File Ref.No.220483/GA - IV - E1/2018/Admn

UNIVERSITY OF CALICUT

Abstract

General and Academic Branch - Faculty of Engineering-B.Tech programme - OBE based Curriculum (I to VIII) and Syllabus of first to sixth semester Electrical & Electronics Engineering (EEE) and Electronics & Communication Engineering (ECE) w.e.f 2019 Admn onwards - Implemented subject to ratification by the Academic Council - Orders issued.

G & A - IV - E

U.O.No. 7635/2021/Admn Dated, Calicut University.P.O, 05.08.2021

Read:-1. Item no. 1 & 2 of the minutes of the Board of Studies in Electrical,Electronics and Communication Engineering held on 18.06.2021

2. Item no. 1 of the minutes of the meeting of the Faculty of Engineering held on 07.07.2021

3. Orders of the Vice-chancellor in the file 234359/GA-IV-E1/2018/Admn dt. 02.08.2021

ORDER

1. The meeting of the Board of Studies in Electrical, Electronics and Communication Engineering, vide paper read (1) above, presented and approved the B.Tech Syllabus of 5th and 6th semester Electrical and Electronics Engineering and Electronics and Communication Engineering (2019 scheme)
2. The Faculty of Engineering held on 07.07.2021 approved the Syllabus of Electrical and Electronics Engineering and Electronics and Communication Engineering from (S5-S6). Thus the OBE based syllabus of both Electrical and Electronics Engineering and Electronics and Communication Engineering up to 6thsemester is approved by the Faculty, as per paper read (2) above.
3. Considering the urgency, the Vice Chancellor has accorded sanction to implement the OBE based curriculum (I to VIII semester) and syllabus of Electrical and Electronics Engineering and Electronics and Communication Engineering up to 6th semester, subject to ratification by Academic Council, vide paper read (3) above.
4. Orders are issued accordingly. (Curriculum (I to VIII semester) and Syllabus of Electrical and Electronics Engineering and Electronics and Communication Engineering up to 6th semester - w.e.f 2019 Admission onwards appended)

Arsad M

Assistant Registrar

To

1. The Principal, CUIET
2. The Controller of Examinations

Copy to:PA to VC/PA to Registrar/PA to CE/DR, B.Tech/EX & EG sections/ GA I F/SF/DF/FC

Forwarded / By Order

Section Officer

UNIVERSITY OF CALICUT

CURRICULUM

(1 TO 8 SEMESTERS)

&

SYLLABUS

B. Tech. - Electrical & Electronics Engineering

(2019 SCHEME)

(Applicable to 2019 admission onwards)

CURRICULUM 2019 SCHEME

I to VIII SEMESTERS

Every course of B. Tech. Program shall be placed in one of the ten categories as listed in table below.

Sl. No	Category	Credits
1	Humanities and Social Sciences including Management courses	3
2	Basic Science courses	24
3	Engineering Science Courses	19
4	Program Core Courses	74
5	Program Elective Courses	15
6	Open Elective Courses	3
7	Internship, Project work, Seminar and Viva Voce	15
8	Mandatory Non-credit Courses (P/F) with grade	-----
9	Mandatory Student Activities (P/F)	1
10	Laboratory sessions and Mini Project	16
	Total Mandatory Credits	**170**
11	Value Added Course (Optional)	20

Semester-wise credit distribution shall be as below:

Sem	1	2	3	4	5	6	7	8	Total
Credits	19	19	20	20	23	22	22	24	169
Activity Points	50/ 25*				50				100/ 75*
Credits for Activity	1								1
Grand Total									**170**

*** applicable for Lateral Entry (LE) students.**

BASIC SCIENCE COURSES: Maths, Physics, Chemistry, Biology for Engineers, Life Science etc

ENGINEERING SCIENCE COURSES: Basic Electrical, Basic Electronics, Engineering Graphics, Programming, Basic Printing, Basic Civil, Engineering Mechanics, Workshops etc.

HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT COURSES: Management & Economics etc.

MANDATORY NON-CREDIT COURSES: Environmental Science, Constitution of India, Life Skills & Ethics for Engineers, Communicative English, and Concept based Engineering. There will be only internal evaluation of non-credit courses, and no University examinations will be conducted. A minimum 50% internal mark is to be obtained for securing a pass in these subjects. A student has to pass the exam within 4 chances, failing which the student has to undergo course repeat for the subject.

VALUE ADDED COURSE: Students can attend various value added MOOC (Massive Open Online Courses) like NPTEL courses conducted by nationally or internationally reputed institutions with in like IIT,IIST etc, and abroad(from foreign universities) and earn a maximum of 20 additional credits for getting 'Honours' degree in the discipline with a condition that he/she should have secured an aggregate of 8.0 CGPA up till final semester without any history of backlogs. Thus, the candidate can earn a max of 190 credits during his/her period of studies up to 8th semester. The selected course can be in the same discipline or in any other relevant discipline pertaining to engineering/management/social science. 4 credits will be awarded to a student on successful completion of each MOOC. Thus, a student will be eligible to get an undergraduate degree with 'Honours' when he/she successfully earns an additional requirement of 20 credits through the successful completion of 5 MOOCs.

Successful completion of a MOOC is considered only when a student scores a minimum score of 60 (or equivalent to 60%) and above in the respective course. The additional value-added MOOC courses can be of 8 – 12-week duration. Each student who wish to do a MOOC should take prior permission from the respective Head of the Department, registering for the same with the institution which is hosting the course. The Head of the Department should verify the details of the course and ensure that the course content is relevant to his/her discipline before giving the approval. The details of MOOC courses undertaken by a student (if any) and the credits earned must be consolidated by the Tutor, forwarded by HOD and approved by the Principal. The same has to be entered in the University portal by the college officials before the commencement of every end semester university examination.

HONOURS: -

Calicut University is providing this option for academically extra brilliant students to acquire Honours. Honours is an additional credential; a student may earn if she/he opts for the extra 20 credits needed for this in her/his own discipline with a condition that he/she should not have failed in any of the subjects till final semester and have secured an aggregate of 8.0CGPA up till final semester. Honours is not indicative of class. Honours is intended for a student to gain expertise/specialise in an area inside his/her major B-Tech discipline to enrich knowledge in emerging/advanced areas in the branch of engineering concerned and interdisciplinary areas including management. However, the additional credits thus far earned by the student shall be included in the grade card but shall not be considered in calculating the CGPA. Upon completion of Honours, a student will be better equipped to perform research in her/his branch of engineering and allied sectors. On successful achievement of 20 credits from the honours and 170 credits from their respective B-tech syllabus, the student will earn a total credit of 190 at the end of the programme which he/she will be eligible to get the Degree Certificate as "Bachelor of Technology in Electrical and Electronics Engineering, with Honours."

The details of the students eligible for conferring the Honours Degree must be sent to the university by the principal, with the details of her/his marks up to seventh semester and the number of value-added courses and credits earned before the commencement of the 8^{th} semester university examination.

COURSE CODE AND COURSE NUMBER:

Each course is denoted by a unique code consisting of two alphabets followed by two numerals like EE19 807 (P)**.** The first two letter code refers to the department offering the course. EE stands for Electrical and Electronics Engineering. The second two digits represent the year in which the syllabus is implemented, thus the digit 19 represents the year 2019. Out of the next three digits, the first digit represents the semester in which the subject belongs, Eg. In 807, 8 means 8^{th} semester and 07 is the 7^{th} subject in that semester. The last alphabet represents whether the subject belongs to the Practical or laboratory category. Eg. (P) Means the subject belongs to the Practical category.

L-T-P STRUCTURE:

Notations	Description
L	Lecture hours- For theory based courses hours are represented in this form Eg 3-0-0 , means 3 hour lecture per week is dedicated for this subject
T	Tutorial hours- These hours may be assigned for solving numerical problems and allied activities. Eg. 3-1-0, means 1 hour per week is dedicated for this purpose.
P	Practical/Drawing/Interactive session/Visits etc- These hours may be dedicated for conducting laboratory sessions, practical classes, Engg/machine drawing classes, interactive sessions, group discussions and even industrial visits pertaining to a specific subject for better learning. Eg. 0-0-1 means one hour is dedicated for the above mentioned purpose.

Description
Theory based courses (other than the lecture hours, these courses can have tutorial and practical hours, e.g., L-T-P structures 3-0-0, 3-1-2, 3-0-2 etc.)
Laboratory based courses (where performance is evaluated primarily on the basis of practical or laboratory work with LTP structures like 0-0-3, 1-0-3, 0-1-3 etc.)

DEPARTMENTS

Each course is offered by a Department and their two-letter course prefix is given in Table

Departments and their codes

Sl. No	Department	Course Prefix
01	Electrical & Electronics Engineering	EE
02	Electronics & Communication Engineering	EC
03	Information Technology	IT
04	Mechanical Engineering	ME
05	Printing Technology	PT

INDUCTION PROGRAM

A mandatory induction program for first semester students is designed for three weeks. This unique three-week immersion foundation programme designed especially for the fresher's, includes a wide range of activities right from workshops, lectures and seminars by eminent people, visits to local areas, familiarization to branch, department and innovations, physical activity, yoga, literacy, sports tournaments, social work and much more. The programme is designed to mould students into well-rounded individuals, aware and sensitized to local and global conditions and foster their creativity, improve their level of confidence, to involve with the existing environment, inculcate values and ethics, and help students to discover their passion. Foundation Programme also serves as a platform for the fresher's to interact with their batch mates, faculty and seniors and start working as a team with them. The program is structured around the following four themes:

The programme is designed to attain the following objectives:

- **Values and Ethics**: Focus on fostering a strong sense of ethical judgment and moral fortitude.
- **Creativity**: Provide channels to exhibit and develop individual creativity by expressing themselves through art, craft, music, singing, media, dramatics, and other creative designs/activities.
- **Leadership, Communication and Teamwork**: Develop a culture of teamwork and group communication.
- **Social Awareness**: Nurture a deeper understanding of the existing local and global environment and our role in that place as a responsible citizen of the world.

SUBJECTS AND GROUPS IN 1st and 2nd SEMESTER			
GROUP	**SUBJECT CODE**	**SUBJECT NAME**	**COMP/OPT**
A	MA19 100	Calculus and Linear Algebra	COMP FOR SEM1
	MA19 200	Differential Equations and Vector Calculus	COMP FOR SEM 2
B	CH19 100	Engineering Chemistry	OPT (1/2) IN BOTH SEMESTERS
	PH19 100	Engineering Physics	
C	GS19 100	Engineering. Graphics	OPT (1/2) IN BOTH SEMESTERS
	EM19 100	Engineering Mechanics	
D	EC19 100	Concepts of Electronics Engineering	COMP FOR EC IN SEM 1
	EE19 100	Concepts of Electrical Engineering	COMP FOR EE IN SEM 1
	ME19 100	Concepts of Mechanical Engineering	COMP FOR ME IN SEM 1
	IT19 100	Introduction to Computing and Problem Solving	COMP FOR IT IN SEM 1
	PT19 100	Concepts of Printing Technology	COMP FOR PT IN SEM 1
E*	EC19 101	Basics of Electronics Engineering	OPT (1/4) FOR SEM1 & OPT (2/4) FOR SEM 2- RELEVANT SUBJECTS
	EE19 101	Basics of Electrical Engineering	
	CE19 101	Basics of Civil Engineering	
	ME19 101	Basics of Mechanical Engineering	
F	ES19 100	Environmental Science	COMP FOR SEM 1
	DE19 200	Concept Based Engineering	COMP FOR SEM 2
G	CH19 100(P)	Engineering Chemistry Lab	OPT (1/2) IN BOTH SEMESTERS
	PH19 100(P)	Engineering Physics Lab	
H**	EE19 100(P)	Electrical Engineering Workshop	OPT (2/4) IN BOTH SEMESTERS
	EC19 100(P)	Electronics Engineering Workshop	
	CE19 100(P)	Civil Engineering Workshop	
	ME19 100(P)	Mechanical Engineering Workshop	
	IT19 100(P)	Introduction to Computing and Problem Solving Lab	
	PT19 100 (P)	Printing Technology Workshop	
I	CM19 100	Communicative English	COMP FOR SEM 1
	LL19 200	Language Lab	COMP FOR SEM2

COMP- COMPULSORY SUBJECT

OPT – OPTIONAL SUBJECT

* Concerned branches have to avoid choosing Basic of Engineering (E) ie., Electrical and Electronics Engineering students are not permitted to choose Basics of Electrical Engineering and the same is applicable for other branches also.
** EE19 100(P), EC19 100(P), ME19 100(P), IT19 100 (P), PT19 100 (P) are COMPULSORY for respective branches in SEMESTER 1.

SCHEME OF 1ST SEMESTER B.Tech ELECTRICAL AND ELECTRONICS ENGINEERING COURSE								
Subject code	**Subject Name**	**HOURS**			**MARKS**		**Duration of End Semester Examination**	**Credits**
		L	**T**	**P**	**Internal**	**End Semester**		
MA19 100	Calculus and Linear Algebra	3	1	0	50	100	3	4
PH19/ CH19 100	Engineering Physics/ Engineering Chemistry	3	1	0	50	100	3	4
GS19 / EM19 100	Engineering Graphics/	3	0	2	50	100	3	4
	Engineering Mechanics	3	2	0				
EE 19 100	Concepts of Electrical Engineering.	2	1	0	50	100	3	2
EC19 101 ME19/EE19 / CE19 101	Basics of Electronics Engineering Basics of Basics of Mechanical/ Electrical/Civil Engineering	2	1	0	50	100	3	2
ES19 100	Environmental Science	2	0	1	100	---	---	---
CM19 100	Communicative English	2	0	0	100	---	---	---
PH19/CH19 100 (P)	Engineering Physics/ Engineering Chemistry Lab	0	0	2	100	---	3	1
EC19/ ME19 100 (P)	Electronics/ Mechanical Engineering Workshop	0	0	2	100	---	3	1
EE19 100 (P)	Electrical Engineering Workshop	0	0	2	100	---	3	1

<table>
<tr><td rowspan="2"></td><td rowspan="2">TOTAL</td><td>17</td><td>6</td><td>7</td><td rowspan="2">750</td><td rowspan="2">500</td><td rowspan="2">24</td><td rowspan="2">19</td></tr>
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NOTE:

COMMUNICATIVE ENGLISH

Objective is to develop in the under-graduate students of engineering a level of competence in English required for independent and effective communication for their professional needs. Coverage: Listening, Barriers to listening, Steps to overcome them, Purposive listening practice, Use of technology in the professional world. Speaking, Fluency & accuracy in speech, Positive thinking, Improving self-expression, Tonal variations, Group discussion practice, Reading, Speed reading practice, Use of extensive readers, Analytical and critical reading practice, Writing Professional Correspondence, Formal and informal letters, Tone in formal writing, Introduction to reports. Study Skills, Use of dictionary, thesaurus etc., Importance of contents page, cover & back pages, Bibliography, Language Lab.

SCHEME OF 2nd SEMESTER B.Tech ELECTRICAL AND ELECTRONICS ENGINEERING COURSE								
Subject code	**Subject Name**	**Hours**			**Marks**		**Duration of End Semester Examination**	**Credits**
		L	**T**	**P**	**Internal**	**End Semester**		
MA19 200	Differential Equations and Vector Calculus	3	1	0	50	100	3	4
PH19 100/ CH19 100	Engineering Physics/Engineering Chemistry	3	1	0	50	100	3	4
GS19/ EM19 100	Engineering Graphics	3	0	2	50	100	3	4
	Engineering Mechanics	3	2	0				
CE19/ EE19 101	Basics of Civil/ Electrical Engineering	2	1	0	50	100	3	2
ME19/EC19 101	Basics of Mechanical/ Electronics Engineering	2	1	0	50	100	3	2
DE19 200	Concept Based Engineering	2	0	1	100	---	---	---
LL19 200	Language Lab	0	0	2	100	---	---	---
PH19/CH19 100 (P)	Engineering Physics/ Engineering Chemistry Lab	0	0	2	100	---	3	1
EE19/ CE19 100 (P)	Electrical/Civil Engineering Workshop	0	0	2	100	---	3	1
ME19/EC19 100 (P)	Mechanical/ Electronics Engineering Workshop	0	0	2	100	---	3	1
	TOTAL	15	6	9	**750**	**500**	**24**	**19**
		30						

<table>
<tr><th colspan="10">SCHEME OF III SEMESTER B.Tech ELECTRICAL AND ELECTRONICS ENGINEERING COURSE</th></tr>
<tr><th rowspan="2">Subject code</th><th rowspan="2">Subject Name</th><th colspan="3">Hours</th><th colspan="2">Marks</th><th rowspan="2">Duration of End Semester Examination</th><th rowspan="2">Credits</th></tr>
<tr><th>L</th><th>T</th><th>P</th><th>Internal</th><th>End Semester</th></tr>
<tr><td>EN19 301</td><td>Engineering Mathematics III</td><td>3</td><td>1</td><td>0</td><td>50</td><td>100</td><td>3</td><td>4</td></tr>
<tr><td>EE19 302</td><td>Electrical Circuit Analysis</td><td>3</td><td>1</td><td>0</td><td>50</td><td>100</td><td>3</td><td>4</td></tr>
<tr><td>EE19 303</td><td>Electronic Devices and Circuits</td><td>3</td><td>1</td><td>0</td><td>50</td><td>100</td><td>3</td><td>4</td></tr>
<tr><td>EE19 304</td><td>Electrical Measurements and Instrumentation Systems</td><td>3</td><td>1</td><td>0</td><td>50</td><td>100</td><td>3</td><td>3</td></tr>
<tr><td>EE19 305</td><td>Fluid Mechanics & Power Plant Engineering</td><td>3</td><td>1</td><td>0</td><td>50</td><td>100</td><td>3</td><td>3</td></tr>
<tr><td>EN19 306</td><td>Life Skills & ethics for Engineers</td><td>2</td><td>0</td><td>2</td><td>100</td><td>---</td><td>---</td><td>---</td></tr>
<tr><td>EE19 307 (P)</td><td>Basic Electrical Lab</td><td>0</td><td>0</td><td>3</td><td>50</td><td>100</td><td>3</td><td>1</td></tr>
<tr><td>EE19 308 (P)</td><td>Electronics Lab</td><td>0</td><td>0</td><td>3</td><td>50</td><td>100</td><td>3</td><td>1</td></tr>
<tr><td rowspan="2"></td><td rowspan="2">TOTAL</td><td>17</td><td>5</td><td>8</td><td rowspan="2">450</td><td rowspan="2">700</td><td rowspan="2">21</td><td rowspan="2">20</td></tr>
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LIFE SKILLS & ETHICS FOR ENGINEERS

Life skills are those competencies that provide the means for an individual to be resourceful and positive while taking on life's vicissitudes. Development of one's personality by being aware of the self, connecting with others, reflecting on the abstract and the concrete, leading and generating change, and staying rooted in time-tested values and principles is being aimed at. This course is designed to enhance the employability and maximize the potential of the students by introducing them to the principles that underlie personal and professional success, and help them acquire the skills needed to apply these principles in their lives and careers. Professional ethics is highly needed for an engineer. This course will focus on to improvise the ethical quality of an engineer to meet the changing demands and requirements of the society.

SCHEME OF IV SEMESTER B.Tech ELECTRICAL AND ELECTRONICS ENGINEERING COURSE								
Subject code	**Subject Name**	**Hours**			**Marks**		**Duration of End Semester Examination**	**Credits**
		L	**T**	**P**	**Internal**	**End Semester**		
EN19 401	Engineering Mathematics IV	3	1	0	50	100	3	4
EE19 402	Electromagnetic Field Theory	3	1	0	50	100	3	3
EE19 403	Electrical Machines - I	3	1	0	50	100	3	4
EE19 404	Digital Electronics and Logic Circuits	3	1	0	50	100	3	3
EE19 405	Signals and Systems	3	1	0	50	100	3	4
EN19 406	Constitution of India	2	0	2	100	---	---	---
EE19 407(P)	Measurements & Instrumentation lab	0	0	3	50	100	3	1
EE19 408(P)	Mechanical Engineering Lab	0	0	3	50	100	3	1
	TOTAL	**17**	**5**	**8**	**450**	**700**	**21**	**20**
		30						

SCHEME OF V SEMESTER B.Tech ELECTRICAL AND ELECTRONICS ENGINEERING COURSE								
Subject code	**Subject Name**	**Hours**			**Marks**		**Duration of End Semester Examination**	**Credits**
		L	**T**	**P**	**Internal**	**End Semester**		
EN19 501	Engineering Economics and Principles of Management	3	1	0	50	100	3	3
EE19 502	Linear Control Systems	3	1	0	50	100	3	4
EE19 503	Electrical Machines II	3	1	0	50	100	3	4
EE19 504	Power system I- Generation, Transmission& Distribution	3	1	0	50	100	3	4
EE19 505	Microprocessors	3	1	0	50	100	3	3
EE19 506	Program Elective -I	3	1	0	50	100	3	3
EE19 507(P)	Electrical Machines Lab - I	0	0	3	50	100	3	1
EE19 508(P)	Digital Electronics Lab	0	0	3	50	100	3	1
	TOTAL	**18**	**6**	**6**	**400**	**800**	**24**	**23**
		30						

Program Elective- I	
EE19 506 (A)	Computing and Problem Solving
EE19 506 (B)	Instrumentation Systems
EE19 506 (C)	Computer Organization and Architecture
EE19 506 (D)	Electrical Material Science
EE19 506 (E)	Object Oriented Programming
EE19 506 (F)	Analog and Digital Communication

SCHEME OF VI SEMESTER B.Tech ELECTRICAL AND ELECTRONICS ENGINEERING COURSE								
Subject code	**Subject Name**	**Hours**			**Marks**		**Duration of End Semester Examination**	**Credits**
		L	**T**	**P**	**Internal**	**End Semester**		
EE19 601	Power System Analysis	3	1	0	50	100	3	4
EE19 602	Modern Control Theory	3	1	0	50	100	3	4
EE19 603	Power Electronics	3	1	0	50	100	3	3
EE19 604	Digital System Design	3	1	0	50	100	3	3
EE19 605	Program Elective - II	3	1	0	50	100	3	3
EE19 606	Open Elective - I	3	1	0	50	100	3	3
EE19 607(P)	Electrical Machines Lab - II	0	0	3	50	100	3	1
EE19 608(P)	Mini Project	0	0	3	100	---	-	1
	TOTAL	**18**	**6**	**6**	**450**	**700**	**21**	**22**
		30						

***Submission of report for internship done during the break of semester 6 can be done during the start of semester 7.**

Program Elective- II		**Open Elective-I**	
EE19 605(A)	Biomedical Engineering	EE19 606(A)	Industrial Safety Engineering
EE19 605(B)	High Voltage Engineering	EE19 606(B)	Numerical Analysis And Optimization Theory
EE19 605(C)	Photovoltaic Design And Installation	EE19 606(C)	Control Systems Engineering
EE19 605(D)	Digital Control Systems	EE19 606(D)	Electric Vehicles
EE19 605(E)	Illumination Technology	EE19 606(E)	Professional Ethics
EE19 605(F)	Modern Operating Systems	EE19 606(F)	Renewable Energy Systems

OPEN ELECTIVE:

These elective subjects are open to all students of various engineering disciplines. Any student can opt an elective subject based on his/her interest. These elective topics are of general in nature and focused on thrust areas. The number of students that can be accommodated in an elective is limited to 50; the allotment can be on a first come first serve basis.

SCHEME OF VII SEMESTER B.Tech ELECTRICAL AND ELECTRONICS ENGINEERING COURSE								
Subject code	**Subject Name**	**Hours**			**Marks**		**Duration of End Semester Examination**	**Credits**
		L	**T**	**P**	**Internal**	**End Semester**		
EE19 701	Power System – III- Switch gears, Protection &Utilization	3	1	0	50	100	3	4
EE19 702	Electrical Drives	3	1	0	50	100	3	3
EE19 703	Digital Signal Processing	3	1	0	50	100	3	3
EE19 704	Soft computing Techniques	3	1	0	50	100	3	3
EE19 705	Program Elective - III	3	1	0	50	100	3	3
EE19 706(P)	System Simulation Lab	0	0	3	50	100	3	1
EE19 707(P)	Power Electronics Lab	0	0	3	50	100	3	1
EE19 708(P)	Project Phase - I	0	0	4	100	-	-	3
EE19 709(P)	Internship *	0	0	0	100	-	-	1
	TOTAL	**15**	**5**	**10**	**550**	**700**	**21**	**22**
		30						

***Submission of report for internship done during the break of semester 6 can be done during the start of semester 7.**

Program Elective- III	
EE19 705 (A)	Distributed Generation & Smart Grids
EE19 705 (B)	Embedded Systems
EE19 705 (C)	VLSI Design
EE19 705 (D)	Power Quality Issues and Remedial Measures
EE19 705 (E)	Electrical Machine Design
EE19 705 (F)	Switched Mode Power Converters

INTERNSHIP:

Students need to undergo a minimum of 10-15 days internship in an Industry/Firm associated with rural technology and agriculture/Rural village to observe, identify and give suggestions to the problems related to Electrical and Electronics and allied engineering sector in the society. The Internship should give exposure to the practical aspects of the Electrical and allied engineering discipline. In addition, the student may also work on a specified task or project which may be assigned to him/her. The students will have an opportunity to develop observational skills, develop confidence to identify and understand the issues related with machines/systems and come up with solutions to rectify the same. This motive of the programme is ultimately focused on the mutual benefit to the students, industry and society. The outcome of the internship should be presented in the form of a report.

Total marks: 100, minimum marks required to pass the internship is 50, split-up of the marks are as follows

Attendance	: 10
Coordinator	: 20
Technical Content of the Report	: 30
Presentation	: 40

PROJECT PHASE I:

A Project topic must be selected either from research literature or the students themselves may propose suitable topics in consultation with their guides. The guides may encourage socially relevant project which can be interdisciplinary in nature.

Faculty members and students can interact with members of the local body, practicing engineers, industry and research institutions, to identify the issues which are predominant in that area/state and need immediate attention. Such issues may be categorized and converted into a research problem so that they can study the feasibility of doing a research project in that area. This method of addressing the problems of society will enhance the culture and social concern of the students. This initiative can produce engineers with social commitment.

The objective of project work is to enable the student to take up investigative study in the broad field which can be of interdisciplinary nature, either fully theoretical/simulation/practical or involving both theoretical and practical work. The department can assign a group of four students, under the guidance of a faculty to do the project work. Thus the assigned faculty can constantly interact with these students and mentor them properly to gain confidence in taking up research work and supporting them to make it a reality. This initiative is expected to provide a good base for the student(s) in taking up a research & development project.

Faculty themselves or along with students in the Institutions/departments can apply for project grants with research organizations like Kerala State Council for Science Technology and Environment (KSCSTE), Department of Science & Technology (DST) for doing projects. Faculty/students can also approach Agricultural, Veterinary, Fisheries, and Health Sciences Universities for doing projects in a variety of fields where they require technical support from the engineering sector. These types of funded research projects will improve the creativity and outlook of the students which will be beneficial to the society.

The assignment to normally include:

- Survey and study of published literature on the assigned topic;
- Preparing an Action Plan for conducting the investigation, including teamwork;
- Working out a preliminary Approach to the Problem relating to the assigned topic;
- Block level design documentation
- Conducting preliminary Analysis/ Modelling/ Simulation/ Experiment/ Design/ Feasibility;
- Preparing a Written Report on the Study conducted for presentation to the department;
- Final seminar, as oral presentation before the evaluation committee.

Total marks: 100, minimum marks required to get a pass is 50, Mark distribution is as follows

Project Guide	: 30
Interim evaluation by the evaluation committee	: 20
Final presentation	: 30
Report evaluation by the evaluation committee	: 20

SCHEME OF VIII SEMESTER B.Tech ELECTRICAL AND ELECTRONICS ENGINEERING COURSE								
Subject code	**Subject Name**	**Hours**			**Marks**		**Duration of End Semester Examination**	**Credits**
		L	**T**	**P**	**Internal**	**End Semester**		
EE19 801	Electrical System Design	3	1	0	50	100	3	4
EE19 802	Special Electrical Machines	3	1	0	50	100	3	3
EE19 803	Program Elective - IV	3	1	0	50	100	3	3
EE19 804	Program Elective - V	3	1	0	50	100	3	3
EE19 805(P)	Seminar	0	0	6	100	-	-	2
EE19 806(P)	Project Phase II	0	0	8	100	-	-	6
EE19 807(P)	Viva Voce	0	0	0	-	100	-	3
	TOTAL	**12**	**4**	**14**	**400**	**500**	**12**	**24**
		30						

Program Elective- IV		**Program Elective- V**	
EE19 803(A)	Design of Power Electronic Systems	EE19 804(A)	Image Processing
EE19 803(B)	Flexible AC Transmission Systems	EE19 804(B)	Electrical Energy Auditing, Conservation And Management
EE19 803(C)	Internet of Things	EE19 804(C)	Robotics And Automation
EE19 803(D)	Electric And Hybrid Vehicles	EE19 804(D)	Robust And Adaptive Control
EE19 803(E)	Solar PV Systems	EE19 804(E)	Satellite Communication
EE19 803(F)	Advanced Electronic Design	EE19 804(F)	Industrial Instrumentation & Automation

SEMINAR:

To encourage and motivate the students to read and collect recent and reliable information from their area of interest confined to the relevant discipline from technical publications including peer reviewed journals, conference, books, project reports etc., prepare a report based on a central theme and present it before a peer audience. A faculty member can guide a maximum of five students of his area of interest to have better interaction and creative support in guiding the seminar. Each student shall present the seminar for about 20 minutes duration on the selected topic. The report and the presentation shall be evaluated by a team of internal members comprising three senior faculty members based on style of presentation, technical content, adequacy of references, depth of knowledge and overall quality of the report.

Total marks: 100, minimum marks required to pass the seminar is 50, split-up of the marks are as follows

Attendance	: 10
Seminar Guide	: 20
Technical Content of the Report	: 30
Presentation	: 40

PROJECT PHASE II:

The objective of project work II & dissertation is to enable the students to extend further the investigative study taken up in Project Phase I. This work can be either fully theoretical/practical or involving both theoretical and practical work, socially relevant initiatives (work from local body/village) funded project from a research organization. The project is under the guidance of a faculty (project Guide) from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This project work is expected to provide a good overall training for the students in research and development, execution of a theory into practical by facing the challenges with confidence by developing technical leadership. The assigned project work is normally evaluated based on the following points:

- Depth of knowledge in the topic assigned/work executed based on the report prepared under Phase I;
- Review and finalization of the approach to the identified problem relating to the assigned topic/work;
- Detailed Analysis/ Modelling/ Simulation/ Design/ Problem Solving/ Experiment as needed;
- Final development of product/process, testing, results, conclusions and future directions;
- Preparation of a paper for Conference presentation/Publication in Journals, if available;
- Preparation of a Dissertation in the standard format for evaluation by the Department;
- Final Presentation before a Committee

Total marks: 100, minimum marks required to pass 50

Project Guide	: 30
Interim evaluation, by the evaluation committee	: 20
Quality of the report evaluated by the above committee	: 20
Final evaluation by a three member faculty committee	: 30

Activities that a student can engage in and the maximum quantum of points that can be earned from them are listed below.

Annexure-I

i) National Level Activities			
Code	**Name of activity**	**Max. Activity Points**	**Minimum Duration**
NA1	N S O	70	Two Semesters
NA2	N C C	70	Two Semesters
NA3	N S S	70	Two Semesters
ii) College Level Activities			
CA1	Active Member/Office bearer of Professional Societies (Student Chapters)	30/40	Four Semesters
CA2	Elected Office bearer of Student forums	30	Two semesters
CA3	Member/Captain- College Athletic/ Games teams	20/30	Two Semesters
CA3	Executive Member of Student Clubs	20	Two Semesters
CA4	Volunteer for important College functions	20	Two Semesters
CA5	Committee member/ Organizer of Tech Fest/ Cultural Fest/ Conference	20/30	Two Semesters
CA6	Placed within top three in Paper presentation/debate/ cultural competitions etc	30	
CA7	Placed within top three in State level Sports/Games	30	
Additional 20 points to be given for CA3/CA7 if the achievement is at the national level.			
iii) Entrepreneurship			
EA1	Any Creative Project execution	40	
EA2	Awards for Projects	60	
EA3	Initiation of Start-ups	60	
EA4	Attracted Venture Capital	80	
EA5	Fileda Patent	80	

EA6	Completed Prototype Development	80	
	iv) Self Initiatives		
SA1	Attend a National Conference	20	
SA2	Attend an Int. National Conference	30	
SA3	Published/got an Award for a technical paper.	30/40	
SA4	Organiser of student technical Conf/Competition	30	
SA5	Foreign language skills	50	
SA6	Webinar related to the Engineering/Management/Social science(Max of Ten)	2	
SA7	Online courses taken & completed	Maximum 50	10 week duration

ACTIVITY POINTS: -

The Tutor, HOD and Principal must ensure that the students have acquired the required mandatory 50 activity points (25 activity points in the case of LE students) by the end of 4^{th} and another 50 activity points by the end of 8^{th} semester. The accumulated activity points of all students must be consolidated and entered in to the university portal by the college officials upon completion of the 4^{th} semester (50/ 25 points) and the 8^{th} semester (50 points) before the commencement of the respective University examinations.

SEMESTER - 1&2

GROUP A

MA19 100	CALCULUS AND LINEAR ALGEBRA	3-1-0-4 (L-T-P-C)

COURSE OBJECTIVES:

- To familiarize with functions of several variables that is essential in most branches of Engineering.
- To develop the tool of Power series for learning Advanced Engineering Mathematics.
- To develop the tool of Fourier series for learning Advanced Engineering Mathematics.
- To develop the essential tool of Matrices and Linear Algebra in a comprehensive manner.

SYLLABUS:

Module I: Sequences and Series. (12 hours)

Indeterminate forms and L'Hospital's rule ; Definition of sequences and series; Convergence of sequence and infinite series, Tests for convergence of infinite series- Comparison test, Ratio test, Root test, Raabe's, Logarithmic test; convergence of Alternating series (Leibnitz's test), absolute convergence.

Module II: Power Series. (8 hours)

Taylor's and Maclaurin's theorems with remainders, Power series, Taylor's Series, Maclaurin's series, series for exponential, trigonometric, hyperbolic and logarithmic functions. Leibnitz formula for derivative of product of two functions.

Module III: Multivariable Calculus. (10 hours)

Functions of several variables; Limit, continuity and partial derivatives, total derivative; Maxima, minima and saddle points; Radius of curvature, Circle of curvature, evolutes and involutes.

Module IV: Fourier Series. (10 hours)

Periodic functions, Trigonometric series, Fourier series, Euler Formula, Even and Odd functions, Fourier series for Even and Odd functions, Functions having arbitrary period, Fourier series of functions having arbitrary period, Half range expansions, Half range sine and cosine series.

Module V: Matrices. (12 hours)

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Rank of a matrix, Solution of System of linear equations-Homogeneous and non-homogeneous; Hermitian, skew –Hermitian and Unitary matrices; Eigen values and Eigen vectors; Cayley Hamilton theorem; Diagonalisation of matrices; Quadratic forms; OrthogonalTransformation.

COURSE OUTCOMES:

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

- Use the derivatives to find critical points, inflection points and local extrema.
- Understand the basic concept of partial differentiation and its applications in engineering.
- Develop skills in computations and applications of infinite sequences and sums.
- Expand the periodic function by using Fourier series and apply it in signals and systems.
- Use matrices and determinants for solving systems of linear equations and apply it in engineering problems.

TEXT BOOKS:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

REFERENCE BOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley& Sons,2006.
2. Veerarajan T., Engineering Mathematics for First year, Tata McGraw-Hill, New Delhi2008.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw-Hill, New Delhi, 11th Reprint, 2010.
4. D.Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
5. N.P. Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, Reprint,2008.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, Edition, 2010.

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern *(Maximum Marks-100).*
PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

MA19 200	DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS	3-1-0-4(L-T-P-C)

COURSE OBJECTIVES:

- To introduce effective mathematical tools for the solutions of differential equations that model physical process
- To acquaint with mathematical tools needed in evaluating multiple integrals and their usage.
- To familiarize with the concept of vector differentiation and vector integration.

SYLLABUS:

Module I: First order ordinary differential equations. (10 hours)

Differential equations reducible to homogeneous, Exact, linear and Bernoulli's equations, Equations of the first order and higher degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairout's type. Applications of differential equations of first order- orthogonal trajectories.

Module II: Ordinary differential equations of higher orders. (10 hours)

Second order linear differential equations with constant coefficients, method of variation of parameters, second order linear differential equations with variable coefficients, Cauchy-Euler equations, Legender's linear equations.

Module III: Multiple integrals and their applications**.** (12 hours)

Double integrals (cartesian and polar co-ordinates), Change of order of integration of double integrals, change of variables (cartesian to polar), applications: areas and volumes, triple integrals, volume of solids, change of variables (rectangular to cylindrical, rectangular to spherical polar).

Module IV: Vector differential calculus. (10 hours)

Vector functions of a single variable, Differentiation of vector functions, scalar and vector fields, gradient of scalar field, divergence and curl of vector fields, physical meaning, relation between the vector differential operators.

Module V: Vector integral calculus. (10 hours)

Integration of vectors, scalar line integrals, surface and volume integrals of vector functions, Gauss divergence theorem, Stokes theorem, Greens theorem (without proof).

COURSE OUTCOMES:

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

- Acquire basic knowledge of differential equations and methods of solving them.
- Model and analyse differential equations in a wide range of physical phenomena and has got applications across all branches of engineering.
- Model physical phenomena involving continuous changes of variables and parameters
- Apply the concept of vector functions and learn to work with conservative vector fields.
- Apply computing integrals of scalar and vector fields over surfaces in three-dimensional space.

TEXT BOOKS / REFERENCE BOOKS:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002 Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley& Sons, 2006.
2. Erwin Kreyszig, Advanced engineering mathematics, 9th Edition, John Wiley & sons 2006.
3. E.A.Coddington, An introduction to ordinary differential equations, Prentice Hall 1995.
4. S L Ross, Differential Equation, 3rd ed., Wiley India 1984.
5. N.P. Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
6. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers,36th Edition, 2010.

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern *(Maximum Marks-100).*

PART A*: Analytical/problem solving SHORT questions* **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B*: Analytical/Problem solving DESCRIPTIVE questions* **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

GROUP B

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CH19 100	ENGINEERING CHEMISTRY	3-1-0-4 (L-T-P-C)

COURSE OBJECTIVES:

- To enable the students to acquire knowledge in the concepts of chemistry for engineering applications.
- To familiarize the students with different application oriented topics like polymers, nanomaterials, lubricants, fuels, storage devices, etc.
- To focus the students on the chemistry of compounds resulting from pollution, waste generation and environmental degradation and to apply the knowledge in solving these current environmental problems effectively.
- To develop abilities and skills that are relevant to the study and practice of chemistry.

SYLLABUS:

Module I: (10 Hours)

Water: hardness, determination of hardness by edta method, softening (lime-soda and ion exchange methods), numerical problems based on hardness and lime soda method, purification of water for domestic use.
Polymers: classification, addition polymerization (free radical, cationic, anionic, and coordination mechanism of polymerisation), condensation polymerization, crystallinity in polymers (amorphous, crystalline and semi-crystalline), concept of glass transition temperature (Tg), factors affecting Tg.
Conducting polymers: introduction, synthesis, structure, properties and applications of conducting polymers like polyacetylene and polyaniline.

Module II: (10 Hours)

Lubricants: classification of lubricants (solid, liquid, and semisolid), Mechanism of lubrication (thick film, thin film, and extreme pressure), properties of lubricants (viscosity, flash and fire point, cloud and pour point, aniline point, and corrosion stability).

Fuels: classification of fuels, calorific value, determination of calorific value using bomb calorimeter; numerical problems based on calorific value, liquid fuels (petroleum), refining of petroleum, cracking and reforming, petrol knock and octane number, diesel knock and cetane number, bio-diesel.

Module III: (10 Hours)

Nanoscience: introduction, classification of nanomaterials, synthesis of nanomaterials

(hydrolysis and reduction), fullerenes and carbon, nanotubes, properties and applications of CNTs.
Green chemistry : definition, importance and limitations, twelve principles of green chemistry with their explanations and examples.

Module IV: (10 Hours)

Electrochemistry: electrochemical cells, salt bridge, Helmholtz double layer, single electrode potential, EMF and its measurement by Poggendorf's compensation method, determination of single electrode potential using SHE, electrochemical series and its applications, Nernst equation and its applications; numerical problems based on potential and Nernst equation, concentration cells (electrode and electrolyte concentration cells), glass electrode and pH measurement using glass electrode (Numerical problems).

Storage and fuel cells: lead acid accumulator and nickel cadmium battery, fuel cells, H2/O2 fuel cell, solar cells.

Module V: (12 Hours)

Corrosion: theories of corrosion, dry corrosion (self protecting corrosion products, pilling-bed worth rule), wet corrosion (corrosion of iron in acidic, neutral and basic conditions), galvanic corrosion and galvanic series, differential aeration corrosion, stress corrosion, factors influencing corrosion, corrosion control by cathodic protection.

Protective coatings: inorganic metallic coatings (galvanizing, tinning, cementation, electroplating), inorganic non-metallic coatings (phosphate, chromate, chemical oxide, anodising), organic coatings (paints).

COURSE OUTCOME:

The student will be able to

- Analyze the importance of hardness of water and the basic concept of polymers
- Rationalize the properties of lubricants and the major fuels used in the daily life
- Explore the basic idea of nanoscience and the significance of environmental protection by studying the green chemistry
- Streamline the worth of electrical storage using batteries or fuel cells by learning the electrochemistry
- List major chemical corrosion reactions and prevention methods that are used in the protection of metals

TEXT BOOKS:

1. A textbook of Engineering Chemistry by Dr. Sunitha Rattan, S. K. Kataria Publisher.
2. Engineering Chemistry by N. Krishnamurthy and D. Madhavan, PHI Learning, Pvt Ltd.

REFERENCE BOOKS:

1. Seymour R.B, Introduction to Polymer Chemistry, McGraw Hill, New York.
2. Billmeyar F.W, Text book of Polymer Science, Wiley Inter-science, New York.
3. L.H. Sperling, Introduction to Physical Polymer Science, Wiley Interscience, New York.
4. P.K. Goel, Water Pollution, Causes, Effects and Control, New Age International F. A. Cotton, and G. Wilkinson, Advanced Inorganic Chemistry, 3^{rd} Ed., Wiley Eastern Ltd.
5. P. W. Atkins, Physical Chemistry, J.D. Paula, Oxford University Press.
6. V. Kumar, Introduction to Green Chemistry, Vishal Publishing House.
7. V.S. Muraleedharan and A. Subramania – Nano Science and Technology, Ane Books.
8. B. S. Bahl and ArunBahl S. Advanced Organic Chemistry, Chand & Company.
9. L. S. Brown and Thomas A. Holme, Chemistry for Engineering Students, Cengage Learning.
10. Engineering Chemistry by Jain and Jain, Dhanpat Rai Publishers.
11. Engineering Chemistry by P. Rath, Cengage Learning.
12. Engineering Chemistry by M.J Shultz, Cengage Learning, New Delhi.
13. Engineering Chemistry by R. Mukhopadhyay and S. Datta, New Age International Publishers.
14. A textbook of Engineering Chemistry by S. S. Dara and S. S. Umare, S. Chand Pvt Ltd.

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class

University Examination Pattern *(Maximum Marks-100).*

PART A**: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B**: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks

Two questions from each module with choice to answer one question.

PH19 100	ENGINEERING PHYSICS	3-1-0-4 (L-T-P-C)

COURSE OBJECTIVES:

- To impart the basic concepts and ideas in physics.
- To develop scientific attitudes and enable the students to correlate the concepts of physics with the core programmes.

SYLLABUS:

Module I: (10 Hours)

Interference: coherence, interference in thin films and wedge shaped films (reflected system) Newton's rings; measurement of wavelength and refractive index of liquid, interference filters, antireflection coating.
Diffraction: Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit, plane transmission grating, grating equation; measurement of wavelength, Rayleigh's criterion for resolution of grating, resolving power and dispersive power of grating.
Polarization of Light: types of polarized light, double refraction, Nicol Prism, quarter wave plate and half wave plate, production and detection of circularly and elliptically polarized light, induced birefringence; Kerr Cell, polaroid & applications.

Module II: (10 Hours)

Quantum Mechanics: uncertainty principle and its applications, formulation of time dependent and time independent Schrodinger equations, physical meaning of wave function, energy and momentum operators, eigen values and functions, one dimensional infinite square well potential , quantum mechanical tunnelling (qualitative).
Statistical Mechanics: macrostates and microstates, phase space, basic postulates of Maxwell-Boltzmann, Bose-Einstein and Fermi Dirac statistics, distribution equations in the three cases (no derivation), Fermi level and its significance.

Module III: (10 Hours)

Waves: one dimensional wave; differential equation and solution. three dimensional waves: differential equation and its solution (no derivation), transverse vibrations of a stretched string.

Acoustics: Intensity of sound, loudness, absorption coefficient, reverberation and reverberation time, significance of reverberation time, Sabine's formula (no derivation), factors affecting acoustics of a building.
Ultrasonics: production of ultrasonic waves; magnetostriction effect and piezoelectric effect, magnetostriction oscillator and piezoelectric oscillator, detection of ultrasonics; thermal and

piezoelectric methods, applications of ultrasonics - NDT and medical.

Module IV: (12 Hours)

Photonics: basics of solid state lighting, LED, photodetectors, photovoltaic cell, junction and avalanche photodiodes, phototransistors, thermal detectors, solar cells; V-I characteristics.

Optic fibres: principle of propagation-numerical aperture, optic fibre communication system (block diagram), industrial, medical and technological applications of optical fibre, fibre optic sensors, basics of intensity modulated and phase modulated sensors.

Module V: (10 Hours)

Laser: properties of lasers, absorption, spontaneous and stimulated emissions, population inversion, Einstein's coefficients, working principle of laser, optical resonant cavity, Ruby laser, Helium-Neon laser, semiconductor laser (qualitative), applications of laser, holography (recording and reconstruction).

Superconductivity: superconducting phenomena, Meissner effect. Type-I and Type-II superconductors, BCS theory (qualitative), high temperature superconductors, Josephson Junction, SQUID; Applications of superconductors.

COURSE OUTCOME:

Students will be able to

- Familiarised with the basic principles of Physics and its significance in engineering systems and technological advancements.
- Able to apply the theories of Physics in the field of Engineering and Technology.
- Exposed to the different branches of Physics and their field of applications in engineering.
- Able to understand the modern developments in Physics and to utilize them in technological developments.
- Able to develop the scientific attitudes and to correlate the concepts of Physics to core programmes

TEXT BOOKS:

1. Physics for Engineers- M.R.Seenivasan- New Age Publishers 1996 Edition.
2. Beiser A, Concepts of Modern Physics, McGraw Hill India Ltd.
3. Brijlal and Subramanyam, A TextBook of Optics, S.Chand & Co.
4. Mehta V K, Principles of Electronics, S.Chand & Co.
5. Rajendran V and Marikani A, Physics I, Tata McGraw Hill Co Ltd.

REFERENCE BOOKS:

1. Aruldhas G, Engineering Physics, PHI Ltd.
2. Bhattacharya and Tandon, Engineering Physics , Oxford India.
3. Dominic and Nahari, A Text Book of Engineering Physics, Owl Books Publishers
4. Hecht E, Optics, PearsonEducation.
5. Mehta N, Applied Physics for Engineers, PHILtd.
6. Palais J. C, Fiber Optic Communications, Pearson Education.
7. Pandey B. K and Chathurvedi S, Engineering Physics, Cengage Learning.
8. Philip J, A Text Book of Engineering Physics, Educational Publishers.
9. Premlet B, Engineering Physics, McGraw Hill India Ltd.
10. Sarin A and Rewal A, Engineering Physics, Wiley India Pvt Ltd.
11. Sears and Zemansky, University Physics, Pearson.
12. Vasudeva A. S, A Text Book of Engineering Physics, S. Chand &Co.
13. Kakani A. S, A Text Book of Electronics, New Age International (p) publishers 2000 Edition.

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern *(Maximum Marks-100)*

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PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks.***
Two questions from each module with choice to answer one question.

GROUP C

GS19 100	ENGINEERING GRAPHICS	3-0-2- 4 (L-T-P-C)

COURSE OBJECTIVES:

- Graphics is the language of engineers and hence makes the student capable of conceiving shape and geometry of various objects and to effectively communicate their design ideas through drawings and sketches as per standards.
- Enable students to prepare & understand engineering drawings.

SYLLABUS:

Module I: (8 hours)

Engineering Graphics – introduction - Drawing instruments and their use – lines, Lettering and dimensioning – Scales- Familiarization with Standard Code of practice for general engineering drawing. Theory of projections - Projections of points in different quadrants.

Module II: (16 hours)

a) Projections of straight lines - True length and inclinations of a line with reference planes. Traces of lines – Line parallel to both reference planes - Perpendicular to one of the reference planes - Inclined to one and parallel to other reference plane - Inclined to both the reference planes – Rotating line method – Rotating plane method.

b) Projections of planes - lamina of geometrical shapes - Plane lamina parallel, inclined and perpendicular to the reference planes - Inclined to one and perpendicular to the other reference plane - Inclined to both the reference planes - Inclined to the two reference planes but perpendicular to the profile plane.

Module III: (16 hours)

a) Projections of Solids of revolution and Frustums - Projections of solids with axis parallel to one and inclined to the other reference plane - Axis inclined to both the reference planes - Projections of solids on auxiliary planes (Solids to be drawn: Cube, Prisms, Pyramids, Tetrahedron, Cone and Cylinder).

b) Sections of solids - Sections by cutting planes parallel to the reference planes - Cutting plane inclined to one and perpendicular to other reference plane - True shape of the section by projecting on auxiliary plane (Solids to be drawn: Cube, Prisms, Pyramids, Tetrahedron, Cone and Cylinder).

Module IV: (15 hours)

a) Development of surfaces of solids - Method of parallel line & radial line developments - Development of Polyhedra, Cylinder, Cone and sectioned solids - Development of solids having hole or cut.

b) Introduction to isometric projection - Isometric scale - Isometric views - Isometric projections of Prisms, Pyramids, Cylinder, Cone, Spheres, sectioned solids and combination of them.

Module V: (10 hours)

a) Introduction to perspective projections – Classification of perspective views - Visual ray and vanishing point method of drawing perspective projection - Perspective views of plane figures such as polygons and circles - Perspective views of solids like Prisms and Cube.

b) Conventional representation of threaded fasteners - Drawing of nuts, bolts, washers and screws -Locking arrangements of nuts - Bolted and screwed joints - Foundation bolts.

c) Introduction to Computer Aided Drafting (CAD) - Preparation of engineering drawings by using any software capable of drafting and modelling - Creation of simple figures like polygon and general multiline figures only.

(Module V, Part C: For internal work assessment only, not for University Examination)

COURSE OUTCOMES:

After completion of the course, the student will be able to

- Familiarise with the Fundamentals of Engineering Drawing standards.
- Interpret 3D shapes from orthographic projections of objects and they will be able to make orthographic projections of any object.
- Draw the sectional view of the solids.
- Make developments of surfaces & solids.
- Draw the perspective projections of objects and prepare CAD drawings.

TEXT BOOKS

1. P.I Varghese, Engineering Graphics, VIP Publications, Thrissur.
2. N D Bhatt, "Engineering Drawing", Charotar Publications.

REFERENCE BOOKS:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. John.K.C, Engineering graphics, PHI Learning Pvt, Ltd. 2009.

Internal Continuous Assessment *(Maximum Marks-50).*

60% - Assignments (minimum 10 Drawing sheets, 2 from each module) plus two assignments on CAD.

30% - Tests (minimum 2).

10% - Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).

PART A

Q 1. Two questions (a) and (b) of 20 marks each from module II, one from module II (a) and one from module II(b), with a choice to answer any one.
Q 2. Two questions (a) and (b) of 20 marks each from module III, one from module III(a) and one from module III(b), with a choice to answer any one.
Q 3. Two questions (a) and (b) of 20 marks each from module IV, one from module IV(a) and one from module IV(b), with a choice to answer any one.

PART B

Q 4. Three Questions (a), (b) and (c) of 20 marks each from module III &V, one from module III(b), one from module V(a) and one from module V(b), with choice to answer any two.

EM19 100	ENGINEERING MECHANICS	3-2-0-4 (L-T-P-C)

COURSE OBJECTIVES:

- To acquaint with general approach of solving engineering problems.
- To illustrate the application of the theory learned in Mechanics in practical engineering problems.
- To lay clear fundamentals to core Engineering Subjects.

SYLLABUS:

Module I: (16 hours)

Introduction to engineering mechanics - units - dimensions - vector and scalar quantities - laws of mechanics - elements of vector algebra - important vector quantities - equivalent force systems – translation of a force to a parallel position - resultant of a force system - simplest resultant of special force systems - distributed force systems - equations of equilibrium - free body diagrams - free bodies involving interior sections - general equations of equilibrium - problems of equilibrium - static indeterminacy. (Both vector and scalar formulations are to be introduced to solve problems).

Module II: (12 hours)

Friction – laws of friction – simple contact friction problems. Introduction to structural mechanics - trusses - analysis of simple trusses - method of sections – method of joints.

Module III: (12 hours)

First moment and centroid– theorems of Pappus-Guldinus - second moment of plane and composite areas – parallel and perpendicular axis theorems – polar moment of inertia of area – product of inertia and principal axis (conceptual level treatment only).
Moment of inertia of a rigid body and lamina (derivation of MI for cylinder, rod and sphere).

Module IV: (15 hours)

Dynamics: Rectangular and Cylindrical coordinate system **-** Combined motion of rotation and translation – Concept of instantaneous center – Motion of connecting rod of piston and crank of a reciprocating pump- Rectilinear translation – Newton’s second law – D’Alembert’s Principle– Application to connected bodies (Problems on motion of lift only).

Module V: *(10 hours)*

Mechanical vibrations – Free and forced vibration - Degree of freedom - Simple harmonic motion – Spring-mass model – Period – Stiffness –Frequency – Simple numerical problems of single degree of freedom.

COURSE OUTCOMES:

After completion of the course, the student will be able to

- Gain knowledge on basic concepts of Engineering Mechanics.
- Apply the theory of mechanics on a practical level.
- Get an idea on centroid, moment of inertia and mass moment of inertia of composite structures.
- Relate kinematics with kinetics equations in simple practical problems.
- Get knowledge on vibrations during motion.

TEXT BOOKS:

1. Shames I. H, Engineering Mechanics - Statics and Dynamics, Pearson Prentice.
2. Timoshenko, S & Young D. H, Engineering Mechanics, McGraw Hill.

REFERENCE BOOKS:

1. Benjamin J., Engineering Mechanics, Pentex Book Publishers and Distributors.
2. Bhavikatti S. S., Engineering Mechanics, New Age International Publishers.
3. Hibbeler R. C., Engineering Mechanics: Statics and Dynamics. Pearson PrenticeHall.
4. Kumar, D.S., Engineering Mechanics: Statics and Dynamics, S.K. Kataria& Sons.
5. Kumar K. L., Engineering Mechanics, Tata McGraw Hill Publishing Company Ltd.
6. Rajasekaran S and Sankarasubramanian G, Engineering Mechanics, Vikas Publishing House Private Limited.
7. Tayal, A. K., Engineering Mechanics- Statics and Dynamics, Umesh Publications.

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2).

20% -Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern *(Maximum Marks-100).*

PART A*: Analytical/problem solving SHORT questions* ***10 x 5 marks= 50 marks*** Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks*** Two questions from each module with choice to answer one question.

GROUP D

EE19 100	CONCEPTS OF ELECTRICAL ENGINEERING	2-1-0-2 (L-T-P-C)

COURSE OBJECTIVES:

The objective of this course is to set a firm and solid foundation in Electrical Engineering with strong analytical skills and conceptual understanding of basic laws and analysis methods in electrical and magnetic circuits.

SYLLABUS:

Module I: (8 hours)

D. C. Circuits (Only Independent sources) Kirchhoff's law, ideal and practical voltage and current sources. Mesh and Nodal analysis (Super node and super Mesh excluded). Source transformation. Star delta transformation. Superposition theorem, Thevenin's theorem Norton's theorem, maximum power transfer theorem (Source transformation not allowed for superposition theorem, Mesh and Nodal analysis.

Module II: (8 hours)

Fundamentals: Sinusoidal voltage and currents, their mathematical and graphical representation, concept of cycle period, frequency, instantaneous, peak, average, R.M.S. values, peak factor, and form factor, phase difference, lagging, leading and in phase quantities and phasor representation. Rectangular and polar representation of phasors.

Study of circuits of pure resistance, inductance and capacitance and corresponding voltage-current phasor diagrams, voltage – current and power waveforms.

Module III: (8 hours)

Single phase and polyphase A. C. circuits:
A) Single phase AC Circuits: Study of series and parallel R-L, R-C, R-L-C circuits, concept of impedance and admittance for different combinations, wave form and relevant voltage current phasor diagrams. Concept of active, reactive, apparent, complex power and power factor, resonance in series and parallel RLC circuit. Q- factor.
B) Polyphase AC circuits: Concept of three phase supply and phase sequence. Balanced and unbalanced loads voltage current and power relations in three phase balanced star and delta loads and their phasor diagrams.

Module IV: (7 hours)

Electromagnetism:
A) Magnetic effect of electrical current cross and dot convention, right hand thumb rule and cork screw rule, nature of magnetic field of long straight conductor, concepts of solenoid and toroid. Concepts of m.m.f, flux, flux density, reluctance, permeability and field strength, their

units and relationship. Simple series and parallel magnetic circuits, comparison between electrical and magnetic circuits ,force on current carrying conductor placed in magnetic field, Fleming's left hand rule.
B) Faraday's law of electromagnetic induction, Fleming's right hand rule, statically and dynamically induced EMF's self and mutual inductance coefficient of coupling, energy stored in magnetic field.

Module V: (8 hours)

Introduction to electrical AC and DC Machines: Principles of operation and applications. Single phase transformer and electrostatics, Single phase transformers: Construction, principle of working, e.m.f equations, voltage and current ratios, losses, definition of regulation and efficiency, determination of these by direct loading method. Descriptive treatment of autotransformer. Electrostatics: electrostatic field, electric flux density, electric field strength, absolute permittivity, relative permittivity and capacitance, composite dielectric capacitors, capacitors in series and parallel, energy stored in capacitors, charging and discharging of capacitors and concept of time constant.

COURSE OUTCOMES:

At the end of this course, students will acquire the ability

- Apply fundamental concepts and circuit laws to solve simple DC electric circuits.
- To understand and analyse basic magnetic circuits.
- Apply the fundamental laws of electrical engineering to solve simple ac circuits in steady state
- To study the working principles of electrical machines.
- To introduce the components of low-voltage electrical installations.

TEXT BOOKS:

1. Edward Hugs – Electrical & Electronic Technology, Pearson Education.
2. Vincent Del Toro, Electrical Engineering Fundamentals, Pearson Education.
3. SK Bhattacharya, Basic Electrical & Electronics Engineering, Pearson.
4. M.S Sukhija and T.K Nagsarkar, Basic Electrical and Electronics Engineering, Oxford University press, 2012.

REFERENCE BOOKS:

1. Kothari and Nagrath, Theory & problems of Basic Electrical engineering. Tata McGraw Hill.
2. JB Gupta, A course in electrical Engg. SK. Kataria & Sons.
3. BL Theraja, Electrical Technology Vol. 1.

