BIRLA VISHVAKARMA MAHAVIDYALAYA

(ENGINEERING COLLEGE)

(AN AUTONOMOUS INSTITUTION)

VALLABH VIDYANAGAR – 388120, GUJARAT

AFFILIATED TO GUJARAT TECHNOLOGICAL UNIVERSITY

ACADEMIC REGULATIONS

AND

COURSES OF STUDY

FOR

FOUR YEAR DEGREE PROGRAMMES LEADING TO BACHELOR OF TECHNOLOGY (B.TECH.)

IN

ELECTRONICS ENGINEERING

Implemented from the batch admitted in academic year 2018-19

Contents

Institute Vision

"Produce globally employable innovative engineers with core values."

Institute Mission

- Re-engineer curricula to meet global employment requirement
- Promote innovative practices at all levels.
- Imbibe core values
- Reform policies, systems and processes at all levels.
- Develop faculty and staff members to meet the challenges

Core Values

Quality, Creativity, Team Work, Lifelong Learning, Pro-activeness, Cost Consciousness, Sharing, Transparency

B. Tech. Electronics programme offered by Department of Electronics Engineering

Programme Vision

"Produce globally employable innovative Electronics Engineers with core values"

Programme Mission

- Promote innovative practices to strengthen teaching and learning process in Electronics engineering
- Develop faculty and staff members to meet challenges in Electronics engineering
- Adapt engineering curricula to meet global requirements for Electronics engineering programme
- Reform policies, systems and processes at all levels
- Imbibe core values.

Program Educational Objectives (PEO's):

1. Study and Analysis of Electronics Engineering Systems
2. Adapt state-of-the-art developments in Electronics Engineering and eco-friendly technologies
3. Design and Develop Electronics hardware and software based applications

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

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

Program Specific Outcomes (PSO) for Electronics Engineering Program:

1. Analyze electronic circuits and performance evaluation of electronics system.
2. Design analogue and digital circuits using relevant software and hardware for various applications in electronics domain.
3. Demonstrate the skills to design electronics systems.

Academic Regulations (Major) – UG.18

FOR **UNDER GRADUATE** PROGRAMMES (FULL TIME)

UG.18.1 ADMISSION

UG.18.1.1 A candidate seeking admission to the four year degree programme for Bachelor of Technology must have eligibility as per the Gujarat Government/ Admission Committee for Professional Courses (ACPC) / Gujarat Technological University (GTU)/ Charutar Vidya Mandal (CVM) rules.

UG.18.1.2 Admission granted to an applicant is to be considered provisional until all the fees are paid and all the prescribed documents are in order. BVM Engineering College DISCLAIMS ALL RESPONSIBILITIES**,** if any, of the documents required as per ACPC/ GTU norms, which are not submitted or found unacceptable by it. The institute will not accept any responsibility for students who do not submit the expected examination / registration / enrollment forms in time.

UG.18.2 PROGRAMMES OF STUDY

UG.18.2.1 A student shall undergo the prescribed courses as given in the programme of studies to obtain his/her degree in major in which he/she is admitted. These courses for various programmes are listed in Annexure – I.

UG.18.2.2 A student shall undergo the courses as prescribed by the respective Board of Studies from time to time to obtain minor engineering degree in the respective programme(s). For awarding minor degree, regulations are annexed here as Annexure – III.

UG.18.3 COURSE LEVELS

UG.18.3.1 At the commencement of each semester a student shall register for the set of courses offered during the semester. For the registration process, refer UG.18.9.

UG.18.3.2 All courses offered are divided into four levels: Level 1 to Level 4. The levels correspond to successive years of study of a typical B. Tech. student, i.e. a regular student will complete his/her Level-1 courses during his/her first year, Level-2 courses during his/her second year, and so on.

UG.18.4 COURSE CATEGORIES

Courses taken by a student to complete his/her degree programme are divided into Humanities and Social Science, Basic Science, Engineering Science, Mandatory Courses, Professional Core Courses, Programme Elective Courses, Open Elective Courses, Project Work, Seminar and Internship.

UG.18.4.1 COMPULSORY COURSES

Each programme of studies contains a certain number of compulsory courses, they are categorized as Programme core courses, seminar and project work / dissertation.

UG.18.4.2 PROGRAMME ELECTIVE COURSES

Each programme of studies contains a certain number of programme elective courses. Programme elective courses will be offered under each discipline at corresponding level from which a student may choose course(s).

UG.18.4.3 **OPEN ELECTIVE COURSES**

Open elective courses are courses offered by a discipline for students other than the corresponding discipline.

UG.18.4.4 **MANDATORY NON CREDIT COURSES**

Each programme of studies contains a certain number of mandatory non-credit courses decided by respective Board of Studies.

UG.18.5 DEFINATION OF STATUS OF COURSE

UG.18.5.1 **REGULAR COURSES**

Each programme of studies contains a certain number of courses (including elective courses and mandatory non-credit courses) to be studied in respective semester decided by respective Board of Studies.

UG.18.5.2 **BACKLOG COURSES**

The courses in which student has not obtained letter grade DD or above / PP at first attempt (Refer UG.18.13).

UG.18.6 PRE-REQUISITES

UG.18.6.1 A student shall not be allowed to enroll for any course at Level-4 unless he/she has completed all his/her course requirements at Level-1 with acceptable grades (Refer UG.18.13).

UG.18.7 COURSE CREDITS

UG.18.7.1 Each course offered has **L-T-P** structure, where "**L"** means number of theory lecture hours per week, **T** means number of tutorial hours per week and "**P"** means number of practical hours per week.

UG.18.7.2 Total course credits for a course are obtained by adding credits of theory lectures, tutorials and practical together. e.g. 1 hr. Lecture = 1 credit, 1 hr. Tutorial = 1 credit & 1 hr. Practical = 0.5 credit.

UG.18.8 FACULTY COUNSELOR

UG.18.8.1 Each student is assigned to a Faculty Counselor who will advise and counsel him/her regarding the selection of courses to be registered in a given semester as well as monitor his/ her holistic growth.

UG.18.8.2 Each student must obtain approval for "Backlog" courses (Refer UG.18.5.2) from the Faculty Counselor.

UG.18.9 REGISTRATION

UG.18.9.1 To earn course credits in a semester a student must register for the courses at the commencement of the semester.

UG.18.9.2 At the commencement of each semester the **first working day** is designated as the Registration Day. A student must complete his/her registration formalities on that day as per the procedure laid down by the institute.

UG.18.9.3 A further period of 12 working days is designated as late registration period. During this period a student shall require to pay late registration fees, as decided by the institute from time to time to complete his/her registration. Late registration will only be permitted on genuine reasons, (Refer UG.18.12.3) subject to the approval of the Principal.

UG.18.9.4 Student shall not be permitted to attend classes without registration.

UG.18.9.5 The registration must be completed by the student in person.

UG.18.9.6 A student who has completed all the requirements for his/her B. Tech. degree (Refer UG.18.19) will not be allowed to register in any further courses.

UG.18.9.7 All registrations in every semester must be duly approved by the Principal.

UG.18.9.8 Student should obtain approval from Faculty Counsellor to register any Backlog course(s) within 10 days of declaration of results of the previous semester or first 10 days of the commencement of semester, whichever is later.

UG.18.9.9 Total number of credits for Backlog courses should not be more than 24.

UG.18.10 WITHDRAWAL

UG.18.10.1 Student may withdraw all the courses registered in a semester before four weeks of commencement of End Semester examination. Further, on genuine reasons (Refer UG.18.12.3) a student can withdraw at any time during the entire semester. In such cases NO FEES will be refunded.

UG.18.11 ASSESSMENT OF STUDENT PERFORMANCE IN A COURSE

UG.18.11.1 The performance of a student in a course will be evaluated based on (i) continuous assessment of theory and tutorial/practical work and (ii) end-semester theory and tutorial / practical examinations.

UG.18.11.2 The end- semester theory examination in a course has a weightage of 60 % of total theory marks. Out of the remaining 40 % of theory marks, 30 % of marks will be evaluated based on mid semester examination and remaining 10 % based on continuous assessment carried out during the semester as declared by the course coordinator in first week of beginning of the semester.

UG.18.11.3 The end-semester tutorial/practical examination in a course has a weightage of 40 percent of total tutorial/practical marks and continuous assessment of the same carries the remaining 60 % of total tutorial/practical marks. Tutorial/practical work (both end-semester and continuous) shall be evaluated on the basis of the following instruments of assessment: observation of experimental skills, reports, oral examination, quizzes, end-semester practical examination and attendance.

Continuous assessment (tutorial/practical) scheme is given below:

Term work	30 % (Equal weightage for every practical. At least 10 practical/tutorial need to be performed or mini project)
Quiz/Assignment/ Viva/ active learning component	30 %
Total	**60 %**

The respective Board of Studies shall decide the list of the courses in which end semester practical evaluation is feasible. In such courses evaluation shall be based on practical as well as viva for 40 % marks of end semester tutorial/practical. If practical performance is not feasible then 40 % of marks as end semester tutorial/practical evaluation will be based only on viva**.**

UG.18.11.4 The overall performance of a student in a course is assessed on the principle of "single head of passing", i.e., there will be a single grade for a course based upon the aggregate of marks obtained by the student in theory and tutorial/practical components in continuous assessment as well as end semester examination. However, a student must score minimum 35% marks in end semester theory and tutorial/practical examination to make himself/ herself gradable.

UG.18.12 EXAMINATIONS

UG.18.12.1 The end-semester examination for all courses offered in an academic year will be conducted by the institute for awarding 60 % of marks out of the total theory marks.

UG.18.12.2 No student shall be allowed to appear in the end semester examination unless he/she has attended 100% of theory and tutorial/practical classes of each course and will be awarded letter grade FA (Refer UG.18.13) in all the courses he/she has registered in the corresponding semester, except backlog courses.

However, a maximum 25 % relaxation in attendance is permissible with prior intimation, along with required documents, from concerned authorities. The relaxation includes medical, co-curricular and extra-curricular activities, genuine social engagements etc.

UG.18.12.3 The institute will conduct two continuous assessment of theory (mid semester examination) in a semester for each course for the evaluation of 30 % of total theory marks. The average marks of two mid semester examinations shall be considered as the final marks for mid semester examination.

A student who remains absent in any of the two mid semester examination for whatsoever reason(s) shall be awarded with zero marks in the respective mid semester examination.

However, if a student remains absent due to any of the following genuine reasons, for such students a special examination may be conducted by the department and marks obtained in the special examination will be considered as marks of the mid semester examination in which he/she has remained absent. Such student should obtain prior approval from the Principal.

a) A student is critically ill or injured and certified by Civil Surgeon.
b) Death of direct blood relation relative.
c) A student representing Gujarat state in national level events and/or India in International events organized by official boards.

UG.18.12.4 The institute will conduct only one continuous assessment of theory (mid semester examination) for all courses of the semester in the following cases.

a) First Semester of B. Tech. programme.
b) Third semester of B. Tech. programme for the students who are admitted in the second year of B. Tech. Diploma to Degree students.
c) Corresponding semester of the year of transfer for transferred students or international students, if the admission of such students is five weeks later than commencement of academic calendar.

UG.18.12.5 No student shall be allowed to appear in the end semester examination of a course unless he/she has scored at least 35% marks in mid semester examination and will be considered in "NOT PERMITTED TO APPEAR (NPTA)" status for the respective course and letter grade "NA" will be awarded (Refer UG.18.13).

The NPTA student(s) shall appear in mid semester remedial examination of the next semester.

UG.18.12.6 The End Semester tutorial/practical examination shall be rearranged for a student who is not able to appear in the regular schedule due to genuine reason(s) (Refer UG.18.12.3). Such student should obtain prior approval from the Principal.
However, such rearrangement should be confined within the Academic Calendar of the respective semester.

UG.18.13 LETTER GRADES

UG.18.13.1 The overall performance of a student in credit courses is represented by a letter grade from AA to FP, FA, NA and WD with the following meaning and equivalent grade points:

LETTER GRADE	EQUIVALENT GRADE POINTS	REMARK
AA	10	Outstanding
AB	9	Excellent
BB	8	Very Good
BC	7	Good
CC	6	Average
CD	5	Satisfactory
DD	4	Pass
FP	0	Failure due to Performance
FA	0	Failure due to Attendance
NA	0	Not Permitted To Appear
WD	0	Withdrawal

For non-credit courses the evaluation will be PASS or FAIL and for that the letter grade will be awarded PP or FP, respectively.

UG.18.13.2 A credit course is said to be completed successfully, only if a letter grade DD or better (in grade points) is obtained in that course.

UG.18.13.3 A non-credit course is said to be completed successfully only if a letter grade PP is obtained in that course.

UG.18.13.4 The scheme of awarding letter grades and the letter grades awarded in each course are subjected to scrutiny and approval by the Academic Council.

UG.18.14 FAILURE IN A COURSE

UG.18.14.1 A student earns **zero** credit for a course when he/she gets letter grade FP, NA, FA or WD in that credit course.

UG.18.14.2 If letter grade FA is obtained in an elective course, the student may change the elective.

UG.18.14.3 A student with letter grade FA/WD in courses should re-register the courses subsequently whenever offered.

UG.18.14.4 A student with letter grade FP should appear, at the earliest, in the end semester theory as well as practical/ viva exam and should obtain a letter grade DD or better (in grade points) in credit courses and PP in non-credit courses.

UG.18.14.5 A student having more than six Backlog courses (Refer UG.18.6.2) will not be allowed to move to the next level.

UG.18.15 SEMESTER PERFORMANCE INDEX (SPI)

UG.18.15.1 The performance of a student in a semester is expressed in terms of the semester Performance Index (SPI).

UG.18.15.2 The semester Performance Index is the weighted average of course grade points obtained by the student in the regular courses (Refer UG.18.6.1) registered in the semester. The weights assigned to course grade points are the credits carried by the respective courses.

That is,

$$SPI = \frac{\sum_{i=1}^{n} g_i c_i}{\sum_{i=1}^{n} c_i}$$

where, g_i is the equivalent grade point of i^{th} course,
c_i is the credit of the course
n is total number of regular courses registered by the student in a semester

UG.18.16 CUMULATIVE PERFORMANCE INDEX (CPI)

UG.18.16.1 The cumulative performance of student is expressed in terms of the Cumulative Performance Index (CPI). This index is defined as the weighted average of course grade points obtained by the student for all courses taken since his/her entry to the programme. The weights are defined in same way as in UG.18.15.2.

UG.18.16.2 If a student repeats a course, only the grade points obtained in the latest attempt is counted towards the Cumulative Performance Index (CPI).

UG.18.17 ADMISSION BY TRANSFER

UG.18.17.1 Any student aspiring for admission by transfer in any B.Tech. programme is not eligible for the same after 5th Semester of the respective B.Tech. programme.

UG.18.17.2 For a student admitted by transfer to any B.Tech. programme after completing part of his/her degree requirements elsewhere or under the previous academic regulations of BVM, he/she will be allowed to continue in subsequent level after completing all the requirements of previous levels of the respective institute or previous academic regulation. He/She will be exempted from all courses upto the completed levels. For these courses "EXEMPTED" status will be shown in the Transcript.

UG.18.17.3 The remaining requirements must be completed by the student as per UG.18.18.

UG.18.17.4 The CPI of such a student will be calculated only on the basis of the courses taken after transfer.

UG.18.18 REQUIREMENTS FOR THE AWARD OF B. Tech. DEGREE

UG.18.18.1 To be eligible for the award of the degree of Bachelor of Technology a student must earn total credits as prescribed by respective Board of Studies.

UG.18.18.2 The total credits requirements for the degree of B. Tech. must be completed in not more than 16 semesters from the date of admission. However, for a student admitted by transfer or Diploma to Degree (D2D) the maximum permissible duration shall be 100 % more than the period prescribed for completion of the programme at the time of admission.

UG.18.19 AWARD OF CLASS

UG.18.19.1 The class awarded to a student with his B. Tech. degree is decided by his final CPI as per the following table:

FIRST CLASS WITH DISTINCTION	- CPI not less than 7.10
FIRST CLASS	- CPI less than 7.10 but not less than 6.50
SECOND CLASS	- CPI less than 6.50 but not less than 5.50
PASS CLASS	- CPI less than 5.50

A candidate who passes in all courses and all heads of passing in the examination shall be given a gracing of the required CPI for getting second class/first class/first class with distinction, subject to a maximum of CPI 0.10, in concurrence with rules and guidelines of AICTE/ GTU.

UG.18.20 TRANSCRIPT

UG.18.20.1 The Transcript will be issued to the student as and when required and will contain a consolidated record of all the courses undergone by him/her, grades obtained and CPI upto the date of issue of transcript.

UG.18.20.2 Only last letter grade obtained in a course by the student upto the date of issue of transcript will be shown in the Transcript.

UG.18.21 EXAMINERS

UG.18.21.1 The respective board of studies shall appoint at least two examiners for end semester theory as well as practical/viva examination. For each end semester theory examination, there shall be two paper setters. One paper setter out of the two shall be from outside the institute (external examiner). The end semester practical examination of each subject shall be conducted by an internal (Examiner from the institute) and an external examiner. For 4^{th} level courses, each end semester theory examination evaluation shall be made by an internal and an external examiner. One of the internal examiner/s shall be appointed as convener who shall co-ordinate the examination procedure for end semester examinations of the respective subject.

UG.18.21.2 In the end semester practical examination maximum upto 60 students can be examined per day per examiner for first, second and third level courses and upto 45 students can be examined per day per examiner for fourth level courses.

UG.18.21.3 In the end semester practical examinations of Projects maximum upto 12 groups can be examined per day per examiner.

In the end semester practical examinations of Seminars maximum upto 20 groups can be examined per day per examiner

UG.18.22 REVIEW OF ESE THEORY ANSWER BOOKS

UG.18.22.1 A student shall apply for review of end semester theory answer book(s) within 7 working days after declaration of semester results. The student will have to pay the fees for the same as decided from time to time.

The answer book(s) of the student(s) who has applied for the review will be shown to him/her.

If student is satisfied with the assessment then he/she shall sign the answer book with a remark "Seen and Satisfied".

If student is not satisfied with the assessment, then the respective Board of Studies shall appoint two examiners (Convener of original exam and a new examiner) for the review of the end semester examination (theory) both sections. Both examiners

shall jointly review both the sections and marks awarded in the previous assessment shall be kept open.
The marks obtained by the candidate after the review shall be considered for grading, only if, the change in mark is more than or equal to 10% of total mark of End Semester (Theory) Examination.

If change in grade is found after review, the review fees shall be refunded.

UG.18.23 GRADING

UG.18.23.1 The office of Controller of Examinations shall prepare the histogram of each course for the purpose of grading after the completion of assessment of the course.

UG.18.23.2 The convener of the respective course shall grade the students based on the histogram provided by the Controller of Examinations.

UG.18.24 GRADE REVIEW

UG.18.24.1 The Academic Council shall appoint a Grade Review Committee for each semester. The Grade Review Committee shall comprise of following members:

(a) Principal
(b) All Board of Studies Chairman
(c) University Nominee
(d) Dean, Academics
(e) Associate Dean, Academics
(f) Controller of the Examinations
(g) Joint Controller of Examinations
(h) Member Secretary, Academic Council
(i) Officer-in-Charge of Credit System

UG.18.24.2 The Grade Review Committee shall meet immediately after results of all courses are completed and review the grades awarded by the convener of respective course. The revision of the grade suggested by the Grade Review committee shall be considered as final grade and binding.

UG.18.24.3 The Grade Review Committee can grace upto 10 % of total marks of theory examination in marks of end semester theory exam to make a student gradable. However grace marks shall not be counted in the aggregate marks obtained by the student for the grade.

ANNEXURE – I: Programme of studies leading to the degree of the Bachelor of Technology (Electronics Engineering)

Semester 1

Sr. No.	Course Code and Course Title	L	T	P	H	C
1	**BS111: ADVANCED CALCULUS**	3	1	0	4	4
2	**ES109: ENGINEERING GRAPHICS AND DESIGN**	2	0	4	6	4
3	**ES103: BASIC ELECTRICAL ENGINEERING**	3	0	2	5	4
4	**BS104: SEMICONDUCTOR PHYSICS**	3	0	2	5	4
5	**HS101: ENGLISH**	2	0	2	4	3
		13	**1**	**10**	**24**	**19**

*For Students admitted in AY 2018-19, **BS101: ADVANCED CALCULUS** (LTP:3,2,0)

Semester 2

Sr. No.	Course Code and Course Title	L	T	P	H	C
1	**BS112: LINEAR ALGEBRA AND FOURIER SERIES**	3	1	0	4	4
2	**ES105: PROGRAMMING FOR PROBLEM SOLVING**	3	0	2	5	4
3	**BS105: ELECTROMAGNETIC PHYSICS**	3	0	2	5	4
4	**ES101: BASIC ELECTRONICS**	3	0	2	5	4
5	**ES112: BASICS OF MANUFACTURING PRACTICES**	0	0	2	2	1
6	**ES102: ELECTRONICS WORKSHOP**	0	0	2	2	1
7	**HS112: ENVIRONMENTAL SCIENCE**	3	0	0	3	0
		15	**1**	**10**	**26**	**18**

[#] For Students admitted in AY 2018-19,**BS102: LINEAR ALGEBRA AND FOURIER SERIES** (LTP-3,2,0)

[$] For Students admitted in AY 2018-19, **HS102: ENVIRONMENTAL SCIENCE** (LTP-2,2,0)

Semester 3

Sr. No.	Course Code and Course Title	L	T	P	H	C
1	**2BS01: ORDINARY DIFFERENTIAL EQUATIONS AND STATISTICS**	3	1	0	4	4
2	**2EL01: SIGNALS AND SYSTEMS**	3	0	0	3	3
3	**2EL02: NETWORK THEORY**	3	0	0	3	3
4	**2EL03: ANALOG ELECTRONICS**	3	0	0	3	3
5	**2EL04: ANALOG ELECTRONICS LABORATORY**	0	0	2	2	1
6	**2EL05: DIGITAL LOGIC DESIGN**	3	0	0	3	3
7	**2EL06: DIGITAL LOGIC DESIGN LABORATORY**	0	0	2	2	1
8	**2EL07: ELECTRONIC DESIGN AND AUTOMATION TOOLS**	0	0	2	2	1
9	**2HS01: PROFESSIONAL SOFT SKILLS**	1	0	2	3	2
		16	**1**	**8**	**25**	**21**

Semester 4

Sr. No.	Course Code and Course Title	L	T	P	H	C
1	**2EL08: ANALOG AND DIGITAL COMMUNICATION**	3	0	0	3	3
2	**2EL09: ANALOG AND DIGITAL COMMUNICATION LABORATORY**	0	0	2	2	1
3	**2EL10: CONTROL THEORY**	3	0	0	3	3
4	**2EL11: MICRO-CONTROLLERS**	3	0	0	3	3
5	**2EL12: MICROCONTROLLERS LABORATORY**	0	0	2	2	1
6	**2EL13: SENSORS AND TRANSDUCERS**	3	0	0	3	3
7	**2EL14: SENSORS AND TRANSDUCERS LABORATORY**	0	0	2	2	1
8	**2HS02: ECONOMICS AND MANAGEMENT**	3	0	0	3	3
9	**2EL31: MINI PROJECT**	0	0	2	2	1
		15	**0**	**8**	**23**	**19**

	ELIT1: Summer Internship – I (Two Weeks)	-	-	-	-	**0**

Semester 5

Sr. No.	Course Code	Name of Course	L	T	P	H	C
1		**Open Elective - I**	3	0	0	3	3
2	3EL01	PROBABILITY THEORY AND STOCHASTIC PROCESSES	3	0	0	3	3
3	3EL02	ANALOG CIRCUIT DESIGN	3	0	0	3	3
4	3EL03	ANALOG CIRCUIT DESIGN LABORATORY	0	0	2	2	1
5	3EL04	EMBEDDED AND IOT SYSTEM DESIGN	3	0	0	3	3
6	3EL05	EMBEDDED AND IOT SYSTEM DESIGN LABORATORY	0	0	2	2	1
7	3EL06	ELECTROMAGNETICS WAVE THEORY	3	0	0	3	3
8		**Program Elective - I**	3	0	2	5	4
		Total	18	0	6	24	21

Open Elective - I

1.	3CE81	ENVIRONMENT AND HEALTH	3	0	0	3	3
2.	3CE83	EARTH SYSTEM AND GEO-ENVIRONMENT	3	0	0	3	3
3.	3SE81	DISASTER MANAGEMENT AND MITIGATION	3	0	0	3	3
4.	3CP81	FUNDAMENTALS OF COMPUTER NETWORKS AND SECURITY	3	0	0	3	3
5.	3CP82	FUNDAMENTALS OF OPERATING SYSTEMS	3	0	0	3	3
6.	3IT81	CYBER SECURITY	3	0	0	3	3
7.	3IT82	INTERNET TECHNOLOGY	3	0	0	3	3
8.	3IT83	SOFTWARE PROJECT MANAGEMENT	3	0	0	3	3
9.	3IT84	ENTERPRISE RESOURCE PLANNING	3	0	0	3	3
10.	3EE81	ENERGY AUDIT & CONSERVATION	3	0	0	3	3
11.	3EE83	INSTALLATION AND COMMISSIONING OF ELECTRICAL EQUIPMENTS	3	0	0	3	3
12.	3ME81	INDUSTRIAL ENGINEERING AND QUALITY ASSURANCE	3	0	0	3	3
13.	3ME82	PROJECT MANAGEMENT	3	0	0	3	3
14.	3PE81	PRINCIPLES OF SUPPLY CHAIN MANAGEMENT	3	0	0	3	3
15.	3PE82	INDUSTRIAL INTERNET OF THINGS	3	0	0	3	3

		Program Elective - I					
1	**3EL41**	**PROCESS INSTRUMENTATION AND CONTROL**	**3**	**0**	**2**	**5**	**4**
2	**3EL42**	**DIGITAL SYSTEM DESIGN**	**3**	**0**	**2**	**5**	**4**
3	**3EL43**	**OPTICAL FIBER COMMUNICATION**	**3**	**0**	**2**	**5**	**4**
		Semester 6					
Sr. No.	**Course Code**	**Name of Course**	**L**	**T**	**P**	**H**	**C**
1		**Open Elective - II**	**3**	**0**	**2**	**5**	**4**
2	**3EL07**	**VLSI DESIGN**	**3**	**0**	**0**	**3**	**3**
3	**3EL08**	**VLSI DESIGN LABORATORY**	**0**	**0**	**2**	**2**	**1**
4	**3EL09**	**DIGITAL SIGNAL PROCESSING**	**3**	**0**	**0**	**3**	**3**
5	**3EL10**	**DIGITAL SIGNAL PROCESSING LABORATORY**	**0**	**0**	**2**	**2**	**1**
6	**3EL11**	**ANTENNAS**	**3**	**0**	**0**	**3**	**3**
7	**3EL12**	**ANTENNAS AND MEASUREMENT LABORATORY**	**0**	**0**	**2**	**2**	**1**
8	**3EL13**	**ELECTRONICS SYSTEM DESIGN LABORATORY**	**0**	**0**	**2**	**2**	**1**
9	**3HS01**	**ETHICS & CONSTITUTION OF INDIA**	**2**	**0**	**0**	**2**	**0**
10		**Program Elective - II**	**3**	**0**	**0**	**3**	**3**
		Total	**17**	**0**	**10**	**27**	**20**
	ELIS2	**Summer Internship – II (Two Weeks)#**	**-**	**-**	**-**	**-**	**0**
		#Non-Credit Mandatory course					
		Open Elective - II					
1.	**3CE82**	**GEO-INFORMATICS**	**3**	**0**	**2**	**5**	**4**
2.	**3SE82**	**ADVANCED STRENGTH OF MATERIALS**	**3**	**0**	**2**	**5**	**4**
3.	**3SE83**	**BASIC CONCEPTS OF STRUCTURAL BEHAVIOUR**	**3**	**0**	**2**	**5**	**4**
4.	**3CP85**	**OBJECT ORIENTED CONCEPTS AND PROGRAMMING**	**3**	**0**	**2**	**5**	**4**
5.	**3CP84**	**INFORMATION TECHNOLOGY ESSENTIALS**	**3**	**0**	**2**	**5**	**4**
6.	**3CP83**	**PROGRAMMING WITH PYTHON**	**3**	**0**	**2**	**5**	**4**
7.	**3IT85**	**WEB APPLICATION AND DEVELOPMENT**	**3**	**0**	**2**	**5**	**4**
8.	**3IT86**	**JAVA PROGRAMING**	**3**	**0**	**2**	**5**	**4**
9.	**3IT87**	**OBJECT ORIENTED PROGRAMMING WITH C++**	**3**	**0**	**2**	**5**	**4**

10	3IT88	MOBILE APPLICATION DEVELOPMENT	3	0	2	5	4
11	3EE82	RENEWABLE ENERGY TECHNOLOGY	3	0	2	5	4
12	3EE84	INDUSTRIAL AUTOMATION	3	0	2	5	4
13	3ME83	RENEWABLE ENERGY SOURCES	3	0	2	5	4
14	3ME84	ENERGY CONSERVATION AND MANAGEMENT	3	0	2	5	4
15	3PE83	MANAGING PROJECTS	3	0	2	5	4
16	3PE84	ADDITIVE MANUFACTURING	3	0	2	5	4
		Program Elective - II					
1	3EL44	PROGRAMMABLE LOGIC CONTROLLERS	3	0	0	3	3
2	3EL45	DIGITAL COMPUTER ORGANIZATION	3	0	0	3	3
3	3EL46	INFORMATION THEORY AND CODING	3	0	0	3	3

Semester 7

Sr. No.	Course Code	Name of Course	L	T	P	H	C
1	4EL01	POWER ELECTRONICS	3	0	0	3	3
2	4EL02	POWER ELECTRONICS LABORATORY	0	0	2	2	1
3	4EL03	WIRELESS COMMUNICATION	3	0	0	3	3
4	4EL04	WIRELESS COMMUNICATION LABORATORY	0	0	2	2	1
5	4EL05	GUIDED RESEARCH READING	0	0	2	2	1
6	4EL31	PROJECT-I	0	0	4	4	2
7		Program Elective - III	3	0	2	5	4
8		Program Elective - IV	3	0	2	5	4
		Total	12	0	14	26	19
		Program Elective - III					
1	4EL41	DIGITAL IMAGE PROCESSING	3	0	2	5	4
2	4EL42	DATA COMMUNICATION AND NETWORKING	3	0	2	5	4
3	4EL43	RADAR AND NAVIGATIONAL AIDS	3	0	2	5	4
		Program Elective - IV					
1	4EL44	MIXED SIGNAL PROCESSOR	3	0	2	5	4
2	4EL45	MICROWAVE ENGINEERING	3	0	2	5	4
3	4EL46	DIGITAL CONTROL DESIGN	3	0	2	5	4

Semester 8 [Scheme A]

Sr. No.	Course Code	Name of Course	L	T	P	H	C
1	4EL32	PROJECT-II	0	0	24	24	12
2		Program Elective - V	3	0	2	5	4
3		Program Elective - VI	3	0	2	5	4
		Total	6	0	28	34	20

Program Elective - V

1	4EL47	ROBOTICS	3	0	2	5	4
2	4EL48	MIXED SIGNAL DESIGN	3	0	2	5	4
3	4EL49	ANTENNA DESIGN	3	0	2	5	4
4	4EL50	INDUSTRIAL IOT	3	0	2	5	4

Program Elective - VI

1	4EL51	BIOMEDICAL INSTRUMENTATION	3	0	2	5	4
2	4EL52	MACHINE LEARNING TECHNIQUES	3	0	2	5	4
3	4EL53	SATELLITE COMMUNICATION	3	0	2	5	4
4	4EL54	FUNDAMENTALS OF ELECTRIC VEHICLES AND DRIVES	3	0	2	5	4

OR
Semester 8 [Scheme B]

Sr. No.	Course Code	Name of Course	L	T	P	H	C
1	4EL33	INDUSTRY DEFINED PROJECT	0	0	40	40	20
		Total Credits Distribution (Scheme-A)	112	3	94	209	159
		Total Credits Distribution (Scheme-B)	106	3	106	215	159

L=Lecture Hrs./wk; T=Tutorial Hrs./wk; P=Practical Hrs./wk; H=Total Contact Hrs./wk; C=Credits of Course

ANNEXURE –II: Syllabi for the courses offered in programme of studies leading to the degree of Bachelor of Technology (Electronics Engineering)

BS111: ADVANCED CALCULUS
CREDITS - 4 (LTP:3,1,0)

Course Objectives:

The basic necessity for the Foundation of Engineering & Technology being Mathematics, the main aim is, to teach Mathematical concepts, develop Mathematical skills & enhance thinking power of students.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	150
3	1	0	4	60	40	20	30	

Course Contents:

Unit No.	Topics	Teaching Hours
1	Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	08
2	Rolle's theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Differentiation of Hyperbolic and Inverse Hyperbolic functions, Successive differentiation, standard forms, Leibnitz's theorem and applications, power series, expansion of functions, Indeterminate forms and L'Hospital's rule; Maxima and minima.	08
3	Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.	10
4	Multiple Integration: double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes by (double integration) Center of mass and Gravity (constant and variable densities). Theorems of Green, Gauss and Stokes, orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds.	10
5	Sequence and Their Convergence, Convergence and Divergence of Infinite Series, Geometric Series, P-Test, A Necessary Condition for Convergence, Comparison Test, Ratio Test.	06
	Total	**42**

List of References:

1. Weir, M.D. et al., *Thomas' Calculus (*11*th Edition*), Pearson Education, 2008.
2. Grewal B. S., "*Higher Engineering Mathematics*", Khanna Publisher, New Delhi, (Latest Edition).

3. Sastry S. S., "*Engineering Mathematics – Vol. I and II*", Prentice Hall of India.
4. Stuart J., "*Calculus*", Cengage Learning, India Pvt. Ltd. (2008).

BS101: ADVANCED CALCULUS
CREDITS = 5 (L=3, T=2, P=0)

Course Objectives:
The basic necessity for the Foundation of Engineering & Technology being Mathematics, the main aim is, to teach Mathematical concepts, develop Mathematical skills & enhance thinking power of students.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				Total Marks
				Theory Marks		Tutorial/Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	2	0	5	70	30	30	20	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	08
2	Rolle's theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Differentiation of Hyperbolic and Inverse Hyperbolic functions, Successive differentiation, standard forms, Leibnitz's theorem and applications, power series, expansion of functions, Indeterminate forms and L'Hospital's rule; Maxima and minima.	08
3	Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.	10
4	Multiple Integration: double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes by (double integration) Center of mass and Gravity (constant and variable densities). Theorems of Green, Gauss and Stokes, orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds.	10
5	Sequence and Their Convergence, Convergence and Divergence of Infinite Series, Geometric Series, P-Test, A Necessary Condition for Convergence, Comparison Test, Ratio Test.	06
	TOTAL	42

List of References:

1. Weir, M.D. et al., Thomas' Calculus (11th Edition), Pearson Education, 2008.
2. Grewal B. S., "Higher Engineering Mathematics", Khanna Publisher, New Delhi, (Latest Edition).
3. Sastry S. S., "Engineering Mathematics – Vol. I and II", Prentice Hall of India.
4. Stuart J., "Calculus", Cengage Learning, India Pvt. Ltd. (2008).

ES109: ENGINEERING GRAPHICS AND DESIGN
CREDITS - 4 (LTP:2,0,2)

Course Objectives:

To enable students to acquire and use engineering drawing skills as a means of accurately and clearly communicating ideas, information and instructions

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
2	0	4	4	30	20	40	60	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction to Engineering Graphics:** Drawing instruments and accessories, BIS – SP 46.	2 (Lab Hours)
2	Use of plane scales, Diagonal Scales.	2
3	**Orthographic Projections:** Fundamental of projection along with classification, Projections from the pictorial view of the object on the principal planes for view from front, top and sides using first angle projection method and third angle projection method, full sectional view	4
4	**Engineering Curves:** Classification and application of Engineering Curves, Construction of Conics, Cycloidal Curves, Involutes and Spirals along with normal and tangent to each curve	4
5	**Projections of Points and Lines:** Introduction to principal planes of projections, Projections of the points located in same quadrant and different quadrants, Projections of line with its inclination to one reference plane and with two reference planes. True length and inclination with the reference planes	4
6	**Projections of Planes:** Projections of planes (polygons, circle and ellipse) with its inclination to one reference plane and with two reference planes, Concept of auxiliary plane method for projections of the plane	4

Unit No.	Topics	Teaching Hours
7	**Projections of Solids, Section of Solids and Development of Surfaces:** Classification of solids. Projections of solids (Cylinder, Cone, Pyramid and Prism) along with frustum with its inclination to one reference plane and with two reference planes, Section of such solids and the true shape of the section, Development of surfaces	7
8	**Isometric Projections and Isometric View or Drawing:** Isometric Scale, Conversion of orthographic views into isometric projection, isometric view or drawing of objects	3
9	**Computer Aided Drawing:** Design concepts**,** Introduction to AutoCAD, Basic commands for 2D drawing like: Line, Circle, Polyline, Rectangle, Hatch, Fillet, Chamfer, Trim, Extend, Offset, Dimension style, etc. Industrial Drawing symbols, Program specific commands and tools.	6 (Lab Teaching)
	Total	**28**

List of References:

1. N.D.Bhatt, *"Engineering Drawing*", 53rd Edition, 2014, Charotar Publishing house Pvt. Ltd. Anand and Gujarat.
2. P.J.Shah, *"A Text Book of Engineering Graphics"* S.Chand & Company Ltd. New Delhi.
3. P.S.Gill, *"A Text Book of Engineering Drawing, S*.K.Kataria & Sons, Delhi.
4. B. Agrawal and C M Agrawal, "*Engineering Drawing*", Tata McGraw Hill, New Delhi.

ES103: BASIC ELECTRICAL ENGINEERING
CREDITS - 4 (LTP:3,0,1)

Course Objectives:

Electricity is the basic requirement for all citizens of a Country. It is also very important for all sectors of Industry, Engineering and Infrastructure. In view of this, it is desirable for all discipline engineering graduates to know the fundamental concepts of electrical engineering. This subject deals with fundamental circuit analysis and solution methods, introduction to electrical machines, power converters and basics of domestic electrical installations.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**DC Circuits:** Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.	8
2	**AC Circuits**: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections.	8
3	**Transformers:** Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.	6
4	**Electrical Machines:** Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.	8
5	**Power Converters:** DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.	6
6	**Electrical Installations** Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.	6
	Total	**42**

Suggested Text / Reference Books

1. D.P. Kothari and I. J. Nagrath, "*Basic Electrical Engineering*", Tata McGraw Hill,2010.
2. D.C. Kulshreshtha, "*Basic Electrical Engineering*", McGrawHill,2009.
3. Ritu Sahdev, *Basic Electrical Engineering*, (ISBN: 9789386173492), Khanna Book Publishing Co.
4. B. L. Theraja, "*A Textbook of Electrical Technology*" - Volume I and II, S. Chand Publishers, 2012
5. L.S. Bobrow, "*Fundamentals of Electrical Engineering*", Oxford University Press,2011.
6. E. Hughes, "*Electrical and Electronics Technology*", Pearson,2010.
7. V.D. Toro, "*Electrical Engineering Fundamentals*", Prentice Hall India, 1989.

List of experiments/demonstrations:

1. Basic safety precautions. Introduction and use of measuring instruments–voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
3. Transformers: Observation of the no-load current waveform on an oscilloscope (non- sinusoidal wave-shape due to B-H curve non-linearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
4. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
5. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging – slip-ring arrangement) and single-phase induction machine.
6. Torque Speed Characteristic of separately excited dc motor.
7. Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super-synchronous speed.
8. Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.
9. Demonstration of (a) dc-dc converters (b) dc-ac converters –PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switch-gear.

