTURE AND HERITAGE L T P C
0 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: describe Indian culture, civilization and its features.
CO2: demonstrate stone age, Indian races and their contribution in pre-historic culture.
CO3: explain historical development of Indian culture.
CO4: explain the significance, conditions and development of Vedic culture.
CO5: analyze the advent of Islam and European culture.

UNIT I INTRODUCTION

Introduction to Culture - Meaning and Scope - Culture and Civilization - General Characteristics Features of Indian Culture - Geographical Impact on Indian Culture.

UNIT II PRE-HISTORIC CULTURE

Dravidian Culture - Old Stone Age - New Stone Age - Metal Age - Indian Races and their Contribution to Indian Culture.

UNIT III HISTORICAL DEVELOPMENT OF INDIAN CULTURE

Indus Valley Culture - City Planning - Social and Religious Conditions - Vedic and Later Vedic Cultures - Dharmasastras and Caste Systems - Comparison of Indus and Vedic Culture - Importance of Indus Valley and Vedic Cultures.

UNIT IV CULTURE IN SANGAM AGE AND POST SANGAM AGE

Sangam Literature - Society - Political and Economical Conditions - Trade - Religion and Fine Arts.

UNIT V ADVENT OF ISLAM AND EUROPEAN CULTURE

Impact on Indian Culture and Heritage – Reform Movements - Brahma Samaj, Ariya Samaj, Self Respect Movement – Post Colonial Development.

TEXT BOOKS

1. Luniya B.N, "Evolution of Indian Culture", Lakshmi Narain Agarwal Publishers, Agra, 1986.
2. Jeyapalan N, "History of Indian culture", Atlantic publishers, New Delhi, 2001.
3. Sharma H.C, "Indian Culture and Heritage", Neha Publishers & Distributors, New Delhi, 2012.

REFERENCES

1. John G.A, "Dictionary of Indian Philosophy (Sanskrit-English)", University of Madras, Madras, 1998.
2. Misra R.S, "Studies in philosophy and Religion", Bharathiya Vidya Prakasans, Varanasi, 1991.
3. Misra S.K, "Culture and Rationality", Sage publications India Pvt. Ltd., New Delhi, 1988.
4. Suda J.P, "Religious in India", Sterling Publishers Pvt. Ltd., New Delhi, 1978.

15TD12E INDIAN HISTORY L T P C
0 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: illustrate the basics of Indian cultural heritage.
CO2: describe interaction between Ancient Indian cultural heritage and Islamic culture.
CO3: demonstrate Innovation by rulers of medieval period in the area of Administration, and their contact with the Europeans.
CO4: analyse modern Indian movements, Economic history and Impact of the British rule on India.
CO5: demonstrate the concepts of Indian National Movement and the history of freedom struggle in India.

UNIT I ANCIENTY INDIAN CULTURE

Ancient Indian Cultural Heritage - Social, Political, Legal and in the Area of Religion and Philosophy.

UNIT II LAW RELATING TO CULTURE

Law Givers and Dispute Resolution Systems in Ancient India (Administration of Justice in Ancient India - Pre-Islamic Period) - Law Relating to Culture - The Advent of Islam - Interaction between Ancient Indian Cultural Heritage and Islamic Culture - The Emergence of Synthetic Indian Culture.

UNIT III ADMINISTRATION IN ANCIENT INDIA

Innovation by Rulers of Medieval Period in the Area of General and Revenue Administration - District Administration - Court Systems - Indian Contact with the Europeans.

UNIT IV SOCIO-ECONOMIC HISTORY

Socio-Religious Reform Movements in Modern India and its Legal Culture - Economic History of India During British Period - Impact of the British Rule on India – Education.

UNIT V EUROPEAN CULTURE IMPACT

Impact of European Culture and Liberal Thought on India – The Indian National Movement - The History of Freedom Struggle in India upto 1947.

TEXT BOOKS

1. Sreenivasa M.H.V, “History of India Part I and II”, JBA Publishers, New Delhi, 2015.
2. Agarwal R.C, Bhatnagar M, “Constitutional Development and National Movement of India”, S. Chand Publishers, New Delhi, 2005.