4. K Uma Rao, Basic Electrical Engineering, Pearson.

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2).

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern *(Maximum Marks-100).*

PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***

Two questions from each module with choice to answer one question.

GROUP E

EC19 101	BASICS OF ELECTRONICS ENGINEERING	2-1-0-2 (L-T-P-C)

COURSE OBJECTIVES:

- To get knowledge about types, specification and common values of passive components.
- To understand the working of diodes and transistors.
- To impart knowledge about basic electronic and digital systems
- To familiarize the working of amplifiers and oscillators.
- To give basic ideas about various communication systems (no analysis required in this subject).

SYLLABUS:

Module I: (7 hours)

Passive components: Resistors: concepts of fixed & variable resistors, Carbon composition type resistors, metal film resistors, wire wound resistors, construction, power rating & tolerance.
Capacitors: different types, construction of mica and ceramic capacitors (disc & tubular), colorcode, electrolytic (Teflon) capacitors.
Inductors: construction of single layer, multilayer and variable inductors, principle of low power transformers.
Electro mechanical components: relays and contactors.

Module II: (7 hours)

Semiconductor Physics: Basic concepts, Intrinsic and extrinsic semiconductors, PN Junction diode, Principle of operation, V-I characteristics, principle of working of Zener diode, Photo diode, LED and Solar cell. Bipolar Junction Transistors, PNP and NPN structures, Principle of operation, input and output characteristics of common emitter configuration (NPN only).

Module III: (9 hours)

Digital Systems: logic expressions, Boolean laws, duality, De-Morgan's law, logic functions and gates, adders and subtractors.
Block diagram description of a dc power supply, half wave and full wave (including bridge) rectifiers, capacitor filter, working of simple zener voltage regulator.

Module IV: (7 hours)

Amplifiers and Oscillators: principle of electronic amplifiers, circuit diagram and working of common emitter amplifier, working principles of oscillators, concepts of feedback, circuit diagram & working of RC phase shift oscillator, Functional block diagram of operational amplifier, ideal operational amplifier, inverting and non-inverting amplifier.

Module V: (9 hours)

Radio Communication: modulation, principle of AM & FM, block diagrams of transmitters, waveforms, band width, principle of AM & FM demodulation, comparison of AM & FM, principle of superheterodyne receiver, block diagram.

Mobile communication: basic principles of cellular communications, concepts of cells, frequency reuse.

Optical communication: block diagram of the optical communication system, principle of light transmission through fiber, advantages of optical communication systems.

COURSE OUTCOMES:

Students will be able to

1. List the basic electronic components such as passive and electromechanical components.
2. Illustrate the basic concept of different types of diodes and transistors.
3. Develop simple circuits using diodes and transistors.
4. Analyze simple circuits on operational amplifiers and digital gates.
5. Explain about the basic communication systems.

TEXT BOOKS:

1. Bell D. A., Electronic Devices and Circuits, Oxford University Press.
2. Tomasy W., Advanced Electronic Communication system, PHI Publishers.

REFERENCE BOOKS:

1. Boylested R. L. and Nashelsky L., Electronic Devices and Circuit Theory, Pearson Education.
2. Frenzel L. E., Principles of Electronic Communication Systems, McGraw Hill.
3. Kennedy G. and Davis B., Electronic Communication Systems, McGraw Hill.
4. Rajendra Prasad, Fundamentals of Electronic Engineering, Cengage Learning.

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2).

20% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern *(Maximum Marks-100).*

PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

CE19 101	BASICS OF CIVIL ENGINEERING	2-1-0-2 (L-T-P-C)

COURSE OBJECTIVES:

The main objective of the course fundamentals of civil engineering is:

- To satisfy the technical requirement of understanding various principles associated with civil Engineering.
- To make the students pursue the civil engineering work that is an integral part of an Engineering professional's life irrespective of the discipline.
- To give a broad perspective to the students to identify the oldest branch of engineering providing basic infrastructure for development.

SYLLABUS:

Module I: Scope of Civil Engineering. (8 hours)

Overview of Civil Engineering: Civil Engineering contributions to the welfare of society; specialized sub-disciplines in Civil Engineering: structural, construction, geotechnical, environmental, transportation and water resources engineering. Introduction to types of buildings as per NBC: selection of site for buildings, structural components of a residential building and their functions.

Module II: Building Planning. (8 hours)

Introduction to planning of residential buildings: site plan, orientation of a building, open space requirements, position of doors and windows, size of rooms.; Introduction to the various building area terms: computation of plinth area / built up area; floor area / carpet area- for a simple single storeyed building; setting out of a building.
Building drawing: plan, section and elevation of a single room building with RCC roof (sketching in the paper/notebook only is expected).

Module III: Introduction to Surveying. (8 hours)

Surveying: objects, classification, principles; Brief description of the following instruments: (i) chain and accessories (ii) Dumpy level (iii) Theodolite. Use of levelling instrument for determining reduced levels of various stations: simple problems on leveling, use of theodolite for measuring horizontal angles (only brief description is required). Modern tools of surveying and mapping: total station, global positioning system, remote sensing and geographic information system.

Module IV: Civil Engineering Materials & Building Construction. (8 hours)

Brief description of Engineering properties and applications of the construction materials: bricks, stones, sand, cement, concrete, steel, timber, modern materials (Study on laboratory tests & detailed manufacturing processes of materials are not required).
Cement mortar and cement concrete: properties and applications: reinforced cement

concrete fundamentals (only brief description is required).

Module V: Building Construction. (7 hours)

Foundations: types of foundations (sketches only), bearing capacity and settlement (definition only), functions of foundations, requirement of good foundations.

Stone and brick masonry construction: bonds used in general constructions, elevation and plan (one brick thick walls only).

Geometric, structural, and functional features of roads, bridges and dams.

COURSE OUTCOMES:

After completion of the course, the student will be able to

- Get an overview of surveying, building planning, water resources and transportation engineering.
- Understand the basics of civil engineering works that an engineer comes across in professional as well as personal life.
- Prepare the layouts of buildings and other infrastructures, obtain understanding of the basic elements of the transportation system, techniques for water conservation, and prepare layouts of different buildings.
- Understand the Surveying with advanced instruments like remote sensing, GIS and GPS.
- Understand the property, use, advantages & disadvantages of different materials used in construction.

TEXT BOOKS:

1. Surveying Vol. I, II by Dr. B.C. Punamia.
2. Building planning, designing and scheduling by Gurcharan Singh.
3. Building Construction.,Rangwala, S. C. and Dalal, K. B.,Charotar Publishing house.
4. Basic Civil Engineering., S.S Bhavikatti., New Age International Pvt.Ltd,Publishers.

REFERENCE BOOKS:

1. Surveying Vol. I, II by Dr. B.C. Punamia.
2. Surveying and Levelling Vol. I and II by T.P Kanetkar and S.V Kulkarni.
3. Surveying Theory and Practice (Seventh Edition) by James M. Anderson, Edward M. Mikhail.
4. Remote sensing and Image interpretation by T.M Lillesand, R.W Kiefer. And J.W Chipman 5th edition.
5. Building Science and Planning by S.V.Deodhar.

6. Principles of Town planning by Keeble Lewis.

7. Rangwala, S. C., Essentials of Civil Engineering, Charotar Publishing House.

8. Rangwala, S. C. and Dalal, K. B., Engineering Materials, Charotar Publishing house

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)

20% -Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern *(Maximum Marks-100).*

PART A*: Analytical/problem solving SHORT questions* ***10 x 5 marks= 50 marks***

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***

Two questions from each module with choice to answer one question.

ME19 101	BASICS OF MECHANICAL ENGINEERING	2-1-0-2 (L-T-P-C)

COURSE OBJECTIVES:

To expose the students to the thrust areas in Mechanical Engineering and their relevance by conveying the fundamental concepts.

SYLLABUS:

Module I: (8 hours)

Thermodynamic processes: isobaric, isochoric, isothermal, adiabatic and polytropic : work done and P-V diagrams; Laws of Thermodynamics, entropy, enthalpy; Ideal and real gas equations; Analysis of Carnot cycle, Otto cycle , Diesel cycle and Dual cycle; Efficiency of these cycles.

Module II: (8 hours)

Engines: major components and their functions (description only); Working principle of two stroke and four stroke I.C. Engines (diesel and petrol), comparison; MPFI & CRDI Engines. Power Transmission Devices: Belts and belt drives; chain drive, rope drive. Gears and gear trains: friction clutch (cone and single plate), brakes (types and applications only).

Module III: (8 hours)

Refrigeration: vapour compression and vapour absorption refrigeration systems, COP, Study of household refrigerator, energy efficiency rating; Refrigerants and their impact on environment.

Hydraulic turbines: Pelton, Francis and Kaplan turbines (applications only).

Pumps: introduction, classification, reciprocating and centrifugal (brief description and working only).

Module IV: (8 hours)

Sources of Energy: introduction, classification; Non-renewable energy: fossil fuels, solid, liquid and gaseous, calorific value; Renewable energy: hydroelectric, solar, wind, biomass, biogas, ocean thermal, tidal, wave and geothermal energy.

Power Plants: introduction, layout and working of diesel, nuclear, thermal and hydel power plants.

Module V: (7 hours)

Machine Tools: basic elements, Working principle and types of operations; lathe, drilling machine, shaper, planer, slotter, milling machine, grinding machine. Introduction to NC and CNC machines.
Engineering materials: classification, properties, alloys and their applications
Manufacturing process: introduction, elementary ideas of rolling and extrusion machining operations, turning, shaping, milling and drilling.

COURSE OUTCOMES:

After completion of the course, the student will be able to

- Analyse thermodynamic cycles and calculate its efficiency
- Illustrate the working and features of IC Engines and power transmission devices.
- Explain the basic principles of Refrigeration and describe the working of hydraulic machines
- Acquire knowledge about various energy sources and describe the layout and working of various Power Plants
- Describe the basic manufacturing, metal joining and machining processes

TEXT BOOKS

1. Balachandran, Basic Mechanical Engineering, Owl Books.
2. Benjamin J., Basic Mechanical Engineering, Pentex Books.
3. Clifford M., Simmons K. and Shipway P., An Introduction to Mechanical Engineering Part I – CRC Press.
4. Pravin Kumar, Basic Mechanical Engineering, pearson publications
5. Roy and Choudhary, Elements of Mechanical Engineering, Media Promoters & Publishers Pvt. Ltd. Mumbai.
6. Sawhney G. S., Fundamentals of Mechanical Engineering, PHI.

REFERENCE BOOKS:

1. Crouse, Automobile Engineering, Tata Mc-Graw-Hill, New Delhi.
2. Gill, Smith and Zuirys, Fundamentals of IC Engines, Oxford and IBH publishing company Pvt. Ltd. New Delhi. Crouse, Automobile Engineering, Tata Mc-Graw-Hill, New Delhi.
3. Nag P. K., Basic and Applied Thermodynamics, Tata McGraw-Hill.
4. V Ganeshan, Internal combustion engines, Mc-Graw-Hill.
5. R K Rajput, Thermal Engineering, Laxmi Publications, 2010

6. R K Bansal, A Text Book of Fluid mechanics and hydraulic machines, Laxmi Publications.
7. P C Sharma, Production Technology, S Chand publications

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2).

20% -Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern (*Maximum Marks-100).*

PART A*: Analytical/problem solving SHORT questions* ***10 x 5 marks= 50 marks***

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***

Two questions from each module with choice to answer one question.

GROUP F

ES19 100	ENVIRONMENTAL SCIENCE	2-0-1-0 (L-T-P-C)

COURSE OBJECTIVES:

- To understand the problems of pollution, deforestation, solid waste disposal, degradation of environment, loss of biodiversity and other environmental issues at local and global levels.
- To create awareness among the students to address these issues and conserve the environment in a better way.

SYLLABUS:

Module I: Resources (9 hours)

The multidisciplinary nature of environmental science: definition scope and importance, need for public awareness.

Natural resources: renewable and non-renewable resources; natural-associated problems.

Forest resources: use and over-exploitation; deforestation: case studies- timber extraction, mining, dams and their effects on forests and tribal people.

Water resources: use and over utilization of surface and ground water; floods, drought, and conflicts over water; dams (benefits and problems).

Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources- case studies.

Food resources: world food problems, changes caused by agriculture over grazing-, effects of modern agriculture fertilizer, pesticide problems, water logging, and salinity- case studies.

Energy resources: growing energy needs, renewable and non-renewable energy resources, use of alternate energy resources.

Land resources: land as a resource, land degradation, man-induced landslides (soil erosion and desertification).

Module II: Ecosystems (8 hours)

Concept of an ecosystem: structure and function of an ecosystem; producers, consumers and decomposers; Energy flow in the ecosystem: food chains and food webs, ecological pyramids, ecological succession.

Different Ecosystems: introduction, types, characteristics, features, structure; Function of the ecosystems: forest ecosystem, grassland ecosystem, desert ecosystem, aquatic ecosystem (ponds, streams, lakes, rivers, ocean, and estuaries).

Module III: Biodiversity (8 hours)

Introduction: definition, genetic, species and ecosystem diversity; Biogeographical classification of India.

Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values; Biodiversity at global, national, and local level; India as mega-diversity nation; Hotspot of biodiversity.

Threats to biodiversity: habitat loss, poaching of wildlife, and man-wildlife conflicts; Endangered and endemic species of India; Conservation of biodiversity (In-situ and Ex- situ conservation of biodiversity).

Module IV: Environmental Pollution. (7 hours)

Definition, causes, effects and control measures of air pollution; Water pollution; Soil pollution; Marine pollution; Noise pollution; Thermal pollution; Nuclear hazards.

Solid waste management: causes, effects and control measures of urban and industrial wastes.

Waste management: role of an individual in prevention of pollution, pollution case studies.

Disaster management: floods, earth-quake, cyclone and landslides.

Module V: Environment and Sustainable Development. (7 hours)

Sustainable use of natural resources; Conversion of renewable energy resources into other forms; Problems related to energy and energy auditing- case studies.

Water conservation: rain water harvesting and watershed management- case studies.

Climate change: global warming, acid rain and ozone layer depletion- case studies.

Nuclear accidents and holocaust- case studies.

Waste land reclamation: consumerism and waste products: reduce, reuse and recycle concept of products; Value education.

COURSE OUTCOMES:

After completion of the course, the student will be able to

- Develop concepts and methods from surroundings and their application in environmental problem solving.
- Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.
- Realize the importance of ecosystem and biodiversity for maintaining ecological balance.
- Identify and value the effect of the pollutants on the environment: atmosphere, water and soil.
- Analyse an industrial activity and identify the environmental problems

TEXT BOOKS:

1. Daniels and Krishnaswamy, Environmental studies, Wiley India Pvt Ltd, 2009.
2. Raman Sivakumar, Introduction to environmental science and engineering, 2nd edn, . Tata McGraw Hill, 2010.
3. AninditaBasak, Environmental Studies, Pearson Education, 2009.
4. Suresh K.D, Environmental Engineering and Management, Katson Books, 2007.
5. Benny Joseph, Environmental studies, 2nd edn, McGraw Hill, 2009.

REFERENCE BOOKS:

1. Raghavan Nambiar, K Text book of Environmental Studies, Scitech Publishers(India) Pvt. Ltd.
2. S.P Misra, S.N Pandey, Essential Environmental studies, Ane books, Pvt Ltd, 2009.
3. P N Palanisamy, P Manikandan, A Geetha, Manjula Rani, Environmental Science, Pearson Education, 2012.
4. D.L. Manjunath, Environmental Studies, Pearson Education, 2011.

Internal Continuous Assessment *(Maximum Marks-100).*

70% - Tests (minimum 2).

20% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

DE19 200	CONCEPT BASED ENGINEERING	2-0-1-0 (L-T-P-C)

COURSE OBJECTIVES:

- To excite the student on creative design and its significance.
- To make students aware of the processes involved in the design.
- To make the student understand the interesting interaction of various segments of humanities, science and engineering in the evolution of a design.
- To get an exposure as to how to engineer a design.

SYLLABUS:

Module I: (8 hours)

Introduction: example of different kinds of designs and designers, design problems; Definition of design; engineering design and research: importance, role of science, engineering and technology in design, design constraints, design functions, design means and design form, functional and strength designs. design form, function and strength; initiation of creative designs; initiating the thinking process for designing a product of daily use. need identification; problem statement; market survey- customer requirements; design attributes and objectives; ideation; brainstorming approaches; arriving at solutions; Closing on to the Design needs.

Module II: (8 hours)

Product life cycle: morphology of design, introduction to system design process, stage models, design process- different stages in design and their significance; define problem, concept generation and evaluation, detailed design process, defining the design space; analogies, quality function deployment: meeting what the customer wants; evaluation and choosing of a design.

Module III: (8 hours)

Design for X; covering quality, reliability, safety, manufacturing/construction, assembly, maintenance, logistics, handling; disassembly; recycling; re-engineering etc. design communication; realization of the concept into a configuration, drawing and model. design for function and strength. design detailing- material selection, design visualization- solid modeling; detailed 2D drawings.

Module IV: (8 hours)

Prototyping- rapid prototyping; testing and evaluation of design; design modifications; freezing the design; cost analysis. engineering the design from prototype to product. planning; scheduling; supply chains; inventory; handling; manufacturing/construction operations; storage; packaging; shipping; marketing; feed-back on design. list out the standards organizations. Prepare a list of standard items used in any engineering specialization.

Module V: *(7 hours)*

Product centred and user centred design. product centred attributes and user centred attributes. bringing the two closer. example: smart phone. aesthetics and ergonomics. value engineering, concurrent engineering, reverse engineering in design; culture based design; architectural designs; motifs and cultural background; tradition and design; design as a marketing tool; intellectual property rights, trade secret; patent; copy-right; trademarks; product liability.

COURSE OUTCOMES:

The student will be able to:

- Initiate process and component elements in good and optimal design.
- Design process stages and evaluation of the different steps involved.
- Visualize models by combining all interdisciplinary fields.
- Testing and evaluating the models while considering non engineering attributes.
- Improve product quality by design survey and obtaining the patent for the product.

TEXT BOOKS/REFERENCE BOOKS:

1. Pahl G, and Beitz, W. Engineering Design: A Systematic Approach, 3rd Ed., Springer, 2007.
2. Cross N. Engineering Design Methods: Strategies for Product Design (4th edition), John Wiley and Sons Ltd., Chichester, 2008.
3. Roozenburg N.F.M., Eekels J. Product Design, Fundamentals and Methods, Wiley, Chichester, 1995.
4. James A Senn, Analysis and Design of Information system, McGraw Hill 2003.

Internal Continuous Assessment *(Maximum Marks-100).*

70% - Tests (minimum 2).

20% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10%- Attendance and Regularity in the class.

GROUP G

CH19 100 (P)	ENGINEERING CHEMISTRY LAB	0-0-2-1 (L-T-P-C)

COURSE OBJECTIVES:

- To equip the students with the working knowledge of chemical principles, nature and transformation of materials and their applications.
- To develop analytical capabilities of students so that they can understand the role of chemistry in the field of Engineering and Environmental Sciences.

SYLLABUS:

List of Experiments

(Minimum 9 experiments out of 10)

1. Preparation of urea–formaldehyde and phenol–formaldehyde resin.
2. Estimation of total hardness in a given sample of water using EDTA.
3. Estimation of chloride ions in domestic water.
4. Determination of dissolved oxygen present in a given sample of water.
5. Determination of available chlorine in a sample of bleaching powder.
6. Estimation of copper in a given sample of brass.
7. Estimation of iron in a sample of iron ore.
8. Estimation of iron in Mohr's salt using standard $K_2Cr_2O_7$.
9. Determination of flash point and fire point of oil.
10. Preparation of buffers and standardization of pH meter.

COURSE OUTCOME:

The student will be able to

- Apply and demonstrate the theoretical concepts of Engineering Chemistry.
- Synthesize of polymers like Bakelite and UF resins
- Estimate the amount of hardness, chloride ion and dissolved oxygen in water
- Measure the available chlorine present in bleaching powder
- Determine the amount of metals like iron or copper present in their ores

TEXT BOOK:

1. Dr. Sunita Rattan, Experiments in Applied Chemistry, S.K. Kataria and Sons, New Delhi.

REFERENCE BOOK:

1. Vogel, A Text Book of Quantitative Analysis, ELBS, London.

Internal Continuous Assessment *(Maximum Marks-100).*

60% - Laboratory practical, record and Viva voce.

30% - Tests.

10% - Regularity in the lab.

PH19 100 (P)	ENGINEERING PHYSICS LAB	0-0-2-1 (L-T-P-C)

COURSE OBJECTIVES:

This course is designed

- To impart practical knowledge about some of the phenomena they have studied in the Engineering Physics course.
- To develop the experimental skills of the students.

SYLLABUS:

List of experiments

(Minimum 10 experiments out of 20)

1. Characteristics of Zener diode.
2. Determination of band gap energy in a semiconductor.
3. Voltage regulation using Zener diodes.
4. Static characteristics of a transistor in common emitter configuration.
5. Characteristics of photodiodes.
6. Characteristics of a LED and wavelength of emitted radiation.
7. Draw the aerial and illumination characteristics of a solar cell.
8. Draw the power load and current-voltage characteristics of a solar cell.
9. Wavelength of mercury spectral lines using diffraction grating and spectrometer.
10. Dispersive power using diffraction grating and spectrometer.
11. Diameter of a thin wire or thickness of a thin wire by Air-wedge method.
12. Wavelength of sodium light by Newton's Ring method.
13. Refractive index of given liquid by Newton's Ring method.
14. Specific rotation of cane sugar solution using polarimeter.
15. Wavelength of laser using Grating. Standardise the Grating using sodium light.
16. Resolving power using diffraction grating and spectrometer.
17. To determine the angular divergence of a laser beam.
18. To measure the numerical aperture of an optical fibre.
19. Melde’s string apparatus. Measurement of frequency in the transverse and longitudinal mode.

20. Wavelength and velocity of ultrasonic waves using ultrasonic diffractometer.

COURSE OUTCOME

- Demonstrate the understanding of the fundamental concepts in physics by setting up laboratory equipment safely and efficiently and planning and carrying out experimental procedures.
- Demonstrate the ability to apply knowledge/skills to real world settings by identifying possible sources of error and implementing techniques that enhance precision.
- Demonstrate critical thinking ability through analyzing and interpreting experimental data.
- Demonstrate effective communication skills by reporting verbally and in written language the experimental data, results, and assessment of reliability.
- Demonstrate teamwork skills by working in groups on a laboratory experiment.
- Demonstrate ability to innovate and be creative in a laboratory experiment.

REFERENCE BOOKS:

1. Avadhanulu M. N., Dani A. A. and Pokley P. M., Experiments in Engineering Physics, S. Chand & Co.
2. Gupta S. K., Engineering Physics Practicals, Krishna Prakashan Pvt Ltd.
3. Koser A. A., Practical Engineering Physics, Nakoda Publishers and Printers India Ltd.
4. Rao, B. S. and Krishna, K. V., Engineering Physics Practicals, Laxmi Publications Sasikumar, P. R. Practical Physics, PHI.

Internal Continuous Assessment *(Maximum Marks-100).*

60% - Laboratory practical, record and Viva voce.

30% - Tests.

10% - Regularity in the lab.

GROUP H

EE19 100 (P)	ELECTRICAL ENGINEERING WORKSHOP	0-0-2-1 (L-T-P-C)

COURSE OBJECTIVES:

- To impart a basic knowledge of electrical circuits, machines and power systems.

SYLLABUS:

List of experiments

(Minimum 10 experiments out of 10)

1. Familiarization of various types of service mains:wiring installations, accessories and household electrical appliances.
2. Methods of earthing: measurement of earth resistance, testing of electrical installations, precautions against and cure from electric shock.
3. Practice of making different joints: britannia, married and T-joints on copper/aluminium.
4. Wiring practice of a circuit to control two lamps by two SPST switches.
5. Wiring practice of a circuit to control one lamp by two SPDT switches.
6. Wiring practice of a circuit to control one fluorescent lamp and one three pin plug socket.
7. Wiring practice of a main switch board consisting of ICDP switch, DB, MCB and ELCB.
8. Familiarization of various parts of electrical motors and wiring of three phase and single phase motor with starter.
9. Familiarization of energy meter and measurement of energy consumption by a single phase load.
10. Familiarization of various electrical and electronic components such as transformers, resistors, AF and RF chokes, capacitors, transistors, diodes, IC‘s and PCB.

COURSE OUTCOMES:

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

- Familiarize with the important electrical components and their working.
- Make use of various testing instruments and commonly used tools.
- Get an idea of electrical protective devices.
- Practice simple electrical wirings and installations.
- Familiarize with the methods of earthing.

Internal Continuous Assessment *(Maximum Marks-100)*

60% - Laboratory practical, record and Viva voce

30% - Tests

10% - Regularity in the lab

EC19 100 (P)	ELECTRONICS ENGINEERING WORKSHOP	0-0-2-1 (L-T-P-C)

COURSE OBJECTIVES:

The objective of this course is to familiarize the students about electronic components, measuring instruments, bread board assembling, soldering tools and components etc.

SYLLABUS:

List of Exercises / Experiments

(Minimum 10 experiments out of 11)

1. Familiarization/identification of electronic components.
2. Draw electronic circuit diagrams using IEEE standard symbols.
3. Familiarization/application of instruments and equipment: multimeter, power supply, CRO, function generator.
4. Assembling electronic circuit on general purpose bread board: Fixed voltage power supply with transformer, rectifier diode, capacitor filter, zener regulator.
5. Bread board assembling: Common emitter amplifier.
6. Introduction to soldering practice: study of soldering components, soldiers, tools, heat sink.
7. PCB assembly and testing of full wave rectifier circuit diagram.
8. PCB assembly and testing of inverting amplifier circuits.
9. Familiarization of setting up a PA system with different microphones, loud speakers, mixer etc.
10. Assembling and dismantling desktop computer/laptop/mobile phones.
11. Introduction to robotics: familiarization of components (motor, sensors, battery etc.) used in robotics and assembling of simple robotic configurations.

COURSE OUTCOMES:

The student will be able to

- Identify and test various active and passive components.
- Make use of various testing instruments and commonly used tools.
- Build electronic circuits on breadboards.
- Solder electronic circuits on PCB.
- Identify various subsystems of electronic systems like PA Systems and desktop computers.

Internal Continuous Assessment *(Maximum Marks-100).*

60% - Laboratory practical, record and Viva voce.

30% - Tests.

10% - Regularity in the lab

CE19 100 (P)	CIVIL ENGINEERING WORKSHOP	0-0-2-1 (L-T-P-C)

COURSE OBJECTIVES:

- To provide experience on plotting, measuring/determining horizontal distances, level differences between stations and horizontal angles.
- To provide experience on setting out for small buildings, masonry construction and model making.

SYLLABUS:

List of Experiments

1. Setting out of a building: the student should set out a building (single room only) as per the given building plan using tape only.
2. Setting out of a building: the student should set out a building (single room only) as per the given building plan using tape and cross staff.
3. Chain surveying : study of chain and accessories, plotting one side of a building/ five or six points in the field using chain and cross-staff.
4. Horizontal measurements: study of compass, plotting one side of a building/five or six points in the field using compass; Find the area of an irregular polygon set out on the field.
5. Levelling: study of levelling instruments, determination of reduced levels of five or six points in the field.
6. Theodolite: study of theodolite, measuring horizontal angles.
7. Theodolite: study of theodolite, measuring vertical angles.
8. Brick Masonry.
9. Plumbing: demonstration of plumbing fixtures, exercise in joints
10. Model making of simple solids.

COURSE OUTCOMES:

After the completion of the course, student will be able

- Understand the procedures for construction of several structures.
- Interpret survey data and compute areas and volumes.
- Familiarize with different components, equipment and technical standards.
- Get an overview of surveying, building planning, plumbing, leveling.
- Understand the basics of civil engineering works.

Internal Continuous Assessment *(Maximum Marks-100).*

60% - Laboratory practical, record and Viva voce.

30% - Tests.

10% - Regularity in the lab.

ME19 100 (P)	MECHANICAL ENGINEERING WORKSHOP	0-0-2-1 (L-T-P-C)

COURSE OBJECTIVES:

- To inculcate engineering aptitude, confidence and experience towards technical skills.
- To train the students mentally and physically for industries.
- To impart knowledge and technical skills on basic manufacturing methods.

SYLLABUS:

List of Experiments

1. Carpentry: study of tools and joints, planning, chiseling, marking and sawing practice, different joints, use of power tools.
2. Fitting: study of tools, chipping, filing, cutting, drilling, tapping, male and female joints and stepped joints.
3. Smithy: study of tools, forging of square prism, hexagonal bolt.
4. Foundry: study of tools, sand preparation, moulding practice.
5. Sheet Metal work: study of tools, selection of different gauge sheets, types of joints, trays and containers.
6. Welding**:** study of tools, different types of joints, practice.

COURSE OUTCOMES:

After completion of the course, the student will be able to

- Obtain knowledge about various tools and operations used in carpentry.
- Perform various fitting operations and basic operations done in a smithy.
- Obtain sound knowledge in sheet metal work.
- Obtain knowledge of welding and metal properties.
- Obtain knowledge about various tools and operations used in Fitting.

Internal Continuous Assessment *(Maximum Marks-100)*

60% - Laboratory practical, record and Viva voce.
30% - Tests.
10% - Regularity in the lab.

GROUP I

CM19 100	COMMUNICATIVE ENGLISH	2-0-0-0 (L-T-P-C)

COURSE OBJECTIVES:

- To adapt the employability and career requirements of the industry.
- To adapt students with ease to the Industry environment by equipping them with communication skills.
- To focus on overall capability in communicating ideas in an effective manner, apart from gaining academic competence.

SYLLABUS:

Module I: (4 hours)

Communication: definition, communication process; types of communication: formal and informal. Relevance of body language; verbal and non-verbal effective communication; communication breakdown: how to overcome communication barriers.

Module II: (7 hours)

Listening skills: listening and typing, focused listening, listening and sequencing of sentences, fill in the blanks, listening and answering questions. Reading comprehension: questions and answers, close exercises; Vocabulary building tasks: vocabulary trees, learning words through situations, word formation, roots, prefixes and suffixes, derivatives, synonyms and antonyms, phrasal verbs, homonyms.

Module III: (8 hours)

Parts of speech with special focuses on nouns & pronouns, verbs, adverbs, adjectives. subject- verb agreement. Speaking skills: linguistic and phonetics; vowels and Consonants; 44 phonetic symbols, Diphthongs, syllables, phonemes; stress and rhythm in connected speech: intonations and voice modulations, weak forms and strong forms, production of speech sounds in connected speech, shifting the stress for emphasis, relevance of correct pronunciation, face to face conversation of telephonic conversation.

Module IV: (3 hours)

Writing skills: C.V, effective resume, report, memo, business letters, structuring a report and e-mail communication.

Module V: (4 hours)

Developing self-esteem: presentation skills, facing the interview board, group discussions and debating skills; soft skills and time management; Psychometrics and stress management;

emotional quotient.

COURSE OUTCOME:

The student will able to:

- Not only understand the process and nature of communication but also recognize the barriers to effective communication and learn to eradicate them.
- Attain and enhance competence in the four modes of learning: writing, speaking, reading and listening, and are able to recognize the meaning of new words based on contextual comprehension.
- Heighten their awareness of correct usage of English grammar in writing and sounds in speaking.
- To write official correspondences i.e., is reports, memos, letters, and e-mails and also prepare impressive curriculum vitae and resumes.
- Improve their self-esteem and also captivate to give effective presentations in a professional and facing interview boards confidently.

REFERENCE BOOKS*:*

1. Meenakshi Raman and Sangeeta Sharma., Technical Communication- Principles and Practice, Oxford University press.
2. R C Bhatia, Business Communication, Ane Books Pvt. Ltd, 2009.
3. Sunita Mishra and C Muralikrishna, Communication Skills for Engineers, Pearson Education.
4. Jovan van Emden and Lucinda Becker, Effective Communication for Arts and Humanities Students, Palgrave macmillam, 2009.
5. Sanjay Kumar and Pushpalata , Communication skills, Oxford University Press, 2011.
6. Practical English Usage. Michael Swan. OUP. 1995.
7. Remedial English Grammar. F.T. Wood. Macmillan, 2007.
8. On Writing Well. William Zinsser. Harper Resource Book. 2001.
9. Study Writing. Liz Hamp- Lyons and Ben Heasly. Cambridge University Press. 2006.
10. Communication Skills. Sanjay Kumar and PushpLata. Oxford.
11. T M Farhathullah, Communication Skills for Technical Students, Orient Longman, Hyderabad.

EVALUATION SCHEME:

Internal Continuous Assessment *(Maximum Marks-100).*

70% - Tests (minimum 2).

20% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10%- Attendance and Regularity in the class.

LL19 200	LANGUAGE LAB	0-0-2-0 (L-T-P-C)

COURSE OBJECTIVES:

- To enhance the linguistic skill of the students, keeping in view of the necessity of imparting employability skills of engineering graduates
- To Provide with a software platform which has functions like Listen- Respond-Intercommunicate-Monitor- Teacher call etc.
- To focus on the students overall ability in using English as a tool for communication.
- To overcome the inhibition factor while using English and equip them to adapt themselves to the industry environment with ease and confidence, bringing about a sort of transformation in each student.

LAB SESSIONS

1. Sessions on introduction to Linguistics and Phonetics: speech sounds and phonetic symbols; Syllables and phonemes.
2. Training to develop sharp listening skills: focused listening with emotional content; Relevance of correct pronunciation.
3. Sessions beginning with two minutes Oral Presentation on topics of their choice;
   Role plays: students take on roles and engage in dialogues/ conversations.
4. The art of effective communication: effective presentation skills; presentation tools, voice modulations, word accent, rhythm and intonation; audience analysis.
5. Vocabulary building tasks: fun games in English.
6. Relevance of body language, how to face an interview board; mock interviews; group discussions with special focus on a candidate's etiquette; debates and the art of exhibiting interpersonal skills; public speaking.
7. Soft-skills; Emotional quotient; Training sessions; Stress Management.

COURSE OUTCOMES:

- It brings about a consistent accent and articulacy in the pronunciation through the familiarity of phonetics.
- Advance the capability to listening English conversations
- Enhance their verbal communication skills through free speeches, role plays, activities, and interactions.
- Better understanding of nuances of English language through audio- visual experience and speaking skills with clarity and confidence which in turn enhances their employability skills.

It brings about a consistent accent and intelligibility in the pronunciation of English by providing an opportunity for practice in speaking for all the students.

- Capable of identifying the meaning of novel words based on contextual comprehension.
- Equip the students to face the interview board with confidence, making them aware of the nuisances and methodology involved in this area; help them to actively participate in debates and group discussions and face the interview confidently.
- Prepared for creating effective presentations in front of different clusters.

SUGGESTED SOFTWARE:

1. Cambridge Advanced Learners' English Dictionary with CD.
2. The Rosetta Stone English Library.
3. Clarity Pronunciation Power.
4. Mastering English in Vocabulary, Grammar, Spellings, Composition.
5. Dorling Kindersley series of Grammar, Punctuation, Composition etc.
6. Language in Use, Foundation Books Pvt Ltd with CD.
7. Learning to Speak English - 4 CDs.
8. Microsoft Encarta with CD.
9. Murphy's English Grammar, Cambridge with CD.

REFERENCE BOOKS:

1. Spoken English (CIEFL) in 3 volumes with 6 cassettes, OUP.
2. English Pronouncing Dictionary Daniel Jones Current Edition with CD.
3. Spoken English- R. K. Bansal and J. B. Harrison, Orient Longman 2006 Edn.
4. A Practical course in English Pronunciation, (with two Audio cassettes) by J. Sethi, Kamlesh Sadanand & D.V. Jindal, Prentice-Hall of India Pvt. Ltd., New Delhi.

EVALUATION SCHEME:

Internal Continuous Assessment *(Maximum Marks-100).*

70% - Tests (minimum 2).

20% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

SEMESTER - 3

EN19 301	ENGINEERING MATHEMATICS - III	3-1-0-4

PRE-REQUISITES: Calculus and Linear Algebra

COURSE OBJECTIVES:

- To provide a quick overview of the concepts and results in complex analysis that may be useful in engineering.
- To introduce the concepts of linear algebra and Fourier transform which are wealths of ideas and results with wide area of application

SYLLABUS:

Module I: Linear Algebra – (Proofs not required) (11hours)

Vector spaces – Definition, Examples – Subspaces – Linear Span – Linear Independence – Linear Dependence – Basis – Dimension– Orthogonal and Orthonormal Sets – Orthogonal Basis – Orthonormal Basis – Gram-Schmidt orthogonalisation process – Inner product spaces – Definition – Examples– Inequalities ; Schwartz, Triangle (No proof).

Module II: Fourier Transforms (11 hours)

Fourier Integral theorem (Proof not required) – Fourier Sine and Cosine integral representations – Fourier transforms – transforms of some elementary functions – Elementary properties of Fourier transforms – Convolution theorem (No proof) – Fourier Sine and Cosine transforms – transforms of some elementary functions – Properties of Fourier Sine and Cosine transforms.

Module III: Laplace Transforms (10 hours)

Laplace transform-Elementary properties-Inverse laplace transform-convolution theorem- Solution of ordinary differential Equations using Laplace transform.

Module IV: Series Solutions of Differential Equations (10 hours)

Power series method for solving ordinary differential equations – Frobenius method for solving ordinary differential equations – Bessel‘s equation – Bessel functions – Relation between Bessel functions.

Module V: Partial Differential Equations (10 hours)

Introduction – Solutions of equations of the form F(p,q) =0 ; F(x,p,q) =0 ; F(z,p,q) =0 ; F1(x,p) = F2(y,q) ; Clairaut‘s form, z = px + qy + F(p,q) ; Legrange‘s form, Pp + Qq =R-Classification of Linear PDE‘s – Derivation of one dimensional wave equation and one dimensional heat equation – Solution of these equation by the method of separation of variables.

COURSE OUTCOMES:

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

- Develop the essential tool of linear algebra in a comprehensive manner.
- Use tools for Fourier Transforms.
- Use tools for Laplace transforms and apply it in the solution of differential equations.
- Acquire the knowledge of power series for learning advanced Engineering Mathematics.
- Use mathematical tools for the solution of Partial differential equations that models physical processes.

TEXT BOOKS:

1. Bernaed Kolman, David R Hill, Introductory Linear Algebra, An Applied First Course, Pearson Education.
2. Erwin Kreysig, Advanced Engineering Mathematics ,9thEdition, John Wiley & Sons,2006.
3. P.Ramesh Babu, R. Anandanatarajan ,Signals and Systems, Scitech Publications(India) Pvt.ltd, 4th Edition.
4. B.S.Grewal, Higher Engineering Mathematics ,Khanna Publishers,35th Edition.

REFERENCE BOOKS:

1. N.P.Bali, ManishGoyal, TextBook of Engineering Mathematics,LaxmiPublications, Reprint 2010.
2. Wylie C.R and L.C. Barrett, Advanced Engineering Mathematics, McGraw Hill.
3. S.J. Farlow, Partial Differential Equations for Scientists and Engineers, Dover Publications,1993.

INTERNAL CONTINUOUS ASSESSMENT (**Maximum Marks-50)**

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class

UNIVERSITY EXAMINATION PATTERN **(Maximum Marks-100)**

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 **marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question.

EE19 302	ELECTRICAL CIRCUIT ANALYSIS	3-1-0-4

PRE-REQUISITES: Concept Of Electrical Engineering and Basic knowledge in Calculus and Linear Algebra.

COURSE OBJECTIVES:

- To expose the students to the basic concepts of electric circuits and their analysis in time and frequency domain
- Familiarization of various network topologies related to two- phase and three- phase systems.
- Understanding the various methods for analysis of electrical networks.
- To gain the capability to synthesize a circuit for a particular purpose.
- To learn about various techniques available to solve various types of circuits and networks.

SYLLABUS:

Module I: (9 hours)

DC excitation: Network elements- lumped parameters, active and passive elements – Dependent and independent sources- source transformation- super mesh and super node.

Steady state ac analysis: Complex form - polar form, phasor representation of series circuits (current reference) - parallel circuits (voltage reference) - series parallel- parallel series combinations, series resonance and parallel resonance –band width, quality factor.

Module II: (11 hours)

Transformed circuits: Analysis of transformed circuits- solution of transformed circuits including mutually coupled circuits.

Sinusoidal steady state in 3- phase circuits: 3 phase 3 wire and 3 phase 4 wire Y and Δ connected source and load.

Analysis of unbalanced three phase circuits: Y-Y 4 wire circuit neutral current- neutral impedance- Y-Y system with neutral isolated (3 wire)- neutral shift - Δ-Y -Δ-Δ systems- circulating currents in unbalanced Δ connected sources – 3 phase circuits with balanced sources and unbalanced loads.

Module III: (9 hours)

Measurement of power and power factor: one wattmeter, two wattmeter and three wattmeter methods.

Symmetrical components: Zero sequence, positive sequence and negative sequence components active power in sequence components.

Laplace Transform: gate function – shifting theorem initial and final value theorem- Laplace transform of periodic signals- sinusoidal- square- inverse Laplace transform.

Module IV: **(11 hours)**

DC Transients: Initial conditions in network- steady state and transient responses of two element circuits consisting of RL,RC and LC circuits(both classic and Laplace Transform methods) for step input- transient and steady state responses of RLC circuits with step input(Laplace transform method only).

AC transients: Transient and steady state responses of R,L,C circuits for sinusoidal inputs using Laplace transform approach.

Module V: **(12 hours)**

Network functions: Driving point immittance & transfer immittance functions- poles & zeros- pole-zero plots- time domain response from pole-zero plots.

Two port networks: Z, Y, h parameters- relationship between parameter sets- conditions for symmetry and reciprocity- interconnections of two port networks- open circuit and short circuit impedances- input and output impedances- image parameters- attenuation and phase constants characteristic impedance- T-π transformation.

COURSE OUTCOMES:

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

- Understand the concept of two phase and three phase system
- Analyse measurement of power and power factor
- Ability to analyse DC and AC transients
- Ability to apply Laplace Transform to find transient response
- Ability to synthesize networks

TEXT BOOKS

1. Valkenberg, Network Analysis, Prentice-Hall of India
2. K.S. Suresh Kumar, Electric Circuits & Networks, Pearson Education
3. Edminister, Electric Circuits – Schaum’s Outline Series, McGraw-Hill.

4. William H Hayt Jack E Kemmerly, Engineering Circuit Analysis, TMH

REFERENCE BOOKS

1. Robert Boylestad, Introductory Circuit Analysis, Pearson Education
2. S.D. Rajankar, Kaduskar & Shedge, Network Synthesis & Filter Design, Wiley
3. B.C. Kuo, Network Analysis & Synthesis, Wiley-India
4. Richard C. Dorf& J.A. Svoboda, Introduction to Electric Circuits, Wiley-India
5. Huelsman L.P., Basic Circuit Theory, Prentice Hall of India
6. Roy Choudhury, Networks & Systems, New Age International publishers
7. Gopal G Bhise, Engineering Network Analysis and Filter Design, Umesh Publications
8. Nilsson & Riedel , Electric Circuits, Pearson Education
9. Lawrence Heulsman, Basic Circuit Theory, Prentice Hall of India

INTERNAL CONTINUOUS ASSESSMENT (Maximum Marks-50)

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, Group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

UNIVERSITY EXAMINATION PATTERN (Maximum Total Marks: 100)

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question.

EE19 303	ELECTRONIC DEVICES AND CIRCUITS	3-1-0-4

PRE-REQUISITES: Basics of Electronics Engineering

COURSE OBJECTIVES:

- To impart an in-depth knowledge in electronic semiconductor devices & circuits giving importance to the various aspects of design & analysis.
- To provide knowledge about different types amplifier & oscillator circuits
- To design amplifier and oscillator design.
- To study linear and non linear applications of Op-Amp.
- To study and design filter circuits.

SYLLABUS:

Module I: **(12 hours)**

BJT: Operating point of a BJT – Factors affecting stability of Q point- DC biasing – Biasing circuits: fixed bias, collector to base bias, voltage division bias and self bias.- bias stability - (Derivation of stability factors for Voltage Divider Biasing only)- thermal runaway.
AC Concepts – role of capacitors in amplifiers – common emitter AC equivalent circuit - amplifier gain and impedance calculations- h parameter model of a BJT - common emitter and emitter follower analysis and comparison using hybrid equivalent circuit –cascaded amplifiers, frequency response of amplifiers (basic concepts only).

Module II: **(8 hours)**

FET: Construction and characteristics of JFET and MOSFET, types of JFET and MOSFET, merits and demerits of JFET, Comparison of JFET and MOSFET, Comparison of N- channel FETs with P-channel FETs. DC load line and Bias point, biasing circuits of a JFET and MOSFET, JFET and MOSFET small signal model - CS and CD amplifiers-FET as switch and voltage controlled resistance. Low and High Frequency response of FET amplifiers.

Module III: **(11 hours)**

Power Amplifiers: Considerations in cascading transistor amplifiers- class B and class AB – power amplifiers using BJT

Feedback: - Concepts – negative and positive feedback – loop gain- advantages of negative feedback -feedback connection Types - practical feedback circuits

Oscillators: Basics - stability and positive feedback- Barkhausen's criterion – phase shift oscillators- Wein bridge oscillators – crystal oscillators.

Module IV: **(11 hours)**

Operational amplifier - Ideal Op-Amp properties - properties of practical Op-Amps - Analysis of Op-Amp circuits using ideal Op-Amp model – open loop and closed loop configuration – concept of virtual short and its relation to negative feedback.

Linear Op-Amp Circuits: Non-inverting amplifier -voltage follower - inverting amplifier - summing amplifier - subtracting circuits - voltage to current converter for floating and grounded loads - Op-Amp integrator - Op-Amp differentiator.

Signal Generators: Square, triangle and ramp generator circuits using Op-Amps, voltage controlled oscillators.

Comparator Circuits: Zero crossing detector- regenerative comparator circuits.

MODULE V: **(10 hours)**

Active filters – different types and their characteristics- frequency response of different types of filters- order and cutoff frequency -Butterworth low pass filter – first order and second order filter design - Butterworth high pass filters - second order wide band and narrow band filters.

Timer IC 555: Functional diagram- astable and monostable modes

Phase locked loops: Principles – building blocks of PLL-Lock and capture ranges – capture process - frequency multiplication using PLL.

COURSE OUTCOMES:

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

- Design biasing scheme for transistor circuits.
- Model BJT and FET amplifier circuits and develop the ability to understand the design and working of BJT / FET amplifiers.
- Choose a power amplifier with appropriate specifications for electronic circuit applications and design & analysis oscillator circuits.
- Design & implement analog circuits using OPAMPs.
- Design and understand the working of active filters and 555 timer.

TEXT BOOKS:

1. Allen Mottershead, Electronic Devices and Circuits: An Introduction, Prentice Hall of India.

2. V. Boylestad and Nashelsky, Electronic Devices and Circuits, Pearson Education
3. Ramakant A Gayakwad, Op- Amps and Linear Integrated Circuits, Prentice Hall of India

REFERENCE BOOKS

1. Schilling and Belove, Electronic Circuits, McGraw Hill
2. Theodore F. Bogart Jr., Electronic Devices and Circuits,
3. Coughlin and Driscoll, Operational amplifiers and Linear Integrated Circuits,
4. K. R. Botkar, Integrated Circuits, Khanna Publishers
5. Somanathan Nair, Linear Integrated Circuits – Analysis, Design & Application, Wiley-India

INTERNAL CONTINUOUS ASSESSMENT **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving,
Group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

UNIVERSITY EXAMINATION PATTERN **(Maximum Total Marks: 100)**

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question.

EE19 304	ELECTRICAL MEASUREMENTS & INSTRUMENTATION SYSTEMS	3-1-0-3

PRE-REQUISITES: Concept of Electrical Engineering

COURSE OBJECTIVES:

- Understanding the basic working principle of electrical measuring instruments
- To understand about range extension of meters
- To design and calibrate an electrical measuring instruments
- Understanding about various bridges
- Develop an instrumentation system for a particular application

SYLLABUS:

Module I: **(11 hours)**

Measuring Instruments: Classification, Absolute and secondary instruments.
Classification of errors - Errors in indicating instruments and compensation, Accuracy, precision, sensitivity, resolution, loading effect.

Indicating Instruments: Principle- Types of controls (spring and gravity controls) and Types of Damping (eddy current, air friction), Moving coil instruments - Permanent magnet, dynamometer type meters, Moving iron instruments – attraction and repulsion type, Dynamometer wattmeter – principles and torque equation

Module II: **(9 hours)**

Range extension: Ammeter and voltmeter by using shunts, multipliers, Current transformers and Potential transformers – Phasor diagram – ratio and phase angle errors of CT's and PT's – use of instrument transformers with wattmeter

Module III: **(11 hours)**

Watt meters: Working principle of wattmeter-Dynamometer and induction type wattmeter, Errors & compensation in Wattmeter.

Energy Meters: Ampere hour meter (AH mercury motor meter), 1-φ and 3-φ energy meters(principles and torque equation) – errors and compensation, static wattmeter and energy meters – principle.

Special purpose measuring Instruments: Power factor meters (Dynamometer type –single and three phase), Vibrating reed frequency meter - TOD meter and Tri-vector meter.

Module IV: **(10 hours)**

Measurement of resistance: Ohmmeter, Megger –measurement of insulation resistance by direct deflection method – Testing of earth electrode resistance, localization of cable fault by Murray and Varley loop tests.

DC Bridges: Introduction, sources & detectors for DC bridge, general equation for bridge at balance. Wheatstone and Kelvin's double bridge – brief description only.

AC bridges: Introduction, sources & detectors for a.c bridge, general equation for bridge at balance. Maxwell's Inductance & Maxwell's Inductance – Capacitance Bridge, Anderson bridge, Measurements of capacitance using Schering Bridge.

Potentiometers: General principle, Modern forms of dc potentiometers, standardization, Vernier dial principle, calibration of ammeter, voltmeter and wattmeter using potentiometer.

Module V: **(11 hours)**

Magnetic measurements: Measurement of flux, magnetizing force and permeability – Hibbert's magnetic standard – flux meter – Hall Effect gauss meter.

Transducers: Definition - different types of transducers-common transducers for measurement of displacement, velocity, flow, force, pressure, strain and temperature and angular displacement.

Display methods, recorders: Different types of display devices (CRT, LED, LCD, PDP and OLED), different types of recorders – galvanometric recorders - XY recorders– null type - pen driving system (Basic concepts only).

COURSE OUTCOMES:

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

- Understand the various electrical measuring instruments and instrumentation systems.
- Understand basic working principles used in electrical measuring instruments
- Understand about working of AC & DC bridges
- Understand about different applications of transducers
- Analyse design and calibration of electrical measuring instruments.

TEXT BOOKS:

1. A.K. Sawhney, A Course in Electrical and Electronics Measurements and Instrumentation, DhanpatRai and sons
2. Joseph J Carr, Elements of Electronic Instrumentation and Measurement, Pearson Education
3. Arun K Ghosh, Introduction to Measurements and Instrumentation, PHI

REFERENCE BOOKS:

1. William David Cooper, Electronic Instrumentation and Measurement Techniques, PHI
2. K.B. Klaassan, Electronic Measurements and Instrumentation, Cambridge UniversityPress
3. GK. Banerjee, Electrical and Electronic Measurements, PHI
4. John Bentley, Principles of Measurements Systems, Pearson Education

INTERNAL CONTINUOUS ASSESSMENT (Maximum Marks-50)

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, Group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

UNIVERSITY EXAMINATION PATTERN (Maximum Total Marks: 100)

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question.

EE19 305	FLUID MECHANICS & POWER PLANT ENGINEERING	3-1-0-3

PRE-REQUISITES: Basics Of Mechanical Engineering

COURSE OBJECTIVES:

- To impart the basics of the application of heat transfer, fluid mechanics, and hydraulic machines.
- To familiarize various power producing cycles
- To study various mechanical devices.

(Steam table, Refrigeration table and Heat transfer data book are permitted for the examination).

SYLLABUS:

Module I: (10 hours)

Fluid Mechanics: Fluid properties, Newton's Law of viscosity, Pressure, Measurement of Pressure, Pascal's law. Continuity equation, Euler's equation, Bernoulli's equation. Flow measuring instruments- Venturi meter, orifice meter, Pitot tubes (Simple numerical problems.)

Module II: (11 hours)

Hydraulic machines:
Turbines - Pelton Wheel – major parts, construction, working, Francis turbine - major parts, construction, working, Kaplan turbine - major parts, construction, working - Heads and efficiencies, specific speed, unit quantities, Characteristic Curves. (simple problems)

Pumps - Centrifugal Pump - major parts, construction, working, Heads and Efficiencies, Specific Speed, Characteristic Curves, Cavitation, Maximum Suction Lift, Net Positive Suction Head (NPSH) Reciprocating pumps - major parts, construction, working, discharge, work done, power required and slip in a reciprocating pump. (simple numerical only)

Module III: (10 hours)

Thermodynamics: Definitions and basic concepts – systems, properties, state, process and cycle, Thermodynamic equilibrium, Zeroth law, Work and Heat, First law – internal energy and enthalpy, Heat engine Refrigerator and heat pump, Second law –entropy, Thermodynamic processes – isometric, isobaric, isothermal, poly tropic, adiabatic and isentropic, PV and TS diagrams.

Applied thermodynamics: Properties of steam, saturation temperature, dryness fraction, degree of superheat, specific volume, enthalpy and Vapour power cycle-Carnot cycle, Rankine cycle- thermal efficiency, work ratio and specific steam consumption, methods of improvement of thermal efficiency –regeneration and reheat. (Simple numerical problems.)

Module IV: **(10 hours)**

Gas power cycles: Carnot cycle, Otto cycle, Diesel cycle- thermal efficiency Brayton cycle thermal efficiency and work ratio, methods of improvement of thermal efficiency - regeneration, inter cooling and reheat.
Refrigeration cycles: Reversed Carnot cycle, vapour compression refrigeration cycle, gas refrigeration cycle (Simple numerical problems).

Module V: **(11 hours)**

Heat Transfer: Modes of Heat Transfer
Conduction: Fourier Law of Conduction, Thermal Conductivity, Conduction Through Slab, composite wall, cylinder,
Convection: Heat Transfer Coefficient, Natural and Forced Convection, Combined Conduction and Convection, concept of thermal resistance. Critical thickness of insulation.Fins and their application.(Simple numerical problems.).
Radiation:
Concept of Black Body, Monochromatic and Total Emissive Power, Concept of Gray Body and Emissivity, Kirchhoff's Law.(Simple numerical problems).

COURSE OUTCOMES:

The student will be able to

- Understand the basic concepts of fluid mechanics and heat transfer.
- Understand various flow measuring devices.
- Know the working of turbines and select the type of turbine for an application.
- Apply the thermodynamic concepts into various thermal applications like IC engines, power plants etc.
- Analyze various thermodynamic power cycles.

TEXT BOOKS:

1. R. K Rajput, Engineering Thermodynamics, Laxmi Publications (P) Ltd.
2. Dr.R.K.Bansal, Fluid Mechanics and Hydraulic Machine, Laxmi Publications (P) Ltd.
3. P.K.Nag, Engineering Thermodynamics, Tata McGraw Hill

REFERENCE BOOKS:

1. Domkundwar & Kothandaraman, Thermal Engineering, DhanpatRai& Co. (P) Ltd.
2. D.S.Kumar, Heat Transfer, S. K.Kataria and Sons
3. P. K. Nag, Heat Transfer, Tata McGraw Hill.

INTERNAL CONTINUOUS ASSESSMENT (Maximum Marks-50)

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, Group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

UNIVERSITY EXAMINATION PATTERN (Maximum Total Marks: 100)

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question.

EN19 306	LIFE SKILLS & ETHICS FOR ENGINEERS	2-0-2-0

PRE-REQUISITES: Nil

LIFE SKILLS

Life skills are those competencies that provide the means for an individual to be resourceful and positive while taking on life's vicissitudes. Development of one's personality by being aware of the self, connecting with others, reflecting on the abstract and the concrete, leading and generating change, and staying rooted in time tested values and principles is being aimed at. This course is designed to enhance the employability and maximize the potential of the students by introducing them to the principles that underlie personal and professional success, and help them acquire the skills needed to apply these principles in their lives and careers.

COURSE OBJECTIVES

- To develop communication competence in prospective engineers.
- To enable them to convey thoughts and ideas with clarity and focus.
- To equip them to face Group Discussion.
- To inculcate a critical thinking process.
- To prepare them on problem solving skills.
- To provide symbolic, verbal, and graphical interpretations of statements in a problem description.
- To understand team dynamics & effectiveness.
- To create an awareness on Engineering Ethics and Human Values.
- To instill Moral and Social Values, Loyalty and also to learn to appreciate the rights of others.
- To learn leadership qualities and practice them.

SYLLABUS:

MODULE 1 **(14 hours)**

Overview of Life Skills: Meaning and significance of life skills, Life skills identified by WHO: Self- awareness, Empathy, Critical thinking, Creative thinking, Decision making, problem solving, Effective communication, interpersonal relationship, coping with stress, coping with emotion.

Life skills for professionals: positive thinking, right attitude, attention to detail, having the big picture, learning skills, research skills, perseverance, setting goals and achieving them, helping others, leadership, motivation, self-motivation, and motivating others, personality development, IQ, EQ, and SQ

Group Discussion: Differences between group discussion and debate; Ensuring success in group discussions, **Presentation Skills:** Oral presentation and public speaking skills; business presentations, Technology-based Communication: Netiquettes: effective e-mail messages; power-point presentation; enhancing editing skills using computer software.

MODULE 2 **(8 hours)**

Need for Creativity in the 21st century, Imagination, Intuition, Experience, Sources of Creativity, Lateral Thinking, Myths of creativity

Critical thinking Vs Creative thinking, Functions of Left Brain & Right brain, Convergent & Divergent Thinking, Critical reading & Multiple Intelligence.

Steps in problem solving, Problem Solving Techniques, Problem Solving through Six Thinking Hats, Mind Mapping, Forced Connections.

Problem Solving strategies, Analytical Thinking and quantitative reasoning expressed in written form, Numeric, symbolic, and graphic reasoning, Solving application problems.

MODULE 3 **(10 hours)**

Introduction to Groups and Teams, Team Composition, Managing Team Performance, Importance of Group, Stages of Group, Group Cycle, Group thinking, getting acquainted, Clarifying expectations.

Group Problem Solving, Achieving Group Consensus.

Group Dynamics techniques, Group vs Team, Team Dynamics, Teams for enhancing productivity, Building & Managing Successful Virtual Teams. Managing Team Performance & Managing Conflict in Teams.

Working Together in Teams, Team Decision-Making, Team Culture & Power, Team Leader Development.

MODULE 4 **(10 hours)**

Morals, Values and Ethics, Integrity, Work Ethic, Service Learning, Civic Virtue, Respect for Others, Living Peacefully.

Caring, Sharing, Honesty, Courage, Valuing Time, Cooperation, Commitment, Empathy, Self-Confidence, Character Spirituality, Senses of 'Engineering Ethics', variety of moral issued, Types of inquiry, moral dilemmas, moral autonomy, Kohlberg's theory, Gilligan's theory, Consensus and controversy, Models of Professional Roles, Theories about right action, Self-interest, customs and religion, application of ethical theories. Engineering as experimentation, engineers as responsible experimenters, Codes of ethics, Balanced outlook on.