BS104: SEMICONDUCTOR PHYSICS
CREDITS - 4 (LTP:3,0,1)

Course Objective:

1. To understand the fundamentals of basic semiconductor physics which includes the,
2. Electronic materials, Semiconductors,.
3. To understand the basic materials and properties of semiconductors
4. To provide problem solving experience and learning of concepts through it in Semiconductor Physics, in both the classroom and the laboratory learning environment.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No	Topics	Teaching Hours
1.	**Electronic materials** Free electron theory, Density of states and energy band diagrams, Kronig-Penny model (to introduce origin of band gap), Energy bands in solids, E-k diagram, Direct and indirect bandgaps, Types of electronic materials: metals, semiconductors, and insulators, Density of states, Occupation probability, Fermi level, Effective mass, Phonons.	12
2.	**Semiconductors** Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Metal-semiconductor junction (Ohmic and Schottky), Semiconductor materials of interest for optoelectronic devices.	12
3.	**Light-semiconductor interaction** Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission; Joint density of states, Density of states for photons, Transition rates (Fermi's golden rule), Optical loss and gain; Photovoltaic effect, Exciton, Drude model. Laser, Einstein's theory of matter radiation interaction and A and B coefficients, Amplification of light by population inversion, different types of lasers: gas laser(He-Ne, CO_2), Solid state laser (Ruby, Neodymium), Dye laser, Properties of laser beams, Monochromaticity, Coherence, directionality and brightness, Applications of laser in science and medicines.	12
4.	**Measurements** Four-point probe and van der Pauw measurements for carrier density, resistivity, and hall mobility; Hot-point probe measurement, capacitance-voltage measurements, parameter extraction from diode I-V characteristics, DLTS, band gap by UV-Vis spectroscopy, absorption/transmission.	6
	Total	**42**

List of References:

1. J. Singh, "*Semiconductor Optoelectronics: Physics and Technology*", McGraw-Hill Inc. (1995). 2. B. E. A. Saleh and M. C. Teich, "*Fundamentals of Photonics"*, John Wiley & Sons, Inc., (2007). 3. S. M. Sze, "*Semiconductor Devices: Physics and Technology*", Wiley (2008).
4. A. Yariv and P. Yeh, Photonics: "*Optical Electronics in Modern Communications*", Oxford University Press, New York (2007).
5. P. Bhattacharya, "*Semiconductor Optoelectronic Devices*", Prentice Hall of India (1997).
6. Online course: "*Semiconductor Optoelectronics*" by M R Shenoy on NPTEL
7. Online course: "*Optoelectronic Materials and Devices*" by Monica Katiyar and Deepak Gupta on NPTEL

HS101: ENGLISH
CREDITS - 3 (LTP:2,0,1)

Course Objectives:

To acquaint BE students with the basics of English. The curriculum intends to familiarize students with LSRW Skills and provides exposure and practice in all four aspects to equip them with the useful language competencies and confidence to communicate well. The course accentuates good drilling in practicum in order to enable students to learn, perform and enhance their accuracy and skills in English language to excel in their field of specialization

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
2	0	2	3	30	20	20	30	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Vocabulary Building** The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. Synonyms, antonyms, and standard abbreviations. General English words and their technical equivalent words	4
2	**Basic Writing Skills** Sentence Structures. Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence and Cohesion, Organizing principles of paragraphs in documents, Techniques for writing precisely	6
3	**Identifying Common Errors in Writing** Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés, Collocations	6
4	**Nature and Style of sensible Writing** Types of writing- descriptive, narrative, argumentative, Describing, Defining, Classifying, Providing examples or evidence, Writing introduction and conclusion	4
5	**Writing Practices** Paragraph Writing: Topic sentence, supportive sentences and conclusion, Précis Writing, Essay Writing	4
6	**Language Skills** (This unit involves interactive practice sessions In Language Lab) Listening Comprehension, Reading Comprehension, Writing Skills (Permission letter, Invitation letter, Acknowledgement letter, Reporting complaint/grievance), Pronunciation, Intonation, Stress and Rhythm, Common Everyday Situations: Conversations and Dialogues Communication at Workplace, Interviews, Formal Presentations, Public Speeches: Talking about self (Professional Setting, social setting), Introduction of Speakers, Vote of thanks	6
	Total	**30**

Language Lab Activities:

Sr. No.	Language Laboratory Activities	Duration	Nature of Activities
1	Listening Comprehension	1	Individual Task
2	Reading aloud stories - developing dialogues - deciding roles and enactment and performance analysis	2	Group work
3	Dialogue Writing (Cue cards)	1	(Team Work- Teacher Guided)
4	Reading Comprehension	2	Individual Tasks & Group Tasks (Digital Language Lab)
5	Note Taking and Note Making	1	
6	Book/Story Review/Article Review	1	
7	Group Discussion	1	
8	Short Oral Presentations (preferably recorded for self-analysis)	1	
9	Extempore (preferably recorded for self-analysis)	1	Individual Task
10	ICT Based presentations/ Technology based presentation	2	1 in Group & 1 individual
11	Graph/Chart Interpretation	1/2	Individual Task
12	Diagram illustration	1/2	Individual Task

List of References:

1. Michael Swan, "*Practical English Usage*". OUP. 1995.
2. F.T. Wood, "*Remedial English Grammar*". Macmillan.2007
3. William Zinsser, "*On Writing Well"*, Harper Resource Book. 2001
4. Liz Hamp-Lyons and Ben Heasly, *"Study Writing"*. Cambridge University Press. 2006.
5. Sanjay Kumar and PushpLata, "*Communication Skills"* Oxford University Press. 2011.
6. *"Exercises in Spoken English",* Parts. I-III. CIEFL, Hyderabad. Oxford University Press
7. Michael McCarthy& Felicity O' Dell, "*English Vocabulary in Use".* CUP 1994
8. Michael McCarthy& Felicity O' Dell, "*English Collocations in Use"*. CUP 2005
9. "Writing Skills: Success in 20 Minutes a Day". .GP Goodwill's 2013
10. Judith F. Olson, "*Write Better; Speak better"*. Reader's Digest.1998
11. *"How to Say It"*, Third Edition: Choice Words, Phrases, Sentences, and Paragraphs for Evry Situation Original Edition, Rosalie Maggio, Prentice Hall Press, 2009

BS112: LINEAR ALGEBRA AND FOURIER SERIES
CREDITS - 4 (LTP:3,1,0)

Course Objectives:

The basic necessity for the Foundation of Engineering & Technology being Mathematics, the main aim is, to teach Mathematical concepts, develop Mathematical skills & enhance thinking power of students.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	1	0	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Matrices: addition and multiplication by scalar, matrix multiplication; Linear systems of equations (homogeneous and nonhomogeneous), rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.	10
2	Vector Space, linear dependence of vectors, basis, dimension; Linear transformations (maps), range and kernel of a linear map, rank and nullity, Inverse of a linear transformation, rank-nullity theorem, composition of linear maps, Matrix associated with a linear map.	12
3	Eigenvalues, eigenvectors, symmetric, skew-symmetric, and orthogonal Matrices, eigen bases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.	10
4	Periodic function, Fourier series, Functions of any period, Even and odd functions, Half-range Expansion, Parseval's theorem.	10
	Total	**42**

List of References:

1. Howard A. and Chris R., "*Elementary Linear Algebra*", John Wiley & Sons, 2005.
2. Grewal B. S., "*Higher Engineering Mathematics*", Khanna Publisher, New Delhi, (Latest Edition).
3. Bali N. P. and Goyal M., "*Engineering Mathematics*", Laxmi Publication (Latest Edition).

BS102: LINEAR ALGEBRA AND FOURIER SERIES
CREDITS = 5 (L=3, T=2, P=0)

Course Objectives:

The basic necessity for the Foundation of Engineering & Technology being Mathematics, the main aim is, to teach Mathematical concepts, develop Mathematical skills & enhance thinking power of students.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	

3	2	0	5	70	30	30	20	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Matrices: addition and multiplication by scalar, matrix multiplication; Linear systems of equations (homogeneous and nonhomogeneous), rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.	10
2	Vector Space, linear dependence of vectors, basis, dimension; Linear transformations (maps), range and kernel of a linear map, rank and nullity, Inverse of a linear transformation, rank-nullity theorem, composition of linear maps, Matrix associated with a linear map.	12
3	Eigenvalues, eigenvectors, symmetric, skew-symmetric, and orthogonal Matrices, eigen bases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.	10
4	Periodic function, Fourier series, Functions of any period, Even and odd functions, Half-range Expansion, Parseval's theorem.	10
	TOTAL	**42**

List of References:

1. Howard A. and Chris R., *"Elementary Linear Algebra*", John Wiley & Sons, 2005.
2. Grewal B. S., "*Higher Engineering Mathematics*", Khanna Publisher, New Delhi, (Latest Edition).
3. Bali N. P. and Goyal M., "*Engineering Mathematics*", Laxmi Publication (Latest Edition).

ES105: PROGRAMMING FOR PROBLEM SOLVING
CREDITS - 4 (LTP:3,0,1)

Course Objectives:

To enhance logical thinking and to impart basic programming skills using C programming language

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction:** Introduction to components of a computer system (disks, memory, processor, Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.),	6

Unit No.	Topics	Teaching Hours
	notion of machine level, assembly level and high level languages, Idea of algorithm: steps to solve logical and numerical problems, representation of algorithm: flowchart / pseudo code with examples.	
2	**Fundamentals:** Features of 'C' language, structure of a 'C' program, basic data types, constants and variables, operators and their hierarchy, arithmetic expressions and precedence, writing simple programs in 'C', concept of header files	7
3	**Control Structure Of 'C':** Conditional branching using *if – else* statement, variations in usage of *if – else* statement, *switch-case*, and *goto* statements; looping using *for, while, and do – while,* use of *break* and *continue* statements	6
4	**Arrays and Strings:** 1D and 2D arrays, character arrays and strings, library functions for manipulation of strings	7
5	**Functions and Recursion**: Library and user-defined function, passing parameters to functions, passing array to functions, recursion as different way of solving problems, overview of macros and pre-processors	6
6	**Pointers and Structures:** Idea of pointers, defining pointers, simple programs using pointers in 'C', pointers and arrays, calling function by value and by reference, dynamic memory allocation: *malloc* and *calloc*, structures, defining structures, array of structures, nested structures, structure as an argument to functions, structures and pointers, unions	7
7	**File Handling in C:** Introduction, opening, closing, and input / output operations on files, error handling during I/O operations, random access of files	3
	Total	**42**

List of References:

1. Balagarusamy E, "*Programming in ANCI C",* Sixth edition; Tata McGraw-Hill Publishing Company Limited, 2012
2. Gottfried B S, "*Programming with C*", Second edition; Tata McGraw-Hill Publishing Company Limited, 2006
3. Kernighan B W and Ritchie D M, "*C Programming language*" Second edition; Prentice Hall, 2006
4. Kanetkar Y. P., "*Let us C*" Fifth edition; BPB Publication, 2004

BS105: ELECTROMAGNETIC PHYSICS
CREDITS - 4 (LTP:3,0,1)

Teaching and Examination Scheme:

Teaching Scheme	Credits	Assessment Scheme	Total

(Hours per week)								Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No	Topics	Teaching Hours
1.	**Electrostatics in vacuum** Calculation of electric field and electrostatic potential for a charge distribution; Divergence and curl of electrostatic field; Laplace's and Poisson's equations for electrostatic potential and uniqueness of their solution and connection with steady state diffusion and thermal conduction; Practical examples like Farady's cage and coffee-ring effect; Boundary conditions of electric field and electrostatic potential; method of images; energy of a charge distribution and its expression in terms of electric field.	6
2.	**Electrostatics in a linear dielectric medium** Electrostatic field and potential of a dipole. Bound charges due to electric polarization; Electric displacement; boundary conditions on displacement; Solving simple electrostatics problems in presence of dielectrics – Point charge at the centre of a dielectric sphere, charge in front of a dielectric slab, dielectric slab and dielectric sphere in uniform electric field.	6
3.	**Magnetostatics** Bio-Savart law, Divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes' theorem; the equation for the vector potential and its solution for given current densities.	4
4.	**Magnetostatics in a linear magnetic medium** Magnetization and associated bound currents; auxiliary magnetic field; Boundary conditions on and . Solving for magnetic field due to simple magnets like a bar magnet; magnetic susceptibility and feromagnetic, paramagnetic and diamagnetic materials; Qualitative discussion of magnetic field in presence of magnetic materials.	6
5.	**Faraday's law** Faraday's law in terms of EMF produced by changing magnetic flux; equivalence of Faraday's law and motional EMF; Lenz's law; Electromagnetic breaking and its applications; Differential form of Faraday's law expressing curl of electric field in terms of time-derivative of magnetic field and calculating electric field due to changing magnetic fields in quasi-static approximation; energy stored in a magnetic field.	4

Unit No	Topics	Teaching Hours
6.	**Displacement current, Magnetic field due to time dependent electric field and Maxwell's equations** Continuity equation for current densities; Modifying equation for the curl of magnetic field to satisfy continuity equation; displace current and magnetic field arising from time-dependent electric field; calculating magnetic field due to changing electric fields in quasi-static approximation. Maxwell's equation in vacuum and non-conducting medium; Energy in an electromagnetic field; Flow of energy and Poynting vector with examples. Qualitative discussion of momentum in electromagnetic fields.	6
7.	**Electromagnetic waves** The wave equation; Plane electromagnetic waves in vacuum, their transverse nature and polarization; relation between electric and magnetic fields of an electromagnetic wave; energy carried by electromagnetic waves and examples. Momentum carried by electromagnetic waves and resultant pressure. Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.	10
	Total	**42**

Text Book:
1. David Griffiths, "*Introduction to Electrodynamics*"

List of References:
1. Halliday and Resnick, "*Physics*"
2. W. Saslow, "*Electricity, Magnetism and Light*"

ES101: BASIC ELECTRONICS
CREDITS - 4 (LTP:3,0,1)

Course Objectives:
The objective of this Course is to provide the students with an introductory and broad treatment of the field of Electronics Engineering to facilitate better understanding of the devices, instruments and sensors used in engineering applications. Lab should be taken concurrently. This course emphasizes more on the laboratory/practical use of the knowledge gained from the course lectures.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No	Topics	Teaching Hours
1.	**Diode theory and Applications** Semiconductor Diode - Ideal versus Practical, Resistance Levels, Diode Equivalent Circuits, Load Line Analysis; Diode as a Switch, Diode as a Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Design of un regulated DC power supply, Clipping circuit, Clamping circuit,	10

Unit No	Topics	Teaching Hours
	Voltage multiplier circuit. Breakdown Mechanisms, Zener Diode – Operation and Applications; Opto-Electronic Devices – LEDs, Photo Diode and Applications; Silicon Controlled Rectifier (SCR) – Operation, Construction, Characteristics, Ratings, Applications;	
2.	**Bipolar Junction Transistor** Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Voltage Divider Bias Configuration; Biasing BJT switching circuits.	10
3.	**Transistor Amplifiers and Oscillators** Classification, Small Signal Amplifiers –Basic Features, Common Emitter Amplifier, Coupling and Bypass Capacitors, Distortion, AC Equivalent Circuit; Feedback Amplifiers – Principle, Advantages of Negative Feedback, Topologies, Current Series and Voltage Series Feedback Amplifiers; Oscillators – Classification, RC Phase Shift, Wien Bridge, High Frequency LC and Non-Sinusoidal type Oscillators	7
4.	**Field Effect Transistor (FET)** Construction, Characteristics of Junction FET, Depletion and Enhancement type Metal Oxide Semiconductor (MOS) FETs, Introduction to CMOS circuits, FET biasing in ohmic region and active region.	7
5.	**Operational Amplifiers and Applications** Introduction to Op-Amp, Differential Amplifier Configurations, CMRR, PSRR, Slew Rate; Block Diagram, Pin Configuration of 741 Op- Amp, Characteristics of Ideal OpAmp, Concept of Virtual Ground; Op-Amp Applications – Invering amplifier, Non Inverting amplifier, Differential amplifier, Adder, Subtractor, Voltage Follower and Comparator; Differentiator and Integrator, Astable and Monostable Multivibrators.	8
	Total	**42**

Practicals:

Module 1:
Laboratory Sessions covering, Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Switches (SPDT, DPDT and DIP), Bread Boards and Printed Circuit Boards (PCBs); Identification, Specifications, Testing of Active Devices – Diodes, BJTs, JFETs, MOSFETs, Power Transistors, SCRs and LEDs

Module 2:
Study and Operation of Digital Multi Meter, Function / Signal Generator, Regulated Power Supply (RPS), Cathode Ray Oscilloscopes; Amplitude, Phase and Frequency of Sinusoidal Signals using Lissajous Patterns on CRO; (CRO);

Module 3:
Experimental Verification of PN Junction Diode Characteristics in A) Forward Bias B) Reverse Bias, Zener Diode Characteristics and Zener Diode as Voltage Regulator, Input and Output Characteristics of BJT in Common Emitter (CE) Configuration,

Module 4:
Study of Half Wave and Full Wave Rectification, Regulation with Filters, Gain and

Bandwidth of BJT Common Emitter (CE) Amplifier, Drain and Transfer Characteristics of JFET in Common Source (CS) Configuration; Gain and Bandwidth of JFET Common Source (CS) Amplifier, Gain and Bandwidth of BJT Current Series and Voltage Series Feedback Amplifiers, Oscillation Frequency of BJT based RC Phase Shift, Hartley and Colpitts Oscillators;

Module 5:
Op-Amp Applications – Adder, Subtractor, Voltage Follower and Comparator; Op-Amp Applications – Differentiator and Integrator, Square Wave and Triangular Wave Generation,

Text/Reference Books:
1. David. A. Bell (2003), "*Laboratory Manual for Electronic Devices and Circuits"*, Prentice Hall, India
2. Santiram Kal (2002), "*Basic Electronics- Devices, Circuits and IT Fundamentals"*, Prentice Hall,India
3. Thomas L. Floyd and R. P. Jain (2009), "*Digital Fundamentals*" by Pearson Education,
4. Paul B. Zbar, A.P. Malvino and M.A. Miller (2009), "*Basic Electronics – A Text-Lab. Manual,TMH"*
5. R.T. Paynter (2009), "*Introductory Electronic Devices & Circuits, Conventional Flow Version*," Pearson
6. R. Boylested and L. Nashelsky. "*Electronics Devices and Circuit Theory*", Pearson Education.

ES112: BASICS OF MANUFACTURING PRACTICES
CREDITS - 1 (LTP:0,0,1)

Course Objectives:
To introduce the concepts of basic manufacturing processes and demonstrate the conversion of raw material into a finished product.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
0	0	2	1	0	0	40	60	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction to workshop and safety aspect:** Orientation of the workshop, Introduction to safety aspects to be observed in workshop or industries.	2
2	**Machine Shop:** Introduction and demonstration of various machine tools such as Lathe, Drilling, Shaping, Slotting, Planning, Milling, Grinding.	8
3	**Manufacturing Shops:** Introduction and demonstration to Carpentry, Fitting, Welding, Brazing Soldering ,Casting, Plastic moulding & Glass cutting.	18

Unit No.	Topics	Teaching Hours
	Total	**28**

List of References:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "*Elements of Workshop Technology*", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "*Manufacturing Engineering and Technology*", 4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu,"*Manufacturing Technology – I*" Pearson Education, 2008.
4. Roy A. Lindberg, "*Processes and Materials of Manufacture*", 4th edition, Prentice Hall India, 1998.
5. Rao P.N., "*Manufacturing Technology*", Vol. I and Vol. II, Tata McGrawHill House, 2017.
.

ES102: ELECTRONICS WORKSHOP
CREDITS - 1 (LTP:0,0,1)

Course Objectives:

1. The goal of this course is to introduce basic principles of electronics workshop and establish the fundamentals of electronics components based projects as required for electronics and communication engineering students.
2. The course aims to make the student familiar with principles of electronics workshop like various electronics components, analog/digital troubleshooting, soldering techniques and PCB design, etc.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
0	0	2	1	00	00	40	60	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction to Electronics Components**: Resistor, Capacitor, Inductor, Diode, LEDs, Transistor, MOSFET, Thyristor, Relays, Op-Amp, ICs, Breadboard etc. Soldering techniques, stripping and tinning stranded wires, mounting components- plated through hole and surface mount technology, hand wire soldering, desoldering techniques, electrostatic discharge, SMD soldering techniques	06
2	**Analog Troubleshooting:** Electronics troubleshooting basics, troubleshooting with Oscilloscopes, signal injection and signal tracing, system analysis, diagnostics methods, servicing close loop circuits, troubleshooting noise and intermittent.	04

Unit No.	Topics	Teaching Hours
3	**Digital Troubleshooting:** Introduction to Superconductivity, General properties of superconductor Types of Superconductors, High Temperature Superconductors (only Definition), BCS Theory for Superconductivity, Applications of Superconductor	04
4	**Study of Soldering Techniques and PCB Design:** Students are expected to select any experiment. Soldering and testing is to be done for the selected experiment. Perform simulation of the same experiment by using CAD tools. Schematic as well as PCB design is to be carried out using CAD tools, Packages of Integrated Circuits (ICs) i.e. SOIC, PDIP,TQFP, MLFP, CBGA etc	06
5	**Design and Implementation of Analog/Digital/Mix Mode Project:** Students are expected to design any analog/digital/mix mode application of their choice. PCB design, fabrication of PCB, testing and implementation should be done. Documentation of the project is to be done in standard IEEE format. Project report should include abstract in maximum 100 words, keywords, introduction, design, simulation, implementation, results, conclusion and references. Example: Design and Implementation of DC Power Supply. (any other project can be taken in place of this example)	08
	Total	**28**

References Books:

1. Jean Andrews; "*Enhanced Guide to managing and maintain your PC",*Edition , 2001, Course Technology - Thomsan learning publishers.
2. Rashid M.H.; *"SPICE for Circuits and electronics using PSpice*"; Prentice Hall.
3. Boshsart;"*Printed Circuit Boards: Design and Technology"* Tata McGraw Hill OrCAD/PCB II, User's Guide.

HS112: ENVIRONMENTAL SCIENCE
CREDITS - 0 (LTP:2,0,0)

Rationale:

To inculcate the environmental values translating into pro-conservation actions Honorable Supreme Court of India has made it 'mandatory' to introduce a basic course on environment at the undergraduate level.

Course Objectives:

1. Develop awareness about various environmental pollution effects and control measures.
2. Create awareness about environmental ethics.

Teaching and Assessment Scheme

Teaching Scheme (Hours per week)			Credits	Assessment Scheme		Total Marks
L	T	P	C	Theory Marks	Practical Marks	

				ESE	**CE**	**ESE**	**CE**	
2	0	0	0	30	20	00	00	50

Course Content:

Unit No.	Topics	Teaching Hours
1	**INTRODUCTION TO ENVIRONMENT** Definition, principles and scope of Environmental Science. Impacts of technology on Environment, Environmental Degradation, Importance for different engineering disciplines	02
2	**ENVIRONMENTAL POLLUTION** **Water Pollution**: Introduction – Water Quality Standards, Sources of Water Pollution, Classification of water pollutants, Effects of water pollutants **Air Pollution:** Composition of air, Structure of atmosphere, Ambient Air Quality Standards, Classification of air pollutants, Sources of common air pollutants like PM, SO_2, NOX, Auto exhaust, Effects of common air pollutants **Noise Pollution:** Introduction, Sound and Noise, Noise measurements, Causes and Effects **Solid Waste:** Generation and management **Bio-medical Waste:** Generation and management **E-waste:** Generation and management	12
3	**GLOBAL ENVIRONMENTAL** ISSUES Sustainable Development, Climate Change, Global Warming and Green House Effect, Acid Rain, Depletion of Ozone layer, Carbon Footprint, Cleaner Development Mechanism (CDM), International Steps for Mitigating Global Change	07
4.	**SOCIAL ISSUES AND ENVIRONMENT** Role of an individual in prevention of environmental pollution. Environmental ethics: Issues and possible solution. Wasteland reclamation, consumerisms and waste products.	05
5	**CONCEPT OF 4R's** Principles, Application of 4R's :Reduce, Reuse, Recycle, Recovery	02
	Total	**28**

HS102: ENVIRONMENTAL SCIENCE
CREDITS - 0 (L=2, T=2, P=0)

Rationale:
To inculcate the environmental values translating into pro-conservation actions Honorable Supreme Court of India has made it 'mandatory' to introduce a basic course on environment at the undergraduate level.

Course Objectives:

1. Develop awareness about various environmental pollution effects and control measures.
2. Create awareness about environmental ethics.

Teaching and Assessment Scheme

Teaching Scheme			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
2	2	0	0	35	15	30	20	100

Course Content:

Unit No.	Topics	Teaching Hours
1	**INTRODUCTION TO ENVIRONMENT** Definition, principles and scope of Environmental Science. Impacts of technology on Environment, Environmental Degradation, Importance for different engineering disciplines	02
2	**ENVIRONMENTAL POLLUTION** **Water Pollution**: Introduction – Water Quality Standards, Sources of Water Pollution, Classification of water pollutants, Effects of water pollutants **Air Pollution:** Composition of air, Structure of atmosphere, Ambient Air Quality Standards, Classification of air pollutants, Sources of common air pollutants like PM, SO_2, NOX, Auto exhaust, Effects of common air pollutants **Noise Pollution:** Introduction, Sound and Noise, Noise measurements, Causes and Effects **Solid Waste:** Generation and management **Bio-medical Waste:** Generation and management **E-waste:** Generation and management	12
3	**GLOBAL ENVIRONMENTAL** ISSUES Sustainable Development, Climate Change, Global Warming and Green House Effect, Acid Rain, Depletion of Ozone layer, Carbon Footprint, Cleaner Development Mechanism (CDM), International Steps for Mitigating Global Change	07
4.	**SOCIAL ISSUES AND ENVIRONMENT** Role of an individual in prevention of environmental pollution. Environmental ethics: Issues and possible solution. Wasteland reclamation, consumerisms and waste products.	05
5	**CONCEPT OF 4R's** Principles, Application of 4R's :Reduce, Reuse, Recycle, Recovery	02
	Total	**28**

2BS01: ORDINARY DIFFERENTIAL EQUATIONS AND STATISTICS
CREDITS - 4 (LTP:3,1,0)
2nd Year, B. Tech. (CP, EL, EE, EC, IT)

Course objective:
To introduce differential equations and statistics techniques used in engineering analysis.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	150
3	1	0	4	60	40	20	30	

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Ordinary differential equations of higher orders** Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.	8
2	**Transform Calculus -1** Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs by Laplace Transform method.	10
3	**Transform Calculus-2** Fourier transforms: properties, methods, inverses and their applications.	4
4	**Basic Statistics:** Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.	8
5	**Applied Statistics*:*** Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.	8
6	**Small samples*:*** Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.	4
	TOTAL	**42**

List of References:
1. Erwin Kreyszig, "*Advanced Engineering Mathematics"*, 9th Edition, John Wiley & Sons, 2006.

2. Chandrika Prasad and Reena Garg, *"Advanced Engineering Mathematics*", Khanna Book Publishing Co. (P) Ltd., Delhi
3. N.P. Bali and Manish Goyal, "*A text book of Engineering Mathematics"*, Laxmi Publications, Reprint, 2010.
4. B.S. Grewal, "*Higher Engineering Mathematics"*, Khanna Publishers, 35th Edition, 2000.
5. W. E. Boyce and R. C. Di Prima, *"Elementary Differential Equations and Boundary Value Problems*", 9th Edition, Wiley India, 2009.
6. S. C. Gupta, V. K. Kapur, *"Fundamental of Statistics"*, Sultan Chand & Sons, India,
7. S. Ross, "*A first course in Probability"*, Pearson Education India, 2002.
8. Richard A. Johnson, Miller and Freund's – *"Probability and Statistics for Engineers"*, Prentice Hall of India, 2011.

Course Outcome:

At the end of this course students will be able to

1. Understand effective mathematical tools for the solutions of ordinary differential equations.
2. Analyze and solve ordinary differential equations using various techniques including transform techniques.
3. Apply effective mathematical tools of ordinary differential equations, Laplace and Fourier transform.
4. Understand the concepts and tools of Statistics.
5. Analyze and solve various engineering problems through the tools of Statistics.
6. Adapt tools of applied statistics and sampling theory and apply them in engineering problems.

2EL01: SIGNALS AND SYSTEMS
CREDITS - 3 (LTP:3,0,0)

Course Objective:

1. The goal of this course is to introduce basic principles of signals and systems and establish the fundamentals of signals and system applications as required for electronics and communication engineering students.
2. The course aims to make the student familiar with principles of signals and systems like various transformations, time-frequency characterization, sampling process for analog and digital application, etc.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	Energy and power signals, periodic and aperiodic signals, continuous and discrete time signals, continuous and discrete amplitude signals. Some useful signals: unit impulse, unit step, unit ramp, square pulse, exponential sinusoidal, real sinusoidal and their parameters. Some useful signal operations: Shift in time, Scaling in time, inner product, convolution, correlation. (ACF & CCF). The idea of signal space and orthogonal bases.	09
2	Linear shift-invariant (LSI) systems impulse response and step response, convolution, input output behaviour with aperiodic convergent inputs. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, reliability. Characterization of causality and stability of linear shift-invariant systems. System representation through differential equations and difference equations.	09
3	Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem.	06
4	The Laplace Transform, notion of Eigen functions of LSI systems, a basis of Eigen functions, region of convergence, poles and zeros of system, Laplace domain analysis, solution to differential equations and system behaviour.	06
5	The z-Transform for discrete time signals and systems- Eigen functions, region of convergence z-domain analysis.	06
6	The Sampling Theorem and its implications- Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold, and so on. Aliasing and its effects. Relation between continuous and discrete time systems.	09
	Total	**45**

List of References:

1. A.V. Oppenheim, A.S. Willsky and I.T. Young, *"Signals and Systems"*, Prentice Hall, 1983.
2. R.F. Ziemer, W.H. Tranter and D.R. Fannin, *"Signals and Systems - Continuous and Discrete"*, 4th edition, Prentice Hall, 1998.
3. Papoulis, *"Circuits and Systems: A Modern Approach"*, HRW, 1980.
4. B.P. Lathi, "*Signal Processing and Linear Systems"*, Oxford University Press, c1998.
5. Douglas K. Lindner, "*Introduction to Signals and Systems"*, McGraw Hill International Edition: c1999.
6. Simon Haykin, Barry van Veen, *"Signals and Systems*", John Wiley and Sons (Asia) Private Limited, c1998.
7. Robert A. Gabel, Richard A. Roberts, *"Signals and Linear Systems"*, John Wiley and Sons, 1995.
8. M. J. Roberts, *"Signals and Systems - Analysis using Transform methods and MATLAB"*, TMH, 2003.
9. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, *"Signals and Systems*", TMH New Delhi, 2001.
10. Ashok Ambardar,*"Analog and Digital Signal Processing*", 2nd Edition, Brooks/ Cole Publishing Company (An international Thomson Publishing Company), 1999.

Course Outcomes (COs):

At the end of this course students will demonstrate the ability to

1. Analyze different types of signals and perform various signal operations.
2. Investigate whether the system is LSI, causal and stable.
3. Represent continuous and discrete LSI systems in time and frequency domain using different transforms.
4. Sampling and reconstruction of a signal

2EL02: NETWORK THEORY
CREDITS - 3 (LTP:3,0,0)

Course Objective:

1. Understanding of concepts and principles of passive circuit analysis and synthesis.
2. Ability to solve complex circuits using different theorems and methods.
3. Advanced understanding of electrical networks which will be useful for advance Subjects.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Basic Nodal and Mesh Analysis:** Node and Mesh Analysis, matrix approach of network containing voltage and current sources, and reactance, source transformation and duality.	08
2	**Network Theorems & Useful Circuit Analysis Techniques:** Network theorems: Superposition, reciprocity, Thevenin's, Norton's, Maximum power Transfer and compensation theorem as applied to AC. circuits.	10
3	**Laplace Transform for steady state and transient analysis:** Discrete spectra and symmetry of waveform, steady state response of a network to non-sinusoidal periodic inputs, power factor, effective values, Fourier transform and continuous spectra, three phase unbalanced circuit and power calculation.	09
4	**Different Network Functions:** Partial fractions, singularity functions, waveform synthesis, analysis of RC, RL, and RLC networks with and without initial conditions with Laplace transforms evaluation of initial conditions.	09

Unit No.	Topics	Teaching Hours
5	**Frequency Domain Techniques:** Transient behavior, concept of complex frequency, Driving points and transfer functions poles and zeros of admittance function, their properties, sinusoidal response from pole-zero locations, convolution theorem and Two port network and interconnections, Behaviors of series and parallel resonant circuits, Introduction to band pass, low pass, high pass and band reject filters.	09
	Total	**45**

List of References:

1. Van, Valkenburg.; *"Network analysis*"; Prentice hall of India,2000.
2. Sudhakar, A., Shyammohan, S. P.; *"Circuits and Network*"; Tata McGraw-Hill New Delhi, 1994.
3. A William Hayt, "*Engineering Circuit Analysis*" 8th Edition, McGraw-Hill Education.

Course Outcomes (COs):

At the end of this course students will demonstrate the ability to

1. Understand basics electrical circuits with nodal and mesh analysis.
2. Understand and apply electrical network theorems.
3. Apply Laplace Transform for steady state and transient analysis.
4. Analyze different network functions.
5. Understand and apply the frequency domain techniques.

2EL03: ANALOG ELECTRONICS
CREDITS -3 (LTP:3,0,0)

Course Objective:

1. The goal of this course is to introduce and verify basic principles, operation and applications of the various analog electronic circuits and devices like: BJT and MOSFET for various functions.
2. To make students understand and analyze the design and working of amplifiers and their configurations.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Transistor as an Amplifier:** Biasing of BJT and MOS amplifier circuits, Thermal stabilization, Small-Signal Operation and Models for BJT, Basic BJT/HBT Amplifier Configurations, Discrete-Circuit BJT Amplifier, Introduction to Small-Signal Operation and Models for MOSFET, Basic MOSFET Amplifier Configurations, Discrete-Circuit MOS Amplifiers.	12
2	**Building Blocks of Amplifiers:** Comparison of the MOSFET and BJT, IC Design Philosophy, The Basic Gain Cell, Cascade Amplifier, Cascode Amplifier, IC Biasing-Current Sources & Current Mirrors Circuits, Cascade Configurations: CC-CE, CD-CS, CD-CE, Darlington, CC-CB and CD-CG	08
3	**Differential Amplifiers:** MOS Differential Pair and Small-Signal Operation, BJT Differential Pair, Non ideal Characteristics of Differential Amplifier, Multistage Amplifiers.	08
4	**Frequency Response of Amplifiers:** Low-Frequency Response of CS and CE Amplifiers, Internal Capacitive Effects, High-Frequency Models of MOSFET and BJT, High-Frequency Response of CS and CE Amplifiers, High-Frequency Response of Source and Emitter Followers.	08
5	**Feedback Amplifiers:** General Feedback Structure, Properties of Negative Feedback, Basic Feedback Topologies for Amplifiers, Feedback Voltage-Amplifier (Series-Shunt) , Feedback Trans conductance-Amplifier (Series-Series) , Feedback Trans resistance-Amplifier (Shunt-Shunt) , Feedback Current-Amplifier (Shunt-Series).	08
6	**Power Amplifiers:** Classification of Output Stages, Class A Output Stage, Class B Output Stage, Class AB Output Stage, Class C Output Stage, Biasing of Power Amplifiers, Design of Power Amplifiers, Power BJTs.	06
	Total	**50**

List of References:

1. Sedra/Smith, *"Microelectronic Circuits",* Sixth Edition, Oxford University, 2010.
2. Jacob Millman and Christos C. Halkias, *"Integrated Electronics*", Ninth Edition, Tata McGraw Hill Publication.
3. Robert Boylestad and Louis Nashelsky, *"Electronic Devices and Circuit Theory*", Tenth Edition, Pearson Publication.
4. Albert Malvino and David J. Bates, *"Electronic Principles*", Seventh Edition,Tata McGraw-Hill.
5. Schilling And Beloved "*Electronic circuits, discrete and integrated*", McGraw-Hill.
6. Steve Cripps *"Power amplifier design"*

Course Outcomes (COs):

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

1. To analyze the BJT and MOS amplifiers.
2. To analyze the differential amplifiers.
3. To analyze negative feedback amplifiers.

4. To analyze the power amplifiers.

2EL04: ANALOG ELECTRONICS LABORATORY
CREDITS -1 (LTP:0,0,1)

Course Objective:

1. The goal of this course is to verify practically basic principles, operation and applications of the various analog electronic circuits and devices like: BJT and MOSFET for various functions.
2. To make students understand and analyze the design and working of amplifiers and their configurations.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
0	0	2	1	00	00	40	60	100

Course Contents:

Sr. No	Suggested List of Practical
1.	To analyze various schemes of biasing for BJT.
2.	To analyze input impedance, output impedance and the frequency response of a CE amplifier.
3.	To analyze input impedance, output impedance and the frequency response of a CC amplifier.
4.	To analyze input impedance, output impedance and the frequency response of a CB amplifier.
5.	To analyze the frequency response of a two-stage direct coupled amplifier.
6.	To analyze the frequency response of an RC coupled amplifier.
7.	To analyze current feedback amplifier with the series and shunt feedback.
8.	To analyze voltage feedback amplifier with the series and shunt feedback.
9.	To analyze operation of differential amplifier.
10.	To analyze operation of class A and class B power amplifiers.
11.	To analyze operation of class AB push pull power amplifier.
12.	Design an amplifier/project and its verification.

List of References:

1. Microelectronic Circuits by Sedra/Smith – Sixth Edition.
2. Integrated Electronics by Jacob Millman and Christos C. Halkias, Tata McGraw Hill Publication.

3. Electronic Devices and Circuit Theory by Robert Boylestad and Louis Nashelsky -Ninth Edition.
4. Electronic Principles by Albert Malvino and David J. Bates – 7th Edition.
5. "Electronic circuits, discrete and integrated" by schilling and beloved, McGraw-Hill.
6. "Power amplifier design" by Steve Cripps

Course Outcomes:

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

1. To analyze the operation of single stage amplifier. .
2. To analyze operation of multistage amplifiers.
3. To analyze operation of the negative feedback amplifier.
4. To analyze operation of power amplifiers

2EL05: DIGITAL LOGIC DESIGN
CREDITS -3 (LTP:3,0,0)

Course Objective:

1. The goal of this course is to introduce basic principles of Digital Electronics, number systems codes and logical gates, Boolean algebra and minimization logic, design of combinational and sequential logic design.
2. The course also covers the basics of modern Computer-Aided Digital System Design techniques by using hardware descriptive languages (HDL) and its simulations.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction to Digital System Design: Design of basic building blocks using electronic circuit's elements, Basic logic gates, logic families and specifications, noise margin, propagation delay, fan-in, fan-out, TTL, ECL, CMOS families and their comparison.	05
2	**Boolean Algebra:** Review of binary number systems, code conversion, and Arithmetic operations using binary numbers, numbers complement and their use in operations. Review of Boolean algebra and logic design, Theorem and properties of Boolean algebra, logic operations, De-Morgan's Theorem, logic simplifications, SOP & POS forms, canonical forms, logic design using Karnaugh maps and Quine-McLuskey methods.	08

Unit No.	Topics	Teaching Hours
3	Combinational Logic Design: MSI and LSI design, Comparators, Multiplexers, Encoder, Decoder, Driver & Multiplexed Display, Multiplexers and De-Multiplexers, Adder and Subtractor , Serial and Parallel Adders, BCD Adder, Multipliers, Barrel shifter and ALU.	10
4	Sequential Logic Design: Introduction, Flip-Flops, Triggering of Flip-Flops, Analysis of Clocked Sequential Circuits, State Reduction and Assignment, Flip-Flop Excitation Tables, Design Procedure, Design of Counters, Design with State Equations. Registers, Shift Registers, Ripple Counters, Synchronous Counters, Timing Sequences. Semiconductor Memories: Memory elements, Concept of Programmable logic devices like FPGA. Logic implementation using Programmable Devices.	12
5	Finite State Machine (FSM): Sequential Design using FSM, Mealy Machine, Moore Machine, Design problem using FSM.	04
6	Introduction to Hardware description Language (Verilog): Evolution of Computer-Aided Digital Design, Emergence of HDLs, Importance of HDLs, Popularity of Verilog HDL, Trends in HDLs, Typical Design Flow, Trends in HDLs, Hierarchical Modeling Concepts, Basic Concepts, Modules and Ports, Switch level modeling, Gate-Level Modeling, Dataflow Modeling, Behavioral Modeling. UDP, FSM using HDL.	06
	Total	**45**

List of References:

1. M Morris Mano, "*Digital Logic and Computer Design*", Prentice Hall
2. Malvino&Leach , "*Principle of digital Electronics*", Tata Mcgraw Hill Education
3. David J. Comer, "*Digital Logic & State Machine Design*" ,Oxford Press
4. Samir Palnitkar ,"*Verilog HDL*",Pearson
5. M Morris Mano,Michael D. iletti ,"*Digital Design with An Introduction to Verilog HDL*", Pearson
6. R.P.Jain, "*Modern Digital Electronics*", Mcgraw Hill Education

Course Outcomes (COs):

At the end of this course students will be able to:

1. Understand Boolean algebra and logic gates.
2. Analyze logic function minimization.
3. Design combinational and sequential circuits and using FSM methods.
4. Simulate digital circuits using Hardware descriptive language (HDL).

2EL06: DIGITAL LOGIC DESIGN LABORATORY
CREDITS - 1 (LTP:0,0,1)

Course Objective:

1. The goal of this course is to do experiments with digital hardware l System Design and verifying the theorems and basic design principles.