REFERENCES

1. Altekar S, “State and Government in Ancient India”, Motilal Banarsidass Publishers, New Delhi, 2002.
2. Majumdur R.C, “History and Culture of the Indian People”, Vol. 2, The Age of Imperial Unity, Bharatiya Vidya Bhavan, New Delhi, 2001

15TD13E SUSTAINABLE DEVELOPMENT AND PRACTICES L T P C
0 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: recognize the sustainable development and the way to achieve the sustainable development.
CO 2: outline the concept, factors governing the sustainability and their linkages.
CO 3: explain the environmental impact assessment and environmental audit.
CO 4: describe the environmental planning and managing the resources.
CO 5: acquire the knowledge about the environmental problems and their solutions.

UNIT I SUSTAINABLE DEVELOPMENT

Need for Sustainability - Nine Ways to Achieve Sustainability - Economics as the Dismal Science - Population, Resources and Environment.

UNIT II CHALLENGES OF SUSTAINABLE DEVELOPMENT

Concept of Sustainability - Factors Governing Sustainable Development - Linkages among Sustainable Development, Determinants of Sustainable Development - Case Studies on Sustainable Development.

UNIT III ENVIRONMENT IMPACT ASSESSMENT AND AUDIT

Concepts-process-evaluation methodology-EIA and EMS integration-setting up of audit programme - typical audit process - carrying out the audit-benefits of environmental auditing-environmental audit programmes in India.

UNIT IV ENVIRONMENTAL PLANNING

Introduction - Perspective of Environmental Planning - land resource development planning - Planning and managing the natural resources - landscape ecological planning - information and decision of environmental planning - Land use policy in India.

UNIT V ENVIRONMENTAL EDUCATION

Knowledge about the environment - Knowledge about the environment and population growth -Knowledge about the solution and environmental problems - Environmental education (EE) – Strategies for EE – Models for future Environmental Education Systems.

TEXT BOOKS

1. Rogers P, Jalal K.F, Boyd J.A, "An Introduction to Sustainable Development", Earth scan Publications Ltd., UK, 2006.
2. Santra S.C," Environmental Science", 3rd Edition, New Central Book Agency (P) Ltd., London, 2013.

REFERENCES

1. Stavins R.N. "Economics of the Environment: Selected Readings", 5th Edition, W.W. Norton and Company, New York, 2005.
2. Sachs J.D, "The Age of Sustainable Development", Columbia University Press, New York, 2015.

15TD14E WOMEN IN INDIAN SOCIETY L T P C
0 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Demonstrate historical perspective about women in Indian society.
CO2: Explain social problems of women.
CO3: Understand the legislation for women protection in India.
CO4: Demonstrate the involvement of women literacy, career and politics.
CO5: Analyse the role of NGO's in women empowerment.

UNIT I INTRODUCTION

A Historical Perspective - Early Vedic, Colonial and Modern Periods - Position of Women in Contemporary India.

UNIT II SOCIAL ISSUES

Issues of Girl Child - Female Infanticide and Foeticide, Sex Ratio, Child Marriage, Dowry and Property Rights - Women's Health and Birth Control - Reproduction - Violence against Women - Domestic Violence - Female Headed Households - Women in the Unorganized Sector of Employment - Women's Work- Status and Problems - Problems of Dalit Women.

UNIT III PROTECTIVE LEGISLATION FOR WOMEN

Protective Legislation for Women in the Indian Constitution - Anti Dowry, SITA, PNDT, And Prevention Sexual Harassment At Workplace (Visaka Case) - Domestic Violence (Prevention) Act.

UNIT IV WOMEN AND EDUCATION

Formal and Non-Formal Literacy - Post Literacy - Vocational Training - Dual Career Modernization – Women and Politics - Political Status - Global Movements and Indian Movements.

UNIT V ROLE OF NGO'S IN WOMEN EMPOWERMENT

Gender Economy - All India Women's Conference (AIWC) – Women's India Association (WIA) - National Council of Women in India (NCWIE) - Indian Association of Women's Studies – Women Development Cells - Self Help Groups.