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

MODULE 5 **(10 hours)**

Introduction, a framework for considering leadership, entrepreneurial and moral leadership, vision, people selection and development, cultural dimensions of leadership, style, followers, crises.

Growing as a leader, turnaround leadership, gaining control, trust, managing diverse stakeholders, crisis management

Implications of national culture and multicultural leadership   Types of Leadership, Leadership Traits.

Leadership Styles, VUCA Leadership, DART Leadership, Transactional vs Transformational Leaders, Leadership Grid, Effective Leaders, making of a Leader, Formulate Leadership

COURSE OUTCOMES:

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

1. Define and Identify different life skills required in personal and professional life, which will enable them to make effective presentations and face group discussions.
2. Critically think about a particular problem and Solve problems.
3. Work in Group & Teams
4. Handle Engineering Ethics and Human Values.
5. Become an effective leader.

TEXT BOOKS :

1.Life Skills for Engineers, Compiled by ICT Academy of Kerala, McGraw Hill Education (India) Private Ltd., 2016.

REFERENCE BOOKS:

1. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
2. Barun K. Mitra; (2011), “Personality Development & Soft Skills”, First Edition; Oxford Publishers.
3. Kalyana; (2015) “Soft Skill for Managers”; First Edition; Wiley Publishing Ltd.
4. Larry James (2016); “The First Book of Life Skills”; First Edition; Embassy Books.
5. ShaliniVerma (2014); “Development of Life Skills and Professional Practice”; First Edition; Sultan Chand (G/L) & Company
6. John C. Maxwell (2014); “The 5 Levels of Leadership”, Centre Street, A division of Hachette Book Group Inc.
7. Remesh S., Vishnu R.G., "Life Skills for Engineers", Ridhima Publications, First Edition, 2016

EVALUATION SCHEME

Internal Evaluation

(Conducted by the College)

Total Marks: 100

Part – A

1. Group Discussion – Create groups of about 10 students each and engage them on a GD on a suitable topic for about 20 minutes. Parameters to be used for evaluation is as follows;

(i) Communication Skills – 20 marks (ii) Subject Clarity – 10 marks (iii) Group Dynamics - 10 marks (iv) Behaviors And Mannerisms - 10 marks **(Marks: 50)**

Part – B

2. Presentation Skills – Identify a suitable topic and ask the students to prepare a presentation (preferably a powerpoint presentation) for about 10 minutes. Parameters to be used for evaluation is as follows;

(i) Communication Skills* -20 marks (ii) Platform Skills** - 20 marks (iii) Subject Clarity/Knowledge - 10 marks **(Marks: 50)**

* Language fluency, auditability, voice modulation, rate of speech, listening, summarizes key learnings etc.

** Postures/Gestures, Smiles/Expressions, Movements, usage of floor area etc.

EE19 307(P)	BASIC ELECTRICAL LAB	0-0-3-1

PRE-REQUISITES: Concept Of Electrical Engineering

COURSE OBJECTIVES:

- Impart basic knowledge in measurement of electrical quantities such as current, voltage ,power
- Implementation of basic electrical circuits
- Verify different circuit theorems
- Analysis of basic DC and AC circuits used in electrical devices

SYLLABUS:

List of Experiments

(A minimum of 10 experiments must be conducted)

1. Study of PMMC/MI voltmeter/ammeter, dynamometer type wattmeter, clip on ammeter, analog/digital multimeters and static energy meters.
2. Determination of V-I characteristics of a) wire wound rheostat and b) incandescent lamps in series & parallel.
3. Measurement of linear resistance using voltmeter-ammeter method
4. Verification of Kirchoff's laws in DC circuit
5. Verification of Superposition theorem in DC circuit
6. Verification of Thevenin's theorem in DC circuit
7. Verification of Reciprocity theorem in DC circuit
8. Determination of impedance, admittance, power factor and real/reactive/apparent power drawn in RLC series/parallel circuits.
9. Single phase power measurement using
    a) Dynamometer type wattmeter
    b) 3 Ammeters method and
    c) 3 Voltmeters method in an RL load.
10. 3-Phase power measurement using one wattmeter and two wattmeters.
11. Power factor improvement in an RL circuit

COURSE OUTCOMES:

The student will be able to

- Understand different types of measuring instruments
- Verify different laws and theorem in electric circuits
- Measure power and energy in single phase and three phase circuits
- Measurement of power and power factor single phase and three phase circuits
- To understand the power factor improvement in an RL circuit

INTERNAL CONTINUOUS ASSESSMENT **(Maximum Marks-50)**

60% - Laboratory practical, record and viva voce

30% - Tests

10% - Regularity in the class

SEMESTER END EXAMINATION **(Maximum Marks-100)**

70% - Procedure, conducting experiment, result, tabulation, and inference

20% - Viva voce

10% - Fair record

EE19 308(P)	ELECTRONICS LAB	0-0-3-1

PRE-REQUISITES: Basics of Electronics Engineering

COURSE OBJECTIVES:

- To familiarize the various instruments used in electronics lab
- To familiarize and conduct experiments on various analog electronic circuits
- To introduce the concept of electronic circuit simulation

SYLLABUS:

List Of Experiments

(A minimum of 10 experiments must be conducted)

1. Study & Use of CRO:
   a) Measurement of current voltage, frequency and phase shift.
2. Clipping and clamping circuits with diodes
3. Rectifiers with and without filter - Characteristics full wave rectifier Ripple factor, Rectification efficiency, and % regulation.
4. RC coupled amplifier with and without emitter capacitor using BJT in CE configuration
5. FET amplifier- Measurement of voltage gain, current gain, input and output impedance
6. Characteristics of voltage regulators
7. Power amplifier
8. OPAMP circuits – Design and set up of non-inverting amplifier, inverting amplifier, ZCD, voltage follower, summing amplifier, integrator, and differentiator.
9. Phase shift and Wein's Bridge oscillator with amplitude stabilization using OPAMPs.
10. Waveform generation – Square, triangular and sawtooth waveform generation using OPAMPs.
11. Astable multivibrator and monostable multivibrator using 555 IC.
12. Introduction to circuit simulation-simulation of OP AMP and other analog IC circuits

COURSE OUTCOMES:

The student will be able to

- Study experimentally the characteristics of diodes and BJTs.
- Study experimentally the characteristics of FET.

- Understand the functioning of OP-AMP and design OP-AMP based circuits
- Study experimentally the function of 555 IC.
- To simulate various semiconductor devices using tools such as spice.

INTERNAL CONTINUOUS ASSESSMENT (Maximum Marks-50)

60% - Laboratory practical, record and viva voce

30% - Tests

10% - Regularity in the class

SEMESTER END EXAMINATION (Maximum Marks-100)

70% - Procedure, conducting experiment, result, tabulation, and inference

20% - Viva voce

10% - Fair record

SEMESTER - 4

EN19 401	ENGINEERING MATHEMATICS IV	3-1-0-4

Pre-Requisites: Nil

Course Objectives:

- To deal with the methods for collection, classification and analysis of numerical data.
- To describe the characteristics and compute probabilities using both discrete and continuous probability distributions.
- To develop hypothesis testing methodology using test statistics.
- To introduce the tools of differentiation and integration of functions of complex variables that are used in various techniques dealing with engineering problems.

Syllabus:

Module I: (10 hours)

Bivariate Probability Distributions: Two random variables-Joint probability mass function- Joint probability density function-Marginal probability distributions-Conditional probability distributions-Independence of random variables- Joint distribution function- Bivariate moments-Conditional expectation- Conditional variance.

ModuleII: (10 hours)

Probability Distributions: Random variables - Mean and Variance of probability distributions - Binomial Distribution - Poisson Distribution - Poisson approximation to Binomial distribution - Hypergeometric Distribution – Geometric Distribution - Probability densities - Normal Distribution - Uniform Distribution - Gamma Distribution.

Module III: (12 hours)

Sampling Distributions and Testing of Hypothesis: Population and Samples - Sampling Distribution - Sampling distribution of Mean (s known) - Sampling Mean (s known) – Sampling distribution of Mean (σ unknown) - Sampling distribution of Variance - Interval Distribution – Confidence interval for Mean - Null Hypothesis and Test of Hypothesis - Hypothesis concerning one mean – Hypothesis concerning two means - Estimation of Variances - Hypothesis concerning one variance - Hypothesis concerning two variances - Test of Goodness of fit.

Module IV: (10 hours)

Functions of a Complex Variable-I: Functions of a Complex Variable – Limit – Continuity – Derivative of a Complex function – Analytic functions – Cauchy-Riemann Equations – Laplace equation – Harmonic Functions – Conformal Mapping – Examples: e^z, $sinz, coshz, \left(z + \frac{1}{z}\right)$– Mobius Transformation.

Module V: **(10 hours)**

Functions of a Complex Variable-II: Definition of Line integral in the complex plane – Cauchy's integral theorem (Proof of existence of indefinite integral to be omitted) – Independence of path – Cauchy's integral formula – Derivatives of analytic functions (Proof not required) – Taylor series (No proof) – Laurent series (No proof) – Singularities – Zeros – Poles – Residues – Evaluation of residues – Cauchy's residue theorem – Evaluation of real definite integrals.

Course Outcome:

The student will be able to

- Acquire the knowledge of basic ideas of joint probability distributions.
- Acquire the knowledge to describe the characteristics and compute probabilities using both discrete and continuous probability distributions.
- Develops the skills of hypothesis testing methodology using test statistics.
- Distinguish to compute the differentials of various complex functions in various engineering problems.
- Acquire the mathematical tools of integration of functions of complex variables that are used in various techniques dealing with engineering problems.

Text Books:

1. Richard A Johnson, CB Gupta, Miller and Freund's Probability and statistics for Engineers,
2. Wylie C.R and L.C. Barret, Advanced Engineering Mathematics, McGraw Hill.
3. B.S.Grewal,Higher Engineering Mathematics ,Khanna Publishers,35th Edition

Reference Books:

1. Erwin Kreysig, Advanced Engineering Mathematics, 8e, John Wiley and Sons, Inc.
2. N Bali, M Goyal, C Watkins, Advanced Engineering Mathematics, A Computer Approach, 7e, Infinity Science Press, Fire Wall Media.
3. William Hines, Douglas Montgomery, avid Goldman, Connie Borror,Probability and Statistics in Engineering, 4e, John Wiley and Sons, Inc.
4. Sheldon M Ross, Introduction to Probability and Statistics for Engineers and Scientists, 3e, Elsevier, Academic Press.
5. H Parthasarathy, Engineering Mathematics, A Project & Problem based approach, Ane Books India.
6. B V Ramana, Higher Engineering Mathematics, McGrawHill.
7. J K Sharma, Business Mathematics, Theory and Applications, AneBooksIndia.
8. Babu Ram, Engineering Mathematics Vol. II, 2nd edition, Pearson Education.

9. Sastry S.S., Advanced Engineering Mathematics-Vol. I and II., Prentice Hall of India.
10. T .Veerarajan, Probability , Statistics and Random Processes , Tata McGraw- Hill , 2nd edition

Internal Continuous Assessment (Maximum Marks-50)

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, Group discussions,quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (Maximum Total Marks: 100)

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREEquestions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question.

EE19 402	ELECTROMAGNETIC FIELD THEORY	3-1-0-3

Pre-Requisites: Basic knowledge in Differential Equations and Vector Calculus is required

Course Objectives:

- Understanding the basic principle of Electric and Magnetic Fields.
- Studying the governing relations between electric and magnetic fields.
- Studying the principle behind electromagnetic wave propagation.
- To develop a conceptual basis of electrostatics, magnetostatics.
- To understand various engineering applications of electromagnetic.

Syllabus:

Module I: **(13 hours)**

Coordinate Systems: Orthogonal Coordinate Systems: Cartesian coordinates-Cylindrical Coordinates-Spherical, Coordinates-transformation between ordinate systems, Gradient of scalar field, Gradient operator in cylindrical and spherical coordinates
Divergence of a vector: Physical significance-Divergence Theorem
Curl of a vector field: Physical significance-Stoke's theorem
Static Electric fields: Fundamental postulates of electrostatic in free space-Coulomb's law-electric field due to discrete charges-continuous distribution of charge-Gauss Law and its applications-Electric potential due to discrete charges and charge distribution-Electric dipole-Conductors in static field-Dielectrics in static field-electric flux density and dielectric constant-Boundary conditions for electrostatic field-Capacitance-capacitances in multi-conductor system-electrostatic shielding-Electrostatic energy and forces.

Module II: **(10 hours)**

Steady Electric Current: Current density and ohm's law- electromotive force and kirchoff's law-Equation of continuity and kirchhoff's current law-power dissipation and joule's law-Boundary condition for current density-Resistance calculations.

Static Magnetic field: Fundamental postulates of magnetostatics in free space-Vector magnetic Potential-Conduction current, Conduction current density, BiotSavart's Law and Ampere's Law, Vector potential Concept of inductance, Inductance of solenoid, Toroid Concept of resistance, magnetic moment, Torque on a loop, transmission lines, Electromagnetic induction – Faraday's law.

Module III: **(8 hours)**

Faraday's law of electromagnetic Induction: Stationary loop in a time varying magnetic field-Ideal transformer - moving conductor in a Static magnetic field - the electromagnetic generator-Moving conductor in a time varying field - displacement current - continuity equation.

Module IV: **(8 hours)**

Maxwell's equation: Differential and integral forms-its physical interpretations- Potential functions - **Electromagnetic boundary conditions**: Interface between two lossless media- Interface between a dielectric and perfect conductor - **Wave equation and their solution:** Solution of wave equation for potentials-source free wave equations.

Time Harmonic Fields: The use of phasors-Time harmonics electromagnetic-source free field in simple media-the electromagnetic spectrum.

Module V: **(12 hours)**

Introduction to electromagnetic spectrum: Plane Electromagnetic Waves- Plane waves in lossless media—Doppler effect-Transverse electromagnetic waves-Polarization of plane waves-Plane waves in lossy media-low loss dielectrics-good conductors-ionized gases-Group velocity

Flow of electromagnetic Power and Poynting vector: instantaneous and average power densities.

Normal incidence: normal incidence at plane conducting boundaries-plane dielectric boundaries-multiple dielectric interface.

General Transmission line equations: Wave characteristics on infinite transmission lines-Transmission line parameters-Characteristic impedance-Reflection fundamentals -at short circuit and open circuit reflection coefficients.

Course Outcomes:

The student will be able to

- Define and recognize different co-ordinate systems to describe the spatial variations of the physical quantities dealt in electromagnetic field theory as they are functions of space and time.
- Apply different techniques of vector calculus to understand different concepts of electromagnetic field theory.
- Explain fundamental laws governing electromagnetic fields and evaluate the physical quantities of electromagnetic fields (Field intensity, Flux density etc.) in different media using the fundamental laws.
- Determine the electromagnetic force exerted on charged particles, current elements, workingPrinciple of various electric and electromagnetic energy conversion devices are based on this force.
- Generalize the concepts of guided structures like transmission line, means of transporting energy or information, commonly used in power distribution and communication.

Text Books

1. Mattew N.O Sadiku, Elements of Electromagnetics, Addison – Wesley,2-nd edition
2. FawwazT.Ulaby, Electromagnetic for engineers, Pearson Education
3. David K. Cheng, Field and Wave Electromagnetics , Pearson Education

Reference Books

1. NannapaneniNarayanaRao, Elements of Engineering Electromagnetics, Pearson Education
2. W. H. Hayt, Engineering Electromagnetics, McGraw Hill
3. Guru and Hiziroglu, Electromagnetic Field Theory- Fundamentals,
4. Pramanik, Electromagnetism, Theory and Applications, Prentice Hall of India
5. David J. Griffiths, Introduction to ElectroDynamics, Prentice Hall of India
6. Umran S Inan& Aziz S Inan, Engineering Electromagnetics, Pearson
7. John Reitz, Frederick Milford & Robert Christy, Foundations of ElectromagneticTheory, Pearson
8. GottapuSasibhushanaRao, Electromagnetic Field Theory & Transmission Lines,Wiley-India
9. Dash &Khundia, Fundamentals of Electromagnetic Theory, PHI
10. Lonngren, Fundamentals of Electromagnetics with MATLAB, PHI
11. Somanathan Nair & Deepa, Applied Electromagnetic Theory, PHI

Internal Continuous Assessment (Maximum Marks-50)

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving,
Group discussions,quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (Maximum Total Marks: 100)

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREEquestions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks
Two questions from each module with a choice to answer one question.

EE19 403	ELECTRICAL MACHINES-I	3-1-0-4

Pre-Requisites: Basic knowledge in Electrical Circuit Analysis and Concept of Electrical Engineering is required.

Course Objectives:

- Study the basic working principles of electrical machines
- Study the performance analysis of electrical machines
- Study about various tests on electrical machines
- Study about equivalent circuit parameter design in transformer
- Study the basic concepts of electrical machine design

Syllabus:

Module I: **(10 hours)**

DC Machines: Construction of DC Machine – Principle of operation - Types of Windings – Simplex lap and wave windings- developed winding diagram – EMF equation-Armature reaction - Demagnetising and cross magnetizing ampere turns-Commutation-Reactance voltage-Interpoles-Compensating winding.

Module II: **(9 hours)**

DC Generators: Types-Separately excited and self excited-shunt, series and compound wound generators- Performance characteristics - applications - Parallel operation of DC generators

Module III: **(12 hours)**

DC Motors: Principle of operation-Back emf-Torque and speed equations -Types- Performance characteristics applications - Starting-Need for starter- -design of starter resistance - Speed control-Theory of armature and field control methods-Solid state speed control methods-Series motor speed control - Losses and efficiency –Condition for maximum efficiency- Testing-Swinburne's test - Hopkinson's test- -Retardation test- Separation of losses.

ModuleIV: **(11 hours)**

Transformers: Types-Construction-Principle of operation-emf equation-phasor diagram-equivalent circuit- Per unit resistance and reactance of transformers-Voltage Regulation - losses-efficiency-SC & OC test- -Sumpner's test- Separation of losses - Parallel operation(with equal turns ratio) - Auto transformer-Comparison with two winding transformer – 3-phase transformer – Types of transformer connections Δ-Δ, Y -Y, Δ-Y, Y-Δ, V-V –Tap changing transformers-On load and Off load tap changing-Cooling of transformers.

Module V: **(10 hours)**

Design fundamentals: DC machines – specific loading- choice of specific electric and magnetic loadings - output equation- main dimensions-separation of D and L choice of speed and number of poles--. Transformer design - specific loading –stacking factor and window space factor-output equation & window dimensions- single phase and three phase core type transformers- -square and cruciform cross sections only.

Course Outcomes:

The student will be able to

- Acquire Basic working principles of electrical machines.
- Acquire the performance analysis of electrical machines.
- Understanding about various test on electrical machine
- Understanding to design equivalent parameters
- Understanding electrical machine design

Text Books

1. Clayton & Hancock, Performance & Design of DC machines, ELBS
2. P.S. Bhimbra, Electrical Machinery, Khanna Publishers
3. M.N.Bandyopadhyay, Electrical Machinery, Prentice Hall of India

Reference Books

1. Fitzgerald A.E and Kingsley, Electrical Machinery, McGraw Hill
2. Nagrath I J and Kothari D P, Electric Machines,TataMcGraw Hill
3. Stephen J Chapman, Electric Machinery Fundamentals, McGraw Hill.
4. Vincent Del Toro, Electrical Machines and Power Systems, Prentice Hall
5. Charles Hubert, Electric Machines, Pearson Education
6. K. Murukesh Kumar, DC Machines and Transformers, Vikas Publishing House

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving,
Group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern **(Maximum Total Marks: 100)**

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREEquestions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question.

EE19 404	DIGITAL ELECTRONICS AND LOGIC CIRCUITS	3-1-0-3

Pre-requisites: Electronic Devices And Circuits

Course Objectives:

- Creation of awareness about the basic principles of digital electronics.
- Study of logic design techniques.
- Understanding the concepts behind the hardware implementation of a digital computer.
- To understand combinational circuits and sequential circuits
- Learn assembly language programming

Syllabus:

Module I: **(10 hours)**

Logic gates and Number systems: Ideal Logic Gates-Truth Tables of basic gates- TTL logic-Number Systems-Binary Numbers- Hexadecimal numbers-Complements- Signed and unsigned numbers-one's complement and two's complement-Arithmetic operations of Binary and Hexadecimal Numbers-Binary codes – Gray codes.

Module II: **(11 hours)**

Boolean Algebra and Combinational circuits: Boolean Functions-Canonical and Standard forms-Simplification of Boolean Functions by Karnaugh Mapup to five variable map (SOP and POS), Quine-McCluskey Method -NAND, NOR implementation.

Combinational circuits- Code Converters- Binary-to-Gray Converter, Gray-to-Binary Converter, Binary-to-BCD Converter – Adders - Subtractors- BCD Adder-Magnitude Comparator-Decoders and Encoders-Multiplexers and Demultiplexers.

Module III: **(11 hours)**

Sequential Circuits: Comparison of sequential and combinational circuits-Latches, Flip Flops - RS , JK , T and D Flip Flops - Triggering of Flip Flops

Registers - Shift Registers –Different types-bidirectional shift register- Ring Counter – Johnson Counter.

Ripple Counters –Counters with truncated sequences.

Synchronous Counters – design of synchronous counters-state tables and state diagrams-state reduction and assignment-Flip Flop Excitation Tables.

Module IV: **(8 hours)**

Memories - ROM, Static and Dynamic RAM, Read/Write Memory, EPROM, EEPROM, Memory Decoding. Implementation of Combinational Logic by using Multiplexers, ROM, PLA and PAL.

Module V: **(10 hours)**

Microprocessor 8085: Basic concepts of Microprocessor-Internal Architecture of 8085- Pin diagram of 8085- Register structure-Bus structure.

Instruction set- Addressing modes- Instruction sets -Simple programs-Timing diagram-(Read and Write Timing diagram)

Course Outcomes:

The student will be able to

- To understand and examine the structure of various number systems and its application in digital design.
- Design and analyse any digital logic gate circuits and Flip flop based systems.
- The ability to understand, analyze and design various combinational and sequential circuits.
- Ability to identify basic requirements for a design application and propose a cost effective solution.
- To understand microprocessors and develop skill in programming.

Text Books

1. Thomas L Floyd, Digital Fundamentals, Pearson Education

2. Ramesh S. Gaonkar, Microprocessor Architecture- Programming and Application,

Wiley- Eastern(Module V)

3. Mano M M, Logic and Computer Design Fundamentals, 4/e, Pearson Education

4. Donald P Leach, Albert Paul Malvino and Goutam Saha, Digital Principles and Applications, 8/e, by McGraw Hill

Reference Books

1. A. Anand Kumar, Digital Circuits, PHI

2. B. Ram, Fundamentals of Microprocessors and Microcontrollers, PHI

3. John F Wakerly, Digital Design: Principles and Practices, 4/e, Pearson

4. B. Somanathan Nair, Digital Electronics and Logic Design, PHI

5. John M. Yarbrough, Digital Logic Application Design, P W S Publishing Company

6. Maini, Digital Electronics-Principles & Integrated Circuits, Wiley-India

Internal Continuous Assessment **(Maximum Marks-50)**

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, Group discussions,quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern **(Maximum Total Marks: 100)**

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question.

EE19 405	SIGNALS AND SYSTEMS	3-1-0-4

Pre-requisites: Basic knowledge in Fourier Transforms and Laplace Transforms is required.

Course Objectives:

- Understand the concepts of signals and systems.
- Understand basic signals- Impulse, step, ramp, exponential and sinusoidal signals- operations of signals and its properties and analyse the continuous time system with Laplace transform
- Understanding signals and systems in terms of both the time and transform domains, taking advantage of the complementary insights and tools that these different perspectives provide.
- Represent and analyse signals using Fourier
- Analyse the discrete time system using Z -Transform

Syllabus:

Module I: **(11 hours)**

Signals – Classification – continuous-time/discrete-time, deterministic/non-deterministic, periodic/ aperiodic, even/odd, energy/power signals – elementary signals – unit step, impulse, ramp, exponential, sinusoidal,–Operation on signals (Amplitude and time dependent)-time-shifting, scaling, folding.

Systems – classification – continuous-time/discrete-time, static/dynamic, linear/non-linear, time-invariant/variant, causal/non-causal, stable/unstable - Linear Time Invariant (LTI) systems- properties of LTI systems– impulse response – convolution integral – convolution sum – condition for BIBO stability for CT and DT systems in terms of impulse response.

Module II: **(11 hours)**

Representation of signals – Periodic signals – continuous-time fourier series (CTFS) – Trigonometric and exponential – symmetry conditions – amplitude & phase spectrum – properties of CTFS – Parserval's theorem for power signals – power spectral density.

Steady state solution of electric circuits with non-sinusoidal periodic inputs using Fourier series – effective values of voltages and currents.

Module III: **(10 hours)**

Non-periodic signals - continuous-time fourier transform (CTFT) – amplitude & phase spectra - gate function – sampling function – properties – convolution – Parseval's theorem for energy signals

– energy-spectral density - Frequency response - Linear Constant-Coefficient Differential equations - review of Laplace transform - relation between Laplace transform and Fourier transform

ModuleIV: **(10 hours)**

Periodic signals - Discrete-time Fourier series (DTFS) – properties of DTFS – aperiodic signals – discrete-time fourier transform (DTFT) – properties of DTFT - Parseval's theorem – energy spectral density – frequency response - Sampling and reconstruction.

Module V: **(10 hours)**

Z-transform - Linear Constant-Coefficient Difference Equations (LCCDE) – Review of Z-transform – Region of Convergence (ROC) – importance of ROC - properties – inverse Z-transform by long division method & partial fraction expansion method – one-sided Z-transform – properties – initial value & final value theorem - solution of LCCDE with initial conditions.

Course Outcomes:

The student will be able to

- Characterize and analyze the properties of continuous-time and discrete-time signals and systems.
- Classify systems based on their properties and determine the response of LSI systems using convolution.
- Analyze system properties based on impulse response and Fourier analysis.
- Apply the Laplace transform and Z- transform for analysis of continuous-time and discrete-time signals and systems.
- Understand the process of sampling.

Text Books:

1. Oppenheim A. V. & Schafer R. W., Signals and Systems, Pearson Education
2. Simon Haykin& Barry Van Veen, Signals and Systems, Wiley-India
3. Proakis J. G. manolakis D. G., Digital Signal Processing, Principles, algorithms & applications, Pearson Education.

Reference Books:

1. Charles L. Phillips, John M. Parr & Eve A Riskin, Signals, Systems and Transforms, PearsonEducation
2. D. Ganesh Rao Satish Tunga, Signals and Systems, Sanguine Technical Publishers

3. Roy Choudhury, Networks & Systems, New Age International publishers
4. S.Palani , Signals and Systems, Ane Books Pvt. Ltd
5. V. Krishnaveni& R. Rajeswari, Signals & Systems, Wiley-India
6. Anand Kumar, Signals & Systems, Prentice-Hall of India
7. Guru, Signals & Systems, Prentice-Hall of India

Internal Continuous Assessment (Maximum Marks-50)

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, Group discussions,quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (Maximum Total Marks: 100)

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREEquestions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question.

EN19 406	CONSTITUTION OF INDIA	2-0-2-0

Pre-requisites: Nil

Course Objectives:

- To help the students to concentrate on their dayto day discipline.
- To give the knowledge and strength to face the society and people.

Syllabus:

Module I: **(8 hours)**
Definition of constitution, historical background, salient features of the constitution - Preamble of the constitution, union and its territory - Meaning of citizenship, types, termination of citizenship.

Module II: **(12 hours)**
Definition of state, fundamental rights, general nature, classification, right to equality ,right to freedom , right against exploitation - Right to freedom of religion, cultural and educational rights, right to constitutional remedies. Protection in respect of conviction for offences - Directive principles of state policy, classification of directives, fundamental duties.

Module III: **(10 hours)**
The Union executive, the President, the vice President, the council of ministers, the Prime minister, Attorney-General, functions - The parliament, composition, Rajyasabha, Loksabha, qualification and disqualification of membership, functions of parliament - Union judiciary, the supreme court, jurisdiction, appeal by special leave.

Module IV: **(9 hours)**
The State executive, the Governor, the council of ministers, the Chief minister, advocate general, union Territories - The State Legislature, composition, qualification and disqualification of membership, functions - The state judiciary, the high court, jurisdiction, writs jurisdiction.

Module V: **(9 hours)**
Relations between the Union and the States, legislative relation, administrative relation, financial Relations, Inter State council, finance commission - Emergency provision, freedom of trade commerce and intercourse, comptroller and auditor general of India, public Services, public service commission, administrative Tribunals - Official language, elections, special provisions relating to certain classes, amendment of the Constitution.

Course Outcomes:

Upon completion of the course, the student will be able to:

- Explain the background of the present constitution of India and features.
- Utilize the fundamental rights and duties.
- Understand the working of the union executive, parliament and judiciary.
- Understand the working of the state executive, legislature and judiciary.
- Utilize the special provisions and statutory institutions.

Text Books:

1. DD Basu, Introduction to the constitution of India, LexisNexis, New Delhi, 24e,2019
2. PM Bhakshi, The constitution of India, Universal Law, 14e, 2017

Reference Books:

1. Ministry of law and justice, the constitution of India, Govt of India, New Delhi, 2019.
2. JN Pandey, The constitutional law of India, Central Law agency, Allahabad, 51e, 2019
3. MV Pylee, India's Constitution, S Chand and company, New Delhi, 16e, 2016

Internal Continuous Assessment **(Maximum Marks-100)**

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

EE19 407(P)	MEASUREMENTS & INSTRUMENTATION LAB	0-0-3-1

Pre-requisites: Electrical Measurements & Instrumentation Systems

Course Objectives:

- Calibration of various electrical measuring instruments
- Measurement of different physical parameters using transducers

Syllabus:

List of Experiments:

(A minimum of 10 experiments must be conducted)

MEASUREMENTS LAB

1. (a) Calibration of single-phase energy meter by direct loading
   (b) Calibration of single-phase static energy meter
2. (a) Calibration of single-phase energy meter by phantom loading phase shifting transformer
   (b) Calibration of single-phase energy meter by phantom loading without phase shifting transformer
3. Measurement of self and mutual inductance
4. Calibration of ammeter, voltmeter and wattmeter using vernier potentiometer
5. Calibration of three phase energy meter

INSTRUMENTATION LAB

1. Measurement of resistance using Wheastone's Bridge
2. Measurement of resistance using Kelvin Double bridge
3. Extension of range of wattmeter using CT & PT
4. Measurement of displacement using LVDT
5. Measurement of current/ voltage using Hall effect transducer
6. Thermocouple based temperature measurement
7. Measurement of physical quantities – strain, torque and angle
8. Measurement of temperature by RTD method

Course Outcomes:

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

- Upon completion of study of the course should be able to calibrate and test single phase energy meter, calibrate PMMC voltmeter and calibrate LPF wattmeter
- Student should be able to measure resistance, inductance and capacitance
- Students should be able to measure 3-Φ active power and reactive power
- Students should be able to test current transformers and dielectric strength of oil.
- Students should be able to calibrate LVDT and resistance strain gauge

Internal Continuous Assessment **(Maximum Marks-50)**

60% - Laboratory practical, record and viva voce

30% - Tests

10% - Regularity in the class

Semester End Examination **(Maximum Marks-100)**

70% - Procedure, conducting experiment, result, tabulation, and inference

20% - Viva voce

10% - Fair record

EE19 408(P)	MECHANICAL ENGINEERING LAB	0-0-3-1

Pre-requisites: Fluid Mechanics & Power Plant Engineering

Course Objectives:

- To strengthen the knowledge on principles of Fluid mechanics, Hydraulic Machineries, and Heat engines through experiments.
- To equip the students to carry out experiments, and to train them to analyse, report and infer the results.
- To acquaint the students with the measurement of various mechanical parameters.

Syllabus:

(A minimum of 10 experiments must be conducted)

Study

1. Study of pipe fittings and plumbing tools
2. Study of discharge/flow measurement instruments/devices
3. Study of IC engines petrol/diesel
4. Study of refrigeration and air conditioning systems

Calibration

5. Calibration of venturimeter and orifice meter
6. Calibration of notches
7. Calibration of pressure gauges

Performance of Pumps

8. Operating characteristics of Centrifugal pumps
9. Operating characteristics of Reciprocating pumps

Evaluation of Friction

10. Determination of Darcy's coefficient of friction- major losses due to friction and using pipe friction apparatus
11. Determination of minor losses due to friction in bend, elbow and sudden expansion and contraction.

Performance of turbines

12. Operating characteristics of Pelton wheel Turbine
13. Operating characteristics and Francis turbine

Performance of Engines & RAC systems

14. Load test on petrol engine.
15. Load test on diesel engine.
16. Performance test on refrigeration and air conditioning system.

Course Outcomes:

The student will be able to

- Understand basic units of measurement, convert units, and appreciate their magnitudes and utilize basic measurement techniques of fluid mechanics and IC engines.
- Analyze the performance parameters of various turbines, pumps, air conditioning & refrigeration systems and engines and interpret its results.
- Measure fluid pressure and relate it to flow velocity.
- Demonstrate practical understanding of the various equations of Bernoulli and friction losses in internal flows.
- Understand the relevance and applications of various mechanical systems, and its components and working of components in other relevant and allied areas will help to do interdisciplinary research which will be beneficial to society.

Internal Continuous Assessment (Maximum Marks-50)

60% - Laboratory practical, record and viva voce

30% - Tests

10% - Regularity in the class

Semester End Examination (Maximum Marks-100)

70% - Procedure, conducting experiment, result, tabulation, and inference

20% - Viva voce

10% - Fair record

SEMESTER - 5

EN19 501	ENGINEERING ECONOMICS AND PRINCIPLES OF MANAGEMENT	3-1-0-3

SECTION 1: ENGINEERING ECONOMICS

Pre-Requisites: Nil

Course Objectives:

- To make a fundamentally strong base for decision making skills by applying the concepts of economics.
- Educate the students on how to systematically evaluate the various cost elements of a typical manufactured product, an engineering project or service, with a view to determining the price offer.
- Prepare engineering students to analyze profit/revenue data and carry out economic analysis in the decision making process to justify or reject alternatives/projects.

Syllabus:

Module I: **(11 Hours)**

Introduction to Engineering Economics – Technical efficiency, Economic efficiency.
Supply and Demand: Determinants of demand, Law of demand, Determinants of supply, Law of supply, Market equilibrium. Elasticity of demand – Types of elasticity, Factors affecting the price elasticity of demand - Utility analysis, indifference curves, Law of equi- marginal utility, marginal utility theory, Law of diminishing marginal utility -production possibility curve Production concepts-average product-marginal product-law of variable proportions, Isoquant.

Module II: **(10 Hours)**

Value Analysis - Time value of money - Interest formulae and their applications: Single-payment compound amount factor, Single-payment present worth factor, Equal-payment series compound amount factor, Equal-payment series sinking fund factor, Equal-payment series present worth factor, Equal-payment series capital recovery factor, Effective interest rate. Investment criteria: Payback Period, Net Present Value, Internal Rate of Return, Benefit-cost ratio.

Course Outcomes:

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

- Understand the basic concepts used in engineering economics and apply the basics of economics and cost analysis to make economically sound decisions.
- Understand Time Value of Money and apply suitable cash flow methods for different situations.

Text Books:

1. Panneer Selvam, R, ―Engineering Economics‖, Prentice Hall of India Ltd, New Delhi, 2001.

2. Dwivedi, D.N., “Managerial Economics, 7/E”, Vikas Publishing House, 2009.
3. Salvatore D. Managerial Economics: Principles and Worldwide Application:(adapted version). OUP Catalogue. 2012.

Reference Books:

1. Sullivan, W.G, Wicks, M.W., and Koelling. C.P., ―Engineering Economy 15/E‖, Prentice Hall, New York, 2011.
2. Chan S. Park, ―Contemporary Engineering Economics‖, Prentice Hall of India, 2002.
3. Prasanna Chandra, ―Financial Management: Theory & Practice, 8/E”, Tata-McGraw Hill, 2011.
4. Rangarajan C. Indian economy: essays on money and finance. UBS Publishers' Distributors; 1999.

EVALUATION SCHEME

Internal Continuous Assessment ***(Maximum Marks-20)***

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class

University Examination Pattern ***(Maximum Marks-40)***

PART A*: Analytical/problem solving SHORT questions* ***4 x 5 marks= 20 marks***

Candidates have to answer FOUR questions out of SIX. There shall be THREE questions from each module with total SIX questions.

PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***2 x 10 marks= 20 marks***

Two questions from each module with a choice to answer one question.

SECTION 2: PRINCIPLES OF MANAGEMENT

Pre-Requisites: Nil

Course Objectives:

- To develop ability to analyze and evaluate a management processes and variety of management practices in the contemporary context;
- To understand and apply the basic concepts of functional areas of management like Human resources, Marketing and Finance;
- To be able to evaluate managerial decision-making process, project management techniques, developing innovative products and social responsibility ideologies to create sustainable organizations;
- To be able to understand existing managerial practices to create their own innovative management competencies, required for a complex global workplace.

Syllabus:

Module III : **(10 Hours)**

The management process: managerial skills and roles, evolution of management theory; principles of planning: types of plans, steps in planning; principles of organizing: organizational structures; directing; motivation; controlling; sustainability in management.

Module IV: **(11 Hours)**

Human resource management: human resource planning, performance metrics.

Marketing management: fundamentals of marketing, market segmentation, consumer and industrial markets.

Financial management: Basic principles of: double entry bookkeeping, financial statements, sources of finance, classification of costs, break-even analysis (Basic concepts only).

Module V: **(10 Hours)**

Managerial decision-making process: decision making under certainty, risk and uncertainty; network techniques for project management: critical path method (CPM); Programme Evaluation and Review Technique (PERT): time/cost trade-off in critical path networks (simple problems only).

Entrepreneurial processes: analysis of new ventures/start-ups, creating innovative products/services and business plans, importance of corporate social responsibility

Course Outcomes:

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

- Understand the roles, skills and functions of management.
- Understand the basic concept of human resources, marketing and financial management in the organizations and integrate the learning in handling these complexities.
- Apply the concept of decision making, network techniques, analysis of new venturers as a part of project management / an organization.

Text Books:

1. H. Koontz, and H. Weihrich, *Essentials of Management: An International Perspective*, 10th Edition. McGraw-Hill, 2015.
2. Ramesh Unnikrishnan, Principles of Management, Educational Publishers and Distributors, 2021.
3. O. P. Khanna, Industrial Engineering and Management, 17th Edition, Dhanpat Rai Publications, 2018.

Reference Books:

1. R. W. Griffin, *Management: Principles and Applications*. 10th Edition, Cengage Learning, 2008.
2. P. Kotler, K. L. Keller, A. Koshy, and M. Jha, *Marketing Management: A South Asian Perspective,* 15th ed. Pearson, 2014.
3. M. Y. Khan, and P. K. Jain, *Financial Management*. 8th Edition Tata-McGraw Hill, 2018.
4. Heinz Weirich, Mark V Cannice and Harold Koontz, Management: a Global, Innovative and Entrepreneurial Perspective, 14th Edition, McGraw Hill Education, 2013.

EVALUATION SCHEME:

Internal Continuous Assessment ***(Maximum Marks-30)***

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class

University Examination Pattern ***(Maximum Marks-60)***

PART A*: Analytical/problem solving SHORT questions* ***6 x 5 marks= 30 marks***

Candidates have to answer SIX questions out of NINE. There shall be THREE questions from each module with total NINE questions.

PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***3 x 10 marks= 30 marks***

Two questions from each module with a choice to answer one question.

Note: Section 1 and Section 2 are to be answered in separate answer books.

Maximum 40 marks and 60 marks for Section 1 and Section 2 respectively.

EE19 502	LINEAR CONTROL SYSTEMS	3-1-0-4

Pre-Requisites: Signals and Systems

Course Objectives:

- To model electrical, mechanical and electromechanical systems, using differential equations, transfer functions, block diagrams, and state variables.
- To learn the block diagram reduction method and Mason's gain formula.
- To analyze type of Systems, dynamics of physical systems, classification of control system, analysis and design objective.
- To demonstrate their knowledge in time domain, frequency domain and stability analysis of systems using Root locus, bode plot, polar plot or Nyquist plot.
- Design of feedback controllers, such as PID, lead and lag compensators, pole placement designs, to meet desired system performance specifications.

Syllabus:

Module I: (10 hours)

Principle of Automatic control- Open loop and closed loop systems – examples
System modeling - modeling of electrical systems – dynamic equations using KCL & KVL of RL, RC and RLC circuits - Modeling of translational and rotational mechanical systems D'Alembert's principle- differential equations for mass, spring, dashpot elements - dynamic equations & transfer function for typical mechanical systems- Electromechanical systems - transfer function of armature controlled dc motor & field controlled dc motor.
Analogous systems - force-voltage & force-current analogy.

Module II: (11 hours)

Block diagrams: Development of block diagrams of Electrical and Electromechanical systems - block diagram reduction.
Signal flow graphs - Mason's gain formula.

Time domain analysis – continuous systems -standard test signals – transient and steady state response –first order systems - unit step responses of first order systems - second order systems - unit step response of under damped second order systems – time domain specifications.

Module III: (10 hours)

Error analysis: Steady state error - static position, velocity & acceleration error constants **Concept of stability** - stability & location of the poles in S-plane - Routh-Hurwitz stability criterion-Root Locus Method- Construction of root locus- Effect of poles and zeros and their location on the root locus.

Module IV: **(11 hours)**

Frequency Domain Analysis- Frequency Response representation- Polar Plot- Bode Plot- **Frequency Domain Specifications**- Minimum phase & Non-minimum Phase Systems- Nyquist Stability Criterion—Stability from Bode Plots- Relative Stability- Gain Margin and Phase Margin- M- N Circles (Concept only).

Module V: **(10 hours)**

Compensators & Controllers- Cascade Compensation - Lead, Lag and Lead- Lag compensator (Concept only)- Design of lead, lag and lead- lag compensators using frequency response and root locus methods. Transfer function of PI, PD and PID controllers.

Course Outcomes:

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

- Illustrate the specifications of the system using transfer function concept and formulate mathematical models for physical systems.
- Summarize time domain specifications of linear time control system.
- Analyze concept of stability in time domain by different methods.
- Describe the frequency domain analysis to explain the nature of stability of the system.
- Differentiate controllers and compensators to ascertain the required dynamic response from the system.

Text Books

1. Nagrath & Gopal, Control Systems Engineering, New Age International (P) Limited
2. Katsuhiko Ogata, Modem Control Engineering, PHI

Reference Books

1. Norman S. Nise, Control Systems Engineering, Wiley-India
2. K. Ogata, Discrete- Time Control Systems, Pearson Education
3. Kuo, Automatic Control Systems, PHI
4. Hasan Saeed, S. K. Kataria & Sons Automatic Control Systems With Matlab Programs
5. K.R. Varmah, Control systems, , McGraw hill
6. D. Roy Chowdhuri, Control System Engineering, PHI

Internal Continuous Assessment ***(Maximum Marks-50)***

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, Group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (***Maximum Total Marks: 100***)

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks
Two questions from each module with a choice to answer one question.

EE19 503	ELECTRICAL MACHINES II	3-1-0-4

Pre-requisites: Electrical Machines - I

Course Objectives:

- To give exposure to the students about the concepts of alternating current machines including the Constructional details, principle of operation and performance analysis.
- To learn the characteristics of synchronous machines and to learn how it can be employed for various applications.
- To impart knowledge on principles of design of synchronous machines.
- To study the design and estimation of electrical installations.

Syllabus:

Module I: **(12 hours)**

Synchronous machines- types-constructional details-types of armature windings- double layer - integral & fractional slot – lap – single layer – hemitropic, whole-coil & mush windings - (developed winding diagram for assignment only) - principle of operation - synchronous generators - EMF equation-winding factor- space and time harmonics - flux density distribution and their analysis – Armature reaction in 3-phase and 1-phase alternators - leakage reactance - synchronous reactance - phasor diagram under loaded condition - losses and efficiency- load characteristics.

Module II: **(11 hours)**

Voltage regulation of alternators- methods for finding regulation - emf, mmf, Potier methods-salient pole machines - two reaction theory – regulation by slip test- reluctance power - short circuit conditions-concept of transient and sub transient reactances.

Parallel operation of alternators- synchronising methods - two alternators in parallel – effect of change of fuel supply – effect of change of excitation- governor characteristics – load sharing - synchronising power- operation on infinite bus bars - torque angle - maximum power – power angle diagram – methods of excitation - automatic voltage regulators.

Module III: **(10 hours)**

Synchronous motors- principle of operation- operation on infinite bus bars - equivalent circuit- phasor diagrams- torque and power relations – effect of load changes on synchronous motor - constant excitation and constant power output circle diagram - V curves and inverted V curves for motor and generator operations - hunting and suppression - starting methods – synchronous condenser – losses and efficiency calculations-applications of synchronous motor.

Module IV: **(10 hours)**

3-phase induction motor – types – constructional features – principle of operation – slip – phasor diagram – equivalent circuit – expression for torque – torque-slip characteristics - effect of voltage variation and rotor resistance on torque slip characteristics –losses and efficiency– starting torque, maximum torque & full-load torque - no load and blocked rotor test - circle diagram – predetermination of characteristics from circle diagram – measurement of slip.

Starting – methods of starting – DOL starter – autotransformer starter – star-delta starter – rotor resistance starter – design of rotor resistance starter Improvement of starting torque

Module V: **(9 hours)**

Deep bar and double cage rotor – torque-slip characteristics - effects of space harmonics – cogging & crawling – single phasing Speed control – stator voltage control – stator frequency control – pole changing – rotor resistance control – injecting emf into rotor circuit.

1-phase induction motor – Principle - Double revolving field theory - equivalent circuit – analysis with equivalent circuit - types of 1-phase induction motors- Induction generator – principle of operation - self-excited & line-excited induction generators – applications.

Course Outcomes:

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

- Illustrate constructional details and working of Synchronous machines.
- Analyze voltage regulation, performance of alternators.
- Describe the principle of operation of synchronous motors and its applications.
- Describe 3 phase Induction Machines and appreciate their performance.
- Analyze the performance of Single phase Induction motor and Induction Generators.

Text Books

1. M.G. Say, Performance & Design of AC machines, Pitman ELBS
2. P.S. Bhimbra, Electrical Machinery, Khanna Publishers
3. A.K. Sawhney, A Course in Electrical Machine Design, Dhanpat Rai & Co

Reference Books

1. Fitzgerald A.E and Kingsley, Electrical Machinery, McGraw Hill
2. Langsdorf A S, Theory of A C Machinery, McGraw Hill
3. Nagrath I J and Kothari D P, Electric Machines,Tata Mc Graw Hill
4. Stephen J Chapman, Electric Machinery Fundamentals, McGraw Hill.
5. Vincent Del Toro, Electrical Machines and Power Systems, Prentice Hall
6. Charles Hubert, Electric Machines, Pearson Education
7. K. Murukesh Kumar, DC Machines and Transformers, Vikas Publishing House

Internal Continuous Assessment ***(Maximum Marks-50)***

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, Group discussions,quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (***Maximum Total Marks: 100***)

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question.

EE19 504	POWER SYSTEM I- GENERATION, TRANSMISSION & DISTRIBUTION	3-1-0-4

Pre-Requisites: Nil

Course Objectives:

- To set a foundation on the fundamental concepts of Power System Generation, Transmission, Distribution and Protection.
- To understand the various conventional and non- conventional energy sources.
- To develop an understanding about transmission and distribution systems.
- To evaluate the performance of transmission lines

Syllabus:

Module I: (10 hours)

Introduction: Typical layout of Power System Network: Generation of electrical energy – Sources of energy – Comparison of energy sources -Conventional & non-conventional sources of energy (basic concepts only)– Power Generating Plants – Thermal – Hydroelectric – Diesel –Gas – Nuclear power plants – Solar Power Utilization – Wind Mill power generation [Layout &description, Advantages and Disadvantages, Site selection] – Comparison of Power Plants.

Module II: (9 hours)

Load on Power Station & Economics of Generation: Types of Loads – Load Curve –Selection of Generating Units – Base Load – Peak Load – Load Duration Curve – Connected Load – Maximum Demand – Load Factor – Demand Factor – Diversity factor – Plant factor
Economics of Power Generation – Cost of Electrical Energy - Depreciation– Tariff – Types of Tariff –Power factor and its improvement methods, Economics of PF Improvement.

Module III: (12 hours)

Introduction of Overhead transmission
Conductors –Types of Conductors – Copper, Aluminum and ACSR conductors – Conductor for various systems of Transmission (Voltage Levels), Kelvin's law for economic choice of conductor - Choice of Transmission voltage, Insulators –Different Types – Voltage distribution in Suspension type insulators– Grading and string efficiency of suspension insulators.

Mechanical Characteristics of transmission lines– Types of Towers – Calculation of Sag and Tension – Supports at Equal and Unequal heights – Effect of Wind and Ice Loading -Corona – Disruptive Critical Voltage –Visual Critical Voltage –Power Loss due to Corona –Factors affecting Corona – Effects of Corona.

Module IV: (11 hours)

Distribution systems: Classification and Arrangement of Distribution Systems –Voltage drop Calculations in radial and Ring Mains – Comparison of Different Systems - DC, AC - Single phase – Three phase 3 wire, 4 wire systems

Underground cables: Construction – Different types – Insulation Resistance – Capacitance of Single Core Cables & Three Core Cables– Grading of Cables – Sheath Effects.

Module V: **(10 hours)**

Performance of Transmission Lines: Calculation of Transmission line Resistance, Inductance and Capacitance –GMD and GMR – Transposition – Representation of Short, Medium and Long lines – ABCD Constants, Effect of Capacitance: Nominal T and π methods of calculations, rigorous solution of long lines, Ferranti effect, Surge impedance and Surge impedance loading.

Course Outcomes:

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

- Illustrate the basic aspects in the area of power generation based on conventional and nonconventional energy sources.
- Describe power factor correction equipment, Economics of Power Generation.
- Analyze mechanical and electrical design aspects of transmission systems in terms of the various insulators, conductors, towers, sag, underground cables etc.
- Differentiate distribution systems and its design.
- Classify the design and analysis of line parameters in power transmission.

Text books:

1. V K Mehta, Electric Power Systems, S Chand & Sons
2. Soni, Gupta, Bhatnagar, A Course in Electrical Power, DhanpatRai& Sons
3. D P Kothari and I Nagrath, "Power System Engineering," 2/e Tata McGraw Hills, 2008
4. S N Singh, Electric Power Generation, Transmission and Distribution, PHI

References:

1. C L Wadhwa, Electric Power Systems, Wiley Eastern Ltd
2. B R Gupta, Power System Analysis and Design, Wheeler Publishing Company, New Delhi.

Internal Continuous Assessment ***(Maximum Marks-50)***

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, Group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (***Maximum Total Marks: 100***)

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREEquestions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question.

EE19 505	MICROPROCESSORS	3-1-0-3

Pre-requisites: Digital Electronics and Logic Circuits

Course Objectives:

- To provide a strong foundation about the principles, programming and various applications of different microprocessors and microcontrollers.
- To learn to program a processor using assembly language and learn the configuring and using different peripherals in a digital system.

Syllabus:

Module I: (10 hours)

Architecture of Intel 8086 processor – Pin description – Internal Operation – Memory Decoding– 8086 configurations: Minimum mode and Maximum mode - Instruction execution – system bus timing - Timing diagrams – Interrupts : Interrupt mechanism – Types and priority – Interrupt vector table – Software interrupts – Non maskable interrupts. Direct memory access

Module II: (9 hours)

8086 Addressing modes – Instruction set – Data transfer Instructions – String Instructions – Logical Instructions – Arithmetic Instructions – transfer control Instructions – Processor control instructions and simple programs.

Module III: (10 hours)

Basic Concepts of modular programming – Assembler directives – Memory organization – full segments and models – Macros- Simple assembly language programs

Introduction to Pentium microprocessor – Special features - Pentium registers – Pentium memory management

Module IV: (12 hours)

Serial Communication Interfaces – Asynchronous communication – Synchronous communication – Programmable communication Interface (8251) – Interfacing programs –Programmable interval timer 8254 – Operating modes – Interfacing and Programming Intel 8254 – Interval timer application A/D interfacing. DMA Controller – Organization of Intel 8237 – Different modes of operation. Interrupt Controller - Organization of programmable interrupt controller 8259. Keyboard and Display interface – keyboard display controller – Internal block diagram of 8279. Interfacing of matrix keyboard, seven segment LED display using 8279 – Interfacing programs for key board and LED display.

Module V: **(11 hours)**

Overview of 8051 microcontrollers – Architecture – Assembly programming –data types and directives –flag bits – register banks and stack – loop and Jump instructions – call instructions – Arithmetic and Logic instructions and simple programs – 8051 interrupts – programming timer interrupts. Interfacing of microcontroller- Stepper motor control.

Course Outcomes:

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

- Learn 8086 processor architecture.
- Describe the fundamentals of assembly level programming in microprocessors and microcontrollers.
- Illustrate hardware architecture and memory organization of 8086 and 8051.
- Analyze standard microprocessor real time interfaces.
- Design microprocessors/microcontrollers-based systems.

Text Books

1. Ramesh Gaonkar, Microprocessor, Architecture, Programming and Applications, Penram International Publishing; Sixth edition, 2014.
2. Walter A.Triebel, Avathar Singh, The 8088 and 8086 Microprocessors Programming, interfacing Software and Hardware Applications, Pearson Education 2008
3. Douglas V. Hall, Microprocessors and Interfacing, Tata McGraw Hill, Education, New Delhi, Third Edition.
4. Rafiquzzaman, Microprocessor Theory and Application, PHI Learning, First Edition.
5. Ray Ajoy and Burchandi, Advanced Microprocessor & Peripherals, Tata McGraw Hill, Education, New Delhi, Second Edition.
6. Mohamed Ali Mazidi,Janice Gillispie Mazidi," The 8051 microcontroller and embedded systems using Assembly and C",second edition, Pearson education /Prentice hall of India
7. Scott MacKenzie, Raphael C W Phan, " The 8051 Microcontroller", Fourth Edition, Pearson education.

Reference Books

1. John Uffenbeck, The 8086 / 8088 Family Design, Programming and Interfacing, Prentice Hall of India, 2002
2. Brey B.B., The Intel Microprocessor system – Architecture, programming and Interfacing
3. Hall D.V. , Microprocessor and Interfacing , Tata McGraw Hill
4. Mohamed Ali Mazidi, Janice Gillispie Mazidi, The 8051 Microcontroller and Embedded systems, Pearson Education 2007. (Module IV- Interfacing)
5. Dr. K. Uma Rao, Dr. Andhe Pallavi, The 8051 Microcontroller, Sanguine Technical Publishers
6. Mathur, Microprocessor 8086, Architecture, Programming & Interfacing, PHI.

Internal Continuous Assessment ***(Maximum Marks-50)***

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, Group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (***Maximum Total Marks: 100***)

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question.

EE19 506 (A)	COMPUTING AND PROBLEM SOLVING	3-1-0-3

Pre-Requisites: Nil

Course Objectives:

- To impart the basic concepts of computer and information technology.
- To develop skill in problem solving concepts through learning C programming in practical approach.

Syllabus:

Module I: **(8 hours)**

Introduction to Computers- CPU, Memory, input-output devices, secondary storage devices, Processor Concepts – Machine language, assembly language, and high level language. Inside a PC, Latest trends and technologies of storage, memory, processor, printing etc. Concept of Program and data, System software – BIOS, Operating System- Definition-Functions-Windows, and Linux. Compilers and assemblers, Computer networks, LAN, WiFi.

Module II: **(11 hours)**

Introduction to C language - Basic elements of C- Flowchart and algorithm – Development of algorithms for simple problems. Structure of C program – Preprocessor directives- Header files- Library functions-Operators and expressions – Procedure and order of evaluation – Input and Output functions. While, do-while and for statements, if, if-else, switch, break, Programming examples.

Module III: **(11 hours)**

Arrays and functions strings- Introduction to Arrays-Declaration, Initialization – One dimensional array –Defining and processing arrays and strings - two dimensional and multidimensional arrays – application of arrays.

Functions- Declaring, defining, and accessing functions – parameter passing methods – passing arrays to functions -Recursion – Storage classes – extern, auto, register and static- Programming examples.

Module IV: **(9 hours)**

Structures- Declaration, definition and initialization of structures - union.

Pointers- Concepts, declaration -initialization of pointer variables, Pointer Expressions, Pointer Increments and Scale Factor -simple examples.

Module V: **(11 hours)**

Introduction to python – Data types (Mutable and immutable), variables, basic operators, conditional statements, looping, Functions- Function definition and call , Types of functions, Programming examples.

Course Outcomes:

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

- Describe different hardware, software and languages in computer systems.
- Implement algorithms using efficient C programming techniques
- Design and implement applications using arrays and functions.
- Write readable C programs which use pointers for array processing and parameter passing.
- Develop and implement applications in python using basic constructs

Text Books:

1. P. Norton, Peter Norton’s Introduction to Computers, Tata McGraw Hill, New Delhi.
2. E. Balaguruswamy, Programming in ANSI C, 3rd ed., Tata McGraw Hill, New Delhi, 2004.
3. Rajaraman V , Computer basics programming in C, PHI.
4. Lambert K A., Fundamentals of Python- First Programs, Cengage Learning India, 2015.

Reference Books:

1. B. Gottfried, Programming with C, 2nd ed, Tata McGraw Hill, New Delhi, 2006
2. B. W. Kernighan, and D. M. Ritchie, The C Programming Language, Prentice Hall of India, New Delhi, 1988
3. K. N. King. C Programming: A Modern Approach, 2nd ed., W. W. Norton & Company, 2008
4. Downey. A. et al., How to think like a Computer Scientist: Learning with Python, John Wiley, 2015
5. S. Kochan, Programming in C, CBS publishers & distributors
6. M. Meyer, R. Baber, B. Pfaffenberger, Computers in Your Future, 3rd ed., Pearson Education India

Internal Continuous Assessment ***(Maximum Marks-50)***

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving,
Group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern **(*Maximum Total Marks: 100*)**

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks
Two questions from each module with a choice to answer one question.

EE19 506 (B)	INSTRUMENTATION SYSTEMS	3-1-0-3

Pre-Requisites: Electrical Measurements & Instrumentation Systems

Course Objectives:

- Understanding the basic working principle of electrical Instrumentation systems
- To select appropriate instruments for application
- Develop an instrumentation system for a particular application

Syllabus:

Module I: (10 hours)

General measurement systems: specifications of instruments, their static and dynamic Characteristics. Active and passive transducers and their classification.

Transducers: Resistance type - potentiometer, strain gauge; Inductive type – LVDT, RVDT Sensing elements: Temperature sensing elements – RTD, thermistor, thermocouple, semiconductor IC sensors; Pressure sensing elements – manometers, elastic elements, Bourdon tube, diaphragm, bellows.

Module II: (10 hours)

Electrical type - McLeod gauge, Pirani gauge; Flow sensing transducers. Velocity measurement. Electromagnetic flow meter, Coriolis flow meter, Ultrasonic flow meter; capacitive sensors. Photoconductive sensors – Capacitive sensors- Variable area – Variable distance – Variable dielectric type sensors. Analytical sensors – pH measurement. Hall effect transducer.