2. The course aims to hands experiments on modern design tools used for Digital Systems Design.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	100
0	0	2	1	00	00	40	60	

Course Contents:

Unit No.	Suggested Experiment List
1	To Verify the truth tables of basic digital gates for digital sytems by using Digital ICs.
2	Designing Digital Boolean equation and testing hardware with basic gate ICs. Prove D'Morgan's theorem.
3	Design logic and Implement it using NAND gate as universal gates.
4	Design of half and full adder/subtractor digital circuit using selector switch using combinational logic with Digital ICs.
5	Design of BCD adders circuits using combinational logic with Digital ICs.
6	Design of digital multiplexer using combinational logic with Digital ICs.
7	Testing of Flip Flops truth tables using Sequential logic with Digital ICs.
8	Design of digital counter using Sequential logic with Digital ICs.
9	Design of digital shift register using Sequential logic with Digital ICs.
10	Design of Sequential logic with Finite State Machine (FSM) using Digital ICs.
11	Introduction to Verilog HDL compiler for digital design.
12	Simulate and test basic digital gates using verilog HDL language tool.
13	Implement combinational digital design using verilog HDL language tool.
14	Implement Traffic light controller problem using Finite State Machine in Verilog HDL.
15	Small Mini project development using digital design concepts using Digital ICs.

List of References:

1. M Morris Mano," *Digital Logic and Computer Design*", Prentice Hall
2. Malvino&Leach ,"*Principle of digital Electronics*", Tata Mcgraw Hill Education
3. David J. Comer, "*Digital Logic & State Machine Design*" ,Oxford Press
4. Samir Palnitkar ,"*Verilog HDL*",Pearson
5. M Morris Mano,Michael D. iletti ,"*Digital Design with An Introduction to Verilog HDL*", Pearson
6. R.P.Jain, "*Modern Digital Electronics*", Mcgraw Hill Education

Course Outcomes (COs):

At the end of this course students will be able to:

1. Verify and understand Boolean logic and basic logic gates.
2. Analyze and Verify of logic function minimization.
3. Designing and verify combinational and sequential circuits (FSM) using Digital ICs.

4. Simulate and test digital circuits using Hardware descriptive language (HDL).

2EL07: ELECTRONIC DESIGN AND AUTOMATION TOOLS
CREDITS -1 (LTP:0,0,1)

Course Objectives:
1. The course provides introduction to Simulation and Designing software for electronic circuits.
2. Using software the students will able to design and analyze various analog and digital circuits.
3. The students will able to design PCB layout using PCB design tools.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
0	0	2	1	00	00	40	60	100

Course Contents:

Unit No	Course content	Teaching Hours
1	**Introduction to Simulation software :** General purpose circuit simulation using Schematic Editor, Introduction to netlist command based SPICE simulation, basic netlist commands. Basic circuit analyses: DC, AC, Transient.	16
2	**Introduction to PCB Design software** Schematic Entry, Netlist Creation, Working with component libraries, Design of Boards, Layout of Parts, Optimizing Parts Placements, Pads and Via, Manual and Auto Routing, Handling Multiple Layers	14
	Total	**30**

List of References:
1. Rashid H. Muhammad *"Introduction to Pspice Using Orcad for Circuits and Electronics"*

List of Software/learning website:
NGspice, LTSpice, MULTISIM, Orcad, Proteus or other open source PCB design tools
http://www.linear.com/, www.autodesk.com/, http://www.expresspcb.com/

Suggested List of Practical:
1. Simulation of Resistive network.
2. Simulation of R-L, R-C and R-L-C circuits.
3. Simulation of Network Theorems (Thevenines, Nortons, Millmens etc.)
4. Simulation of Clipper and clamper circuits.
5. Simulation of rectifier circuit using transformer.
6. Simulation of filter circuits.
7. Simulation of P-N junction diode and Zener diode V-I characteristics.

8. Simulation of BJT V-I characteristics for NPN and PNP configuration.
9. Simulation of transistor biasing circuit.
10. Simulation of single/double stage amplifier circuits transient analysis and Frequency response.
11. Simulation of negative feedback circuits.
12. Simulate of Oscillators.
13. Simulation of inverting and non-inverting Op-Amp amplifier circuits.
14. Simulation basic digital gates.
15. Simulation of encoder/decoder circuit.
16. Simulation of decoder/encoder circuit.
17. Simulation of flip-flop circuit using gates.
18. Simulation of register/counter circuit.
19. Design of PCB for Analog circuits.
20. Design of PCB for digital circuits.
21. Mini Project

Course Outcomes:
After successful completion of this course students will be able to:
1. Design the electronics circuits using simulation software tools.
2. Simulate various analog and digital circuits using simulation software tools.
3. Design PCB for given circuit using PCB design Software.

2HS01: PROFESSIONAL SOFT SKILLS
CREDITS – 2 (LTP:1,0,1)

Course Objectives:
To equip students with Professional soft skills like communication, interviews, group discussion, presentation etc. The subject also will enable them to learn interpersonal skills, work culture and effective management of time and stress. .

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
1	0	2*	2	30	20	20	30	100

***Will be conducted in Class Room**

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Communication skills:**	2

Unit No.	Topics	Teaching Hours
	Process of communication, Flows of Communication in organization, Barriers to communication (Formal Flow – Upward, Downward, lateral and diagonal, Strategies to improve Organizational Communication, Effectiveness in Managerial Communication, and importance of technical communication, Non verbal communication	
2	**Interviews and Meetings**: Types of interview, General preparation for interview, Gathering information about the company, knowing about the role/job position, Types of interviewing questions, Non-verbal communication to win the interview.	2
3	**Meeting and Conferences**: Planning a meeting (Agenda and notice), Conducting a meeting, Post meeting actions (Minutes), Planning & Conducting a Conference (anchoring and Report writing), and Video/web conferences **,**Indentifying Strengths and Weakness	2
4	**Presentation Skills and Letters:** Effective Presentation strategies: Purpose, analyzing the audience and locale, organizing the content Oral presentation, Graphic presentation, Presentation aids, Personality Development. Newsletters, technical article and business letters. Technical Reports, characteristics, Importance, objectives, categories of report, format structure of reports, types of reports	4
5	**Group Discussion**: Qualities needed for effective group discussion. Email etiquettes, Telephone Etiquettes, Role and responsibility of engineer, Work culture in jobs. Work place, rights and responsibilities	3
6	**Time and Stress Management**: Concept & Importance of Time Management, Techniques of Time Management, and Concept & Importance of Stress Management, Techniques of Stress Management, and Overcoming Stage fear and Interpersonal Relationships	2
	Total	**15**

Activities for Practical (Conducted in Class Room)

Sr. No	Activity	Duration (Hours)	Nature of Activity
1	Mock interview	1	Individual
2	Letter Writing	1	Individual
3	Group Discussion	2	Group
4	Group Discussion	2	Group
5	Presentation	2	Individual
6	Presentation	2	Group
7	CV preparation	1	Individual
8	Extempore (over coming stage fear)	1	Individual
9	Aptitude Test	1	Individual

10	Writing skills	1	Individual

List of References:

1. G,S,B,K Babu Rao, "*Business Communication and Soft Skill*", Himalaya Publishing house (1st Edition)
2. Diane Hacker, "*Pocket Style Manual",* Bedford Publication, New York, 2003. (ISBN 0312406843)
3. Shiv Khera, "*You Can Win",* Macmillan Books, New York, 2003.
4. Raman Sharma, "*Technical Communications*", Oxford Publication, London, 2004.
5. *"Ethics in Engineering practice and research" (2nd Edition)* by Caroline Whit beck Cambridge
6. Sharma, R. and Mohan, K. "*Business Correspondence and Report Writing*", TMH New Delhi 2002.

Course Outcomes (COs):

At the end of this course students will be able to …

1. Understand the communication process and communicate professionally.
2. Participate in Group Discussion and evaluate the same.
3. Develop Interview skills and Write Reports
4. Make effective Presentations.
5. Conduct meetings and conferences.
6. Effectively manage time and stress.

2EL08: ANALOG AND DIGITAL COMMUNICATION
CREDITS - 3 (LTP:3,0,0)

Course Objective:

1. The goal of this course is to introduce basic principles of Continuous wave (CW) Modulation, Pulse Modulation, Noise in CW modulation system as required for Electronics engineering students.
2. The course aims to make the student familiar with Digital Modulation and Demodulation techniques, Digital transmission, reception etc.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	Review of signals and systems, Frequency domain representation of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals.	09
2	Review of probability and random process. Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and De-emphasis, Threshold effect in angle modulation.	09
3	Pulse modulation. Sampling process. Pulse Amplitude and Pulse code modulation (PCM), Differential pulse code modulation. Delta modulation, Noise considerations in PCM, Time Division multiplexing, Digital Multiplexers	09
4	Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations. Base band Pulse Transmission- Inter symbol Interference and Nyquist criterion. Pass band Digital Modulation schemes- Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying.	09
5	Digital Modulation tradeoffs. Optimum demodulation of digital signals over band- limited channels- Maximum likelihood sequence detection (Viterbi receiver). Equalization Techniques. Synchronization and Carrier Recovery for Digit al modulation.	09
	Total	**45**

List of References:

1. Haykin S., "*Communications Systems*", John Wiley and Sons, 2001.
2. Proakis J. G. and Salehi M., "*Communication Systems Engineering*", Pearson Education, 2002.
3. Taub H. and Schilling D.L., "*Principles of Communication Systems*", Tat a McGraw Hill, 2001.
4. Wozencraft J. M. and Jacobs I. M., ``*Principles of Communication Engineering''*, John Wiley, 965.
5. Barry J. R., Lee E. A. and Messerschmitt D. G., ``*Digital Communication''*, Kluwer Academic Publishers, 2004.
6. Proakis J.G., ``*Digital Communications''*, 4th Edition, McGraw Hill, 2000.

Course Outcomes (COs):

At the end of this course students will demonstrate the ability to

1. Analyze and compare different analog modulation schemes for their efficiency and bandwidth
2. Analyze the behavior of a communication system in presence of noise
3. Investigate pulsed modulation system and analyze their system performance
4. Analyze different digital modulation schemes and can compute the bit error performance

2EL09: ANALOG AND DIGITAL COMMUNICATION LABORATORY
CREDITS - 1 (LTP:0,0,1)

Course Objective:

1. The goal of this course is to introduce basic principles of Continuous wave (CW) Modulation, Pulse Modulation, as required for Electronics engineering students.
2. The course aims to make the student familiar with Digital Modulation and Demodulation techniques, Digital transmission, reception etc.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
0	0	2	1	00	00	40	60	100

Experiment List:

1. To generate amplitude modulation (AM) waveform and to measure modulation index of AM wave using waveform method and trapezoidal method
2. To extract information signal from the AM wave using diode detector.
3. To observe frequency modulated waveform and to measure peak frequency deviation for 2V peak to peak modulating signal
4. To extract information signal from the FM wave using FM detector
5. To obtain frequency response of pre-emphasis and de-emphasis circuits.
6. To understand working of AGC circuit.
7. To study about sampling and reconstruction of the signal.
8. To study about Pulse Amplitude Modulation (PAM), Pulse Width Modulation (PWM), Pulse Position Modulation (PPM) Techniques.
9. To Study about Pulse Code Modulation (PCM).
10. To study about Time Division Multiplexing.
11. To study various formatting techniques.
12. To study about Amplitude Shift Keying(ASK) Modulation and demodulation, Frequency Shift Keying (FSK) Modulation and Demodulation, Phase Shift Keying (PSK) Modulation and Demodulation.
13. To study about Minimum Shift Keying (MSK) Modulation and demodulation.
14. To Study About Delta Modulation & Demodulation.
15. To study of compressor and expander.

List of References:

1. B. P. Lathi, "*Modern Digital and Analog Communication Systems*", Oxford Publication
2. Taub & Schilling, "*Principles of Communication Systems*", Tata McGraw Hill Publication
3. S.Haykin, "*Communication systems*", John Wiley
4. Bhattacharya Amitabh, "*Digital Communication*", Tata McGraw-Hill
5. Prokis J.J, "*Digital Communications" ,*McGraw Hill

Course Outcomes (COs):

At the end of this course students will demonstrate the ability to

1. Analyze and compare different analog modulation schemes like AM, FM for their efficiency and bandwidth.
2. Analyze the behavior of a communication receiver system module.
3. Analyze pulsed modulation systems and their performance.
4. Analyze different digital modulation schemes, Digital receiver system module.

2EL10: CONTROL THEORY
CREDITS - 3 (LTP:3,0,0)

Course Objective:

1. The goal of this course is to introduce basic Control Theory and establish the fundamentals of devices in Control applications as required by Electronics engineering students.
2. To develop skills, to analyze feedback control systems in continuous- and discrete time domains and learn methods for improving system response transient and steady state behavior (response).
3. Understand system stability concept and learn methods for examining system stability in both time and frequency domains including determining the system stability margins.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction to Control Systems:** Introduction Examples of Control Systems, Closed-Loop Control Versus Open-Loop Control, Design and Compensation of Control Systems	04
2	**Mathematical Modeling of Control Systems:** Introduction, Transfer Function and Impulse-Response Function, Automatic Control Systems, Mathematical Modeling of Mechanical Systems, Mathematical Modeling of Electrical Systems, Signal-Flow Graph and Block Diagram Models, Alternative Signal-Flow Graph and Block Diagram Models (Continuous time and Discrete time domain), Modeling in State Space, State-Space Representation of Scalar Differential Equation Systems, Transformation of Mathematical Models, Linearization of Nonlinear Mathematical Models	12
3	**Transient and Steady-State Response Analyses:** Introduction, First-Order Systems, Second-Order Systems, Transient-Response Analysis, Routh's Stability Criterion, Effects of Integral and Derivative Control Actions on System Performance (Continuous time and Discrete time domain), Steady-State Errors in Unity-Feedback Control Systems	07

Unit No.	Topics	Teaching Hours
4	**Analysis and Design by the Root-Locus Method:** Introduction, Root-Locus Plots, Plotting Root Loci, Root-Locus Plots of Positive Feedback Systems, Root-Locus Approach to Control-Systems Design, Lead Compensation, Lag Compensation, Lag–Lead Compensation	07
5	**Analysis and Design by the Frequency-Response Method:** Introduction, Bode Diagrams, Polar Plots, Log-Magnitude-versus-Phase Plots, Nyquist Stability Criterion, Stability Analysis (Continuous time and Discrete time domain), Relative Stability Analysis	09
6	**Control Systems Analysis in State Space:** Introduction, State-Space Representations of Transfer-Function Systems, Transformation of System Models, Solving the Time-Invariant State Equation, Some Useful Results in Vector-Matrix Analysis, Controllability, and Observability.	06
	Total	**45**

List of References:

1. Katsuhiko Ogata, "*Modern Control Engineering*", Prentice Hall of India.
2. Benjamin C.Kuo and Farid Golnaraghi "*Automatic Control Systems*", John Wiley & Sons.
3. Richarc C. Drof and Robert H. Bishop, "*Modern Control System*", Person Publications.
4. Joseph J Distefano, "*Feedback and Control System*", Tata macgraw hill publications.
5. Nagrath and Gopal, "*Control Systems Engineering",* New Age Publication

Course Outcomes (COs):

At the end of this course students will able to:

1. Understanding of basic linear feedback principles and find out the transfer function using various methods.
2. Design system with controller to improve system transient and steady state response
3. Sketch the root locus and determine the location of the closed-loop poles.
4. Analyze the system using frequency response methods and find stability margins.
5. Present and analyze linear control system using the state space technique

2EL11: MICRO-CONTROLLERS
CREDITS -3 (LTP:3,0,0)

Course Objective:

1. The goal of this course is to introduce basics of microprocessor, microcontrollers and it's interfacing with various peripherals, programming microcontrollers and simulations
2. The course aims to make the student familiar with working with microcontroller based design, development of microcontroller based projects. The knowledge of working with any one microcontroller thoroughly enables students to design embedded systems with advance microcontrollers.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)	Credits	Assessment Scheme	Total Marks

L	T	P	C	Theory Marks		Practical Marks		
				ESE	CE	ESE	CE	100
3	0	0	3	60	40	00	00	

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction to Microprocessors:** Introduction to microprocessor, Applications, 8085 Microprocessor architecture, buses, register, flags. 8085 pin configuration & function of each pin. Fetch, Decode and execute operations. Memory and I/O read and write cycles, Interfacing of memory chips with 8085, Memory mapped I/O and I/O mapped I/O. Address decoding, Interfacing of input/output chips with 8085	09
2	**Architecture of 8-bit AVR Microcontroller:** Introduction to Microcontrollers, Difference between microprocessor and Microcontrollers, Overview of AVR family, AVR Microcontroller architecture: Register, AVR status register, Memory Space, ATmega32 pin-configuration & function of each pin.	08
3	**Introduction to AVR Programming in Assembly and C:** Addressing modes of AVR, Instructions: Data transfer Arithmetic, Logic and Compare, Rotate and Shift, Branch and Call instructions, AVR data types and assembler directives. Assembly Programming and C Programming.	08
4	**AVR on chip peripherals:** AVR Concepts of I/O Ports, Timers, Interrupts, serial port, ADC with programming in Assembly and C.	14
5	**Peripheral Interfacing:** LCD and Keyboard Interfacing, DAC and sensor interfacing, DC Motor, Stepper Motor Interfacing with AVR	6
	Total	**45**

List of References:

1. Muhammad Ali Mazidi, SarmadNaimi and SepehrNaimi,"*The AVR Microcontroller and Embedded Systems", Using Assembly and C*, Pearson Education, 1st Edition, 2012.
2. Dhananjay Gadre,*"Programming and Customizing the AVR Microcontroller*", TMH, 1st Edition, 2001.
3. Ramesh Gaonkar, "*Microprocessor Architecture , Programming and Applications with the 8085"*, 5th edition Penram.

Course Outcomes (COs):

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

1. Explore Architecture of basic microprocessor and microcontroller.
2. Do assembly language programming for microcontrollers.
3. Program the on chip peripherals like I/O ports, timers, UART etc
4. Do interfacing design of peripherals like D/A, LCD, Keyboard, sensors etc.
5. Design Microcontrollers based systems.

2EL12: MICROCONTROLLERS LABORATORY
CREDITS - 1 (LTP:0,0,1)

Course Objective:

1. To provide students with practical knowledge of microcontroller based Electronic Systems for various applications.
2. Design and Development of Hardware and Software design for basic microcontroller based systems.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
0	0	2	1	00	00	40	60	100

Experiment List:

1. Introduction to 8085 Hardware Kit. Basic Assembly Language Programming for 8085 on Hardware kits.
2. Basic Assembly Language Programming for 8085. Data Saving, Retrieving, Arithmetic and Logical Operations
3. Introduction to EDA Tools for AVR Microcontrollers. Basic Assembly Language Programming for ATMEG32.
4. Assembly Language Programming for Byte Level Operations and Bit Level Operations
5. AVR Programming in C
6. AVR I/O port Programming in Assembly and C. Simulations of same on Proteous software.
7. AVR Timer Programming for Mode 0, 1 and 2 with Polling in Assembly and C. Simulations of same on Proteous software.
8. AVR Timer Programming for Mode 0,1 and 2 with timer interrupt in Assembly and C. Simulations of same on Proteous software
9. AVR Interrupt Programming in Assembly and C. Simulations of same on Proteous software
10. AVR Serial Port Programming for transmitter using polling and serial interrupt in Assembly and C. Simulations of same on Proteous software
11. AVR Serial Port Programming for Receiver using polling and serial interrupt in Assembly and C. Simulations of same on Proteous software
12. LCD Interfacing with ATMEG32 and Programming for the same.
13. AVR Programming of ADC in Assembly and C. Simulations of same on Proteous software
14. DAC Interfacing with ATMEG32 and Programming for the same.
15. Stepper Motor Interfacing with ATMEG32 and Programming for the same.

16. Mini Project

List of References:

1. Muhammad Ali Mazidi, Sarmad Naimi and Sepehr Naimi,"*The AVR Microcontroller and Embedded Systems*", Using Assembly and C, Pearson Education, 1st Edition, 2012.
2. DhananjayGadre,"*Programming and Customizing the AVR Microcontroller*", TMH, 1st Edition, 2001.
3. Ramesh Gaonkar, "*Microprocessor Architecture , Programming and Applications with the 8085*", 5th edition Penram.

Course Outcomes (COs):

At the end of this course students will demonstrate the ability to

1. Program the microprocessors and microcontrollers in Assembly Language.
2. Program the on chip peripherals like I/O ports, timers, UART , ADC in Assembely and C
3. Do interfacing design of peripherals like D/A, LCD, Keyboard, sensorsetc
4. Use software tools to simulate and ability to analyze the peripherals interfacing Design of microcontroller based Systems, and use it in applications.
5. Ability to identify, formulate and solve engineering problems related to microprocessor and microcontroller applications.

2EL13: SENSORS AND TRANSDUCERS
CREDITS - 3 (LTP:3,0,0)

Course Objective:

1. Introduce students to the principle of various Transducers, their construction, applications and principles of operation, standards and units of measurements.
2. Provide students with opportunities to develop basic skills in the design of electronic equipment.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction to Electronics Measurement and Instrumentation:** Transducers and sensors- Accuracy and precisions, types of errors, statistical analysis, probability of errors, limiting errors, sensitivity, linearity, hysteresis, resolution, reproducibility, transfer function.	5

Unit No.	Topics	Teaching Hours
2	**Analog Signal Conditioning:** Signal conditioning, Loading effects, Bridges for measurement techniques, Wheatstone, Wein, Kelvin's, Maxwell bridge and Hey bridge, Attenuators and Amplifiers, Passive filters, Op-amp based signal conditioning circuits, Inverting and Non-Inverting Amplifiers, Linearization, Differential amplifiers and Instrumentation amplifiers.	8
3	**Digital Signal Conditioning:** Digital measuring techniques, Sample and Hold Circuits, Comparator, Buffers, D/A Conversion and A/D Conversion, Weighted Resistor DAC, R-2R ladder DAC, Dual Slope, Parallel-comparator Successive Approximation ADC techniques, Single channel and multi-channel Data Acquisition System (DAS).	8
4	**Temperature Sensors:** Resistance Vs Temperature characteristics for different materials, Thermistors, Thermocouples - thermoelectric effects for thermocouples, thermocouple tables, RTD, Other Thermal Sensors.	8
5	**Pressure, force, displacement and weight measurement:** Capacitive and inductive transducers, Displacement Sensor (LVDT), Strain Sensors – strain gauges, its principle, applications, types of strain gauges, Load cells, Piezo-electric sensors, Motion sensors.	8
6	**Flow measurement:** Basic principle of flow meter, Differential pressure flow meters, Variable area flow meter, Volumetric flow meter, Hotwire anemometer, Magnetic and ultrasonic flow meter, Rota meter, Hall effect transducer working and measurement techniques.	8
	Total	**45**

List of References:

1. Curtis D. Johnson, *"Process Control Instrumentation Technology"*, Prentice Hall India.
2. D.V.S. Murty, "*Transducers and Instrumentation"*, Prentice Hall India.
3. Helfrick Albert D. and Cooper W. D., "*Modern Electronic Instrumentation and Measurement Techniques"*, Prentice Hall India.
4. Kalsi H. S. *"Electronic Instrumentation"*, Tata McGraw-Hill Education.
5. Shawhney A. K. "*A Course In Electrical and Electronics Measurements and Instrumentation",* DhanpatRai& Sons, 11th Ed., 1999.
6. Bell David A. "*Electronic Instrumentation and Measurements"*, PHI / Pearson Education.

Course Outcomes (COs):

At the end of this course students will be able to:

1. Understand the terminology of Instrumentation and analyze various sensors.
2. Able to apply signal conditioning for measurements.
3. Explain various measurements techniques for industrial applications based on transducers.

2EL14: SENSORS AND TRANSDUCERS LABORATORY
CREDITS - 1 (LTP:0,0,1)

Course Objective:

1. Introduce students to the principle of various Transducers, their construction, applications and principles of operation, standards and units of measurements.
2. Provide students with opportunities to develop basic skills in the design of electronic equipment.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
0	0	2	1	00	00	40	60	100

Suggested List of Experiments:

1. To develop understanding of various measuring instruments.
2. To find the value of unknown resistor using Wheatstone bridge.
3. To find the value of unknown capacitance and inductance using Maxwell's bridge
4. Plot Lissajous patterns on CRO for different frequency combinations.
5. Verify characteristic of RTD and find out sensitivity.
6. Verify characteristic of Thermocouple and design signal conditioning circuit.
7. Verify characteristic of variable resistor transducer (strain gauge).
8. Measurement of distance using LVDT plot ac and dc characteristics.
9. Design signal conditioning circuit using Op-Amp and temperature sensor.
10. Implement Data Acquisition System.
11. Demonstrate the speed measurement using opto-coupler.
12. Presentation on latest topics.

List of References:

1. Curtis D. Johnson, *"Process Control Instrumentation Technology",* Prentice Hall India.
2. D.V.S. Murty, *"Transducers and Instrumentation",* Prentice Hall India.
1. Helfrick Albert D. and Cooper W. D., "*Modern Electronic Instrumentation and Measurement Techniques",* Prentice Hall India.
3. Kalsi H. S. *"Electronic Instrumentation",* Tata McGraw-Hill Education.
4. Shawhney A. K. "*A Course In Electrical and Electronics Measurements and Instrumentation"*, DhanpatRai & Sons, 11th Ed., 1999.
5. Bell David A. *"Electronic Instrumentation and Measurements*", PHI / Pearson Education.

Course Outcomes (COs):

At the end of this course students will be able to:

1. Understand the terminology of Instrumentation and analyze various sensors.
2. Able to apply signal conditioning for measurements.
3. Explain various measurements techniques for industrial and laboratory applications of various transducers.

2HS02: ECONOMICS AND MANAGEMENT
CREDITS – 3 (LTP:3,0,0)

Course Objectives:

To provide the basics of economics and management applicable to various branches of engineering. The subject will enable them to connect the concepts of economics to the practical situation and take appropriate decision. It will help select projects and price the products as well as to fix capacity utilization to maximum benefits. The subject provides understanding towards implications of monetary and fiscal policy variables on business organizations. It will prepare students towards entrepreneurship and identify business opportunity, prepare business plans and to judge business feasibility.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Economics:** Definitions, Nature, Scope, Difference between Microeconomics & Macroeconomics Theory of Demand and Supply: meaning, determinants, law of demand, law of supply, equilibrium between demand & supply ,elasticity of demand, price elasticity, income elasticity, cross elasticity Cost: Meaning, short run & long run cost, fixed cost, variable cost, total cost, average cost, marginal cost, opportunity cost Break even analysis: Meaning, explanation, numerical **Markets:** Meaning, types of markets & their characteristics Perfect competition, monopoly, monopolistic competition anti-competitive laws and concept of dumping, Inflation, types of inflation, measures to control inflation, Fiscal and monetary policy. National Income, NI current price and NI at market price, GNP,GDP,NNP,NDP and personal and disposable income	20
2	**Introduction to Management**: Definition, nature and scope of management. Functions of Management, Planning, Organizing, Staffing, Directing and Controlling Introduction to Marketing Management: Marketing Mix, Marketing v/s Selling, Market segmentation and Holistic marketing	5
3	**Introduction to Financial Accounting and Costing**: Costing, Concepts of Costing, Balance Sheet, Investment Appraisal-Net present Value (NPV), Payback period, Internal Rate of Return (IRR), Depreciation, Numerical	6
4	**Entrepreneurship:** Concepts, Importance; Characteristics of a Successful Entrepreneur, Problems faced by Entrepreneurs, Types of Entrepreneur, Creativity, Innovation and	6

Unit No.	Topics	Teaching Hours
	Entrepreneurship.	
5	**Formalities For Setting Up of A Small Business Enterprise**: Identifying The Business Opportunity; Growth of a Business Idea; Business Plan Preparation	5
	Total	**42**

List of References:

1. Dewett, K.K. "*Modern Economic Theory"*, S. Chand & Company Ltd.
2. Ahuja, H.L. "*Advanced Economic Theory",* S. Chand & Company Ltd.
3. Gail Freeman-Bell and James Balkwill, "*Management in Engineering"*, Prentice Hall of India.
4. James A .F. Stoner, R. Edward Freeman, Daniel R. Gilbert. Jr, "*Management",* Pearson, Lt. Ed.
5. Hishrich Robert, Peters Michael and Sheperd Dean, "*Entrepreneurship",* Tata McGraw-Hill
6. Roy Rajiv, *"Entrepreneurship",* Oxford, Latest Edition.
7. Pednekar Achut, *"Entrepreneurship"* Himalaya Publishing, Latest Edition.

Course Outcomes (COs):

At the end of this course students will be able to …

1. Understand and apply the basics of economics, demand, demand forecasting, elasticity and management to engineering areas.
2. Apply the basics of project planning, project evaluation; break even, depreciation, quality concepts and costing and et al to engineering.
3. Analyze product development, product life cycle and its advantages to the organization.
4. Evaluate the need of human resource development, recruitment and training and its advantages to the organization
5. Develop Motivation towards Entrepreneurship and Innovation and thus design business plan and analyze scope and profitability

2EL31: MINI PROJECT
CREDITS - 1 (LTP:0,0,1)

Course Objectives:

1. To provide students for knowledge of Electronics Components and soldering techniques and its package information for electronics circuit design.
2. Knowledge for the assembling of electronics circuit with components on PCB (Printed Circuit Board) of circuit design.
3. Design and development of Small electronic project based on hardware and software for electronics systems.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
0	0	2	1	00	00	40	60	100

Course Contents:
Mini project may be carried out in one or more form of following:
Product preparations, working/non-working models, prototype development, fabrication of set-ups, laboratory experiment development, process modification/development, simulation, software development, integration of software and hardware, statistical data analysis, survey, creating awareness in society.
The student is required to submit a report based on the work. The evaluation of the project shall be on continuous basis.

Course Guidelines:
1. Students should select a problem which addresses some basic home, office or other real life applications.
2. Students should understand testing of various components.
3. Simulation and Soldering of components should be carried out by students as per the project opted.
4. Students should develop a necessary PCB for the circuit.
5. Students should see that final circuit submitted by them is in working condition.
6. Group of maximum three students can be permitted to work on a single mini project.
7. The mini project must have hardware part. The software part is optional.
8. Department may arrange demonstration with poster presentation of all mini projects developed by the students at the end of semester.
9. It is desirable that the electronic circuit/systems developed by the students have some novel features.
10. Minimum 5-10 pages report to be submitted by students.

Course Outcome:
At the end of this course, students will be able to:
1. Practice acquired knowledge within the chosen area of technology for project development.
2. Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach which will Reproduce, improve and refine engineering projects.
3. Work as an individual or in a team in development of technical projects.
4. Understand the financial and management aspect of the project. Also communicate and report effectively project related activities and findings.

3EL01: PROBABILITY AND STOCHASTIC PROCESSES
CREDITS - 3 (LTP: 3,0,0)

Course Objective:

4. The goal of this course is to Introduce Basic concepts of probability theory and random variables.
5. To use the Probability for more than one variables.
6. To analyze random process and Transmission of random process through LTI.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme		Total Marks
L	T	P	C	Theory Marks	Practical Marks	

				ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	**100**

Course Contents:

Unit No.	Topics	Teaching Hours
1.	Sets and set operations; Probability space; Conditional probability and Bayes theorem; Combinatorial probability and sampling models.	**06**
2.	Discrete random variables, probability mass function, probability distribution function, example random variables and distributions; Continuous random variables, probability density function, probability distribution function, example distributions;	**12**
3.	Joint distributions, functions of one and two random variables, moments of random variables; Conditional distribution, densities and moments; Characteristic functions of a random variable; Markov, Chebyshev and Chernoff bounds;	**09**
4.	Random sequences and modes of convergence (everywhere, almost everywhere, probability, distribution and mean square); Limit theorems; Strong and weak laws of large numbers, central limit theorem.	**09**
5.	Random process. Stationary processes. Mean and covariance functions. Ergodicity.Transmission of random process through LTI. Power spectral density.	**09**
	Total	**45**

List of References:

1. A.Papoulis and S. Unnikrishnan Pillai, ``*Probability, Random Variables and Stochastic Processes,"* Fourth Edition, McGraw Hill.
2. H. Stark and J. Woods, ``*Probability and Random Processes with Applications to Signal Processing,"* Third Edition, Pearson Education
3. K. L. Chung, *"Introduction to Probability Theory with Stochastic Processes",* Springer International.
4. P. G. Hoel, S. C. Port and C. J. Stone, *"Introduction to Probability",* UBS Publishers,
5. P. G. Hoel, S. C. Port and C. J. Stone*, "Introduction to Stochastic Processes",* UBS Publishers
6. S. Ross, *"Introduction to Stochastic Models",* Harcourt Asia, Academic Press.

Course Outcomes (COs):

At the end of this course students will demonstrate the ability to:

6. Understand representation of random variables.
7. Investigate characteristics of Joint random variables.
8. Make use of theorems related to random variables.
9. To understand propagation of random processes in LTI systems.

3EL02: ANALOG CIRCUIT DESIGN
CREDITS - 3 (LTP: 3,0,0)

Course Objective:

1. The main objective of this course is to study the basic principles, configurations and practical limitations of op-amp and to understand the various linear and non-linear applications of op-amp.
2. The course aims to make the student familiar with comparators, convertors, active filters, special purpose ICs, their principles and applications.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	-	-	100

Course Contents:

Unit No.	Topics	Teaching Hours.
1.	**Introduction to Operational Amplifiers:** The basic operational amplifier, The differential amplifier, The emitter coupled differential amplifier, Transfer characteristics of a differential amplifier, types of ICs, Manufacturers' designations and package types for ICs, Power supplies for ICs.	**06**
2.	**Performance of Op-Amps:** Opamp Parameters: input offset voltage, and current, input bias current, differential input resistance, input capacitance, offset voltage adjustment range, input voltage range, common mode rejection ratio, supply voltage rejection ratio, large signal voltage gain, output voltage swing, output resistance, output short circuit current, supply current, power consumption, transient response, slew rate, gain bandwidth product, average temperature coefficient of input offset voltage and current, noise, Opamp: Characteristics of ideal op-amp, equivalent circuit, virtual ground, Open loop configuration for inverting, noninverting opamps.	**06**
3.	**Op-amp with Negative Feedback:** Voltage series feedback amplifier, Voltage shunt feedback amplifier, Differential Amplifier, Input offset voltage, Input bias current, Input offset current, Total output offset voltage, Thermal Drift, Effect of variation in power supply voltages on offset voltage, Change in input offset voltage and input offset current with time, Other temperature and supply voltage sensitive parameters, Noise.	**06**
4.	**General Linear Applications:** DC and AC Amplifiers, AC amplifiers with single supply voltage, Peaking amplifier, Summing, Scaling and Averaging Amplifier, Instrumentation Amplifier, Differential input and differential output amplifier, Voltage-to-current converter, Zener diode tester, Light emitting diode tester, Current-to-voltage converter, Integrator, Differentiator.	**06**
5.	**Comparators and Converters:** Comparator, Zero crossing detector, Schmitt Trigger, Voltage limiters, Clipper and clampers, Absolute value output circuit, Peak detector, Sample and hold circuit, Precision rectifier – Half/Full Wave, Square, Triangular and Saw tooth wave generator, Common mode configuration and common	**06**

Unit No.	Topics	Teaching Hours.
	mode rejection ratio, Slew rate and its equations, Effect of slew rate in applications	
6.	**Op-amp based Filter Circuits:** Classification of filters, Magnitude and frequency scaling, Magnitude and attenuation characteristics of ideal and practical filters, Design parameter Q and ω_0, Butterworth low pass and high-pass filters – 1st and 2nd order circuits design, Butterworth band pass filters, Chebyshev filter characteristics, Band reject filters.	**06**
7.	**Special ICs and its Applications:** Timer IC 555, IC 556 and applications, Phase Locked Loops and its Applications: Block diagram and operation, PLL Application as Frequency Multiplier, PLL Application as Frequency Shift Keying. Simple op-amp voltage regulator, Three terminal voltage regulators, Fixed and adjustable voltage regulators (78XX, LM317), Heat sink, Dual power supply (LM320, LM317), Basic switching regulator and its characteristics.	**09**
	Total	**45**

List of References:

1. Ramakant A. Gayakwad, "*Op-amps and Linear Integrated Circuits*", PHI Publication, 4th Edition.
2. Roy Choudhury and Shail Jain, "*Linear Integrated Circuits*", Wiley Eastern Ltd, 3rd Edition.
3. Sergio Franco, "*Design with operational amplifier and analog integrated circuits*", McGraw Hill, 3rd Edition.

Course Outcomes (COs):

At the end of this course students will demonstrate the ability to

1. Understand basic characteristics, block diagram and datasheets of op-amp.
2. Analyze negative feedback amplifier.
3. Analyze and test Linear and non-linear circuits.
4. Design the op-amp based filters and oscillators.

3EL03: ANALOG CIRCUIT DESIGN LABORATORY
CREDITS - 1 (LTP: 0,0,1)

Course Objective:

1. The main objective of this course is to study the basic principles, configurations and practical limitations of op-amp and to understand the various linear and non-linear applications of op-amp.

2. The course aims to make the student familiar with comparators, convertors, active filters, special purpose ICs, their principles and applications.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme		
L	**T**	**P**	**C**	**Theory Marks**	**Practical Marks**	**Total Marks**

				ESE	CE	ESE	CE	
0	0	2	1	-	-	40	60	100

Experiment List:

Sr. No.	Suggested List of Experiments
1.	Measurement of input and output offset voltage of 741 ICs.
2.	To configure op-amp in voltage follower mode and to measure its slew rate.
3.	To configure op-amp in inverting and non-inverting amplifier mode and measure their gain and bandwidth.
4.	Use op-amp for its linear applications like adder, summing amplifier, Integrator and Differentiator.
5.	To prepare precision rectifier using op-amp and verify its operation using measurements.
6.	To prepare half and full-wave rectifier using op-amp and verify its operation using measurements.
7.	To measure PSRR and CMRR of given op-amp.
8.	Measurement of regulation factor using voltage regulator ICs.
9.	To design, build and obtain the frequency responses of first order low pass filter.
10.	To design, build and obtain the frequency responses of band pass active filter.
11.	Mini Project

List of References:

1. Ramakant A. Gayakwad, "Op-amps and Linear Integrated Circuits", PHI Publication, 4th Edition.
2. Roy Choudhury and Shail Jain, "Linear Integrated Circuits", Wiley Eastern Ltd, 3rd Edition.
3. Sergio Franco, "Design with operational amplifier and analog integrated circuits", McGraw Hill, 3rd Edition.

Course Outcomes (COs):

At the end of this course students will demonstrate the ability to

5. Measure the parameters mentioned in datasheets of op-amp.
6. Test and Analyze negative feedback amplifier, Linear and non-linear circuits.
7. Analyze the op-amp based filters.
8. Design the op-amp based mini project.

3EL04: EMBEDDED AND IOT SYSTEM DESIGN
CREDITS –3 (LTP: 3,0,0)

Course Objective:

1. To provide students with good depth of knowledge of Designing Embedded and IOT Systems for various application.

2. Knowledge for the design and analysis of Embedded and IOT Systems for Electronics Engineering students.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Course Contents:

Unit No.	Topics	Teaching Hours
1.	**Introduction to Embedded and IOT Systems:** Definition, Examples and components of embedded Systems, Classification of an Embedded system. Architecture of Embedded system. General purpose computers vs embedded system, Embedded System Design Process, Various Embedded cores controller. Embedded system with IOT connectivity.	5
2.	**Hardware/Software Co-design for Embedded Systems:** Microcontrollers for embedded systems, 32-bit RISC Architectures for embedded Design, ARM architectural details, The ARM programmer's model, ARM development tools, ARM microcontroller programming in C, Peripheral Interafcing with ARM, Basic Wire and Wireless Protocols like, UART, I2C, SPI, PLCC, Bluetooth, WiFi, Zig-Bee and LoRa for IoT applications.	10
3.	**Embedded Operating Systems:** Operating system requirements for Embedded systems, Fundamentals of Real Time Operating System (RTOS), Operating system services, Process, Task and Thread, System calls, Timer and Event Function, Memory management, File and I/O subsystem management, Device Management, Device drivers and It's Programming for Embedded platform	10
4.	**OS based Software development:** Programming in higher level languages on embedded OS platform, Communication protocols and it's applications , Embedded Systems with Internet of Things (IoT) and Cloud support	05
5.	**Introduction to IOT based Embedded Systems:** Basic architecture of an IoT based Embedded Systems., Embedded Hardware for IoT applications, like Raspberry Pi, Arduino, and ARM development board, IoT Cloud Platform and IoT client applications on mobile phones.	05
6.	**Case Studies of Embedded Systems:** Embedded application development through ARM based development boards, Development of mini Project on new version of Operating systems and development board. That project should also address to the current societal needs.	05

Unit No.	Topics	Teaching Hours
	Total	**45**

List of Reference:

1. Muhammad Ali Mazidi,Shujen Chen, Sepehr Naimi,Sarmad Naimi, "*Embedded Programming Using C Language"*, 1st Edition, Freescale ARM Cortex-M.
2. Steve Ferbur, "*ARM System on Chip*".
3. Rajkamal, "*Embedded System: Architecture, Programming and Design*", TMH3.
4. Dr. OvidiuVermesan, Dr. Peter Friess, "*Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems*", River Publisher

Course Outcome:

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

1. Knowledge of theory and practice related to Embedded and IOT System.
2. Ability to identify, formulate and solve engineering problems by using Embedded Systems with IoT.
3. Ability to implement real field problem by gained knowledge of Embedded Systems with IoT capability.