TEXT BOOKS

1. Majumdar M, "Social Status of Women in India", Wisdom Press, New Delhi, 2012.
2. Harish R, Harishankar V.B, "Re-Defining Feminisms", Rawat Publications, Jaipur, 2011.

REFERENCES

1. Rathod P.B, "An Introduction to Women's Studies", ABD Publishers, Jaipur, 2010.
2. Ray R, "Hand Book of Gender", Oxford University Press, New Delhi, 2012.

15TD15E INDIAN CONSTITUTION L T P C
0 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: describe the basic understanding of the Indian Constitution.
CO2: understand the structure and functions of parliament.
CO3: demonstrate the organization and working of the Judiciary.
CO4: understand the structure and functions of state legislature.
CO5: understand the 73rd and 74th Constitutional Amendments.

UNIT I INDIAN CONSTITUTION

Salient Features - Preamble - Fundamental Rights – Directive Principles of State Policy - Fundamental Duties.

UNIT II PARLIAMENTARY SYSTEM

Powers and Functions of President and Prime Minister - Council of Ministers - The Legislature Structure and Functions of Lok Sabha and Rajya Sabha – Speaker.

UNIT III THE JUDICIARY

Organisation and Composition of Judiciary - Powers and Functions of the Supreme Court - Judicial Review – High Courts.

UNIT IV STATE GOVERNMENTS

Powers and Functions of Governor and Chief Minister – Council of Ministers - State Legislature.

UNIT V LOCAL GOVERNMENTS

73rd and 74th Constitutional Amendments – Federalism - Center – State Relations.

TEXT BOOKS

1. Basu D.D," Introduction to Indian Constitution", Prentice Hall of India, New Delhi, 2015.
2. Gupta D.C, "Indian Government and Politics", Vikas Publishing House, New Delhi, 2010.

REFERENCES

1. Pylee M.V, "Introduction to the Constitution of India", Vikas Publishing House, NewDelhi, 2011.
2. Kashyap S, "Our Constitution", National Book Trust, New Delhi, 2010.

15TD16E BIO MECHANICS IN SPORTS L T P C
0 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1**:** discuss the basics of biomechanics in sports & movement technique accurately.
CO2**:** discuss the basics of linear kinematics and its applications in the field of sports.
CO3: demonstrate the linear kinematics in the field of sports.
CO4**:** discuss the basics of angular kinematics and its applications in the field of sports.
CO5: demonstrate the angular kinematics in the field of sports.

UNIT I INTRODUCTION

Meaning, Aim and Objectives, Importance of Biomechanics in Sports - Types of Motion Linear, Angular, Curvilinear and Circular Motion.

UNIT II LINEAR KINEMATICS

Speed, Velocity, Acceleration, Motion, Projectile Motion – Application of Linear Kinematics in The Field of Physical Education and Sports.

UNIT III ANGULAR KINEMATICS

Angular Speed - Angular Velocity - Angular Acceleration - Relationship between Linear and Angular Motion – Application of Angular Kinematics in the Field of Physical Education and Sports.

UNIT IV LINEAR KINETICS

Mass, Weight, Force, Pressure, Work, Power, Energy, Impulse, Momentum, Impact, Friction, Newton's Law of Motion - Law of Inertia and Types of Inertia.

UNIT V ANGULAR KINETICS

Levers, Equilibrium and Centre of Gravity – Friction and its Types, Centrifugal and Centripetal Force Bio Mechanical Principles Involved in Designing Sports Equipments.

TEXT BOOKS

1. Singh S.K, "Biomechanics in Sports", Neha Publishers & Distributors, New Delhi, 2009.
2. McGinnis P.M, "Biomechanics of Sports and Exercise", 2nd Edition, Human Kinetics Publishers, USA, 2004.

REFERENCES

1. Saxena A, “Biomechanics in Sports”, Neha Publishers & Distributors, New Delhi, 2011.
2. Heyward V.H, Gibson A.L, “Advanced Fitness Assessment and Exercise Prescription”, 7th Edition, Human Kinetics, USA, 2014.