Module III: (10 hours)

Feedback transducer systems, data display and recording systems: Self balancing systems, servo operated system, data- loggers, analog and digital data acquisition systems, Analog and magnetic tape recorders, digital input-output devices. MEMS- principle of operation, materials, basic process, manufacturing technology.

Module IV: (10 hours)

Telemetry- Data transmission – methods of data transmission, current, voltage, and position telemetry systems.

Modulation techniques: FM, AM, ASK, FSK, Time division and frequency division multiplexing, applications, signal isolation techniques (MCT2E). Digital methods of frequency, phase and time period measurements.

Module V: (10 hours)

Optical instruments - Eye, telescopes, microscopes, photographic lenses, optical projection systems, cameras, Abbe's refractometer, monochromatic. Thermal detectors and Quantum detectors, bolo meter, Photodiodes- PIN and avalanche photodiodes, phototransistors, photo multipliers, IR detectors. CCD devices – principle and operation.

Course Outcome:

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

- Classify various types of transducers.
- Summarize the concepts of modulation techniques.
- Explain the operation of different optical instruments.
- Differentiate the controller like electronic, pneumatic and hydraulic.
- Implement different control schemes to various processes.

Text Books

1. A.K. Sawhney, A Course in Electrical and Electronics Measurements and Instrumentation, Dhanpat Rai and sons.
2. D. V. S. Murty, Transducers and Instrumentation, PHI, New Delhi, 2003.
3. E.O. Doebelin, Measurement Systems Application and Design, McGraw Hill, 4th Edition, 1990
4. Arun K Ghosh, Introduction to Measurements and Instrumentation, PHI
5. Ramakant Gaikwad, Operational Amplifiers, PHI

Reference Books :

1. William David Cooper, Electronic Instrumentation and Measurement Techniques, Prentice Hall, India
2. K.B. Klaassan, Electronic Measurements and Instrumentation, Cambridge University Press
3. GK. Banerjee, Electrical and Electronic Measurements, , PHI
4. John Bentley, Principles of Measurements Systems, Pearson Education
5. Patranabis, Principles of Electronic Instrumentation, PHI

Internal Continuous Assessment ***(Maximum Marks-50)***

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving,
Group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (***Maximum Total Marks: 100***)

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks
Two questions from each module with a choice to answer one question.

EE19 506 (C)	COMPUTER ORGANIZATION AND ARCHITECTURE	3-1-0-3

Pre-requisites: Nil

Course Objectives:

- To impart an understanding of the internal organization and operations of a computer.
- To introduce the concepts of processor logic design and control logic design.
- To develop understanding on I/O accessing techniques and memory structures.
- To impart a knowledge about the design of various units of processor.
- To understand the different types of instructions used in design of control logic

Syllabus:

Module I: **(9 hours)**

Basic Structure of computers–functional units – basic operational concepts –bus structures – software. Memory locations and addresses – memory operations – instructions and instruction sequencing – addressing modes – ARM Example (programs not required). Basic I/O operations – stacks subroutine calls.

Module II: **(10 hours)**

Basic processing unit – fundamental concepts – instruction cycle - execution of a complete instruction –multiple- bus organization – sequencing of control signals. Arithmetic algorithms: Algorithms for multiplication and division of binary and BCD numbers — array multiplier— Booth's multiplication algorithm — restoring and non-restoring division — algorithms for floating point, multiplication and division.

Module III: **(11 hours)**

I/O organization: accessing of I/O devices – interrupts –direct memory access –buses –interface circuits –standard I/O interfaces (PCI, SCSI, USB). Memory system: basic concepts –semiconductor RAMs –memory system considerations – semiconductor ROMs –flash memory –cache memory and mapping functions.

Module IV: **(10 hours)**

Processor Logic Design: Register transfer logic – inter register transfer – arithmetic, logic and shift micro operations –conditional control statements. Processor organization:–design of arithmetic unit, logic unit, arithmetic logic unit and shifter –status register –processor unit –design of accumulator.

Module V: **(10 hours)**

Control Logic Design: Control organization – design of hardwired control –control of processor unit –PLA control. Micro-programmed control: Microinstructions –horizontal and vertical micro instructions – micro-program sequencer –micro programmed CPU organization.

Course Outcomes:

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

- Identify the basic structure and functional units of a digital computer.
- Analyze the effect of addressing modes on the execution time of a program.
- Design processing unit using the concepts of ALU and control logic design.
- Summarize the pros and cons of different types of control logic design in processors.
- Differentiate appropriate interfacing standards for I/O devices.

Text Books:

1. Hamacher C., Z. Vranesic and S. Zaky, Computer Organization ,5/e, McGraw Hill, 2011.

2. Mano M. M., Digital Logic & Computer Design, 4/e, Pearson Education, 2013.

Reference Books:

1. Patterson D.A. and J. L. Hennessey, Computer Organization and Design, 5/e, Morgan Kaufmann Publishers, 2013.

2. William Stallings, Computer Organization and Architecture: Designing for Performance, Pearson, 9/e, 2013.

3. Chaudhuri P., Computer Organization and Design, 2/e, Prentice Hall, 2008.

4. Rajaraman V. and T. Radhakrishnan, Computer Organization and Architecture, Prentice Hall, 2011.

5. Messmer H. P., The Indispensable PC Hardware Book, 4/e, Addison-Wesley, 2001

Internal Continuous Assessment ***(Maximum Marks-50)***

70%	-	Tests (minimum 2)
20%	-	Assignments (minimum 2) such as homework, problem solving, Group discussions, quiz, literature survey, seminar, term-project etc.
10%	-	Attendance and Regularity in the class.

University Examination Pattern (***Maximum Total Marks: 100***)

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks
Two questions from each module with a choice to answer one question.

EE19 506 (D)	ELECTRICAL MATERIAL SCIENCE	3-1-0-3

Pre-requisites: Nil

Course Objectives:

- Understanding the properties of various materials used in electrical engineering
- To learn how to select proper material for a particular application.

Syllabus:

Module I: **(10 hours)**

Conducting materials: Principles of Metallic conduction (free electron theory) – Fermi-Dirac distribution. Materials for resistances - (resistor, rheostat, thermostats), brushes of electrical machines, lamp filaments, fuses and solders.
Magnetic materials: Classification of magnetic materials – Ferromagnetism – behaviour below curie temperature – spontaneous magnetization and Weiss theory of ferromagnetism – Ferromagnetic materials at high temperatures, Curie- Weiss law (no derivation required) – Hard and Soft magnetic materials and applications – Ferrites – magnetic materials used in electrical machines, instruments and relays.

Module II: **(10 hours)**

Dielectric parameters: Dielectric constant, dipole moment, polarization, polarisability, dielectric strength, homogeneity, linearity, isotropy. Dielectric polarization under static fields – derivation for Electronic, Ionic and Dipolar polarization – Internal fields in solids and liquids. **Types of dielectric materials and their static dielectric constants**: Elemental solid dielectrics, ionic – non polar solid dielectrics, polar solids. The Clausius – Mosotti Equation (Assumptions included) – Ferroelectric materials and their properties – spontaneous polarization, classification, application, ferroelectric domains (Qualitative explanations only)

Module III: **(10 hours)**

Dielectric breakdown: Mechanism of breakdown in gases – growth of current , electric discharge , factors affecting dielectric strength, field – intensified ionization by electrons ,avalanche mechanism , electron ionization coefficient, secondary ionization coefficient , Townsend's criterion for spark breakdown, Streamer Mechanism

Breakdown in liquids: Suspended particle theory, colloidal theory, bubble theory, breakdown due to liquid globules, electronic theory.

Module IV: **(10 hours)**

Breakdown in solids: Thermal, discharge, tracking. Insulating materials: Good insulator properties and classification on temperature basis – common insulator materials used in electrical apparatus – Inorganic materials(Mica , glass , porcelain ,asbestos) – Organic materials (paper, rubber ,cotton silk fiber ,wood ,plastics , Bakelite) – Liquid insulators (transformer oil) – Gaseous insulators (air , SF_6 and hydrogen) – ageing of insulators.

Module V: **(10 hours)**

Solar energy and Materials: Solar radiation, spectrum, UV, VIS, IR Solar constant, optical response of materials, optical band gap. Photo thermal conversion – use of coatings for enhanced solar thermal energy collection – Solar selective coatings – Cold mirror coatings – Heat mirror coatings – Anti reflection coatings- Photovoltaic conversion – Solar cells –Silicon Cadmium sulphide and Gallium arsenide- Planner PN Junction. I-V curve of dark and illuminated junction. Solar cell parameters.

Course Outcomes:

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

- Describe the characteristics of conducting materials, magnetic materials and different laws related to them.
- Classify dielectrics, its various parameters and the process of polarization.
- Explain the mechanisms of breakdown in liquids and gases.
- Identify and describe different types of solid, liquid and gaseous insulators.
- Summarize Solar energy materials

Text Books:

1. Indulkar CS and Thiruvengadam S, An Introduction to Electrical Engineering Materials, S.Chand& Co.
2. N.P. Singh and Kotalana, Essentials of solar cells
3. G.N. Tiwari, Solar Energy, Narosa Publication
4. Seth S. P. & Gupta P. V., A Course in Electrical Engineering Materials, Dhanpath Rai& Sons.

Reference Books:

1. A. J. Dekker, Electrical Engineering Materials, Prentice Hall of India
2. Agnihotri O. P. and Gupta B. K., Solar Selective Surfaces, John wiley.
3. Terrey, Electrical Engineering Materials, Mir Publishers.
4. Arumugham M., Material Science, Anuradha Agencies.

Internal Continuous Assessment ***(Maximum Marks-50)***

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, Group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (***Maximum Total Marks: 100***)

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question.

EE19 506 (E)	OBJECT ORIENTED PROGRAMMING	3-1-0-3

Pre-requisites: Nil

Course Objectives:

- To familiarize the concept of Object Oriented Programming.
- To give a fair idea about Programming In Java and its use as an Application development tool

Syllabus:

Module I: (10 hours)

Fundamentals of Procedural Languages-Why Do We Need Object-Oriented Programming? - Procedural Languages - The Object-Oriented Approach - Characteristics of Object-Oriented Languages.

Introduction to Java: Basics of Java programming, Data types, Variables, Operators, Arrays in java, Control structures including selection, looping.

Module II: (10 hours)

Review of Object Oriented Concepts – Objects and classes in Java –defining classes – methods – access specifiers – static methods– constructors –overloading - finalize method – packages- Strings– Java Doc comments, Dealing with Errors, Catching Exceptions, Debugging Techniques, Using a Debugger.

Module III: (10 hours)

Inheritance – class hierarchy – polymorphism – dynamic binding – final keyword – abstract classes – the Object class – Reflection – interfaces –object cloning – inner classes-Streams and Files –Use of Streams, Object Streams, File Management.

Module IV: (10 hours)

Multi-threaded programming– Thread properties – Creating a thread –Interrupting threads –Thread priority- thread synchronization – Synchronized method –Inter thread communication.

Applet Basics-The Applet HTML Tags and Attributes, Multimedia, The Applet Context, JAR Files.

Module V: (10 hours)

Database Programming –The Design of JDBC, The Structured Query Language, JDBC Installation, Basic JDBC Programming Concepts, Query Execution, Metadata, Scrollable and Updatable Result Sets, Row Sets, Transactions, Advanced Connection Management.

Course Outcomes:

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

- Demonstrate the basic principles of object-oriented programming and get a concise understanding of basics of Java.
- Study the concepts of objects and classes, strings, packages and several debugging techniques to solve various computing problems using Java.
- Apply various object oriented features like Inheritance, polymorphism, dynamic binding and file management.
- Illustrate multithreaded programming, object streams, Inter thread communication and applet basics.
- Demonstrate an introductory understanding of database programming, design and basic JDBC programming concepts

Text Books:

1. Barbara Liskov and John Guttag, Program Development in Java, Addison-Wesley Professional, 1st edition.

2. Grady Booch, Robert Maksimchuk, Michael Engle and Jim Conallen, object-Oriented Analysis and Design with Applications, 3 rd Ed, Kindle Edition.

3. Cay S. Horstmann and Gary Cornell, Core Java: Volume I & II– Fundamentals, 8th Ed, Pearson Education.

4. Herbert Schildt , The Complete Reference Java2, 8th Edition, Tata McGraw Hill

Reference Books:

1. Bruce Eckel, Thinking in java, 4 th Ed, Pearson.

2. K. Arnold and J. Gosling, The JAVA programming language, 4 th Ed,Pearson Education.

3. Timothy Budd, "Understanding Object-oriented programming with Java", 1st Ed,Pearson Education.

4. Doug Lea, Concurrent programming in Java Design Principles and Patterns,2nd Ed,Pearson Education.

5. George Reese, " Database programming, with JDBC and Java",, 2nd Ed, O'Reilly Media Inc.

6. Mahesh P. Matha-Core Java, A Comprehensive Study, 1st Ed,PHI Learning-2011.

Internal Continuous Assessment ***(Maximum Marks-50)***

70%	-	Tests (minimum 2)
20%	-	Assignments (minimum 2) such as homework, problem solving, Group discussions, quiz, literature survey, seminar, term-project etc.
10%	-	Attendance and Regularity in the class.

University Examination Pattern (***Maximum Total Marks: 100***)

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks
Two questions from each module with a choice to answer one question.

EE19 506 (F)	ANALOG AND DIGITAL COMMUNICATION	3-1-0-3

Pre-requisites: Nil

Course Objectives:

- To understand the basic concepts of analog and digital modulation schemes.
- To impart knowledge on various probability concepts for modeling communication systems.
- To understand the basic working of computer networks, mobile communication and power line carrier communication.

Syllabus:

Module I: **(10 hours)**

Introduction to Communication Systems: Elements of communication systems. Analog and Digital.

Modulation: Need for modulation, types, Amplitude Modulation: Spectrum of amplitude modulated signal-power relations-AM generation and detection- DSB SC generation and detection-SSB SC generation and detection-VSB modulation-AM transmitter and receiver- TRF and super heterodyne receivers.

Module II: **(10 hours)**

Exponential continuous wave modulation - Signals and Spectra of FM & PM - Narrow band and wide band FM, Transmission bandwidth, Generation and Detection of FM and PM - De-emphasis and Pre-emphasis, Noise in FM reception, Capture effect.

Module III: **(10 hours)**

Probability and Sample Space - Random Variables and Probability Functions - Statistical Averages - Probability Models - Random Processes – stationarity - wide sense stationarity- time averages, ergodicity. Wiener - Khintchine-Einstein theorem-response of LTI system to random process, properties of Gaussian Random process, Power Spectrum -Noise - Different types, white noise

Module IV: **(10 hours)**

Analog pulse modulation scheme: Sampling theorem for bandpass signals-PAM-generation and demodulation, PWM-PPM generation and demodulation.

Digital pulse modulation scheme: PCM-DPCM and delta modulation, adaptive delta modulation. Digital pass band transmission: Principles of ASK, FSK and PSK (qualitative level) . Matched filter receiver and correlation receiver- ISI.

Module V: **(10 hours)**

Power line carrier Communication: Principle, purpose, types of coupling, interface equipment and communication standards. Power line modems and networks, Digital PLCC, broadband over power line, Applications.

Multiple Access: TDMA-FDMA-CDMA-Frequency hopped and direct sequence CDMA. Multiuser detection in CDMA. Cellular Concept- frequency reuse, cochannel interference-adjacent channel interference- improving capacity- cell splitting and sectoring-handoff strategies. Computer network:- circuit switching- packet switching –basic concept of OSI Model.

Course Outcomes:

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

- Summarize basic elements of communication systems and the significance of modulation in communication systems.
- Differentiate between the generation and detection methods for different types of modulation schemes
- Demonstrate analog and digital pulse modulation techniques
- Describe about random process and its application in communication system
- Classify communication technologies applied in Mobile communication, power line carrier communication and computer networks

Text Books:

1. Simon Haykin, Communication Systems, Wiley India, New Delhi,4th Ed., 2008
2. B.P. Lathi, Modern Digital & Analog Communication Systems, 3rd Ed., Oxford
3. University press
4. N.N.Biswas, Power Line Communication, Asia Publishing House
5. Rappaport T.S, Wireless Communications, Principles and Practice, PHI
6. Haykin, An Introduction to Analog & Digital Communication, Wiley-India

Reference Books:

1. Sanjay Sharma, Communication Systems:Analog and Digital
2. Dr. JS Chitode, Analog and Digital Communication
3. Sam Shanmugam, Digital and Analog Communication Systems; Wiley Student Edition McGraw Hill, New Delhi, 2003
4. Simon Haykin, Digital Communication, Wiley India

Internal Continuous Assessment ***(Maximum Marks-50)***

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving,
Group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (***Maximum Total Marks: 100***)

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question.

EE19 507(P)	ELECTRICAL MACHINES LAB - I	0-0-3-1

Pre-requisites: Electrical Machines - I

Course Objectives:

- To conduct various tests on dc machines and transformers and to study the performance characteristics.
- To conduct various tests on dc machines to find out efficiency.
- To conduct test on single phase transformer for separation of losses.
- To verify different tests on dc machines and transformer.

Syllabus:

List of Experiments

(A minimum of 10 experiments must be conducted)

1. Obtain the open circuit characteristics of self-excited DC shunt generator at rated speed
   a) Predetermine the OCC at different speeds
   b) Determine the critical field resistance
   c) Obtain maximum voltage built up with given shunt field resistance
   d) Obtain critical speed for a given shunt field resistance
2. Load test on DC shunt generator
   a) Determine the external & internal characteristics
   b) Deduce the armature reaction curve
3. Brake test on DC shunt / series motor
   Plot the following characteristics
      i) Efficiency Vs Output
      ii) Line current Vs Output
      iii) Speed Vs Output
      iv) Speed Vs Torque
      v) Line current Vs Torque
4. Perform Swinburne's test on a DC shunt machine
   Predetermine the armature current and percentage efficiency when the machine operates as a motor and as a generator for various load conditions and plot efficiency Vs output curves.

5. Hopkinson's test on a pair of DC machines

Determination of the efficiency of the given dc shunts machines working as a motor and generator under various load conditions.

6. Retardation test on a DC machine

a) Separation of hysteresis, eddy current, friction & windage losses

b) Find the moment of inertia of the rotating system

7. No load test at different excitations on a DC shunt motor

a) Separation of hysteresis, eddy current, friction & windage losses

b) Plot the losses vs. speed curves

8. O.C. & S.C. tests on the single phase transformer

Predetermination of the following:

a) Efficiency at different load conditions and different power factors

b) Regulation at different load conditions and different power factors

c) Equivalent circuit referred to HV and LV sides

d) UPF load at which efficiency is maximum

f) Power factors at which regulation is maximum and zero

g) Plot % regulation vs. p.f. curves

9. Load test on the single phase transformer

a) Determination of the efficiency at different load conditions and unity power factor

b) Determination of the regulation at different load conditions and unity power factor

c) Plot efficient vs. output & regulation Vs output curves

10. Separation of losses in a single phase transformer

Separate the hysteresis & eddy current losses at different voltages & different frequencies keeping V/f constant & plot losses vs. frequency curves. Hence

i) Separate the hysteresis & eddy current losses at normal voltage & different frequencies & Plot losses vs. frequency curves.

ii) Separate the hysteresis & eddy current losses at normal frequency & different voltages & Plot losses vs. voltage curves.

11. Sumpner's test

a) Predetermination of efficiency at different load conditions and power factors

b) Predetermination of regulation at different load conditions and power factors

c) Plot efficiency vs output & regulation vs. power factor curves

d) Obtain the equivalent circuit referred to LV & HV sides

12. Scott connection of the single phase transformers

Determine the efficiency at different load conditions when

a) Main transformer alone loaded

b) Teaser transformer along loaded

c) Both transformers loaded under balanced conditions

d) Both transformers loaded under unbalanced conditions

e) Plot efficiency vs. output curves for each case.

Course outcomes:

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

- Determine various parameters of DC machines
- Test efficiency and regulation of Transformer
- Predetermine efficiency and regulation of Transformer
- Plot different characteristics of DC machines
- Evaluate separation of losses in DC machines and single phase transformer

Internal Continuous Assessment ***(Maximum Marks-50)***

60% - Laboratory practical, record and viva voce

30% - Tests

10% - Regularity in the class

Semester End Examination ***(Maximum Marks-100)***

70% - Procedure, conducting experiment, result, tabulation, and inference

20% - Viva voce

10% - Fair record

EE19 508(P)	DIGITAL ELECTRONICS LAB	0-0-3-1

Pre-requisites: Digital Electronics and Logic Circuits

Course Objectives:

- To provide experience on design, testing, and analysis of digital electronic circuits

Syllabus:

List Of Experiments

(A minimum of 10 experiments must be conducted)

1. Verification & Realisation of De Morgan’s theorem.
2. Realisation of SOP & POS functions after K-map reduction.
3. Half adder & Full adder using gates.
4. 4-bit adder/subtractor & BCD adder using IC 7483.
5. Realisation of 2-bit comparator using gates and study of four-bit comparator IC 7485.
6. BCD to decimal decoder and BCD to 7-segment decoder & display.
7. Study of multiplexer IC and realization of combinational circuits using multiplexers.
8. Realization of RS, T, D & JK flip flops using gates.
9. Study of flip flop ICs (7474 & 7476).
10. Realization of ripple up and down counters and modulo-N counters using flip-flops.
11. Study of counter ICs (7490, 7493).
12. Design of synchronous up, down & modulo-N counters.
13. Realization of 4-bit serial IN serial OUT registers using flip flops.
14. Study of shift register IC 7495, ring counter and Johnson's counter.

Course Outcomes:

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

- Realize digital functions using Boolean Algebra and verify experimentally
- Design and implement combinational logic circuits.
- Design and implement sequential logic circuits
- Design and fabricate a digital circuit using the knowledge acquired from the laboratory.
- Design, simulate and realize various electronic systems.

Internal Continuous Assessment ***(Maximum Marks-50)***

60%	-	Laboratory practical, record and viva voce
30%	-	Tests
10%	-	Regularity in the class

Semester End Examination ***(Maximum Marks-100)***

70%	-	Procedure, conducting experiment, result, tabulation, and inference
20%	-	Viva voce
10%	-	Fair record

SEMESTER - 6

EE19 601	POWER SYSTEM ANALYSIS	3-1-0-4

Pre-requisites: Power System I- Generation, Transmission & Distribution

Course Objectives:

- To analyze power systems under normal and abnormal conditions.
- To understand power system modeling

Syllabus:

Module I: (10 hours)

Representation of power systems: one line diagrams, impedance and reactance diagrams, per unit quantities- single phase and three phase-selection of base quantities -advantages of per unit system – changing the base of per unit quantities , primitive networks, Y-bus matrix formulation by singular transformation and Direct determination, Z-bus matrices – Building algorithm.

Module II: (10 hours)

Load flow studies: Introduction- problem formulation, classification of buses, Gauss –Seidal method, Newton- Raphson method and fast decoupled load flow method.

Module III: (10 hours)

Economic load dispatch: system constraints, economic dispatch of thermal plants neglecting line losses, optimum load dispatch including transmission line losses,

Speed governing mechanism: speed governing of turbo generator, load sharing and governor characteristics, transfer function model of single area system, Load Frequency Control, Automatic Voltage Regulation, AGC (Basic concepts only).

Module IV: (12 hours)

Short circuit studies : Faults on power systems , three phase to ground faults, SLG , DLG , LL faults, Sequence impedance and sequence networks, symmetrical component methods of analysis of unsymmetrical faults at the terminals of an unloaded generator, fault analysis using Z-bus, faults through impedance , short circuit capacity of a bus and circuit breaker rating.

Module V: (10 hours)

Power system stability studies: steady state, transient and dynamic stability, electrical stiffness, Swing equation, inertia constant, equal area criterion, Step by step method of solution of swing equation , factors affecting stability- Voltage stability problem, causes and improvement methods.

Course Outcomes:

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

- Analyze power systems under normal and abnormal conditions.
- Demonstrate the need for load flow analysis and different methods.
- Illustrate power system modeling.
- Classify faults in the power system.
- Describe the power system stability.

Text Books:

1. Stevenson Jr., *Elements of Power System Analysis*, TMH
2. I J Nagrath& D P Kothari, *Modern Power System Analysis*, TMH
3. C L Wadhwa, *Electric Power Systems*, New-Age International
4. J Wood, B F Woolenberg, *Power Generation, Operation and Control*, Wiley India
5. C W Taylor, *Power System Voltage Stability*, McGraw Hill Inc

Reference Books:

1. S SWadhera , *Power System Analysis and Stability*, Khanna Publishers
2. O I Elgerd, *Electric Energy System Theory- An introduction*, TMH
3. B R Gupta, *Power System Analysis and Design*, Wheeler publishing Company, New Delhi
4. Arthur R Bergen, Vijay Vittal, *Power System Analysis*, Pearson
5. Chakravarti & Halder, *Power System Analysis, Operation & Control*, PHI

Internal Continuous Assessment ***(Maximum Marks-50)***

70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving,
Group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern **(*Maximum Total Marks: 100*)**

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question.

EE19 602	MODERN CONTROL THEORY	3-1-0-4

Pre-requisites: Linear Control Systems

Course Objectives:

- To give an overview of system analysis and design based on state space techniques for linear and non- linear systems.
- To make students understand the concept of Internal Model Control and Optimal Control.
- To Study the stability of Non Linear and Linear systems.

Syllabus:

Module I: (12 hours)

State Space Analysis: Concept of State, state variables, state vector and state space – comparison with transfer function approach- state models for typical electrical, mechanical and electro-mechanical systems - state space representation of linear time- invariant systems- phase variable form- Diagonalisation - Diagonal and Jordan canonical forms- Transfer function from state model- Transfer function Decomposition- state diagrams- solution of time invariant state equation- Zero state and Zero input response- State transition matrix- properties-Discrete time state model.

Module II: (12 hours)

Nonlinear Systems: Introduction- Characteristics of non- linear systems- Types of nonlinearities- Phase plane analysis- Construction of phase trajectory - Isocline method- Singular points- Classification of singular points. Describing function Analysis- Basics of Describing function approach- Definition- Describing functions of common non- linearities namely dead zone, saturation, ideal relay, combined deadzone and saturation, relay with hysteresis- Application of describing function for the stability analysis- Amplitude and frequency of limit cycle using DF.

Module III: (10 hours)

Liapunov Methods: Liapunov Stability- Definition of stability, Asymptotic stability and instability- Quadratic forms and sign definiteness of scalar function- Liapunov stability theorems- Liapunov stability analysis of LTI continuous and discrete time systems.

Methods of construction of Liapunov function for non- linear systems: Krasovskii's method and variable gradient method.

Module IV: (8 hours)

Controllability and Observability: Concept and criteria for controllability and observability. Transfer function and controllability/ observability -State Feedback- Design for continuous systems via pole placement.

Module V: (10 hours)

Introduction to optimal control: Formulation of the optimal control problem- Typical optimal control performance measures- Parameter optimization based on the second method of Liapunov- Optimal control based on Quadratic performance measures- Infinite time regulator problem- Solution of reduced matrix Ricatti equation.

Course Outcomes:

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

- Demonstrate state space analysis.
- Illustrate non-linear system behavior by phase plane and describing function methods.
- Analyze stability in nonlinear systems using various methods.
- Articulate state space and state feedback in modern control systems.
- Compute optimal control parameters.

Text Books

1. I. J. Nagrath & M. Gopal, Control Systems Engineering, New Age International (P) Limited
2. Katsuhiko Ogata, Modem Control Engineering, PHI
3. Dr. K. P. Mohandas, Modern Control Engineering, Sanguine Technical Publishers.

Reference Books

1. Norman S. Nise, Control Systems Engineering, Wiley India Pvt. Ltd.
2. M. Gopal, Control Systems, Principles and Design, Tata McGraw Hill
3. G. F. Franklin, David Powell, Abbas Emami- Nacini,Feedback Control of Dynamic Systems, Pearson Education
4. A. Nagoorkani, Advanced Control Theory, RBA Publications
5. A. Anand Kumar, Control Systems, PHI

Internal Continuous Assessment ***(Maximum Marks-50)***

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, Group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern **(*Maximum Total Marks: 100*)**

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question.

EE19 603	POWER ELECTRONICS	3-1-0-3

Pre-requisites: Electronic Devices and Circuits

Course Objectives:

- Study the different types of power semiconductor devices and their switching characteristics.
- Study the basic concepts of power electronics.
- Study the operation and characteristics of various types of power electronic converters
- Analyze power electronic circuits.

Syllabus:

Module I: **(11 hours)**

Power Semiconductor Devices: Structure, static characteristics & switching (turn-on & turn-off) characteristics of Power Diode, Silicon Controlled Rectifier (SCR) - di/dt & dv/dt protection - structure of TRIAC, GTO, Power Transistor, Power MOSFET & IGBT –Comparison – turn-on methods of SCR – gate triggering circuits – R, RC, UJT triggering circuits - two transistor analogy - series and parallel connection of SCRs – commutation circuits for SCR – class A, B, C, D, E & F commutation.

Module II: **(11 hours)**

Controlled rectifiers – Half-wave controlled rectifier with R load – 1-phase fully controlled bridge rectifier with R load – with RL load with continuous & discontinuous conduction - with RLE load with continuous conduction (ripple free) -1-phase half controlled bridge rectifier with R, RL, RLE loads – 3-phase half-wave converter with R load – 3-phase fully controlled & half-controlled converter with RLE– waveforms – 1-phase & 3-phase dual converter with & without circulating current – four-quadrant operation.

Module III: **(10 hours)**

Inverters – 1-phase half-bridge & full bridge inverter with R & RL loads — voltage control - Pulse Width Modulation – single pulse width, multiple pulse width & sine PWM 3-phase bridge inverter with R load - 120° & 180° conduction mode.

Module IV: **(8 hours)**

AC voltage controllers – 1-phase full-wave ACVC with L & RL loads – waveforms – RMS output voltage, input power factor with R load.

Cycloconverter – midpoint type & bridge type - 1-phase step-up & step-down – with R & RL loads – waveforms.

Module V: **(10 hours)**

DC-DC converters –DC choppers- Step up -step-down chopper – two-quadrant & four quadrant operation – pulse width control & current limit control –buck-boost converters –Switched Mode Power Supply (SMPS) – Block Diagram of SMPC-comparison with linear power supply.

Course Outcomes:

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

- Differentiate signal level and power level devices.
- Demonstrate power electronic converters and its applications.
- Analyze controlled rectifier circuits.
- Deduce the operation of DC-DC choppers.
- Illustrate the operation of voltage source inverters.

Text Books:

1. Muhammad H. Rashid, *Power Electronics Circuits, Devices and Applications*, Pearson Education
2. Mohan, Undeland, Robbins, *Power Electronics, Converters, Applications & Design*, Wiley-India
3. L. Umanand, *Power Electronics – Essentials & Applications*, Wiley-India

Reference Books:

1. P.S. Bimbhra, *Power Electronics*, Khanna Publishers, New Delhi.

Internal Continuous Assessment ***(Maximum Marks-50)***

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, Group discussions,quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern **(*Maximum Total Marks: 100*)**

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question.

EE19 604	DIGITAL SYSTEM DESIGN	3-1-0-3

Pre-requisites: Digital Electronics and Logic Circuits

Course Objectives:

- To make students able to design and build real digital circuits
- To make students able to do VHDL programming

Syllabus:

Module I: **(11 hours)**

Hardware description languages-HDL based digital design-VHDL hardware description language- Program structure- behavioral- structural -data flow modelling. Types, constants and arrays- Functions and procedures. Delay models -Transport vs Inertial Delay. Sequential Processing - Process Statement - Signal Assignment vs Variable Assignment - Assert and report-time dimension-simulation –test benches-VHDL features for sequential logic design.

Module II: **(11 hours)**

Subprograms and functions- libraries and Packages - Predefined Attributes Configurations-Subprogram Overloading - VHDL synthesis - Design Examples
Design using VHDL-decoders-encoders-tri state devices-multiplexer-parity generators-comparators- adders- Subtractors and ALUs –combinational multiplexers.

Module III: **(10 hours)**

Combinational logic design-analysis procedure-design procedure-documentation-block diagram-gate symbols-signal names and active levels-bubble-to- bubble logic design-signal naming in HDL programs-schematic structures. Circuit timing- timing diagrams- propagation delay-timing specifications.

Module IV: **(10 hours)**

Sequential logic design-clocked synchronous state machine analysis-state machine structure-output logic-characteristic equations-state table-state equations-state diagram-Flip-Flop input equations-Analysis of state machines with D Flip-Flops, JK Flip-Flops. Synchronous state machine design- state table design example- state minimization- state assignment-synthesis using D and JK Flip-Flops- Clocked sequential circuit design using VHDL- state machine design-state assignment-pipelined outputs.

Module V: **(10 hours)**

Feedback sequential circuit-basic analysis Algorithmic state machine-introduction-components of ASM chart-salient features-examples. Complex programmable logic devices and FPGAs-Xilinx XC 9500 CPLD family-function block architecture- input output block architecture-switch matrix. FPGAs-Xilinx XC4000 FPGA family-configurable logic block-input output block-programmable interconnect.

Course Outcomes:

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

- Write VHDL code for practical implementation.
- Design of decoders, encoders and tri state devices using VHDL.
- Design any combinational logic circuit for practical application.
- Design any sequential logic circuit for practical application.
- Describe CPLD and FPGA architecture.

Text Books

1. J.Bhasker,AVHDLPrimer,PearsonEducation,2000
2. John F Wakerly, Digital Design, Pearson Education, Delhi, 2002
3. Stephen Brown and Zvonko Vranesic, Fundamentals of Digital Logic with VHDL Design, McGraw Hill(ASM)

Reference Books

1. Ian Grout, Digital Systems Design with FPGAs,Elsevier.
2. Morris Mano,Digital Design, Pearson Education, Delhi, 2002
3. Volnei APedroni Digital Electronics and Design with VHDL,Elsevier
4. R Padmanabhan, B Bala Tripura Sundari, Design through Verilog HDL,Wiley India
5. David Money Harris and Sarah L Harris, Digital Design and Computer Architecture, Elsevier
6. James R Armstrong, F Gail Gray, VHDL Design/Representation and Synthesis, Pearson Education, Delhi, 2002
7. Charles S. Roth, Fundamentals of Logic Design, Jaico Publishing House, 1999
8. B.Holdsworth, R.C Woods, Digital Logic Design, Newnes, Elsevier
9. Mohammad A. Karim, Xinghao Chen, Digital Design. Basic Concepts and Principles
10. A Anandakumar, Digital Electronics, Prentice Hall India Feb 2009

Internal Continuous Assessment ***(Maximum Marks-50)***

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving,

Group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (***Maximum Total Marks: 100***)

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question.

EE19 605(A)	BIOMEDICAL ENGINEERING	3-1-0-3

Pre-requisites: Nil

Course Objectives:

- This course gives a brief introduction to human physiology and presents various instrumentation systems for measurement and analysis of physiological parameters.
- To understand the basic anatomy and physiology of major systems of the body in designing equipments for medical treatments.
- To make students understand the Identification, classification, and working principle of various Biomedical Instruments used for Bio-potential measurement and application of these instruments in diagnosis, therapeutic treatment and imaging fields.

Syllabus:

Module I: **(8 hours)**

Development of biomedical instrumentation, biometrics, man instrument system components
Block diagram, physiological systems of the body (brief discussion on Heart and cardiovascular system, Anatomy of nervous system, Physiology of respiratory systems) problems encountered in biomedical measurements.

Module II: **(12 hours)**

Sources of bioelectric potentials – resting and action potentials - propagation of action potentials – bio electric potentials example (ECG, EEG, EMG,ERG, EOG,EGG etc.)
Electrode theory –Nernst equation .Bio potential electrodes:- microelectrodes – skin surface electrodes – needle electrodes –Biopotential amplifiers, Instrumentation amplifiers – transducers for biomedical applications.
Electro-conduction system of the heart. Electrocardiograph – electrodes and leads – Einthoven triangle, ECG read out devices, ECG machine – block diagram.

Module III: **(10 hours)**

Measurement of blood pressure – direct and indirect measurement – oscillometric measurement – ultrasonic method, measurement of blood flow and cardiac output, plethysmography – photoelectric and impedance plethysmography, measurement of heart sounds – phonocardiography. Cardiac pacemakers – internal and external pacemakers, defibrillators.

Module IV: **(10 hours)**

Electroencephalogram –neuronal communication – EEG measurement. Muscle response – Electromyogram (EMG) – Nerve Conduction velocity measurements- Electromyogram measurements. Respiratory parameters – Spirometer, pneumograph, gas exchange and distribution, respiratory therapy equipment. Ventilators, artificial heart valves, heart lung machine, hemodialysis, lithotripsy, infant incubators

Module V: **(10 hours)**

X-rays- principles of generation, uses of X-rays- diagnostic still picture, fluoroscopy, angiography, endoscopy, diathermy. Basic principle of computed tomography, magnetic resonance imaging system and nuclear medicine system – radiation therapy. Ultrasonic imaging system - introduction and basic principle. Instruments for clinical laboratory – test on blood cells – chemical tests - electrical safety – physiological effects of electric current – shock hazards from electrical equipment – method of accident prevention, introduction to tele- medicine.

Course Outcomes:

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

- Identify various Bio-potential and their specifications in terms of amplitude and frequency.
- Demonstrate the principle and working of various Biomedical measurements and Instruments for diagnosis applications.
- Illustrate the applications of therapeutic instruments for treatment purposes.
- Describe the applications of imaging instruments and the modalities involved in each technique.
- Identify biomedical engineering problems and electrical safety.

Text Books:

1. L. Cromwell, F. J. Weibell and L. A. Pfeiffer, Biomedical Instrumentation Measurements, Pearson education, Delhi, 1990.
2. J. G. Webster, Medical Instrumentation, Application and Design, Wiley-India

Reference Books:

1. R. S. Khandpur, Handbook of Biomedical Instrumentation, Tata Mc Graw Hill
2. J. J. Carr and J. M. Brown, Introduction to Biomedical Equipment Technology, Pearson Education.
3. Barbara Christe, Introduction to Biomedical Instrumentation, Cambridge University Press, 2008.
4. Anand Natarajan, Biomedical Instrumentation & Measurements, PHI.

Internal Continuous Assessment ***(Maximum Marks-50)***

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, Group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (***Maximum Total Marks: 100***)

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question.

EE19 605(B)	HIGH VOLTAGE ENGINEERING	3-1-0-3

Pre-requisites: Nil

Course Objectives:

- To study the breakdown mechanism in electrical insulators
- To study the generation and measurement of high AC, DC and impulse voltages
- Testing of high voltage equipments

Syllabus:

Module I: (10 hours)

Breakdown mechanisms in solids, liquids, vacuum , gases & gas mixtures- breakdown in uniform fields- breakdown in composite dielectrics - partial discharge , penning effect time tag & paschen's law. Townsend's criterion.

Module II: (10 hours)

Generation of High Voltages and Currents: D.C.Voltages : voltage doubler, cascade circuits, Cockcroft Walton double circuits – Multipliers- Vande Graaff generator.

electrostatic machines, voltage stabilization. A.C. Voltages : Cascade transformers, series resonance circuits, Tesla coil.

Impulse Voltages : Single stage and multistage circuits, wave shaping, tripping and control of impulse generators, synchronization with oscilloscope, generation of switching surge voltage, generation of impulse currents.

Module III: (10 hours)

Measurement of High Voltages and Currents : D.C.,A.C. and impulse voltages and currents, CRO, electrostatic generating and peak voltmeters, sphere gaps, factors affecting measurements, potential dividers(capacitive and resistive), series impedance ammeters, Rogowski coils, magnetic links, Hall effect generators, PT’s (magnetic and capacitive types) and CT’s.

Module IV: (12 hours)

Dielectric loss measurements: Schering's bridge- inductively coupled ratio arm bridge. Partial discharge measurement technologies - radio interference measurements.

Module V: (8 hours)

Over voltage phenomenon : travelling waves- line equations, wave transmission, reflection & attenuation, lightning phenomenon - Switching surges - protection against surges - Testing of circuit breakers and generators.

Course Outcomes:

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

- Analyze the breakdown mechanism in different mediums.
- Analyze high voltage AC, DC and impulse voltages.
- Demonstrate measurement techniques used in power equipments.
- Illustrate different techniques for measuring dielectric constant and losses etc.
- Summarize travelling waves and to test circuit breakers and Generators.

Text Books:

1. Naidu M. S. and kamaraju V., *High Voltage Engineering,* Tata McGraw Hill
2. Kuffel and Abdulla M., *High Voltage Engineering,* Pergamon Press
3. Bewley L. V. Lines, Travelling Waves on Transmission, Dover Publishers.
4. S.K. Singh, Fundamentals of High Voltage Engineering, DhanpatRai& Co.

Reference Books:

1. Alston L. L., *H. V. Technology,* Oxford University Press
2. Dieter Kind, *An Introduction to HV*, Wiley Ltd.
3. C.L. Wadhwa, *High Voltage Engineering*, New Age International
4. B. Thaparet. Al., *Power System Transients and High Voltage Principles,* Capital Pub
5. *IEEE Standard Technique for High Voltage Testing*, IEEE John Wiley and Sons

Internal Continuous Assessment ***(Maximum Marks-50)***

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving,
Group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern **(*Maximum Total Marks: 100*)**

PART A: *Analytical/problem solving SHORT questions* *10x 5 marks= 50 marks*

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question.

EE19 605(C)	PHOTOVOLTAIC DESIGN AND INSTALLATION	3-1-0-3

Pre-requisites: Nil

Course Objective:

- To provide necessary knowledge about the modelling, design and analysis of various PV systems.
- To show that PV is an economically viable, environmentally sustainable alternative to the world's energy supplies.
- To understand the power conditioning of PV systems power output.
- To understand various system components and inverters for PV systems.
- To understand various applications of PV systems.

Syllabus:

Module I: **(10 hours)**

Photovoltaic Basics: Structure and working of Solar Cells-Types, Electrical properties and Behavior of Solar Cells –Cell Properties and design- PV Cell Interconnection and Module Fabrication -PV Modules and arrays –Basics Of Load Estimation.

Module II: **(10 hours)**

Manufacturing of PV Cells & Design of PV Systems: Commercial solar cells - Production process of single crystalline silicon cells, multi crystalline silicon cells, amorphous silicon, cadmium telluride, copper indium gallium diselenide cells. Design of solar PV systems and cost estimation. Case study of design of solar PV lantern, standalone PV system - Home lighting and other appliances, solar water pumping systems.

Module III: **(10 hours)**

Classification of PV Systems: Classification - Central Power Station System, Distributed PV System, Standalone PV system, Grid Interactive PV System, small system for consumer applications, Hybrid solar PV system, Concentrator solar photovoltaic.

Module IV: **(10 hours)**

PV System Components: System components - PV arrays, inverters, batteries, charge controls, net power meters, PV array installation, operation, costs, reliability.

Inverters for PV Systems: Inverter control topologies for stand-alone and grid-connected operation-Analysis of inverter at fundamental frequency and at switching frequency-Feasible operating region of inverter at different power factors for grid connected systems and stand-alone PV systems.

Module V: **(10 hours)**

PV System Applications: Building-integrated photovoltaic units, grid -interacting central power stations, stand- alone devices for distributed power supply in remote and rural areas, solar cars, aircraft, space solar power satellites. Socio-economic and environmental merits of photovoltaic systems.

Course Outcomes:

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

- Explain basics of solar photovoltaic systems.
- Identify the feasibility of PV systems as an alternative to the fossil fuels
- Design efficient stand alone and grid connected PV power systems
- Analyze the structure, materials and operation of solar cells, PV modules, and arrays.
- Apply the concept to design PV systems for various applications

Text Books:

1. C.S. Solanki: Solar Photovoltaics–Fundamentals, Technologies and Applications, PHI Learning Pvt. Ltd., 2011.
2. John R. Balfour, Michael L. Shaw, Sharlave Jarosek "Introduction to Photovoltaics", Jones& Bartlett Publishers, Burlington, 2011.

Reference Books:

1. Chetan Singh Solanki., Solar Photovoltaic: "Fundamentals, Technologies and Application", PHI Learning Pvt., Ltd., 2009.
2. Partain .L.D, Fraas L.M., "Solar Cells and Their Applications", 2nd edition, Wiley, 2010.
3. Sukhatme .S.P, Nayak .J.K, "Solar Energy", Tata McGraw Hill Education Private Limited, New Delhi, 2010.

Internal Continuous Assessment ***(Maximum Marks-50)***

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, Group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern **(*Maximum Total Marks: 100*)**

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question.

EE19 605(D)	DIGITAL CONTROL SYSTEMS	3-1-0-3

Pre-requisites: Linear Control Systems

Course Objective:

- To introduce the need and concept of a digital control system.
- To understand the stability analysis in the Z plane.
- To familiarize digital controllers.
- To impart knowledge about different strategies adopted in the design of digital controllers.
- To understand the concept of controllability and observability.

Syllabus:

Module I: **(10 hours)**

Introduction to discrete time control system- Block diagram of a digital control system- Review of z-transforms and inverse z- transforms- solution of difference equations- pulse transfer function pulse transfer function with dead time- system time response- Realization of pulse transfer functions (Digital Controllers)- Direct Programming- Standard Programming- Series programming- parallel programming- ladder programming.

Module II: **(10 hours)**

Review of stability analysis in z- plane- Jury's stability test –Bilinear transformation and extension of Routh's stability criterion to discrete systems- Transient and Steady state response analysis- transient response specifications- steady state error analysis- effect of sampling period on transient response - frequency response specifications-Nyquist stability criterion in the z- plane.

Module III: **(10 hours)**

Digital Controllers- PI, PD & PID Controllers- Lag, lead, and lag-lead compensators- Design of lag compensator and lead compensator based on root locus and Bode plot approaches.

Module IV: **(10 hours)**

State Space analysis of digital control systems- state space representation of discrete time systems- Transfer function from state model- Controllable, Observable, Diagonal/ Jordan Canonical forms from transfer function- Solution of linear time invariant discrete time state equations discretization of continuous time space equation- representing state models in DCF/ JCF using transformation matrix.

Module V: **(10 hours)**

Concept of controllability and observability for a linear time invariant discrete time control system- condition for controllability and observability - state feedback- design via pole placement state observers- design of full order state observer.

Course Outcomes:

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

- Explain the need and concept of a digital control system.
- Analyze the stability in the Z plane using different methods.
- Familiarize digital controllers.
- Describe the different strategies adopted in the design of digital controllers
- Summarize the concept of controllability and observability for a linear time invariant discrete time control system

Text Books:

1. K. Ogata, Discrete- time Control Systems, Pearson Education
2. M. Gopal, Digital Control and State Variable Methods, Tata McGraw Hill

Reference Books:

1. B. C. Kuo, Digital Control Systems, Prentice Hall
2. Charles L. Philip and Troy Nagle, Digital Control Systems, Prentice Hall

Internal Continuous Assessment ***(Maximum Marks-50)***

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, Group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern **(*Maximum Total Marks: 100*)**

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question.

EE19 605(E)	ILLUMINATION TECHNOLOGY	3-1-0-3

Pre-requisites: Nil

Course Objectives:

- To provide an introduction to the fundamentals of illumination engineering and lighting design.
- To impart lighting fundamentals, measurement, and technology and their application in the analysis and design of lighting systems
- To know the requirements of efficient street lighting and flood lighting

Syllabus:

Module I: **(10 hours)**

Introduction of Lighting : Types of illumination, Day lighting, Supplementary artificial lighting and total lighting, Quality of good lighting, Factors affecting the lighting-shadow, glare, reflection, Colour rendering and stroboscopic effect, Methods of artificial lighting, Lighting systems-direct, indirect, semi direct, semi indirect, Lighting scheme, General and localized lighting.

Module II: **(10 hours)**

Measurement of Light : Definition of luminous flux, Luminous intensity, Lumen, Candle power, Illuminance, M.H.C.P, M.S.C.P, M.H.S.C.P, Luminous Efficacy, CRI, Brightness or luminance, Concept of selection of lamps based on luminous efficacy and CRI, Laws of illumination, Inverse square law and Lambert's Cosine law, Illumination at horizontal and vertical plane from point source, Concept of polar curve, Calculation of luminance and illumination in case of linear source, round source and flat source.

Module III: **(12 hours)**

Design of Interior Lighting : Definitions of maintenance factor, Uniformity ratio, Direct ratio, Coefficients of utilisation and factors affecting it, Illumination required for various work planes as per BIS, Space to mounting height ratio, Types of fixtures and relative terms used for interior illumination such as DLOR and ULOR, Selection of lamp and luminaire, Selection of utilisation factor, reflection factor and maintenance factor
Determination of Lamp Lumen output taking into account voltage and temperature variations, Calculation of wattage of each lamp and number of lamps needed, Layout of lamp luminaire, Calculation of space to mounting height ratio, Indian standard recommendation and standard practices for illumination levels in various areas, Special feature for entrance, staircase, Corridor lighting and industrial building

Module IV: **(10 hours)**

Design of Street Lighting : Types of streets and their level of illumination required, Terms related to street and street lighting, Types of fixtures used and their suitable application, Various arrangements in street lighting, factor to be considered for good street lighting, Selection of lamp and luminaire, Calculation of their wattage, Number and arrangement, Calculation of space to mounting height ratio, Calculation of illumination level available on road.

Module V: **(8 hours)**

Design of Outdoor Lighting : Flood Lighting : Terms related to flood lighting, Types of fixtures and their suitable applications, Selection of lamp and projector, Calculation of their wattage and number and their arrangement, Calculation of space to mounting height ratio, Recommended method for aiming of lamp.

Course Outcomes:

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

- Explain the basics of lighting system
- Demonstrate the parameters and its measurements related to the lighting system.
- Design of interior lighting system
- Identify the criteria for the selection of lamps and lighting systems for street lighting.
- Illustrate outdoor lighting schemes.

Text Books:

1. D.C. Pritchard Lighting, Routledge,2016
2. Jack L. Lindsey, Applied Illumination Engineering , PHI,1991
3. John Matthews Introduction to the Design and Analysis of Building Electrical Systems, Springer,1993
4. M.A. Cayless, Lamps and Lighting , Routledge, 1996

Reference Books:

1. V.V Meshkov, Fundamentals of illumination Engineering, Mir Publications
2. IS CODE3646
3. IS CODE6665

Internal Continuous Assessment ***(Maximum Marks-50)***

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, Group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (***Maximum Total Marks: 100***)

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question.

EE19 605(F)	MODERN OPERATING SYSTEMS	3-1-0-3

Pre-requisites: Nil

Course Objectives:

- To impart the knowledge on the need and requirement of an interface between Man and Machine.
- To teach the features of operating systems and the fundamental theory associated with process, memory and file management components of operating systems.

Syllabus:

Module I: (10 hours)

Introduction-Definition– Operating System Structure- Operating System Operations, Process Management- Memory Management Storage Management- Protection and Security Distributed Systems.

Module II: (10 hours)

Computing Environments- Open-Source Operating Systems - Operating-System Services- User Operating-System Interface - System Calls- Types of System Calls- System Programs.

Module III: (10 hours)

Process Management- Process Concept- Operations on Processes - CPU Scheduling- Basic Concepts- Scheduling Criteria- Scheduling Algorithms- Thread Scheduling- Process Synchronization - Threads Overview- Multithreading Models- Thread Libraries Threading Issues.

Module IV: (10 hours)

Memory Management-Swapping- Contiguous Memory Allocation- Paging Segmentation- Virtual Memory- Demand Paging - File Management- File-System Interface- File Concept- Access Methods - Directory and Disk Structure - File-System Mounting - File Sharing- Protection – File System Structure- File-System Implementation.

Module V: (10 hours)

Protection and Security- Protection- Goals of Protection- Principles of Protection- Domain of Protection- Access Matrix Implementation of Access Matrix- Access Control- Revocation of Access Rights- Security –The Security Problem -Program Threats- System and Network Threats.

Course Outcomes:

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

- Describe the general architecture of computers

- Illustrate computing environments.
- Demonstrate different CPU scheduling and threading model.
- Summarize various memory management systems.
- Explain various methods for implementing protection and security for operating systems.

Text Books:

1. William Stallings, Operating Systems: Internals and Design Principles, 6th Ed., Pearson Education

Reference Books:

1. Nutt G.J., Operating Systems, 3rd Ed., Pearson Education.

2. Silberschatz, Galvin, & Gagne, Operating System Concepts, 8th Ed., Wiley.

3. Tanenbaum A.S., Modern Operating Systems, 3rd Ed., Prentice Hall.

Internal Continuous Assessment ***(Maximum Marks-50)***

70%	-	Tests (minimum 2)
20%	-	Assignments (minimum 2) such as homework, problem solving, Group discussions, quiz, literature survey, seminar, term-project etc.
10%	-	Attendance and Regularity in the class.

University Examination Pattern **(*Maximum Total Marks: 100*)**

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question.

EE19 606(A)	INDUSTRIAL SAFETY ENGINEERING	3-1-0-3

Pre-requisites: Nil

Course Objectives:

- To understand the impact of safe industrial operations, its benefits and safety legalization.
- To understand general concept of safety.
- To get an awareness about safety responsibilities of various agencies.
- To know about various occupational health hazards and human factors contributing to industrial accidents.
- To become familiar with the general laws and legislations applicable for an industrial safety practitioner

Syllabus:

Module I: (10 hours)

Introduction to industrial safety: Concept of Safety, Goals of safety engineering, Need for safety engineering, definitions of Accident, injury, unsafe actions & conditions.

Responsibility of Safety - Society, Govt., Management, Union & employees, Duties of safety officer, Safety Committee -Membership, Functions & Scope of Safety committee.

Module II: (10 hours)

Safety Training and Health Management: Occupational Health Hazards, Promoting Safety, Safety and Health training, Stress and Safety. Ergonomics - Introduction, Definition, Objectives, Advantages. Ergonomics Hazards - Musculoskeletal Disorders and Cumulative Trauma Disorders.

Safety Awareness & Training, Training for Safety, Assessment of needs, Design & development of training programme, Training methods and strategies. Training of managers, supervisors & workers. Evaluation of training programmes, Human behavior and safety: Human factors contributing to accidents.

Module III: (10 hours)

Safety Assessment and Control: Safety Management: Role of management in Industrial Safety, Safety Management- Principles & Practices. Safety Organization: Role of safety committee and its formation, Safety awareness programme: motivation, education and training, Appraisal of plant safety and measurement of safety performance, Total loss control concept, Introduction to productivity, Quality, Reliability, and Safety (PQRS) theory. Concept of workplace and its design. Improving safety and productivity through workplace design control measures. Technical and engineering control measures. Control measures against human error. Preventive maintenance. Role of Preventive maintenance in safety and health. Standards and code of practices for plant and equipment.

Module IV: **(10 hours)**

Industrial Safety and Control: Control of Physical Hazards: (Purpose of lighting. Advantages of good illumination. Lighting and safety. Lighting and the work. Control of Chemical Hazards Hazardous properties of chemicals and appreciation of information provided in Material safety data sheets. Classification of dangerous materials with pictorial symbols, common hazard and common precautions for each class.

Control of Electrical Hazards Dangers from electricity. Safe limits of amperages, Voltages Safe distance from lines. Capacity and protection of conductors, Joints and connections, Means of cutting of power overload and short circuit protection. Statutory provisions regarding fire safety. Factors contributing towards fire. Chemistry of fire. Classification of fires. Common causes of industrial fires.

Module V: **(10 hours)**

Safety Legalisation: Legal Provisions regarding safety, Accident prevention & Compensation to affected employees as under Factories Act-1948, Factories Act (Amendment)1987, Maharashtra Factories Rule - 1963, The Mines Act-1952, Maharashtra Safety Officers Rules 1982, The Workmen Compensation Act-1923, ESI Act, Public Liabilities Insurance Act-1991, Fatal Accident Act.

Course Outcomes:

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

- Explain the concept of safety and safety responsible agencies.
- Describe the occupational health hazards and human factors contributing to industrial accidents.
- Demonstrate the concepts of safety management.
- Illustrate the need for timely maintenance of equipment's, the need and measures for industrial safety control
- Extract the general laws and legislations applicable for an industrial safety practitioner.

Text Books:

1. Frank P. Lees, Loss of prevention in Process Industries, Vol. 1 and 2, Butterworth-Heinemann Ltd., London (1991).
2. Grimaldi and Simonds, Safety Management, AITBS Publishers, New Delhi (2001)
3. R.K.Jain and Sunil S.Rao, Industrial Safety, Health and Environment Management Systems, Khanna Publishers, New Delhi (2006).

Reference Books:

1. Industrial Safety -National Safety Council of India.
2. Slote.L. Handbook of Occupational Safety and Health, John Willey and Sons, New York
3. The Factories Act with amendments 1987, Govt. of India Publications DGFASLI, Mumbai

Internal Continuous Assessment ***(Maximum Marks-50)***

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, Group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern **(*Maximum Total Marks: 100*)**

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question.

EE19 606(B)	NUMERICAL ANALYSIS AND OPTIMIZATION THEORY	3-1-0-3

Pre-requisites: Nil

Course Objectives:

- To provide constructive methods for obtaining numerical solutions of algebraic and transcendental equations.
- To introduce a tool of numerical techniques dealing with various engineering problems.
- To impart the knowledge in finding the numerical solutions of ordinary differential equations.
- To develop understanding about the method of applying linear programming problems with the help of computers for solving complex problems.
- To impart knowledge in different types of transportation problems.

Syllabus:

Module I: (10 hours)

Solutions of Algebraic and transcendental equations: Errors in numerical calculations: Sources of errors, significant digits and numerical instability - Numerical solution of polynomial and transcendental equations - Bisection method - Regula falsi method - Newton-Raphson method - fixed-point method of iteration - rate of convergence of these methods - Solution of system of algebraic equations- Exact methods -Gauss elimination - Crout' s triangularization method- Iterative methods - Gauss Jacobi and Gauss seidel methods.

Module II: (10 hours)

Numerical solution of ordinary differential equations: Numerical solution of ordinary differential equations - single step methods - Taylor series - Eulers and Modified Eulers methods - Picard's iteration method - Runga-Kutta methods (Second ,third and fourth order formulae, third and fourth order derivations not required) Multi step method - Milne's predictor and corrector formulae. Numerical differentiation - Differentiation formula in the case of equally spaced points - Numerical integration - Trapezoidal and Simpson's rules - Compounded rules.

Module III: (10 hours)

Interpolation: Polynomial interpolation: Lagrange's interpolation polynomial - Divided difference - Newton's divided difference interpolation polynomial- error in interpolations - finite differences operators - Gregory- Newton forward and backward interpolations -Gauss forward and backward interpolation formula- Stirling's interpolation formula.

Module IV: (10 hours)

Linear programming problems: Optimization Methods - Systems of linear equations and inequalities - Basic concepts of linear vector spaces - Mathematical formulation of linear programming problem - Simplex Method - Charnes M method - Two phase method - Duality - Dual simplex method.

Module V: **(10 hours)**

Transportation problems: Transportation problems -Least cost cell method -Northwest corner rule - Vogel's approximation method - U-V method -Assignment problem .

Course outcome:

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

- Apply numerical methods in algebraic and transcendental equations.
- Solve differential equations using numerical methods.
- Apply interpolation methods to solve differential equations.
- Demonstrate linear programming problems using optimization techniques.
- Develop the skill in different types of transportation problems.

Text Books:

1. Chapra and Canale, Numerical methods for scientists and engineers,McGraw Hill.
2. James B. Scarborough,Numerical Mathematical Analysis, Oxford and IBH Publishing.
3. Kanti Swarup ,Gupta and Manmohan ,Introduction to Linear Programming ,Tata Mc Graw Hill.