3EL05: EMBEDDED AND IOT SYSTEM DESIGN LABORATORY
CREDITS - 1 (LTP: 0,0,1)

Course Objective:

Design and Development of Hardware and Software Design for Embedded and IOT Systems.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
0	0	2	1	00	00	40	60	100

Sr. No.	Suggested List of Experiments
1.	Study of Open source operating system used in Embedded Design.
2.	ARM based Embedded System Programming using Embedded C.
3.	LED Interfacing program for ARM based Embedded System
4.	Interfacing Push button Switch interfacing with ARM based Embedded System
5.	External Peripheral Interfacing with ARM based Embedded System.
6.	On Chip peripheral programming with ARM based Embedded System
7.	Serial Communication Protocol programming with ARM based Embedded Systems.
8.	Wireless Bluetooth communications with Embedded IOT Platform.
9.	WiFi communication interfacing with Embedded IOT Board.

Sr. No.	Suggested List of Experiments
10.	Embedded Systems design with IOT capability.
11.	IOT based Temperature monitoring embedded system with open source cloud tools.
12.	Introduction to RTOS installation on Embedded Boards.
13.	RTOS based programming for LED blinking project.

List of References:

1. Muhammad Ali Mazidi,Shujen Chen, Sepehr Naimi,Sarmad Naimi, "*Embedded Programming Using C Language"*, 1st Edition, Freescale ARM Cortex-M.
2. Steve Ferbur, "*ARM System on Chip*".
3. Rajkamal, "*Embedded System: Architecture, Programming and Design*", TMH3.
4. Dr. OvidiuVermesan, Dr. Peter Friess, "*Internet of Things: Converging Technologies for*
5. *Smart Environments and Integrated Ecosystems*", River Publisher

Course Outcome:

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

4. Understand and analyze the Hardware techniques and Design of Software codes for Embedded Systems.
5. Use software tools to simulate and analyze the performance of Embedded Systems and development of model for real time Application.

3EL06: ELECTROMAGNETIC WAVE THEORY
CREDITS -3 (LTP: 3,0,0)

Course Objective:

1. To introduce Maxwell's equations and their interpretation to electromagnetic waves.
2. To learn electromagnetic theorems and apply them to calculate curl, divergence and gradient of field.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	-	-	100

Course Contents:

Unit No.	Topics	Teaching Hours
1.	**Review of vector calculus :** Scalars and vectors, unit vector, dot product, cross product, Coordinate system and transformation, divergence, curl, gradient, Laplacian equations.	**06**

Unit No.	Topics	Teaching Hours
2.	**Electric and Magnetic fields:** Coulomb's law and electric field intensity, Electric Fields Due to Continuous Charge Distributions, Electric Flux Density , Gauss's Law, Divergence theorem Electric Potential, Relationship between E and V-Maxwell's Equation, Biot-Savart's Law, Ampere's Circuit Law-Maxwell's Equation Applications of Ampere's Law, Magnetic Flux Density, stokes' theorem.	**08**
3.	**Maxwell's equations:** Faraday's law, Displacement current, Maxwell's equation in point form, Maxwell's equation in integral form, Retarded potentials.	**05**
4.	**The Uniform plane waves:** Wave Propagation in Free Space, Wave Propagation in Die-Electric, The Poynting Vector and Power Considerations, Propagation in Good Conductors: Skin Effect, Wave Polarization.	**08**
5.	**The Plane Waves at Boundaries and in Dispersive Media :** Reflection of Uniform Plane Wave at Normal Incidence, Standing Wave Ratio, Wave Reflection from Multiple Interfaces, Plane Wave Propagation in General Directions, Plane Wave Reflection at Oblique Incidence Angle.	**08**
6.	**Electromagnetic Effects on high speed digital systems:** Introduction, Two viewpoints: Lumped or distributed, Distributed systems, Inductance and capacitance, cross talk, Electromagnetic interference	**05**
7.	**Numerical methods:** Laplace's equation in rectangular coordinates, Finite difference method, The integral equation and moment method, FD-TD technique, Finite element method, CW reflection and FEM	**05**
	Total	**45**

List of References:

1. William Hayt and J.A. Buck, "*Engineering Electromagnetics*", Seventh Edition.
2. Kraus/Fleisch, " *Electromagnetics with applications*" , Fifth edition
3. R.S. Shevgaonkar, " *Electromagnetic wave*"
4. Mathew N.O. Sadiku, "*Elements of Electromagnetics*", Oxford University press, 4th Edition

Course Outcomes (COs):

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

1. Apply vector calculus for solving electromagnetic problems of gradient, divergence and curl operations.
2. Understand and apply Maxwell's equations and electromagnetic wave characteristics in different media and interface.
3. Understand the effect of electromagnetic waves on digital systems and numerical methods to calculate wave quantities.

3CE81: ENVIRONMENT AND HEALTH
CREDITS – 3 (LTP: 3,0,0)

Objective of the Course:

1. To make the students conversant with sources of various pollution.
2. Impart knowledge of health effects of various pollutants.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Course Content:

Unit No.	Topics	Teaching Hours
1	**Introduction** Scope and importance of Environmental Health, Introduction to Environmental pollution, its impact on human health, epidemiology, agents of diseases and their pathways, chronic and communicable diseases.	07
2	**Air Pollution and Health** Sources of air pollution, Types of air pollutants, impacts on human health, air quality guidelines in protecting public health, global climatic changes and its impact, Indoor air quality, case studies.	11
3	**Water Pollution and Health** Drinking water quality criteria, water borne diseases, aspects of water and wastewater treatment, Fluoride and Arsenic in drinking water in India, case studies.	10
4	**Solid Waste and Hazardous Waste and Health** Sources, classification and composition of MSW, Introduction to MSW management. Definition and classification of hazardous waste, hazard and risk, Health effects of hazardous waste, Resource Conservation and Recovery Act (RCRA) and The Health and Safety at Work Act 1974 (HSWA), case studies.	12
5	**Noise Pollution and Health** Introduction, Sources of Noise, permission noise level and standards, Effects of noise, noise control, case studies.	05
	Total	**45**

List of References:

1. H.S. Peavy, D.R. Rowe and G. Tchbanoglous, "*Environmental Engineering*", McGraw Hill International Edition.
2. G. Tchabanoglous, "*Solid Waste Treatment and Disposal*", McGraw Hill Pub.
3. J.A. Salvato, "Environmental Sanitation", Wiley Interscience.
4. M.L. Davis and D.A. Cornwell, "Introduction to Environmental Engineering", McGraw Hill International edition.
5. Metcalf and Eddy, (Revised by G. Tchobanoglous, Wastewater Engineering: Treatment, disposal and Reuse, Tata-McGraw Hill, New Delhi.
6. J. E. Park, "*Preventive and Social Medicine*", Banarasidas Bhanot Publishers, Jabalpur, 1995.
7. Rao M.N., "*Air Pollution*", Tata McGraw- Hill Publising Company Ltd.,

Course Outcomes (CO_s):

At the end of this course students will be able to
1. Understand assessment procedure of various pollutants of air water and land.
2. Appreciate the effects of various types of pollution on human health

3CE83: EARTH SYSTEM AND GEO-ENVIRONMENT
CREDITS – 3 (LTP: 3,0,0)

Course Objective:
1. Understand and articulate the ways Earth's interior and surface operates, the interconnection of spheres to earth system and linking biogeochemical processes
2. Acknowledge earth resource and cycles of material and energy exchange, dynamic nature of earth and surficial and sub surficial morphological changes on and within the earth
3. Develop understanding of geo-environment, geo-environment divides, Resilience of environmental systems to the global climate and environmental changes and extreme events.
4. Comprehend the advance tool, techniques to monitor, mitigate and manage the geo-environmental challenges
5. Apply the course acquaintance in the respective field of interest.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Earth System:** Earth system Spheres and interaction: Introduction, Scope and fundamentals of Earth System, Understanding Lithosphere (Geosphere), Hydrosphere, Atmosphere, Cryosphere, Biosphere, and dynamics, Anthroposphere influence and impact on earth system. Physical Earth science and Morphology: Natural agencies and Geological work on land surface, Weathering, erosion, surficial and sub surficial water action and associated morphological changes. Earth's Material and Resources: The Rock cycle and rock formation, Various rock types and mineral as resource and soil types and genesis of soil Earth's dynamics: Earthquakes, Seismic activities and plate tectonics, Volcanic bustle and Morphological changes of earth, Relevant case studies	**20**

Unit No.	Topics	Teaching Hours
2	**Geo environment:** Overview of Geo-environment, Geo-environmental divide: Physiographical, geological, hydrological divides and geo-climate. Geo-environmental disasters: Landslides and Mass movement, Tsunami, Desertification, and hydro-meteorological disasters. Anthropogenic influenced Geo environmental problems. Relevant examples and case studies.	**10**
3	**Global geo-environmental Problems and Challenges:** Environmental changes, Global warming, climate changes and pollution related complexities wicked and super wicked problems, understanding geo-environmental impact and challenges in general, Learning through case studies, trending research work and projects at global scale.	**7**
4	**Tool, Techniques and mitigation for disasters and Geo-environmental Problems:** Basic principles and applications of Remote sensing, GIS and GPS, Gadgets and devices for monitoring, predicting time series geo environmental changes; Disasters warning systems for cyclone, Tsunami etc, Disaster management and Mitigation: Software and Modelling approach. Demonstration of working of tools and techniques (Virtual mode).	**8**
	Total	**45**

List of References:

1. Edward A Keller, "*Environmental Geology*", 9th Edition, Pearson, ISBN-13: 978-0321643759, ISBN-10: 0321643755, 2010
2. Edward A Keller, "*Introduction to Environmental Geology*", 5th edition, Pearson, ISBN-10: 9789352864324, ISBN-13: 978-9352864324, 2011
3. Valdiya K S, "*Environmental Geology*", 2nd edition, McGraw Hill, ISBN: 9781259058479, 2013
4. W G Ernst (Editor), "*Earth System: Processes and Issues*", Cambridge University Press, ISBN-10: 0521473233, ISBN-13: 978-0521473231, 2000
5. Steffen, W., Sanderson, R.A., Tyson, P.D., Jäger, J., Matson, P.A., Moore III, B., Oldfield, F., Richardson, K., Schellnhuber, H.J., Turner, B.L., Wasson, R.J, "*Global change and the Earth system: A planet under pressure*", Springer, 2005
6. Andrew DeWet, Kirsten Menking, "*Environmental geology: An Earth system Approach*", 2d edition, W H Freeman, ISBN-10: 1429237430, ISBN-13: 978-1429237437, 2014
7. Sinha, Rajiv, Ravindra, Rasik (Editors), "*Earth system Processes and Disaster management"*, Springer, ISBN 978-3-642-28845-6, 2013
8. Jensen, "*Remote sensing of the environment: An earth resource Perspective*", 2nd edition, Pearson India, ISBN: 9789332518940, 2013
9. Study Report, "*Thriving on our changing Planet",* The National Academic press, ISBN 978-0-309-46757-5, 2018
10. Basudev Bhatta, "*Remote sensing*", Oxford, ISBN: 9780198072393, 2011
11. Prabin Singh, "*Engineering & General Geology*" 8th edition, S K Kataria & sons ,2013

Course Outcomes (COs):

At the end of this course students will be able to …

1. Acquire knowledge of earth system, natural resources, material and energy exchange, dynamics of earth system, linkage of earth system and geo-environmental issues
2. Think critically and discriminate the natural and anthropogenic causatives of geo-environmental disaster, wicked, super-wicked problems and future challenges
3. Associate developed cognizance and perception to accomplish project and research work in a prolific way
4. Employ tool, techniques and software in the respective field to enlarge the future scope and for the career enrichment

3SE81: DISASTER MANAGEMENT AND MITIGATION
CREDITS – 3 (LTP: 3,0,0)

Course Objectives:

1. To impart knowledge of causes of various disaster and its impact
2. To understand the concept of Disaster Management Cycle and Framework
3. To explain the Applications of Science and Technology for Disaster Management & Mitigation

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Course Contents:

Sr. No.	Topics	Teaching Hrs.
1	**Introduction** Understanding the Concepts and definitions of Disaster and its types, Hazard, Vulnerability, Risk, Capacity, Disaster and Development, and disaster management	4
2	**Consequences and Control of Disasters** Geological, Hydro-Meteorological, Biological, Technological and Man- made Disasters, Global Disaster Trends, Emerging Risks of Disasters, Climate Change and Urban Disasters	8
3	**Disaster Management Cycle and Framework** Disaster Management Cycle, Paradigm Shift in Disaster Management Pre-Disaster Risk Assessment and Analysis, Risk Mapping, zonation and Micro zonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development, Awareness During Disaster Evacuation, Disaster Communication, Search and Rescue, Emergency Operation Centre, Incident Command System, Relief and Rehabilitation, Damage and Needs Assessment, Restoration of Critical Infrastructure, Early Recovery, Reconstruction and Redevelopment, IDNDR, Yokohama Strategy, Hyogo Framework of Action	12

4	**Disaster Management in India** Disaster Profile of India, Mega Disasters of India and Lessons Learnt, Disaster Management Act 2005, Institutional and Financial Mechanism, National Policy on Disaster Management, National Guidelines and Plans on Disaster Management, Role of Government, Non-Government and Inter-Governmental Agencies	11
5	**Applications of Science and Technology for Disaster Management & Mitigation** Geo-informatics in Disaster Management, Disaster Communication System, Land Use Planning and Development Regulations, Structural and Non Structural Mitigation of Disasters, S&T Institutions for Disaster Management in India	10
	Total	**45**

List of References:

1. Coppola D P, 2007. Introduction to International Disaster Management, Elsevier Science (B/H), London.
2. Manual on natural disaster management in India, M C Gupta, NIDM, New Delhi
3. An overview on natural & man-made disasters and their reduction, R K Bhandani, CSIR, New Delhi
4. Disaster Management Act, Publisher by Govt. of India
5. Publications of National Disaster Management Authority (NDMA) on Various Templates and Guidelines for Disaster Management
6. NIDM Publications, GoI
7. National Disaster Management Policy, GoI
8. Roy, P.S. (2000): Space Technology for Disaster management: A Remote Sensing & GIS Perspective, Indian Institute of Remote Sensing (NRSA) Dehradun.

Course Outcomes:

After learning the course the students should be able to:

1. Understand disasters, disaster preparedness and apply the mitigation measures
2. Understand role of IT, remote sensing, GIS and GPS in risk reduction
3. Apply knowledge of disaster management acts and guidelines.

List of Open Source Software/learning website:

www.GIS. Development.net
www.iirs.nrsa.org
http://quake.usgs.gov
www.nidmindia.nic.in

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide.

3CP81: FUNDAMENTALS OF COMPUTER NETWORKS AND SECURITY
CREDITS- 3 (LTP: 3,0,0)

Course Objective:
To learn the fundamentals of computer networks and network security concepts.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	-	-	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction** Components, Direction of Data flow, networks, Components and Categories, types of Connections, Topologies, Protocols and Standards, ISO / OSI model, Transmission Media, Coaxial Cable, Fiber Optics, Line Coding Modems	8
2.	**Networks basic** Error, detection and correction, Parity, LRC, CRC, Network Layer, Internetworks, Packet Switching and Datagram approach, IP addressing methods, Subnetting, Routing, Distance Vector Routing, Link State Routing, Routers.	8
3.	**Networking protocols** Functions of transport layer, Multiplexing, De-multiplexing, Sockets, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), Congestion Control, Quality of services (QOS), Integrated Services, Domain Name Space (DNS), SMTP, FTP, HTTP, WWW, Security, Cryptography**.**	10
4	**Security at the application layer** Email architecture, Email Security, PGP-Pretty Good Privacy, PGP Certificates, Trust model in PGP, Key rings, S/MIME-simple multipurpose Internet Mail Extension	7
5	**Security at the transport Layer** SSL Architecture, Key Exchange algorithms, Encryption/ Decryption algorithms, Hash Algorithms, Protocols related to SSL, TLS- Transport layer security, version, cipher suite	6
6	**Security at network layer:** Transport mode, Tunnel mode, comparison, Security protocols, services provide by IPSec, Security Association, Security Policy, Internet Key Exchange	6
	Total	**45**

List of References:

1. Behrouz A forouzan, "*Data Communication and networking*", Mc-Graw hill.
2. Behrouz A forouzan, "*Cryptography and Network Security*".
3. William Stallings, "*Network Security Essentials: Applications and Standards*"

Course Outcomes (COs):

At the end of this course students will be able to…

1. Understand the concepts of Data Communication, Networking and Reference models
2. Understand the concepts of Internetworking Devices and Routing techniques
3. Understand the Application layer protocols like DNS, SMTP, SNMP, FTP, HTTP etc.
4. Understand the concepts of Security at Application layer.
5. Understand the concepts of Security at the Transport Layer.
6. Understand the concepts Security at Network layer.

3CP82: FUNDAMENTALS OF OPERATING SYSTEMS
CREDITS - 3 (LTP: 3,0,0)

Course Objective:

To learn the fundamentals and various functions of operating systems.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction** Functions of operating systems, processes, files, command interpreter, Different types of operating systems, operating system interface. Operating system structure: Monolithic, Layered, Hexokernels, Virtual Machines and Client-Server.	05
2	**Processes and their implementation** Process states and state transition diagram, Inter process communication: shared memory and message passing, Race condition, critical sections, mutual exclusion, semaphores and monitors. Threads and thread implementation. Process scheduling: Objectives, First come first serve, shortest job first, Round-robin, Priority-based scheduling and Multilevel	12

Unit No.	Topics	Teaching Hours
	feedback queue Scheduling algorithms. Scheduling algorithms of Real Time Operating system.	
3	**Deadlocks** Definition and simple examples, deadlock detection, recovery, avoidance and Prevention.	**04**
4	**Memory management** Fixed and variable size partitions, protection of user address space, Swapping, virtual memory systems, demand paging, working set, page replacement strategies, Segmentation.	**09**
5	**File system** Files, Directories and Special files, access methods, Implementing Files and Shared Files, Disk space management and file space allocation methods, file system security, reliability and performance, File-System Backups, File-System Consistency, Reliability and Performance.	**09**
6	**Input and output** Basic concepts, I/O software layers: interrupt handlers, device drivers, and device-independent I/O software. Disk arm scheduling algorithms, clocks, power management.	**06**
	Total	**45**

List of References:

1. Andrew S. Tanenbaum, "*Modern Operating Systems*", Prentice Hall International
2. Silberschatz and Galvin, "*Operating System Concepts*", John Willey and Sons
3. William Stallings,"*Operating Systems*" Prentice Hall of India
4. D.M.Dhamdhere, "*Operating Systems*", Tata McGraw Hill

Course Outcomes (COs):

At the end of this course students will be able to…

1. Understand basic functions of operating system, system call and design structures
2. Explore the process management policies, process synchronization, Dead lock detection and prevention mechanisms used in different operating systems
3. Analyze scheduling algorithms used in general purpose and real time operating systems
4. Compare different memory management schemes and page replacement algorithms.
5. Understand file systems from user and design perspective.
6. Understand role of device driver in I/O management.

3IT81: CYBER SECURITY
CREDITS –3(LTP: 3,0,0)

Course Objective:

To learn importance of securing applications and to make aware about Cyber Security Cyber law, Cyber Crime.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme		Total Marks
L	**T**	**P**	**C**	**Theory Marks**	**Practical Marks**	

				ESE	CE	ESE	CE	100
3	0	0	3	60	40	-	-	

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction:** A brief history of the internet,Application security, Data security, Security technology-Firewall and VPNs, Access control, Security threats, Malicious software, Network and denial of services attack, Electronic payment system, E-Cash, Credit/Debit cards, Digital signature.	5
2	**Cyber Security And Cyber Crime Investigation:** Introduction to cyber security, Introduction to cyberspace, Survey of malware and its existence, Definition of security hole, Security patch, Viruses, Worms, Trojan horses, Social engineering, Avoiding Malwares, Spyware, Keyboard loggers, Ransomware, E-Mail and SPAM, Spoofing, Spammer's tools.	7
3	**Vulnerability Scanning:** Introduction to vulnerability, Vulnerability scanning, Different web vulnerabilities, Open Port and Service Id, Banner disclosure, Traffic probe, Web application testing, Penetration testing.	7
4	**Port Scanning:** Understanding port and services tools, Port scanning tool- Nmap, Netcat, Network sniffers and injection tools, Wireshark.	5
5	**Network Defense Tools:** Firewall basics, Packet filter Vs firewall, How a firewall protects a network, Packet characteristic to filter, Stateless Vs Stateful firewalls, Network address translation (NAT) and port forwarding, The basic of virtual private networks.	6
6	**Web Application Tools:** Scanning for web vulnerabilities tools: Nikto and W3af, Web application testing using DVWA, Manual SQL injection scanning using DVWA, Password Cracking and Brute-Force tools, Wi-Fi passwords cracking WEP & WAP/WAP2 with Aircrack-ng.	8
7	**Introduction to Cyber Crime:** Cyber Crimes, Types of cybercrime, Hacking, Attack vectors, Cyberspace, Traditional problems Associated with Computer Crime, Introduction to incident response, Cybercrime against individual, Cybercrime against property Cybercrime against organization, Cybercrimes against society, Cybercriminals.	7
	Total	**45**

List of References:

1. Mike Shema, *"Anti-Hacker Tool Kit (Indian Edition)"*, Mc Graw Hill.
2. Nina Godbole and Sunit Belpure, *"Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives",*Wiley Publication
3. Dafydd Stuttard and Marcus Pinto, *"The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws"*, WileyPublication

Course Outcomes (COs):
At the end of this course students will be able to …

1. Learn the concepts of confidentiality, availability and integrity in Information Security.
2. Explain the concepts cyber-attack, cybercrimes, cyber laws and also how to protect themselves and ultimately society from such attacks.
3. Develop Secure Web Application through vulnerability scanning and understanding the importance of data privacy and protecting data.
4. Distinguish and classify the forms of cybercriminal activity and the technological methods used to undertake such crimes.
5. Investigate assumptions about the behavior and role of victims in cyberspace, and use basic web-tools to explore behavior on-line.
6. Analyze and assess the impact of cybercrime on government, businesses, individuals and society.

3IT82: INTERNET TECHNOLOGY
CREDITS -3 (LTP: 3,0,0)

Course Objective:
To provide knowledge regarding working of Internet, implementation of network with different topologies and server configuration.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	-	-	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction To Internet:** Internet, Growth of internet, Owners of the internet, Anatomy of internet, ARPANET and internet, History of WWW, HTTP protocol, Request and response messages, Methods of HTTP, HTTPS, SMTP, IMAP, POP3 and DNS, Internet applications, Impact of internet on society, Transmission infrastructure, Internet Standards: Standards bodies and the standards process, IETF, ITU, IEEE, ATM forum.	8
2	**Internet Technology, Protocols And Addressing:** Packet switching technology, Internet protocols: TCP/IP, Router, Internet addressing scheme: Machine addressing (IP address), E-mail addresses and Resources addresses.	6

Unit No.	Topics	Teaching Hours
3	**Internet Network:** Network definition, Common terminologies: LAN, WAN, Node, Host, Workstation, Bandwidth, Interoperability, Network administrator, Network security, Network components: Severs, Clients, Communication media, Types of network: Peer to Peer, Clients server, Addressing in internet: DNS, Domain Name and their organization, understanding the internet protocol address, Network topologies: Bust, Star and ring, Ethernet, FDDI, ATM and intranet.	8
4	**Networking Hardware And Software Components:** Network interface cards, Network cables, Network connecting devices, Core Components:Hardware platforms, Internet server components, Web servers, E-mail servers, FTP servers, Proxy servers, News servers, Directory servers, Mirrored servers.	6
5	**Access Methods and Internet Working:** Access Network Architectures: Access Network characteristics. Differences between Access Networks, Local Area Networks and WideArea Networks. Access Technologies: Why there is an upper limit on modem speeds.Voice grade modems, ADSL, Cable Modems, Frame Relay.	5
6	**Internet Application:** FTP, Telnet, Email, Chat. World Wide Web: HTTP protocol.Search Engines. E-Commerce and security issues including symmetric and asymmetrickey, encryption and digital signature, and authentication. Emerging trends, Internettelephony, virtual reality over the web, etc.	6
7	**Internet Security Management Concepts, Information Privacy And Copyright Issues:** Overview of internet security, Firewalls, Internet security, Management concepts and information privacy and copyright issues, Basics of asymmetric cryptosystems.	6
	Total	**45**

List of References:

1. Greenlaw R and Hepp E*, "Fundamentals of Internet and www"*, 2nd EL, Tata McGraw-Hill, 2007.
2. D. Comer, *"The Internet Book",* Pearson Education, 2009.
3. P. J. Deitel, H. M. Deitel, *"Internet and World Wide Web: How to program",* Pearson publication.
4. M. L. Young, *"The Complete reference to Internet",* Tata McGraw Hill, 2007.
5. Douglas E Comer, *"Computer Networks and Internets With Internet Applications",* Pearson.
6. Douglas E Comer, *"Internetworking with TCP / IP, Principles, Protocols & Architecture",*6th Edition, PHI.
7. William Stallings "*Data & Computer Communications*" 8th Edition.
8. A.Farrel IElseviers, "*The Internet and its protocols – A Comparative Approach*" , Morgan Kaufmann Publishers.

Course Outcomes (COs):

At the end of this course students will be able to …

1. Understand the current topics in Web & Internet technologies.

2. Describe the basic concepts for network implementation.
3. Learn the basic working scheme of the Internet and its working.
4. Understand fundamental working of networking hardware and software technology.
5. Understand various internet application and its importance.
6. Identify the various security hazards on the Internet and need of security measures.

3IT83: SOFTWARE PROJECT MANAGEMENT
CREDITS – 3 (LTP: 3,0,0)

Course Objective:
To provide understanding of various stages of software development and quality management process.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	-	-	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Project Management:** The management spectrum, The people, The product, The process, The project, Software development life cycle, Typical software roles and responsibilities, Components, Review of models for software development, The W5HH principle.	4
2	**Project Life Cycle And Effort Estimation** Software process and process models, Choice of process models, Rapid application development, Agile methods, Extreme Programming, SCRUM, Managing interactive processes, Basics of software estimation, Effort and Cost estimation techniques, COCOMO II A Parametric productivity model - Staffing Pattern.	8
3	**Activity Planning And Risk Management** Objectives of activity planning, Project schedules, Activities, Sequencing and scheduling, Network planning models, Forward pass & backward pass techniques, Critical path (CRM) method, Risk identification, Assessment monitoring, PERT technique, Monte carlo simulation, Resource allocation, Creation of critical patterns, Cost schedules.	8
4	**Quality Planning:** Quality concepts, Procedural approach to quality Management, Quantitative approaches to quality management, Quantitative quality management planning, Setting the quality goal, Estimating defects for other stages, Quality process planning, Defect prevention planning.	4

Unit No.	Topics	Teaching Hours
5	**Quality Management:** Quality concepts, Software quality assurances, software reviews,formal technical reviews, Formal approaches to SQA, Statistical software qualityassurances, Change Management: software Configuration management, The SCMrepository, SCM Process, Configuration management for web engineering.	4
6	**Project Management in Maintenance of Projects:** Introduction, Software project maintenance life cycle, Process, estimation, Configuration management, Metrics, Defect prevention.	8
7	**Project Execution And Closure:** The review process, Planning, Overview and preparation, Group review meeting, Rework and follow-up, one-person review, Guidelines for reviews in projects, Data collection, Analysis and control guidelines, Introduction of reviews and the NAH syndrome.	6
8	**Software Testing Tools:** Test case generation Methodology, Study of various testing tools.	3
	Total	**45**

List of References:

1. R. S. Pressman, "*Software Engineering*", 7thed ,Tata McGraw Hills.
2. Pankaj Jalote, "*Software project management in practice*", Addison-Wesley.
3. B. Hughes & M. Cotterell, "*Software Project Management*", Tata McGraw Hills.
4. Mantel et al., "*Project Management* – Core text Book", Wiley .
5. Roger S. Pressman, "*Software Engineering*: *A practical Approach*", McGraw-Hill.

Course Outcomes (COs):

At the end of this course students will be able to …

1. Understand significance of Software development life cycle.
2. Understand steps of software estimation.
3. Analysis of various risk management technique.
4. Reconstruct software using quality management technique.
5. Calculate overall time of software using project execution cycle.
6. Apply software testing tool on real time software.

3IT84: ENTERPRISE RESOURCE PLANNING
CREDITS - 3 (LTP: 3,0,0)

Course Objective:

To understand the business process, project management life cycle and emerging trends of ERP.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	100

3	0	0	3	60	40	-	-	

Course Contents:

Unit No.	Topics	Teaching Hours
1	**ERP and Related Technologies:** Introduction, Related Technologies, Business Intelligence, E-Commerce and E-Business, Business Process Reengineering, Data Warehousing, Data Mining, OLAP, Product life Cycle management, Supply chain management, Customer relationship management, Management information system, Decision support system, Executive information system.	8
2	**ERP Manufacturing Perspective :** MRP - Material Requirement Planning, BOM - Bill Of Material, MRP - Manufacturing Resource Planning, DRP - Distributed Requirement Planning, PDM - Product Data Management.	5
3	**ERP Implementation:** Implementation Challenges, Strategies, Life Cycle, Pre-implementation Tasks, Requirements Definition, Methodologies, Package selection, Project Teams, Process Definitions, Vendors and Consultants, Data Migration, Project management, Post Implementation Activities.	10
4	**ERP in Action and Business Modules:** Operation and Maintenance, Performance, Maximizing the ERP System. **Business Modules:** Finance, Manufacturing, Human Resources, Plant maintenance, Materials Management, Quality management, Marketing, Sales, Distribution and service.	10
5	**ERP Case studies and ERP Tools:** E-Commerce to E-business, E-Business structural transformation, Flexible Business Design, Customer Experience, Create the new techno enterprise, New generation e-business leaders, memo to CEO, Empower your customer, Integrate Sales and Service, Integrated Enterprise applications. **Introduction to ERP Tools:** JD Edwards-Enterprise One, Microsoft Dynamics-CRM Module.	8
6	**Emerging Trends of ERP:** Extended ERP systems and ERP add-ons, Business analytics, Enterprise architecture planning, ERP usage in Real world, ERP implementation, Future of ERP applications. **Trends in ERP Systems:** Web enabled, wireless technologies, cloud computing.	4
	Total	**45**

List of References:

1. Alexis Leon, *"ERP demystified"*, Third Edition,Tata McGraw-Hill, 2014
2. Alexis Leon, *"Enterprise Resource Planning",* Third Edition,Tata McGraw Hill,2012
3. Ravi Shankar & S. Jaiswal, *"Enterprise Resource Planning"*, Galgotia.
4. Annetta Clewwto and Dane Franklin, *"Guide to Planning ERP Application"*, McGRaw-Hill

Course Outcomes (COs):

At the end of this course students will be able to …
1. Analyze the life cycle of ERP and its related technologies.
2. Identify implementation strategy used for ERP.
3. Explain the performance and maintenance operations of ERP.
4. Examine the working and design principles of various business modules of ERP.
5. Understand the basic tools of ERP.
6. Apply different emerging technologies for implementation of ERP.

3EE81: ENERGY AUDIT & CONSERVATION (O. E.-I)
CREDITS - 3 (LTP: 3,0,0)

Course Objective:
To enhance practical exposure in energy management of industrial utilities such as electrical as well as thermal.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	**100**

Course Contents:

Unit No.	Topics	Teaching Hours
01	**General Aspects**: Basics of electrical & thermal energy, energy units and conversion. Energy Scenario: Primary & Secondary energy, Commercial & Non-Commercial energy, Nonrenewable & renewable energy, Globally energy reserves and production, Energy conservation and its importance. Energy Conservation Acts: 2001, 2010, Electricity act 2003, National action plan on climate changes, Integrated energy policy, Schemes under EC act 2001. Perform Achieve and Trade (PAT) by BEE in 2008.	05
02	**Energy Management & Audit:** Definition as per EC act-2001, Objective, Need, Types, Benchmarking. Management : Top management commitment & support, Energy policy & planning, Evaluating Energy Performance, Management Tools for Effective Implementation- 5S, KAIZEN, TPM, TQM, ISO 50001, Financial analysis: techniques, Role of ESCOs, project management technique- critical path method, pert analysis. Energy Monitoring & Targeting: Definition, Key elements, CUSUM analysis, Industry 4.0.	07
03	**Renewable Energy Sources:** Concept & Fundamental, Applications: solar-thermal, solar –electrical, wind energy, biomass energy, hydro energy, fuel cell, energy from waste, wave energy, tidal energy, geothermal energy. Global energy Issues: Acid rain, Ozone layer, depletion, global warming & climate change, loss of biodiversity.	05
04	**Energy Efficiency And Performance Of Electrical Utilities:**	10

Unit No.	Topics	Teaching Hours
	Electric motor, Air compressed system, HVAC and refrigeration system, Fans & Blowers, Pumps & Pumping System, Cooling towers , Lighting system, DG, ECBC codes. Case study.	
05	**Energy Efficiency & Performance Of Thermal Utilities:** Boiler, furnace, Insulation & Refractories, Heat exchangers. Case study.	10
06	**Energy Audit Case Study:** Thermal Power Plant, Textile Industry, Ceramic Industry And Cement Industry.	05
	Total	**42**

List of References:

1. General aspects of energy management and energy audit, Guide book EA-EM, BEE, India.
2. Energy efficiency in electrical utilities, Guide book EA-EM, BEE, India.
3. Energy efficiency in thermal utilities, Guide book EA-EM, BEE, India.
4. Energy performance assessment for equipment and utility systems, Guide book EA-EM, BEE, India.
5. Doty, Steven; Turner, Wayne C, Energy Management Handbook (8th Edition), Fairmont Press, Inc., 978-0-88173-707-3
6. Amlan Chakrabarti, Energy Engineering and management, PHI Publication

Course Outcomes (COs):

After learning this course the students will be able to:

1. Understand the recent energy management scenario and nee schemes.
2. Operate and control the industrial process.
3: Identify the utility problems for energy management in different sectors.
4. Solve the industrial energy management and control issues.
5. Solve the problems in different utilities individually.

3EE83: INSTALLATION AND COMMISSIONING OF ELECTRICAL EQUIPMENT CREDITS - 3 (LTP:3,0,0)

Course Objective:

It is required to carry out/supervise installation, commissioning and maintenance of various electrical equipment in power stations, substations and industry. This course will enable the students to understand the concepts, principles and acquire basic skills of installation, commissioning and maintenance of electrical equipment in power stations, substations and industry.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	--	---	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Installation of Electrical Equipment:** Introduction unloading of electrical equipment at site, inspection storage foundation alignment of electrical machines, Tools/Instruments necessary for installation inspection, storage and handling of transformer, switchgear and induction motor preparation of technical report.	04
2	**Commissioning and Testing:** Tests before commissioning of electrical equipment; Electrical and Mechanical test, specific tests on – transformer, induction motor, alternator, need of gradually loading of various machines, tests to be performed after commissioning and before starting the machine, various instruments required for testing, commissioning of switchgear, test report on commissioning and test certificate of electrical equipment, preparations before commissioning of power transformer, commissioning-power transformer, three phase induction motor, transformer insulation oil: properties as per IS, sampling, testing and filtering/purifying, standard tests as per IS, measurement of insulation resistance of different equipment's/machines, methods of Drying the winding of electrical equipment's and its record, classification and measurement of insulation resistance, Polarization Index, appropriate insulation test for specific purpose	08
3	**Maintenance of Electrical Equipments:** General aspect of maintenance, classification, preventive maintenance-concept, classification, advantages, activities, functions of the maintenance department, breakdown maintenance-concept, advantages, activities reasons of failure of electrical equipment due to poor maintenance, factors for preparing maintenance schedule, frequency of maintenance, maintenance schedule of transformer below and above 1000kVA, maintenance schedule - induction motor, circuit breaker, overhead line, storage Battery, probable faults due to poor maintenance in transformer, induction motor, circuit breaker, overhead lines and battery	08
4	**Trouble Shooting:** Causes of fault in electrical equipment's, Internal and external Instruments and tools for trouble shooting, common troubles in electrical equipment – DC Machines, AC Machines, Transformers, Circuit-breaker, underground cable, electrical installation, need of trouble shooting chart, advantages, trouble shooting chart – DC Motor, DC Generator, Transformer, Synchronous Motor, Induction Motor, Circuit-breaker, troubleshooting chart for Domestic appliances- electrical iron, ceiling fan, Washing machine, Air cooler, Vacuum cleaner Fluorescent tube light: Construction, working and troubleshooting chart.	06
5	**Earthing:** Necessity of earthing, system earthing; advantage of neutral earthing of generator in power station, equipment earthing: Objective Types of earth electrodes, Methods of earthing; plate earthing, pipe earthing and coil earthing, Earthing in extra high voltage and underground cable Earthing resistance, factor affecting Determination of maximum permissible resistance of the earthing system, measurement of earth resistance: voltmeter-ammeter method, earth tester method, ohm meter method and earth loop tester method Earthing, grounding and bonding, Comparison between equipment earthing and system grounding Earthing procedure – Building installation, Domestic	06

Unit No.	Topics	Teaching Hours
	appliances, Industrial premises Earthing in substation, generating station and overhead line	
6	**Electrical Accidents and Safety:** Causes of electrical accidents, Factors affecting the severity of electrical shock, Actions to be taken when a person gets attached to live part, Safety regulations and safety measures, Indian electricity supply act 1948- 1956, Factory act 1948, Procedure of shut down for substation and power lines, Permit to work : certificate of (i)requisition for shut down(ii) Permit to work and (iii) Line clear certificate Instruction for the safety of persons working on a job with a permit to work, Fire extinguishers- For fixed installation and portable devices	04
	Total	**36**

List of References:

1. Rao, S., "Testing, commissioning, operation and maintenance of electrical equipment", 6/E., Khanna Publishers, New Delhi
2. Ramesh. L, Chakrasali, "Testing & Commissioning of Electrical Equipment", Prism Books Pvt. Ltd., 2014.
3. Paul Gill, "Electrical power equipment maintenance and testing", CRC Press, 2008.
4. Singh Tarlok,"Installation, commissioning and maintenance of Electrical Equipment's. K. Kataria and Sons, New Delhi,
5. Philip Kismet, "Electrical Equipment Handbook: Troubleshooting and Maintenance", McGraw- Hill, 2003.
6. Relevant Indian Standards (IS Code) and IEEE Standards for-Installation, maintenance and commissioning of electrical equipment/machines.

Course Outcomes (COs):

After learning the course, the students will be able to

1. Installation of Electrical Equipment's
2. Perform commissioning and testing of electrical equipment's
3. Preparation of maintenance schedule of different equipment and machines
4. Trouble shooting chart for various electrical equipment, machines and domestic appliances
5. Procedure of different types of earthling for different types of electrical installations
6. To become familiar about electrical safety regulations and rules during maintenance.

3ME81: INDUSTRIAL ENGINEERING AND QUALITY ASSURANCE
CREDITS - 3 (LTP: 3,0,0)

Course Objective:

1. To select appropriate plant location and layout.
2. To apply the concept of productivity and work-study.
3. To understand different aspects of quality assurance and their applications.

Teaching and Assessment Scheme:

Teaching Scheme (Hours Per Week)			Credits	Assessment Scheme		
L	**T**	**P**	**C**	**Theory Marks**	**Practical Marks**	**Total Marks**

				ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Course Content:

Unit No.	Topics	Teaching Hours
1	**Plant Location Selection and Layout:** Nature of location decision, Importance of plant location, Dynamic nature of plant location, Choice of site for selection, Comparison of location, types of plant layout and selection of layout, Quantitative methods of plant layout: CRAFT and CORELAP, Relationship diagrams, Principles factors governing flow pattern, travel chart.	08
2	**Productivity and Work Study:** Definition of productivity, application and advantages of productivity improvement tools, reasons for increase and decreases in productivity. Areas of application of work study in industry, Reaction of management and labor to work study. *Method Study:* Objectives and procedure for methods analysis, Recording techniques: String Diagram, Operations Process Chart, Flow Process Chart, Flow diagram, Man-Machine, Multiple Activity Chart, Travel Chart, and Two Handed process chart, Therbligs, Micro-motion and macro-motion study: Principles of motion economy, SIMO chart, Normal work areas and work place design. *Work Measurement:* Objectives, Work measurement techniques – time study, work sampling, pre-determined motion time standards (PMTS) Determination of time standards	12
3	**Job Evaluation and Wage Plan:** Objective, Methods of job evaluation, job evaluation procedure, merit rating (Performance appraisal), method of merit rating, wage and wage incentive plans, Non monitory incentives.	05
4	**Inspection and Statistical Quality Control:** Inspection – functions, types, objectives and benefits, quality control principles, Concepts of quality circles, Total quality management, PDCA cycle, concept of Zero Defect, Basic Concept ISO 9000, ISO 14000 and QS 9000, Six sigma: Concept, Principle, Methodology, Scope, Advantage and limitations. SQC Concept, variable and attributes, normal distribution curves and its property charts for variable and attributes and their applications and interpretation (analysis) process capability. Acceptance sampling, sampling plans, OC curves and AOQ curves Quality assurance, Quality audit.	10
5	**Industrial Legislation:** Need for Industrial legislation, Factories act 1948, Industrial dispute act 1947, The Indian trade unions act 1926, Industrial employment act 1946, Payment of wage act 1936, Workmen compensation act 1923, Payment of bonus act 1965, Employees provident fund scheme 1952.	03
6	**Ergonomics:** Scope and objectives of ergonomics, Man-machine interface, anthropometry, Application of human factors in engineering, Work place design.	04
	Total	**42**

List of Reference:

1. Banga and Sharma, "*Industrial Engineering and Production Management"*, Khanna Publishers
2. Barnes, R.L., "*Motion and Time Study, Design & Measurement of Work"*, 7th edition, John Wiley & Sons, New York, 1980
3. Currie R.M, "*Work Study"*, 4th edition, ELBS & Pitman, London, 1977
4. M. Mahajan, "*Industrial Engineering and Production Management"*, 2nd edition, Dhanpat Rai & CO. (P) LTD, 2002.
5. M. Mahajan, "*Statistical Quality Control*", 3rd edition, Dhanpat Rai & CO. (P) LTD, 2002.
6. Martand Telsang, "*Industrial Engineering and Production Management"*, 2nd edition, S Chand & company, 2002.
7. International Labour Organisation (ILO), *"Introduction to Work study"*, Oxford and IBH Publishing.

Course Outcomes (COs):

At the end of this course students will be able to …

1. Select an appropriate plant location and develop optimized plant layout.
2. Apply the concepts of productivity and work-study.
3. Evaluate job and wage plans using different methods.
4. Analyze the concept of inspection and quality assurance to enhance productivity.
5. Understand industrial legislation.
6. Explain the concepts of ergonomics in designing of various products

3ME82: PROJECT MANAGEMENT
CREDITS - 3 (LTP: 3,0,0)

Course Objective:

To illustrate Project management practices

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	0	0	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction to project management:** Project management vs general management, life cycle of projects, selection of projects to meet organizational goals. Types of Projects, Government Regulatory Framework, Market Analysis, Technical Analysis. **Management of the organization & the team**: the project manager's role, responsibilities; selection of a project manager, projects & organization.	08

Unit No.	Topics	Teaching Hours
2	**Planning the project:** The planning process, work break down structure, multidisciplinary teams. **Budgeting the project**: methods of budgeting, cost estimating & its improvement, budget uncertainty & risk management. Brief idea on Project Financing. Project cash flow, Financial estimates and Projections, cost of capital.	08
3	**Scheduling the project:** CPM & PERT networks, project uncertainty & risk management, Gantt chart, Use of computer aided tools for the analysis.	08
4	**Allocating resources to the project:** Expediting a project, resource loading & levelling, allocating resources to projects, Goldratt's critical chain.	08
5	**Monitoring & controlling the project:** The plan-monitor-control cycle, data collecting and reporting, earned value, project control, designing the control system, scope creep & change control.	05
6	**Project Execution**. Various phases of project execution, Timely execution of project, various statutory approvals, OH & S (Occupational Health and Safety) aspects during project execution, Case Study **Evaluating & terminating the project:** Evaluation, project auditing, and project termination. Project quality assurance.	05
	Total	**42**

List of References:

1. Samuel J Mantel Jr., Jack R Meredith, Scott M Shafer, Margaret M Sutton, M R Gopalan, "*Project Management*", Wiley India Pvt. Ltd.
2. Eliyahu M. Goldratt, "*Critical Chain: A Business Novel*", North River Press 1997.
3. Dr. B. C. Punmia, K. K. Khandelwal "*Project Planning and Control with PERT and CPM*", Laxmi Publication (P) Ltd.
4. Chandra Prasanaa, "*Projects-Planning analysis, Selection, Implementation and Review"* –Tata Mcgrow-Hill-

Course Outcomes (COs):

At the end of this course students will be able to …

1. Appraise project manager's role
2. Apply the concepts of project planning and budgeting
3. Apply the concepts of scheduling of projects
4. Apply the concepts of allocation of resources to projects
5. Apply methods of monitoring of projects
6. Appraise how to evaluate and terminate projects

3PE81: PRINCIPLES OF SUPPLY CHAIN MANGEMENT
CREDITS – 3 (LTP: 3,0,0)

Course Objective:

To develpoe skills to set analyze an individual corporation's current supply chain practices, to compare those with best industry practices and provide a road-map for improvement.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction to Supply Chain Management:** Definition of Supply Chain, Objectives of Supply Chain, Supply Chain principles, building blocks of a supply chain network, Types of supply chains, Supply Chain as a source of competitive advantage, business processes in supply chains. Strategic, tactical, and operational decisions in supply chains, supply chain design issues, role and importance of Supply Chain Management, Supply Chain Management methodology. Functional view of Supply Chain Management.	07
2	**Supply Chain Drivers and Metrics:** Drivers of Supply Chain Performance, Framework for Structuring Drivers, Facilities, Inventory, Transportation, Information, Sourcing, Pricing, Obstacles to Achieving Fit	04
3	**Designing Distribution Networks & Network Design in the Supply Chain:** The Role of Distribution in the Supply Chain, Factors Influencing Distribution Network Design, Design Options for a Distribution Network. The Role of Network Design in the Supply Chain, Factors Influencing Network Design Decisions, Framework for Network Design Decisions, Models for Facility Location and Capacity Allocation	09
4	**Coordination in Supply Chain:** Role and importance of Supply Chain Coordination, Coordinating procurement, Coordinating pricing decision, coordinating process and product design, coordination for reduced sourcing, vendor development and supplier partnership, Business cycle ownership with Supply Chain Management, Supply Chain integration through push-pull mechanism, Bullwhip Effect. Lack of Supply Chain Coordination ,The Effect on Performance of Lack of Coordination, Obstacles to Coordination in a Supply Chain, Managerial Levers to Achieve Coordination, Building Strategic Partnerships and Trust Within a Supply Chain, Continuous Replenishment and Vendor-Managed Inventories, Collaborative Planning,	09

Unit No.	Topics	Teaching Hours
5	**Supply Chain Globalization & IT Enablement of Supply Chains** The impact of Globalization, enterprise globalization strategies, the global integrated enterprise, requirements and challenges, operational differences, potential hidden costs and total cost strategy. Role of ICT in Supply chains, ICT tools: Information Technology in a supply chain, Upcoming use of Cloud computing, RFID, Use of Telecommunication,e-Procurement,B2B & B2C end of supply chains,Impact of Lead time,Concpet of Block chain.	09
6	**Supply Chain Management Performance Measures:** Performance Measurement of Supply Chain Management, Traditional and Contemporary approaches (Supply Chain Operation Reference Model (SCOR), Performance Benchmarking, Balance Score Card**)**	04
	Total	**42**

List of References:

1. Ronald Ballou, "*Supply Chain Management*", Pearson Education.
2. Sunil Sharma, "*Supply Chain Management – Concepts, Practice & Implementation*", Oxford University Press.
3. N. Chandrasekaran, "*Supply Chain Management – Process, Systems and Practice*", Oxford University Press.
4. David Simchi Levi, Philip Kaminsky, Edith Simchi Levi, "*Designing and Managing the Supply Chain*", Tata McGraw Hill.
5. Blanchard, B.S., "*Logistics Engineering & Management",* Prentice Hall, New Jersey, 1997
6. Sunil Chopra and Peter Menidl, "*Supply Chain Management- Strategy Planning and Operations",* Prentice Hall, 2001.
7. Manish Govil and Jean Marie Prop, "*Supply Chain Design and Management: Statistical and Tactical Perspectives*", Academic Press, San Diego.
8. Sridhar Tayur, Ram Ganeshan and Micheal Magazine, "*Quantitative Models for Supply Chain Management",* Kluwer Academic Publishers, 2002.
9. R.P. Mohanty and S. G. Deshmukh, "*Supply Chain Management Theories and Practices (Set)",* Biztantra Publication.
10. Janat Shah, "*Supply Chain Management",* Pearson Education.
11. Joel Wisner, G. Keong, "*Principles of Supply Chain Management*", Cengage Learning.

Course Outcomes (COs):

At the end of this course students will be able to …

1. Understand the effect of supply chain on business operations
2. Apply theory and practices to the design and management of supply chains
3. Able to create basic supply network distribution models.
4. Know the world class best practices being carried out in supply chain management.
5. Apply concepts and activities of the supply chain to actual organizations.

3PE82: INDUSTRIAL INTERNET OF THINGS
CREDITS – 3 (LTP: 3,0,0)

Course Objective:

1. To familiarize with Industrial Internet of things for planning to embark in the industrial sector.

2. Introduce the tools and techniques that enable IoT solution and Security aspects

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction to Industrial Internet of Things (IIoT):** Introduction to IOT and IIOT, History of IIOT, Components of IIOT - IOT Market, Trends& future Real life examples, Key terms – IOT Platform, Role of IIOT in Manufacturing Processes Use of IIOT in plant maintenance practices, Sustainability through Business excellence tools Challenges & Benefits in implementing IIOT, Scope, History, Vertical and Business Process areas, Importance of building Ecosystems, IIoT Value Chain – who does what? Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories.	10
2	**Introduction: Sensing & actuation, Communication and Networking Sensor and Interfacing** Introduction to Sensors, Transducers, Classification, Roles of sensors in IIOT, Various types of Sensors, Design of sensors, Sensor architecture, special requirements for IIOT sensors, Role of actuators, types of actuators, Interface, Networks, People &Process, Hype cycle, API, clouds, Data Management Analytics, Mining & Manipulation. Hardwire the sensors with different protocols such as HART, MODBUS-Serial & Parallel, Ethernet, BACNet , Current, M2M etc.	12
3	**Basics of Industrial IoT: Industrial Processes, Industrial Internet Systems** Internet of Things Applications: Smart Metering, e-Health Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Plant Automation, Real life examples of IIOT in Manufacturing Sector, Industrial IoT- Application Domains: Factories and Assembly Line, Food Industry, Power Plants, Inventory Management & Quality Control	10
4	**Industrial IoT: Data Analytics and Networking :** IOT Analytics: Role of Analytics in IOT, Data visualization Techniques, Machine Learning and Data Science – data management, Programming, Introduction to R Programming, Statistical Methods., Plant Safety and Security (Including AR and VR safety applications), Facility Management, Case studies, Privacy, Security and Governance. Advances in IoT.	10
	Total	**42**

List of References:

1. Daniel Minoli, *"Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications"*, ISBN: 978-1-118-47347-4, Willy Publications.
2. Michahelles, "*Architecting the Internet of Things",* ISBN 978-3- 642-19156-5 e-ISBN 978-3-642-19157-2, Springer.
3. Hakima Chaouchi, "The Internet of Things Connecting Objects to the Web" ISBN : 978-1-84821-140-7, Willy Publications.
4. Olivier Hersent, David Boswarthick, Omar Elloumi, "*The Internet of Things: Key Applications and Protocols",* ISBN: 978-1-119-99435-0, 2nd Edition, Willy Publications
5. Ovidiu & Peter; "*Internet of Things- From Research and Innovation to Market Deployment",* River Publishers Series

Course Outcomes (COs):

At the end of this course students will be able to …

1. Describe IOT, IIOT, Understand, design and develop the real life IoT applications.
2. Understand need of various hardware and software, IoT Layers and their relative importance
3. Study various IoT platforms and Security and Realize the importance of Data Analytics in IoT
4. Understand the concepts of Design Thinking.

3EL41: PROCESS INSTRUMANTATION AND CONTROL
CREDITS -4 (LTP: 3,0,1)

Course Objective:

1. The goal of this course is to develop understanding of process characteristic, control system parameters, discontinues controller modes and continues controller modes with composite control modes.
2. This introduces the analog and digital controllers, actuators and final control elements their characteristics.
3. The course aims to provide opportunities to develop basic skills in the design of process controllers.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1.	**Introduction to process control:** Control system, Process control block diagram, Analog and digital processing, Time response, Statistics	06

Unit No.	Topics	Teaching Hours
2.	**Controller principles:** Process characteristics, Control system parameters, Continuous and Discontinues controller modes, Composite controller modes	08
3.	**Analog controllers:** Electronics controllers, error detector, Single mode, composite controller modes, Pneumatic controllers, Design consideration, Difference Equations.	08
4.	**Final control:** Final control operation, Signal Conversion, Actuators, Control Element ,SignalConversions,Analog,Digital,Pneumatic,Actuators,Electrical,Pneuma tic-Hydraulic, Control elements	08
5.	**Control Loop Characteristics:** Introduction , Control System Configuration, Multi Variable Control System Control System Quality, Stability, Process Loop Tuning	08
6.	**Active Learning Assignments:** A small group of 2-4 students should give seminar on latest and current topics like Industry 4.0 from Instrumentation and control from quality journals. They should understand and analyze the latest trends in the area of the selected topic and prepare and present power-point slides, which may include videos, animations, pictures, and graphics for better understanding of the topic. This can improve Communication skills, relevance with society, safety aspects and individual and teamwork among the colleagues. The faculty will guide and help the students in identifying the topic of research.	07
	Total	**45**

List of References:

1. Curtis Johnson, "*Process Control Instrumentation Technology*", Prentice Hall India
2. Stephanopoulos, G."*Chemical process control: an introduction to theory and practice*," Prentice-Hall, New Delhi.
3. C.A.Smith and A.B.Corripio, "*Principles and practice of automatic process control*," Wiley, New York.
4. Thomas E Marlin, "*Process Control- Designing processes and Control Systems for Dynamic Performance*", McGraw-Hill International Editions.
5. F.G.Shinskey-, "*Process control Systems*", TMH
6. Bequette B.W., "*Process Control Modeling, Design and Simulation*", Prentice Hall of India, 2004

Suggested List of Experiments:

1. Introduction to Software tools.
2. To find Unit step, Ramp, Impulse response of the first and second-order system using the simulation tool.
3. To implement the ON-OFF control with an op-amp or other equivalent circuits.
4. Software implementation of the ON-OFF controller.
5. Implementation of PI controller with an op-amp or another equivalent circuit.
6. Implementation of PID controller with an op-amp or another equivalent circuit.
7. Temperature control system using temperature sensors thermocouple and RTD.
8. Speed measurement using a proximity sensor.

9. Weight measurement using Load Cells.
10. Case study for Multi-channel DAS
11. Study of LABVIEW for industrial application.
12. Study of LABVIEW for industrial application.

Course Outcomes (COs):

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

1. Understand complex process control systems, simple process problems, Process characteristics, Control system parameters, Continuous and Discontinues controller modes, Composite controller modes.
2. Analyze and design electronics controllers, Continuous and Discontinues controllers, Composite controllers, Pneumatic controllers.
3. Understand the principle of Final control operation, Control System Configurations, Multivariable Control Systems, Stability, Process Loop Tuning, etc.

3EL42: DIGITAL SYSTEM DESIGN
CREDITS - 4 (LTP: 3,0,1)

Course Objectives:

1. Learn hardware description language (HDL).
2. Utilize HDL to design and analyze digital systems
3. Learn field programmable gate array (FPGA) technologies and implementation of digital circuits using EDA Tools and PLD board.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1.	**Introduction:** Introduction to hardware descriptive language (HDL). HDL based digital design flow based on FPGA. Evolution of Computer Aided Digital Design, trends in Verilog.	02
2.	**Programmable Logic Devices:** Basic concepts- ROM, PLA, PAL, CPLD, FPGA	04
3.	**Basic Concepts of Verilog HDL:** Hierarchical modelling concepts, Lexical Conventions, Data Types System Tasks and Compiler Directives, Modules and Ports	05
4.	**Hardware Modelling :** Gate Types, Array of Instances, Gate Delays, Writing a test bench Gate level modelling of various digital circuits, Continuous Assignments, Delays, Operators,Data Flow modeling of various digital circuits, Structured Procedures, Procedural Assignments, Timing Control,Conditional	14

Unit No.	Topics	Teaching Hours
	Statements, Multiway Branching, Loops, Sequential and Parallel Blocks, Generate Blocks, Behavioral modeling of various digital circuits	
5.	**Advanced Verilog Topics:** Tasks and Functions, Finite state machine Timing and Delays, Switch Level Modeling, User-Defined Primitives, Programming Language Interface.	**10**
6.	**Introduction to System Verilog:** System Verilog modeling concepts, Data types, declarations, syntax rules, Procedural blocks and assignments, Programming statements, Operators and operation rules, Compound data types and packages, System Verilog interface ports, Verification constructs and testbench interfaces, Verification timing using clocking blocks, Object Oriented testbench, Dynamic arrays and scoreboards, Constrained random stimulus generation, Functional coverage, Synchronization (events, mailboxes, semaphores), Assertions overview	**10**
	Total	**45**

List of References:

1. Samir Palnitkar,"*Verilog HDL*",2/E,Pearson
2. Stephen Brown, *"Fundamentals of Digital Logic with Veryilog Design",* 2/E, McGraw Hill Education
3. J Bhasker ,"*Verilog Primer*", 3/E,Pearson Education
4. Chales H. Roth ,"*Digital System Design Using VHDL*' ,2/E,McGraw Hill Education
5. Stephen Brown, Zvonko Vranesic,"*Fundamentals of Digital Logic with VHDL design*", 2/E McGraw Hill Education.
6. Douglas Perry, "*VHDL:Programming by example*",4/E, McGraw Hill Education .
7. J Bhasker ,"System *Verilog Primer*", BS Publications.
8. Chris spear,"SystemVerilog for Verification: A Guide to Learning the Testbench Language Features",Springer.

Suggested List of Practicals :

Sr. No.	Suggested List of Experiments
1	Introduction to programmable logic devices, Hardware Descriptive Language and programming tool.
2	Implementation of basic logic gates and testing.
3	Implementation of adder circuits and testing.
4	Implementation of Multiplexer and testing.
5	Implementation of Decoder and testing.
6	Implementation of BCD to Seven Segment Display and testing.
7	Implementation of Flip-flops and testing.
8	Implementation of registers and testing.
9	Implementation of counters and testing.
10	Implementation of Mealy and Moore FSM and testing.

Sr. No.	Suggested List of Experiments
11	To write test bench for digital circuits using System Verilog.

Course Outcomes (COs):

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

1. Understand Hardware Descriptive Language and different design methodology.
2. Use Principles to design Combinational, sequential and synchronous circuits.
3. Test and analyse digital circuits using EDA Tools and Logic devices.
4. Use Principles of SystemVerilog to simulate digital circuits.

3EL43: OPTICAL FIBER COMMUNICATION
CREDITS - 4 (LTP: 3,0,1)

Course Objective:

1. To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures, different kind of losses, signal distortion in optical wave guides and other signal degradation factors etc.

2. To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes, the fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1.	**Overview of optical fiber communication**: The electromagnetic spectrum, Optical Spectral bands, Elements of an optical fiber transmission link with the functional description of each block, WDM concepts, transmission widows, advantages of optical fiber link over conventional copper systems, applications of fiber optic transmission systems	**06**

Unit No.	Topics	Teaching Hours
2.	**Optical fibers: structures, waveguiding and fabrication:** Optical laws and definitions, optical fiber modes and configurations, Mode theory, Step Index and Graded Index (GI) fibers, single-mode and graded-index fibers, Derivation for numerical aperture, V number and modes supported by step-index fiber, mode field, Numerical aperture and modes supported by GI fibers, fiber materials, linearly Polarized modes, Optical Fibers: fiber materials, photonic crystal, fiber optic cables, fiber fabrication techniques.	**08**
3.	**Signal Degradation in Optical Fibers :** Introduction, Attenuation, absorption, scattering losses, bending loss, dispersion, Intra modal dispersion, Inter modal dispersion.	**08**
4.	**Optical sources and detectors:** Introduction, LED's, LASER diodes, Photo detectors, Photo detector noise, Response time, double hetero junction structure, Photo diodes, comparison of photo detectors.	**08**
5.	**Power Launching and Coupling:** Source to fiber power launching, Lensing schemes, fiber-to-fiber joints,LED coupling to single-mode fibers, fiber splicing, Optical fiberconnectors.	**07**
6.	**Optical Amplifiers and networks:** Semiconductor optical Amplifier, EDFA, Raman Amplifier, WidebandOptical Amplifiers, Optical Networks: Introduction, SONET / SDH.	**07**
	Total	**45**

List of References:

1. Gerd Keiser, "*Optical Fiber Communication*", Mc Graw Hill.
2. John M. Senior, "*Optical Fiber Communication*", PHI/Pearson.
3. Djafar Mymbaev & Lowell L, Scheiner, "*Fiber optical communication Technology*", Pearson.
4. G. Agrawal, "*Fiber optic Communication Systems*", John Wiley and sons.

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	35	30	10	5	0

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels **(Revised Bloom's Taxonomy)**

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from the above table.

Suggested List of Experiments:

1. Setting -up of Analog/ Digital Optical communication Link
2. Measurement of attenuation characteristics of an optical fiber
3. Measurement of NA of a multimode fiber

4. Measurement of Mode field diameter of a single-mode fiber.
5. Measurement of Dispersion of optical fiber
6. Performance of PAM on fiber optic link
7. Performance of PWM on fiber optic link
8. Performance of PPM on fiber optic link
9. Measurement of attenuation with OTDR
10. Measurement of the emission wavelength of LED/LASER source
11. Measurement of Data quality with EYE PATTERN
12. Preparation of optical fiber end and practices on splicing/connector joints.
13. Performance of TDM on fiber optic link
14. Setting -up of voice link on Optical communication Link.
15. Performing Experiments on the VI characteristics of the optical Sources.
16. Performing Experiments on the characteristics of the optical detectors.

Course Outcomes (COs):

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

1. Understand the basic elements of optical fiber transmission link, fiber modes, and structure configurations, fabrication process, various power launching methods like Lensing schemes, fiber-to-fiber joints, LED coupling to single-mode fibers, fiber splicing, Optical fiber connectors.
2. Visualize the significance of different kinds of losses, signal distortion in optical waveguides,
3. Compare the various optical source materials, LED / Laser diodes, photodetector structures, optical amplifiers and SONET/ SDH.

3EL07: VLSI DESIGN
CREDITS - 3(LTP: 3,0,0)

Course Objective:

To provide basic principles of digital integrated CMOS circuits.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Course Content:

Unit No.	Topics	Teaching Hours
1.	**Introduction and Fabrication of MOSFET:** Overview of VLSI design methodology, VLSI design flow, Design hierarchy, Concept of regularity, Modularity, and Locality, VLSI design style, Design quality, package technology, introduction to FPGA and CPLD, computer aided design technology. Fabrication Process flow: Basic steps, C-MOS n-Well Process.	**07**

Unit No.	Topics	Teaching Hours
2.	**MOS Transistor:** The Metal Oxide Semiconductor (MOS) structure, The MOS System under external bias, Structure and Operation of MOS transistor, MOSFET Current-Voltage characteristics, MOSFET scaling and small-geometry effects, MOS Capacitance.	**08**
3.	**MOS Inverters: Static Characteristics:** Introduction to Resistive load Inverter Inverter and n-type MOSFET load (Enhancement and Depletion type MOSFET load), CMOS Inverter.	**05**
4.	**MOS Inverters Switching characteristics and Interconnect effects:** Introduction, Delay-time definitions, Calculation of Delay times, Inverter design with delay constraints, Estimation of Interconnect Parasitic, Calculation of interconnect delay, Switching Power Dissipation of CMOS Inverters. Logical effort and modeling delay. energy delay optimization	**06**
5.	**Combinational, Sequential and Dynamic MOS Logic Circuits:** CMOS logic circuits, CMOS Transmission Gates (TGs). Behaviour of Bistable elements, The SR latch circuit, Clocked latch and Flip-flop circuit, CMOS D-latch and Edge-triggered flip-flop. Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques.	**08**
6.	**Clock, Power and I/O Circuits:** Introduction, ESD Protections, Input circuits, Output circuits and L(di/dt) noise, On chip Clock Generation and Distribution, clock skewing Latch – Up and its Prevention. Power consumption and optimization in CMOS. I/O constraints.	**04**
7.	**Design for testability:** Introduction, Fault types and models, Controllability and observability, Ad Hoc Testable design techniques, Scan –based techniques, built-in Self-Test (BIST) techniques, current monitoring IDDQ test	**03**
8.	**Introduction to Nanotechnology:** Introduction, FINFET, Silicon Nanowire Transistor, Carbon Nanotubes.	**04**
	Total	**45**

List of References:

1. Sung – Mo Kang, Yusuf Leblebici ,"*CMOS Digital Integrated circuits – Analysis and Desig* ", 4/E,McGraw-Hill Pub.
2. Neil H.E.Weste,"*CMOS VLSI Design,A circuits and systems perspective"*3/E,Pearson
3. Pucknell and Eshraghian ,*"Basic VLSI Design*", 3/E,PHI
4. R. Jacob Baker, Harry W. Li , David E. Boyce ,"*CMOS circuit design, layout and simulation*" ,Willay edition.
5. Jan.M.Rabaey,*"Digital Integrated Circuits,A Design Perspective"*2/E,PHI
6. Tsividis Yannis , Operation and Modelling of the MOS Transistor, Oxford University Press.

Course Outcomes (COs):

At the end of this course students will be able to

1 Understand VLSI design flow and different design methodology.
2 Analyze and apply CMOS fundamentals to design CMOS based digital circuits.
3 Analyze Dynamic CMOS circuits, interconnect parasitic capacitance, clocking strategy and testing principles.

3EL08: VLSI DESIGN LABORATORY
CREDITS - 1(LTP: 0,0,1)

Course Objective:
To provide students with practical knowledge of Digital circuit design using MOSFET and CMOS technology.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	100
0	0	2	1	00	00	40	60	

Experiment List:

Sr. No.	Suggested List of Experiments
17.	To study I-V characteristics of NMOS.
18.	To study I-V characteristics of PMOS.
19.	To Study I-V characteristics of CMOS
20.	To study VTC characteristics of CMOS inverter.
21.	To study noise margin analysis of Inverter.
22.	To study delay calculation of Inverter.
23.	To study Layout design of NMOS
24.	To study Layout design of PMOS
25.	To study Layout design of CMOS
26.	To study Layout design of NAND
27.	To study Layout design of NOR
28.	To study Layout design of SR Latch
29.	To study Layout design of D Latch

List of References:
1. Sung –Mo Kang, Yusuf Leblebici ,"*CMOS Digital Integrated circuits – Analysis and Design* ", 4/E,McGraw-Hill Pub.
2. Neil H.E.Weste,"*CMOS VLSI Design,A circuits and systems perspective"*3/E,Pearson
3. Pucknell and Eshraghian ,*"Basic VLSI Design*", 3/E,PHI
4. R. Jacob Baker, Harry W. Li , David E. Boyce ,"*CMOS circuit design, layout and simulation*" , Willay edition.
5. Jan.M.Rabaey,*"Digital Integrated Circuits,A Design Perspective"*2/E,PHI

Course Outcomes (COs):
At the end of this course students will be able to

1. Analyze and simulate MOS based Digital Circuits.
2. Design Layout of MOS based Digital Circuits.

3EL09: DIGITAL SIGNAL PROCESSING
CREDITS –3 (LTP: 3,0,0)

Course Objective:

1. The purpose of this course is to provide an understanding of Digital Signal Processing and establish the fundamentals of DSP as required for electronics and communication engineering students.
2. The course aims to make the student familiar with analysis of discrete time signals and systems, filters design and DSP based applications.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	-	-	100

Course Contents:

Unit No.	Topics	Teaching Hours
1.	**Discrete-Time Signals and Systems:** Introduction, Signals, systems and signal processing, Elements of digital signal processing system, Concept of frequency in continuous and discrete time signals, Periodic Sampling, Frequency domain representation of sampling, General applications of DSP, Discrete-Time Signals, Discrete-Time Systems, LTI Systems, Properties of LTI Systems, Linear convolution and its properties, Linear Constant Coefficient Difference equations, Frequency domain representation of Discrete-Time Signals & Systems, Review of Fourier Transform, Review of representation of sequences by Discrete Time Fourier Transform, (DTFT),properties of discrete time Fourier Transform and correlation of signals , Fourier transform theorems	**09**
2.	**The Z-transform and Analysis Linear Time Invariant System:** Transform, Properties of ROC for Z-transform, the inverse Z-transform methods, Z- Transforms properties, Analysis of LTI systems in time domain and stability considerations, Frequency response of LTI system, System functions for systems with linear constant-coefficient, Difference equations, Freq. response of rational system functions relationship between magnitude & phase, All pass systems, inverse systems, Minimum/Maximum phase systems, systems with linear phase	**09**
3.	**Structures of Discrete Time Systems:** Block Diagram and signal flow diagram representations of Linear Constant-Coefficient, Difference equations, Basic Structures of IIR Systems, Transposed forms, Direct and cascade form Structures for FIR Systems, Effects of Co-efficient quantization	**06**

Unit No.	Topics	Teaching Hours
4.	**Filter Design Techniques:** Representation Design of Discrete-Time IIR filters from Continuous-Time filters, Approximation by Impulse invariance and Bilinear Transformation methods, Design of FIR filters by windowing techniques, Illustrative design examples of IIR and filters	**09**
5.	**Discrete-Fourier Transform andFast Fourier Transform:** Representation of Periodic sequences: The discrete Fourier Series and its Properties, Fourier Transform of Periodic Signals, Sampling the Fourier Transform, The Discrete-Fourier Transform, Properties of DFT, Linear Convolution using DFT, Computational complexity of direct Computation of DFT, DIT-FFT algorithm, DIF- FFT algorithm, Comparison between DIT and DIF algorithm	**09**
6.	**DSP Processors:** HardwardArchitecture , pipelining , Multiplier- Accumulator (MAC) hardware, architectures of fixed and floating point (TMSC6000) DSP processor. Applications.	**03**
	Total	**45**

List of References:

1. ProakisManolakis, "*Digital Signal Processing: Principles, Algorithm & Application*" Cengage Learning, 4th edition, Pearson Education
2. Alan V. Oppenheim, R.W.Schafer, J. R.Buck, " *Discrete-Time Signal Processing*" 2nd Edition, Pearson Education
3. Sen M. Kuo, "*Digital Signal Processors, Architectures, Implementations and Applications*", Pearson Education
4. B. Venkatramani, "*Digital Signal Processors, Architecture, programming and applications*", Tata Mc-Graw Hill Publications

Course Outcomes (COs):

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

1. Represent and Analyze discrete time signals and systems in Transformed domains.
2. Design and Realize Low-pass and High-pass Digital Filters.
3. Understand and use the FFT algorithm and architecture of DSP processors.

3EL10: DIGITAL SIGNAL PROCESSING LABORATORY
CREDITS - 1 (LTP: 0,0,1)

Course Objective:

The objective of the course is to make familiar with practical implementation of the digital signal processing. Students can able to develop DSP algorithms for convolution, correlation, DFT, filtering of signals etc.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)	Credits	Assessment Scheme	

L	T	P	C	Theory Marks		Practical Marks		Total Marks
				ESE	CE	ESE	CE	
0	0	2	1	-	-	40	60	100

Experiment List:

Sr. No.	Suggested List of Experiments
1.	To generate discrete sequence, basic signals (Unit step, unit impulse, ramp, exponential, sine cosine etc) and implementation of Arithmetic operations on discrete signals using software tool.
2.	Synthesis of square and triangle waves having odd & even symmetry using Fourier series.
3.	To study aliasing effect in Sampling.
4.	4. To observe the output of an LTI system with given impulse function and observe amplitude and delay.
5.	First order inverse system with an example of commutative sum and backward difference.
6.	Realization of the inverse system of a SOS (second order subsystem) with arbitrary coefficients SOS(a_1 , a_2 , b_0 , b_1 , b_2)
7.	Frequency Response of the SoSIIR filter for the given pole-zero pair.
8.	Simulation on DTFT (Discrete Time Fourier Transform) and its properties.
9.	Illustration of the effect of up-sampling and down sampling on DTFT.
10.	Windowed approximation of an ideal LPF and effect of rectangular windowing on DTFT
11.	Low pass filtering of composite signal with windowed approximation of ideal LPF.
12.	M-point windowed approximation of High-Pass filter derived from LPF by spectral shift method
13.	Autocorrelation function and energy spectral density o rectangular window and their relationship.
14.	Design of Butterworth LPF for the given specifications.
15.	Design of digital IIR and FIR filters.
16.	Study of Architecture of fixed and floating point DSP processors
17.	Implementation of DSP algorithms on LCDKC6748 kit 1. Linear convolution 2. Circular convolution 3. Impulse response
18.	Implementation of real-time programs on LCDKC6748 kit 1. Average-filter 2. Implementation of FIR filter

List of References:

1. Alan V. Oppenheim, R.W.Schafer, J. R.Buck, " Discrete-Time Signal Processing" 2nd Edition, Pearson Education

2. ProakisManolakis, "Digital Signal Processing: Principles, Algorithm & Application"Cengage Learning, 4th edition, Pearson Education
3. Sen M. Kuo, "Digital Signal Processors, Architectures, Implementations and Applications", Pearson Education
4. B. Venkatramani, "Digital Signal Processors, Architecture, programming and applications", Tata Mc-Graw Hill Publications

Course Outcomes (COs):

At the end of this course students will demonstrate the ability to

1. To use computational tools to do basic operations for signal processing.
2. To develop algorithms for designing and implementation of FIR and IIR filters with standard techniques.

3EL11: ANTENNAS
CREDITS -3 (LTP: 3,0,0)

Course Objective:

1. Enable students to understand and analyse different types of antenna.
2. To introduce the various principles of antenna theory and apply them in designing purpose.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	-	-	100

Course Contents:

Unit No.	Topics	Teaching Hours
1.	**Fundamental concepts:** Physical concept of radiation, Radiation pattern, near-and far-field Regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, Efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions.	06
2.	**Linear Wire antennas and Loop Antenna:** Radiation from Wires and Loops- Infinitesimal dipole, finite-length dipole, linear elements near Conductors, dipoles for mobile communication, small circular loop.	08
3.	**Antenna Arrays:**	08

Unit No.	Topics	Teaching Hours
	Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays, synthesis of antenna arrays using Schelkunoff polynomial method	
4.	**Aperture and Reflector Antennas:** Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas.	**07**
5.	**Broadband Antennas:** Log-periodic and Yagi-Uda antennas, frequency independent antennas, Broadcast antennas.	**06**
6.	**Micro strip Antennas:** Basic characteristics of micro strip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas.	**05**
7.	**Basic Concepts of Smart Antennas:** Concept and benefits of smart antennas, fixed weight beam forming basics, Adaptive beam forming.	**05**
	Total	**45**

List of References:

1. J.D. Kraus, "*Antennas"*, McGraw Hill, third Edition
2. C.A. Balanis, "*Antenna Theory - Analysis and Design*", third edition
3. R.E. Collin, "*Antennas and Radio Wave Propagation*", McGraw Hill
4. R.K. Shevgaonkar, "*Electromagnetic Waves*"

Course Outcomes (COs):

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

1. Understand the properties and various types of antennas.
2. Analyse the properties of different types of antennas and their design.
3. Operate antenna design software tools and come up with the design of the antenna of Required specifications.

3EL12: ANTENNAS AND MEASUREMENT LAB
CREDITS - 1 (LTP: 0,0,1)

Course Objective:

1. To introduce and verify characteristics of different antennas.
2. To learn modern software tools to design antennas.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	

0	0	2	1	-	-	60	40	**100**

Experiment List:

Sr. No.	Suggested List of Experiments
1	To study and verify the radiation Pattern of simple dipole antenna.
2	To study and verify the radiation Pattern of folded dipole.
3	To study and verify the Radiation Pattern of folded dipole with reflector.
4	To Study the radiation Pattern of Yagi UDA 5E folded dipole.
5	To Study the Radiation Pattern of Micro strip Antenna.
6	Introduction to HFSS.
7	To design Micro strip Patch antenna using HFSS.
8	To design Horn antenna using HFSS.
9	To design and verify radiation patterns of different antenna using PCAAD.
10	Introduction to VNA.
11	Laboratory measurement parameters: S parameters , gain , Directivity, impedance
12	To study Effects of radiation on Humans.

List of References:

1. J.D. Kraus, "*Antennas"*, McGraw Hill, third Edition
2. C.A. Balanis, "*Antenna Theory - Analysis and Design*", third edition
3. R.E. Collin, "*Antennas and Radio Wave Propagation*", McGraw Hill
4. R.K. Shevgaonkar, "*Electromagnetic Waves*"

Course Outcomes (COs):

At the end of this course students will demonstrate the ability to

1. Understand and analyze the radiation characteristics of different antennas.
2. Design and measure antenna parameters of modern antenna using software tools.

3EL13: ELECTRONICS SYSTEM DESIGN LABORATORY
CREDITS - 1 (LTP: 0,0,1)

Course Objectives:

1. To prepare the students for designing Electronics Systems using various hardware and software tool kits.
2. To synthesis Electronics Systems and test their performances in laboratory and field.
3. To demonstrate various applications of Electronics Systems.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)	Credits	Marks Distribution	Total Marks

L	T	P	C	Theory Marks		Practical Marks		
				ESE	CE	ESE	CE	
0	0	2	1	0	0	40	60	**100**

Course Contents:

The work under this course should be carried out in one or more form of following:

Electronics System Design with appropriate motivation and possible utilization for solving some problems of the society or catering or addressing the needs of the society.

Synthesizing an integrated Electronics System that may have Electronics Hardware or Software Tool kits or mix of both.

Presenting the capabilities of the designed system by performance testing in laboratory or by demonstrating an application of the designed system in field.

The student is required to submit a report based on the work. The evaluation of the progress in this course shall be continuous basis.

Course Guidelines:

1. Students should select a problem which addresses some domestic, industrial or any other real life applications.
2. Students should identify the specifications of various parameters for the electronic system design.
3. Students should design an electronics systems based on the specification and their engineering knowledge.
4. Students should simulate / synthesize an integrated prototype of the proposed design.
5. Students should test and demonstrate the prototype of the designed system either in laboratory by testing the performance parameters or by demonstrating a working application of the system or both, whichever applicable.
6. The work under the course can be carried out in a group of maximum three students.
7. The department may arrange demonstration with poster presentation of all the electronics systems developed by the students at the end of semester.
8. It is desirable that the electronic systems developed by the students have some novel features and should not have any significant overlap with the other projects carried out in past in the same course or any other courses.
9. A comprehensive report should be submitted by the students.

References:

Books and other online references as prescribed by course instructor.

Course Outcome:

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

1. Demonstrate their design skills for solving complex problems.
2. Identify, the societal needs and propose the specifications of electronics systems for the same.
3. Synthesize and test the electronics systems.

3CE82: GEOINFORMATICS
CREDITS - 4 (LTP: 3,0,1)

Course Objective:

1. Learn basics of optical remote sensing for mapping the earth surface.
2. Understand thematic mapping using GIS.
3. Study to map location of various objects on the surface of earth.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction:** Remote sensing systems, multi concept of remote sensing, Remote sensing in India, GIS: Basic Concepts, Basic concept of Positioning and Mapping, Positioning Using Satellites, Concept of Regional and Global Navigation Satellite System.	05
2	**Electromagnetic radiation:** Introduction: EM radiation, EM Spectrum and Wavelength useful for remote sensing, Energy interaction in the atmosphere, Energy interaction with earth surface feature, Resolution: Spatial, Spectral, Radiometric and Temporal.	05
3	**Sensors and platforms:** Classification: Land observation satellites, high resolution sensors, and Satellite data products: Introduction, data reception, transmission and processing of Remote sensing data products and Digital data products.	05
4	**Image interpretation & Digital image processing:** Procedure and elements of visual interpretation, interpretation keys. Overview of digital analysis steps, Image atmospheric correction, Image geo-referencing and resampling. Image contrast enhancement, Image filtering: Low-pass and High-pass filters, Image transformation: PCT, Supervised Classification, Unsupervised Classification and Accuracy Assessment.	10
5	**Geographical Information System (GIS):** Definitions, Key Components and Functions of GIS, Spatial data and its structures, Attribute data for GIS, Geospatial Analysis: Spatial interpolation, Surface analysis, Network analysis and Integration of Remote Sensing and GIS.	10
6	**Global Navigation Satellite System (GNSS):** Global Positioning System (GPS-United States): Introduction and Three Segments of GPS, GPS Positioning Techniques, Surveying Using GPS and Mapping Using GPS. Introduction to GLONASS (Russia), Galelio (European Union), BeiDuo (China) and IRNSS (India).	05
7	**Applications of Geoinformatics in Utility Management** Applications in Utility management of Electricity, Gas sector, Telecommunication, Water supply and waste water collection utility sector.	05
	Total	**45**

List of References:

1. Bhatta B., "*Remote Sensing and GIS*", Oxford University Press, New Delhi. ISBN: 9780198085423, 2011.
2. Chandra A.M. and Ghosh S.K., "*Remote Sensing and Geographical Information System*", Narosa Publishing House, New Delhi. ISBN: 978-1842652788, 2006.
3. Joseph G. and C. Jeganathan, "*Fundamentals of Remote Sensing",* University Press, Hyderabad. ISBN: 9788173715358, 2018.
4. Kang-tsung Chang, "*Introduction to Geographic Information Systems*", McGraw-Hill Education, 4th edition, ISBN: 9780070658981, 2017.
5. Lillesand T.M., Kiefer R.W. and Chipman J.W., "*Remote Sensing and Image Interpretation*", 5th edition, John Wiley and Sons, India, ISBN: 978-8126513352, 2011.
6. Richards J.A. and Xiuping Jia, "*Remote sensing digital image analysis: An Introduction*" 4th edition, Springer, 1999, ISBN: 9788181288660.
7. Rao G.S., "*Global Navigation Satellite System*", Tata McGraw-Hill Education Pvt. Ltd., New Delhi, ISBN: 978-0070700291, 2010.