Reference Books:

1. Froberg, Introduction to numerical analysis, Addison Wesley.
2. Kandaswamy, NumericalAnalysis,SChand.
3. Hildebrand, introduction to Numerical Analysis. Tata McGraw Hill.
4. Dr.B.S.Grewal, Numerical Methods in engineering and science, Khanna Publications.
5. S. Sankara Rao, Numerical Methods of Scientists and Engineers, 3rd ed., PHI.
6. R. Panneerselvam, Operation Research , PHI.

Internal Continuous Assessment ***(Maximum Marks-50)***

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving,
Group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (***Maximum Total Marks: 100***)

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question.

EE19 606(C)	CONTROL SYSTEMS ENGINEERING	3-1-0-3

Pre-requisites: Nil

Course Objectives:

- To impart the basic theory behind the analysis of continuous and discrete Systems in time and frequency domains
- To introduce concepts about the state space modeling of systems.

Syllabus:

Module I: (10 hours)

General Schematic Diagram of Control Systems-Open loop and Closed loop systems – Merits and demerits-Concepts of feedback –Modeling of Continuous Time Systems. Basic ideas of poles and zeros. Transfer functions-block diagrams-order and type-signal flow graph –Mason‘s Gain formula – derivation of transfer function of simple systems from physical relations -spring mass damper –DC servomotor for position and speed control.

Module II: (10 hours)

Time Domain analysis: Analysis of Continuous Time systems-Transient and steady State Responses-Standard Test signals response comparisons for various Root locations in the S-plane-Time Domain Solutions of First order systems- Step Response of Second order system –Time domain specifications –Relationships between Damping ratio and the amount of Overshoot for a second Order system - Steady state Response-steady state error –computations of steady state error –error constants - Concepts of Stability –Routh-Hurwitz Criterion - Root locus (Concept only).

Module III: (9 hours)

Frequency Domain Analysis: Frequency Domain Plots-Polar and Bode Plots (Concept only)-Theory of Nyquist Criterion Frequency Response characteristics- Frequency domain specifications-computation of gain and phase Margins from Bode Plot.

Module IV: (11 hours)

Modeling of discrete-time systems-sampling-mathematical derivations for sampling-sample and hold- -solutions of difference Equations using Z-transforms-example of sampled data systems – mapping between s plane and z plane –analysis of discrete time systems-pulse transfer function-examples.

Module V: (10 hours)

State Space Analysis: Introduction-Definitions and explanations of the Terms State, state variables, state vector and state space-State Space Representations of Linear Time-invariant System - Laplace Transform approach to the solutions of state equations-State Transition Matrix-properties. State

Space representation of Discrete Time Systems-Relation between Transfer function- Transfer Matrix and State Space models for continuous and discrete cases.

Course Outcomes:

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

- Develop the transfer function of physical systems from its mathematical models.
- Analyze the system in time domain and the stability aspects of linear time invariant systems.
- Analyze the stability of linear time invariant systems in frequency domain.
- Analyze the stability of discrete time systems.
- Evaluate continuous and discrete systems using state space methods.

Text Books

1. Ogata K. ―Modern Control Engineering‖, Prentice Hall of India
2. M Gopal,'Control systems- Principles & Design', Tata McGraw Hill, New Delhi, 3rd Ed. 2008
3. B.C Kuo.,‖ Automatic Control System‖, Prentice Hall of India
4. Nagarath IJ & Gopan M.,‖Control System Engineering‖,Wiley India Ltd

Reference Books

1. Ziemer R.E.,Tranter W.H& Fanin D.R.,‖Signals and Systems‖Pearson Education Asia
2. Dorf RC & Bishop R.H.,Modern Control Systems‖,Addison Wesley
3. Ogata K.,‖Discrete Time Control Systems‖,Pearson Education Asia, 2007
4. Kuo B.C .,‖Digital Control Systems‖ Oxford University Press

Internal Continuous Assessment ***(Maximum Marks-50)***

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving,
Group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern **(*Maximum Total Marks: 100*)**

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question.

EE19 606(D)	ELECTRIC VEHICLES	3-1-0-3

Pre-requisites: Nil

Course Objectives:

- To learn the design aspects of electric vehicles and to learn how it can be employed for various applications.
- To give exposure to the students about the Constructional details, performance analysis and importance of electric vehicles.
- To present a comprehensive overview of Electric and Hybrid Electric Vehicles

Syllabus:

Module I: **(10 hours)**

Introduction to Electric Vehicles: History of electric vehicles, Classification of Electric vehicles - social and environmental importance of electric vehicles- impact of modern drive-trains on energy supplies.

Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, mathematical models to describe vehicle performance.

Module II: **(10 hours)**

Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

Electric Propulsion unit: Introduction to electric components used in electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives.

Module III: **(10 hours)**

Introduction to Hybrid Electric Vehicles: History of hybrid vehicles- social and environmental importance of hybrid vehicles- impact of modern drive-trains on energy supplies.

Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies- power flow control in hybrid drive-train topologies- fuel efficiency analysis-electric components used in hybrid vehicles, Plug in Hybrids-Introduction

Module IV: **(10 hours)**

Energy Storage: Introduction to Energy Storage Requirements in Electric Vehicles, Battery based energy storage and its analysis, Battery management System, Fuel Cell based energy storage and its analysis, Hybridization of different energy storage devices. Metal Air Batteries -Types

Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies.

Communication Protocols between charging station and Electric vehicles

Module V: **(10 hours)**

Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology.

Course Outcomes:

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

- Compare Electric and Conventional Vehicles.
- Demonstrate suitable drive scheme and propulsion unit for developing an electric vehicle.
- Design and develop basic schemes of hybrid electric vehicles and hybrid electric drive-trains.
- Describe energy storage and management strategies.
- Illustrate Electric vehicles with proper sizing of components.

Text Books

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003

Reference Books

2. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.
3. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and
4. Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.

Internal Continuous Assessment ***(Maximum Marks-50)***

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, Group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern **(*Maximum Total Marks: 100*)**

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question.

EE19 606(E)	PROFESSIONAL ETHICS	3-1-0-3

Pre-requisites: Nil

Course Objectives:

- To create awareness on professional ethics for engineers.
- To instill human values and integrity.
- To respect the rights of others and develop a global perspective.

Syllabus:

Module I: **(10 hours)**

Understanding Professional Ethics and Human Values Current scenario, contradictions, dilemmas, need for value education and self esteem-Engineering as people serving profession, engineer's responsibility to environment, principles of sustainability, industrial, economic, environmental, agricultural and urban sustainability, Sustainable development.

Module II: **(10 hours)**

Engineering ethics: Senses of Engineering Ethics - Variety of moral issues - Types of inquiry - Moral dilemmas - Moral autonomy. Kohlberg's theory - Gilligan's theory - Consensus and Controversy - Professional ideals and virtues - Attributes of an ethical personality - Theories about right action - Self interest.
Responsibilities and Rights of engineers - Collegiality and Loyalty - Respect for authority - Collective bargaining. Confidentiality - Conflicts of interest - Professional rights.

Module III: **(10 hours)**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – Plagiarism – A Balanced Outlook on Law – Challenges case study – Bhopal gas tragedy

Module IV: **(10 hours)**

Responsibility for Safety and Risk – Types of risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

Module V: **(10 hours)**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers –Consulting Engineers–Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.

Course Outcomes:

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

- Explain the core values that shape the ethical behavior of a professional.
- Demonstrate various attributes of engineering ethics.
- Illustrate ethical responsibility of engineers in experiments and documentation.
- Describe responsibility for safety and risk in engineering design.
- Apply the knowledge of human values and social values to contemporary ethical issues and global issues.

Text Books:

1. Mike W Martin, Roland Schinzinger, *Ethics in Engineering*, Tata McGraw -Hill,2013.
2. Govindarajan, Natarajan, Senthil Kumar, *Engineering Ethics*, PHI ,2009.
3. Aarne Vesblind PA, Alastair S Gunn, *Engineering Ethics and the Environment*, Cambridge UniversitiesPress.1998.
4. Edmund Seebauer, Robert Barry, *Fundamentals of Ethics for Scientists and Engineers*, Oxford University Press,2001.
5. Gaur R. R., R. Sangal, G. P. Bagaria, *A Foundation Course in Value Education and Professional Ethics*, Excel Books, New Delhi,2009.

Reference Books:

1. RSNaagarazan,Atextbookonprofessionalethicsandhumanvalues,Newageinternational
2. Charles D Fleddermann, Engineering Ethics, Pearson Education/ Prentice Hall of India, New Jersey,2004.
3. Charles E Harris, Michael S Protchard and Michael J Rabins, Engineering Ethics- Concepts and cases, Wadsworth Thomson Learning, United states,2005.

Internal Continuous Assessment ***(Maximum Marks-50)***

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving,
Group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern **(*Maximum Total Marks: 100*)**

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question.

EE19 606(F)	RENEWABLE ENERGY SYSTEMS	3-1-0-3

Pre-requisites: Nil

Course Objectives:

- To give sufficient knowledge about the promising new and renewable sources of energy.
- To get exposure on solar radiation and its environmental impact to power.
- To get awareness about various methods ocean power generation systems.
- To get a basic idea about power generation from wind energy.
- To equip students in working with projects and to take up research work in connected areas.

Syllabus:

Module I: **(9 hours)**

Introduction to Renewable Energy: Classification of Energy Resources; Conventional Energy Resources - Availability and their limitations; Non-Conventional Energy Resources – Classification, Advantages, Limitations; Comparison of Conventional and Non-Conventional Energy Resources; World Energy Scenario; Indian Energy Scenario.

Energy Storage: Sizing and Necessity of Energy Storage.

Module II: **(12 hours)**

Solar Thermal Systems: Introduction, Solar Constant, Basic Sun-Earth Angles, Measurement of Solar Radiation Data – Pyranometer and Pyrheliometer. Principle of Conversion of Solar Radiation into Heat, – Solar thermal collectors – General description and characteristics – Flat plate collectors – Heat transfer processes – Solar concentrators (parabolic trough, parabolic dish, Central Tower Collector) – performance evaluation.

Solar Electric Systems: Solar Thermal Electric Power Generation –Solar Photovoltaic – Solar Cell fundamentals, characteristics, classification, construction of module, panel and array - Solar PV Systems – stand-alone and grid connected - Applications – Street lighting, Domestic lighting and Solar Water pumping systems.

Module III: **(9 hours)**

Energy from Ocean: Tidal Energy – Principle of Tidal Power, Components of Tidal Power Plant (TPP), Classification of Tidal Power Plants, Advantages and Limitations of TPP. Ocean Thermal Energy Conversion (OTEC): Principle of OTEC system, Methods of OTEC power generation – Open Cycle (Claude cycle), Closed Cycle (Anderson cycle) and Hybrid cycle (block diagram description of OTEC); Site-selection criteria, Biofouling, Advantages & Limitations of OTEC.

Module IV: **(9 hours)**

Wind Energy: Introduction, Wind and its Properties, History of Wind Energy, Wind Energy Scenario – World and India. Basic principles of Wind Energy Conversion Systems (WECS), Classification of WECS, Parts of WECS, Derivation for Power in the wind, Electrical Power Output and Capacity Factor of WECS, Advantages and Disadvantages of WECS.

Module V: **(11 hours)**

Biomass Energy: Introduction, Photosynthesis process, Biomass fuels, Biomass conversion technologies, Urban waste to Energy Conversion, Biomass Gasification, Biomass to Ethanol Production, Biogas production from waste biomass, factors affecting biogas generation, types of biogas plants – KVIC and Janata model; Biomass program in India. Small hydro power: Classification as micro, mini and small hydro projects - Basic concepts and types of turbines – Design and selection considerations.

Emerging Technologies: Fuel Cell, Small Hydro Resources, Hydrogen Energy, alcohol energy, nuclear fusion and power from satellite stations.

Course Outcomes:

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

- Describe the environmental aspects of non-conventional energy resources in comparison with various conventional energy systems, their prospects and limitations.
- Explain the use of solar energy and the various components used in the energy Production.
- Appreciate the need of Wind Energy and the various components used in energy generation and know the classifications.
- Underline the concept of Biomass energy resources and their classification, types of biogas Plants- applications
- Summarize the knowledge of fuel cells, wave power, tidal power and geothermal principles and applications.

Text Books:

1. Sawhney G. S., Non-Conventional Energy Resources, PHI Learning, 2012.
2. Sab S. L., Renewable and Novel Energy Sources, MI. Publications, 1995.
3. Khan B. H., Non-Conventional Energy Resources, Tata McGraw Hill, 2009.
4. A.A.M. Saigh (Ed): Solar Energy Engineering, Academic Press, 1977
5. Rai G.D. , Non-Conventional Energy Sources, Khanna Publishers, 2011
6. Abbasi S. A. and N. Abbasi, Renewable Energy Sources and Their Environmental Impact, Prentice Hall of India, 2001.

Reference Books:

1. Tiwari G. N., Solar Energy- Fundamentals, Design, Modelling and Applications, CRCPress, 2002.
2. Johansson T. B., H. Kelly, A. K. N. Reddy and R. H. Williams, Renewable Energy - Sources for Fuel and Electricity, Earth scan Publications, London, 1993.
3. G.N. Tiwari: Solar Energy-Fundamentals, Design, Modelling and Applications, NarosaPublishers, 2002
4. Earnest J. and T. Wizelius, Wind Power Plants and Project Development, PHI Learning,2011.
5. F. Kreith and J.F. Kreider: Principles of Solar Engineering, McGraw Hill, 1978
6. J.A. Duffie and W.A. Beckman: Solar Energy Thermal Processes, J. Wiley, 1994
7. Boyle G. (ed.), Renewable Energy - Power for Sustainable Future, Oxford UniversityPress, 1996
8. Rao S. and B. B. Parulekar, Energy Technology, Khanna Publishers, 1999.

Internal Continuous Assessment ***(Maximum Marks-50)***

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, Group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (***Maximum Total Marks: 100***)

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question.

EE19 607(P)	ELECTRICAL MACHINES LAB - II	0-0-3-1

Pre-requisites: Electrical Machines II

Course Objectives:

- To conduct various tests on different ac machines and transformers and to study the performance.
- To predetermine performance characteristics and working of ac machines.
- To analyze the regulation of alternators and predetermine regulation.
- To conduct speed control methods at different loads.

Syllabus:

List of Experiments

(A minimum of 10 experiments must be conducted)

1. No load & blocked rotor tests on 3 phase squirrel cage & slip ring induction motors
2. Brake test on 3 phase squirrel cage & slip ring induction motors
3. Performance of induction machine (1ϕ or 3 ϕ) as a generator and motor
4. Slip test on 3-phase salient pole alternator
5. Voltage regulation of alternators, methods can be specified as emf, mmf etc.
6. Load test on pole changing induction motor
7. No load & blocked rotor tests on single phase induction motor
8. V and inverted V curves on synchronous machine
9. Speed control of induction motor by variable frequency method
10. Drawing of different types of windings using Autocad
11. Drawing of different types of machine with parts using Autocad
12. Variation of starting Torque with Rotor resistance can be included

Course Outcome:

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

- Demonstrate various performance characteristics of ac machines.
- Predetermine the voltage regulation by different methods.
- Evaluate synchronous machine characteristics and to plot V and inverted V curves.

- Analyze the Induction Generator characteristics.
- Familiarize the starting methods and windings used in ac machines.

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Laboratory practical, record and viva voce

30% - Tests

10% - Regularity in the class

Semester End Examination *(Maximum Marks-100)*

70% - Procedure, conducting experiment, result, tabulation, and inference

20% - Viva voce

10% - Fair record

EE19 608(P)	MINI PROJECT	0-0-3-1

Pre-requisites: Nil

Course Objectives:

- To estimate the ability of the student in transforming the theoretical knowledge studied so far into a working model of an electrical/electronic system.
- For enabling the students to gain experience in organization and implementation of a small project and thus acquire the necessary confidence to carry out the main project in the final year.

In this practical course, each group consisting of three/four members is expected to design and develop a moderately complex electrical/electronic system with practical applications; this should be a working model. The basic concepts of product design may be taken into consideration while designing the project.

A committee consisting of minimum three faculty members specialized in Electrical and Electronics Engineering will perform assessment of the mini project. Students have to submit a report on the mini project and demonstrate the working model before the evaluation committee.

Course Outcome:

The student will be able to:

- Design and analyze a practical electrical/electronic circuit.
- Build an electrical/electronic product.
- Demonstrate the product and its applications.
- Inculcate group management and leadership skills.
- Develop documentation skills.

Internal Continuous Assessment ***(Maximum Marks-100)***

30% - Design
30% - Implementation and Result Analysis
10% - Report
20% - Viva voce
10% - Regularity

UNIVERSITY OF CALICUT

CURRICULUM

(1 TO 8 SEMESTERS)

&

SYLLABUS

B. Tech. -

Electronics & Communication Engineering

(2019 SCHEME)

(Applicable to 2019 admission onwards)

CURRICULUM

1st to 8th SEMESTER

Every course of B. Tech. Program shall be placed in one of the nine categories as listed in table below.

Sl. No	Category	Credits
1	Humanities and Social Sciences including Management courses	3
2	Basic Science courses	24
3	Engineering Science Courses	16
4	Program Core Courses	77
5	Program Elective Courses	15
6	Open Elective Courses	3
7	Internship, Project work, Seminar and Viva Voce	15
8	Practical Session	16
9	Mandatory Non-credit Courses	-----
10	Mandatory Student Activities	1
	Total Mandatory Credits	**170**
11	Value Added Course (Optional)	20

No semester shall have more than six lecture-based courses and two laboratory and/or drawing/seminar/project courses in the curriculum. Semester-wise credit distribution shall be as below:

Sem	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Credits	19	19	21	20	21	22	23	24	169
Activity Points	50/ 25*				50				100/75*
Credits for Activity	1								1
Grand Total									**170**

*** applicable for Lateral Entry (LE) students.**

BASIC SCIENCE COURSES: Maths, Physics, Chemistry, Biology for Engineers, Life Science etc

ENGINEERING SCIENCE COURSES: Basic Electrical, Engineering Graphics, Programming, Basic Mechanical, Basic Civil, Engineering Mechanics, Workshops etc.

HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT COURSES: English, Professional Communication, Management & Economics etc.

MANDATORY NON-CREDIT COURSES: Environmental Science, Constitution of India, Life Skills & Ethics for Engineers, Communicative English, and Concept based Engineering. There will be only internal evaluation of non-credit courses, and no University examinations will be conducted. A minimum 50% internal mark is to be obtained for securing a pass in these subjects. A student has to pass the exam within 4 chances, failing which the student has to undergo course repeat for the subject.

VALUE ADDED COURSE: Students can attend various value added MOOC (Massive Open Online Courses) like NPTEL courses conducted by nationally or internationally reputed institutions with in like IIT,IIST etc, and abroad (from foreign universities) and earn a maximum of 20 additional credits for getting 'Honours' degree in the discipline with a condition that he/she should have secured an aggregate of 8.0 CGPA up till final semester without any history of backlogs. Thus, the candidate can earn a max of 190 credits during his/her period of studies up to 8th semester. The selected course can be on same discipline or in any other relevant discipline pertaining to engineering/management/social science. 4 credits will be awarded to a student on successful completion of each MOOC. Thus, a student will be eligible to get an undergraduate degree with 'Honours' when he/she successfully earns an additional requirement of 20 credits through the successful completion of 5 MOOCs.

Successful completion of a MOOC is considered only when a student scores a minimum score of 60 (or equivalent to 60%) and above in the respective course. The additional value-added MOOC courses can be of 8 – 12-week duration. Each student who wish to do a MOOC should take prior permission from the respective Head of the Department, registering for the same with the institution which is hosting the course. The Head of the Department should verify the details of the course and ensure that the course content is relevant to his/her discipline before giving the approval. The details of MOOC courses undertaken by a student (if any) and the credits earned must be consolidated by the Tutor, forwarded by HOD and approved by Principal. The same has to be entered in the University portal by the college officials before the commencement of every end semester university examination.

HONOURS: -

Calicut University is providing this option for academically extra brilliant students to acquire Honours. Honours is an additional credential; a student may earn if she/he opts for the extra 20 credits needed for this in her/his own discipline with a condition that he/she should not have failed in any of the subjects till final semester and have secured an aggregate of 8.0 CGPA up till final semester. Honours is not indicative of class. Honours is intended for a student to gain expertise/specialise in an area inside his/her major B-Tech discipline to enrich knowledge in emerging/advanced areas in the branch of engineering concerned and interdisciplinary areas including management. However, the additional credits thus far earned by the student shall be included in the grade card but shall not be considered in calculating the CGPA. Upon completion of Honours, a student will be better equipped to perform research in her/his branch of engineering and allied sectors. On successful achievement of 20 credits from the honours and 170 credits from their respective B-tech syllabus, the student will earn a total credit of 190 at the end of the programme which he/she will be eligible to get the Degree Certificate as “Bachelor of Technology in Electronics and Communication Engineering, with Honours.”

The details of the students eligible for conferring the Honours Degree must be sent to the university by the principal, with the details of his/her marks up to seventh semester and the number of value-added courses and credits earned before the commencement of the 8th semester university examination.

COURSE CODE AND COURSE NUMBER

Each course is denoted by a unique code consisting of three alphabets followed by three numerals like EC19 807 (P)**.** The first two letter code refers to the department offering the course. EC stands for Electronics and Communication. The second two digits represent the year in which the syllabus is set, the digit 19 represents the year 2019. Out of the next three digits, the first digit represents the semester in which the subject belongs, Eg. in 807, 8 means 8th semester and 07 is the 7th subject in that semester. The last alphabet represents whether the subject belongs to the Practical or laboratory category. Eg. (P) Means the subject belongs to the Practical category.

L-T-P STRUCTURE

Notations	Description
L	Lecture hours- For theory based courses hours are represented in this form Eg 3-0-0 , means 3 hour lecture per week is dedicated for this subject
T	Tutorial hours- These hours may be assigned for solving numerical problems and allied activities. Eg. 3-1-0, means 1 hour per week is dedicated for this purpose.
P	Practical/Drawing/Interactive session/Visits etc- These hours may be dedicated for conducting laboratory sessions, practical classes, Engg/machine drawing classes, interactive sessions, group discussions and even industrial visits pertaining to a specific subject for better learning. Eg. 0-0-1 means one hour is dedicated for the above-mentioned purpose.

Description
Theory based courses (other the lecture hours, these courses can have tutorial and practical hours, e.g., L-T-P structures 3-0-0, 3-1-2, 3-0-2 etc.)
Laboratory based courses (where performance is evaluated primarily on the basis of practical or laboratory work with LTP structures like 0-0-3, 1-0-3, 0-1-3 etc.)

DEPARTMENTS: -

Each course is offered by a Department and their two-letter course prefix is given in Table

Departments and their codes

Sl.No	Department	Course Prefix
01	Electrical & Electronics Engineering	EE
02	Electronics & Communication Engineering	EC
03	Information Technology	IT
04	Mechanical Engineering	ME
05	Printing Technology	PT

INDUCTION PROGRAM

A mandatory induction program for first semester students is designed for three weeks. This unique three-week immersion foundation programme designed especially for the fresher's, includes a wide range of activities right from workshops, lectures and seminars by eminent people, visits to local areas, familiarization to branch, department and innovations, physical activity, yoga, literacy, sports tournaments, social work and much more. The programme is designed to mould students into well-rounded individuals, aware and sensitized to local and global conditions and foster their creativity, improve their level of confidence, to involve with the existing environment, inculcate values and ethics, and help students to discover their passion. Foundation Programme also serves as a platform for the fresher's to interact with their batch mates, faculty and seniors and start working as a team with them. The program is structured around the following four themes:

The programme is designed to attain the following objectives:

- **Values and Ethics**: Focus on fostering a strong sense of ethical judgment and moral fortitude.
- **Creativity**: Provide channels to exhibit and develop individual creativity by expressing themselves through art, craft, music, singing, media, dramatics, and other creative designs/activities.
- **Leadership, Communication and Teamwork**: Develop a culture of teamwork and group communication.
- **Social Awareness**: Nurture a deeper understanding of the existing local and global environment and our role in that place as a responsible citizen of the world.

SUBJECTS AND GROUPS IN 1st and 2nd SEMESTER			
GROUP	**SUBJECT CODE**	**SUBJECT NAME**	**COMP/OPT**
A	MA19 100	Calculus and Linear Algebra	COMP FOR SEM1
	MA19 200	Differential Equations and Vector Calculus	COMP FOR SEM 2
B	CH19 100	Engineering Chemistry	OPT (1/2) IN BOTH SEMESTERS
	PH19 100	Engineering Physics	
C	GS19 100	Engineering. Graphics	OPT (1/2) IN BOTH SEMESTERS
	EM19 100	Engineering Mechanics	
D	EC19 100	Concepts of Electronics Engineering	COMP FOR EC IN SEM 1
	EE19 100	Concepts of Electrical Engineering	COMP FOR EE IN SEM 1
	ME19 100	Concepts of Mechanical Engineering	COMP FOR ME IN SEM 1
	IT19 100	Introduction to Computing and Problem Solving	COMP FOR IT IN SEM 1
	PT19 100	Concepts of Printing Technology	COMP FOR PT IN SEM 1
E*	EC19 101	Basics of Electronics Engineering	OPT (1/4) FOR SEM1 & OPT (2/4) FOR SEM 2- RELEVANT SUBJECTS
	EE19 101	Basics of Electrical Engineering	
	CE19 101	Basics of Civil Engineering	
	ME19 101	Basics of Mechanical Engineering	
F	ES19 100	Environmental Science	COMP FOR SEM 1
	DE19 200	Concept Based Engineering	COMP FOR SEM 2
G	CH19 100(P)	Engineering Chemistry Lab	OPT (1/2) IN BOTH SEMESTERS
	PH19 100(P)	Engineering Physics Lab	
H**	EE19 100(P)	Electrical Engineering Workshop	OPT (2/4) IN BOTH SEMESTERS
	EC19 100(P)	Electronics Engineering Workshop	
	CE19 100(P)	Civil Engineering Workshop	
	ME19 100(P)	Mechanical Engineering Workshop	
	IT19 100(P)	Introduction to Computing and Problem Solving Lab	
	PT19 100 (P)	Printing Technology Workshop	
I	CM19 100	Communicative English	COMP FOR SEM 1
	LL19 200	Language Lab	COMP FOR SEM2

COMP- COMPULSORY SUBJECT

OPT – OPTIONAL SUBJECT

* Concerned branches have to avoid choosing Basic of Engineering (E) ie., Mechanical Engineering

Engineering students are not permitted to choose Basics of Mechanical Engineering and same is applicable for other branches also.

** EE19 100(P), EC19 100(P), ME19 100(P), IT19 100 (P), PT19 100 (P) are COMPULSORY for respective branches in SEMESTER 1.

SCHEME OF I SEMESTER B.Tech ECE COURSE

Subject Code	Subject Name	Hours/Week			Marks		Duration of Semester End Examination	Credits
		L	T	P/D	Internal	End Semester		
MA19 100	Calculus and Linear Algebra	3	1	0	50	100	3	4
PH19/ CH19 100	Engineering Physics/ Engineering Chemistry	3	1	0	50	100	3	4
GS19/ EM19 100	Engineering Mechanics	3	2	0	50	100	3	4
	Engineering Graphics	3	0	2				
EC19 100	Concepts of Electronics Engineering	2	1	0	50	100	3	2
EE19/ CE19 / ME19 101	Basics of Electrical Engineering/ Basics of Civil Engineering/ Basics of Mechanical Engineering	2	1	0	50	100	3	2
ES19 100	Environmental Science	2	0	1	100	-	-	0
CM19 100	Communicative English	2	0	0	100	-	-	0
CH19/ PH19 100 (P)	Engineering Chemistry Lab / Engineering Physics Lab	0	0	2	100	-	3	1
EE19/ CE19/ ME19 100 (P)	Electrical Engineering Workshop / Civil Engineering Workshop / Basics of Mechanical Engineering	0	0	2	100	-	3	1
EC19 100 (P)	Electronics Engineering Workshop	0	0	2	100	-	3	1
	TOTAL	**30**			**750**	**500**		**19**

NOTE:

COMMUNICATIVE ENGLISH

Objective is to develop in the under-graduate students of engineering a level of competence in English required for independent and effective communication for their professional needs. Coverage: Listening, Barriers to listening, Steps to overcome them, Purposive listening practice, Use of technology in the professional world. Speaking, Fluency & accuracy in speech, Positive thinking, Improving self-expression, Tonal variations, Group discussion practice, Reading, Speed reading practice, Use of extensive readers, Analytical and critical reading practice, Writing Professional Correspondence, Formal and informal letters, Tone in formal writing, Introduction to reports. Study Skills, Use of dictionary, thesaurus etc., Importance of contents page, cover & back pages, Bibliography, Language Lab.

SCHEME OF II SEMESTER B.Tech ECE COURSE								
Subject Code	**Subject Name**	**Hours/Week**			**Marks**		**Duration of Semester End Examination**	**Credits**
		L	**T**	**P/D**	**Internal**	**End Semester**		
MA19 200	Differential Equations and Vector Calculus	3	1	0	50	100	3	4
PH19/ CH19 100	Engineering Physics/ Engineering Chemistry	3	1	0	50	100	3	4
GS19/ EM19 100	Engineering Mechanics	3	2	0	50	100	3	4
	Engineering Graphics	3	0	2				
EE19 / CE19 101	Basics of Electrical Engineering / Basics of Civil Engineering	2	1	0	50	100	3	2
EE19 / ME19 101	Basics of Mechanical Engineering	2	1	0	50	100	3	2
DE19 200	Concept Based Engineering	2	0	1	100	-	-	0
CH19/ PH19 100 (P)	Engineering Chemistry Lab / Engineering Physics Lab	0	0	2	100	-	3	1
EE19 / CE19 100 (P)	Electrical Engineering Workshop / Civil Engineering Workshop	0	0	2	100	-	3	1
EC19 / ME19 100 (P)	Electronics Engineering Workshop / Mechanical Engineering Workshop	0	0	2	100	-	3	1
LL19 200	Language Lab	0	0	2	100	-	-	0
	TOTAL	**30**			**750**	**500**		**19**

SCHEME OF III SEMESTER B.Tech COURSE								
Subject Code	**Subject Name**	**Hours/Week**			**Marks**		**Duration of Semester End examination**	**Credits**
		L	**T**	**P/D**	**Internal**	**End Semester**		
EN19 301	Engineering Mathematics III	3	1	0	50	100	3	4
EC19 302	Electronic Circuits	3	1	0	50	100	2	4
EC19 303	Network Theory	3	1	0	50	100	3	4
EC19 304	Digital Electronics	3	1	0	50	100	3	4
EC19 305	Electronic Devices	3	1	0	50	100	3	3
EN19 306	Life Skills and Ethics for Engineers	2	0	2	100	-	-	0
EC19 307(P)	Digital Electronics Lab	0	0	3	50	100	3	1
EC19 308(P)	Electronic Circuits Lab	0	0	3	50	100	3	1
	TOTAL	**17**	**5**	**8**	**450**	**700**		**21**
		30						

NOTE:

LIFE SKILLS& ETHICS FOR ENGINEERS

Life skills are those competencies that provide the means for an individual to be resourceful and positive while taking on life's vicissitudes. Development of one's personality by being aware of the self, connecting with others, reflecting on the abstract and the concrete, leading and generating change, and staying rooted in time-tested values and principles is being aimed at. This course is designed to enhance the employability and maximize the potential of the students by introducing them to the principles that underlie personal and professional success, and help them acquire the skills needed to apply these principles in their lives and careers. Professional ethics is highly needed for an engineer. This course will focus on to improvise the ethical quality of an engineer to meet the changing demands and requirements of the society.

SCHEME OF IV SEMESTER B.Tech ECE COURSE								
Subject Code	**Subject Name**	**Hours/Week**			**Marks**		**Duration of Semester End examination**	**Credits**
		L	**T**	**P/D**	**Internal**	**End Semester**		
EN19 401	Engineering Mathematics IV	3	1	0	50	100	3	4
EC19 402	Signals and Systems	3	1	0	50	100	3	4
EC19 403	Microprocessor & Microcontroller	3	1	0	50	100	3	4
EC19 404	Analog Communication	3	1	0	50	100	3	3
EC19 405	Analog Circuits	3	1	0	50	100	3	3
EN19 406	Constitution of India	2	0	2	100	-	-	0
EC19 407(P)	Analog Circuits Lab	0	0	3	50	100	3	1
EC19 408(P)	Analog Communication Lab	0	0	3	50	100	3	1
	TOTAL	**17**	**5**	**8**	**450**	**700**		**20**
		30						

SCHEME OF V SEMESTER B.Tech ECE COURSE								
Subject Code	**Subject Name**	**Hours/Week**			**Marks**		**Duration of Semester End examination**	**Credits**
		L	**T**	**P/D**	**Internal**	**End Semester**		
EN19 501	Engineering Economics and Principles of Management	3	1	0	50	100	3	3
EC19 502	Digital Signal Processing	3	1	0	50	100	3	4
EC19 503	Digital Communication	3	1	0	50	100	3	3
EC19 504	Electromagnetic Waves	3	1	0	50	100	3	3
EC19 505	Computer Architecture	3	1	0	50	100	3	3
EC19 506	Program Elective 1	3	1	0	50	100	3	3
EC19 507(P)	Digital Signal Processing Lab	0	0	3	50	100	3	1
EC19 508(P)	Microcontrollers Lab	0	0	3	50	100	3	1
	TOTAL	**18**	**6**	**6**	**400**	**800**		**21**
		30						

Program Elective I	
EC19 506(A)	Computing and Problem Solving
EC19 506(B)	Scientific Computing
EC19 506(C)	Embedded Systems
EC19 506(D)	Power Electronics
EC19 506(E)	Electronic Instrumentation
EC19 506(F)	Data Analysis

SCHEME OF VI SEMESTER B.Tech ECE COURSE

Subject Code	Subject Name	Hours/Week L	T	P/D	Marks Internal	End Semester	Duration of Semester End examination	Credits
EC19 601	Control System	3	1	0	50	100	3	4
EC19 602	VLSI Design	3	1	0	50	100	3	4
EC19 603	Data Communication & Networking	3	1	0	50	100	3	3
EC19 604	Antennas and Propagation	3	1	0	50	100	3	3
EC19 605	Program Elective II	3	1	0	50	100	3	3
EC19 606	Open Elective I	3	1	0	50	100	3	3
EC19 607(P)	Digital Communication Lab	0	0	3	50	100	3	1
EC19 608(P)	Mini Project	0	0	3	100	-	-	1
	TOTAL	**18**	**6**	**6**	**450**	**700**		**22**
		30						

*** Submission of report for internship done during the break of semester 6 can be done during the start of semester 7.**

Program Elective II		Open Elective I	
EC19 605(A)	Multirate Signal Processing	EC19 606(A)	Industrial Safety Engineering
EC19 605(B)	Renewable Energy Systems	EC19 606(B)	Soft Skill & Communication
EC19 605(C)	Basic Thermodynamics	EC19 606(C)	Entertainment Electronics
EC19 605(D)	Satellite Communication	EC19 606(D)	IoT and Applications
EC19 605(E)	Robotics	EC19 606(E)	Project Management
EC19 605(F)	Entrepreneurship	EC19 606(F)	Disaster Management

NOTE:

OPEN ELECTIVE:

These elective subjects are open to all students of various engineering disciplines. Any student can opt an elective subject based on his/her interest. These elective topics are of general in nature and focused on thrust areas. The number of students that can be accommodated in an elective is limited to 50, the allotment can be on first come first serve basis.

SCHEME OF VII SEMESTER B.Tech ECE COURSE								
Subject Code	**Subject Name**	**Hours/Week**			**Marks**		**Duration of Semester End examination**	**Credits**
		L	**T**	**P/D**	**Internal**	**End Semester**		
EN19 701	Information Theory and Coding	3	1	0	50	100	3	4
EC19 702	Digital System Design	3	1	0	50	100	3	4
EC19 703	Microwave Theory and Techniques	3	1	0	50	100	3	3
EC19 704	Optical Communication	3	1	0	50	100	3	3
EC19 705	Program Elective III	3	1	0	50	100	3	3
EC19 706(P)	VLSI Design Lab	0	0	3	50	100	3	1
EC19 707(P)	Advanced Communication Lab	0	0	3	50	100	3	1
EC19 708(P)	Project Phase 1	0	0	4	100	-	-	3
EC19 709(P)	Internship *	0	0	0	100	-	-	1
	TOTAL	**15**	**5**	**10**	**550**	**700**		**23**
		30						

*** Submission of report for internship done during the break of semester 6 can be done during the start of semester 7.**

Program Elective III	
EC19 705(A)	Adaptive Signal Processing
EC19 705(B)	Speech and Audio Processing
EC19 705(C)	Bio-Medical Electronics
EC19 705(D)	Opto-Electronic Devices
EC19 705(E)	Introduction To MEMS
EC19 705(F)	Error Control Codes

NOTE:

1. PROJECT PHASE I:

A Project topic must be selected either from research literature or the students themselves may propose suitable topics in consultation with their guides. The guides may encourage socially relevant project which can be interdisciplinary in nature.

Faculty members and students can interact with members of the local body, practicing engineers, industry and research institutions, to identify the issues which are predominant in that area/state and needs immediate attention. Such issues may be categorized and converted into a research problem so that they can study the feasibility of doing a research project in that area. This method of addressing the problems of society will enhance the culture and social concern of the students. This initiative can produce engineers with social commitment.

The objective of project work is to enable the student to take up investigative study in the broad field which can be of interdisciplinary in nature, either fully theoretical/simulation/practical or involving both theoretical and practical work. The department can assign a group of four students, under the guidance of a faculty to do the project work. Thus the assigned faculty can constantly interact with these students and mentor them properly to gain confidence in taking up a research work and supporting them for making it a reality. This initiative is expected to provide a good base for the student(s) in taking up a research & development project.

Faculty themselves or along with students in the Institutions/departments can apply for project grants with research organizations like Kerala State Council for Science Technology and Environment (KSCSTE), Department of Science & Technology (DST) for doing projects. Faculty/students can also approach Agricultural, Veterinary, Fisheries, and Health Sciences Universities for doing projects in a variety of fields where they require technical support from the engineering sector. These types of funded research projects will improve the creativity and outlook of the students which will be beneficial to the society.

The assignment to normally include:

- Survey and study of published literature on the assigned topic;
- Preparing an Action Plan for conducting the investigation, including team work;
- Working out a preliminary Approach to the Problem relating to the assigned topic;
- Block level design documentation
- Conducting preliminary Analysis/ Modeling/ Simulation/ Experiment/ Design/ Feasibility.
- Preparing a Written Report on the Study conducted for presentation to the department.
- Final seminar, as oral presentation before the evaluation committee.

Total marks: 100, minimum marks required to get a pass is 50, Mark distribution is as follows

Project Guide	: 30
Interim evaluation by the evaluation committee	: 20
Final presentation	: 30
Report evaluation by the evaluation committee	: 20

2. INTERNSHIP

Students need to undergo a minimum of 10-15 days internship in an Industry/Firm associated with rural technology and agriculture/Rural village to observe, identify and give suggestions to the problems related to electronics and communication or allied engineering sector in the society. The Internship should give exposure to the practical aspects of the electronics and allied engineering discipline. In addition, the student may also work on a specified task or project which may be assigned to him/her. The students will have an opportunity to develop observational skills, develop confidence to identify and understand the issues related with electronic and communication devices/systems and come up with solutions to rectify the same. This motive of the programme is ultimately focused on the mutual benefit to the students, industry and society. The outcome of the internship should be presented in the form of a report.

Total marks: 100, minimum marks required to pass the internship is 50, split-up of the marks are as follows

Attendance	: 10
Coordinator	: 20
Technical Content of the Report	: 30
Presentation	: 40

SCHEME OF VIII SEMESTER B.Tech ECE COURSE								
Subject Code	**Subject Name**	**Hours/Week**			**Marks**		**Duration of Semester End examination**	**Credits**
		L	**T**	**P/D**	**Internal**	**End Semester**		
EN19 801	Image and Video Processing	3	1	0	50	100	3	4
EC19 802	Wireless Mobile Communication	3	1	0	50	100	3	3
EC19 803	Program Elective IV	3	1	0	50	100	3	3
EC19 804	Program Elective V	3	1	0	50	100	3	3
EC19 805(P)	Seminar	0	0	6	100	-	-	2
EC19 806(P)	Project Phase II	0	0	8	100	-	-	6
EC19 807(P)	Viva Voce	0	0	0	-	100	-	3
	TOTAL	**12**	**4**	**14**	**400**	**500**		**24**
		30						

Program Elective IV		**Program Elective V**	
EC19 803(A)	Computer Vision	EC19 804(A)	Wireless Sensor Networks
EC19 803(B)	Nano Electronics	EC19 804(B)	CMOS Design
EC19 803(C)	High Speed Electronics	EC19 804(C)	Wavelets
EC19 803(D)	Biomedical Signal Processing	EC19 804(D)	Cryptography and Network Security
EC19 803(E)	Pattern Recognition	EC19 804(E)	Artificial Intelligence & Machine Learning
EC19 803(F)	Quantum Computing	EC19 804(F)	Organic Electronics

NOTE:

1. SEMINAR

To encourage and motivate the students to read and collect recent and reliable information from their area of interest confined to the relevant discipline from technical publications including peer reviewed journals, conference, books, project reports etc., prepare a report based on a central theme and present it before a peer audience. A faculty member can guide maximum of five students of his/her area of interest to have better interaction and creative support in guiding the seminar. Each student shall present the seminar for about 20 minutes duration on the selected topic. The report and the presentation shall be evaluated by a team of internal members comprising three senior faculty members based on style of presentation, technical content, adequacy of references, depth of knowledge and overall quality of the report.

Total marks: 100, minimum marks required to pass the seminar is 50, split-up of the marks are as follows

Attendance	: 10
Seminar Guide	: 20
Technical Content of the Report	: 30
Presentation	: 40

2. PROJECT PHASE II:

The objective of project work II & dissertation is to enable the students to extend further the investigative study taken up in Project Phase I. This work can be either fully theoretical/practical or involving both theoretical and practical work, socially relevant initiatives (work from local body/village) funded project from a research organization. The project is under the guidance of a faculty (project Guide) from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This project work is expected to provide a good overall training for the students in research and development, execution of a theory into practical by facing the challenges with confidence by developing technical leadership. The assigned project work is normally evaluated based on the following points:

- Depth of knowledge in the topic assigned/work executed based on the report prepared under Phase I;
- Review and finalization of the approach to the identified problem relating to the assigned topic/work.
- Detailed Analysis/ Modeling/ Simulation/ Design/ Problem Solving/ Experiment as needed.
- Final development of product/process, testing, results, conclusions, and future directions.
- Preparation of a paper for Conference presentation/Publication in Journals, if available.
- Preparation of a Dissertation in the standard format for evaluation by the Department.
- Final Presentation before a Committee.

Total marks: 100, minimum marks required to pass 50

Project Guide	: 30
Interim evaluation, by the evaluation committee	: 20
Quality of the report evaluated by the above committee	: 20
Final evaluation by a three-member faculty committee	: 30

Activities that a student can engage in and the maximum quantum of points that can be earned from them are listed below.

Annexure-I

i) National Level Activities			
Code	**Name of activity**	**Max. Activity Points**	**Minimum Duration**
NA1	N S O	70	Two Semesters
NA2	N C C	70	Two Semesters
NA3	N S S	70	Two Semesters
ii) College Level Activities			
CA1	Active Member/Office bearer of Professional Societies (Student Chapters)	30/40	Four Semesters
CA2	Elected Office bearer of Student forums	30	Two semesters
CA3	Member/Captain- College Athletic/ Games teams	20/30	Two Semesters
CA3	Executive Member of Student Clubs	20	Two Semesters
CA4	Volunteer for important College functions	20	Two Semesters
CA5	Committee member/ Organizer of Tech Fest/ Cultural Fest/ Conference	20/30	Two Semesters
CA6	Placed within top three in Paper presentation/debate/ cultural competitions etc	30	
CA7	Placed within top three in State level Sports/Games	30	
Additional 20 points to be given for CA3/CA7 if the achievement is at the national level.			
iii) Entrepreneurship			
EA1	Any Creative Project execution	40	
EA2	Awards for Projects	60	
EA3	Initiation of Start-ups	60	
EA4	Attracted Venture Capital	80	
EA5	Filed a Patent	80	

EA6	Completed Prototype Development	80	
iv) Self Initiatives			
SA1	Attend a National Conference	20	
SA2	Attend an Int. National Conference	30	
SA3	Published/got an Award for a technical paper.	30/40	
SA4	Organizer of student technical Conf/Competition	30	
SA5	Foreign language skills	50	
SA6	Webinar related to the Engineering/Management/Social science (Max of Ten)	2	
SA7	Online courses taken & completed	Maximum 50	10 weeks

ACTIVITY POINTS: -

The Tutor, HOD and Principal must ensure that the students have acquired the required mandatory 50 activity points (25 activity points in the case of LE students) by the end of 4th and another 50 activity points by the end of 8th semester. The accumulated activity points of all students must be consolidated and entered in to the university portal by the college officials upon completion of the 4th semester (50/25 points) and the 8th semester (50 points) before the commencement of the respective University examinations.

GROUP A

MA19 100	CALCULUS AND LINEAR ALGEBRA	3-1-0-4 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To familiarize with functions of several variables that is essential in most branches of Engineering.
- To develop the tool of Power series for learning Advanced Engineering Mathematics.
- To develop the tool of Fourier series for learning Advanced Engineering Mathematics.
- To develop the essential tool of Matrices and Linear Algebra in a comprehensive manner.

SYLLABUS:

Module I: Sequences and Series. (12 hours)

Indeterminate forms and L'Hospital's rule ; Definition of sequences and series; Convergence of sequence and infinite series, Tests for convergence of infinite series- Comparison test, Ratio test, Root test, Raabe's, Logarithmic test; convergence of Alternating series (Leibnitz's test), absolute convergence.

Module II: Power Series. (8 hours)

Taylor's and Maclaurin's theorems with remainders, Power series, Taylor's Series, Maclaurin's series, series for exponential, trigonometric, hyperbolic and logarithmic functions. Leibnitz formula for derivative of product of two functions.

Module III: Multivariable Calculus. (10 hours)

Functions of several variables; Limit, continuity and partial derivatives, total derivative; Maxima, minima and saddle points; Radius of curvature, Circle of curvature, evolutes and involutes.

Module IV: Fourier Series. (10 hours)

Periodic functions, Trigonometric series, Fourier series, Euler Formula, Even and Odd functions, Fourier series for Even and Odd functions, Functions having arbitrary period, Fourier series of functions having arbitrary period, Half range expansions, Half range sine and cosine series.

Module V: Matrices. (12 hours)

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Rank of a matrix, Solution of System of linear equations-Homogeneous and non-homogeneous; Hermitian, skew –Hermitian and Unitary matrices; Eigen values and Eigen vectors; Cayley Hamilton theorem; Diagonalisation of matrices; Quadratic forms; Orthogonal Transformation.

COURSE OUTCOMES:

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

- Use the derivatives to find critical points, inflection points and local extrema.
- Understand the basic concept of partial differentiation and its applications in engineering.
- Develop skills in computations and applications of infinite sequences and sums.
- Expand the periodic function by using Fourier series and apply it in signals and systems.
- Use matrices and determinants for solving system of linear equations and apply it in engineering problems.

TEXT BOOKS:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

REFERENCE BOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley& Sons,2006.
2. Veerarajan T., Engineering Mathematics for First year, Tata McGraw-Hill, New Delhi2008.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw-Hill, New Delhi, 11th Reprint, 2010.
4. D.Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint,2008.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, Edition, 2010.

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern *(Maximum Marks-100).*
PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks*** Two questions from each module with choice to answer one question.

MA19 200	DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS	3-1-0-4(L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To introduce effective mathematical tools for the solutions of differential equations that model physical process
- To acquaint with mathematical tools needed in evaluating multiple integrals and their usage.
- To familiarize with concept of vector differentiation and vector integration.

SYLLABUS:

Module I: First order ordinary differential equations. (10 hours)

Differential equations reducible to homogeneous, Exact, linear and Bernoulli's equations, Equations of the first order and higher degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairout's type. Applications of differential equations of first order- orthogonal trajectories.

Module II: Ordinary differential equations of higher orders. (10 hours)

Second order linear differential equations with constant coefficients, method of variation of parameters, second order linear differential equations with variable coefficients, Cauchy- Euler equations, Legender's linear equations.

Module III: Multiple integrals and their applications. (12 hours)

Double integrals (cartesian and polar co-ordinates), Change of order of integration of double integrals, change of variables (cartesian to polar), applications: areas and volumes, triple integrals, volume of solids, change of variables (rectangular to cylindrical, rectangular to spherical polar).

Module IV: Vector differential calculus. (10 hours)

Vector functions of a single variable, Differentiation of vector functions, scalar and vector fields, gradient of scalar field, divergence and curl of vector fields, physical meaning, relation between the vector differential operators.

Module V: Vector integral calculus. (10 hours)

Integration of vectors, scalar line integrals, surface and volume integrals of vector functions, Gauss divergence theorem, Stokes theorem, Greens theorem (without proof).

COURSE OUTCOMES:

At the end of the course the student will be able to.

- Acquire basic knowledge of differential equations and methods of solving them.
- Model and analyse differential equations in a wide range of physical phenomena and has got applications across all branches of engineering.
- Model physical phenomena involving continuous changes of variables and parameters
- Apply the concept of vector functions and learn to work with conservative vector field.
- Apply computing integrals of scalar and vector field over surfaces in three-dimensional space.

TEXT BOOKS / REFERENCE BOOKS:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9^{th} Edition, Pearson, Reprint, 2002 Erwin Kreyszig, Advanced Engineering Mathematics, 9^{th} Edition, John Wiley& Sons, 2006.
2. Erwin Kreyszig, Advanced engineering mathematics, 9^{th} Edition, John Wiley & sons 2006.
3. E.A.Coddington, An introduction to ordinary differential equations, Prentice Hall 1995.
4. S L Ross, Differential Equation, 3^{rd} ed., Wiley India 1984.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
6. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers,36^{th} Edition, 2010.

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern *(Maximum Marks-100).*

PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***

Two questions from each module with choice to answer one question.

GROUP B

CH19 100	ENGINEERING CHEMISTRY	3-1-0-4 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To enable the students to acquire knowledge in the concepts of chemistry for engineering applications.
- To familiarize the students with different application oriented topics like polymers, nanomaterial's, lubricants, fuels, storage devices, etc.
- To focus the students on the chemistry of compounds resulting from pollution, waste generation and environmental degradation and to apply the knowledge in solving these current environmental problems effectively.
- To develop abilities and skills that is relevant to the study and practice of chemistry.

SYLLABUS:

Module I: (10 Hours)

Water: hardness, determination of hardness by edta method, softening (lime-soda and ion exchange methods), numerical problems based on hardness and lime soda method, purification of water for domestic use.
Polymers: classification, addition polymerization (free radical, cationic, anionic, and coordination mechanism of polymerisation), condensation polymerization, crystallinity in polymers (amorphous, crystalline and semi-crystalline), concept of glass transition temperature (Tg), factors affecting Tg.
Conducting polymers: introduction, synthesis, structure, properties and applications of conducting polymers like polyacetylene and polyaniline.

Module II: (10 Hours)

Lubricants: classification of lubricants (solid, liquid, and semisolid), Mechanism of lubrication (thick film, thin film, and extreme pressure), properties of lubricants (viscosity, flash and fire point, cloud and pour point, aniline point, and corrosion stability).

Fuels: classification of fuels, calorific value, determination of calorific value using bomb calorimeter; numerical problems based on calorific value, liquid fuels (petroleum), refining of petroleum, cracking and reforming, petrol knock and octane number, diesel knock and cetane number, bio-diesel.

Module III: (10 Hours)

Nanoscience: introduction, classification of nanomaterials, synthesis of nanomaterials (hydrolysis and reduction), fullerenes and carbon, nanotubes, properties and applications of CNTs.
Green chemistry : definition, importance and limitations, twelve principles of green chemistry with their explanations and examples.

Module IV: (10 Hours)

Electrochemistry: electrochemical cells, salt bridge, Helmholtz double layer, single electrode potential, EMF and its measurement by Poggendorf's compensation method, determination of single electrode potential using SHE, electrochemical series and its applications, Nernst equation and its applications; numerical problems based on potential and Nernst equation, concentration cells (electrode and electrolyte concentration cells), glass electrode and pH measurement using glass electrode (Numerical problems).

Storage and fuel cells: lead acid accumulator and nickel cadmium battery, fuel cells, H_2/O_2 fuel cell, solar cells.

Module V: (12 Hours)

Corrosion: theories of corrosion, dry corrosion (self protecting corrosion products, pilling-bed worth rule), wet corrosion (corrosion of iron in acidic, neutral and basic conditions), galvanic corrosion and galvanic series, differential aeration corrosion, stress corrosion, factors influencing corrosion, corrosion control by cathodic protection.

Protective coatings: inorganic metallic coatings (galvanizing, tinning, cementation, electroplating), inorganic non-metallic coatings (phosphate, chromate, chemical oxide, anodising), organic coatings (paints).

COURSE OUTCOME:

The student will be able to

- Analyze the importance of hardness of water and the basic concept of polymers
- Rationalize the properties of lubricants and the major fuels used in the daily life
- Explore the basic idea of nanoscience and the significance of environmental protection by studying the green chemistry
- Streamline the worth of electrical storage using batteries or fuel cells by learning the electrochemistry
- List major chemical corrosion reactions and prevention methods that are used in the protection of metals

TEXT BOOKS:

1. A textbook of Engineering Chemistry by Dr. Sunitha Rattan, S. K. Kataria Publisher.
2. Engineering Chemistry by N. Krishnamurthy and D. Madhavan, PHI Learning, Pvt Ltd.

REFERENCE BOOKS:

1. Seymour R.B, Introduction to Polymer Chemistry, McGraw Hill, New York.
2. Billmeyar F.W, Text book of Polymer Science, Wiley Inter-science, New York.
3. L.H. Sperling, Introduction to Physical Polymer Science, Wiley Interscience, New York.
4. P.K. Goel, Water Pollution, Causes, Effects and Control, New Age International
5. F. A. Cotton, and G. Wilkinson, Advanced Inorganic Chemistry, 3rd Ed., Wiley Eastern Ltd.
6. P. W. Atkins, Physical Chemistry, J.D. Paula, Oxford University Press.
7. V. Kumar, Introduction to Green Chemistry, Vishal Publishing House.
8. V.S. Muraleedharan and A. Subramania – Nano Science and Technology, Ane Books.
9. B. S. Bahl and ArunBahl S. Advanced Organic Chemistry, Chand & Company.
10. L. S. Brown and Thomas A. Holme, Chemistry for Engineering Students, Cengage Learning.
11. Engineering Chemistry by Jain and Jain, Dhanpat Rai Publishers.
12. Engineering Chemistry by P. Rath, Cengage Learning.
13. Engineering Chemistry by M.J Shultz, Cengage Learning, New Delhi.
14. Engineering Chemistry by R. Mukhopadhyay and S. Datta, New Age International Publishers.
15. A textbook of Engineering Chemistry by S. S. Dara and S. S. Umare, S. Chand Pvt Ltd.

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class

University Examination Pattern *(Maximum Marks-100).*
PART A**: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B**: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks
Two questions from each module with choice to answer one question.

PH19 100	ENGINEERING PHYSICS	3-1-0-4 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To impart the basic concepts and ideas in physics.
- To develop scientific attitudes and enable the students to correlate the concepts of physics with the core programmes.

SYLLABUS:

Module I: (10 Hours)

Interference: coherence, interference in thin films and wedge shaped films (reflected system) Newton's rings; measurement of wavelength and refractive index of liquid, interference filters, antireflection coating.
Diffraction: Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit, plane transmission grating, grating equation; measurement of wavelength, Rayleigh's criterion for resolution of grating, resolving power and dispersive power of grating.
Polarization of Light: types of polarized light, double refraction, Nicol Prism, quarter wave plate and half wave plate, production and detection of circularly and elliptically polarized light, induced birefringence; Kerr Cell, polaroid & applications.

Module II: (10 Hours)

Quantum Mechanics: uncertainty principle and its applications, formulation of time dependent and time independent Schrodinger equations, physical meaning of wave function, energy and momentum operators, eigen values and functions, one dimensional infinite square well potential , quantum mechanical tunnelling (qualitative).
Statistical Mechanics: macrostates and microstates, phase space, basic postulates of Maxwell-Boltzmann, Bose-Einstein and Fermi Dirac statistics, distribution equations in the three cases (no derivation), Fermi level and its significance.

Module III: (10 Hours)

Waves: one dimensional wave; differential equation and solution. three dimensional waves: differential equation and its solution (no derivation), transverse vibrations of a stretched string.

Acoustics: Intensity of sound, loudness, absorption coefficient, reverberation and reverberation time, significance of reverberation time, Sabine's formula (no derivation), factors affecting acoustics of a building.

Ultrasonics: production of ultrasonic waves; magnetostriction effect and piezoelectric effect, magnetostriction oscillator and piezoelectric oscillator, detection of ultrasonics; thermal and piezoelectric methods, applications of ultrasonics - NDT and medical.

Module IV: (12 Hours)

Photonics: basics of solid state lighting, LED, photodetectors, photo voltaic cell, junction and avalanche photo diodes, photo transistors, thermal detectors, solar cells; V-I characteristics.

Optic fibres: principle of propagation-numerical aperture, optic fibre communication system (block diagram), industrial, medical and technological applications of optical fibre, fibre optic sensors, basics of intensity modulated and phase modulated sensors.

Module V: (10 Hours)

Laser: properties of lasers, absorption, spontaneous and stimulated emissions, population inversion, Einstein's coefficients, working principle of laser, optical resonant cavity, Ruby laser, Helium-Neon laser, semiconductor laser (qualitative), applications of laser, holography (recording and reconstruction).

Superconductivity: superconducting phenomena, Meissner effect. Type-I and Type-II superconductors, BCS theory (qualitative), high temperature superconductors, Josephson Junction, SQUID; Applications of superconductors.

COURSE OUTCOME:

Students will be

- Familiarised with the basic principles of Physics and its significance in engineering systems and technological advancements.
- Able to apply the theories of Physics in the field of Engineering and Technology.
- Exposed to the different branches of Physics and their field of applications in engineering.
- Able to understand the modern developments in Physics and to utilized them in technological developments.
- Able to develop the scientific attitudes and to correlate the concepts of Physics to core programmes

TEXT BOOKS:

1. Physics for Engineers- M.R.Seenivasan- New Age Publishers 1996 Edition.
2. Beiser A, Concepts of Modern Physics, McGraw Hill India Ltd.
3. Brijlal and Subramanyam, A Text Book of Optics, S.Chand & Co.
4. Mehta V K, Principles of Electronics, S.Chand & Co.
5. Rajendran V and Marikani A, Physics I, Tata McGraw Hill Co Ltd.