Course Outcomes (COs):

At the end of this course students will be able to …

1. Apply up-to-date information of optical remote sensing to map surface of earth.
2. Ability to develop various thematic maps.
3. Use Geoinformatics for location based mapping and monitoring.
4. Understand to apply Geoinfromatics to solve problems related with utility sector.

3SE82: ADVANCED STRENGTH OF MATERIALS
CREDITS – 4 (LTP: 3,0,1)

Course Objectives:

1. To impart knowledge of analysis for structural elements.
2. To explain various theories of failure.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
03	00	02	04	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Strain energy:** Resilience, Proof resilience, modulus of resilience,Gradual, sudden and Impact loads, Energy of dilation and distortion, Castigliano's theorem, Maxwell's theorem of reciprocal deflection	9

Unit No.	Topics	Teaching Hours
2	**Stresses in Springs:** Leaf spring, deflection and bending stresses; open coiled helical springs; derivation of formula and application for deflection and rotation of free end under the action of axial load and/or axial couple; flat spiral springs – derivation of formula for strain energy, maximum stress and rotation	7
3	**Theories of Failure:** Maximum principal stress theory, maximum shear stress theory, Total strain energy theory, shear strain energy theory, graphical representation and derivation of equation for each and their applications.	7
4	**Bending of curved elements:** Calculation of stresses in crane or chain hooks, rings of circular section and trapezoidal section and chain links with straight sided	5
5	**Shear flow in elements:** Shear stress distribution in rectangular, circular,I,T and channel section and the compression with bending stresses, Shear flow in thin walled open sections, Determination of Shear centre, Derivation of equation of torsion, Assumptions, application of theory of torsion equation to solid & hollow circular shaft, torsional rigidity.	6
6	**Thick Cylinders:** Derivation of Lame's equations, calculation of radial longitudinal and hoop stresses and strains due to internal pressure in thick cylinders, compound cylinders, hub shrunk on solid shafts	5
7	**Rotational stresses:** Rotational stresses in discs and rims of uniform thickness; discs of uniform strength	6
	Total	**45**

List of References:

1. S. P. Timoshenko and D. H. Young, "*Elements of Strength of Materials*" East West Press.
2. GH Ryder, "Strength of Materials", MacMillan and Co.
3. R.S. Lehri and A.S. Lehri, "*Strength of Materials*", S.K Kataria and Sons
4. Advanced Soild Mechanics by LS Srinath, McGraw-Hill.
5. Introduction to Mechanics of Solids by Crandell, Dahl and Lardner, McGraw Hill
6. Advanced Mechanics of Materials by Fred B. Seely and James O. Smith
7. Fundamentals of Solid Mechanics (A Treatise on Strength of Materials) by M. L. Gambhir, PHI Learning pvt. Ltd.
8. Strength of Materials by R. K. Rajput, S. Chand Publisher.
9. Mechanics of Materials by Dr.Kirpal Singh, Standard Publishers & Distributors.

Course Outcomes (COs):

1. Apply the strain energy concept to structural elements.
2. Apply theories of failure in structural elements.
3. Analyze curved elements.
4. Analyze different stresses in thin walled sections, thick shells and rotating elements.

3SE83: BASIC CONCEPTS OF STRUCTURAL BEHAVIOUR
CREDITS – 4 (LTP: 3,0,1)

Course Objectives:

1. To impart the basic concepts of behaviour of different structures.
2. Introduction to Structural Analysis and Design criteria of structural elements.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Structures and Overview:** Classification, Basic issues in analysis and design of structures. Types and selection of suitable structural system.	12
2	**Principles of Mechanics:** Internal forces and moments. Mechanical properties of building materials.	10
3	**Analysis and Design criteria:** Introduction to Structural Analysis and Design criteria of structural Elements like truss, Cable, arch, Beam, Column and Shell.	15
4	**Plate and Grid structures:** Introduction to plate and grid structures	08
	Total	**45**

List of References:

1. Daniel L.Schodek, “Structures”, Prentice Hall
2. S. B. Junnarkar and H. J. Shah, “Applied Mechanics”, Charotar Publishing House Pvt. Ltd.
3. S. B. Junnarkar and H. J. Shah, “Mechanics of Structure Vol. I”, Charotar Publishing House Pvt. Ltd.
4. Popov E.V., “Engineering Mechanics of Solids” Prentice Hall of India, New Delhi.
5. Hibbler R. C., “Structural Analysis” Pearson Education.
6. Patil H.S., Patil Y.D. and Patel Jignesh, “Structural Analysis-I”, Synergy Knowledgeware.
7. Charles E. Reynolds, James C. Steedman (Author), Anthony J. Threlfall, “Reinforced Concrete Designer's Handbook”; CRC press-Taylor and Francis.

Course Outcomes (COs):

At the end of this course students will be able to …

1. Understand different structural systems and their behaviour.
2. Compute internal forces and moments induced in structural systems due to different types of loading and apply the knowledge of building materials to structural engineering problems.
3. Analyze different structural systems and apply design concepts to them.
4. Understand plate and grid structures and their behaviour.

3CP83: PROGRAMMING WITH PYTHON
CREDITS - 4 (LTP: 3,0,1)

Course Objective:
To impart programming skills of python programming language.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction** Basic elements of python; Control Structures; Strings and Inputs.	04
2	**Functions, Scoping and Abstraction** Functions and scoping; Specifications; Recursion; Global variables; Modules; Files; System Functions and Parameters.	06
3	**Structured Types, Mutability and Higher-Order Functions** Tuples; Lists and Dictionaries; Lists and Mutability; Functions as Objects.	04
4	**Testing, Debugging, Exceptions and Assertions** Types of testing; Black-box and Glass-box; Debugging; Handling Exceptions; Assertions.	04
5	**Classes and Object-Oriented Programming** Abstract Data Types and Classes; Inheritance; Encapsulation and Information Hiding.	05
6	**Advanced Topics** Plotting using PyLab; Network Programming – Sockets; Graphics and GUI Programming; Drawing using Turtle, Tkinter and Python; Other GUIs; Database Access.	15
7	**Hardware Interfacing** Introduction; Arduino IOP, Programming PYNQ-Z1's onboard peripherals - LEDs, switches and buttons; Peripheral Example; Controlling a single LED; Controlling all the LEDs, switches and buttons	07
	Total	**45**

List of References:

1. John V Guttag. "*Introduction to Computation and Programming Using Python*", Prentice Hall of India

2. R. Nageswara Rao, "*Core Python Programming*", dreamtech
3. Wesley J. Chun. "*Core Python Programming - Second Edition*", Prentice Hall
4. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "*Data Structures and Algorithms in Pyhon*", Wiley
5. Kenneth A. Lambert, "*Fundamentals of Python – First Programs*", CENGAGE Publication
6. Luke Sneeringer, "*Professional Python*", Wrox

Course Outcomes (COs):

At the end of this course student will be able to…

1. Develop proficiency in creating applications using the Python Programming Language.
2. Describe various data structures available in Python programming language and apply them in solving computational problems.
3. Test the code written in Python.
4. Draw various kinds of graphs using PyLab.
5. Perform interfacing with different hardware.
6. Create applications with graphical user interfaces.

3CP84: INFORMATION TECHNOLOGY ESSENTIALS
CREDITS - 4 (LTP: 3,0,1)

Course Objective:

To provide basic knowledge of the technologies needed for application development.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Networking Essentials** Fundamental computer network concepts, Types of computer networks,, Network layers, TCP/IP model, Wireless Local Area Network, Ethernet, WiFi, Network Routing, Switching, Network components, web server	**04**

Unit No.	Topics	Teaching Hours
2	**Web Essentials** Creating a Website, Working principle of a Website, Browser fundamentals, Authoring tools, Types of servers: Application Server, Web Server, Database Server, HTML basics, HTML tags and their use, CSS	**07**
3	**Scripting Essentials** Need for Scripting languages, Types of scripting languages **Client side scripting** Client side scripting with JavaScript, variables, functions, conditions, loops and repetition, Pop up boxes, Advance JavaScript: JavaScript and objects, JavaScript own objects, the DOM and web browser environments, Manipulation using DOM, forms and validations, **Server side scripting** PHP, Working principle of PHP, PHP Variables, Constants, Operators, Flow Control and Looping, Arrays, Strings, Functions, Cookies, Sessions, database connectivity	**20**
4	**Database Essentials** Database management, Database terms, MySQL, commands, Data types, DDL and DML Queries, Accessing MySQL using PHP.	**10**
5	**Application Essentials** Design and development of real time information systems using database connectivity, networking and scripting languages.	**05**
	Total	**45**

List of References:

1. Ralph Moseley and M.T. Savaliya, *"Developing Web Applications*", Wiley-India.
2. Harwani, "*Developing Web Applications in PHP and AJAX*", McGrawHill
3. A Silberschatz, H F Korth and S Sudarshan, "*Database System Concepts*", McGraw Hill. (E-book available on the BVM intranet).
4. Behrouz A Forouzan, "*Data Communication and Networking*", 5th Edition, McGraw Hill, 2013 (E-Book available on the BVM intranet)
5. W3Schools is a web developers site, with tutorials and references on web development languages such as HTML, CSS, JavaScript and PHP. URL: https://www.w3schools.com/
6. MDN Web docs. URL: https://developer.mozilla.org/en-US/

Course Outcomes (COs):

At the end of this course students will be able to…

1. Understand the basics of networking.
2. Design and deploy website using HTML and CSS.
3. Design and develop simple web application using client side and server side scripting.
4. Understand database management system.
5. Formulate basic SQL queries.
6. Develop applications using information technologies.

3CP85: OBJECT ORIENTED CONCEPTS AND PROGRAMMING
CREDITS - 4 (LTP: 3,0,1)

Course Objective:
To impart knowledge about the principles of object-oriented programming paradigm using C++.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Overview and Concepts of C++** Review of fundamental concepts of Object-oriented programming, Procedural Vs. Object Oriented Programming, Principles of OOP , Benefits and applications of OOP, Introduction to C++, Program structure, namespace, identifiers, variables, constants, enum, operators, typecasting, control structures	05
2	**Objects and Classes** Basics of object and class; Private and public members; static data and function members; constructors and their types; destructors; type conversion; new and delete operators. Arrays of objects; Reference variables.	10
3	**Functions and Inheritance** Simple functions; Call and Return by reference; Inline functions; Macro Vs. Inline functions; Operator overloading; Overloading of functions; default arguments; friend functions; Concept of Inheritance; types of inheritance: single; multiple; multilevel; hierarchical; hybrid; protected members; overriding; virtual base class.	10
4	**Dynamic Polymorphism** Pointers and Objects; this pointer; virtual and pure virtual functions; Implementing dynamic polymorphism.	05
5	**I/O and File Management** Concept of streams; cin and cout; Overloading of inserter and extractor operators; C++ stream classes; Unformatted and formatted I/O; manipulators; File stream and C++ classes; File management functions; File modes; Binary and random Files.	05
6	**Exception Handling** Review of traditional error handling; basics of exception handling; exception handling mechanism; throwing mechanism; catching mechanism; rethrowing an exception; specifying exceptions, Introduction of Advanced topics.	06
7	**Introduction to Java** Introduction, OOP basics, Packages, Interface.	04

Unit No.	Topics	Teaching Hours
	Total	**45**

List of References:

1. E Balagurusamy, "*Object Oriented Programming with C++",* McGraw-Hill (E-book available on the BVM intranet)
2. Herbert Schildt, "*The Compete Reference C++",* McGraw-Hill
3. Deitel, "*C++: How to Program*", PHI
4. Jana Debasish, "*C++ and Object Oriented Programming Paradigm*", PHI
5. Saurav Sahay, "*Object Oriented Programming with C++",* Oxford
6. Herbert Schildt, "*The Complete Reference, Java*", McGraw-Hill.

Course Outcomes (COs):

At the end of this course students will be able to…

1. Differentiate between object-oriented programming and procedural programming paradigms
2. Understand features of object-oriented programming like encapsulation, inheritance, polymorphism, etc. using C++
3. Design a solution to a given problem using object-oriented programming concepts
4. Prepare an application in C++ using I/O, File management and exception handling concepts.
5. Understand concepts of OOP with Java.
6. Enhance logical reasoning and programming skills.

3IT85: WEB APPLICATION AND DEVELOPMENT
CREDITS – 4 (LTP: 3,0,1)

Course Objective:

To learn the concepts of web designing to design and implement web application.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Web server, Access and security, Web Protocol(HTTP/1.1):** Overview of HTTP, HTTP language elements, HTTP extensibility, SSL and security, Evolution of HTTP/1.1 protocol 2.8 methods-headers and response codes in 1.0 /1.1, Cloud Web hosting, Web Server Basics.	3
2	**Web Design:**	4

	Concepts of effective web design, Web design issues including browser, Bandwidth and cache, Display resolution, Look and feel of the website, Page layout and linking, Sitemap, Planning and publishing website.	
3	**HTML:** Basics of HTML, Formatting and fonts, Commenting code, Color, Hyperlink, Lists, Tables, Images, Forms, Frames, Browser architecture and web site structure.	6
4	**HTML5:** HTML5 New Element, HTML5 Canvas, HTML5 Drag/Drop, HTML5 Video, HTML5 Audio, HTML5 Input type, HTML5 Form Element, HTML5 Form Attribute, Features of HTML5.	5
5	**Style sheets:** Need for CSS, Introduction to CSS, Basic syntax and structure, Background images, Colors and properties, Manipulating texts, Using fonts, Borders and boxes, Margins, Padding , lists, Positioning using CSS, CSS2, Overview and features of CSS3.	7
6	**JavaScript:** Client side scripting with JavaScript, Variables, Functions, Pop up boxes, The DOM and web browser environments, Manipulation using DOM, Forms and validations. **DHTML:** Combining HTML, CSS and JavaScript, Events and buttons.	8
7	**PHP:** Introduction and basic syntax of PHP, PHP and HTML, Arrays, Functions, String, Form processing, Files, Advance Features: cookies and sessions.	6
8	**PHP and MySQL:** Introduction to MySQL, Connection to server, Creating database, Selecting a database, Creating a table, Inserting data, Altering tables, Queries, Deleting database, Deleting data and tables.	6
	Total	**45**

List of References:

1. Ralph Moseley and M. T. Savaliya, *"Developing Web Applications"*, Wiley-India.
2. Black Book, *"Web Technologies"*, dreamtech Press.
3. Black Book,*"HTML 5"*, Dreamtech Pr.
4. Joel Sklar, *"Web Design"*, Cengage Learning.
5. Harwani, *"Developing Web Applications in PHP and AJAX"*, McGrawHill.
6. P.J. Deitel & H.M. Deitel, *"Internet and World Wide Web How to program"*, Pearson.

Course Outcomes (COs):

At the end of this course students will be able to …

1. Able to understand internet concepts that are vital in understanding web development.
2. Understand the role of computer languages and protocols in the workings of the web and able to explain the roles of web development.
3. Describe the strengths and weaknesses of the client-server internet approaches to web design and implementation.
4. Design and apply markup languages for processing, identifying, and presenting of information in web pages.
5. Design and implement an interactive web site(s) with regard to issues of usability, accessibility and internationalization.

6. Design and implement a client-server internet application that accommodates specific requirements and constraints, based on analysis, modeling or requirements specification.

3IT86: JAVA PROGRAMING
CREDITS – 4(LTP: 3,0,1)

Course Objective:
To be familiar with different object oriented concepts which are commonly applied in implementation of various java applications using business logic.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	150
3	0	2	4	60	40	20	30	

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction to JAVA:** Object-oriented programming paradigms & principles, Key features of JAVA, Byte code and Java development Kit, Lexical issues, Data types, Variables, Control statements, Loop.	4
2	**Arrays and Operators:** One-dimensional arrays, Multi-dimensional arrays, Arithmetic operators, The bitwise operators, Shift operators, Relational operators, Short-circuit logical operators, The? operator, Operator precedence.	4
3	**Introduction to Classes and Methods:** Class Fundamentals, Declaring objects, Assigning object reference variables, Introducing methods, Constructors, Overloading methods, Overloading constructors, Using objects as parameters, Recursion, Passing and returning object form method, Introducing nested and inner classes, Command-line arguments, Understanding keywords: this, final & static.	6
4	**Inheritance and String Handling:** Inheritance basics, Super keyword, Multilevel hierarchy, Method overriding, Dynamic method dispatch, Using abstract classes, The object class, Special string operations, Character extraction, String comparison, Searching strings, Modifying a string, Data conversion using valueOf( ), String Buffer class & its methods.	4
5	**Packages and Interfaces:** Defining a package, Finding packages and CLASSPATH, Access protection, Importing packages, Defining an interface, Implementing interfaces, Applying interfaces, Variables in interfaces.	4
6	**Exception Handling:** Exception-handling fundamentals, Exception types, Use of try and catch, Multiple catch clauses, Nested try statements, Throw, Throws, Finally keywords, Java's built-in exceptions, Custom exception, Chained exceptions.	6

Unit No.	Topics	Teaching Hours
7	**Multithreaded Programming:** The java thread model, Creating a thread using implementing runnable & extending thread, Creating multiple threads, isAlive( ) and join( ), Thread priorities, Synchronization, Deadlock.	4
8	**Input/Output and File Operation:** Streams, Byte streams and character streams, The predefined streams, Reading console input, Writing console output, The PrintWriter class, Reading and writing files.	4
9	**The Applet Class:** Applet basics, Applet architecture, An applet skeleton, Simple applet display methods, Repainting, Using the status window, The HTML APPLET tag, Passing parameters to applets.	4
10	**Introducing the AWT and Graphics:** AWT classes, Window fundamentals, Working with frame windows, Creating a frame window in an applet, Working with graphics: Drawing lines, Rectangles, Ellipses, Circles, Arcs and polygons, Sizing graphics, Working with color, Working with fonts.	5
	Total	**45**

List of References:

1. Herbert Schildt, *"The Complete Reference, Java 2",* Ninth Edition, Tata McGraw Hill .
2. Herbert Schildt & Dale Skrien, *"Java Fundamentals A comprehensive introduction",* Tata McGraw Hill .
3. E.Balaguruswamy, *"Programming with Java A Primer",* Tata McGraw Hill.
4. Horstmann & Cornell, *"Core Java Volume-I Fundamentals",* Eight Edition, Pearson Education.

Course Outcomes (COs):

At the end of this course students will be able to …

1. Create java program for simple business logic.
2. Understand the concept of OOP as well as the purpose and usage principles of inheritance, polymorphism, encapsulation and method overloading.
3. Identify classes, objects, members of a class and the relationships among them needed for a specific problem.
4. Demonstrate programs on exceptions, multithreading, various collection classes and applets.
5. Understand the concept of file handling.
6. Identify various event classes and methods which are needed for event based applications.

3IT87: OBJECT ORIENTED PROGRAMMING WITH C++
CREDITS – 4(LTP: 3,0,1)

Course Objective:

Analyzing and solving the real-world problems using various concepts of object oriented programming.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)	Credits	Assessment Scheme	Total Marks

L	T	P	C	Theory Marks		Practical Marks		
				ESE	CE	ESE	CE	150
3	0	2	4	60	40	20	30	

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction to C++:** Introduction OOP, Procedural VS. Object oriented Programming, Basic concept of OOP, Principals of OOP, Benefits and applications of OOP, Programming in C++.	3
2	**Data types, operators and Control Structures:** Data Types, Keyword, Tokens, identifiers, variables, constants, enum, operators, typecasting, control structures.	4
3	**C++ Functions:** Function Prototyping, Call by value and reference, Return by reference, Inline function and macro function, Default Arguments, Function Overloading.	5
4	**Class and objects:** Structure vs Class, Member function Declaration, Access Specified for member function, Static data Member and Member Function, Friend Function, Object as Argument, Constructor, Types of Constructor, Destructor.	6
5	**Operator Overloading and Type Conversion:** Unary and Binary Operator Overloading, Types of Type Conversion.	5
6	**Inheritance:** Inheritance, Types of Inheritance, Virtual Base Classes, Abstract Class, Constructor in Derived Class.	5
7	**Virtual Function and Polymorphism:** Polymorphism, Types of Polymorphism, this Pointer, Virtual Function, Pure Virtual Function.	5
8	**I/O functions:** Formatted and Unformatted I/O Operations, Manipulators.	4
9	**File Management:** Classes for File Operations, Basic File Operations, File Functions, Error Handling Operations, Command Line Arguments.	4
10	**Exception Handling:** Try, Catch and Throw, Multiple Catch, Re-throw Exception.	4
	Total	**45**

List of References:

1. E Balagurusamy, *"Object Oriented Programming with C++",* Second Edition,Tata McGraw Hill.
2. Herbert Schlitz, *"The Compete Reference C++",* Second Edition, Tata McGraw Hill.
3. Ashok Kamthane, *"Object Oriented Programming with ANSI and Turbo C++",* Pearson.

Course Outcomes (COs):

At the end of this course students will be able to …

1. Design and analyze real world problem effectively.
2. Understand functions and parameter passing.
3. Differentiate the use of class and structure to develop a program.
4. Develop a program show usage of abstraction.
5. Design effective program using various IOS functions.
6. Create a file to manage data using object oriented programming.

3IT88: MOBILE APPLICATION DEVELOPMENT
CREDITS - 4 (LTP: 3,0,1)

Course Objective:
Design and develop useful Android applications with compelling user interfaces by using, extending, and creating your own layouts and Views and using Menus.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Basics of Android Programming:** Introduction, History, Features and android architecture, Introduction to java and android, Introducing development framework, Dalvik virtual machine – DVM, Installation of Android Studio, Android virtual device (AVD) and SDK manager, Android manifest file,	8
2	**Android Building Blocks:** Types of android applications, Activity lifecycle, Intents, services, Content provider, broadcast receivers, Activity classes, Component lifecycle,Layouts,Views and Resources, Activity with Implicit Intents.	7
3	**Android User Interface :** Buttons,RadioButtons,checkboxes,Pickers,Spinners,Menus:Optionsmenu,contextual menu, Popup menu, Adding menu items, Navigation: Screen Navigation, navigation drawer, Theme and Styles: uses of drawable in android	7
4	**Multimedia in Android:** Introduction to audio and video in Android, Android persistence, Android preferences, Using file system, Accessing SD cards, Location and maps, Using GEOCoder, Android text to speech, Paranoid android, Internet services, Broadcast receivers, Sensor manager, different Parsing techniques like JSON Parsing and SAX Parsing.	10
5	**Database Connectivity**: SQLite database, SQLite data types, Cursors and content values, SQLite open helper, Adding, Updating and deleting content, Firebasedatabase, connection of firebase database with android app.	7

Unit No.	Topics	Teaching Hours
6	**Test and Debug Android Application :** Basics of testing, testing and commercializing applications, Activity testing, service testing, Content provider testing, Test classes, Debugging using DDMS, Configuration changes, Security and permissions, Web services integration, Deployment.	6
	Total	**45**

List of References:

1. Mike Wolfson, *"Android Developer Tools Essentials"*, O'Reilly Media Publications.
2. Jeff Friesen, *"Learn Java for Android Development",* A press Publications, 2nd Edition.
3. Kevin Brothaler*, "OpenGL ES 2 for Android -The Pragmatic Programmers".*
4. Wei-MengLee, John Wileyand sons, *"Android Application Development Cookbook",*2013

Course Outcomes (COs):

At the end of this course students will be able to …

1. Design and develop user Interfaces for the Android platform.
2. Gain knowledge to create and publish their own Apps for Android devices
3. Understand the limitations and features of developing application for mobile devices
4. Learn database connectivity using real time database.
5. Analyze different parsing techniques.
6. Apply different Testing techniques on android applications.

3EE82: RENEWABLE ENERGY TECHNOLOGIES (O.E-II)
CREDITS - 4 (LTP: 3,0,1)

Course Objectives:

The subject aims to provide the student with the knowledge of upcoming renewable energy technology, applications and be able in the future to design and development of various energy technologies.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course content:

Unit No	Topics	Teaching Hours
1	**Introduction:** Renewable Sources of Energy, Grid-Supplied Electricity, Distributed Generation-Renewable. Various non-conventional energy resources; Introduction, availability, classification, relative merits and demerits. Energy Policy and Regulations, CDM prospects (carbon credits)	6
2	**Solar Energy:** Introduction ,Photo voltaic power generation, spectral distribution of energy in solar radiation, solar cell Configurations, voltage developed by solar cell, Solar Cell Efficiency and losses , practical solar cell performance, commercial photo voltaic systems, specifications for PV systems, Applications , Design of roof top solar PV system .Introduction and Application of Solar thermal Energy .	6
3	**Wind Energy :** Introduction, Site selection criterion, Classification of wind power plants, wind characteristics, performance and limitations of energy conversion systems. Power from wind, properties of air and wind, types of wind Turbines, operating characteristics, New Developments.	6
4	**Geothermal Energy:** Introduction ,Resources of geothermal energy, Types of Geo thermal Energy , Environmental Consideration, Power generation methods, Hybrid systems	6
5	**Wave and Tidal Wave energy:** Introduction, Mechanism and wave motion, Properties of waves and power content, vertex motion of waves, Device applications. Types of ocean thermal energy conversion systems, Application of OTEC systems, Examples.	6
6	**Biomass Energy Conversion:** Introduction, Technologies available for thermal and power generation applications, Bio-fuels and decentralized energy systems (Co—operative Rural power plant, Biogas generation, Waste minimization and utilization.	6
7	**Advanced Technologies:** Introduction of Green Building Concepts, CO_2 Sequestration, Electric Vehicle, Fuel Cells, Hydrogen Energy, Building material selection ,Designing of building ,Heat transfer concepts ,Green building rating systems etc.	6
	Total :	42

List of References:

1. G. D Rai, "*Non-conventional energy sources*", Khanna Publishers.
2. Chetan Singh Solanki, "*Solar Photovoltaic Technology and Systems: A Manual for Technicians, Trainers and Engineers*", PHI Publisher, 2013.
3. S.P. Sukhatme, "*Solar Energy - Principles of thermal collection and storage*", TMH, 2008.
4. Dr. R K Singal, "*Non-Conventional Energy Resources*", S.K Kataria & Sons.
5. Thomas Ackermann, "*Wind Power in Power System*", John Willey &Sons, 2005.
6. Felix A. Farret, M. Godoy Simoes, "*Integration of Alternative Sources of Energy*", John Wiley & Sons, 2006.

Web Resources:

1. Non-Conventional Energy Systems, Electrical Engineering Prof. L. Umanand, IISc Bangalore https://nptel.ac.in/courses/108/108/108108078

Course Outcomes (COs):

After learning this course the students will be able to:

1. Comprehend Solar Energy technologies and applications.
2. Learn wind and other Energy generation technologies and applications.
3. Design of solar PV system and associated problems.
4. Identify Energy generation problem as per environmental conditions and Geographical Locations.
5. Learn advance technologies and limitations.
6. Solve Field problems using recent technological development as per need of an hour.

3EE84: INDUSTRIAL AUTOMATION
CREDITS - 4 (LTP:3,0,1)

Course Objectives:

Understand automation technologies and identify advantages, limitations and applications of the same. Develop ability to recognize, articulate and solve industrial problems using automation technologies.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Details of Assessment Instruments under CE Practical Component:

Term work [15]	Allied Evaluation [15]
Report/Presentations/Assignment/Journal	Performance/Quiz/ Questions & Answers

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Programmable Logic Controller (PLC) :** An overview of PLC, introduction, definitions and history of PLC, manufacturing and assembly processes, PLC advantages and disadvantages, overall PLC system, CPU, PLC, input and output modules, program recording devices, general programming procedure, Input and Output module interfacing, relation of digital gate logic to contact / coil logic	6
2	**PLC Programming:** Creating ladder diagrams from process control descriptions, basics of register.	6
3	**PLC Functions:** Timer function, Counter function, Arithmetic function, Number comparison functions, Numbering systems and number conversion function, Skip and Master control relay functions, Jump functions, PLC data move systems, Digital bit functions and applications, Sequencer function.	8
4	**Analog PLC operations:** Different PLC operations, applications of PLCs: Stepper motor control, speed control of D.C. motor & Induction motor, lift/elevator control, water level control, Traffic control, Temperature control.	6
5	**HMI: A**rchitecture, types and specifications, Interfacing and Networking with PLC, **SCADA:** Introduction, features and applications.	5
6	**Introduction to Distributed Control System:** DCS architecture, Communication Protocol.	4
7	**Introduction to Industry 4.0** History of industrial revolutions, concept of IR4.0, typical architecture of IR4.0, design principles and major role players in IR4.0, advantages and challenges.	5
	Total	**40**

List of Experiments:

Exp. No.	Suggested List of Experiments
1	Introduction to different PLC programming languages.
2	To develop digital circuits using ladder logic and Codesys software.
3	To develop traffic controller logic using ST 2401.
4	To develop water level controller logic using ST 2401.
5	To develop elevator controller logic using ST 2401.
6	Introduction to Dynalog test bench.
7	To demonstrate set and Reset using Push Buttons.
8	To develop NOT, AND & OR logic using switches and indicators.

9	To develop NAND & NOR logic using switches and indicators.
10	To develop industrial control systems.
11	Industry Visit : Process Industry , Automation Industry

List of References:

1. John W. Webb, Ronald A. Reis, "Programmable Logic Controllers", 5th Ed., PHI, 2012.
2. John R. Hackworth, Fredrick D. Hackworth Jr., "Programmable Logic Controllers: Programming Methods and Applications", Pearson,
3. William Bolton, "Programmable Logic Controllers", 4th Edition, Elsevier.
4. L.A. Bryan and E. A. Bryan, "Programmable Controllers – Theory and implementation," Second edition, An Industrial text company publication, USA, 1997.
5. Richard L. Shell and Ernest L. Hall, "Handbook of industrial automation," CRC press 2000.

Web Resources:

Video Course on "Industrial Automation & Control" by Prof Siddhartha Mukhopadhyay (IIT, Kharagpur) available at:
https://nptel.ac.in/courses/108/105/108105088/

Course Outcomes (COs):

At the end of this course students will be able to:

1. Understand the basics of PLC programming.
2. Understand the different parameters of PLC.
3. Design different process control applications through ladder logic.
4. Analyze & explain different functions of PLC.
5. Build and experiment with PLC based SCADA systems for various industrial applications.
6. Implement HMI, distributed control system and Industry standard 4.0

3ME83: RENEWABLE ENERGY SOURCES
CREDITS - 4 (LTP: 3,0,1)

Course Objective:

To illustrate renewable energy sources and its effective technologies.

Teaching and Assessment Scheme:

Teaching Scheme (Hours Per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction:** Energy Consumption & Standard of living, Forms of Energy, Classification of Energy Resources, Application of non-conventional energy	4

Unit No.	Topics	Teaching Hours
	sources, Energy scenario	
2	**Solar Energy:** Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, Solar air heaters-types, solar driers, storage of solar energy-thermal storage, solar pond , solar water heaters, solar distillation, solar still, solar cooker, solar heating & cooling of buildings, photo voltaic - solar cells & its applications	10
3	**Wind Energy:** Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; wind data and site selection considerations	4
4	**Biomass Energy:** Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration, filling a digester for starting, maintaining biogas production, Fuel properties of bio gas, utilization of biogas.	8
5	**Geothermal Energy:** Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India **Ocean Energy:** Tidal Energy-Principle of working, performance and limitations. Wave Energy-Principle of working, performance and limitations. Ocean Thermal Energy-Availability, theory and working principle, performance and limitations	10
6	**Miscellaneous Technologies:** **Magneto Hydrodynamic Power Conversion:** Principle of working of MHD Power plant, performance and limitations. **Fuel Cell:** Principle of working of various types of fuel cells and their working, performance and limitations **Hydrogen Energy:** Hydrogen Production methods, Hydrogen storage, hydrogen transportation, utilization of hydrogen gas, hydrogen as alternative fuel for vehicles.	6
	Total	**42**

List of References:

1. G. D. Rai, "*Non-Conventional Energy Sources*", 1th Edition, Khanna Publishers, Reprint 2010
2. S. P. Sukhatme, "*Solar Energy*",3rd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2008
3. B H Khan , " *Non-Conventional Energy Resources*", 2nd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2011
4. S.Hasan Saeed and D.K.Sharma, "*Non-Conventional Energy Resources*",3rd Edition,S.K.Kataria & Sons, 2012
5. G.N.Tiwari and M.K.Ghosal, "*Renewable Energy Resource: Basic Principles And Applications*", Narosa Publishing House,2004
6. Shobh Nath Singh, "*Non-Conventional Energy Resources*", Pearson Education India; First

edition (2015).

Course Outcomes (COs):

At the end of this course students will be able to …

1. Identify energy demand and relate with available energy resources.
2. Analyze solar energy technologies.
3. Outline the wind energy sources.
4. Analyze harnessing of biomass energy.
5. Outline the geothermal and ocean energies.
6. Describe magneto hydrodynamics, hydrogen energy and fuel cell technology.

3ME84: ENERGY CONSERVATION AND MANAGEMENT
CREDITS – 4 (LTP: 3,0,1)

Course Objective:

To apply energy conservation principles and management techniques to different energy conversion systems

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Energy Scenario:** Introduction to energy & power scenario of world, National Energy consumption data and environmental aspects associated with energy utilization; Energy Auditing- need, types, methodology and barriers, role of energy managers, instruments of energy auditing.	8
2	**Energy Conservation Act 2001 and related policies:** Energy conservation Act 2001 and its features, notifications under the Act, Schemes of Bureau of Energy Efficiency (BEE) including Designated consumers, State Designated Agencies, ECBC code for Building Construction.	3
3	**Financial Management:** Energy Economics- discount period, payback period, internal rate of return, net present value; Life Cycle costing- ESCO concept.	5
4	**Energy Monitoring and Targeting:** Defining monitoring & targeting, elements of monitoring & targeting, data and information-analysis, techniques – energy consumption, production, cumulative sum of differences (CUSUM).	5

Unit No.	Topics	Teaching Hours
5	**Energy Conservation in Electrical Utilities :** Components of EB billing, HT and LT supply, transformers, cable sizing; Concept of capacitors, power factor improvement, harmonics; Electric motors- motor efficiency computation, energy efficient motors; Illumination- Lux, Lumens, types of lighting, efficacy, LED lighting and scope of energy conservation in lighting.	8
6	**Energy Efficiency in Thermal Utilities and systems:** Thermal systems, Boilers, Furnaces, Heat exchangers and Thermic Fluid heaters- efficiency computation and energy conservation measures; Steam distribution and usage, steam traps, condensate recovery, flash steam utilization; Insulation & Refractories. Energy conservation in major utilities; pumps, fans, blowers, compressed air systems, Refrigeration& Air Conditioning systems, Cooling Towers, DG sets	13
	Total	**42**

List of References:

1. Witte L.C., Schmidt P.S. and Brown D.R., "*Industrial Energy Management and Utilization*", Hemisphere Publ., Washington, 1988..
2. Callaghan P.W., "*Design and Management for Energy Conservation*", Pergamum Press, Oxford
3. Murphy W.R. and McKay G., "*Energy Management*", Butterworth's, London, 1987.
4. Bureau of Energy Efficiency, "*Energy Manager Training Manual*", Reference book No:1 to 4.
5. Dale R Patrick, Stephen W Fardo, "*Energy Conservation Guidebook*", 2nd Edition, CRC Press.
6. Shobh Nath Singh, "*Non-Conventional Energy Resources*", Pearson Education India; First edition (2015).

Course Outcomes (COs):

After learning the course the students should be able to:

1. Outline energy scenario, audit and management.
2. Apply energy conservation policy, regulations in industrial practices.
3. Evaluate energy economics.
4. Identify opportunities for rational use of energy.
5. Analyze electrical systems for energy conservation.
6. Analyze the thermal systems for energy efficiency.

3PE83: MANAGING PROJECT
CREDITS – 4 (LTP: 3,0,1)

Course Objective:

To provides a systematic and thorough introduction to all the aspects of project management.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction to Project Management:** Definition of Project, Program and Portfolio, Project parameters: Scope, Quality, Cost, Time, Resources, And The scope triangle: Time, Cost, and Resource Availability, The life cycles of Projects. Project Classification. Project Management, Project Management Vs General Management, Principles of Project Management: Defining, Planning, Executing, Controlling, Closing, Phases of Project Management: Scope the Project, Develop the project plan, Launch the plan, Monitor/control project progress, Close out the Project.	06
2	**Organizing the Project and Scope of the Project:** The PM's Roles, The PM's responsibility to the project, Selection of a project Manager, and The Project team. Developing Conditions of Satisfaction, Establishing Clarity of Purpose, Creating the Project Overview Statement, Parts of the POS, Attachments Submitting a Project for Approval, Submitting a project for Approval, Participants in the Approval Process, The Project Definition Statement.	07
3	**Planning the Project and Budgeting the Project:** The contents of a Project Plan, The Planning Process- Overview, The Planning Process- Nuts and Bolts, The project action plan, The Work breakdown Structure, Use for the WBS, Generating the WBS, Six criteria to test for completeness in the WBS, Approaches to Building the WBS, Representing the WBS. Methods of Budgeting: Top-Down Budgeting, Bottom-Up Budgeting, Cost Estimating, Improving Cost Estimates, Budget Uncertainty and Risk Management.	07
4	**Scheduling the Project- Network Analysis-PERT:** **Elements of network:** Introduction to Project Evaluation and Review Technique, Event, Activity, Dummy, Network rules, Graphical guidelines for network, Common partial situations in network, numbering the events, cycles. **Developing the Network:** Planning for network construction, modes of network construction, steps in developing network, hierarchies. **Time Estimates in PERT:** Uncertainties and use of PERT, Time estimates, Frequency distribution, Mean, Variance & standard deviation, Probability distribution, Beta distribution, Expected time. **Time Computations:** Earliest expected time, Formulation for T_E, Latest allowable occurrence time, Formulation for T_L, Combined tabular computations for T_E, T_L. **Network Analysis**: Slack, Critical Path and Probability of meeting schedule	08

Unit No.	Topics	Teaching Hours
	date.	
5	**Scheduling the Project- Network Analysis-CPM and Allocating the Resources to the Project:** **Network Analysis** :Introduction to Critical Path Method, CPM- Process, CPM - networks, Activity time estimate, Earliest event time, Latest allowable occurrence time, Combined tabular computations for T_E and T_L, Start & Finish times of activity, Float, Critical activities & Critical path. **Cost Model**: Introduction, Project cost, Indirect project cost, Direct Project cost, Crashing of project network. Introduction, Resources Usage Profiles: Histograms, Resources Smoothing, Resources Levelling.	08
6	**Monitoring and Controlling the Project and Closing out the Project:** Control versus Risk, Purpose of Controls, Control versus Quality, Progress reporting System, Applying Graphical Reporting Tools: Cost Schedule control, Deciding on Report Level of Detail, Managing project Status meetings, Managing Change, Managing Problem Escalation. Steps in Closing a project, Getting client Acceptance, Installing Project Deliverables, Documenting the Project, Post Implementation Audit, The Final Report.	06
	Total	**42**

List of References:

1. Robert K. Wysocki, Robert Beck. Jr., and David B. Crane, "*Effective Project Management*", Wiley India.
2. Samuel Mantel, Jack Meredith, Scott Shafer, Margaret Sutton, M. R. Gopalan, *"Project Management Core Textbook",* Wiley India.
3. Harold Kerzner, "*Project Management: A Systems Approach to Planning, Scheduling and Controlling*", Wiley India.
4. Dr. B.C. Punamia & K. K. Khandelwal, *"Project Planning and Control with CPM and PERT"*, Laxmi Publications, New Delhi.

Course Outcomes (COs):

After completion of this subject, the students will be able to…

1. Understand about Project, Project management and role of project manager.
2. Define& develop project statement & project plan.
3. Develop & analyze project network diagram with cost model.
4. Estimate project budget and resource allocation.
5. Monitor, control and close out the Project.

3PE84: ADDITIVE MANUFACTURING
CREDITS - 4 (LTP: 3,0,1)

Course Objective:

The revolutionary change in factory production techniques & management require a direct involvement of computer-controlled systems in the entire production process with every operation, from product design, to manufacturing, to assembly & product inspection, being monitored &

controlled by computers. This subject enhances knowledge-base with possible applications in respective fields of engineering of the students of various disciplines.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction:** Fundamentals of Prototype & Rapid prototyping, Commonly used terms, Difference between rapid prototyping & additive manufacturing (AM) concepts including classes of prototypes and basic aspects of additive manufacturing, Classification & advantages of AM Systems, Applications in engineering field of mechanical, production, civil, structural as well as electronics & information technology (machine part printing, concrete printing, metallic & ceramic part printing, circuit board printing, etc.).	04
2	**(a) Additive Manufacturing Process Chain:** Fundamental automated processes, Process chain, 3D modeling, Data conversion & transmission, Checking & preparing, Building, and post-processing. **(b) Additive Manufacturing Data Formats:** STL format, STL file problems/errors & repairing, Consequences of building a valid & invalid tessellated model, Other translators, Standards for representing objects manufactured by additive manufacturing methods.	08
3	**Liquid-based Additive Manufacturing:** Stereolithography Apparatus (SLA), Polyjet, Perfactory, Solid Object Ultraviolet-Laser Printer (SOUP),Bioplotter & Bioprinting, Rapid Freeze Prototyping (RFP), Other notable liquid-based AM systems - Two Laser Beams, Solid Ground Curing (SGC).	09
4	**Solid-based Additive Manufacturing:** Laminated Object Manufacturing (LOM), Fused Deposition Modeling (FDM), Selective Deposition Lamination (SDL), Paper Lamination Technology (PLT), Ultrasonic Consolidation, Benchtop System, Multi-Jet Modeling System (MJM), Other notable solid-based AM systems – Offset Fabber, Shape Deposition Manufacturing (SDM) process	09
5	**Powder-based Additive Manufacturing:** Selective Laser Sintering (SLS), EOSINT Systems, Laser Engineered Net Shaping (LENS),Electron Beam Melting (EBM),Selective Laser Melting (SLM), ColorJet Printing (CJP), Aerosol Jet System (AJS), Digital Part Materialisation (DPM), Other notable powder-based AM systems, Three	09

Unit No.	Topics	Teaching Hours
	Dimensional Printing (3DP) to be covered in laboratory.	
6	**Evaluation and Benchmarking:** Using Bureau Services, Setting Up a Service Bureau, Technical Evaluation Through Benchmarking, Industrial Growth, Future Trends.	03
	Total	**42**

List of References:

1. Chua C. K., Leong Kah Fai & Lim Chu Sing, *"3D Printing & Additive Manufacturing*", World Scientific Publishing Co. Pvt. Ltd., 2017.
2. Chua C. K., Leong Kah Fai & Lim Chu Sing *"Rapid Prototyping: Principles and Applications",* World Scientific Publishing Co. Pvt. Ltd. 2nd Edition
3. Ian Gibson, *"Additive Manufacturing Technologies"*, Springer, 2015.
4. Amit Bandyopadhyay, *"Additive Manufacturing"*, CRC Press, 2015.
5. Andreas Gebhardt, *"Additive Manufacturing"*, Hanser Publications, 2016.
6. Adedeji B. Badiru, "Additive Manufacturing Handbook", CRC Press, 2017.

Course Outcomes (COs):

At the end of this course students will be able to …

1. Understand and differentiate the concept of rapid prototyping & additive manufacturing (AM) including classes of prototypes and basic aspects of AM & its applications.
2. Understand and describe the AM process chain, classification & advantages of AM Systems.
3. Understand AM data formats, their limitations/errors & Standards for AM parts.
4. Understand and describe basic terminology/specifications, principles, benefits, limitations & applications of various additive manufacturing techniques.
5. Explain the process steps, set-ups and case studies related to liquid-based, solid-based & powder-based AM methods.
6. Understand and explain the requirement of service bureau, the procedure and reasons for evaluation & benchmarking as well as futuristic development of these manufacturing techniques.

3EL44: PROGRAMMABLE LOGIC CONTROLLERS
CREDITS -3 (LTP: 3,0,0)

Course Objective:

1. The goal of this course is learn how to use PLC in automation system.
2. The course aims understand Basic block diagram and software and hardware part of PLC. Practical implementation of small automation system using PLC is focused. It deals with different i/o device interface also.The knowledge of this controller thoroughly enables students to design automation system for industries.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	0	0	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction to Programmable Logic Controllers (PLCs):** Block diagram based PLC programming, Basics for PLC programming architecture, Processor memory organisation, Programme files and data files, Input and output file operations, Scan process, PLC programming languages.	10
2	**Programming Languages for PLCs.:** Instructions set of PLC, Programming Language, Support, Ladder Diagram programming requirements, Symbols of ladder syntaxes	10
3	**Automation using PLC:** Automation challenges in Industries, PLC based automation system, PLC requirements in SCADA based automation systems, PLC Architectures, Operation of PLCs, Logic Control And Sequencing, Timer and counter implementations using PLC.	10
4	**Case Studies for PLCs:** Global Process Automation system.	05
5	**Application of PLCs:** Continuous Bottle-filling system, Batch mixing system , Speed control of dc motor, 3-stage air conditioning system, Control of planar machine, Automatic frequency control of Induction heating, PLC in Industry 4.0.	10
	Total	**45**

List of References:

1. Curtis Johnson, "*Process Control Instrumentation Technology*", Prentice Hall India
2. Garry Dunning, "*Introduction To Programmable Logic Controller*", Thomson Publication.
3. John w Webb, "*Programmable Logic Controllers: Principles and Applications*", Macmillan Publishing.

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	30	20	20	5	5

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels **(Revised Bloom's Taxonomy)**

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (COs):
At the end of this course, students will be able to:
1. Apply the knowledge of control system in Electronics engineering, formulate, review literature, and analyze industrial automation problems.
2. Apply reasoning informed by the contextual knowledge to assess societal, safety issues and the consequent responsibilities relevant to the Electronics engineering practice.
3. Apply principles and application toward fulfillment of professional responsibilities of the Electronics engineering practices in industries.
4. Create, and apply appropriate techniques, resources, and modern engineering and software tools for complex engineering activities with an understanding of the limitations

3EL45: DIGITAL COMPUTER ORGANIZATION
CREDITS - 3 (LTP: 3,0,0)

Course Objective:
To impart knowledge of the basic structure of digital computer, its operation, design of basic processors, memory organization and its interface with various memories& input/output devices

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	-	-	100

Course Contents:

Unit No.	Topics	Teaching Hours
1.	**Basic Structure of Computers:** Block Diagram of General Purpose Computers; Detailed Understanding of Each Functional Unit; Data Transfer Across Bus; Simple Bus StructuresWith Registers and Memory; Details of Address; Control and Data Bus with Interfacing.	04
2.	**Instruction Set:** Instruction format; Addressing Modes. Instruction Set of A Simple RealWorld Microprocessor Covering Data Transfer; Arithmetic; Logical; Control; Subroutine; Stack; Basic I/O and Interrupt Operations.	08
3.	**Central Processor Unit Design:** Single Bus Architecture; Detailed Design of Execution Unit Using	10

Unit No.	Topics	Teaching Hours
	Hardwired Control as Well As Microprogrammed Control; Horizontal and Vertical Microinstructions; Concept of Nano-programming; Introduction to RISC and CISC Architectures.	
4.	**Arithmetic Processor Design:** Addition; Subtraction; Multiplication and Division Algorithms in Signed Binary Arithmetic for Fixed and Floating Point Representations and Related Design Standards and Issues.	**05**
5.	**Memory and Input-Output Organisation:** Types of Memory; Memory Hierarchies; Organisation of Static and Dynamic SemiconductorMemories; Associative Memory Organization; Cache Organisation. Device Interfacing and Selection; Memory and I/OMapped I/Os; Modes of Data Transfer-Programmed; Interrupt and DMADriven I/O-Interrupt Types and Priority Schemes; SynchronousandAsynchronous Data Transfer.	**10**
6.	**Pipeline& Superscalar architecture:** Pipelining, basic concepts; Hazards, types of hazards, ways to overcome the hazards. Superscalar architecture, instruction issue policies, anti and output dependencies, Architecture of Very Long Instruction Word (VLIW) processors, Multithreading, Interleaved, Blocked, Simultaneous and Chip Multithreading. Multicore architecture.	**08**
	Total	**45**

List of References:

1. Hamacher, Vranesic, Zaky, "*Computer Organization*", McGraw Hill
2. M. Morris Mano, "*Computer System Architecture*", Pearson Education
3. Andrew S. Tanenbaum and Todd Austin, "*Structured Computer Organization*", Pearson
4. Education
5. N D Jotwani, "*Computer system organization*", McGraw Hill
6. R.S.Gaonkar, "*Microprocessor Architecture, Programming and Applications with 8085A*", Penram International

Course Outcomes (COs):

After learning the course, students will be able to

1. Understand the organization of the control unit, arithmetic and logical unit, memory unit and I/O unit
2. Learn and apply knowledge for assembly programming to provide solutions of given problems.
3. Learn and design a basic central processing unit, Arithmetic processor design, and memory and I/O module.
4. Learn pipelining and different types of computer architectures.

3EL46: INFORMATION THEORY AND CODING
CREDITS -3 (LTP: 3,0,0)

Course Objective:

Goal of this course is to understand the basic ideas of information theory by the mathematics used to express these ideas.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	-	-	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction** What Information Theory Is Not, What Information Theory Is, Encoding Information, A Problem In Information Transmission	**06**
2	**Information and Sources** The Definition Of Information, The Zero Memory Information Source, Some Properties Of Entropy, Extensions Of A Zero Memory Sources, The Markov Information Source	**06**
3	**Some Properties of Code** Introduction, Uniquely Decodable Codes, Instantaneous Codes, Construction Of An Instantaneous Code, The Kraft Inequality-Statement And Discussion, Mcmillan's Inequality	**09**
4	**Coding Information Sources** The Average Length Of A Code, A Method Of Encoding For Special Sources, Shannon's First Theorem, Shannon's First Theorem For Markov Sources, Coding Without Extensions, Finding Binary Compact Codes- Huffman Codes, Code Efficiency And Redundancy	**09**
5	**Channels and Mutual Information** Introduction, Information Channel, Probability Relation In A Channel, A Priori And Posteriori Entropies, A GeneralizationOf Shannon's First Theorem, Mutual Information, Properties Of Mutual Information, Noiseless Channels And Deterministic Channels, Channel Capacity, Conditional Mutual Information	**09**

Unit No.	Topics	Teaching Hours
6	**Reliable Message Through Unreliable Channel** Introduction, Error Probability And Decision Rules, The Fano Bound, Reliable Message And Unreliable Channels, An Example Of Coding To Correct Errors, Hamming Distance, Shannon's Second Theorem For The BSC-The First Step, Random Coding-The Second Step, Shannon's Second Theorem-Discussion	**06**
	Total	**45**

List of References:

1. N. Abramson, "*Information and Coding"*, McGraw Hill.
2. Ranjan Bose, "*Information Theory, Coding and Cryptography*", McGraw Hill.
3. M. Mansurpur, "*Introduction to Information Theory"*, McGraw Hill.
4. R.B. Ash, "*Information Theory"*, Prentice Hall.
5. Shu Lin and D.J. Costello Jr., "*Error Control Coding"*, Prentice Hall.

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	20	30	30	-	-

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels **(Revised Bloom's Taxonomy)**

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (COs):

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

1. Understand the information and Coding.
2. Apply coding techniques for information sources.
3. Apply coding techniques for deterministic channels and unreliable channels.

4EL01: POWER ELECTRONICS
CREDITS -3 (LTP: 3,0,0)

Course Objective:

1. Understand semiconductor power devices.
2. Understand the concept of power converters used for conversion of power between AC-DC, DC-DC and DC-AC.
3. Explain applications of power electronics.

Teaching and Assessment Scheme:

Teaching Scheme (Hours Per Week)			Credits	Assessment Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	-	-	100

Details of Assessment Instruments under CE Practical Component: NA

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction to Power Electronics devices and protection:** Introduction to thyristor family devices, SCR Characteristics, Two Transistor model of SCR, ratings and data sheet, Turn ON and Turn OFF methods: Gate circuit requirements, Isolation of gate with pulse transformer and Opto-couplers, Firing circuits: R Trigger, R-C Trigger and UJT based triggering circuits, Protections circuits for SCRs. Snubber Designs. Importance of Grounding	09
2	**AC-DC converters:** Introduction to rectifier: Single phase semi-controlled and fully controlled rectifiers, three phase controlled rectifiers, design, phase control and analysis with resistive and inductive load.	09
3	**DC- DC converters:** Introduction to chopper, Principle of operation, various topologies analysis buck, boost and buck-boost Converters. Chopper classifications, PWM control and operation.	06
4	**DC- AC converters:** Introduction to inverters, Thyristor inverter classification and principle of operation, Voltage and current source inverters single phase configurations. Bridge Inverters, The McMurray and McMurray Bedford inverters, PWM control methods.	06
5	**Modern Semiconductor power devices:** Inverter- grade Thyristor, Reverse conducting Thyristor, Diac, TRIAC, LASCR, Power MOSFETs, IGBT and Power Integrated Circuits (PICs)	06
6.	**Application of thyristor :** AC Regulators, Cyclo-converter, Uninterruptible Power Supply, Switched mode Power Supply, RF Heating, Battery Charger.	09
	Total	**45**

List of References:

1. M. Rashid, *"Power Electronics – Circuit, Devices and Applications"*, Pearson Education.
2. M.D. Singh and Khanchandani, *"Power Electronic"*, Tata McGraw Hill Publications.
3. Ned Mohan, and Robbins, *"Power Electronics – Converters, Applications and Design",* John Willey & sons, Inc.
4. P.S. Bimbhra, *"Power Electronics",* Khanna Publishers.

Course Outcomes (COs):

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

1. Understanding power semiconductor devices and protection.
2. Analyze, operate and design power converter circuits.
3. Apply knowledge to build important applications of power electronics.

4EL02: POWER ELECTRONICS LAB
CREDITS - 1 (LTP:0,0,1)

Course Objective:

3. To provide students with practical knowledge Power Electronics devices
4. Design and Development power converter circuits.
5. Understand applications of power electronics.

Teaching and Assessment Scheme:

Teaching Scheme (Hours Per Week)			Credits	Assessment Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
0	0	2	1	-	-	40	60	100

Details of Assessment Instruments under CE Practical Component:

Term work [30]	Viva [30]
Attendance/report/presentations/Assignment	Performance/Attitude-Aptitude/Quiz/ Questions & Answers/ Discussion

Experiment List:

Sr. No.	Suggested List of Experiments
1	Obtain characteristics of SCR and measure Latching current and holding current.
2	Obtain V-I characteristics of DIAC and TRIAC.
3	To obtain characteristics of UJT and understand some important specifications.
4	Design UJT as a relaxation oscillator circuit.
5	Analyze various Forced Commutation Methods of SCR.

Sr. No.	Suggested List of Experiments
6	Design of ac regulator(dimmer) circuit.
7	Analyze "R" and "RC" triggering circuit for SCR.
8	Design UJT triggering circuit for SCR.
9	Analyze Single phase half Wave controlled rectifier with "R" load.
10	Analyze Single phase half Wave controlled rectifier with "RL" load with and without FWD.
11	Analyze Single phase full Wave / centre-tap controlled rectifier with " R/ " load .
12	Analyze single phase full Wave / Bridge controlled rectifier with "RL" load with and without FWD.
13	Study switching characteristics of IGBT.
14	To study UPS (Uninterruptible Power Supply).
15	Mini Project

List of References:

1. M. Rashid, *"Power Electronics – Circuit, Devices and Applications"*, Pearson Education.
2. M.D. Singh and Khanchandani, *"Power Electronic"*, Tata McGraw Hill Publications.
3. Ned Mohan, and Robbins, *"Power Electronics – Converters, Applications and Design",* John Willey & sons, Inc.
4. P.S. Bimbhra, *"Power Electronics",* Khanna Publishers.

Course Outcomes (COs):

At the end of this course students will demonstrate the ability to

1. Understand the power semiconductor devices characteristics and ratings.
2. Analyze and design power converter circuits.
3. Apply knowledge to build important applications of power electronics.

4EL03 – WIRELESS COMMUNICATION
CREDITS - 3 (LTP:3,0,0)

Course Objective:

1. The goal of this course is to introduce basic of cellular concept, Propagation model, multiple access techniques for Electronics engineering students.
2. The course aims to make the student familiar with wireless systems like GSM, CDMA 2000 and recent trends like Wi-Fi, SDR, UWB, OFDM, MIMO, LTE Advanced etc.

Teaching and Assessment Scheme:

Teaching Scheme (Hours Per Week)			**Credits**	**Assessment Scheme**				
				Theory Marks		**Practical Marks**		**Total Marks**
L	**T**	**P**	**C**	**ESE**	**CE**	**ESE**	**CE**	
3	0	0	3	60	40	00	00	**100**

Details of Assessment Instruments under CE Practical Component:

Term work [10]	Viva [10]
Attendance/report/presentations/Assignments	Performance/Attitude-Aptitude/Quiz/ Questions & Answers/ Discussion

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction to Wireless Communication System:** Evolution of mobile communications, Mobile Radio System around the world, Types of Wireless communication System, Comparison of Common wireless system, Trend in Cellular radio and personal communication. Second generation Cellular Networks, Third Generation (3G) Wireless Networks, Fourth Generation (4G) Wireless Networks, Fifth Generation (5G) Wireless Networks .	03
2	**The Cellular Concept- System Design Fundamentals:** Cellular system, Hexagonal geometry cell and concept of frequency reuse, Channel Assignment Strategies Distance to frequency reuse ratio, Channel & co-channel interference reduction factor, S/I ratio consideration and calculation for Minimum Co-channel and adjacent interference, Handoff Strategies, Umbrella Cell Concept, Trunking and Grade of Service, Improving Coverage & Capacity in Cellular System-cell splitting, Cell Sectorization , Repeaters, Micro cell zone concept, Channel antenna system design considerations.	10
3	**Mobile Radio Propagation Model, Small Scale Fading and diversity:** Large scale path loss:-Free Space Propagation loss equation, Path-loss of NLOS and LOS systems, Reflection, Ray ground reflection model, Diffraction, Scattering, Link budget design, Max. Distance Coverage formula, Empirical formula for path loss, Indoor and outdoor propagation models, Small scale multipath propagation, Impulse model for multipath channel, Delay spread, Feher's delay spread, upper bound Small scale, Multipath Measurement parameters of multipath channels, Types of small scale Fading, Rayleigh and Rician distribution, Statistical for models multipath fading channels and diversity techniques in brief.	10
4	**Multiple Access Techniques:** Multiple access schemes-FDMA, TDMA, CDMA and SDMA. Modulation schemes- BPSK, QPSK and variants, QAM, MSK and GMSK, multicarrier modulation, OFDM.	06
5	**Wireless Systems:** GSM system architecture, Radio interface, Protocols, Localization and calling, Handover, Authentication and security in GSM, GSM speech coding, Concept of spread spectrum, Architecture of IS-95 CDMA system, Air interface, CDMA forward channels, CDMA reverse channels, Soft handoff, CDMA features, Power control in CDMA, Performance of CDMA System, RAKE Receiver, CDMA2000 cellular technology, GPRS system architecture.	10

Unit No.	Topics	Teaching Hours
6	**Recent trends:** Introduction to Wi-Fi, WiMAX, ZigBee Networks, Software Defined Radio, UWB Radio, Wireless Adhoc Network and Mobile Portability, Security issues and challenges in a Wireless network. OFDM, MIMO channel, LTE Advanced, Energy harvesting, EMI-EMC Product Compliance.	06
	Total	**45**

List of References:

1. Theodore S. Rappaport, "*Wireless Communication*", Prentice Hall
2. Vijay Garg, "*Wireless Communications and Networking*", Elsevier
3. Kamilo Feher, "*Wireless digital communication*", PHI Publications
4. William C. Y. Lee, "*Mobile Communications Engineering*", Mc Graw Hill Publications
5. Rajpandya, "*Mobile and personal Communication system and services",* IEEE press (PHI).
6. T.L.Singhal, "*Wireless Communications*", Mc Graw Hill Publications
7. C.K.Toh, "*Adhoc Mobile Wireless network*", Pearson Publication

Course Outcomes (COs):

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

1. Demonstrate their understanding on functioning of wireless communication system and evolution of different wireless communication systems and standards.
2. Compare different technologies used for wireless communication systems.
3. Demonstrate an ability explain multiple access techniques for Wireless Communication
4. Analyze mobile communication systems for improved performance.

4EL04 – WIRELESS COMMUNICATION LABORATORY
CREDITS - 1 (LTP:0,0,1)

Course Objective:

1. The goal of this course is to introduce Simulation of the basic of cellular concept, Propagation model for Electronics engineering students.
2. The course aims to experiments on modern design tools used for Wireless Communication.

Teaching and Assessment Scheme:

Teaching Scheme (Hours Per Week)			Credits	Assessment Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
0	0	2	1	00	00	40	60	**100**

Details of Assessment Instruments under CE Practical Component:

Term work [10]	Viva [10]
Attendance/report/presentations/Assignments	Performance/Attitude-Aptitude/Quiz/ Questions & Answers/ Discussion

Course Contents:

Unit No.	Topics
1	Understand Matlab functions useful for mobile communication
2	Study Random data generation and calculating bit error rate in it.
3	For Modern GSM phones find the effect of different Duty cycle and transmit time to see the wide range of battery life time.
4	Simulate AWGN and multipath fading environment in Matlab
5	To find blocking probability using Erlang B-Formula
6	To find blocking probability using Erlang C-Formula.
7	To plot a graph of angle Vs Doppler frequency.
8	To find path loss using Okumura model.
9	To find average fade duration and level crossing rate.
10	Simulation of Gaussian Minimum shift keying (GMSK) modulation demodulation
11	Demonstration of GSM and GPRS
12	Demonstration of CDMA

List of References:

1. Theodore S. Rappaport, "*Wireless Communication*", Prentice Hall
2. Vijay Garg, "*Wireless Communications and Networking*", Elsevier
3. Kamilo Feher, "*Wireless digital communication*", PHI Publications
4. William C. Y. Lee, "*Mobile Communications Engineering*", Mc Graw Hill Publications
5. Rajpandya, "*Mobile and personal Communication system and services",* IEEE press (PHI).
6. T.L.Singhal, "*Wireless Communications*", Mc Graw Hill Publications
7. C.K.Toh, "*Adhoc Mobile Wireless network*", Pearson Publication

Course Outcomes (COs):

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

1. Understand the basics of Wireless Communication through simulation and hardware.
2. Understand and analyze the plots between basic parameters.

4EL05: GUIDED RESEARCH & READING
CREDITS - 1 (LTP:0,0,1)

Course Objectives:

A final year graduate should be well aware of the recent innovation and research activities in the field of their interest or specialization. The objectives of this course are:

1. To make student read research papers and articles published in the reputed journals and proceedings of conferences, and deduce some meaningful conclusions, observations, and critical comparisons.
2. To make students write and present their findings from the research papers to exhibit the insights they have gained by reading the research papers.

Teaching and Assessment Scheme:

Teaching Scheme (Hours Per Week)			Credits	Assessment Scheme		Total Marks
				Practical Marks		
L	T	P	C	ESE	CE	
0	0	2	1	40	60	100

Details of Assessment Instruments under CE Practical Component:

Review-I [30]	Review-II [30]
The team of students will make a presentation and brief summary report of the progress made in the first 4-5 weeks on the topic finalized by the students their respective faculty guide. A standard format may be shared by the faculty coordinator to all the students and guides	The team of students will make a presentation and brief summary report of the progress made in the second 4-5 weeks on the topic finalized by the students their respective faculty guide. A standard format may be shared by the faculty coordinator to all the students and guides

Course Content:

Unit No.	Topics	Teaching Hours
1	The team formation and broad area of the topic for GRR. A team will consist of two students and one faculty guide. One more faculty may be added in the team as a Co-guide. This activity should be completed in the first week.	2
2	Identification of the reading material that may contain but not be limited to Research Papers, Project Reports, etc. This activity should be completed by the students with approval of the guide in the first-second week.	2
3	The students should read and study the material and discuss their findings and important conclusions about the same with the guide (+ co-guide if any).	2

Unit No.	Topics	Teaching Hours
4	**Review-I:** The students should prepare a report of their findings and discussions with the guide and make a presentation of the same. The guide may arrange a review of the students work and progress at this stage. This will be called Review-I and the format of this assessment may be provided by the course coordinator. The guide will do the assessment of Review-I	4
5	After receiving the comments in Review-I, the students should do a more rigorous study of the reading material and also include some new reading material as per the suggestions and requirement. They should do weekly report to the guide.	4
6	**Review-II:** The students should prepare a report of their findings and discussions with the guide and make a presentation of the same. The guide may arrange a review of the students work and progress at this stage. This will be called Review-II and the format of this assessment may be provided by the course coordinator. The guide will do the assessment of Review-II	2
7	After receiving the comments in Review-II, the students should do a more rigorous study of the reading material and also include some new reading material as per the suggestions and requirement to make it towards completion. They should do weekly report to the guide.	4
8	**Draft Report:** The students should prepare a draft report of their findings and discussions. The draft report should be submitted to the guide for corrections. The guide will return the draft report to the student with corrections and suggestions if any within week.	4
9	**Final Report and Presentation:** The students should prepare a final report incorporation all the corrections and suggestion by the guide and will take approval on the final report. The students will make a final presentation of their work.	4
	Total	**28**

List of References:

1. Askew, B. and I. Fountas. “Building an Early Reading Process: Active from the Start,” The Reading Teacher, vol. 52, no. 2 (1998): pp. 126–134
2. http://learning.gov.wales/docs/learningwales/publications/130718-guided-reaching-approach-en.pdf

Course Outcome: By the end of this course, the student should be able to do the followings:

1. To comprehend and summarize new reading material presenting the knowledge and the research activities in the area of their interest.
2. To use the available information for learning and problem analysis.
3. To integrate and outline the information in a report.
4. To critique and compare various research outcomes in the area of their interest.

4EL31: PROJECT-I
CREDITS - 2 (LTP:0,0,2)

Course Objectives:

1. The goal of this course is to understand the concepts of innovative project design, program development etc. The individual’s or group’s project should involve analysis, design, and implementation and testing of substantial hardware, software or any combination thereof in the field of study in the seventh semester.

Teaching and Assessment Scheme:

Teaching Scheme (Hours Per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
0	0	4	2	0	0	40	60	**100**

Course Content and guideline:

1. Every student individually or in a group (group size is of 2-3 students). However, if project complexity demands a maximum group size of 4 students, the departmental committee should be convinced about such complexity and scope of the work. Project may be continuing to eighth semester.
2. The individual's or group's project should involve analysis, design, and implementation and testing of substantial hardware, software or any combination thereof in the field of electronics engineering.
3. The topic should be related to any application in the field of Electronics and Communication. The investigation of practical problem in the manufacture and/or testing of electronics communication equipments, the Microprocessor/Microcontroller based projects, VLSI, Communication, Instrumentation, Signal Processing, Image Processing, Remote sensing, RF applications, etc.
4. Interdisciplinary projects should be encouraged. The examination will be conducted independently in respective departments.
5. Periodical monitoring and assessment will be done by the internal guides.
6. A project report will be prepared and submitted for a viva – voice examination at the end of term.
7. A good quality research paper has to publish based on their project.

Course Outcome:

1. Review research literature, and analyze complex engineering problems reaching substantiated conclusions.
2. Apply appropriate techniques and modern engineering tools to design electronics project using relevant software and hardware.
3. Understand the impact of the electronics engineering solutions to societal and environmental contexts, ethical etc.
4. Function effectively as an individual, and as a member or leader in diverse teams to manage projects, communicate effectively.

4EL41: DIGITAL IMAGE PROCESSING
CREDITS -4 (LTP:3,0,1)

Course Objective:

1. To learn and understand the fundamentals of digital image processing, and various image Transforms, Image Enhancement Techniques, Image restoration Techniques andmethods, image compression and Segmentation used in digital image processing.

2. Expose students to current technologies and issues that are specific to image processing systems and develop hands-on experience in using computers to process images.

Teaching and Assessment Scheme:

Teaching Scheme (Hours Per Week)			Credits	Assessment Scheme				
L	T	P	C	Theory Marks		Practical Marks		Total Marks
				ESE	CE	ESE	CE	
3	0	1	4	60	40	20	30	150

Details of Assessment Instruments under CE Practical Component:

Term work [10]	Viva [20]
Attendance/report/presentations/Assignments	Performance/Attitude-Aptitude/Quiz/ Questions & Answers/ Discussion

Course Contents:

Unit No.	Topics	Teaching Hours
1.	**Digital Image Fundamentals:** Introduction, Fundamental steps and components in Image Processing, Human visual system, A simple Image Formation Model, Image Sampling and Quantization, Basic Relationships between Pixels, Mathematical Tools Used in Digital Image Processing.	04
2.	**Intensity Transformations and Spatial Filtering:** Introduction, Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.	09
3.	**Filtering in the Frequency Domain:** Preliminary Concepts, 2D- DFT, The Basics of Filtering in the Frequency Domain, Image Smoothing Using Frequency Domain Filters, Image Sharpening Using Frequency Domain Filters, Introduction to Wavelets.	08
4.	**Image Restoration and Reconstruction:** A Model of the Image Degradation/Restoration Process, Noise Models, Restoration in the Presence of Noise Only—Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Estimating the Degradation Function, Inverse Filtering, Wiener Filtering.	06
5.	**Color Image Processing:** Color Fundamentals, Color Models, Pseudo color image processing	04
6.	**Image Compression:** Fundamentals of redundancies, Basic Compression Methods: Huffman Coding, Arithmetic Coding, LZW Coding, JPEG Compression Standard.	04

Unit No.	Topics	Teaching Hours
7.	**Image Segmentation:** Edge based Segmentation, Region based Segmentation, Region split and merge techniques, Region growing by pixel aggregation, optimal thresholding.	04
8.	**Morphological Image Processing:** Erosion, dilation, opening, closing, The Hit or Miss Transformation. Basic Morphological Algorithms: hole filling, connected components, thinning, skeletons.	04
9.	**Active Learning Assignments:** A small group of 2-4 students will study and implement one published paper from reputed journal. They should understand and analyze the latest trends in the area of the selected topic and prepare and present power-point slides, which may include videos, animations, pictures, and graphics for better understanding of the topic.	02
	Total	**45**

List of References:

1. Rafael C. Gonzalez and Richard E. Woods, "*Digital Image Processing*", Third Edition, Pearson Education
2. Rafael C. Gonzalez and Richard E. Woods , "*Digital Image Processing Using MATLAB*", Third Edition, Pearson Education
3. S Sridhar, "*Digital Image Processing*", Oxford University Press.

Course Outcomes (COs):

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

1. Understand the basic concepts of two-dimensional signal acquisition, Sampling, and quantization.
2. Apply the knowledge of spatial filtering techniques and enhance image quality using image enhancement techniques.
3. Understand the DFT and able to filter given image using frequency domain filtering technique.
4. Apply the knowledge of Image restoration and reconstruction, Image segmentation, image compression and image morphological operations.

4EL42: DATA COMMUNICATION AND NETWORKING
CREDITS - 4 (LTP:3,0,1)

Course Objectives:

1. The aims of the course are to make the students familiar with layered architecture and protocol hierarchy.
2. The objective of this course is to understand protocol design, application and working. Also it aimed to apply basic knowledge of layers and protocols in various applications.

Teaching and Assessment Scheme:

Teaching Scheme (Hours Per Week)			Credits	Assessment Scheme				
L	T	P	C	Theory Marks		Practical Marks		Total Marks
				ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Details of Assessment Instruments under CE Theory Component:

Mid Component[30]	Term work[10]
Average of 1st and 2nd Internal Mid Exam Test	Assignment/Quiz/ Questions & Answers/Presentation

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction:** Network Hardware, Topology, Network Software, Reference Models, Example Networks, Uses of Computer Networks, ARPANET, Connection Oriented Networks.	09
2	**Physical Layer:** The Theoretical Basis for Data Communication, The Public Switched Telephone Network, The Mobile Telephone System.	03
3	**Data Link Layer:** Data Link Layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols, Example Data Link Protocols. **Medium Access Control Sub Layer:** The Channel Allocation Problem, Multiple Access Protocols, Ethernet, Wireless LANs, Broadband Wireless	12
4	**Network Layer:** Network Layer Design Issues, Routing Algorithms, Congestion Control Algorithms, Quality of Service, Internetworking, The network Layer in the Internet.	06
5	**Transport Layer:** The Transport Service, Elements of Transport Protocols, Congestion Control Algorithms, The Internet Transport Protocols: UDP, The Internet Transport Protocols: TCP, Performance Issues.	06
6	**Application Layer Security** DNS-The Domain Name System, The World Wide Web, Real-time Audio and Video, Content Delivery and Peer-To-Peer, SMTP and HTTP Protocol, Cryptography, Symmetric-Key Algorithms, Public-Key Algorithms, Digital Signatures, Management Of Public Keys, Firewalls, Virtual Private Networks.	09
	Total	**45**

List of References:

1. Computer Networks, Andrew Tanenbaum, Pearson Education.
2. Data Communication And Networking, Behrouz Forouzan, TMH.
3. Introduction to Data Communication and Networking, Wayne Tomasi, Pearson
4. Data and Computer Communications, 3rd Edition By: William Stallings

Course Outcome:

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

1. Apply the knowledge of communication techniques, medias and fundamentals of layer architecture to the solve computer networks' problems.
2. Design and Analyze different communication networks as layered architecture system
3. Able to choose appropriate protocol on each layer based on application demand.

4EL43: RADAR AND NAVIGATION AIDS
CREDITS –4 (LTP: 3,0,1)

Course Objectives:

1. To introduce the fundamental concepts of RADAR (Radio Detection and Ranging) and Navigational aids.
2. To expose the students to different types of RADAR systems and Navigation.

Teaching and Examination Scheme:

Teaching Scheme (Hours Per Week)			Credits	Assessment Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Details of Assessment Instruments under CE Practical Component:

Term work [10]	Viva [10]
Attendance/report/presentations/Assignments	Performance/Attitude-Aptitude/Quiz/ Questions & Answers/ Discussion

Contents:

Unit No.	Topics	Teaching Hours
1.	**Introduction** The simple form of Radar Equation, Radar Block diagram and Operation, Radar Frequencies, millimeter and submilimeter waves, Applications of Radar.	04

Unit No.	Topics	Teaching Hours
2.	**Radar Equation** Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Signal to Noise Ratio, Matched filter impulse response, Integration of radar Pulses, Radar Cross Section of Targets, Cross section Fluctuations, Radar Clutter-surface clutter, sea clutter and Land clutter ,weather clutter, Transmitter Power, Pulse Repetition Frequency and Range ambiguities, Antenna Parameters, system losses, propagation effects, other considerations	08
3.	**CW and FM CW Radar** Doppler effect. CW radar. FM CW radar. Multiple frequencies based CW Radar and Its application.	04
4.	**MTI And Pulse Doppler Radar** Introduction, Delay line Cancellers, Multiple orstaggered Pulse Repetition Frequencies, Range gated Doppler Filters, BlockDiagram of Digital Signal Processor, Example of MTI radar Processor, PulseDoppler Radar, Non coherent MTI ,MTI from moving platform, Other typesof MTI, Airborne radar.	04
5.	**TrackingRadar** Sequential loping, conical scan, Monopulse, Tracking in range and Doppler, Acquisition.	03
6.	**Radar Transmitters, Antennas and Receivers** Hard tube and pulse modulators. Types of Radar antennas, Duplexers, Displays.	03
7.	**Electronic Scanning Radar** Principle of phased array for electronic scanning, Advantages and capabilities of electronic scanning, block diagram of an electronic scanning system and its operation	04
8.	**Navigational Aids** Introduction, Four Methods of Navigation ,Radio Direction Findings, Radio Ranges, Hyperbolic Systems of Navigation, Aids to approach and Landing	05
9.	**Modern Navigation :** Doppler navigation-Doppler Effect, New configuration, Doppler frequency equations, Track stabilization, Doppler navigation system , GPS principle of operation, Position location determination, principle of GPS receiver.	05
10.	**Active Learning Activities :** Preparation of power-point slides, which may include illustrative examples, videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters / parts of chapters to groups of students so that the entire syllabus to be covered.	05
	Total	**45**

List of References:

1. M.I. Skolnik, *"Introduction to Radar System"*, Publisher: McGraw Hill.
2. Sen& Bhattacharya, *"Radar Systems and Radio Aids to Navigation",* Publisher: Khanna publishers.
3. F.E. Terman, *"Electronic and Radio Engineering"*, Publisher: McGraw Hill.
4. M.I. Skolnik , *"Radar Engineering Hand Book*", Publisher: McGraw Hill.
5. Roger J Suullivan, "*Radar Foundations for Imaging and Advanced Topics*".
6. N S Nagaraja, *"Elements of Electronic Navigation"*, TMH.

Web Resources:

- http://nptel.iitm.ac.in/courses.php?branch=Ece
- http://www.radartutorial.eu/07.waves/wa04.en.html

Course Outcomes:

1. To become familiar with fundamentals of Different types of RADAR and their operations.
2. Understand signal detection in RADAR and various detection techniques.
3. Understand Navigational Aids and Modern Navigation.

4EL44: MIXED SIGNAL PROCESSOR
CREDITS –4 (LTP:3,0,1)

Course Objective:

1. To provide students with good depth of knowledge of designing microcontroller based Electronic Systems for various applications.
2. Design and Development of Hardware and Software design for advanced microcontroller based systems.

Teaching and Assessment Scheme:

Teaching Scheme (Hours Per Week)			Credits	Assessment Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Details of Assessment Instruments under CE Practical Component: NA

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction to Advanced Microcontrollers Architecture:** The drawback of earlier architectures, Architectural requirements for Microcontrollers, Difference between RISC and CISC architectures, and Advantages of RISC architecture for microcontroller design Embedded Electronic Systems and Microcontrollers.	4
2	**Architecture of the MSP430 Processor:** Central Processing Unit, Addressing Modes, Constant Generator and Emulated Instructions, Instruction Set with Examples, Reflections on the CPU and Instruction Set, Resets, Clock System.	10
3	**Functions, Interrupts, and Low-Power Modes:** Functions and Subroutines, Storage for Local Variables , Passing Parameters to a Subroutine and Returning a Result, Mixing C and Assembly, Interrupts, Interrupt Service Routines, Issues Associated with Interrupts, Low-Power Modes of Operation	7

Unit No.	Topics	Teaching Hours
4	**Digital Input, Output, Displays and Timers** Digital Input and Output:Parallel Ports, Interfacing with switches, matrix keyboard and LCD and other I/O devices, Watchdog Timer, Basic Timer1,Real Time Clock, Timer_A , Measurement in the Capture Mode , Output in the Continuous Mode ,Output in the Up Mode: Edge-Aligned Pulse-Width Modulation, Output in the Up/Down Mode: Centered Pulse-Width Modulation.	14
5	**Mixed-Signal Systems: Analog Input and Output , peripheral Interfacing and Communication:** Comparator, Analog-to-Digital Conversion: General Issues, Analog-to-Digital Conversion: Successive Approximation, The ADC10 Successive-Approximation. ADC Basic Operation of the ADC10 More Advanced Operation of the ADC10, DAC and sensor interfacing, Relay, Opto-isolator and Stepper Motor Interfacing , Communication Peripherals in the MSP430. . . Serial Peripheral Interface. SPI with the USI, SPI with the USCI	10
	Total	**45**

List of References:

1. John H. Davies, *MSP430 Microcontroller Basics*, First edition Publications: Elsevier-2010.
2. Steve Furber, *ARMSystem on Chip Architecture*, Second Edition, Publication: Pearson-2009.

Course Outcomes (COs):

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

1. Understand Architecture and practice related to Advanced Microcontrollers available in the market today.
2. Understand and program the on chip peripherals available on microcontroller.
3. Interface the peripheral with microcontroller and can design the microcontroller based Systems and use it in real time applications.
4. Use software tools to simulate and analyze the performance of Design of microcontroller based Systems, and use it in real time applications.