REFERENCE BOOKS:

1. Aruldhas G, Engineering Physics, PHI Ltd.
2. Bhattacharya and Tandon, Engineering Physics , Oxford India.
3. Dominic and Nahari, A Text Book of Engineering Physics, Owl Books Publishers
4. Hecht E, Optics, PearsonEducation.
5. Mehta N, Applied Physics for Engineers, PHILtd.
6. Palais J. C, Fiber Optic Communications, Pearson Education.
7. Pandey B. K and Chathurvedi S, Engineering Physics, Cengage Learning.
8. Philip J, A Text Book of Engineering Physics, Educational Publishers.
9. Premlet B, Engineering Physics, McGraw Hill India Ltd.
10. Sarin A and Rewal A, Engineering Physics, Wiley India Pvt Ltd.
11. Sears and Zemansky, University Physics, Pearson.
12. Vasudeva A. S, A Text Book of Engineering Physics, S. Chand &Co.
13. Kakani A. S, A Text Book of Electronics, New Age International (p) publishers 2000 Edition.

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern *(Maximum Marks-100)*
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PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks.***

Two questions from each module with choice to answer one question.

GROUP C

GS19 100	ENGINEERING GRAPHICS	3-0-2- 4 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- Graphics is the language of engineers and hence make the student capable of conceiving shape and geometry of various objects and to effectively communicate their design ideas through drawings and sketches as per standards.
- Enable students to prepare & understand engineering drawings.

SYLLABUS:

Module I: (8 hours)

Engineering Graphics – introduction - Drawing instruments and their use – lines, Lettering and dimensioning – Scales- Familiarization with Standard Code of practice for general engineering drawing. Theory of projections - Projections of points in different quadrants.

Module II: (16 hours)

a) Projections of straight lines - True length and inclinations of a line with reference planes. Traces of lines – Line parallel to both reference planes - Perpendicular to one of the reference planes - Inclined to one and parallel to other reference plane - Inclined to both the reference planes – Rotating line method – Rotating plane method.

b) Projections of planes - lamina of geometrical shapes - Plane lamina parallel, inclined and perpendicular to the reference planes - Inclined to one and perpendicular to the other reference plane - Inclined to both the reference planes - Inclined to the two reference planes but perpendicular to the profile plane.

Module III: (16 hours)

a) Projections of Solids of revolution and Frustums - Projections of solids with axis parallel to one and inclined to the other reference plane - Axis inclined to both the reference planes - Projections of solids on auxiliary planes (Solids to be drawn: Cube, Prisms, Pyramids, Tetrahedron, Cone and Cylinder).

b) Sections of solids - Sections by cutting planes parallel to the reference planes - Cutting plane inclined to one and perpendicular to other reference plane - True shape of the section by projecting on auxiliary plane (Solids to be drawn: Cube, Prisms, Pyramids, Tetrahedron, Cone and Cylinder).

Module IV: (15 hours)

a) Development of surfaces of solids - Method of parallel line & radial line developments - Development of Polyhedra, Cylinder, Cone and sectioned solids - Development of solids having hole or cut.

b) Introduction to isometric projection - Isometric scale - Isometric views - Isometric projections of Prisms, Pyramids, Cylinder, Cone, Spheres, sectioned solids and combination of them.

Module V: (10 hours)

a) Introduction to perspective projections – Classification of perspective views - Visual ray and vanishing point method of drawing perspective projection - Perspective views of plane figures such as polygons and circles - Perspective views of solids like Prisms and Cube.

b) Conventional representation of threaded fasteners - Drawing of nuts, bolts, washers and screws -Locking arrangements of nuts - Bolted and screwed joints - Foundation bolts.

c) Introduction to Computer Aided Drafting (CAD) - Preparation of engineering drawings by using any software capable of drafting and modelling - Creation of simple figures like polygon and general multiline figures only.

(Module V, Part C: For internal work assessment only, not for University Examination)

COURSE OUTCOMES:

After completion of the course, the student will be able to

- Familiarise with the Fundamentals of Engineering Drawing standards.
- Interpret 3D shapes from orthographic projections of objects and they will be able to make orthographic projections of any object.
- Draw the sectional view of the solids.
- Make developments of surfaces & solids.
- Draw the perspective projections of objects and prepare CAD drawings.

TEXT BOOKS

1. P.I Varghese, Engineering Graphics, VIP Publications, Thrissur.
2. N D Bhatt, "Engineering Drawing", Charotar Publications.

REFERENCE BOOKS:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. John.K.C, Engineering graphics, PHI Learning Pvt, Ltd. 2009.

Internal Continuous Assessment *(Maximum Marks-50).*

60% - Assignments (minimum 10 Drawing sheets, 2 from each module) plus two assignments on CAD.

30% - Tests (minimum 2).

10% - Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).

PART A

Q 1. Two questions (a) and (b) of 20 marks each from module II, one from module II (a) and one from module II(b), with choice to answer any one.

Q 2. Two questions (a) and (b) of 20 marks each from module III, one from module III(a) and one from module III(b), with choice to answer any one.

Q 3. Two questions (a) and (b) of 20 marks each from module IV, one from module IV(a) and one from module IV(b), with choice to answer any one.

PART B

Q 4. Three Questions (a), (b) and (c) of 20 marks each from module III &V, one from module III(b), one from module V(a) and one from module V(b), with choice to answer any two.

EM19 100	ENGINEERING MECHANICS	3-2-0-4 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To acquaint with general approach of solving engineering problems.
- To illustrate the application of the theory learned in Mechanics in practical engineering problems.
- To lay clear fundamentals to core Engineering Subjects.

SYLLABUS:

Module I: (16 hours)

Introduction to engineering mechanics - units - dimensions - vector and scalar quantities - laws of mechanics - elements of vector algebra - important vector quantities - equivalent force systems – translation of a force to a parallel position - resultant of a force system - simplest resultant of special force systems - distributed force systems - equations of equilibrium - free body diagrams - free bodies involving interior sections - general equations of equilibrium - problems of equilibrium - static indeterminacy. (Both vector and scalar formulations are to be introduced to solve problems).

Module II: (12 hours)

Friction – laws of friction – simple contact friction problems. Introduction to structural mechanics - trusses - analysis of simple trusses - method of sections – method of joints.

Module III: (12 hours)

First moment and centroid– theorems of Pappus-Guldinus - second moment of plane and composite areas – parallel and perpendicular axis theorems – polar moment of inertia of area – product of inertia and principal axis (conceptual level treatment only).
Moment of inertia of a rigid body and lamina (derivation of MI for cylinder, rod and sphere).

Module IV: (15 hours)

Dynamics: Rectangular and Cylindrical co-ordinate system **-** Combined motion of rotation and translation – Concept of instantaneous center – Motion of connecting rod of piston and crank of a reciprocating pump- Rectilinear translation – Newton’s second law – D’Alembert’s Principle– Application to connected bodies (Problems on motion of lift only).

Module V: *(10 hours)*

Mechanical vibrations – Free and forced vibration - Degree of freedom - Simple harmonic motion – Spring-mass model – Period – Stiffness –Frequency – Simple numerical problems of single degree of freedom.

COURSE OUTCOMES:

After completion of the course, the student will be able to

- Gain knowledge on basic concepts of Engineering Mechanics.
- Apply the theory of mechanics in practical level.
- Get idea on centroid, moment of inertia and mass moment of inertia of composite structures.
- Relate kinematics with kinetics equations in simple practical problems.
- Get knowledge on vibrations during motion.

TEXT BOOKS:

1. Shames I. H, Engineering Mechanics - Statics and Dynamics, Pearson Prentice.
2. Timoshenko, S & Young D. H, Engineering Mechanics, McGraw Hill.

REFERENCE BOOKS:

1. Benjamin J., Engineering Mechanics, Pentex Book Publishers and Distributors.
2. Bhavikkatti S. S., Engineering Mechanics, New Age International Publishers.
3. Hibbeler R. C., Engineering Mechanics: Statics and Dynamics. Pearson PrenticeHall.
4. Kumar, D.S., Engineering Mechanics: Statics and Dynamics, S.K. Kataria& Sons.
5. Kumar K. L., Engineering Mechanics, Tata McGraw Hill Publishing Company Ltd.
6. Rajasekaran S and Sankarasubramanian G, Engineering Mechanics, Vikas Publishing House Private Limited.
7. Tayal, A. K., Engineering Mechanics- Statics and Dynamics, Umesh Publications.

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2).

20% -Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern *(Maximum Marks-100).*

PART A*: Analytical/problem solving SHORT questions* ***10 x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

GROUP D

EC19 100	CONCEPTS OF ELECTRONICS ENGINEERING	2-1-0-2 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To get knowledge about types, specification and common values of passive components.
- To understand the working of diodes and its applications.
- To understand the working of transistors and its applications.
- To familiarize the working and characteristics of MOSFET.
- To familiarize some measuring instruments.

SYLLABUS:

Module I: (8 hours)

Passive components: Resistors: concepts of fixed & variable resistors, Carbon composition type resistors, metal film resistors, wire wound resistors, construction, power rating & tolerance, Capacitors: different types, construction of mica and ceramic capacitors (disc & tubular), color code, electrolytic (Teflon) capacitors, Inductors: construction of single layer, multilayer and variable inductors, principle of low power transformers, Electro mechanical components: relays and contactors.

Module II: (8 hours)

Semiconductor Physics: Basic concepts, Intrinsic and extrinsic semiconductors, PN Junction diode, barrier potential, Terminal characteristics of diodes, V-I characteristics, Effect of temperature, Equivalent circuit of a diode, Diode small signal model, Specification parameters of diodes and numbering, Diode applications - diode clipping and clamping circuits, voltage multiplier circuits, Rectifiers, Half wave and full wave rectifiers, derivation of rectifier specifications like PIV, DC output voltage, ripple factor, efficiency, rectification factor, analysis of filters with rectifiers L, C, LC and pi filters, Zener diode, Varactor diode, characteristics, working principle of LED, photo diode, solar cell.

Module III: (8 hours)

Bipolar Junction Transistors: Structure, typical doping, Principle of operation, concept of different configurations. Detailed study of input and output characteristics of common base and common emitter configuration, current gain, comparison of three configurations. Concept of load line and operating point. Need for biasing and stabilization, voltage divider biasing, Transistor as amplifier, switch, RC coupled amplifier and frequency response.

Module IV: (8 hours)

Junction Field Effect Transistors: Structure, principle of operation, characteristics, comparison with BJT.

MOSFET: Structure, principle of operation of Enhancement type MOSFET, Current voltage characteristics, Depletion-type MOSFET.

Principle of operation of Photo transistor, UJT, SCR.

Module V: (7 hours)

Electronic Measurements and measuring Instruments, Generalized performance parameters of instruments: error, accuracy, sensitivity, precision and resolution, Principle and block diagram of analog and digital multimeter, Block diagram of CRO, Measurements using CRO, Lissajous patterns, Principle and block diagram of DSO, function generator.

COURSE OUTCOMES:

The student will be able to

- Identify various active and passive electronic components.
- Explain the operation, uses and limitations of PN junction diodes.
- Explain the operation of Bipolar Junction Transistors and some applications.
- Describe the operation of Field Effect Transistors.
- Identify the constructional details and functions of various electronic measuring instruments.

TEXT/ REFERENCE BOOKS:

1. Bell D. A., Electronic Devices and Circuits, Oxford University Press.
2. Boylested R. L. and Nashelsky L., Electronic Devices and Circuit Theory, Pearson Education.
3. Kal S., Basic Electronics: Devices, Circuits and its Fundamentals, PHI Learning.
4. Millman J., Halkias, C and Parikhu C. D., Integrated Electronics, Tata McGraw Hill.
5. Neaman D. A, Electronic Circuits Analysis and Design, McGraw Hill.
6. Sedra, A. S. and Smith K. C., Microelectronic Circuits, Oxford University Press.

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).

***PART A**: Analytical/problem solving SHORT questions* **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

***PART B**: Analytical/Problem solving DESCRIPTIVE questions* **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

GROUP E

EE19 101	BASICS OF ELECTRICAL ENGINEERING	2-1-0-2 (L-T-P-C)

COURSE OBJECTIVES:

- To impart a basic knowledge in Electrical Engineering with an understanding of fundamental concepts.

SYLLABUS:

Module I: (7 hours)

Elementary concepts of electric circuits: Kirchhoff's laws, constant voltage and current sources-Problems; Formation of network equations by mesh current and node voltage methods: matrix representation, solution of network equations by matrix methods- problems; star-delta conversion (resistive networks only-derivation is not needed) -problems.

Module II: (7 hours)

Magnetic Circuits: MMF, field strength, flux density, reluctance (definition only); comparison between electric and magnetic circuits.
Energy stored in magnetic circuits, magnetic circuits with air gap: numerical problems on series magnetic circuits.
Electromagnetic Induction: Faraday's laws, Lenz's laws- statically induced and dynamically induced emf - self inductance and mutual inductance, coefficient of coupling.

Module III: (10 hours)

Alternating Current fundamentals: Generation of alternating voltages-waveforms, frequency, period, average, RMS values and form factor of periodic waveform (pure sinusoidal)- numerical problems.
AC Circuits: Phasor representation of alternating quantities-rectangular and polar representation, Analysis of simple AC circuits: concept of impedance, power and power factor in ac circuits-active, reactive and apparent power solution of RL, RC and RLC series circuits-numerical problems.
Three phase systems: Generation of three phase voltages advantages of three phase systems, star and delta connection (balanced only), relation between line and phase voltages, line and phase currents three phase power measurement by two wattmeter method (derivation is not required)- numerical problems.

Module IV: (8 hours)

Electric Machines: DC Generator and Motor: Construction, working principle,Back EMF.

Types of motor: shunt, series, compound (short and long), principle of operation of dc motor, applications, numerical problems (voltage - current relations only).

Transformer: Construction of single phase and three phase.
Transformers (core type only): EMF equation and related numerical problems.
Losses and efficiency of transformer for full load– numerical problems (no equivalent circuit).

Module V: (7 hours)

AC Motors: Three phase induction motor-squirrel cage and slip ring induction motor working principle- synchronous speed, slip and related numerical problems (No equivalent circuit).
Power Systems: block diagram of power system, generation of power.
Block schematic representation of generating stations- hydro electric, thermal and nuclear power plants.
Renewable energy sources: solar, wind, tidal, geo thermal (block diagram & working only).

COURSE OUTCOMES:

Students will be able to

- Apply fundamental concepts and basic circuit laws to solve simple DC electric circuits.
- Understand and analyse basic magnetic circuits.
- Apply the fundamental laws of electrical engineering to solve simple ac circuits in steady state.
- Study the working principles of electrical machines.
- Get an idea about various schemes of electric power generation.

TEXT BOOKS:

1. Bhattacharya S. K., Basic Electrical & Electronics Engineering, Pearson.
2. Bird J., Electrical Circuit Theory and Technology, Routledge, Taylor & Francis Group.
3. Del Toro V., Electrical Engineering Fundamentals, Prentice Hall of India.
4. Hayt W. H., Kemmerly J. E., and Durbin, S. M., Engineering Circuit Analysis, Tata McGraw Hill.
5. Hughes, Electrical and Electronic Technology, Pearson Education.
6. Mehta V.K. and Mehta R., Basic Electrical Engineering, S. Chand Publishing.
7. Parker and Smith, Problems in Electrical Engineering, CBS Publishers and Distributors.
8. Sudhakar and Syam Mohan, Circuits and Networks Analysis and Synthesis, Tata McGraw Hill.
9. Suresh Kumar K. S, Electric Circuits and Networks, Pearson Education.

REFERENCE BOOKS:

1. D.P Kothari and I.J Nagrath, :Basic electrical Engineering", Tata McGraw Hill, 2010.
2. D.C Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L.S. Bobrow : Fundamentals of Electrical Engineering, Oxford University Press, 2011.

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2).
20% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern *(Maximum Marks- 100).*

PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC19 101	BASICS OF ELECTRONICS ENGINEERING	2-1-0-2 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To get knowledge about types, specification and common values of passive components.
- To understand the working of diodes and transistors.
- To impart knowledge about basic electronic and digital systems
- To familiarize the working of amplifiers and oscillators.
- To give basic ideas about various communication systems (no analysis required in this subject).

SYLLABUS:

Module I: (7 hours)

Passive components: Resistors: concepts of fixed & variable resistors, Carbon composition type resistors, metal film resistors, wire wound resistors, construction, power rating & tolerance.
Capacitors: different types, construction of mica and ceramic capacitors (disc & tubular), colorcode, electrolytic (Teflon) capacitors.
Inductors: construction of single layer, multilayer and variable inductors, principle of low power transformers.
Electro mechanical components: relays and contactors.

Module II: (7 hours)

Semiconductor Physics: Basic concepts, Intrinsic and extrinsic semiconductors, PN Junction diode, Principle of operation, V-I characteristics, principle of working of Zener diode, Photo diode, LED and Solar cell. Bipolar Junction Transistors, PNP and NPN structures, Principle of operation, input and output characteristics of common emitter configuration (NPN only).

Module III: (9 hours)

Digital Systems: logic expressions, Boolean laws, duality, De-Morgan's law, logic functions and gates, adders and subtractors.
Block diagram description of a dc power supply, half wave and full wave (including bridge) rectifiers, capacitor filter, working of simple zener voltage regulator.

Module IV: (7 hours)

Amplifiers and Oscillators: principle of electronic amplifiers, circuit diagram and working of common emitter amplifier, working principles of oscillators, concepts of feedback, circuit diagram & working of RC phase shift oscillator, Functional block diagram of operational amplifier, ideal operational amplifier, inverting and non-inverting amplifier.

Module V: (9 hours)

Radio Communication: modulation, principle of AM & FM, block diagrams of transmitters, waveforms, band width, principle of AM & FM demodulation, comparison of AM & FM, principle of super heterodyne receiver, block diagram.

Mobile communication: basic principles of cellular communications, concepts of cells, frequency reuse.

Optical communication: block diagram of the optical communication system, principle of light transmission through fiber, advantages of optical communication systems.

COURSE OUTCOMES:

Students will be able to

- List the basic electronic components such as passive and electro mechanical components.
- Illustrate the basic concept of different types of diodes and transistors.
- Develop simple circuits using diodes and transistors.
- Analyze simple circuits on operational amplifiers and digital gates.
- Explain about the basic communication systems.

TEXT BOOKS:

1. Bell D. A., Electronic Devices and Circuits, Oxford University Press.
2. Tomasy W., Advanced Electronic Communication system, PHI Publishers.

REFERENCE BOOKS:

1. Boylested R. L. and Nashelsky L., Electronic Devices and Circuit Theory, Pearson Education.
2. Frenzel L. E., Principles of Electronic Communication Systems, McGraw Hill.
3. Kennedy G. and Davis B., Electronic Communication Systems, McGraw Hill.
4. Rajendra Prasad, Fundamentals of Electronic Engineering, Cengage Learning.

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2).
20% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern *(Maximum Marks-100).*
PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

CE19 101	BASICS OF CIVIL ENGINEERING	2-1-0-2 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

The main objective of the course fundamentals of civil engineering is:

- To satisfy the technical requirement of understanding various principles associated with civil Engineering.
- To make the students persuade the civil engineering works that is an integral part of Engineering professional's life irrespective of the discipline.
- To give a broad perspective to the students to identify the oldest branch of engineering providing basic infrastructure for development.

SYLLABUS:

Module I: Scope of Civil Engineering. (8 hours)

Overview of Civil Engineering : Civil Engineering contributions to the welfare of society; specialized sub-disciplines in Civil Engineering: structural, construction, geotechnical, environmental, transportation and water resources engineering. Introduction to types of buildings as per NBC: selection of site for buildings, structural components of a residential building and their functions.

Module II: Building Planning. (8 hours)

Introduction to planning of residential buildings: site plan, orientation of a building, open space requirements, position of doors and windows, size of rooms.; Introduction to the various building area terms: computation of plinth area / built up area; floor area / carpet area- for a simple single storeyed building; setting out of a building.
Building drawing: plan, section and elevation of a single room building with RCC roof (sketching in the paper/note book only is expected).

Module III: Introduction to Surveying. (8 hours)

Surveying: objects, classification, principles; Brief description of the following instruments: (i) chain and accessories (ii) Dumpy level (iii) Theodolite. Use of levelling instrument for determining reduced levels of various stations: simple problems on leveling, use of theodolite for measuring horizontal angles (only brief description is required). Modern tools of surveying and mapping: total station, global positioning system, remote sensing and geographic information system.

Module IV: Civil Engineering Materials & Building Construction. (8 hours)

Brief description of Engineering properties and applications of the construction materials: bricks, stones, sand, cement, concrete, steel, timber, modern materials (Study on laboratory tests & detailed manufacturing processes of materials are not required).
Cement mortar and cement concrete: properties and applications: reinforced cement concrete fundamentals (only brief description is required).

Module V: Building Construction. (7 hours)

Foundations: types of foundations (sketches only), bearing capacity and settlement (definition only), functions of foundations, requirement of good foundations.

Stone and brick masonry construction: bonds used in general constructions, elevation and plan (one brick thick walls only).

Geometric, structural, and functional features of roads, bridges and dams.

COURSE OUTCOMES:

After completion of the course, the student will be able to

- Get an overview of surveying, building planning, water resources and transportation engineering.
- Understand the basics of civil engineering works that an engineer come across in professional as well as personal life.
- Prepare the layouts of buildings and other infrastructures, obtain understanding of the basic elements of the transportation system, techniques for water conservation, to prepare layouts of different buildings.
- Understand the Surveying with advanced instruments like remote sensing, GIS and GPS.
- Understand the property, use, advantages& disadvantages of different materials used in construction.

TEXT BOOKS:

1. Surveying Vol. I, II by Dr. B.C. Punamia.
2. Building planning, designing and scheduling by Gurcharan Singh.
3. Building Construction.,Rangwala, S. C. and Dalal, K. B.,Charotar Publishing house.
4. Basic Civil Engineering., S.S Bhavikatti., New Age International Pvt.Ltd,Publishers.

REFERENCE BOOKS:

1. Surveying Vol. I, II by Dr. B.C. Punamia.
2. Surveying and Levelling Vol. I and II by T.P Kanetkar and S.V Kulkarni.
3. Surveying Theory and Practice (Seventh Edition) by James M. Anderson, Edward M. Mikhail.
4. Remote sensing and Image interpretation by T.M Lillesand, R.W Kiefer. And J.W Chipman 5th edition.
5. Building Science and Planning by S.V.Doedhar.
6. Principles of Town planning by Keeble Lewis.
7. Rangwala, S. C., Essentials of Civil Engineering, Charotar Publishing House.
8. Rangwala, S. C. and Dalal, K. B., Engineering Materials, Charotar Publishing house.

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)
20% -Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Regularity in the class.

University Examination Pattern *(Maximum Marks-100).*
PART A*: Analytical/problem solving SHORT questions* ***10 x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

ME19 101	BASICS OF MECHANICAL ENGINEERING	2-1-0-2 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

To expose the students to the thrust areas in Mechanical Engineering and their relevance by conveying the fundamental concepts.

SYLLABUS:

Module I: (8 hours)

Thermodynamic processes: isobaric, isochoric, isothermal, adiabatic and polytropic : workdone and P-V diagrams; Laws of Thermodynamics, entropy, enthalpy; Ideal and real gas equations; Analysis of Carnot cycle, Otto cycle , Diesel cycle and Dual cycle; Efficiency of these cycles.

Module II: (8 hours)

Engines: major components and their functions (description only); Working principle of two stroke and four stroke I.C. Engines (diesel and petrol), comparison; MPFI & CRDI Engines. Power Transmission Devices: Belts and belt drives; chain drive, rope drive. Gears and gear trains: friction clutch (cone and single plate), brakes (types and applications only).

Module III: (8 hours)

Refrigeration: vapour compression and vapour absorption refrigeration systems, COP, Study of household refrigerator, energy efficiency rating; Refrigerants and their impact on environment.

Hydraulic turbines: Pelton, Francis and Kaplan turbines (applications only).

Pumps: introduction, classification, reciprocating and centrifugal (brief description and working only).

Module IV: (8 hours)

Sources of Energy: introduction, classification; Non-renewable energy: fossil fuels, solid, liquid and gaseous, calorific value; Renewable energy: hydroelectric, solar, wind, biomass, biogas, ocean thermal, tidal, wave and geothermal energy.

Power Plants: introduction, layout and working of diesel, nuclear, thermal and hydel power plants.

Module V: (7 hours)

Machine Tools: basic elements, Working principle and types of operations; lathe, drilling machine, shaper, planer, slotter, milling machine, grinding machine. Introduction to NC and CNC machines.
Engineering materials: classification, properties, alloys and their applications
Manufacturing process: introduction, elementary ideas of rolling and extrusion machining operations, turning, shaping, milling and drilling.

COURSE OUTCOMES:

After completion of the course, the student will be able to

- Analyse thermodynamic cycles and calculate its efficiency
- Illustrate the working and features of IC Engines and power transmission devices.
- Explain the basic principles of Refrigeration and describe the working of hydraulic machines
- Acquire knowledge about various energy sources and describe the layout and working of various Power Plants
- Describe the basic manufacturing, metal joining and machining processes

TEXT BOOKS

1. Balachandran, Basic Mechanical Engineering, Owl Books.
2. Benjamin J., Basic Mechanical Engineering, Pentex Books.
3. Clifford M., Simmons K. and Shipway P., An Introduction to Mechanical Engineering Part I – CRC Press.
4. Pravin Kumar, Basic Mechanical Engineering, pearson publications
5. Roy and Choudhary, Elements of Mechanical Engineering, Media Promoters & Publishers Pvt. Ltd. Mumbai.
6. Sawhney G. S., Fundamentals of Mechanical Engineering, PHI.

REFERENCE BOOKS:

1. Crouse, Automobile Engineering, Tata Mc-Graw-Hill, New Delhi.
2. Gill, Smith and Zuirys, Fundamentals of IC Engines, Oxford and IBH publishing company Pvt. Ltd. New Delhi. Crouse, Automobile Engineering, Tata Mc-Graw-Hill, New Delhi.
3. Nag P. K., Basic and Applied Thermodynamics, Tata McGraw-Hill.
4. V Ganeshan, Internal combustion engines, Mc-Graw-Hill.

5. R K Rajput, Thermal Engineering, Laxmi Publications, 2010
6. R K Bansal, A Text Book of Fluid mechanics and hydraulic machines, Laxmi Publications.
7. P C Sharma, Production Technology, S Chand publications

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2).
20% -Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Regularity in the class.

University Examination Pattern (*Maximum Marks-100).*
PART A*: Analytical/problem solving SHORT questions* ***10 x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

GROUP F

ES19 100	ENVIRONMENTAL SCIENCE	2-0-1-0 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To understand the problems of pollution, deforestation, solid waste disposal, degradation of environment, loss of biodiversity and other environmental issues at local and global levels.
- To create awareness among the students to address these issues and conserve the environment in a better way.

SYLLABUS:

Module I: Resources (9 hours)

The multidisciplinary nature of environmental science: definition scope and importance,

need for public awareness.

Natural resources: renewable and non-renewable resources; natural-associated problems.

Forest resources: use and over-exploitation; deforestation: case studies- timber extraction, mining, dams and their effects on forests and tribal people.

Water resources: use and over utilization of surface and ground water; floods, drought, and conflicts over water; dams (benefits and problems).

Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources- case studies.

Food resources: world food problems, changes caused by agriculture over grazing-, effects of modern agriculture fertilizer, pesticide problems, water logging, and salinity- case studies.

Energy resources: growing energy needs, renewable and non-renewable energy resources , use of alternate energy resources.

Land resources: land as a resource, land degradation, man-induced landslides (soil erosion and desertification).

Module II: Ecosystems (8 hours)

Concept of an ecosystem: structure and function of an ecosystem; producers, consumers and decomposers; Energy flow in the ecosystem: food chains and food webs, ecological pyramids, ecological succession.

Different Ecosystems: introduction, types, characteristics, features, structure; Function of the ecosystems: forest ecosystem, grassland ecosystem, desert ecosystem, aquatic ecosystem (ponds, streams, lakes, rivers, ocean , and estuaries).

Module III: Biodiversity (8 hours)

Introduction: definition, genetic, species and ecosystem diversity; Biogeographical classification of India.

Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values; Biodiversity at global, national, and local level; India as mega-diversity nation; Hot spot of biodiversity.

Threats to biodiversity: habitat loss, poaching of wild life, and man-wild life conflicts; Endangered and endemic species of India; Conservation of biodiversity (In-situ and Ex- situ conservation of biodiversity).

Module IV: Environmental Pollution. (7 hours)

Definition, causes, effects and control measures of air pollution; Water pollution; Soil pollution; Marine pollution; Noise pollution; Thermal pollution; Nuclear hazards.

Solid waste management: causes, effects and control measures of urban and industrial wastes.

Waste management: role of an individual in prevention of pollution, pollution case studies.

Disaster management: floods, earth-quake, cyclone and landslides.

Module V: Environment and Sustainable Development. (7 hours)

Sustainable use of natural resources; Conversion of renewable energy resources into other forms; Problems related to energy and energy auditing- case studies.

Water conservation: rain water harvesting and watershed management- case studies. Climate change: global warming, acid rain and ozone layer depletion- case studies. Nuclear accidents and holocaust- case studies.

Waste land reclamation: consumerism and waste products: reduce, reuse and recycle concept of products; Value education.

COURSE OUTCOMES:

After completion of the course, the student will be able to

- Develop concepts and methods from surroundings and their application in environmental problem solving.
- Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.
- Realize the importance of ecosystem and biodiversity for maintaining ecological balance.
- Identify and value the effect of the pollutants on the environment: atmosphere, water and soil.
- Analyse an industrial activity and identify the environmental problems

TEXT BOOKS:

1. Daniels and Krishnaswamy, Environmental studies, Wiley India Pvt Ltd, 2009.
2. Raman Sivakumar, Introduction to environmental science and engineering, 2nd edn, . Tata McGraw Hill, 2010.
3. AninditaBasak, Environmental Studies, Pearson Education, 2009.
4. Suresh K.D, Environmental Engineering and Management, Katson Books, 2007.
5. Benny Joseph, Environmental studies, 2nd edn, McGraw Hill, 2009.

REFERENCE BOOKS:

1. Raghavan Nambiar, K Text book of Environmental Studies, Scitech Publishers(India) Pvt. Ltd.
2. S.P Misra, S.N Pandey, Essential Environmental studies, Ane books, Pvt Ltd, 2009.
3. P N Palanisamy, P Manikandan, A Geetha, Manjula Rani, Environmental Science, Pearson Education, 2012.
4. D.L. Manjunath, Environmental Studies, Pearson Education, 2011.

Internal Continuous Assessment *(Maximum Marks-100).*
70% - Tests (minimum 2).
20% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

DE19 200	CONCEPT BASED ENGINEERING	2-0-1-0 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To excite the student on creative design and its significance.
- To make student aware of the processes involved in the design.
- To make the student understand the interesting interaction of various segments of humanities, science and engineering in the evolution of a design.
- To get an exposure as how to engineer a design.

SYLLABUS:

Module I: (8 hours)

Introduction: example of different kinds of designs and designers, design problems; Definition of design; engineering design and research: importance, role of science, engineering and technology in design, design constraints, design functions, design means and design form, functional and strength designs. design form, function and strength; initiation of creative designs; initiating the thinking process for designing a product of daily use. need identification; problem statement; market survey- customer requirements; design attributes and objectives; ideation; brain storming approaches; arriving at solutions; Closing on to the Design needs.

Module II: (8 hours)

Product life cycle: morphology of design, introduction to system design process, stage models, design process- different stages in design and their significance; define problem, concept generation and evaluation, detailed design process, defining the design space; analogies, quality function deployment: meeting what the customer wants; evaluation and choosing of a design.

Module III: (8 hours)

Design for X; covering quality, reliability, safety, manufacturing/construction, assembly, maintenance, logistics, handling; disassembly; recycling; re-engineering etc. design communication; realization of the concept into a configuration, drawing and model. design for function and strength. design detailing- material selection, design visualization- solid modeling; detailed 2D drawings.

Module IV: (8 hours)

Prototyping- rapid prototyping; testing and evaluation of design; design modifications; freezing the design; cost analysis. engineering the design from prototype to product. planning; scheduling; supply chains; inventory; handling; manufacturing/construction operations; storage; packaging; shipping; marketing; feed-back on design. list out the standards organizations. Prepare a list of standard items used in any engineering specialization.

Module V: *(7 hours)*

Product centred and user centred design. product centred attributes and user centred attributes. bringing the two closer. example: smart phone. aesthetics and ergonomics. value engineering, concurrent engineering, reverse engineering in design; culture based design; architectural designs; motifs and cultural background; tradition and design; design as a marketing tool; intellectual property rights, trade secret; patent; copy-right; trademarks; product liability.

COURSE OUTCOMES:

The student will be able to:

- Initiate process and component elements in good and optimal design.
- Design process stages and evaluation of the different steps involved.
- Visualize models by combining all interdisciplinary fields.
- Testing and evaluate the models while considering non engineering attributes.
- Improve product quality by design survey and obtaining the patent for the product.

TEXT BOOKS/REFERENCE BOOKS:

1. Pahl G, and Beitz, W. Engineering Design: A Systematic Approach, 3rd Ed., Springer, 2007.
2. Cross N. Engineering Design Methods: Strategies for Product Design (4th edition), John Wiley and Sons Ltd., Chichester, 2008.
3. Roozenburg N.F.M., Eekels J. Product Design, Fundamentals and Methods, Wiley, Chichester, 1995.
4. James A Senn, Analysis and Design of Information system, McGraw Hill 2003.

Internal Continuous Assessment *(Maximum Marks-100).*

70% - Tests (minimum 2).

20% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

GROUP G

CH19 100 (P)	ENGINEERING CHEMISTRY LAB	0-0-2-1 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To equip the students with the working knowledge of chemical principles, nature and transformation of materials and their applications.
- To develop analytical capabilities of students so that they can understand the role of chemistry in the field of Engineering and Environmental Sciences.

SYLLABUS:

List of Experiments

(Minimum 9 experiments out of 10)

1. Preparation of urea–formaldehyde and phenol–formaldehyde resin.
2. Estimation of total hardness in a given sample of water using EDTA.
3. Estimation of chloride ions in domestic water.
4. Determination of dissolved oxygen present in a given sample of water.
5. Determination of available chlorine in a sample of bleaching powder.
6. Estimation of copper in a given sample of brass.
7. Estimation of iron in a sample of iron ore.
8. Estimation of iron in Mohr's salt using standard $K_2Cr_2O_7$.
9. Determination of flash point and fire point of an oil.
10. Preparation of buffers and standardization of pH meter.

COURSE OUTCOME:

The student will be able to

- Apply and demonstrate the theoretical concepts of Engineering Chemistry.
- Synthesize of polymers like Bakelite and UF resins
- Estimate the amount of hardness, chloride ion and dissolved oxygen in water
- Measure the available chlorine present in bleaching powder
- Determine the amount of metals like iron or copper present in their ores

TEXT BOOK:

1. Dr.Sunita Rattan, Experiments in Applied Chemistry, S.K. Kataria and Sons, New Delhi.

REFERENCE BOOK:

1. Vogel, A Text Book of Quantitative Analysis, ELBS, London.

Internal Continuous Assessment *(Maximum Marks-100).*

60% - Laboratory practical, record and Viva voce.

30% - Tests.

10% - Regularity in the lab.

PH19 100 (P)	ENGINEERING PHYSICS LAB	0-0-2-1 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

This course is designed

- To impart practical knowledge about some of the phenomena they have studied in the Engineering Physics course.
- To develop the experimental skills of the students.

SYLLABUS:

List of experiments

(Minimum 10 experiments out of 20)

1. Characteristics of Zener diode.
2. Determination of band gap energy in a semi-conductor.
3. Voltage regulation using Zener diode.
4. Static characteristics of a transistor in common emitter configuration.
5. Characteristics of photodiode.
6. Characteristics of a LED and wavelength of emitted radiation.
7. Draw the aerial and illumination characteristics of a solar cell.
8. Draw the power load and current-voltage characteristics of a solar cell.
9. Wavelength of mercury spectral lines using diffraction grating and spectrometer.
10. Dispersive power using diffraction grating and spectrometer.
11. Diameter of a thin wire or thickness of a thin wire by Air-wedge method.
12. Wavelength of sodium light by Newtons Ring method.
13. Refractive index of given liquid by Newtons Ring method.
14. Specific rotation of cane sugar solution using polarimeter.
15. Wavelength of laser using Grating. Standardise the Grating using sodium light.
16. Resolving power using diffraction grating and spectrometer.
17. To determine the angular divergence of a laser beam.
18. To measure the numerical aperture of an optical fibre.
19. Melde’s string apparatus. Measurement of frequency in the transverse and longitudinal mode.
20. Wavelength and velocity of ultrasonic waves using ultrasonic diffractometer.

COURSE OUTCOME

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

- Demonstrate the understanding of the fundamental concepts in physics by setting up laboratory equipment safely and efficiently and planning and carrying out experimental procedures.
- Demonstrate the ability to apply knowledge/skills to real world settings by identifying possible sources of error and implementing techniques that enhance precision.
- Demonstrate critical thinking ability through analyzing and interpreting experimental data.
- Demonstrate effective communication skills by reporting verbally and in written language the experimental data, results, and assessment of reliability.
- Demonstrate teamwork skills by working in groups on a laboratory experiment.
- Demonstrate ability to innovate and be creative in a laboratory experiment.

REFERENCE BOOKS:

1. Avadhanulu M. N., Dani A. A. and Pokley P. M., Experiments in Engineering Physics, S. Chand & Co.
2. Gupta S. K., Engineering Physics Practicals, Krishna Prakashan Pvt Ltd.
3. Koser A. A., Practical Engineering Physics, Nakoda Publishers and Printers India Ltd.
4. Rao, B. S. and Krishna, K. V., Engineering Physics Practicals, Laxmi Publications Sasikumar, P. R. Practical Physics, PHI.

Internal Continuous Assessment *(Maximum Marks-100).*

60% - Laboratory practical, record and Viva voce.

30% - Tests.

10% - Regularity in the lab.

GROUP H

EE19 100 (P)	**ELECTRICAL ENGINEERING WORKSHOP**	**0-0-2-1 (L-T-P-C)**

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To impart a basic knowledge of electrical circuits, machines and power systems.

SYLLABUS:

List of experiments
(Minimum 10 experiments out of 10)

1. Familiarization of various types of service mains:wiring installations, accessories and house hold electrical appliances.

2. Methods of earthing: measurement of earth resistance, testing of electrical installations, precautions against and cure from electric shock.

3. Practice of making different joints: britannia, married and T-joints on copper/aluminium.

4. Wiring practice of a circuit to control two lamps by two SPST switches.

5. Wiring practice of a circuit to control one lamp by two SPDT switches.

6. Wiring practice of a circuit to control one fluorescent lamp and one three pin plug socket.

7. Wiring practice of a main switch board consisting of ICDP switch, DB, MCB‘s and ELCB‘s.

8. Familiarization of various parts of electrical motors and wiring of three phase and single phase motor with starter.

9. Familiarization of energy meter and measurement of energy consumption by a single phase load.

10. Familiarization of various electrical and electronic components such as transformers, resistors, AF and RF chokes, capacitors, transistors, diodes, IC‘s and PCB.

COURSE OUTCOMES:

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

- Familiarize with the important electrical components and their working.
- Make use of various testing instruments and commonly used tools.
- Get an idea of electrical protective devices.
- Practice simple electrical wirings and installations.
- Familiarize with the methods of earthing.

Internal Continuous Assessment *(Maximum Marks-100)*

60% - Laboratory practical, record and Viva voce

30% - Tests

10% - Regularity in the lab.

EC19 100 (P)	ELECTRONICS ENGINEERING WORKSHOP	0-0-2-1 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- The objective of this course is to familiarize the students about electronic components, measuring instruments, bread board assembling, soldering tools and components etc.

SYLLABUS:

List of Exercises / Experiments

(Minimum 10 experiments out of 11)

1. Familiarization/identification of electronic components.
2. Draw electronic circuit diagram using IEEE standard symbols.
3. Familiarization/application of instruments and equipment: multimeter, power supply, CRO, function generator.
4. Assembling of electronic circuit on general purpose bread board: Fixed voltage power supply with transformer, rectifier diode, capacitor filter, zener regulator.
5. Bread board assembling: Common emitter amplifier.
6. Introduction to soldering practice: study of soldering components, solders, tools, heat sink.
7. PCB assembly and testing of full wave rectifier circuit diagram.
8. PCB assembly and testing of inverting amplifier circuit.
9. Familiarization of setting up of a PA system with different microphones, loud speakers, mixer etc.
10. Assembling and dismantling of desktop computer/laptop/mobile phones.
11. Introduction to robotics: familiarization of components (motor, sensors, battery etc.) used in robotics and assembling of simple robotic configurations.

COURSE OUTCOMES:

The student will be able to

- Identify and test various active and passive components.
- Make use of various testing instruments and commonly used tools.
- Build electronic circuits on breadboard.
- Solder electronic circuits on PCB.
- Identify various subsystems of electronic systems like PA Systems and desktop computers.

Internal Continuous Assessment *(Maximum Marks-100).*

60% - Laboratory practical, record and Viva voce.

30% - Tests.

10% - Regularity in the lab.

CE19 100 (P)	CIVIL ENGINEERING WORKSHOP	0-0-2-1 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To provide experience on plotting, measuring/determining horizontal distances, level differences between stations and horizontal angles.
- To provide experience on setting out for small buildings, masonry construction and model making.

SYLLABUS:

List of Experiments

1. Setting out of a building: the student should set out a building (single room only) as per the given building plan using tape only.
2. Setting out of a building: the student should set out a building (single room only) as per the given building plan using tape and cross staff.
3. Chain surveying : study of chain and accessories, plotting one side of a building/ five or six points in the field using chain and cross-staff.
4. Horizontal measurements: study of compass, plotting one side of a building/five or six points in the field using compass; Find the area of an irregular polygon set out on the field.
5. Levelling: study of levelling instruments, determination of reduced levels of five or six points in the field.
6. Theodolite: study of theodolite, measuring horizontal angles.
7. Theodolite: study of theodolite, measuring vertrical angles.
8. Brick Masonry.
9. Plumbing: demonstration of plumbing fixtures, exercise in joints
10. Model making of simple solids.

COURSE OUTCOMES:

After the completion of the course, student will be able

- Understand the procedures for construction of several structures.
- Interpret survey data and compute areas and volumes.
- Familiarize with different components, equipment's and technical standards.
- Get an overview of surveying, building planning, plumbing, leveling.
- Understand the basics of civil engineering works.

Internal Continuous Assessment *(Maximum Marks-100).*

60% - Laboratory practical, record and Viva voce.

30% - Tests.

10% - Regularity in the lab.

ME19 100 (P)	MECHANICAL ENGINEERING WORKSHOP	0-0-2-1 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To inculcate engineering aptitude, confidence and experience towards technical skills.
- To train the students mentally and physically for industries.
- To impart knowledge and technical skills on basic manufacturing methods.

SYLLABUS:

List of Experiments

1. Carpentry: study of tools and joints, planning, chiseling, marking and sawing practice, different joints, use of power tools.
2. Fitting: study of tools, chipping, filing, cutting, drilling, tapping, male and female joints and stepped joints.
3. Smithy: study of tools, forging of square prism, hexagonal bolt.
4. Foundry: study of tools, sand preparation, moulding practice.
5. Sheet Metal work: study of tools, selection of different gauge sheets, types of joints, trays and containers.
6. Welding**:** study of tools, different types of joints, practice.

COURSE OUTCOMES:

After completion of the course, the student will be able to

- Obtain knowledge about various tools and operations used in carpentry.
- Perform various fitting operations and basic operations done in a smithy.
- Obtain sound knowledge in sheet metal work.
- Obtain knowledge of welding and metal properties.
- Obtain knowledge about various tools and operations used in Fitting.

Internal Continuous Assessment *(Maximum Marks-100)*

60% - Laboratory practical, record and Viva voce.

30% - Tests.

10% - Regularity in the lab.

GROUP I

CM19 100	COMMUNICATIVE ENGLISH	2-0-0-0 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To adapt the employability and career requirements of the industry.
- To adapt students with ease to the Industry environment by equipping with communication skills.
- To focus on overall capability in communicating ideas in an effective manner, apart from gaining academic competence.

SYLLABUS:

Module I: (4 hours)

Communication: definition, communication process; types of communication: formal and informal. Relevance of body language; verbal and non-verbal effective communication; communication breakdown: how to overcome communication barriers.

Module II: (7 hours)

Listening skills: listening and typing, focused listening, listening and sequencing of sentences, fill in the blanks, listening and answering questions. Reading comprehension: questions and answers, close exercises; Vocabulary building tasks: vocabulary trees, learning words through situations, word formation, roots, prefixes and suffixes, derivatives, synonyms and antonyms, phrasal verbs, homonyms.

Module III: (8 hours)

Parts of speech with special focuses on nouns & pronouns, verbs, adverbs, adjectives. subject- verb agreement. Speaking skills: linguistic and phonetics; vowels and Consonants; 44 phonetic symbols, Diphthongs, syllables, phonemes; stress and rhythm in connected speech: intonations and voice modulations, weak forms and strong forms, production of speech sounds in connected speech, shifting the stress for emphasis, relevance of correct pronunciation, face to face conversation of telephonic conversation.

Module IV: (3 hours)

Writing skills: C.V, effective resume, report, memo, business letters, structuring a report and e-mail communication.

Module V: (4 hours)

Developing self-esteem: presentation skills, facing the interview board, group discussions and debating skills; soft skills and time management; Psychometrics and stress management; emotional quotient.

COURSE OUTCOME:

The student will able to:

- Not only understand the process and nature of communication but also recognize the barriers to effective communication and learn to eradicate them.
- Attain and enhance competence in the four modes of learning: writing, speaking, reading and listening, and are able to recognize the meaning of new words based on contextual comprehension.
- Heighten their awareness of correct usage of English grammar in writing and sounds in speaking.
- To write official correspondences i.e., is reports, memos, letters, and e-mails and also prepare impressive curriculum vitae and resumes.
- Improve their self-esteem and also captivate to give effective presentations in a professional and facing interview boards confidently.

REFERENCE BOOKS:

1. Meenakshi Raman and Sangeeta Sharma., Technical Communication- Principles and Practice, Oxford University press.
2. R C Bhatia, Business Communication, Ane Books Pvt. Ltd, 2009.
3. Sunita Mishra and C Muralikrishna, Communication Skills for Engineers, Pearson Education.
4. Jovan van Emden and Lucinda Becker, Effective Communication for Arts and Humanities Students, Palgrave macmillam, 2009.
5. Sanjay Kumar and Pushpalata , Communication skills, Oxford University Press, 2011.
6. Practical English Usage. Michael Swan. OUP. 1995.
7. Remedial English Grammar. F.T. Wood. Macmillan, 2007.
8. On Writing Well. William Zinsser. Harper Resource Book. 2001.
9. Study Writing. Liz Hamp- Lyons and Ben Heasly. Cambridge University Press. 2006.
10. Communication Skills. Sanjay Kumar and PushpLata. Oxford.
11. T M Farhathullah, Communication Skills for Technical Students, Orient Longman, Hyderabad.

EVALUATION SCHEME:

Internal Continuous Assessment *(Maximum Marks-100).*

70% - Tests (minimum 2).

20% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

LL19 200	LANGUAGE LAB	0-0-2-0 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To enhance the linguistic skill of the students, keeping in view of the necessity of imparting employability skills of engineering graduates
- To Provide with a software platform which has functions like Listen-Respond- Intercommunicate-Monitor- Teacher call etc.
- To focus on the students overall ability in using English as a tool for communication.
- To overcome the inhibition factor while using English and equip them to adapt themselves to the industry environment with ease and confidence, bringing about a sort of transformation in each student.

LAB SESSIONS

1. Sessions on introduction to Linguistics and Phonetics: speech sounds and phonetic symbols; Syllables and phonemes.
2. Training to develop sharp listening skills: focused listening with emotional content; Relevance of correct pronunciation.
3. Sessions beginning with two minutes Oral Presentation on topics of their choice;

Role plays: students take on roles and engage in dialogues/ conversations.

4. The art of effective communication: effective presentation skills; presentation tools, voice modulations, word accent, rhythm and intonation; audience analysis.
5. Vocabulary building tasks: fun games in English.
6. Relevance of body language, how to face an interview board; mock interviews; group discussions with special focus on a candidate's etiquette; debates and the art of exhibiting the interpersonal skills; public speaking.
7. Soft-skills; Emotional quotient; Training sessions; Stress Management.

COURSE OUTCOMES:

- It brings about a consistent accent and articulacy in the pronunciation through the familiarity of phonetics.
- advance the capability to listening English conversations
- enhance their verbal communication skills through free speeches, role plays, activities, and interactions.
- Better understanding of nuances of English language through audio- visual experience and speaking skills with clarity and confidence which in turn enhances their employability skills. It brings about a consistent accent and intelligibility in the pronunciation of English by providing an opportunity for practice in speaking for all the students.
- capable of identify the meaning of novel words based on contextual comprehension.
- Equip the students to face the interview board with confidence, making them aware of the nuisances and methodology involved in this area; help them to actively participate in debates and group discussions and face the interview confidently.
- Prepared for creating effective presentations in front of different clusters.

SUGGESTED SOFTWARE:

1. Cambridge Advanced Learners' English Dictionary with CD.
2. The Rosetta Stone English Library.
3. Clarity Pronunciation Power.
4. Mastering English in Vocabulary, Grammar, Spellings, Composition.
5. Dorling Kindersley series of Grammar, Punctuation, Composition etc.
6. Language in Use, Foundation Books Pvt Ltd with CD.
7. Learning to Speak English - 4 CDs.
8. Microsoft Encarta with CD.
9. Murphy's English Grammar, Cambridge with CD.

REFERENCE BOOKS:

1. Spoken English (CIEFL) in 3 volumes with 6 cassettes, OUP.
2. English Pronouncing Dictionary Daniel Jones Current Edition with CD.
3. Spoken English- R. K. Bansal and J. B. Harrison, Orient Longman 2006 Edn.
4. A Practical course in English Pronunciation, (with two Audio cassettes) by J. Sethi, Kamlesh Sadanand & D.V. Jindal, Prentice-Hall of India Pvt. Ltd., New Delhi.

EVALUATION SCHEME:

Internal Continuous Assessment *(Maximum Marks-100).*

70% - Tests (minimum 2).

20% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

EN 19 301	ENGINEERING MATHEMATICS III	3-1-0-4 (L-T-P-C)

PRE-REQUISITES: CALCULUS AND LINEAR ALGEBRA

COURSE OBJECTIVES:

- To provide a quick overview of the concepts and results in complex analysis that may be useful in engineering
- To introduce the concepts of linear algebra and Fourier transform which are wealths of ideas and results with wide area of application

SYLLABUS:

MODULE I: (11 hours)

Linear Algebra (Proofs not required): Vector spaces – Definition, Examples – Subspaces – Linear Span – Linear Indpendence – Linear Dependence – Basis – Dimension– Orthogonal and Orthonormal Sets – Orthogonal Basis – Orthonormal Basis – Gram-Schmidt orthogonalisation process – Inner product spaces – Definition – Examples – Inequalities ; Schwartz, Triangle (No proof).

MODULE I: (11 hours)

Fourier Transforms - Fourier Integral theorem (Proof not required) – Fourier Sine and Cosine integral representations – Fourier transforms – transforms of some elementary functions – Elementary properties of Fourier transforms – Convolution theorem (No proof) – Fourier Sine and Cosine transforms – transforms of some elementary functions – Properties of Fourier Sine and Cosine transforms

MODULE III: (10 hours)

Laplace transform-Elementary properties- Inverse laplace transform- Solution of ordinary differential Equations using Laplace transform.

MODULE IV: (10 hours)

Series Solutions of Differential Equations-Power series method for solving ordinary differential equations – Frobenius method for solving ordinary differential equations – Bessel‘s equation – Bessel functions – Relation between Bessel functions .

MODULE V: (10 hours)

Partial Differential Equations-Introduction – Solutions of equations of the form F(p,q) =0 ; F(x,p,q) =0 ; F(z,p,q) =0 ; F1(x,p) = F2(y,q) ; Clairaut's form, z = px + qy + F(p,q) ; Legrange's form, Pp + Qq =R- Classification of Linear PDE's – Derivation of one dimensional wave equation and one dimensional heat equation – Solution of these equation by the method of separation of variables.

COURSE OUTCOME:

The student will be able to:

- Develops the essential tool of linear algebra in a comprehensive manner.
- Use tools for Fourier Transforms.
- Use tools for Laplace transforms and apply it in solution of differential equations.
- Acquire the knowledge of power series for learning advanced Engineering Mathematics.
- Use mathematical tools for the solution of Partial differential equations that models physical processes.

Text Books :

1. Bernaed Kolman, David R Hill, Introductory Linear Algebra, An Applied First Course, Pearson Education.
2. Erwin Kreysig, Advanced Engineering Mathematics ,9th Edition, John Wiley & Sons,2006.
3. P.Ramesh Babu, R.Anandanatarajan ,Signals and Systems, Scitech Publications(India) Pvt. ltd, 4th Edition.
4. B.S.Grewal,Higher Engineering Mathematics ,Khanna Publishers,35th Edition

Reference Books :

1. N.P.Bali,ManishGoyal,TextBook of Engineering Mathematics, Laxmi Publications, Reprint 2010.
2. Wylie C.R and L.C. Barrett, Advanced Engineering Mathematics ,McGraw Hill.
3. S.J. Farlow, Partial Differential Equations for Scientists and Engineers, Dover Publications,1993.

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).

PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC19 302	ELECTRONIC CIRCUITS	3-1-0-4 (L-T-P-C)

PRE-REQUISITES: CONCEPTS OF ELECTRONICS ENGINEERING

COURSE OBJECTIVES:

- To impart the basic idea of amplifiers and its design
- To study about different wave generating circuits.
- To develop the skill of analysis and design of various circuits using electronic devices

SYLLABUS:

MODULE I: (11 hours)

Regulators - Zener diode regulator - emitter follower output regulator - series pass transistor feedback voltage regulator - short circuit protection and fold back limiting - load and line regulation curves

Transistor model: h parameter model- BJT amplifiers- analysis and design of CC, CE and CB configurations using h parameter model.

MODULE II: (11 hours)

FET amplifiers: Biasing of JFET-small signal equivalent circuit models-Analysis and design of common source, common drain and common gate amplifier configurations-Low frequency and high frequency responses- Use of open circuit and short circuit time constants in finding the cut-off frequencies-Low and high frequency response of common emitter and common source amplifier - Emitter followers and source followers.

MODULE III: (11 hours)

RC differentiator and integrators Multivibrators – principles & analysis of Astable, Monostable and Bistable multivibrators - triggering methods-Schmitt trigger analysis of emitter coupled circuit- principles of miller and bootstrap circuits.

MODULE IV: (10 hours)

Feedback amplifiers- the general feedback structure - effects of negative feedback-Analysis of negative feedback amplifiers – Stability - study of stability using Bode Plots.

Positive feedback and oscillators - analysis and design of RC phase shift, Wein bridge, LC and crystal oscillators - stabilization of oscillations.

MODULE V: (9hours)

Power amplifier- class A, B, AB, C, D & S power amplifier- harmonic distortion-efficiency- wide band amplifier- broad banding techniques- low frequency and high frequency compensation-cascade amplifier- broad banding using inductive loads - Darlington pairs.

COURSE OUTCOMES:

The student will be able to

- Understand the analysis of different regulator circuits and the design of circuits using transistors.
- Design and analyse FET amplifiers and their frequency response.
- Understand and design various wave generating circuits.
- Understand the concept of feedback amplifiers and hence design different oscillators.
- Design and analyse various power amplifiers.

Text Books:

1.Sedra A.S & Smith K.C., Microelectronic Circuits, Oxford University Press
2.Millman&Halkias :Integrated Electronics, MGH. 1996.

Reference Books:

1.HorensteinM.N:MicroelectroniccircuitsandDevicesPHI
2.Gray &Meyer:Analysis and Design of Analog Integated Circuits; John Wiley
3.Schilling D.L. &Belove C.: Electronic Circuits, McGraw Hill,
4.Spencer &Ghausi, Introduction to Electronic Circuit Design; PearsonEducation
5.Thomas L.Floyd and David Buchla: Fundamentals of Analog Circuits,Pearson
6.Robert L Boylestad and Louis Nashelsky: Electronic Devices and Circuittheory, Pearson

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).

PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC 19 303	NETWORK THEORY	3-1-0-4 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To expose the students to the basic concepts of electric circuits and their analysis in time and frequency domain
- To introduce the concept of filter circuits and design of passive filters
- To introduce the techniques of network synthesis

SYLLABUS:

MODULE I: (11 hours)

Introduction to circuit variables and circuit elements ,Review of Kirchhoff's Laws, Independent and dependent Sources, Source transformations, Network topology, Network graphs, Trees, Incidence matrix, Tie-set matrix and Cut-set matrix, Solution methods applied to dc and phasor circuits: Mesh and node analysis of network containing independent and dependent sources, Network theorems: Thevenin's theorem, Norton's theorem, Superposition theorem, Reciprocity theorem, Millman's theorem, Maximum power transfer theorem

MODULE II: (9 hours)

Laplace transforms and properties: Partial Fraction expansions for inverse Laplace transforms, Solution of differential equations using Laplace transforms. Transformation of basic signals and circuits into s-domain Transient analysis of RL, RC, and RLC networks with impulse, step, pulse and exponential inputs.

MODULE III: (11 hours)

Network functions: The concept of complex frequency- driving point and transfer functions- Impulse response-Poles and Zeros of network functions-Restriction of poles and zeros in the driving point and transfer function, Time domain behavior from the pole-zero plot, Two-port network parameters: Impedance, admittance, transmission and hybrid-Conversion formulae. Analysis of interconnected two port networks-parallel, series, and cascade connections of two port networks.

MODULE IV: (10 hours)

Introduction to filters- low pass, high pass, band pass and band reject filters, RC, RL filters-constant K and m derived filters

Frequency transformations: Transformation to high pass, band pass and band elimination filters. Attenuators: Types of attenuators, T and Bridged T attenuators

MODULE V: (11 hours)

Elements of realizability Theory: Causality and stability-Hurwitz Polynomials-Positive Real Functions- Properties of LC Admittance Functions, Synthesis of L-C Driving point Admittances- Properties of R-C Driving point Impedances- Properties of R-L Impedances and R-C admittances.

COURSE OUTCOMES:

The student will be able to:

- Understand the basic concepts of electric circuits and the theorems.
- Analyse the electric circuits in time and frequency domain
- Understand the network functions and analysis not interconnected networks
- Understand the concept of filter circuits and design of passive filters
- Study the techniques of network synthesis

Text Books:

1. Van Valkenberg, Network Analysis, Prentice-Hall of India
2. Franklin F. Kuo, Network Analysis and Synthesis, Wiley India, Second Edition.
3. Edminister, Electric Circuits – Schaum's Outline Series, McGraw-Hill.
4. A William Hayt, "Engineering Circuit Analysis" 8th Edition, McGraw-Hill Education

Reference Books:

1. DeCarlo/Lin, Linear Circuit Analysis, Oxford University Press, Second edition
2. D. Roy Choudhary, Networks and Systems, New Age International Publishers, Second Edition
3. Sudhakar, A., Shyammohan, S. P.; "Circuits and Network"; Tata McGraw-Hill New Delhi, 1994

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).

PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC19 304	DIGITAL ELECTRONICS	3-1-0-4 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To introduce the basic concepts and laws involved in the Boolean algebra and logic families and digital circuits.
- To study the different number systems, logic gates and combinational as well as synchronous sequential circuits

SYLLABUS:

MODULE I: (11 hours)

Boolean algebra: Theorems and operations- Boolean expressions and truth tables-Duality and Inversion-Multiplying out and factoring expressions Exclusive-OR and equivalence operations Positive and Negative Logic.Combinational logic design using truth table- Minterm and Maxterm expansions-incompletely specified functions

Minimization Techniques: Algebraic Method, Karnaugh maps (including 5 and 6 variable) –Quine-McCluskey method- Multi-output circuits- Multi-level circuits- Design of circuits with universal gates.

MODULE II: (12 hours)

Number Representation: Fixed point - Floating point - 1‘s complement - 2‘scomplement. Binary Codes: BCD- Gray code- Excess 3 code- Alpha

Numeric codes – Error detecting and correcting codes- properties- Code conversion circuits-Number systems (Binary, Octal and Hexadecimal): conversions and arithmetic operations.

Arithmetic circuits: adders and subtractors- ripple carry adders- carry look ahead adders- adder cum subtractor-BCD Adder and Subtractor.

Combinational logic design using MSI circuits: Multiplexers- Demultiplexers- Decoders and Encoders-Digital Comparators -Parity Generators

MODULE III: (10 hours)

Latches and Flip-Flops: SR latch- SR Flip Flop- JK Flip Flop- D Flip flop - T Flip Flop- Flip Flops with preset and clear inputs- Triggering methods and their circuits -Conversion of one types of flip flop to another – Excitation table – Applications of Flip Flops.

Shift Registers: right shift- left shift- bidirectional- SISO- SIPO- PISO- PIPO- universal shift registers. Synchronous counter: Design, Lock out condition.

Asynchronous counter operation- Up counter- Down counter- Up/ down counter-Mod n counters. Other types of Counters: Ring counter- Johnson counter- BCD counter.

MODULE IV: (10 hours)

Synchronous sequential circuits: Finite State Machines- Mealy & Moore types- Basic design steps- Design of counters using Sequential Circuit Approach – FSM – ASM charts.

Asynchronous sequential circuits: Analysis and Synthesis- State Reduction and State Assignment- Hazards.

MODULE V: (9 hours)

Introduction to digital logic families: Characteristics- Basic working of a TTL NAND gate, ECL gate and CMOS logic gate.

Memory- Read-only memory, read/write memory - SRAM and DRAM.

Programmable Logic Devices-PLAs, PALs and their applications; Introduction to field programmable gate arrays (FPGAs).

COURSE OUTCOMES:

The student will be able to:

- Understand logic gates and use boolean algebra
- Design and analyze different combinational circuits
- Design and analyze different sequential circuits
- Design and analyze synchronous and asynchronous sequential circuits
- Study and understand different logic families and memory elements

Text Books:

1. Stephen Brown and Zvonko Vranesic, Fundamentals of Digital Logic with VHDL Design, TMH.
2. Charles H. Roth, Jr. Fundamentals of Logic Design, 5th edition, Thomson Books/Cole R P Jain, Modern Digital Electronics, Tata McGraw Hill
3. H. Taub and D. Schilling, Digital Integrated Electronics, McGraw Hill, 1977
4. D.A. Hodges & H.G. Jackson, Analysis & Design of Digital Integrated Circuits, McGraw Hill, 1983.

Reference Books:

1. John F Wakerly, Digital Design- Principles and Practices(Third edition), Pearson
2. Mano MM, DigitalDesign, PHI
3. Thomas L Floyd & R.P Jain, digital Fundamentals (Eight edition), Pearson
4. F.J. Hill and G.L. Peterson, Switching Theory and Logic Design, John Wiley, 1981.
5. Z. Kohavi, Switching and Finite Automata Theory, McGraw Hill, 1970.

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).

PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC19 305	ELECTRONIC DEVICES	3-1-0-3 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To provide an insight into the basic semiconductor concepts
- To provide a sound understanding of current semiconductor devices and technology to appreciate its applications to electronics circuits and systems

SYLLABUS:

MODULE I: (12 hours)

Energy bands in semiconductors - direct and indirect band gap semiconductors -effective mass - intrinsic and extrinsic semiconductors - Fermi and quasi Fermi level - electron and hole concentrations at equilibrium - temperature dependence of carrier concentration - carrier transport-conductivity and mobility - diffusion and drift of carriers - Einstein relation - continuity equation

MODULE II: (11 hours)

PN junctions - abrupt and graded junctions-contact potential - space charge at a junction - current flow at a junction - carrier injection - diode equation - minority and majority carrier currents - capacitance of pn junctions - reverse bias breakdown - zener and avalanche breakdown- tunnel diode - varactor diode - zener diode - Metal semiconductor junctions

MODULE III: (10 hours)

Bipolar junction transistors-Minority carrier distribution and terminal currents- coupled diode model-switching –Drift in the base region-Base narrowing -Avalanche breakdown-Kirk effect, Frequency limitations of transistor –capacitance and charging times- Hybrid-pi model

MODULE IV: (10 hours)

Junction FET - VI characteristics- MOS capacitor -C V characteristics- MOSFET – p channel and n channel MOSFETs - depletion and enhancement mode MOSFETs – small signal model,

MODULE V: (9 hours)

Power Electronics-Power Diodes - Insulated Gate Bipolar Transistor – Power MOSFETs, LED: working principle, characteristics – Photodiode: working principle, characteristics

COURSE OUTCOMES:

The students will be able to:

- Compute the carrier concentration at equilibrium and to describe the generation and recombination of charge carriers in semiconductors and transport mechanism
- Explain the formation, analysis and operation of PN junction
- Analyse the operation of bipolar junction transistors and compute the terminal currents
- Describe the structure and operation of JFET and MOSFET
- Understand the working of power electronic devices, working principle and characteristics of LED and photodiode

Text Books:

1. Ben G Streetman and Sanjay Banerjee: Solid State Electronic Devices, (Fifth Edition) Pearson Education
2. Neamen, Semiconductor Physics &Devices, Pearson Education
3. Sze S M, Physics of Semiconductor Devices, John Willey
4. Pierret R F, Semiconductor Device Fundamentals, Pearson Education
5. Tyagi M S, Introduction to Semiconductor Materials &Devices, John Willey
6. SimaDimitrije, Physics of Semiconductor Devices, Oxford University Press

Reference Books:

1. Sah C T, Solid State Electronics, World Scientific
2. Muller &Camins, Device Electronics for Integrated Circuits, John Willey
3. Dipankar Nagchoudhuri: Microelectronic Devices, Pearson Education

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).

PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EN19 306	LIFE SKILLS AND ETHICS FOR ENGINEERS	2-0-2-0 (L-T-P-C)

PRE-REQUISITES: NIL

LIFE SKILLS

Life skills are those competencies that provide the means for an individual to be resourceful and positive while taking on life's vicissitudes. Development of one's personality by being aware of the self, connecting with others, reflecting on the abstract and the concrete, leading and generating change, and staying rooted in time tested values and principles is being aimed at. This course is designed to enhance the employability and maximize the potential of the students by introducing them to the principles that underlie personal and professional success, and help them acquire the skills needed to apply these principles in their lives and careers.

COURSE OBJECTIVES:

- To develop communication competence in prospective engineers.
- To enable them to convey thoughts and ideas with clarity and focus.
- To equip them to face Group Discussion.
- To inculcate critical thinking process.
- To prepare them on problem solving skills.
- To provide symbolic, verbal, and graphical interpretations of statements in a problem description.
- To understand team dynamics & effectiveness.
- To create an awareness on Engineering Ethics and Human Values.
- To instill Moral and Social Values, Loyalty and also to learn to appreciate the rights of others.
- To learn leadership qualities and practice them.

SYLLABUS:

MODULE 1 (14 hours)

Overview of Life Skills: Meaning and significance of life skills, Life skills identified by WHO: Self- awareness, Empathy, Critical thinking, Creative thinking, Decision making, problem solving, Effective communication, interpersonal relationship, coping with stress, coping with emotion.

Life skills for professionals: positive thinking, right attitude, attention to detail, having the big picture, learning skills, research skills, perseverance, setting goals and achieving them, helping others, leadership, motivation, self-motivation, and motivating others, personality development, IQ, EQ, and SQ

Group Discussion: Differences between group discussion and debate; Ensuring success in group discussions, **Presentation Skills:** Oral presentation and public speaking skills; business presentations, Technology-based Communication: Netiquettes: effective e-mail messages; power-point presentation; enhancing editing skills using computer software.

MODULE 2 **(8 hours)**

Need for Creativity in the 21st century, Imagination, Intuition, Experience, Sources of Creativity, Lateral Thinking, Myths of creativity

Critical thinking Vs Creative thinking, Functions of Left Brain & Right brain, Convergent & Divergent Thinking, Critical reading & Multiple Intelligence.

Steps in problem solving, Problem Solving Techniques, Problem Solving through Six Thinking Hats, Mind Mapping, Forced Connections.
Problem Solving strategies, Analytical Thinking and quantitative reasoning expressed in written form, Numeric, symbolic, and graphic reasoning, Solving application problems.

MODULE 3 **(10 hours)**

Introduction to Groups and Teams, Team Composition, Managing Team Performance, Importance of Group, Stages of Group, Group Cycle, Group thinking, getting acquainted, Clarifying expectations.
Group Problem Solving, Achieving Group Consensus.
Group Dynamics techniques, Group vs Team, Team Dynamics, Teams for enhancing productivity, Building & Managing Successful Virtual Teams. Managing Team Performance & Managing Conflict in Teams.
Working Together in Teams, Team Decision-Making, Team Culture & Power, Team Leader Development.

MODULE 4 **(10 hours)**

Morals, Values and Ethics, Integrity, Work Ethic, Service Learning, Civic Virtue, Respect for Others, Living Peacefully.
Caring, Sharing, Honesty, Courage, Valuing Time, Cooperation, Commitment, Empathy, Self-Confidence, Character Spirituality, Senses of 'Engineering Ethics', variety of moral issued, Types of inquiry, moral dilemmas, moral autonomy, Kohlberg's theory, Gilligan's theory, Consensus and controversy, Models of Professional Roles, Theories about right action, Self-interest, customs and religion, application of ethical theories. Engineering as experimentation, engineers as responsible experimenters, Codes of ethics, Balanced outlook on.
The challenger case study, Multinational corporations, Environmental ethics, computer ethics, Weapons development, engineers as managers, consulting engineers, engineers as expert witnesses and advisors, moral leadership, sample code of Ethics like ASME, ASCE, IEEE,

Institution of Engineers(India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers(IETE), India, etc.

MODULE 5 **(10 hours)**

Introduction, a framework for considering leadership, entrepreneurial and moral leadership, vision, people selection and development, cultural dimensions of leadership, style, followers, crises.
Growing as a leader, turnaround leadership, gaining control, trust, managing diverse stakeholders, crisis management
Implications of national culture and multicultural leadership Types of Leadership, Leadership Traits.
Leadership Styles, VUCA Leadership, DART Leadership, Transactional vs Transformational Leaders, Leadership Grid, Effective Leaders, making of a Leader, Formulate Leadership

COURSE OUTCOMES:

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

- Define and Identify different life skills required in personal and professional life, which will enable them to make effective presentations and face group discussions.
- Critically think on a particular problem and Solve problems.
- Work in Group & Teams
- Handle Engineering Ethics and Human Values.
- Become an effective leader.

***TEXT BOOKS* :**

1. Life Skills for Engineers, Complied by ICT Academy of Kerala, McGraw Hill Education (India) Private Ltd., 2016

REFERENCE BOOKS:

1. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
2. Barun K. Mitra; (2011), “Personality Development & Soft Skills”, First Edition; Oxford Publishers.
3. Kalyana; (2015) “Soft Skill for Managers”; First Edition; Wiley Publishing Ltd.
4. Larry James (2016); “The First Book of Life Skills”; First Edition; Embassy Books.
5. Shalini Verma (2014); “Development of Life Skills and Professional Practice”; First Edition; Sultan Chand (G/L) & Company
6. John C. Maxwell (2014); “The 5 Levels of Leadership”, Centre Street, A division of Hachette Book Group Inc.
7. Remesh S., Vishnu R.G., "Life Skills for Engineers", Ridhima Publications, First Edition, 2016

EVALUATION SCHEME

Internal Evaluation

(Conducted by the College)

Total Marks: 100

Part – A

1. Group Discussion – Create groups of about 10 students each and engage them on a GD on a suitable topic for about 20 minutes. Parameters to be used for evaluation is as follows;

(i) Communication Skills – 20 marks (ii) Subject Clarity – 10 marks (iii) Group Dynamics - 10 marks (iv) Behaviors & Mannerisms - 10 marks **(Marks: 50)**

Part – B

2. Presentation Skills – Identify a suitable topic and ask the students to prepare a presentation (preferably a power point presentation) for about 10 minutes. Parameters to be used for evaluation is as follows.

(i) Communication Skills* - 20 marks (ii) Platform Skills** - 20 marks (iii) Subject Clarity/Knowledge - 10 marks **(Marks: 50)**

* Language fluency, auditability, voice modulation, rate of speech, listening, summarizes key learnings etc.

** Postures/Gestures, Smiles/Expressions, Movements, usage of floor area etc.

EC19 307(P)	DIGITAL ELECTRONICS LAB	0-0-3-1 (L-T-P-C)

PRE-REQUISITES: DIGITAL ELECTRONICS

COURSE OBJECTIVES:

To provide experience on design, testing, and analysis of digital electronic circuits

List of Experiments

(A minimum of 10 experiments must be conducted)

1. Realization of logic gates using diodes and transistors.
2. Characteristics of TTL Gates
3. Realization of logic gates using universal gates
4. Code converters using basic gates.
5. Seven segment display
6. Realization of Mux, Decoder and Encoder using basic gates
7. Combinational logic design using Decoders and Muxs
8. Half and Full adders and Subtractors.
9. 4-bit adder-subtractor IC & BCD adder circuit
10. Flip-Flop Circuit (RS Latch, JK, T, D and Master Slave) using basic gates.
11. Asynchronous Counters
12. Johnson and Ring Counters.
13. Synchronous counters.
14. A sequence generator circuit.
15. A sequence detector Circuit.
16. Registers.

COURSE OUTCOMES:

The student will be able to

- Apply Boolean laws to simplify digital circuits.
- Understand the operation of various logic gates and digital ICs.
- Understand the operation of digital displays,flip flops and counters.
- Design and understand different combinational logic circuits.
- Design and understand different sequential logic circuits.

Internal Continuous Assessment (Maximum Marks-50).

60% - Laboratory practical, record and Viva voce.

30% - Tests.

10% - Regularity in the lab.

Semester-end Practical Examinations (Maximum Marks-100).

10% - Record of works done

20% - Viva voce

70% - Procedure and tabulation form, Conducting experiment, results, and inference

EC19 308(P)	ELECTRONICS LAB	0-0-3-1 (L-T-P-C)

PRE-REQUISITES: ELECTRONIC CIRCUITS

COURSE OBJECTIVES:

Implementation of Basic Electronic circuits

Each experiment will have two parts - A Simulation part (SPICE) and Hardware realization.

List Of Experiments

(A minimum of 10 experiments must be conducted)

1. Diode and Zener diode characteristics -DC and dynamic resistance
2. First order LPF/HPF with R & C for a given cut off frequency.
3. Clipping and clamping circuits with diodes
4. Half wave rectifier and Full wave rectifier with C, LC filters
5. CE and CB configuration determination of h-parameters
6. Voltage Regulator with and Zener diode and pass transistor.
7. Single / Two Stage RC coupled amplifier- design for gain - frequency response
8. Emitter Follower with and without complementary transistors frequency response
9. JFET amplifier - design for gain - frequency response
10. RC Phase shift oscillator using BJT/FET
11. Crystal / LC Oscillators
12. Power amplifier - Class A / Class AB
13. Cascode amplifier - frequency response
14. UJT relaxation oscillator
15. SPICE - Analysis, Device Models, Netlists, Schematic Capture and plotting.

COURSE OUTCOMES:

The student will be able to:

- Understand the working of basic electronic circuits and analyse their characteristics.
- Understand the working of different transistor configurations and plot their characteristics.
- Understand the functioning of voltage regulator circuits.
- Design and setup different amplifier circuits and understand their frequency response.
- Simulate the various electronic circuits using tools such as SPICE.

Internal Continuous Assessment (Maximum Marks-50).

60% - Laboratory practical, record and Viva voce.

30% - Tests.

10% - Regularity in the lab.

Semester-end Practical Examinations (Maximum Marks-100).

10% - Record of works done

20% - Viva voce

70% - Procedure and tabulation form, Conducting experiment, results and inference

EN 19 401	ENGINEERING MATHEMATICS IV	3-1-0-4 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To deal with the methods for collection, classification and analysis of numerical data.
- To describe the characteristics and compute probabilities using both discrete and continuous probability distributions.
- To develop hypothesis testing methodology using test statistics.
- To introduce the tools of differentiation and integration of functions of complex variable that is used in various techniques dealing engineering problems.

SYLLABUS:

Module I: Bivariate Probability Distributions. (10 hours)

Two random variables-Joint probability mass function- Joint probability density function-Marginal probability distributions-Conditional probability distributions-Independence of random variables- Joint distribution function- Bivariate moments-Conditional expectation- Conditional variance.

Module II: Probability Distributions (10 hours)

Random variables - Mean and Variance of probability distributions - Binomial Distribution - Poisson Distribution - Poisson approximation to Binomial distribution - Hypergeometric Distribution – Geometric Distribution - Probability densities - Normal Distribution - Uniform Distribution - Gamma Distribution.

Module III: Sampling Distributions and Testing of Hypothesis (12hours)

Population and Samples - Sampling Distribution - Sampling distribution of Mean (s known) - Sampling Mean (s known) – Sampling distribution of Mean (σ unknown) - Sampling distribution of Variance - Interval Distribution – Confidence interval for Mean - Null Hypothesis and Test of Hypothesis - Hypothesis concerning one mean – Hypothesis concerning two means - Estimation of Variances - Hypothesis concerning one variance - Hypothesis concerning two variances - Test of Goodness of fit.

Module IV: Functions of a Complex Variable I (10 hours)

Functions of a Complex Variable – Limit – Continuity – Derivative of a Complex function – Analytic functions – Cauchy-Riemann Equations – Laplace equation – Harmonic Functions – Conformal Mapping – Examples:e^z,$sinz, coshz, \left(z+\frac{1}{z}\right)$– Mobius Transformation.

Module V: Functions of a Complex Variable II (10 hours)

Definition of Line integral in the complex plane – Cauchy's integral theorem (Proof of existence of indefinite integral to be omitted) – Independence of path – Cauchy's integral formula – Derivatives of analytic functions (Proof not required) – Taylor series (No proof) – Laurent series (No proof) – Singularities – Zeros – Poles – Residues – Evaluation of residues – Cauchy's residue theorem – Evaluation of real definite integrals.

COURSE OUTCOMES:

The student will be able to:

- Acquire the knowledge of basic ideas of joint probability distributions.
- Acquire the knowledge to describe the characteristics and compute probabilities using both discrete and continuous probability distributions.
- Develops the skills of hypothesis testing methodology using test statistics.
- Distinguish to compute the differentials of various complex function in various engineering problems.
- Acquire the mathematical tools of integration of functions of complex variable that are used in various techniques dealing engineering problems.

Text Books

1. Richard A Johnson, CB Gupta, Miller and Freund's Probability and statistics for Engineers,
2. Wylie C.R and L.C. Barret, Advanced Engineering Mathematics, McGraw Hill.
3. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers,35th Edition

Reference Books :

1. Erwin Kreysig, Advanced Engineering Mathematics, 8e, John Wiley and Sons, Inc.
2. N Bali, M Goyal, C Watkins, Advanced Engineering Mathematics, A Computer Approach, 7e, Infinity Science Press, Fire Wall Media.
3. William Hines, Douglas Montgomery, avid Goldman, Connie Borror, Probability and Statistics in Engineering, 4e, John Wiley and Sons, Inc.

4. Sheldon M Ross, Introduction to Probability and Statistics for Engineers .and Scientists, 3e, Elsevier, Academic Press.
5. H Parthasarathy, Engineering Mathematics, A Project & Problem based approach, Ane Books India.
6. B V Ramana, Higher Engineering Mathematics, McGrawHill.
7. J K Sharma, Business Mathematics, Theory and Applications, Ane Books India.
8. Babu Ram, Engineering Mathematics Vol. II, 2nd edition, Pearson Education.
9. Sastry S.S., Advanced Engineering Mathematics-Vol. I and II., Prentice Hall of India.
10. T .Veerarajan , Probability , Statistics and Random Processes , Tata McGraw- Hill , 2nd edition

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).

PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC19 402	SIGNALS AND SYSTEMS	3-1-0-4 (L-T-P-C)

PRE-REQUISITES: ENGINEERING MATHEMATICS III

COURSE OBJECTIVES:

- To introduce the student to the idea of signals, system analysis and its characterization.
- To study and analyse continuous and discrete-time signals and systems and the properties.
- To study and analysis concepts using Fourier analysis tools, Laplace Transform and Z-transform.
- To study concepts of the sampling process, reconstruction of signals and interpolation.

SYLLABUS:

MODULE I: (12 hours)

Introduction to signals and systems- Classification of signals- Basic operations on signals- Elementary signals- Concept of system- Properties of systems-stability, invertibility, time invariance, linearity, causality, memory- Time domain representation for Linear Time Invariant Systems - Continuous time LTI systems and convolution integral - Discrete time LTI systems and linear convolution. - Differential equation and difference equation representation for LTI systems.

MODULE II: (11 hours)

Fourier representation of continuous time signals- Fourier series-Properties-Convergence-Fourier transform- Existence of the Fourier integral- Properties of Fourier representation- Energy spectral density and power spectral density- Frequency response of LTI systems- Sampling and Reconstruction.

MODULE III: (11 hours)

Laplace transform analysis of systems- Unilateral and Bilateral Laplace Transforms, Properties relation between transfer function and differential equation- Causality and Stability- Inverse system- Determining the frequency response from poles and zeros.

MODULE IV: (8 hours)

Fourier representation of discrete time signals- Discrete time Fourier series and its properties- linearity, time shift, frequency shift, convolution, multiplication, duality, symmetry Parseval’s theorem.

Discrete time Fourier transform and its properties-linearity, time shift, frequency shift, scaling, frequency differentiation, Summation, Time domain convolution, multiplication, Conjugation property, Parseval's theorem.

MODULE V: (10 hours)

Z transform-properties of the region of convergence- Properties of the Z- transform - Relating transfer function and difference equation- Stability and Causality- Inverse Z-transform - Determining the frequency response from poles and zeros- Unilateral Z-transform- Solving difference Equations- Relationship between Z-transform and Fourier transform.

COURSE OUTCOMES:

The student will be able to:

- Define and represent basic properties of continuous and discrete time signals and systems.
- Represent the continuous time signals in Fourier series and explain the properties of Fourier transform and Laplace transform.
- Represent continuous and discrete systems in time and frequency domain using different transforms.
- Investigate the stability of LTI systems using transforms.
- Describe sampling theorem techniques for sampling and reconstruction.

Text Books:

1. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall,1983.
2. Simon Haykin, Signals & Systems, John Wiley, 2/e, 2003
3. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous andDiscrete", 4th edition, Prentice Hall, 1998.
4. Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.
5. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998.
6. Douglas K. Lindner, "Introduction to Signals and Systems", McGraw Hill Internationa lEdition: c1999.

Reference Books:

1. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia)Private Limited, c1998.
2. Robert A. Gabel, Richard A. Roberts, "Signals and Linear Systems", John Wiley andSons, 1995.
3. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB",TMH, 2003.
4. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi,2001.
5. Ashok Ambardar,"Analog and Digital Signal Processing", 2nd Edition, Brooks/ Cole Publishing Company (An international Thomson Publishing Company), 1999.
6. D Ganesh Rao, Satish Tunga, “Signals and Systems”, Sanguine Technical Publishers.

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).
PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC19 403	MICROPROCESSOR AND MICROCONTROLLER	3-1-0-4 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To introduce the student with knowledge about architecture, interfacing and programming with 8086 microprocessor and 8051 microcontroller.
- To design microprocessor-based system for any relevant applications using peripheral ICs.
- To program the microcontroller and to design a system to perform an application.

SYLLABUS:

MODULE I: (9 hours)

Brief history of Microprocessors, Von Neumann and Harvard architecture- Distinction between CISC and RISC computers Intel 8086 processor- Internal Architecture of 8086 /8088microprocessors- Bus Interface Unit(BIU) and Execution Unit(EU) - Address space, Data organization, Registers, Memory segmentation and Addressing, Stack, I/O space

MODULE II: (10 hours)

Hardware structure of 8086 microprocessor -Minimum and Maximum mode- Basic read and write machine cycle timing- Coprocessor and Multiprocessor configuration- Hardware organization of address space- Control signals and I/O interfaces- Memory devices, circuits and sub system design- Various types of memories, Memory address decoding – Interrupts

Programming concepts- Assembly programming using instructions for data transfer, arithmetic, logical, shift and rotate operations and string manipulations -Procedures- Macros

MODULE III: (12 hours)

I/O interfacing circuits - Hand shaking, Serial and Parallel interfacing- Address decoding Interfacing chips- Programmable peripheral interfacing (8255)- Internal block diagram-Modes of operation Programmable communication interface(8251)- Basics of serial communication Internal block diagram of 8251- Programmable timer(8253)- Internal block diagram of 8253- Different Modes DMA controller (8237/8257)- Internal block diagram- Interrupt sequence for an 8086 based system Keyboard display interface(8279)- Keyboard interface-Display interface

MODULE IV: (10 hours)

Microcontrollers: Introduction, Comparison between microprocessors and microcontrollers, Microcontroller families, 8051-features, architecture, memory organization, registers, I/O ports, pin configuration and functions

Timer/counter concept, Operating modes, Addressing modes, Instruction set, Interrupts in 8051: types, Serial communication: RS 232 interface, registers in UART, Modes of operation

MODULE V: (10 hours)

Assembly language programming examples for 8051

Interfacing: Interfacing (block schematic and assembly language programming) of DIP switch, stepper motor, ADC, DAC, LEDs and 7 segment displays, alphanumeric LCD module with 8051, Interrupt handling and programming , Programming examples for serial data transmission and reception

COURSE OUTCOMES:

The student will be able to

- Differentiate various processor architectures
- Describe hardware architecture and memory organization of 8086 and 8051.
- Write assembly language programs for 8086 and 8051.
- Design and develop 8086 systems using peripheral ICs.
- Develop systems using 8051 microcontroller.

Text Books:

1. R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing, 1996
2. Douglas Hall, Microprocessors Interfacing, Tata McGraw Hill, 1991.
3. Kenneth J. Ayala, The 8051 Microcontroller, Penram International Publishing, 1996.
4. Lyla B Das, “Microprocessors and microcontrollers”, Pearson education, India 2011

Reference Books:

1. D A Patterson and J H Hennessy, "Computer Organization and Design The hardware and software interface. Morgan Kaufman Publishers.

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).
PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC19 404	ANALOG COMMUNICATION	3-1-0-3 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To impart the basic concepts of analog modulation schemes
- To develop understanding about performance of analog communication systems in the presence of noise

SYLLABUS:

MODULE I: (10 hours)

Signal Distortion in Transmission – Band pass signals and systems , Introduction, Elements of communication systems, Need for modulation, Amplitude modulation (AM), DSB-FC, DSB-SC & SSB - modulation index, spectrum, power, efficiency , VSB(Introduction only). Modulators and transmitters.

MODULE II: (12 hours)

Generation of AM- square law modulator, switching modulator. Detection of AM- square law detector, envelop detector. Generation of DSBSC waves: Balanced modulator, Ring modulator. Coherent detection of DSBSC modulated waves.

Exponential continuous wave modulation – Signals and Spectra of FM & PM - modulation index, frequency deviation, average power, spectrum of FM. Narrow band and Wide band FM, Transmission bandwidth and Distortion - Generation and Detection of FM and PM - Interference, De-emphasis and Pre emphasis, Capture effect.

MODULE III: (8 hours)

Receivers for continuous wave modulation (Block diagram only) – Superheterodyne Receivers, Receiver specifications, Synchronous detection and Frequency synthesis – FM detection, Analog Pulse Modulation - Signals and Spectra of Pulse Amplitude Modulation(PAM) and Pulse Time Modulation (PWM/PPM).

MODULE IV: (9 hours)

Probability and Sample Space - Random Variables and Probability Functions – Statistical Averages: Function of Random variables, moments, Mean, variance, Correlation and Covariance function - Random Processes - Ensemble Averages and Correlation Functions - Ergodic and Stationary Processes - Gaussian Processes - properties of Gaussian Processes.

MODULE V: (11 hours)

Noise in communication system: Definitions of white noise (thermal noise), Shot noise, Partition noise, Flicker noise (No analysis required) Signal to noise ratio, Noise factor, Noise temperature-noise equivalent bandwidth, Noise Figure.

Linear continuous wave modulation with noise - Synchronous detection - Envelope detection and threshold effect - Exponential continuous wave modulation with noise - Post detection noise - Destination S/N - FM threshold effect - Comparison of continuous wave modulation systems.

COURSE OUTCOMES:

The student will be able to

- Understand the basic components of a communication system
- Understand the concept of modulation and different types of modulation techniques
- Learn the various receivers used in communication systems
- Acquire the knowledge of probability theory and distribution functions
- Understand and analyze the fundamental ideas of noises and its effect in communication systems.

Text Books:

1. Bruce Carlson., Communication Systems, Tata - McGraw Hill.
2. Lathi B.P., Modern Digital and Analog Communication Systems, Oxford University Press.
3. Simon Haykin, Communication Systems, John Wiley.
4. Ziemer R.E. & Tranter W.H., Principles of Communication, John Wiley.
5. Leon W. Couch, Digital and Analog Communication Systems, Pearson Education.
6. Taub H. & Schilling, Principles of Communication Systems, Tata - McGraw Hill.
7. Tomasi, Electronic Communications Systems, Pearson Education.

Reference Books

1. Dennis Roddy, John Coolen, Electronic Communications, Pearson Education.
2. Sam Shanmugam K., Digital and Analog Communication Systems, John Wiley.
3. Proakis & Masoud Salehi, Fundamentals of Communication systems, Pearson Education.

Web resources:

1. Principles of Communication, Prof. V. Venkat Rao, IIT Madras (nptel.iitm.ac.in)
2. Communication Engineering, Prof. Surendra Prasad, IIT Delhi (nptel.iitm.ac.in).
3. Probabilistic Systems Analysis and Applied Probability, Prof. John Tsitsiklis, MIT(ocw.mit.edu).

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).

PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC19 405	ANALOG CIRCUITS	3-1-0-3 (L-T-P-C)

PRE-REQUISITES : ELECTRONIC CIRCUITS

COURSE OBJECTIVES:

- To understand the concept of integrated circuits
- To analyze the functioning of opamp and its various circuits.

SYLLABUS:

MODULE I: (9 hours)

Differential Amplifiers -The BJT differential pair- Large and small signal operation- MOS differential amplifier- Large and small signal operation– Non ideal characteristics of the differential amplifier - Differential amplifier with active load- Concept of CMRR - Methods to improve CMRR - Frequency response analysis.

MODULE II: (10 hours)

Introduction to integrated circuits- Op Amp-block diagram

op-amp 741-typical op-amp parameters-DC analysis –small signal analysis – Gain, frequency response

Linear op amp circuits–summing and difference amplifiers- Differentiator and integrator– I-V and V-I converters- Instrumentation amplifier, Log and antilog amplifiers analog multipliers – Voltage Comparators-Schmitt trigger

MODULE III: (12 hours)

Signal generators (analysis required)- Phase shift and Wien Bridge Oscillators- Astable and Monostable Circuits-Linear sweep circuits.

Active filters (analysis required)- filter transfer function- Butterworth and Chebyshev filters-First order and second order function (Sallen-key) for low-pass, high-pass, band –pass, band-stop and all –pass filters-Delyiannis- Friend band Pass filters-twin tee notch filter-Second order LCLCR Resonator and switched capacitor filters.

MODULE IV: (11 hours)

Data converters-definitions and specifications – DAC - Weighted resistor and R-2R DAC-Bipolar DAC.

ADC - flash, integrating type, Counter Ramp, pipeline, tracking and Successive approximation, dual slope & oversampling ADCs - sigma - delta ADC

Linear voltage regulators- protection mechanisms-LM 723 Functional-diagram-Design of voltage regulator using 723-Three terminal Voltage regulators-functional operation of 78xx series IC and design of fixed and adjustable regulators.

MODULE V: (10 hours)

Phase locked loops- operation of first and second order PLLs-Lock and Capture range-LM565PLL-Application of PLL as AM/FM/FSK/ detectors, frequency translators, phase shifter, tracking filter, signal synchronizer and frequency synthesizer. Voltage controlled oscillator

Timer IC 555 – internal diagram – working – Astable multivibrators and Monostable multivibrator with timer IC 555

COURSE OUTCOMES:

The student will be able to

- Understand the working of differential amplifiers.
- Understand the concept of integrated circuits and OP- AMP.
- Understand the functioning and design of different OP-AMP based circuits.
- Know the various data converters and voltage regulator ICs.
- Analyze the working and applications of PLL and 555 timer IC.

Text Books:

1. Sedra A.S & Smith K.C., Microelectronic Circuits, Oxford University Press.
2. Millman J. &Taub H., Pulse, Digital & Switching Waveforms, Tata McGraw Hill.
3. Horenstein M.N: Microelectronic circuits and Devices PHI.
4. Gray &Meyer:Analysis and Design of Analog Integated Circuits; John Wiley.
5. Schilling D.L. &Belove C.: Electronic Circuits, McGraw Hill.
6. Ramakant A. Gayakwad, Op-amps and Linear Integrated Circuits, Prentice Hall.
7. D. Roy Choudhury, Shail Jain.'Linear Integrated Circuits', New Age International
8. S. Salivahanan, V. S. Kanchana Bhaaskaran, "Linear Integrated Circuits", McGraw-Hill Education

Reference Books

1. Milman & Halkias, Integrated Electronics, McGraw Hill.
2. Robert L Boylestad and Louis Nashelsky: Electronic Devices and Circuit theory, Pearson.
3. Thomas L.Floyd and David Buchla: Fundamentals of Analog Circuits,Pearson.
4. Spencer &Ghausi, Introduction to Electronic Circuit Design; Pearson Education.
5. VenkataRao K, Rama Sudha K, ManmadhaRao G., Pulse and Digital Circuits:Pearson Education.
6. Coughlin R.F. & Driscoll F.F., Operational Amplifiers and Linear Integrated Circuits,Pearson Education.
7. A.V.Bakshi A.P.Godse U.A.Bakshi, "Linear Integrated Circuits", Technical Publications.

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).
PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EN19 406	CONSTITUTION OF INDIA	2-0-2-0 (L-T-P-C)

PRE-REQUISITES:NIL

COURSE OBJECTIVES:

- To help the students to concentrate on their day to day discipline.
- To gives the knowledge and strength to face the society and people.

SYLLABUS:

Module I: (8 hours)

Definition of constitution, historical back ground, salient features of the constitution - Preamble of the constitution, union and its territory - Meaning of citizenship, types, termination of citizenship.

Module II: (12 hours)

Definition of state, fundamental rights, general nature, classification, right to equality, right to freedom, right against exploitation - Right to freedom of religion, cultural and educational rights, right to constitutional remedies. Protection in respect of conviction for offences - Directive principles of state policy, classification of directives, fundamental duties.

Module III: (10 hours)

The Union executive, the President, the vice President, the council of ministers, the Prime minister, Attorney-General, functions- The parliament, composition, Rajya sabha, Lok sabha, qualification and disqualification of membership, functions of parliament - Union judiciary, the supreme court, jurisdiction, appeal by special leave.

Module IV: (9 hours)

The State executive, the Governor, the council of ministers, the Chief minister, advocate general, union Territories - The State Legislature, composition, qualification and disqualification of membership, functions - The state judiciary, the high court, jurisdiction, writs jurisdiction.

Module V: (9 hours)

Relations between the Union and the States, legislative relation, administrative relation, financial Relations, Inter State council, finance commission - Emergency provision, freedom of trade commerce and inter course, comptroller and auditor general of India, public Services, public service commission, administrative Tribunals - Official language, elections, special provisions relating to certain classes, amendment of the Constitution.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to:

- Explain the background of the present constitution of India and features.
- Utilize the fundamental rights and duties.
- Understand the working of the union executive, parliament and judiciary.
- Understand the working of the state executive, legislature and judiciary.
- Utilize the special provisions and statutory institutions.

TEXT BOOKS:

1. D D Basu, Introduction to the constitution of India, Lexis Nexis, New Delhi, 24e, 2019
2. PM Bhakshi, The constitution of India, Universal Law, 14e, 2017

***REFERENCE BOOKS*:**

1. Ministry of law and justice, the constitution of India, Govt of India, New Delhi, 2019.
2. JN Pandey, The constitutional law of India, Central Law agency, Allahabad, 51e, 2019
3. MV Pylee, India's Constitution, S Chand and company, New Delhi, 16e, 2016

Internal Continuous Assessment *(Maximum Marks-100)*

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class

EC19 407(P)	ANALOG CIRCUITS LAB	0-0-3-1 (L-T-P-C)

PRE-REQUISITES: ANALOG CIRCUITS

COURSE OBJECTIVES:

1. To acquire skills in designing and testing analog integrated circuits
2. To expose the students to a variety of practical circuits using various analog ICs**.**

List of Experiments

(A minimum of 10 experiments must be conducted)

1. Measurement of op-amp parameters-CMRR, slew rate, open loop gain, input and output impedances
2. Inverting and non-inverting amplifiers, integrators and differentiators Frequency response, Comparators-Zero crossing detector using op amp IC741 (simulation required – simulate using appropriate software).
3. Schmitt trigger using op amp IC741 -precision limiter
4. Instrumentation amplifier using op amp IC741 -gain, CMRR & input impedance.
5. RC Phase shift oscillator using op amp IC741(simulation required – simulate using appropriate software)
6. Single op-amp second order LFF and HPF using op amp IC741 (frequency response required)
7. Square, triangular and ramp generation using op amp IC741.
8. Voltage regulation using IC 723- line and load regulations.
9. Astable and monostable multivibrators using op amp IC741
10. Astable and monostable multivibrators using IC 555
11. Design of PLL for given lock and capture ranges& frequency multiplication
12. Realization of ADCs and DACs.

COURSE OUTCOMES:

The student should able to:

- Understand the functioning of OP-AMP IC 741 and measure its various parameters.
- Design and setup different operational circuits using IC 741.
- Understand the working of voltage regulator IC 723.
- Design and setup circuits using 555 timer IC.
- Design and setup data converters and PLL.

Internal Continuous Assessment (Maximum Marks-50).

60% - Laboratory practical, record and Viva voce.

30% - Tests.

10% - Regularity in the lab.

Semester-end Practical Examinations (Maximum Marks-100).

10% - Record of works done

20% - Vivavoce

70% - Procedure and tabulation form, Conducting experiment, results and inference

EC19408(P)	ANALOG COMMUNICATION LAB	0-0-3-1 (L-T-P-C)

PRE-REQUISITES: ANALOG COMMUNICATION

COURSE OBJECTIVES:

- To design and setup circuits for Analog communication

List Of Experiments

(A minimum of 10 experiments must be conducted)

1. AM generation using JFET/ BJT
2. AM generation and demodulation
3. Balanced modulator for DSB-SC signal.
4. PAM generation and demodulation
5. Implementation of intermediate frequency (IF) tuned amplifier
6. Mixer using JFET/BJT
7. PWM - Generation and demodulation
8. PPM - Generation and demodulation
9. SSB generation and demodulation using integrated circuits
10. PLL characteristics and demodulation using PLL
11. Frequency multiplier using PLL
12. FM generation
13. FM demodulation

COURSE OUTCOMES:

The student will be able to:

- Analyze generation and detection of different modulation schemes.
- Compare different pulse modulation and demodulation techniques.
- Understand the characteristics and applications of PLL.
- Implement the mixer circuit.
- Design IF tuned amplifier circuit.

Internal Continuous Assessment (Maximum Marks-50).

60% - Laboratory practical, record and Viva voce.

30% - Tests.

10% - Regularity in the lab.

Semester-end Practical Examinations(Maximum Marks-100).

10% - Record of works done

20% - Vivavoce

70% - Procedure and tabulation form, Conducting experiment, results and inference

EN19 501	ENGINEERING ECONOMICS AND PRINCIPLES OF MANAGEMENT	3-1-0-3

PRE-REQUISITES : NIL

SECTION 1: ENGINEERING ECONOMICS

COURSE OBJECTIVES:

- To make a fundamentally strong base for decision making skills by applying the concepts of economics.
- Educate the students on how to systematically evaluate the various cost elements of a typical manufactured product, an engineering project or service, with a view to determining the price offer.
- Prepare engineering students to analyse profit/revenue data and carry out economic analysis in the decision making process to justify or reject alternatives/projects.

SYLLABUS:

Module I: **(11 hours)**

Introduction to Engineering Economics – Technical efficiency, Economic efficiency. Supply and Demand: Determinants of demand, Law of demand, Determinants of supply, Law of supply, Market equilibrium. Elasticity of demand – Types of elasticity, Factors affecting the price elasticity of demand - Utility analysis, indifference curves, Law of equi- marginal utility, marginal utility theory, Law of diminishing marginal utility -production possibility curve Production concepts-average product-marginal product-law of variable proportions, Isoquant.

Module II: **(10 hours)**

Value Analysis - Time value of money - Interest formulae and their applications: Single-payment compound amount factor, Single-payment present worth factor, Equal-payment series compound amount factor, Equal-payment series sinking fund factor, Equal-payment series present worth factor, Equal-payment series capital recovery factor, Effective interest rate. Investment criteria: Payback Period, Net Present Value, Internal Rate of Return, Benefit-cost ratio.

COURSE OUTCOMES:

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

- Understand the basic concepts used in engineering economics and apply the basics of economics and cost analysis to take economically sound decisions.
- Understand Time Value of Money and apply suitable cash flow methods for different situations.

TEXT BOOKS:

1. Panneer Selvam, R, ―Engineering Economics‖, Prentice Hall of India Ltd, New Delhi, 2001.
2. Dwivedi, D.N., "Managerial Economics, 7/E", Vikas Publishing House, 2009.
3. Salvatore D. Managerial Economics: Principles and Worldwide Application:(adapted version). OUP Catalogue. 2012.

REFERENCE BOOKS:

1. Sullivan, W.G, Wicks, M.W., and Koelling. C.P., ―Engineering Economy 15/E‖, Prentice Hall, New York, 2011.
2. Chan S. Park, ―Contemporary Engineering Economics‖, Prentice Hall of India, 2002.
3. Prasanna Chandra, ―Financial Management: Theory & Practice, 8/E", Tata-McGraw Hill, 2011.
4. Rangarajan C. Indian economy: essays on money and finance. UBS Publishers' Distributors; 1999.

Internal Continuous Assessment *(Maximum Marks-20)*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class

University Examination Pattern *(Maximum Marks-40)*
PART A*: Analytical/problem solving SHORT questions* ***4 x 5 marks= 20 marks***
Candidates have to answer FOUR questions out of SIX. There shall be THREE questions from each module with total SIX questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***2 x 10 marks= 20 marks***
Two questions from each module with choice to answer one question.

SECTION 2: PRINCIPLES OF MANAGEMENT

COURSE OBJECTIVES:

- To develop ability to analyse and evaluate a management processes and variety of management practices in the contemporary context.
- To understand and apply the basic concepts of functional areas of management like Human resources, Marketing and Finance.
- To be able to evaluate managerial decision making process, project management techniques, developing innovative products and social responsibility ideologies to create sustainable organisations.
- To be able to understand existing managerial practices to create their own innovative management competencies required for a complex global workplace.

SYLLABUS:

Module III: (10 hours)

The management process: managerial skills and roles, evolution of management theory; principles of planning: types of plans, steps in planning; principles of organizing: organizational structures; directing; motivation; controlling; sustainability in management.

Module IV: (11 hours)

Human resource management: human resource planning, performance metrics.

Marketing management: fundamentals of marketing, market segmentation, consumer and industrial markets.

Financial management: Basic principles of: double entry bookkeeping, financial statements, sources of finance, classification of costs, break-even analysis (Basic concepts only).

Module V: (10 hours)

Managerial decision making process: decision making under certainty, risk and uncertainty; network techniques for project management: critical path method (CPM); Programme Evaluation and Review Technique (PERT): time/cost trade-off in critical path networks (simple problems only).

Entrepreneurial processes: analysis of new ventures/start-ups, creating innovative products/services and business plans, importance of corporate social responsibility

COURSE OUTCOMES:

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

- List out the roles, skills and functions of management.
- Analyse the basic concept of human resources, marketing and financial management in the organizations and integrate the learning in handling these complexities.
- Apply the concept of decision making, network techniques, analysis of new ventures as a part of project management / an organization.

TEXT BOOKS:

1. H. Koontz, and H. Weihrich, *Essentials of Management: An International Perspective*, 10th Edition. McGraw-Hill, 2015.
2. Ramesh Unnikrishnan, Principles of Management, Educational Publishers and Distributors, 2021.
3. O. P. Khanna, Industrial Engineering and Management, 17th Edition, Dhanpat Rai Publications, 2018.

REFERENCE BOOKS:

1. R. W. Griffin, *Management: Principles and Applications*. 10th Edition, Cengage Learning, 2008.
2. P. Kotler, K. L. Keller, A. Koshy, and M. Jha, *Marketing Management: A South Asian Perspective,* 15th ed. Pearson, 2014.
3. M. Y. Khan, and P. K. Jain, *Financial Management*. 8th Edition Tata-McGraw Hill, 2018.
4. Heinz Weirich, Mark V Cannice and Harold Koontz, Management: a Global, Innovative and Entrepreneurial Perspective, 14th Edition, McGraw Hill Education,2013.

Internal Continuous Assessment *(Maximum Marks-30)*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class

University Examination Pattern *(Maximum Marks-60)*
PART A*: Analytical/problem solving SHORT questions* ***6 x 5 marks= 30 marks***
Candidates have to answer SIX questions out of NINE. There shall be THREE questions from each module with total NINE questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***3 x 10 marks= 30 marks***
Two questions from each module with choice to answer one question.

Note: Section 1 and Section 2 are to be answered in separate answer books.
Maximum 40 marks and 60 marks for Section 1 and Section 2 respectively.

EC 19 502	DIGITAL SIGNAL PROCESSING	3-1-0-4 (L-T-P-C)

PRE-REQUISITES : SIGNALS AND SYSTEMS

COURSE OBJECTIVES:

- To understand the basic concepts of discrete fourier transforms
- To study the design techniques for digital filters
- To understand the structure realisation of FIR and IIR filters
- To introduce the architecture of DSP processors

SYLLABUS

MODULE 1 *(11 Hours)*

Review of Discrete Time Fourier series and Discrete Time Fourier Transform - Frequency domain sampling - Discrete Fourier Transform-Properties - Circular convolution – Linear convolution using DFT - Linear filtering of long data sequences - Overlap add and overlap save methods - **Computation of DFT:** Radix-2 Decimation in Time FFT Algorithms, Radix-2 Decimation in Frequency FFT Algorithms, IDFT computation using Radix-2 FFT Algorithms

MODULE 1I *(11 Hours)*

Block diagram and signal flow graph representations of filters - FIR Filter Structures: (Linear structures), Direct Form, Cascade Form and Lattice Structure - IIR Filter Structures: Direct Form, Transposed Form, Cascade Form and Parallel Form - Computational Complexity of Digital filter structures- Representation of numbers & errors due to rounding and truncation - Quantization of filter coefficients - round off effects in digital filters - Limit cycle oscillations, scaling to prevent overflow

MODULE 1II *(10 Hours)*

Digital filters - FIR and IIR filters -specifications of digital Filters - Symmetric and Anti-symmetric FIR Filters - Design of FIR filters -Linear phase Characteristics-Window method, Optimal method and Frequency Sampling method

MODULE 1V *(9 Hours)*

Design of IIR filters from analog filters - IIR Filter Design by Impulse Invariance and Bilinear Transformation - Frequency transformation in the analog and digital domains

MODULE V *(11 Hours)*

Computer Architectures for signal processing-Harvard Architecture, Pipelining, Multiplier Accumulator, Special Instructions for DSP, extended parallelism-General Purpose DSP Processors Implementation of DSP Algorithms for various operations-Special purpose DSP hardware-Hardware Digital filters and FFT processors-Case study and overview of TMS320 series processor, ADSP 21XX processor

COURSE OUTCOMES:

The student will be able to:

- Interpret and represent digital signals and systems
- Illustrate the frequency domain analysis of discrete time signals
- Design & analyze DSP systems like FIR and IIR Filter etc.
- Summarize the practical implementation issues such as computational complexity, hardware resource limitations as well as cost of DSP systems or DSP Processors
- Describe the DSP processor architectures

Text Books:

1. Oppenheim A. V., Schafer R. W., Discrete-Time Signal Processing, Prentice Hall/Pearson.
2. John G. Proakis, Dimitris G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, Prentice Hall of India Pvt. Ltd., 1997.
3. Emmanuel C. Ifeacher, Barry W. Jervis, Digital Signal Processing: A Practical Approach, Pearson Education 2004
4. Li Tan,DSP-Fundamentals & Applications, Elsevier, New Delhi, 2008
5. Roberto Cristi, Modern Digital Signal Processing, Cengage learning India pvt. Ltd.,2004,4th Indian reprint 2009, New Delhi

Reference Books:

1. Mitra S. K., Digital Signal Processing : A Computer Based Approach, Tata McGraw-Hill
2. B Venkataramani & M.Bhaskar, Digital Signal Processors-Architecture,3. Programming and Applications, Tata Mcgraw Hill
3. Dag Strannbby & William Walker,DSP & Applications. Elsevier, New Delhi, 2nd Ed. 2004
4. Vinay K Ingle, John G Proakis, DSP- A MATLAB based approach ,Cengage learning India
5. Sen M. Kuo and Woon-Seng Gem, Digital Signal Processors, Pearson

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).
PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC 19 503	DIGITAL COMMUNICATION	3-1-0-3 (L-T-P-C)

PRE-REQUISITES: ANALOG COMMUNICATION

COURSE OBJECTIVES:

- To understand the concept of Digital representation of analog source
- To understand the Performance comparison various pulse modulation schemes
- To discuss Inter Symbol Interference (ISI) problem in digital communication and to derive the Nyquist Criteria for zero ISI in data Transmission
- To analyse the need for introducing ISI in controlled manner
- To understand signal space representation of signal using Gram Schmidt orthonormalization procedure
- To analyse the error probability for different modulation schemes like BPSK, BFSK, QPSK etc.

SYLLABUS

MODULE 1 *(11 Hours)*

Sampling Theory and Practice - Ideal Sampling and Reconstruction - Practical Sampling and Aliasing - Flat-Top Sampling - Sampling theorem for bandpass signals - Waveform coding - quantization - PCM - DPCM - delta modulation - adaptive delta modulation - Line coding schemes- ON-OFF, NRZ, Bipolar, Manchester signalling and differential encoding.

MODULE 1I *(10 Hours)*

Transmission over baseband channel: Matched filter, Inter Symbol Interference (ISI), Nyquist Criteria for zero ISI, Ideal solution, Eye Pattern, Raised cosine spectrum. Signalling with duobinary pulses, Equalizer, Scrambling and descrambling.

MODULE 1II *(9 Hours)*

Review of Gaussian random process - optimum threshold detection - optimum receiver for AWGN channel - correlation receivers - decision procedure - maximum a- posteriori probability detector - maximum likelihood detector - probability of error - bit error rate - Optimum receiver for coloured noise

MODULE 1V *(11 Hours)*

Digital modulation schemes – Pass band transmission model, coherent binary schemes - ASK, FSK, PSK, MSK coherent M-array schemes, Non- coherent orthogonal modulation schemes, Differential Phase Shift Keying (DPSK) - calculation of average probability of error and BER for different modulation schemes , Power spectra of digitally modulated signals - performance comparison of different digital modulation schemes.

MODULE V *(11 Hours)*

Signal space concepts -geometric structure of the signal space - distance, norm and inner product – properties of inner product spaces, orthogonality - Gram-Schmidt orthogonalization procedure. Properties of pseudo-noise sequence, Generation of PN sequences, Generator polynomials, Maximal length codes, and Gold codes. Carrier, frame and symbol synchronization techniques.

COURSE OUTCOMES:

The student will be able to:

- Evaluate the performance of a digital communication system in the presence of noise.
- Compare the performance of various digital modulation schemes.
- Apply the knowledge of signals and systems to analyse the digital communication system.
- Compare the error probability of different digital modulation schemes.
- Illustrate signal space representation of signal using Gram Schmidt orthonormalisation procedure.

Text Books:

1. Sklar, Digital Communication, Pearson Education.
2. Bruce Carlson., Communication Systems, Tata - McGraw Hill
3. Simon Haykin, Communication Systems, John Wiley.
4. Proakis J.G., Digital Communications, McGraw Hill.

Reference Books:

1. Dennis Roddy, John Coolen, Electronic Communications, Pearson Education
2. Sam Shanmugam K., Digital and Analog Communication Systems, John Wiley.
3. Glover and Grant, Digital Communications, Pearson Education.
4. Rice, Digital Communications, Pearson Education.
5. Proakis and Salehi., Fundamentals of Communication Systems, Pearson Education.
6. Lathi B.P., Modern Digital and Analog Communication Systems, Oxford University Press.
7. M. K. Simon, S. M. Hinedi, and W. C. Lindsey, Digital Communication Techniques, Prentice Hall
8. Tri T. Ha, Theory and Design of Digital Communication Systems, Cambridge University Press

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).
PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC 19 504	ELECTROMAGNETIC WAVES	3-1-0-3 (L-T-P-C)

PRE-REQUISITES : DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

COURSE OBJECTIVES:

- To introduce basic mathematical concepts related to electromagnetic vector fields.
- To impart knowledge on the basic concepts of electric and magnetic fields
- To develop a solid foundation in the analysis and application of electromagnetic fields, Maxwell's equations and Poynting theorem.
- To become familiar with propagation of signal through transmission lines and waveguides.

SYLLABUS:

MODULE I *(11 HOURS)*

Review of vector analysis: Cartesian, Cylindrical and Spherical co-ordinates systems- Co-ordinate transformations. Vector fields: Divergence and curl- Divergence theorem- Stokes theorem.
Electric field -Coulombs law, Different charge distribution , Gauss law, Determination of E and V using Laplace equation. Poison Equation. capacitance , Energy stored in Electric field.
Magnetic Field -Amperes current law, Magnetic vector potential. (B and H), inductance. Energy stored in Magnetic field. Displacement current density, continuity equation

MODULE II *(11 HOURS)*

Maxwell's equation from fundamental laws. Boundary condition of electric field and magnetic field from Maxwell's equation. Solution of EM Wave. Polarization of electromagnetic wave-linear, circular and elliptical polarization. Propagation of plane EM wave in perfect dielectric, free space, Lossy & perfect conductor media. phase velocity, group velocity, skin depth.

MODULE III *(9 HOURS)*

Power density of EM wave, Poynting vector theorem, Complex Poynting vector, Reflection and refraction of plane electromagnetic waves at boundaries for normal & oblique incidence (parallel and perpendicular polarization), Snell's law of refraction, Brewster angle

MODULE IV *(10 HOURS)*

Transmission lines -Primary and secondary constants of a transmission line- Transmission line equations- Loss less transmission line equations, Voltage and Current distribution of a line terminated with load .Reflection coefficient and VSWR. Derivation of input impedance of transmission line. Development of Smith chart - calculation of line impedance and VSWR using smith chart.single stub matching using Smith chart.

MODULE V *(11 HOURS)*

Waveguide transmission- Parallel-Plate Waveguide - modes of propagation of wave- Analysis. The hollow rectangular wave guide, modes of propagation of wave- Analysis. Group velocity and phase velocity. circular waveguide- modes of propagation- dominant modes.

COURSE OUTCOMES:

The student will be able to:

- Summarize vector calculus in learning Electromagnetic fields.
- Apply electric and magnetic fields in analyzing Electromagnetic fields.
- Outline Maxwell's equation in understating the propagation of plane waves in different media.
- Analyze Transmission lines using Smith chart.
- Explain guided wave propagation.

Text Books:

1. Mathew N.O. Sadiku , 'Elements of Electromagnetics', Oxford Pub, 3rd Edition
2. W.H. Hayl, Engineering Electromagnetics –Tata Mc Graw Hill Edition, 5th Edition
3. David J. Griffithe, Introduction to Electrodynamics–Prentice Hall India, 3rd Edition
4. Edward C jordan,Keith G. Balman, Electromagnetic waves and Radiating Systems
5. Dr. T.V.S. Arun Murthy, Electromagnetic Fields (Theory and Problems), S. Chand Publishing

Reference Books:

1. J. D. Kraus, Electromagnetics: Mc Graw Hill Publications.
2. Cheng,Field & Wave Electromagnetic: Pearson Education.
3. Edminister, Electromagnetics: Schaum series, 2 Edn.

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).
PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC 19 505	COMPUTER ARCHITECTURE	3-1-0-3 (L-T-P-C)

PRE-REQUISITES : DIGITAL ELECTRONICS

COURSE OBJECTIVES:

- To impart knowledge in computer architecture.
- To impart knowledge in machine language programming.
- To develop understanding on I/O accessing techniques and memory structures.
- Identify the different types of instructions
- Understand the various addressing modes

SYLLABUS:

MODULE I: (12 hours)

Basic structure of computer hardware - computer arithmetic logic design- fast adders- carry propagate adder, Ripple carry adder, Basics of carry look ahead and prefix adder, Subtractor, Comparator, ALU, multiplication- Booth's algorithm- fast multiplication- integer division- Number System: Review of Fixed point & Floating point number system and operations

MODULE II: (12 hours)

Architecture: Assembly Language, Instructions, Operands, Registers, Register set, Memory, Constants. Machine Language: R-Type, I-Type, J-Type Instructions, Interpreting machine language code. MIPS Addressing modes – Register only, Immediate, Base, PC-relative, Pseudo – direct. MIPS memory map, steps for executing a program - Compilation, Assembling, Linking, Loading Pseudo instructions, Exceptions, Signed and Unsigned instructions, Floating point instructions. MIPS Microarchitectures – State elements of MIPS processor

MODULE III: (10 hours)

Control unit- instruction execution cycle- sequencing of control signals- hardwired control - micro programmed controls- control signals- micro instructions - Micro program sequencing- branch address modification- pre fetching of micro instructions

MODULE IV: (9 hours)

Memory organization- semiconductor RAM memories- internal organization- bipolar and MOS devices- dynamic memories- multiple memory modules and interleaving- cache memories -mapping functions - replacement algorithms- virtual memories- address translation-page tables - memory management units- secondary memories- disk drives- standards

MODULE V: (9 hours)

Input-Output organization- accessing I/O devices- direct memory access (DMA)- interrupts and interrupt handling- handling multiple devices- device identification- vectored interrupts- interrupt nesting- daisy chaining- I/O interfaces- serial and parallel standards- buses- scheduling- bus arbitrations

COURSE OUTCOMES:

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

- Describe Arithmetic Logic Unit architecture.
- Summarize different types of instructions and addressing modes.
- Explain the design of control logic unit.
- Categorize the different types of memories
- Illustrate the I/O accessing methods.

Text Books:

1. Hamacher C.V, Computer Organisation, McGraw Hill.
2. Morris Mano, Computer system architecture, Pearson.
3. John P Hayes, Computer Architecture and Organization McGraw Hill.