4EL45: MICROWAVE ENGINEERING
CREDITS –4 (LTP:3,0,1)

Course Objectives:

1. The goal of this course is to understand basic concepts and applications of microwave systems, microwave transmission lines.
2. Learn microwave waveguide, various passive microwave components, microwave tubes, semiconductor microwave devices.
3. Learn about modern trends in microwave engineering.

Teaching and Assessment Scheme:

Teaching Scheme (Hours Per Week)			Credits	Assessment Scheme:				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	150
3	0	2	4	60	40	20	30	

Details of Assessment Instruments under CE Practical Component:

Term work [10]	Viva [10]
Attendance/report/presentations/Assignments	Performance/Attitude-Aptitude/Quiz/ Questions & Answers/ Discussion

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction:** Introduction of microwave frequencies, advantages and application of microwaves, TEM, TE, TM wave.	03
2	**Microwave transmission line:** transmission line equations & solutions, characteristic impedance, input impedance, reflection and transmission coefficient, standing wave and standing wave ratio, Losses associated with microwave transmission line, Impedance and admittance, impedance matching, using lumped element, using stub line, The quarter-wave transformer, application of smith chart in solving transmission line problems, introduction to strip lines**,** micro strip lines, parallel strip lines, coplanar strip lines, shielded strip lines, Rectangular and circular waveguides theory and analysis, microwave integrated circuits.	11
3	**Microwave components:** Microwave Passive components: Waveguide tees, Magic tees, Directional Coupler, Power Divider, Waveguide Corners, Bends, Twists, Attenuator, Circulator, Isolator and Resonator. Introduction to S parameters, S Matrix and its applications in analyzing microwave components. Microwave Active components: Tunnel diode, Varactor diodes, Step recovery diodes, Schottky Barrier diodes, PIN diodes, Gunn Diodes, IMPATT and TRAPATT diodes, Parametric Amplifiers, Microwave Transistors, Microwave oscillators and Mixers.	15
4	**Microwave tubes:** The limitations of conventional tubes at UHF & Microwave, Klystrons, velocity modulation, multicavity klystron, reflex klystron, traveling wave tube, Magnetron.(Without derivations).	06

Unit No.	Topics	Teaching Hours
5	**Microwave Measurements:** Power, Frequency and impedance measurement at microwave frequency, Network Analyzer and measurement of scattering parameters, Spectrum Analyzer and measurement of spectrum of a microwave signal, Noise at microwave frequency and measurement of noise figure, Measurement of Microwave antenna parameters.	07
6	**Modern Trends in Microwaves Engineering:** The effect of Microwaves on the human body, Medical and Civil applications of microwaves, Electromagnetic interference / Electromagnetic Compatibility (EMI / EMC), RF MEMS for microwave components, Microwave Imaging.	03
	Total	**45**

List of References:

1. Samuel Liao, *Microwave Devices and Circuits*, PHI
2. Annapurna Das, Sisir k. Das ,*Microwave Engineering*, TMG
3. G. Kennedy - *Electronic Communication systems*, McGraw-Hill Book Company
4. David M. Pozar- *Microwave Engineering*, 4ed, Wiley

Course Outcome:

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

1. To understand TE, TM, TEM mode propagation, Advantages and applications of microwave
2. To understand, analyze and solve problems related microwave transmission line.
3. To understand and analyze the concept of various active and passive microwave components for different applications and understand the concept of various microwave tube devices.
4. Measurements of various parameters of microwave systems and learn recent trends of microwave engineering, various applications, and health hazards.

4EL46: DIGITAL CONTROL DESIGN
CREDITS -4 (LTP:3,0,1)

Course Objective:

1. To introduce the basics of Z- Transform.
2. To make the student familiar with stability analysis of digital control system.
3. To equip the basic knowledge of digital process control design.

Teaching and Assessment Scheme:

Teaching Scheme (Hours Per Week)			Credits	Assessment Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	**20**	30	**150**

Details of Assessment Instruments under CE Practical Component: NA

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction to Discrete Time Control System:** Basic building blocks of Discrete time Control system, Sampling Theorem, Z transform and Inverse Z transform for applications for solving differential equations, Mapping between the S-plane and the Z-plane, Impulse sampling and Data Hold	07
2	**Pulse Transfer Function and Digital PID Controllers:** Signal flow graph, The pulse transfer function, pulse transfer function of Closed Loop systems, Pulse transfer function of Digital PID controller, Velocity & Position forms of Digital PID Controller, Realization of Digital Controllers, Deadbeat response and ringing of poles	10
3	**Design of Discrete Time Control System by conventional methods:** Stability analysis in Z-plane, Jury stability criterion, Bilinear transformations, Design based on the root locus method, Digital Controller Design using Analytical Design Method.	05
4	**State Space Analysis of Discrete Time Control System:** State space representation of discrete time systems, Solution of discrete time state space equations, Pulse transfer function matrix, Eigen Values, Eigen Vectors and Matrix Diagonalization, Discretization of continuous time state space equations, Similarity transformations.	06
5	**Pole Placement and Observer Design:** Concept of Controllability and Observability, Useful transformations in state space analysis and design, Stability improvement by state feedback, Design via pole placement, State observers.	08
6	**Optimal Control:** Quadratic Optimal Control and Quadratic performance index, Optimal state regulator through the matrix riccati equations, Steady State Quadratic Optimal Control.	08
	Total	**45**

List of References:

1. K. Ogata,*"Discrete Time Control systems"*, Prentice Hall, Second Edition.
2. M. Gopal,*"Digital Control and State Variable Methods"*, Tata McGraw Hill.
3. B. C. Kuo, *"Digital Control Systems"*, Oxford University Press, 2/e, Indian Edition
4. G.F.Franklin, J.David Powell, Michael Workman,*"Digital control of Dynamic Systems"*, 3rd Edition, Addison Wesley.
5. M. Gopal,*"Digital Control Engineering"*,Wiley Eastern Ltd.
6. Kannan Moudgalya,*"Digital Control"*, John Wiley and Sons.
7. Constantine H. Houpis and Gary B. Lamont,*"Digital Control Systems"*,Second Edition, McGraw-Hill International.

Course Outcomes (COs):

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

1. Understand the role of different types of digital PID controller, its realization in control system design and the methodology of feedback control system and different types of stability analysis for them.
2. Identify, formulate digital control system, and analyze optimal control system.
3. Understand of digital control system and able to predict system behavior.

4EL32: PROJECT-II
CREDITS -12 (LTP:0,0,12)

Course Objectives:

1. The goal of this course is to understand the concepts innovative project design, program development etc. The individual's or group's project should involve analysis, design, and implementation and testing of substantial hardware, software or any combination thereof in the field of study in the eighth semester.

Teaching and Assessment Scheme:

Teaching Scheme (Hours Per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
0	0	24	12	0	0	200	300	**500**

Course Content and guideline:

1. Every student individually or in a group (group size is of 2-3 students). However, if project complexity demands a maximum group size of 4 students, the departmental committee should be convinced about such complexity and scope of the work. Students shall continue a project taken in the beginning of the seventh semester.

2. The individual's or group's project should involve analysis, design, and implementation and testing of substantial hardware, software or any combination thereof in the field of electronics engineering.

3. The topic should be related to any application in the field of Electronics and Communication. The investigation of practical problem in the manufacture and/or testing of electronics communication equipments, the Microprocessor/Microcontroller based projects, VLSI, Communication, Instrumentation, Signal Processing, Image Processing, Remote sensing, RF applications, etc.

4. Interdisciplinary projects should be encouraged. The examination will be conducted independently in respective departments.

5. Periodical monitoring and assessment will be done by the internal guides.

6. A project report will be prepared and submitted for a viva – voice examination at the end of term.

7. A good quality research paper has to publish based on their project.

Course Outcome:

1. Review research literature, and analyze complex engineering problems reaching substantiated conclusions.
2. Apply appropriate techniques and modern engineering tools to design electronics project using relevant software and hardware.
3. Understand the impact of the electronics engineering solutions to societal and environmental contexts, ethical etc.
4. Function effectively as an individual, and as a member or leader in diverse teams to manage projects, communicate effectively.

4EL47: ROBOTICS
CREDITS –4 (LTP:3,0,1)

Course Objective:

1. To provide students with good depth of knowledge of Designing robotics and their control for various application.
2. Knowledge for the design and analysis of Robotics and Control Systems for Electronics Engineering students.

Teaching and Assessment Scheme:

Teaching Scheme (Hours Per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	CE	ESE	CE	
3	0	2	4	60	40	20	30	**150**

Details of Assessment Instruments under CE Practical Component:

Term work [10]	Viva [10]
Attendance/report/presentations/Mini-Project	Performance/Attitude-Aptitude/Quiz/ Questions & Answers/ Discussion

Course Content:

Unit No.	Topics	Teaching Hours
1	**Introduction to Robotics:** Definition and origin of robotics, different types of robotics, various generations of robots, degrees of freedom, Asimov's laws of robotics, dynamic stabilization of robots.	08
2	**Robotic controllers and actuators:** Microprocessors and Microcontrollers based robotic controllers, Peripheral Interfacing with microcontrollers and its programming in C, Arduino platform as robotic controller, Drivers & Actuators interfacing with robotic controller, DC Motors, and Stepper Motors Interfacing and its programming.	10

Unit No.	Topics	Teaching Hours
3	**Grippers, sensors and actuators:** Types of grippers, Properties of grippers, Types of sensors along with working principle, sensor properties, Translational and rotary actuators and their selection	08
4	**Path Planning for Robotic Motions:** Path Planning and Kinematics of Robotic Motions, Inverse kinematics problem, multiple solution Jacobean work envelop, Robot Motion Dynamics and hill climbing techniques.	08
5	**Robot languages and Programming:** Robot Languages, Classification of Robot Languages, Computer Control and Robot Software, Robot Operating Systems (ROS), Raspberry Pi based programming for robots.	06
6	**Case Study:** Multiple robots, machine interface, robots in manufacturing and non-manufacturing applications, robot cell design, selection of robot.	05
	Total	**45**

List of References:

1. S. K. Saha, "*Introduction to Robotics*", Tata McGraw Hill Education Pvt. Ltd., New Delhi.
2. S. R. Deb and S. Deb, "*Robotics Technology and Flexible Automation*", Second Edition, Tata McGraw Hill Education Pvt, Ltd., New Delhi
3. R. K. Mittal, I. J. Nagrath, "*Robotics and Control*", Tata McGraw-Hill Publishing Company Ltd.
4. DhananjayGadre, "*Programming and Customizing the AVR Microcontroller*", TMH, 1st Edition, 2001.
5. Beginning Arduino by McRoberts Michael, Publication: Technology in Action

Course Outcomes:

1. Learn about the fundamentals, history and components for designing robots.
2. Study about Electronics controller for robotics applications and actuators for robotic movements.
3. Learn about Interfacing and programming various sensors and robot gripper mechanism with robotic controllers

4EL48: MIXED SIGNAL DESIGN
CREDITS –3 (LTP:3,0,1)

Course Objective:

Designing Analog and mixed signal designing for various application

Teaching and Assessment Scheme:

Teaching Scheme (Hours Per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	**150**

Course Content:

Unit No.	Topics	Teaching Hours
1	**Basics of Analog amplifier circuits and current mirror circuits** CMOS Analog Circuits: MOS Analog models, Current Sources and sinks, References, amplifiers, Differential Amplifiers, Operational Amplifiers	10
2	**Analog CMOS Sub-circuits** Analog CMOS Sub-Circuits MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors, Degeneration, Cascode current Mirror and Wilson Current Mirror, Current and Voltage References, Band gap Reference	12
3	**MOS Operational Amplifiers** Operational Amplifier: Applications of operational Amplifier, theory and Design; Definition of Performance Characteristics; Design of two stage MOS Operational Amplifier, two stage MOS operational Amplifier with cascodes, MOS telescopic-cascode operational amplifiers, MOS Folded-cascode operational amplifiers, Bipolar operational amplifiers. Frequency response & compensation	12
4	**Data convertor circuits** Analog versus discrete time signals. Sample and hold characteristics. ADC and DAC specifications. DAC architectures. ADC architectures. Sampling and aliasing, Quantization noise & Data converter SNR	11
	Total	**45**

List of References:

1 R.J. Baker, H.W. Li, D.E. Boyce. CMOS. Circuit design, Layout, and Simulation

2 P. Horowitz, W. Hill, Electronic Circuit Design: Art and Practice

3 B. Razavi, Design of Analog CMOS Integrated Circuits

4 R.J. Baker, CMOS Mixed-Signal Circuit Design

5 Douglas R. Holberg and Phillip E. Allen, CMOS Analog Circuit Design

6 B. Razavi. Principles of Data Conversion System Design

Course Outcomes (COs):

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

1. Design CMOS analog circuits to achieve performance specifications.
2. Design a high-gain or multistage CMOS op-amp to meet design specification.
3. Analyze frequency response of CMOS Analog circuits.
4. Understand basics of data converters.

4EL49: ANTENNA DESIGN
CREDITS -4 (LTP:3,0,1)

Course Objective:
Course concentrates on physical principles, modeling techniques, and practical antenna design and it addresses following areas:

1. Basics physical principles (Fields, excitation, radiation, polarization)
2. Tools (Full-wave simulation/optimization software - ANSOFT HFSS)

Teaching and Assessment Scheme:

Teaching Scheme (Hours Per Week)			Credits	Assessment Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	5	60	40	20	30	150

Details of Assessment Instruments under CE Practical Component: NA
Course Contents:

Unit No.	Topics	Teaching Hours
1	**Review of Antenna Theory:** Fundamental theory of antennas: Reciprocity theorem, Antenna equivalent circuit, Classification of antennas, Special types of Antennas for different frequency bands, Antenna parameters: Gain, Directivity, Antenna field zones, polarizations etc	04
2	**Antenna synthesis:** Introduction to Array Antenna, Introduction to various methods of antenna synthesis such as Schelkunoff Polynomial, Fourier transform, Woodward Lawson. Dolph-Chebyshev ,Triangular, Cosine, and Cosine-Squared Amplitude Distributions	09
3	**Structures And Techniques Related To Antennas:** Antenna Applications Of Negative Refractive Index Transmission-Line (NriTl) Metamaterial, Mems Integrated And Micro-machined Antenna Elements, Arrays, And Feeding Networks, Feed Antenna, Antenna Measurement, Antenna Scattering And Design Consideration	09
4	**Methods Of Analysis, Modeling, And Simulation:** Basics of different modeling techniques (FEM, FDTD, MoM), Finite-Element Analysis And Modeling Of Antennas	07

Unit No.	Topics	Teaching Hours
5	**Antenna Analysis:** Introduction to antenna analysis methods: Integral equation method, Moment method, Finite Difference Time Domain methods; Applications of these methods to the practical antennas such as dipole, loop, helical, microstrip patch, PIFA , Horn and reflector.	08
6	**Antenna applications:** Antennas For Mobile Communication, Antenna Array Technologies For Advanced Wireless System, Airborne and Satellite based antennas, Antennas For Medical Therapy And Diagnostic	08
	Total	**45**

List of References:

1. Constantine A. Balanis,, "*Modern Antenna Handbook*" , 2008, A John Wiley & Sons, Inc., Publication.
2. Johnson R C and H Jasik, "*Antenna Engineering Handbooks*", McGraw Hill.
3. Girish Kumar and K. P. Ray, "*Broadband Microstrip Antennas*", 2002, Artech House Publisher.
4. R. S. Elliot, "*Antenna Theory and Design*", Revised edition, Wiley-IEEE Press, 2003.
5. "*An Introduction to HFSS: Fundamental Principles, Concepts, and Use, 2009*", Ansoft, Suite 200 Pittsburgh.

Course Outcomes (COs):

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

1. Understand basic antenna characteristics and able to select and justify an appropriate antenna for a particular engineering task..
2. Design the antenna model using ANSOFT HFSS.
3. Fabricate antenna with optimization of results

4EL50: INDUSTRIAL IOT
CREDITS –4(LTP:3,0,1)

Course Objective:

1. To provide students with good depth of knowledge of Designing Industrial IOT Systems for various application.
2. Knowledge for the design and analysis of Industry 4.0Systems for Electronics Engineering students.

Teaching and Assessment Scheme:

Teaching Scheme (Hours Per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	**150**

Course Content:

Unit No.	Topics	Teaching Hours
1	**Introduction to Industrial IoT (IIoT) Systems:** The Various Industrial Revolutions, Role of Internet of Things (IoT) & Industrial Internet of Things (IIoT) in Industry, Industry 4.0 revolutions, Support System for Industry 4.0, Smart Factories.	**5**
2	**Implementation systems for IIoT:** Sensors and Actuators for Industrial Processes, Sensor networks, Process automation and Data Acquisitions on IoT Platform, Microcontrollers and Embedded PC roles in IIoT, Wireless Sensor nodes with Bluetooth, WiFi, and LoRa Protocols and IoT Hub systems.	**10**
3	**IIoT Data Monitoring & Control:** IoT Gate way, IoT Edge Systems and It's Programming, Cloud computing, Real Time Dashboard for Data Monitoring, Data Analytics and Predictive Maintenance with IIoT technology.	**10**
4	**Cyber Physical Systems:** Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artifical Intelligence, Big Data and Advanced Analysis	**05**
5	**Industrial IoT- Applications:** Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management.	**05**
6	**Case Studies of IIoT Systems:** IIoT application development with Embedded PC based development boards, Development of mini Project on new version of Operating systems and Edge development board. That project should also address to the current societal needs.	**05**
	Total	**45**

List of References:

1. Industry 4.0: The Industrial Internet of Things Alasdair GilchristPublications: Apress
2. The Concept Industry 4.0 An Empirical Analysis of Technologies and Applications in Production Logistics Authors: Bartodziej, Christoph Jan Springer: Publication in the field of economic science.
3. Embedded System: Architecture, Programming and Design by Rajkamal, TMH3.
4. Dr. OvidiuVermesan, Dr. Peter Friess, "*Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems*", River Publishers

Course Outcome:

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

1. Knowledge of theory and practice related to Industrial IoT Systems.
2. Ability to identify, formulate and solve engineering problems by using Industrial IoT.
3. Ability to implement real field problem by gained knowledge of Industrial applications with IoT capability.

4EL51: BIOMEDICAL INSTRUMENTATION
CREDITS - 4 (LTP:3,0,1)

Course Objective:

1. The main objective of this course is to introduce student to basic biomedical engineering technology. As a result student can understand, design and evaluate systems and devices that can measure, test and/or acquire biological information from the human body.
2. To goal of this course is to learn the various systems of the human physiology, signals of biological origin obtained from these systems,
3. To understand the Electrical safety of medical devices, biosensors, transducers, bio electrodes used to acquire such signals, and amplifiers for measuring bio potentials.
4. To learn the measurements of the blood pressure, blood flow, EEG, ECG will also be discussed.

Teaching and Assessment Scheme:

Teaching Scheme (Hours Per Week)			Credits	Assessment Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**The Human Body :** Overview Cell Structure, Body Fluids, Major Systems of the Body	02
2	**Basic concepts of Medical Instrumentation:** Generalized Medical Instrumentation System, Alternative Operational Modes, Medical Measurement Constraints, Classification Of Biomedical Instruments, Design Criteria, Commercial Medical Instrumentation Development Process	03
3	**Fundamentals for bio-signal processing Measurement errors:** Types & Analysis Noise - Types, SNR, Noise Factor, Figure and Temperature, Noise in Cascade Amplifiers, Noise Reduction Strategies Sensor - Types, Error Sources, Tactics and Signals Processing for Improved Sensing, Matching Sensors to Circuit, Bioelectric Amplifiers.	05
4	**The Origin of Bio-potential Electrical activity of excitable cells:** Resting states, Active states, Network equivalent circuit of nerve/ skeletal fiber, propagation of action potential.	04
5	**Bio-potential Electrodes:** The Electrode-Electrolyte Interface, Polarization, Polarizable and Nonpolarizable Electrodes, Electrode Behavior and Circuit Models, The Electrode Skin Interface and Motion Artifact, Body-Surface Recording Electrodes, Internal Electrodes, Electrode Arrays, Microelectrodes.	07

Unit No.	Topics	Teaching Hours
6	**Electrocardiography Anatomy & physiology of heart:** Electro-Conduction System of the Heart, The ECG Waveform. The Standard Lead System, ECG Noises, ECG Amplification and Signal Conditioning Circuits, ECG Readout Devices, ECG machines and maintenance of it, ECG faults & troubleshooting, Blood Pressure, characteristics of blood flow, Heart Sound	07
7	**The Human nervous system & Brain function measurement:** Organization of the Nervous System, the Neuron, Instrumentation for Brain Function Measurement, Cerebral Angiography, Cranial X-Rays, Brain Scans, Ultrasonic Equipment Electroencephalography: Neuron Membrane Potentials, EEG Electrodes and the 10- 20 System, EEG Amplitude and Frequency Bands, EEG Diagnostic Uses and Sleep Patterns, EEG System Block Diagram, EEG Telemetry System, Typical EEG system artifacts, faults, troubleshooting, and maintenance	07
8	**Electrical Safety and Standards :** Physiological effects of electricity, Important susceptibility parameters, distribution of electric power, Macro shock hazards, Electrical- Safety codes and standards, basic approaches to protection against shock, power distribution protection, equipment protection	05
	Total	**45**

List of References:

1. Joseph J. Carr and John M. Brown, *"Introduction to Biomedical Equipment Technology"*, Pearson Education.
2. John. G. Webster, *"Medical Instrumentation- Application and Design"*, John Wiley & Sons.
3. R.S. Khandpur,*"Handbook of Biomedical Instrumentation"*, Mc Graw Hill.
4. Leslie Cromwell, Fred J.Weibell, *"Biomedical Instrumentation and Measurements"*, PHI
5. Willis J. Tompkins,*"Biomedical Digital Signal Processing"*, Prentice-Hall of India.
6. Suresh R. Devashahayan,*"Signals and Systems in Biomedical Engineering"*, Kluwer academics/ Plenum publication.

Course Outcomes (COs):

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

1. Understand anatomy, physiology of important physiological system of human body and design of medical instruments (particularly electronics part) by evaluating medical parameter measurement constraint.
2. Analyze important vital sign parameters to evaluate certain disease conditions.
3. Understand of the electric safety of the medical instruments

4EL52: MACHINE LEARNING TECHNIQUES
CREDITS –4(LTP:3,0,1)

Course Objective:

1. To provide students with good depth of knowledge of Machine learning techniques for various applications in computation.

2. Knowledge for the design and implementation of Machine learning techniquesfor Electronics Engineering students.

Teaching and Assessment Scheme:

Teaching Scheme (Hours Per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	**150**

Details of AssessmentInstruments under CE Practical Component:

Term work [10]	Viva [10]
Attendance/report/presentations/Mini-Project	Performance/Attitude-Aptitude/Quiz/ Questions & Answers/ Discussion

Course Content:

Unit No.	Topics	Teaching Hours
1.	**Introduction to Machine Learning:** A Brief Introduction to Machine Learning, Application and Future of ML, Supervised Learning, Unsupervised Learning, Reinforcement Learning, Linear Algebra.	06
2.	**Regression:** Simple Linear Regression: Gradient Descent, Gradient Descent Intuition, Gradient Descent for Linear Regression. Multivariate Regression: Gradient Descent for Multiple Regressions, Feature Scaling, Learning Rate. Polynomial Regression, Support Vector Regression, Decision Tree Regression, Random Forest Regression.	08
3.	**Classification& Clustering:** Logistic Regression: Cost Function, simplified Cost Function and Gradient Descent, K-Nearest Neighbors, Support Vector Machine, Kernel SVM, Naive Bayes, Decision Tree Classification, Random Forest Classification, K-Means Clustering, Hierarchical Clustering.	08
4.	**Programming Machine Learning Algorithms:** Python programming for MLT, data types, Data Types Operators Expression, Jupyter Notebook, Numpy, Data Analysis using Numpy, Pandas, Data Analysis using Pandas, Matplotlib, Data Visualization using Matplotlib, Seabor..	10
5.	**Introduction to Deep Learning :** A Brief Introduction to Deep Learning, Difference Between ML,DL and AI, Neural Networks: ANN, CNN. ML Models and brief Case Study, ONNX (An open format built to represent machine learning models).	08
6.	**Machine Learning Case Studies and Introduction to Data Science:**Machine learning models, Implementable MLT Models, Hardware implementation of basic MLT algorithm on Embedded boards, like Jatson Nano, Raspberry Pi.	05
	Total	**45**

List of References:

1. Understanding Machine Learning From Theory to Algorithms By Shai Shalev-Shwartz, Shai Ben-David Cambridge University Press.
2. Machine Learning for Absolute Beginners:APlainEnglishIntroduction Volume 1 of Machine Learning from Scratch SeriesIndependent Published.
3. Introduction toMachine Learning with Python A Guide for Data Scientists By Andreas C. Müller, Sarah Guido · 2016 Publisher: O'Reilly Media

Course Outcome:

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

1. Knowledge of theory and practice related to Machine Learning Techniques.
2. Ability to identify, formulate and solve engineering problems by using Machine Learning Algorithms
3. Ability to implement real field problem by gained knowledge of MLT models on Embedded PC.

4EL53: SATELLITE COMMUNICATION
CREDITS - 4 (LTP:3,0,1)

Course Objective:

The main objective of this course is:

1. To understand the basics of satellite communications and different satellite communication orbits.
2. To understand the satellite segment and earth segment.
3. To analyze the various methods of satellite access Link budgets.
4. To learn Digital audio/video broadcasting using satellites.
5. To understand various applications of satellite communications.

Teaching and Assessment Scheme:

Teaching Scheme (Hours Per Week)			Credits	Assessment Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Details of Assessment Instruments under CE Theory Component:

Mid Component[30]	Term work[10]
Average of 1st and 2nd Internal Mid Exam Test	Assignment/Quiz/ Questions & Answers/Presentation

Course Contents:

Unit No.	Topics	Teaching Hours
1.	**Introduction:** Brief History of Satellite, Basic concepts of Satellite Communication, Orbital and Spacecraft problems, Communication Networks and Services,	04

Unit No.	Topics	Teaching Hours
	Applications of Satellite communications, Challenges for Satellite Communication.	
2.	**Orbital Mechanics and Launchers:** Orbital Mechanics, Look Angle Determination, Orbital perturbations, Orbit Determination, Launches and Launch Vehicles, Orbital Effect in Communications Systems Performances, Doppler Shift, Satellite Subsystem, Attitude and Orbit Control System, Telemetry, Tracking, Command and Monitoring, Power Systems, Communication Subsystems, Equipment Reliability and Space Qualification and Satellite Antennas.	10
3.	**Satellite Link Design:** Basic Transmission Theory, System Noise Temperature and G/T Ratio, Design of Downlinks, Satellite Systems Using Small Earth Stations, Uplink Design, Design for Specified C/N: Combining C/N and C/I Values in Satellite Links, System Design Examples.	08
4.	**Multiple Access Techniques for Satellite Links:** Multiple Access, Frequency Division Multiple Access, Time Division Multiple Access, On Board Processing, Demand Access Multiple Access, Random Access, Code Division Multiple Access.	05
5.	**Propagation Effects, Low Earth Orbit and Non-Geostationary Satellite Systems:** Propagation Effects that is not associated with hydrometers, Rain and Ice Effects, Prediction of Rain Attenuation, Prediction of XPD, Orbit Considerations, Coverage and Frequency Considerations, Delay and Throughput Considerations, Operational NGSO Constellation Design.	09
6.	**Direct Broadcast Satellite TV and Global Positioning System:** C-Band and Ku Band Home Satellite TV, Digital DBS –TV, DBS –TV System Design, DBS –TV Link Budget, Error Control in Digital DBS TV, DBS –TV Link Budget, Master Control Station and Uplink, GPS Position Location Principles, GPS Receivers and Codes, Satellite Signal Acquisition, GPS Navigation Message, GPS Signal Levels, Timing Accuracy and GPS Receiver Operation, Overview about GNSS and its applications.	09
	Total	**45**

List of References:

1. Timothy Pratt, Charles Bostian, Jeremy Allnutt, *"Satellite Communication",* Willey Student edition, Second Edition.
2. Dennis Roddy, "*Satellite Communication",* Tata McGraw Hill.
3. Anil K. Maini "Satellite Communication" , Kindle Edition.
4. James Martyn, *"Satellite Communication system",* Prentice Hall.
5. Wilbur L. Pritchard & Josheph A. Sciulli *"Satellite Communication",* PHI.

Course Outcome:

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

1. Understand principle, working and operation of various sub systems of satellite as well as the earth station.
2. Design satellite communication link between transmitter and receiver.
3. Apply various communication techniques for satellite applications and analyze propagation effects on Satellite Systems.
4. Evaluate role of satellite in various applications.

4EL54: FUNDAMENTALS OF ELECTRIC VEHICLES AND DRIVES
CREDITS –4 (LTP:3,0,1)

Course Objective:

1. To provide students with good depth of knowledge of Designing EVs their controlfor various drive mechanism.
2. Knowledge for the design and analysis of Electric Vehiclesfor Electronics Engineering students.

Teaching and Assessment Scheme:

Teaching Scheme (Hours Per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	**150**

Course Content:

Unit No.	Topics	Teaching Hours
1	**Introduction to Electric Vehicles:** EVs and Hybrid EVs, History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains, Energy Management Strategies in EVs.	08
2	**Electric Drives for EVs:** Introduction to electronic components used in hybrid and electric vehicles drives, Configuration and control of DC Motor, Brushless DC Motors drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency	08
3	**Energy Storage:** Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles. Battery, Fuel Cell, Super Capacitor and Flywheel based energy storage and its analysis, Hybridization of different energy storage devices, Solar energy based Energy sources for Electric Vehicles, Solar Battery Chargers.	08
4	**EV Chargers:** Power Electronic Converter for Battery Charging,Charging methods for battery, Termination methods, charging from grid, The Z-converter, Isolated bidirectional DC-DC converter, Design of Z-converter for battery charging,	08
5	**Safety and Maintenance:** Personal Protective equipments (PPE's) used in connection with safe use of electricity like Hand Gloves, Rubber Shoes, Waist belt, , earthing rod, Goggles etc., Safe working clearances for different voltage levels, fire extinguishers used for different applications, knowledge of Static electricity, Lightning	08

Unit No.	Topics	Teaching Hours
	protection, Electrical Safety Audit, elementary knowledge of first aid, protection and preventive maintenance of various motors.	
6	**Case Study:** Development of Simulation model in Matlab using Adviser open source platform. Testing of various modules of EVs in Matlabsimulink tools.	05
	Total	**45**

List of References:

1. M. Ehsani, Y. Gao, S. Gay and Ali Emadi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design, CRC Press, 2005
2. Iqbal Husain, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003
3. Sheldon S. Williamson, Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles, Springer, 2013.
4. C.C. Chan and K.T. Chau, Modern Electric Vehicle Technology, OXFORD University Press, 2001.
5. Chris Mi, M. Abul Masrur, David Wenzhong Gao, Hybrid Electric Vehicles Principles And Applications With Practical Perspectives, Wiley Publication, 2011.

Course Outcomes:

1. Understand working of Electric Vehicles and recent trends
2. Analyze different power converter topology used for electric vehicle application
3. Develop the electric propulsion unit and its control for application of electric vehicles

4EL33: INDUSTRY DEFINED PROJECT
CREDITS -20 (LTP: 0,0,20)

Course Objectives:

The goal of this course is to understand the concepts of innovative project design, program development etc. The individual's or group's project should involve analysis, design, and implementation and testing of substantial hardware, software or any combination thereof in the field of study in the eighth semester.

Teaching and Assessment Scheme:

Teaching Scheme (Hours Per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
0	0	40	20	0	0	240	360	**600**

Course Content and guideline:

1. The Project shall exclusively be carried out at Industries/Organizations/Premier Institutes/Colleges other than BIRLA VISHVAKARMA MAHAVIDYALAYA, etc. Student shall physically be present at Industry/Organization/Premier Institute/Other College etc. Every student individually or in a group (group size is of 2-3 students) can do project.
2. The Project shall be offered as an optional subject in the 8th semester of the respective programmes and the credits of the project shall be equal to the total credits of the 8th semester.
3. The maximum number of the students permitted for the Project shall be decided by the Departmental Academic Committee (DAC) in each year. Subsequently, it shall be approved by the respective Board of Studies.
4. Allocation of the students to Industries/Organizations/Premier Institutes/Other Colleges shall be based on Merit Marks (i.e. CPI of the student). Details of the offering / selection of the industries etc. shall be decided by the Departmental Academic Committee (DAC). Subsequently, it shall be approved by the respective Board of Studies.
5. Minimum two guides shall be appointed for each project. Among them, at least one shall be from Industry/Organization/Premier Institute/other College in which the project is undergone.
6. The student will not accept any stipend from the industry in which student is carrying out the project.
7. Internal Guide/s shall closely monitor the progress of the Project.
8. A project report will be prepared and submitted for a viva – voice examination at the end of term.
9. A good quality research paper has to publish based on their project.

Course Outcome:

1. Review research literature, and analyze complex engineering problems reaching substantiated conclusions.
2. Apply appropriate techniques and modern engineering tools to design electronics project using relevant software and hardware.
3. Understand the impact of the electronics engineering solutions to societal and environmental contexts, ethical etc.
4. Function effectively as an individual, and as a member or leader in diverse teams to manage projects, communicate effectively.

ELIS1: INTERNSHIP-I
CREDITS-0 (LTP: 0,0,0)

Course Objective:

The course aims to make the student familiar with industries and also make them to understand and grasp the recent trends and role of electronics engineering in industries.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory		Practical		
L	T	P	C	ESE	CE	ESE	CE	100
0	0	0	0	0	0	40	60	

Course Contents:

1. The respective Head of the department shall appoint Internship Coordinator (Preferably Training & Placement Coordinator) for the smooth conduction of Internship course/s. The Internship Coordinator shall work as Course Coordinator. The Internship Coordinator shall keep centralized data/record of the Internship.

2. Each Internship course will be evaluated out of 100 Marks as per Practical only course evaluation scheme suggested in Academic Regulations (Major) – UG.18.

3. The Internship shall be monitored under the respective Faculty Counselor. Student(s) (individual / group) shall submit the Internship Report in the prescribed format as given in **Annexure – A** along with the Satisfactory Internship Completion certificate from the Industry Personnel. The counsellor shall award CE P component marks based on this report.

4. The ESE P component of Internship Courses shall be awarded by the Internal Examiner and External Examiner/s preferably from the Industry. The Evaluation should be completed before the commencement of Second week after 1st Mid Semester examination of next semester (semester after the vacation in which the internship course is offered). If student does not get the required marks in this evaluation as per Academic Regulations (Major) – UG.18, he/she has to repeat the internship course.

5. Duration of Internship shall be minimum two weeks. If more days then this requirement are spend then also it will be counted as one internship only.

6. The student has to submit the internship report in a format as prescribed by the internship coordinator. A suggested format of the report for the internship courses is attached in Annexure – A. The internship coordinator may modify the format to suit the needs as and when arises with consultation of DAC in the department.

7. The student will have to submit the INDUSTRIAL INTERNSHIP/TRAINING FEED BACK form in prescribed format available on college website.

8. It is a Mandatory Non Credit course and the student has to complete an industrial internship of the duration of two weeks during vacation after **Semester IV**. The internship should be carried out in any industry with relevant applications (product or process) of electronics engineering, preferably under the guidance of a mentor from the same industry.

9. The student will maintain a log of work done on daily basis and important ideas or practices that he / she has learnt during the internship. The log-book may also be dually signed by the student and the mentor from the industry.

10. The student will submit a detailed report based on the internship immediately after the completion of the internship.

11. The assessment will be based on the following

    (a) Quality of the report and submission of the log-book
    (b) Feedback from the industry mentor in the prescribed form
    (c) Completion certificate from the industry
    (d) Performance in a presentation / viva-voce exam

Suggested Format of Summer Internship Report:

The report shall comply with the summer internship program principles. Main headings are to be centered and written in capital boldface letters. Sub-titles shall be written in small letters and boldface. The typeface shall be Times New Roman font with 12pt. All the margins shall be 2.5cm. The report shall be submitted in printed form and filed. An electronic copy of the report shall be recorded in a CD and enclosed in the report. Each report shall be bound in a simple wire vinyl file and contain the following sections:

- Cover Page
- Page of Approval and Grading
- Abstract page: An abstract gives the essence of the report (usually less than one page). Abstract is written after the report is completed. It must contain the purpose and scope of internship, the actual work done in the plant, and conclusions arrived at.
- TABLE OF CONTENTS (with the corresponding page numbers)
- LIST OF FIGURES AND TABLES (with the corresponding page numbers)
- DESCRIPTION OF THE COMPANY: Summarize the work type, administrative structure, number of employees (how many engineers, under which division, etc.), etc. Provide information regarding
- Location and spread of the company
- Number of employees, engineers, technicians, administrators in the company
- Divisions of the company
- Your group and division
- Administrative tree (if available)
- Main functions of the company
- Customer profile and market share

- **INTRODUCTION**: In this section, give the purpose of the summer internship, reasons for choosing the location and company, and general information regarding the nature of work you carried out.

- **PROBLEM STATEMENT**: What is the problem you are solving, and what are the reasons and causes of this problem.

- **SOLUTION**: In this section, describe what you did and what you observed during the summer internship. It is very important that majority of what you write should be based on what you did and observed that truly belongs to the company/industry/organization.

- **CONCLUSIONS**: In the last section, summarize the summer internship activities. Present your observations, contributions and intellectual benefits. If this is your second summer internship, compare the first and second summer internships and your preferences.

- **REFERENCES**: List any source you have used in the document including books, articles and web sites in a consistent format.

- **APPENDICES**: If you have supplementary material (not appropriate for the main body of the report), you can place them here. These could be schematics, algorithms, drawings, etc. If the document is a datasheet and it can be easily accessed from the internet, then you can refer to it

with the appropriate internet link and document number. In this manner you don't have to print it and waste tons of paper.

Course Outcomes of Internship/Training (COs):

After completion of the internship students will be able:
1. To apply knowledge and skills in real world problems through industries.
2. To function in a team work and to use experience related to professional and ethical issues in the work environment.

ELIS2: INTERNSHIP-II
CREDITS-0 (LTP: 0,0,0)

Course Objective:
The course aims to make the student familiar with industries and also make them to understand and grasp the recent trends and role of electronics engineering in industries.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
0	0	0	0	0	0	40	60	100

Course Contents:

1. The respective Head of the department shall appoint Internship Coordinator (Preferably Training & Placement Coordinator) for the smooth conduction of Internship course/s. The Internship Coordinator shall work as Course Coordinator. The Internship Coordinator shall keep centralized data/record of the Internship.

2. Each Internship course will be evaluated out of 100 Marks as per Practical only course evaluation scheme suggested in Academic Regulations (Major) – UG.18.

3. The Internship shall be monitored under the respective Faculty Counselor. Student(s) (individual / group) shall submit the Internship Report in the prescribed format as given in **Annexure – A** along with the Satisfactory Internship Completion certificate from the Industry Personnel. The counsellor shall award CE P component marks based on this report.

4. The ESE P component of Internship Courses shall be awarded by the Internal Examiner and External Examiner/s preferably from the Industry. The Evaluation should be completed before the commencement of Second week after 1st Mid Semester examination of next semester (semester after the vacation in which the internship course is offered). If student does not get the required marks in this evaluation as per Academic Regulations (Major) – UG.18, he/she has to repeat the internship course.

5. Duration of Internship shall be minimum two weeks. If more days then this requirement are spend then also it will be counted as one internship only.

6. The student has to submit the internship report in a format as prescribed by the internship coordinator. A suggested format of the report for the internship courses is attached in Annexure

– A. The internship coordinator may modify the format to suit the needs as and when arises with consultation of DAC in the department.

7. The student will have to submit the INDUSTRIAL INTERNSHIP/TRAINING FEED BACK form in prescribed format available on college website.

8. It is a Mandatory Non Credit course and the student has to complete an industrial internship of the duration of two weeks during vacation after **Semester VI**. The internship should be carried out in any industry with relevant applications (product or process) of electronics engineering, preferably under the guidance of a mentor from the same industry.

9. The student will maintain a log of work done on daily basis and important ideas or practices that he / she has learnt during the internship. The log-book may also be dually signed by the student and the mentor from the industry.

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- Number of employees, engineers, technicians, administrators in the company
- Divisions of the company
- Your group and division
- Administrative tree (if available)
- Main functions of the company

- Customer profile and market share

- **INTRODUCTION**: In this section, give the purpose of the summer internship, reasons for choosing the location and company, and general information regarding the nature of work you carried out.

- **PROBLEM STATEMENT**: What is the problem you are solving, and what are the reasons and causes of this problem.

- **SOLUTION**: In this section, describe what you did and what you observed during the summer internship. It is very important that majority of what you write should be based on what you did and observed that truly belongs to the company/industry/organization.

- **CONCLUSIONS**: In the last section, summarize the summer internship activities. Present your observations, contributions and intellectual benefits. If this is your second summer internship, compare the first and second summer internships and your preferences.

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