Reference Books:

1. William Stallings, Computer Architecture and Organization, Pearson.
2. Patterson D. A & Hennessy J. L, Computer Organization & Design, Morgan Kaufman.

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).
PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC 19 506 (A)	COMPUTING AND PROBLEM SOLVING	3-1-0-3 (L-T-P-C)

PRE-REQUISITES : NIL

COURSE OBJECTIVES:

- To develop skill in problem solving concepts through learning C
- To impart the basic concepts of Python programming.

SYLLABUS:

MODULE I: (10 hours)

Introduction to C language - Development of Flow chart and Algorithm, Basic elements of C Program - Constants, Variables and Data Types, Operators and expressions, Input and Output functions, Formatted input and Formatted output, Decision Making and Branching statements - if, if---else, nested if---else, switch statement, Looping statements-While, do---while, for statements.

MODULE II: (12 hours)

Arrays and functions - Introduction to Arrays-Declaration, Initialization – One dimensional array –Defining and processing arrays - two dimensional and multidimensional arrays – application of arrays.

Character Arrays and Strings: Declaring and initializing string variables, Reading string from keyboard, writing strings to screen

Functions- Declaring, Defining, and Accessing functions, Parameter passing methods, Passing arrays to functions, String-handling functions, Recursion, Storage classes – extern, auto, register and static- Programming examples.

MODULE III: (10 hours)

Structures- Declaration, definition and initialization of structures, Operations on individual structure members, Arrays of structures, Arrays within structure, Structure within structure, Structures and Functions, Unions.

MODULE IV: (10 hours)

Pointers and Files- Concepts, declaration and initialization of pointer variables, Accessing a variable through pointer, Pointer Expressions, Pointers and Arrays, Array of pointers, Pointers as function arguments, Pointers to functions, Functions returning pointers, Pointers and Structure, File management in C.

MODULE V: (10 hours)

Introduction to python – Data types (Mutable and immutable), variables, basic operators, conditional statements, looping, Functions- Function definition and call , Types of functions, Basic programming examples.

COURSE OUTCOMES:

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

- Analyze a computational problem and develop an algorithm/flowchart to find its solution.
- Develop C programs with branching and looping statements.
- Divide a given problem into a number of modules and develop a multi-function C program
- Implement C programs using structures and pointers
- Develop and implement basic python programs.

Text Books:

1. E. Balaguruswamy, Programming in ANSI C, 3rd ed., Tata McGraw Hill, New Delhi, 2004
2. Rajaraman V , Computer basics programming in C, PHI
3. Lambert K A., Fundamentals of Python- First Programs, Cengage Learning India, 2015.

Reference Books:

1. B. Gottfried, Programming with C, 2nd ed, Tata McGraw Hill, New Delhi, 2006
2. B. W. Kernighan, and D. M. Ritchie, The C Programming Language, Prentice Hall of India, New Delhi, 1988
3. K. N. King. C Programming: A Modern Approach, 2nd ed., W. W. Norton & Company, 2008
4. Downey. A. et al., How to think like a Computer Scientist: Learning with Python, John Wiley, 2015
5. S. Kochan, Programming in C, CBS publishers & distributors

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).
PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC 19 506 (B)	SCIENTIFIC COMPUTING	3-1-0-3 (L-T-P-C)

PRE-REQUISITES : NIL

COURSE OBJECTIVES:

- To understand the scope and limits of mathematical modelling, especially sources of errors from approximation of the model to round-off/truncation error in the calculation
- To provide an overview of some of the issues and problems that arise in scientific computation, such as (non-)linear systems, numerical and symbolic integration, differential equations and simulation

SYLLABUS:

MODULE I: (9 hours)

Sources of errors, significant digits and numerical instability - numerical solution of polynomial and transcendental equations - bisection method - method of false position - Newton-Raphson method - fixed-point iteration - rate of convergence of these methods.

MODULE II: (10 hours)

Iteration based on second degree equation - The Muller's method - Chebyshev method - Graeffe's root squaring method for polynomial equations - Bairstow's method for quadratic factors in the case of polynomial equations.

MODULE III: (10 hours)

Direct methods - gauss and gauss - Jordan methods - Crout's reduction method - error analysis - iterative methods - Jacobi's iteration - Gauss-seidel iteration - the relaxation method - convergence analysis - solution of system of nonlinear equations by Newton-Raphson method - power method for the determination of eigen values - convergence of power method

MODULE IV: (12 hours)

Lagrange's interpolation polynomial - divided differences Newton's divided difference interpolation polynomial - error of interpolation - finite difference operators - Gregory – Newton forward and backward interpolations - Stirling's interpolation formula - interpolation with a cubic spline - numerical differentiation differential formulas-in the case of equally spaced points - numerical integration trapezoidal and Simpson's rules - Gaussian integration - errors of integration formulas

MODULE V: (11 hours)

The Taylor series method - Euler and modified Euler methods - Runge-Kutta methods (2nd order and 4th order only) - multistep methods - Milne's predictor -corrector formulas - adam-bashforth & adam-moulton formulas - solution of boundary value problems in ordinary differential equations - finite difference methods for solving two dimensional Laplace's equation for a rectangular region - finite difference method of solving heat equation and wave equation with given initial and boundary conditions.

COURSE OUTCOMES:

The student will be able to:

- Explain the significance of computing methods, their strengths and application areas.
- Perform the computations on various data using appropriate computation tools.
- Apply numerical methods in engineering problems.
- Develop the skill in using numerical techniques as a tool.
- Compare and contrast constructive methods in solving the complex problems in numerical way.

Text Books:

1. Chapra and Canale, Numerical methods for scientist and engineers, McGraw Hill.
2. James B Scarborough, Numerical Mathematical Analysis, Oxford and IBH Publishing

Reference Books:

1. Froberg, Introduction to Numerical Analysis, Addison Wesley.
2. Kandaswamy, Numerical Analysis, S Chand.
3. Hildebrand, Introduction to Numerical Analysis, Tata McGraw Hill
4. Dr. B.S Grewal, Numerical Methods in Engineering and Science, Khanna Publications.
5. S.Sankara Rao, Numerical Methods of Scientists and Engineer, Third ed, PHI.
6. S.S.Sastry, Introductory Methods of Numerical Analysis, Third ed, PHI.

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).
PART A**: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B**: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks
Two questions from each module with choice to answer one question.

EC 19 506 (C)	EMBEDDED SYSTEMS	3-1-0-3 (L-T-P-C)

PRE-REQUISITES : MICROPROCESSOR & MICROCONTROLLER

COURSE OBJECTIVES:

- Outline the basic structure and design of an Embedded System
- Classify the different ways of communicating with I/O devices and standard I/O interfaces
- Demonstrate the programming concepts of Embedded Systems
- To study the basics of RTOS for Embedded systems.
- To understand the architecture of ARM processor and PIC microcontroller

SYLLABUS:

MODULE I: (12 hours)

Introduction to Embedded Systems: Characteristics of Embedded systems, Categories of Embedded System- Requirements of Embedded Systems, Challenges and Issues in Embedded Software Development, Role of processor selection in Embedded System (Microprocessor V/s Microcontroller), Software embedded into a system - Applications of Embedded Systems in Consumer Electronics, Control System, Biomedical Systems, Handheld computers, Communication devices.

MODULE II: (10 hours)

Real time operating systems: Services- Goals – Structures - Kernel - Process Management – Memory Management – Device Management – File System Organization. Task and Task States, tasks and data, Message queues-Timer Function- Events-Memory Management, Interrupt Routines in an RTOS environment, basic design Using RTOS. OS services. I/O subsystems. Network operating system. Real time embedded system OS.OS security- Real-Time Embedded Software Development.

MODULE III: (12 hours)

Microcontroller: PIC microcontroller- architecture- Internal registers and timer/Clock initialization, Interrupts, Basic programs.
ARM processor- architecture – applications.

MODULE IV: (8 hours)

Introduction to: assembler, compiler, cross compilers and Integrated Development Environment (IDE).
Programming concepts of embedded programming- Features of Embedded C++ and Embedded Java (basics only). Software implementation, Testing, Validation and debugging, system-on-chip. Design Examples: Mobile phones, ATM machine, Set top box

MODULE V: (10 hours)

Embedded system development: Interfacing of external Memory. Interfacing Analog and digital blocks, interfacing of different peripheral devices such as LED, LCD, Graphical LCD, Switches, Relay, stepper motors, ADC, DAC and various sensors.

COURSE OUTCOMES:

The student will be able to:

- Illustrate the concepts of embedded system, components and its applications.
- Describe the basics of RTOS.
- Categorize PIC microcontroller and ARM processor.
- Familiarize with the programming environment to develop embedded solutions.
- Summarize the requirements in embedded system development.

Text Books:

1. Rajkamal ―Embedded Systems Architecture; Programming and Design‖; Tata McGraw Hill Publications.,New Delhi, 3rd Wd. 200.
2. Sreve Heath,'Embedded system design', Elsevier, 2 nd Ed. New Delhi, 2003
3. Steve Farber ,ARM System –on-chip , ,Second Edition,2000 Pearson Education
4. K.J. Ayala ,The 8051 Microcontroller , Penram International
5. J B Peatman, Design with PIC Microcontrollers, Prentice Hall
6. Dhananjay Gadre ,Programming and Customizing the AVR Microcontroller,MGH
7. S.Furbur, ARM system Architecture, Addition wesley, 1996.

Reference Books:

1. Raj Kamal, Microcontrollers Architecture, programming, Interfacing and System Design, Pearson Education.
2. Dr K.V.K.K..Prasad ,Embedded /Real-Time systems :Concepts ,Design & Programming., DreamTech Publishers.,2004
3. Jonathan.W.Valvano, Embedded Microcomputer Systems, Real Time Interfacing, Published by Thomson Brooks/Col, 2002.
4. G.H. Miller, Microcomputer Engineering, 3d edition, Pearson Education.
5. Louis L. Odette ,'Intelligent Embedded Systems' , Addison-Wesley, 1991
6. Microchip Manual for PIC 18F 452

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).
PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC 19 506 (D)	POWER ELECTRONICS	3-1-0-3 (L-T-P-C)

PRE-REQUISITES : ELECTRONIC CIRCUITS and ELECTRONIC DEVICES

COURSE OBJECTIVES:

- To provide an insight on the concepts of Power Electronics.
- To compare between linear power supply and switched mode power supply.
- To study the applications of Power electronics such as Switched mode regulators and inverters.

SYLLABUS:

MODULE I *(11 HOURS)*

Linear electronics Vs power electronics. Power diodes -basic structure and static and dynamic characteristics -various types -power transistors -BJT, MOSFET and IGBT –steady state and switching characteristics -Thyristors -basic structure -static and dynamic characteristics -device specifications and ratings -methods of turning on -gate triggering circuit using UJT -methods of turning off-commutation circuits -TRIAC, Power Integrated Circuits (PIC).

MODULE II *(10 HOURS)*

Line frequency phase controlled rectifiers using SCR -single phase rectifier with R and RL loads -half controlled and fully controlled converters with continuous and constant currents - SCR inverters -circuits for single phase inverters -series, parallel and bridge

MODULE III *(11 HOURS)*

AC regulators -single phase ac regulator with R and RL loads -sequence control of ac regulators - cycloconverter - basic principle of operation. Isolated converters - Flyback, Forward and Push Pull-Waveforms and governing equations (Analysis not required). Uninterruptible power supply- basic circuit operation -different configurations - characteristics and applications .Online and offline UPS

MODULE IV *(10 HOURS)*

Introduction to Switched mode regulators -buck regulators -boost regulators -buck-boost regulators, cuk regulators Waveforms and expression for output voltage ,voltage and current ripple under continuous conduction mode-switched mode power supply -principle of operation and analysis -comparison with linear power supply.

MODULE V *(10 HOURS)*

Switched mode inverters- principle of PWM switching schemes. Single phase inverter- Half bridge, Full Bridge and Push pull (Analysis not required). Three phase inverter-Space vector modulation. Choppers -principle of operation -step-up and step-down choppers -speed control of DC motors and induction motors.

COURSE OUTCOMES:

The student will be able to:

- Explain basic operation and compare performance of various power semiconductor devices, passive components and switching circuits
- Describe the operation of power diodes and transistors.
- Illustrate the working of rectifiers, inverters and power supplies.
- Summarize the basic circuit operation of regulators and choppers.
- Analyze power converter circuits and learn to select suitable power electronic devices by assessing the requirements of application fields.

Text Books:

1. Mohan N and T.M Undeland , Power Electronics: Converters, Applications and Design, John Wiliey.
2. Umanand L., Power Electronics Essentials and Applications, Wiley India 2015
3. Rashid M.H.,Power Electronic Circuits, Devices and Applications, Prentice Hall India,,Third edition,New Delhi
4. Mandal, Power Electronics 1e, McGraw Hill Education ,India,2014

Reference Books:

1. Sen PC, Power Electronics., Tata McGraw Hill
2. Dubey et. al. G.K., Thyristorised Power Controllers. Wiley Eastern Ltd.
3. Dewan & Straughen, Power Semiconductor Circuits, John Wiley
4. Singh M.D. & Khanchandani K.B., Power Electronics, Tata McGraw Hill
5. Lander C.W., Power Electronics, McGraw Hill
6. Sen P.C., Modern Power Electronics, Wheeler Publishers

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).
PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC 19 506 (E)	ELECTRONIC INSTRUMENTATION	3-1-0-3 (L-T-P-C)

PRE-REQUISITES : NIL

COURSE OBJECTIVES:

- To provide an insight on configuration of instruments and its characteristics.
- To impart knowledge in the area of measurement principles and standards
- To provide in depth understanding of operation, performance, and applications of important measuring instruments used in electronics laboratories.

SYLLABUS:

MODULE I: (10 hours)

Generalized configurations of Instruments- Functional element, Analog and Digital modes, Null and deflection methods, Methods of correction. Classification of instruments. Static and Dynamic characteristics of instruments- Calibration, accuracy, precision, bias, sensitivity, linearity, threshold, resolution, hysterisis and dead space. Measurement errors- various types. Measurement standards and calibration.

MODULE II: (10 hours)

Potentiometers: General Principle- Direct Current Potentiometer- AC potentiometer- Application of DC and AC potentiometers.
Bridges: Wheatstone 's bridge – Kelvin's Double Bridge - Carry Foster Slide Wire Bridge - Bridge Current Limitations - Maxwell's bridge- Schering bridge- Anderson's bridge and Wein's bridge (Analysis included for all bridges).

MODULE III: (12 hours)

Analog to digital converters-Tracking, successive approximation, charge distribution, flash, subranging, and integrating type ADCs. Digital to analog converters-weighted resistor, weighted capacitor, potentiometric, and R-2R ladder type DACs. Bipolar DACs, Master-slave DACs. Performance specifications of ADCs and DACs.

Transducers: Resistance Transducer-Principle of operation-Strain Gauge. Inductive transducer-LVDT.Capacitive transducers-Capacitor microphone, Hall effect transducer, Proximity transducer

MODULE IV: (10 hours)

Cathode ray oscilloscope (review), Special purpose oscilloscopes- delayed time- base, analog storage, sampling oscilloscopes. Digital storage oscilloscopes- working principle and applications. Graphic Recording Instruments: strip chart recorder, X-Y recorder, Plotter. Signal generators – low frequency signal generators, function generator, pulse, RF signals, sweep generators, Frequency synthesizer.

MODULE V: (10 hours)

Liquid crystal display (LCD). Waveform analysing instruments: Distortion meter, Spectrum analyser, Digital spectrum analyser, Q meter, Watthour meter, Power-factor meter, Instrument transformers, Thermocouple instruments, Peak response voltmeter, True RMS meter, Electronic multimeter, Digital voltmeter, Spectrum analyzer

COURSE OUTCOMES:

The student will be able to:

- Impart knowledge in the area of measurement principles
- Explain the basic principle of potentiometer and various bridge circuits.
- Introduce the fundamental concepts of transducers and analog to digital converters.
- Describe the basic working principle of signal measuring, signal recording devices and signal generators.
- Summarize the operation of frequency analyzing device.

Text Books:

1. D A Bell, Electronics Instrumentation and Measurements, Prentice Hall of India, Delhi.
2. S. Franco, Design with Operational Amplifiers and Analog Integrated Circuits, Tata Mc-Graw Hill, New Delhi, 2003 (for ADCs and DACs only)
3. J. J. Carr, Elements of Electronic Instrumentation and Measurements, 3rd ed., Pearson Education, Delhi, 2003
4. Sawhney AK, A course in Electrical and Electronic Measurements & instrumentation, Dhanpat Rai

Reference Books:

1. E. O. Doebelin, Measurement Systems: Application and Design, 4th ed., McGraw-Hill, New York, 1990
2. A.D. Helfrick and W. D. Cooper, Modern Electronic Instrumentation and Measurement Techniques, Pearson Education, Delhi, 1992
3. J. P. Bentley, Measurement Systems, Pearson Education, Delhi, 2003

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).
PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC19 506 (F)	DATA ANALYSIS	3-1-0-3 (L-T-P-C)

PRE-REQUISITES : NIL

COURSE OBJECTIVES:

- Provide you with the knowledge and expertise to become a proficient data scientist
- Understanding of statistics and machine learning concepts that are vital for data science.
- Evaluate and analyze data visualization models.

SYLLABUS:

MODULE I *(11 HOURS)*

Introduction to Data Science, Different Sectors using Data science, Purpose and Components of Python in Data Science -Variables, Data types and Operators.

MODULE II *(11 HOURS)*

Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, using multiple data sources.

MODULE III *(10 HOURS)*

Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.

MODULE IV *(10 HOURS)*

Data visualisation: Introduction, Types of data visualisation, Data for visualisation: Data types, Data encodings, Retinal variables, mapping variables to encodings, Visual encodings

MODULE V *(10 HOURS)*

Applications of Data Science, Data Science and Ethical Issues- Discussions on privacy, security, ethics- A look back at Data Science- Next-generation data scientists.

COURSE OUTCOMES:

The student will be able to:

- Explain the basics of data science and enumerate the advantages of python in data science.
- Demonstrate how data is collected, managed and stored for data science.
- Describe the key concepts in data science, including their real-world applications.
- Illustrate data visualization models.
- Apply data science.

Text Books:

1. Joel Grus, Data Science from Scratch, Shroff Publisher Publisher /O'Reilly Publisher Media
2. V.K. Jain, Data Sciences & Analytics, Khanna Publishing House
3. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly Publisher Media.

Reference Books:

1. Annalyn Ng, Kenneth Soo, Numsense! Data Science for the Layman, Shroff Publisher Publisher
2. Philipp Janert, Data Analysis with Open Source Tools, Shroff Publisher Publisher / O'Reilly Publisher Media.
3. NPTEL course on Python for Data Science by Prof. Ragunathan Rengasamy.

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).
PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC 19 507 (P)	DIGITAL SIGNAL PROCESSING LAB	0-0-3-1 (L-T-P-C)

PRE-REQUISITES : SIGNALS AND SYSTEMS

COURSE OBJECTIVES:

- To explore the concepts of digital signal processing.
- To familiarise with simulation software and hardware modules.
- To design, simulate and implement various systems using MATLAB/ SciLab/ OCTAVE & DSP kit.

List Of Experiments

(A minimum of 10 experiments must be conducted)

Part A: **Experiments based on MATLAB/SciLab/OCTAVE (8 experiments are mandatory)**

1. Generation of Waveforms (Continuous and Discrete)
2. Verification of Sampling Theorem.
3. Linear Convolution, Circular Convolution and Linear Convolution using Circular Convolution.
4. To find the DFT and IDFT for the given input sequence.
5. To find the DCT and IDCT for the given input sequence.
6. To find FFT and IFFT for the given input sequence.
7. FIR and IIR filter design using Filter Design Toolbox.
8. FIR Filter (Low-pass, High-pass and Band-pass) design (Window method).
9. IIR Filter (Low-pass, High-pass and Bandpass) design (Butterworth and Chebyshev).
10. Generation of AM, FM & PWM waveforms and their spectrum.
11. Filtering of noisy signals
12. Implementation of simple algorithms in image processing (detection, de-noising, filtering etc)

Part B: Experiments on Digital Signal Processor/ DSP kits (2 experiments are mandatory)

13. Generation of sine wave and standard test signals.
14. Convolution: Linear and Circular
15. Real Time FIR Filter implementation (Low-pass, High-pass and Band-pass) by inputting a signal from the signal generator
16. Real Time IIR Filter implementation (Low-pass, High-pass and Band-pass) by inputting a signal from the signal generator
17. Sampling of analog signal and study of aliasing.

COURSE OUTCOMES:

The students will be able to:

- Apply the basic operations of Signal processing.
- Design and simulate various signals related to DSP.
- Design IIR and FIR digital filters.
- Carry out simulation of DSP systems using DSP Kit.
- Implement DSP processor-based systems.

Internal Continuous Assessment (Maximum Marks-50).

60% - Laboratory practical, record and Viva voce.
30% - Tests.
10% - Regularity in the lab.

Semester-end Practical Examinations(Maximum Marks-100).

10% - Record of works done
20% - Vivavoce
70% - Procedure and tabulation form, Conducting experiment, results and inference

EC 19 508 (P)	MICROCONTROLLERS LAB	0-0-3-1 (L-T-P-C)

PRE-REQUISITES : MICROPROCESSOR & MICROCONTROLLER

COURSE OBJECTIVES:

- To understand Assembly Language programming of Microcontroller.
- To interface simple peripheral devices to a Microcontroller.
- To equip student groups to design and implement simple embedded systems.

List of experiments

(A minimum of 10 experiments must be conducted)

1. 8086 kit familiarization and basic experiments.
2. Programming exercise using BCD and Hexadecimal numbers
3. Programming exercise : sorting ,searching and string
4. Interfacing with A/D and D/A converters
5. Interfacing with stepper motors
6. IBM PC programming : Basic programs using DOS and BIOS interrupts
7. Interfacing with PC: Serial communication and Parallel printer interfacing
8. Interfacing with 8255 - Programmable Peripheral Interface.
9. Interfacing with 8279 - keyboard and display.

8051 Experiments

1. Familiarization of 8051.
2. Basic experiments of 8051 - addition of two 8 bit numbers, subtraction of two 8 bit numbers, multiplication and division.
3. Parallel interfacing I/O ports (Matrix keyboards)
4. Serial communication with PC
5. Parallel interfacing –LCD
6. Interfacing with serial EEPROM

COURSE OUTCOMES:

The students will be able to:

- Perform arithmetic operations using 8086/8051 assembly language programming.
- Implement logical operations using 8086/8051 assembly language programming
- Implement string instructions using 8086/8051 assembly language programming
- Demonstrate sorting operations and using assembly language
- Interface 8086/8051 with peripheral devices.

Internal Continuous Assessment (Maximum Marks-50).

60% - Laboratory practical, record and Viva voce.
30% - Tests.
10% - Regularity in the lab.

Semester-end Practical Examinations(Maximum Marks-100).

10% - Record of works done
20% - Vivavoce
70% - Procedure and tabulation form, Conducting experiment, results and inference

EC 19 601	CONTROL SYSTEM	3-1-0-4 (L-T-P-C)

PRE-REQUISITES: SIGNALS AND SYSTEMS

COURSE OBJECTIVES:

- To introduce the elements of control system and its modeling.
- To introduce methods for analyzing the time response and the stability of systems.
- To introduce methods for analyzing the time response the frequency response the stability of systems.
- To design control systems with compensating techniques.
- To introduce the state variable analysis method.

SYLLABUS:

MODULE I: (12 hours)

Introduction to control system – Basic idea of control systems and their classifications – transfer function– transfer function of electrical and mechanical (translational, rotational) systems, Force-Voltage, Force-Current, Torque-Voltage and Torque-Current analogies. Block diagram reduction – signal flow graph – Mason's gain formula-block diagram reduction using signal flow graph.

MODULE II: (9 hours)

Time domain Analysis –Specifications- Type and order of a system – typical test signals for the time response of control system – impulse and step response of first and second order systems – steady state error – static and dynamic error coefficients – concepts of stability – Routh Hurwitz criterion – basic ideas of proportional, derivative and integral controllers-Construction of root locus.

MODULE III: (12 hours)

Frequency Response Analysis- Frequency domain specifications- computation of gain and phase Margins from Bode Plot -Frequency Domain Plots-Nyquist and Bode Plots-Calculation of phase margin and gain margin from Nyquist and bode plot

MODULE IV: (9 hours)

Modeling of discrete-time systems-sampling-mathematical derivations for sampling-sample and hold- -solutions of difference Equations using Z-transforms-example of sampled data systems -analysis of discrete time systems-pulse transfer function-examples-stability –Jury's criterion –bilinear transformation- stability analysis after bilinear transformation–stability analysis Routh-Hurwitz techniques.

MODULE V: (10 hours)

Introduction-Definitions and explanations of the terms state, state variables, state vector and state space-State Space Representations of Linear Time-invariant System with i) single input and output ii) multi variable systems iii) SISO System in which forcing Function involves-Eigen values- phase variable and Diagonal forms-Invariance of Eigen values under linear transformation- Diagonalization Solutions of Linear Time-invariant State Equations-Homogeneous and Non-homogeneous case(example up to second order only)- Matrix Exponential- Laplace Transform approach to the solutions of state equations-State Transition Matrix-properties.

COURSE OUTCOMES:

The student will be able to:

- Construct mathematical model of an LTI system and obtain its transfer function.
- Analyze the time response of an LTI system.
- Deduce the frequency response of an LTI system to describe the nature of stability of the system.
- Apply Jury's stability test to find the stability of discrete time system.
- Develop the state space representation of an LTI system.

Text Books:

1. Nagoor Kani, Control System Engineering, RBA Publications
2. Nagoor Kani, Advanced Control Theory, RBA Publications
3. Ogata K. ―Modern Control Engineering‖, Prentice Hall of India
4. M Gopal,'Control systems- Principles & Design', Tata McGraw Hill, New Delhi, 3rd Ed. 2008
5. Ogata K.,Discrete Time Control Systems, Pearson Education Asia, 2007
6. Kuo B.C ., Digital Control Systems, Oxford University Press

Reference Books:

1. Ziemer R.E.,Tranter W.H& Fanin D.R.,Signals and Systems, Pearson Education Asia
2. Dorf R.C& Bishop R.H.,Modern Control Systems, Addison Wesley
3. B.C Kuo., Automatic Control System‖, Prentice Hall of India
4. Nagarath I. J & Gopan M., Control System Engineering ,Wiley India Ltd

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).
PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC 19 602	VLSI DESIGN	3-1-0-4 (L-T-P-C)

PRE-REQUISITES : ELECTRONIC DEVICES & ANALOG CIRCUITS

COURSE OBJECTIVES:

- To learn and implement basic CMOS Circuits
- To learn CMOS process technology

SYLLABUS:

MODULE I *(12 HOURS)*

Short and narrow channel effects in MOS transistor– subthreshold conduction–body effect-channel length modulation- drain induced barrier lowering-hot carrier effects-velocity saturation of charge carriers. Scaling of MOS Transistor-constant voltage and constant field scaling. MOS inverters-resistive load, Saturated NMOS load, Depletion NMOS load, pseudo MOS-CMOS inverters-robustness and performance–capacitance components-charge sharing–power dissipation.

MODULE II *(9 HOURS)*

Combinational circuits using static CMOS logic style -Design & implementation of Adder–Full adder, Dynamic adder, Carry bypass adder, Carry select adder, Square root carry select adder, Carry look ahead adder-Multipliers, array multipliers-Multiplexers-Memory elements-SRAM,DRAM,ROM, Sense amplifiers–Differential, Single ended

MODULE III *(11 HOURS)*

Wafer processing–diffusion- Fick‘s Law–analytic solutions for predeposition and drive-in diffusion–Oxidation–Deal-Grove model–Ion implantation-vertical and lateral projected ranges-channeling-stopping power–Optical lithography-optical exposures-modulation transfer function-proximity and projection printing–Photoresists-types-contrast curves-Etching-wet, plasma and ion etching- Epitaxial growth– Physical vapor deposition, chemical vapor deposition , molecular beam epitaxy.

MODULE IV *(11 HOURS)*

Device isolation - junction and oxide isolation–LOCOS-SILO-SWAMI process-trench isolation–silicon on insulator isolation- contacts and metallization Schottky contacts-implanted ohmic contacts-alloyed contacts-refractory metal contact technology-multilevel metallization

MODULE V *(9 HOURS)*

Fabrication of nMOS transistor, pMOS transistor. CMOS- p well process, n well process, twin tub process. Layout and design rules (lambda based)-layout using cell hierarchy-layout of MOSFET–stick diagram-layout of inverter, NOR and NAND gates.

COURSE OUTCOMES:

The student will be able to

- Summarize the secondary effects of MOS transistor and its impact in scaling the device.
- Outline different MOS inverters and its performance parameters
- Elaborate static CMOS logic style in implementing logic circuits.
- Identify the various steps in IC fabrication.
- Express the layout of simple MOS circuit using Lambda based design rules

Text Books:

1. Weste & Harris, CMOS VLSI Design, Pearson Education
2. Plummer, Deal&Griffin,Silicon VLSI Technology, Pearson Education
3. Rabaey J.M., Digital Integrated Circuits-A Design Perspective, Pearson Education
4. Weste & Eshraghian, Principles of CMOS VLSI Design, Addison Wesley
5. S KGandhi,VLSI Fabrication Principles., John Wiley
6. Sung-MoKang&YusufLeblebici,CMOSDigitalIntegratedCircuits-Analysis & Design, McGraw Hill
7. Nagchoudari.,Principles of Microelectronic Technology, Wheeler Publishing

Reference Books:

1. Yuan Taur & NingT.H., Fundamentals of Modern VLSI Devices, Cambridge Univ. Press
2. Baker.Li & Boyce, CMOS-Circuit Design, Layout&Simulation, PHI
3. Sze SM, VLSI Technology, McGraw Hill
4. Ken Martin, Digital Integrated Circuit Design, Oxford Univ. Press
5. Eshraghian &Pucknell, Essentials of VLSI Circuits & Systems,PHI

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).
PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC 19 603	DATA COMMUNICATION & NETWORKING	3-1-0-3 (L-T-P-C)

PRE-REQUISITES : NIL

COURSE OBJECTIVES:

- To give the basic ideas of data communication networks, layers and protocols
- To understand the concept of switching networks and queuing theory.
- To introduce the techniques in secure network communications and their defence mechanisms.

SYLLABUS:

MODULE I *(9 HOURS)*

Introduction to computer communication: Transmission modes - serial and parallel transmission, asynchronous, synchronous, Simplex, half duplex, full duplex communication. Switching: circuit switching and packet switching.
Networks: Network criteria, physical structures, network models, categories of networks, Interconnection of Networks: Internetwork- Network models-Layered tasks, OSI model, Layers in OSI model, TCP/IP protocol suite

MODULE II *(12 HOURS)*

Layered Architectures in Data networks: Physical Layer: Guided and unguided transmission media (Coaxial cable, UTP, STP, Fiber optic cable)
Data Link Layer: Framing, Flow control (stop and wait, sliding window flow control), Error control, Error detection (check sum, CRC), Asynchronous and synchronous protocols-character oriented and bit oriented protocols
Media access control: Ethernet (802.3), Token Bus, Token ring, FDDI, ATM Networks. Routing in ATM networks, X .25 Protocols.
CSMA/CD-Aloha-pure and slotted aloha Random access, Logical link control, Wireless LAN (802.11), CSMA/CA

MODULE III *(11 HOURS)*

Network Layer Logical addressing: IPV4 & IPV6-Address Resolution protocols (ARP, RARP), Subnetting, Classless Routing (CIDR), ICMP, IGMP, DHCP Networking devices (Hubs, Bridges & Switches) – Routing- classification- routing algorithm-Virtual circuit and datagram networks
Transport Layer –UDP, TCP -Congestion Control & Quality of Service and Flow Characteristics
Application Layer – DNS, Remote Logging (Telnet), SMTP, FTP, WWW, HTTP, POP3, MIME, SNMP.

MODULE IV *(11 HOURS)*

Queueing Theory: Markov chain-discrete time and continuous time Markov chains- Poisson Process M/M/1 Queue Little's formula M/M/m/m queueing models-infinite server case State dependent Queues Birth- Death Process M/G/1 Queue.
Elements of Traffic Engg. GoS and Blocking Probability. Incoming traffic and service time characterization. Analysis of blocking models and delay models- Erlang formula.

MODULE V *(9 HOURS)*

Introduction to information system security, common attacks
Security at Application Layer (E-MAIL, PGP and S/MIME). Security at Transport Layer (SSL and TLS). Security at Network Layer (IPSec).
Defence and counter measures: Firewalls and their types. DMZ, Limitations of firewalls, Intrusion Detection Systems -Host based, Network based, and Hybrid IDSs

COURSE OUTCOMES:

The student will be able to

- Explain the Data Communication System and its components and layered architecture.
- Identify the different types of network topologies and protocols.
- Evaluate data communication link considering elementary concepts of data link layer protocols for error detection and correction.
- Apply various network layer techniques and analyse packet flow on basis of routing protocols.
- Summarize the security aspects in designing the communication networks.

Text Books:

1. Behrouz A Forouzan, Data Communications and Networking, 4/e, Tata McGraw-Hill, 2006.
2. Behrouz A. Forouzan, Cryptography & Network Security, IV Edition, Tata McGraw-Hill, 2008
3. William Stallings, "Data and Computer Communication", Fifth Edition, Prentice Hall of India, 1997.
4. Jean Walrand & Pravin Varaiya, "High Performance Communication Networks" Morgan Kaufman Publishers
5. Andrew S.Tanenbaum, "Computer networks", Third Edition, prentice Hall of India, 1996.
6. Viswanathan T., Telecommunication Switching Systems and Networks, Prentice Hall of India Pvt Ltd.
7. Schwartz M., Telecommunication Networks- Protocols, Modeling and Analysis, Addison Wesley Publishing Company

Reference Books:

1. J F Kurose and K W Ross, Computer Network A Top-down Approach Featuring the Internet, 3/e, Pearson Education, 2010
2. Larry Peterson and Bruce S Davie: Computer Network- A System Approach, 4/e, Elsevier India, 2011.
3. Flood J E., Telecommunication Switching Traffic and Networks, Pearson Education Pvt Ltd.

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).
PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC 19 604	ANTENNAS AND PROPAGATION	3-1-0-3 (L-T-P-C)

PRE-REQUISITES: ELECTROMAGNETIC WAVES

COURSE OBJECTIVES:

- To learn the basic working of antennas.
- To study various antennas, arrays and radiation patterns of antennas.
- To understand various techniques involved in various antenna parameter measurements.
- To understand the propagation of radio waves in the atmosphere.

SYLLABUS:

MODULE I *(10 Hours)*

Antenna Parameters: Introduction, Isotropic radiators, Radiation pattern, Gain -radiation intensity-Directive gain, Directivity, antenna efficiency - Reciprocity theorem & its applications, effective aperture area, radiation resistance, terminal impedance, antenna field zones, front-to-back ratio, antenna beamwidth, antenna bandwidth, antenna beam efficiency, antenna beam area or beam solid angle, polarization, antenna temperature.
Measurement of the radiation pattern, gain, directivity, and impedance of an antenna

MODULE II *(14 Hours)*

Concept of Retarded potentials: Radiation, retarded potential -Radiation from an A.C current element- monopoles and dipoles-power radiated from a dipole.

Antenna Arrays: Introduction, various forms of antenna arrays, arrays of two isotropic point sources, arrays of n-isotropic sources of equal amplitude and spacing (Broad-side & End-fire array cases), array factor, directivity and beam width of broadside array and end-fire array, scanning arrays, non-isotropic but similar point sources, multiplication of patterns, Grating lobes, tapering of arrays, binomial arrays, properties of Dolph-Tchebysceff arrays, superdirective arrays.

MODULE III *(10 Hours)*

VLF, LF and MF antennas- Introduction, effects of ground on antenna performance, effects of antenna height, traveling wave antenna, V and inverted V antenna, Rhombic antenna, radio direction finders, loop antennas-small circular loop, Horn antenna and parabolic reflector antennas, Basic Concepts of Smart Antennas- Concept and benefits of smart antennas, fixed weight beamforming basics, Adaptive beamforming.

MODULE IV *(10 Hours)*

VHF, UHF, SHF Antennas- Introduction. Folded dipole antenna, Yagi-Uda antenna, and helical antenna, and turnstile antenna, frequency-independent antennas- log periodic antenna, Microwave antennas- microstrip antenna, design of rectangular patch antenna, slot antenna, fractal antenna. Introduction to simulation software for antenna design.

MODULE V *(8 Hours)*

Factors involved in the propagation of radio waves: the ground wave-Reflection of radio waves by the surface of the earth-space wave propagation-considerations in space wave propagation- atmospheric effects in space wave propagation-ionosphere and its effects on radio waves -mechanism of ionosphere propagation-refraction and reflection of sky waves by ionosphere-ray paths-skip distance-maximum usable frequency-vertical and oblique incidence-fading of signals - selective fading-diversity reception, Duct Propagation.

COURSE OUTCOMES:

The student will be able to:

- Summarize various Parameters of antennas.
- Analyze the properties of different types of antenna arrays and their design.
- Outline different types of antenna and its application.
- Familiarize antenna design software tools.
- Explain the characteristics of radio-wave propagation

Text Books:

1. Jordan & Balman, Electromagnetic waves & Radiating Systems, Prentice Hall India
2. Constantine. A. Balanis: ―Antenna Theory- Analysis and Design‖, Wiley India, 2nd Edition, 2008
3. G.S.N Raju , Antennas and Wave Propagation, Pearson Education, 2005

Reference Books:

1. Kraus, ―Antennas‖, Tata McGraw Hill, NewDelhi, 3‖ Edition, 2003
2. Warren L Stutzman and Gary A Thiele, ―Antenna Theory and Design‖, 2ndEd, John Wiley and Sons Inc. 1998

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).
PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC 19 605 (A)	MULTIRATE SIGNAL PROCESSING	3-1-0-3 (L-T-P-C)

PRE-REQUISITES: DIGITAL SIGNAL PROCESSING

COURSE OBJECTIVES:

- To impart knowledge on Fundamentals of Multirate Theory
- To impart knowledge on M-channel perfect reconstruction filter banks
- To develop understanding on Perfect reconstruction (PR) filter banks

SYLLABUS

MODULE I *(11 HOURS)*

Fundamentals of Multirate Theory
The sampling theorem: sampling at subnyquist rate - Basic Formulations and schemes. Basic Multirate operations: Upsampling, Downsampling, Decimation and Interpolation -Resampling with rational factor, Polyphase decomposition, Multi-stage Interpolation and Decimation systems. Digital Filter Banks- DFT Filter Bank- Identities- Polyphase representation

MODULE II *(11 HOURS)*

Maximally decimated filter banks: Polyphase representation - Errors in the QMF bank- Perfect reconstruction (PR) QMF Bank - Design of an alias free QMF Bank.
M-channel perfect reconstruction filter banks, Uniform band and non uniform filter bank - tree structured filter bank- Errors created by filter bank system- Polyphase representation- perfect reconstruction systems

MODULE III *(11 HOURS)*

Perfect reconstruction (PR) filter banks
Paraunitary PR Filter Banks- Filter Bank Properties induced by paraunitarity- Two channel FIR paraunitary QMF Bank- Linear phase PR Filter banks- Necessary conditions for Linear phase property. Quantization Effects: -Types of quantization effects in filter banks. -coefficient sensitivity effects, dynamic range and scaling

MODULE IV *(9 HOURS)*

Cosine Modulated filter banks- Cosine Modulated pseudo QMF Bank- Alias cancellation- phase - Phase distortion- Closed form expression - Polyphase structure- PR Systems, L-channel QMF banks , Multilevel filter banks

MODULE V *(10 HOURS)*

Applications of filter banks in Signal Processing and Communication such as hearing aids, cognitive radio, Software design radio channelizers. Oversampling A/D and D/A converters , Introduction to wavelets , Discrete-wavelet transform.

COURSE OUTCOMES:

The student will be able to:

- Explain the Fundamentals of Multirate Theory
- Identify perfect reconstruction of filter bank systems.
- Apply efficient realizations for upsampling and downsampling of signals using the polyphase decomposition
- Analyse the quantization effects in filter banks
- Summarize the use of filter banks in application such as signal processing and communication

Text Books:

1. P.P. Vaidyanathan. Multirate systems and filter banks, Prentice Hall. PTR. 1993.
2. N.J. Fliege. Multirate digital signal processing, John Wiley 1994.

Reference Books:

1. Oppenheim, R. Schafer, and J. Buck, "Discrete-time signal processing," Prentice-Hall, 1999
2. Sanjit K. Mitra, Digital Signal Processing: A computer based approach, McGraw Hill. 1998.
3. R.E. Crochiere. L. R., Multirate Digital Signal Processing, Prentice Hall. Inc.1983.
4. J.G. Proakis. D.G. Manolakis, Digital Signal Processing: Principles. Algorithms and Applications, 3rd Edn. Prentice Hall India, 1999.

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).
PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC 19 605 (B)	RENEWABLE ENERGY SYSTEMS	3-1-0-3 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To give sufficient knowledge about the promising new and renewable sources of energy
- To get exposure on solar radiation and its environmental impact to power.
- To equip students in working with projects and to take up research work in connected areas.

SYLLABUS

MODULE I *(9 HOURS)*

Introduction, Classification of Energy Resources; Conventional Energy Resources - Availability and their limitations; Non-Conventional Energy Resources – Classification, Advantages, Limitations; Comparison of Conventional and Non-Conventional Energy Resources; World Energy Scenario; Indian Energy Scenario. ENERGY STORAGE: Sizing and Necessity of Energy Storage.

MODULE II *(13 HOURS)*

SOLAR THERMAL SYSTEMS: Introduction, Solar Constant, Basic Sun-Earth Angles, Measurement of Solar Radiation Data –Pyranometer and Pyrheliometer .Principle of Conversion of Solar Radiation into Heat, – Solar thermal collectors – General description.and characteristics – Flat plate collectors – Heat transfer processes –Solar concentrators (parabolic trough, parabolic dish, Central Tower Collector) –performance evaluation.
SOLAR ELECTRIC SYSTEMS: Solar Thermal Electric Power Generation –; Solar Photovoltaic – Solar Cell fundamentals, characteristics, classification, construction of module, panel and array. Solar PV Systems – stand-alone and grid connected; Applications – Street lighting, Domestic lighting and Solar Water pumping systems.

MODULE III *(9 HOURS)*

ENERGY FROM OCEAN: Tidal Energy – Principle of Tidal Power, Components of Tidal Power Plant (TPP), Classification of Tidal Power Plants, Advantages and Limitations of TPP. Ocean Thermal Energy Conversion (OTEC): Principle of OTEC system, Methods of OTEC power generation – Open Cycle (Claude cycle), Closed Cycle (Anderson cycle) and Hybrid cycle (block diagram description of OTEC); Site-selection criteria, Biofouling, Advantages & Limitations of OTEC.

MODULE IV *(9 HOURS)*

WIND ENERGY: Introduction, Wind and its Properties, History of Wind Energy, Wind Energy Scenario – World and India. Basic principles of Wind Energy Conversion Systems (WECS), Classification of WECS, Parts of WECS, Derivation for Power in the wind, Electrical Power Output and Capacity Factor of WECS, Advantages and Disadvantages of WECS

MODULE V *(12 HOURS)*

BIOMASS ENERGY: Introduction, Photosynthesis process, Biomass fuels, Biomass conversion technologies, Urban waste to Energy Conversion, Biomass Gasification, Biomass to Ethanol Production, Biogas production from waste biomass, factors affecting biogas generation, types of biogas plants – KVIC and Janata model; Biomass program in India. Small hydro power: Classification as micro, mini and small hydro projects - Basic concepts and types of turbines - Design and selection considerations.

EMERGING TECHNOLOGIES: Fuel Cell, Small Hydro Resources, Hydrogen Energy, alcohol energy, nuclear fusion and power from satellite stations.

COURSE OUTCOMES:

The students will be able:

- Describe the environmental aspects of non-conventional energy resources in comparison with various conventional energy systems, their prospects and limitations.
- Explain the use of solar energy and the various components used in the energy Production.
- Appreciate the need of Wind Energy and the various components used in energy generation and know the classifications.
- Underline the concept of Biomass energy resources and their classification, types of biogas Plants- applications
- Summarize the knowledge of fuel cells, wave power, tidal power and geothermal principles and applications.

Text Books:

1. A.A.M. Saigh (Ed): Solar Energy Engineering, Academic Press, 1977
2. Rai G.D. , Non-Conventional Energy Sources, Khanna Publishers, 2011
3. Abbasi S. A. and N. Abbasi, Renewable Energy Sources and Their Environmental Impact, Prentice Hall of India, 2001.

Reference Books:

1. Boyle G. (ed.), Renewable Energy - Power for Sustainable Future, Oxford University Press, 1996
2. Earnest J. and T. Wizelius, Wind Power Plants and Project Development, PHI Learning, 2011.
3. F. Kreith and J.F. Kreider: Principles of Solar Engineering, McGraw Hill, 1978
4. G.N. Tiwari: Solar Energy-Fundamentals, Design, Modelling and Applications, Narosa Publishers, 2002
5. Twidell and Wier, Renewable Energy Resources, CRC Press (Taylor and Francis), 2011

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).
PART A**: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B**: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks
Two questions from each module with choice to answer one question.

EC 19 605 (C)	BASIC THERMODYNAMICS	3-1-0-3 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To explain basic concepts of thermodynamics
- To describe basic laws of thermodynamics
- To determine change in properties of pure substances during phase change processes
- To evaluate properties of gas mixtures and psychometric properties of air
- To understand the basics of various heat engine and refrigeration cycles

SYLLABUS

(Use of steam table & refrigeration table is allowed in examination)

MODULE I (12 Hours)

Introduction- Basic Concepts: System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Cycle, Reversibility, Quasi – static Process, Irreversible Process, Causes of Irreversibility, Energy in State, Work and Heat, Point and Path functions, Perfect Gas Laws, Equation of State, specific and Universal Gas constants (simple numerical only).
Zeroth Law of Thermodynamics, Principles of Thermometry –Reference Points, International Temperature scale.

MODULE II (11 Hours)

First law of Thermodynamics, first law applied to a closed system, Heat and Work Transfer, changes in Internal Energy, first law applied to a flow system – Steady Flow Energy Equation (Simple Problems), Throttling and free Expansion Processes, Limitations of the First Law.
Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence, Perpetual Motion Machines, Thermal Reservoir, Heat Engine, Refrigerator, Heat pump, COP, Efficiency Carnot's theorem, Carnot cycle and its specialties (simple numerical only).
Third Law of Thermodynamics, Clausius Inequality, Principle of Entropy Increase (description only).

MODULE III (7 Hours)

Properties of pure substance, P-V, T-S and h-s diagrams, Phase Transformations, Triple point and critical point, properties during change of phase, Dryness Fraction, Property tables (simple numerical using steam tables).

MODULE IV (11 Hours)

Real gas equations, Vander Waals Equation Of State, Generalized Compressibility Charts, Dalton's Law Of Partial Pressures, Avogadro's Laws Of Additive Volumes, Mole Fraction, Volume Fraction And Partial Pressure, Equivalent Gas Constant And Internal Energy, Enthalpy, Specific Heats And Entropy Of Mixture Of Perfect Gases And Vapour (Description Only).
Atmospheric Air, Saturated Air, Psychometric Properties – Dry Bulb Temperature, Wet Bulb Temperature, Dew Point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, Vapour Pressure, Degree Of Saturation, Various Psychrometric Processes (Description Only)

MODULE V (11 Hours)

Power Cycles- Otto, Diesel cycles, Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressure, comparison of Cycles (simple numerical only).
Refrigeration Cycles- Brayton cycle, Performance Evaluation, Vapour compression cycle-performance Evaluation. (Basics and simple numerical only)

COURSE OUTCOMES:

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

- Explain the basic concepts of thermodynamics.
- Describe the laws of thermodynamics and their significance.
- Illustrate the properties of pure substances like steam.
- Discuss the various properties of gas mixtures & explain the psychometric properties and process of moist air
- Apply the principles of thermodynamics for the analysis of thermal systems and hence evaluate thermal performance of power and refrigeration cycles.

TEXTBOOKS:

1. P.K. Nag, Engineering Thermodynamics, 4th Edition, McGraw Hill, 2013.
2. R. K Rajput, Engineering Thermodynamics, Laxmi Publications (P) Ltd.

REFERENCE BOOKS

1 Fundamentals of Thermodynamics - Sonntag, Borgnakke and Van Wylen - John Wiley 2010.

2 Thermodynamics – An Engineering Approach – Yunus Cengel & Boles /TMH, New Delhi 2008.

Steam Tables/Data book

R.S.Khurmi, Steam table with Mollier chart, S.Chand, 2008.

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).
PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC 19 605 (D)	SATELLITE COMMUNICATION	3-1-0-3 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To impart the basic concepts of satellite communication and systems
- To develop understanding about the link design and the latest trends in satellite communication

SYLLABUS:

MODULE I *(10 HOURS)*

Satellite Orbits: Orbital mechanics-Kepler's laws, locating the satellite in orbit,orbital elements; look angle determination-subsatellite point, azimuth and elevation angle calculation;orbital perturbations- longitudinal and inclination changes

MODULE II *(10 HOURS)*

launches and launch vehicles-ELVs, placing satellites into geostationary orbit;orbital effects in communication system performance-doppler shift, range variations, solar eclipse, sun transit outage

MODULE III *(10 HOURS)*

Communication Satellites- Satellite subsystem; Attitude and orbit control system (AOCS); Telemetry, Tracking, Command and Monitoring (TTC&M); power systems; communications subsystem-description, transponders; satellite antennas-basic antenna types, satellite antennas in practice

MODULE IV *(10 HOURS)*

Satellite link design and Satellite access- Basic transmission theory, system noise temperature and G/T ratio; Downlink design-link budget; Uplink design; design for specified C/N, uplink and downlink attenuation in rain, communication link design procedure; system design examples.

MODULE V *(10 HOURS)*

Multiple access schemes-FDMA, TDMA, CDMA, DAMA; VSAT systems-basic techniques, VSAT earth station engineering, system design; DBS systems-C-band and Ku Band home TV, digital DBS; satellite mobile systems; GPS

COURSE OUTCOMES:

The student will be able to:

- Summarize the basics of various orbital parameters.
- Discuss satellite orbits and orbital effects.
- Describe various sub-systems of communication satellite.
- Solve numerical problems related to orbital motion and design of link budget for the given parameters and conditions.
- Differentiate various modulation and multiple access schemes of satellite communication system.

Text Books:

1. Timothy Pratl, Charles Bostian & Jeremy Allnutt,‘ Satellite communications‘, 2nd Ed., Wiley India, New Delhi, 2008
2. Dennis Roddy, ‗Satellite Communications‘, 4th Ed., Tata Mc-Graw-Hill, New Delhi, 2009
3. Tri T. Ha, ‗Digital Satellite Communications‘ , 2nd Ed., Tata Mc-Graw-Hill, New Delhi, 2009

Reference Books:

1. Wilbur L.Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, “Satellite Communication Systems Engineering”, Prentice Hall/Pearson, 2007.
2. N.Agarwal, “Design of Geosynchronous Space Craft”, Prentice Hall, 1986.
3. Bruce R. Elbert, “The Satellite Communication Applications”, Hand Book, Artech House Bostan London, 1997.
4. Emanuel Fthenakis, “Manual of Satellite Communications”, Mc Graw Hill Book Co., 1984.
5. Robert G. Winch, “Telecommunication Trans Mission Systems”, Mc Graw-Hill Book Co., 1983.
6. Brian Ackroyd, “World Satellite Communication and earth station Design”, BSP professional Books, 1990.
7. G.B.Bleazard, “Introducing Satellite communications“, NCC Publication, 1985.
8. M.Richharia, “Satellite Communication Systems-Design Principles”, Macmillan 2003

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).
PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC 19 605 (E)	ROBOTICS	3-1-0-3 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- Familiarize students with basic terminologies in robotic sciences.
- Analyze and update knowledge in robot system integration.

SYLLABUS:

MODULE I: (11 hours)

Introduction to robotics : Brief History, Basic Concepts of Robotics such as Definition , Three laws, Elements of Robotic Systems i.e. Robot anatomy, DOF, Misunderstood devices etc., Classification of Robotic systems on the basis of various parameters such as work volume, type of drive, etc., Associated parameters i.e. resolution, accuracy, repeatability, dexterity, compliance, RCC device etc., Introduction to Principles & Strategies of Automation, Types & Levels of Automations, Need of automation, Industrial applications of robot.

MODULE II: (11 hours)

Grippers and Sensors for Robotics: Grippers for Robotics - Types of Grippers, Guidelines for design for robotic gripper, Force analysis for various basic gripper system. Sensors for Robots - Types of Sensors used in Robotics, Classification and applications of sensors, Characteristics of sensing devices, Selections of sensors. Need for sensors and vision system in the working and control of a robot.

MODULE III: (10 hours)

Drives and Control for Robotics: Drive - Types of Drives, Types of transmission systems, Actuators and its selection while designing a robot system. Control Systems: Types of Controllers, Introduction to closed loop control

MODULE IV: (10 hours)

Programming and Languages for Robotics: Robot Programming: Methods of robot programming, WAIT, SIGNAL and DELAY commands, subroutines, Programming Languages: Generations of Robotic Languages, Introduction to various types such as VAL, RAIL, AML, Python, ROS etc., Development of languages.

MODULE V: (10 hours)

Robotic vision systems: Imaging, Sensing and Digitization, Image processing techniques, Areas of application in robotics. Introduction to Artificial Intelligence, AI techniques, Need and application of AI, Introduction to kinematics: Position and orientation of objects, Rotation, Euler angles, Rigid motion representation using Homogenous Transformation matrix.

COURSE OUTCOMES:

The student will be able:

- Describe terminologies related to Robotics technology.
- Apply logic for selection of robotic systems.
- Analyse robotic system integration.
- Apply basic concepts robotic programming.
- Introduce artificial intelligence into robotics.

Text Books:

1. 1.S. K. Saha, Introduction to Robotics 2e, TATA McGraw Hills Education (2014)
2. 2. Asitava Ghoshal, Robotics: Fundamental concepts and analysis, Oxford University Press (2006)
3. 3. Dilip Kumar Pratihar, Fundamentals of Robotics, Narosa Publishing House, (2019).

Reference Books:

1. R. K. Mittal, I. J. Nagrath, Robotics and Control, TATA McGraw Hill Publishing Co Ltd, New Delhi (2003) 2. S. B. Niku, Introduction to Robotics – Analysis, Contro, Applications, 3rd edition, John Wiley & Sons Ltd., (2020)
2. J. Angeles, Fundamentals of Robotic Mechanical Systems Theory Methods and Algorithms, Springer (1997)
3. Mikell Groover, Mitchell Weiss, Roger N. Nagel, Nicholas Odrey, Ashish Dutta, Industrial Robotics 2nd edition, SIE, McGraw Hill Education (India) Pvt Ltd (2012)
4. R. D. Klafter, Thomas A. Chmielewski, and Mechael Negin, Robotic Engineering – An Integrated Approach, EEE, Prentice Hall India, Pearson Education Inc. (2009)

SWAYAM/NPTEL Courses:

1. Introduction to robotics by Dr. Krishna Vasudevan, Dr. Balaraman Ravindran, Dr.T.Asokan IIT Madras.
2. Sensors and Actuators Prof. Hardik Jeetendra Pandya IISc Bangalore.

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).
PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC 19 605 (F)	ENTREPRENEURSHIP	3-1-0-3 (L-T-P-C)

PRE-REQUISITES : NIL

COURSE OBJECTIVES:

- To develop and strengthen entrepreneurial quality and motivation in students.
- To impart basic entrepreneurial skills and understanding to run a business efficiently and effectively

SYLLABUS:

MODULE I: (10 hours)

ENTREPRENEURSHIP: Evolution of term 'Entrepreneurship, Factors influencing entrepreneurship, Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth. Barriers to entrepreneurship

MODULE II: (10 hours)

MOTIVATION: Theories, Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.

MODULE III: (10 hours)

CREATIVITY: Creativity and entrepreneurship ,Steps in Creativity ,Innovation and inventions , Using left brain skills to harvest right brain ideas ,Legal Protection of innovation ,Skills of an entrepreneur. Decision making and Problem Solving

MODULE IV: (10 hours)

BUSINESS: Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Industrial Park (Meaning, features, & examples), Special Economic Zone (Meaning, features & examples), Financial assistance by different agencies, Acts.

MODULE V: (12 hours)

Market Survey and Research, Selection of the Product / Service, Aspects of a Project, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies,Case study.

COURSE OUTCOMES:

Students will be able to :

- Discern distinct entrepreneurial traits
- Interpret the parameters to assess opportunities and constraints for new business ideas
- Summarize the systematic process to select and screen a business idea
- Design strategies for successful implementation of ideas
- Apply knowledge and skills to run a business successfully.

Text Books:

1. S.S.Khanka, "Entrepreneurial Development" S.Chand & Co. Ltd., Ram Nagar, New Delhi, 2013.
2. Donald F Kuratko, " Entrepreneurship – Theory, Process and Practice", 9th edition, Cengage Learning 2014.

Reference Books:

1. Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill, 2013.
2. Mathew J Manimala, "Entrepreneurship Theory at Cross Roads: paradigms and Praxis", 2nd Edition DreamTech, 2005.

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).
PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC19 606 (A)	INDUSTRIAL SAFETY ENGINEERING	3-1-0-3 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To understand the impact of safe industrial operations, its benefits and safety legalization.
- To understand general concept of safety
- To get an awareness about safety responsibilities of various agencies
- To know about various occupational health hazards and human factors contributing to industrial accidents
- To become familiar with the general laws and legislations applicable for an industrial safety practitioner

SYLLABUS:

MODULE I: (10 HOURS)

Introduction to industrial safety, Concept of Safety, Goals of safety engineering, Need for safety engineering, definitions of Accident, injury, unsafe actions & conditions.
Responsibility of Safety - Society, Govt., Management, Union& employees, Duties of safety officer, Safety Committee -Membership, Functions & Scope of Safety committee.

MODULE II: (10 HOURS)

Safety Training and Health Management: Occupational Health Hazards, Promoting Safety, Safety and Health training, Stress and Safety. Ergonomics - Introduction, Definition, Objectives, Advantages. Ergonomics Hazards - Musculoskeletal Disorders and Cumulative Trauma Disorders.

Safety Awareness & Training, Training for Safety, Assessment of needs, Design & development of training programme, Training methods and strategies. Training of manager, supervisors & workers. Evaluation of training programmes, Human behavior and safety: Human factors contributing to accidents

MODULE III: (10 HOURS)

Safety Assessment and Control: Safety Management: Role of management in Industrial Safety, Safety Management- Principles & Practices. Safety Organization: Role of safety committee and its formation, Safety awareness programme: motivation, education and training, Appraisal of plant safety and measurement of safety performance, Total loss control concept, Introduction to productivity, Quality, Reliability, and Safety (PQRS) theory.

Concept of workplace and its design. Improving safety and productivity through work place design control measures. Technical and engineering control measures. Control measuresagainst human error. Preventive maintenance. Role of Preventive maintenance in safety and health. Standards and code of practices for plant and equipment.

MODULE IV: (10 HOURS)

Industrial Safety and Control: Control of Physical Hazards: (Purpose of lighting. Advantages of good illumination. Lighting and safety. Lighting and the work. Control of Chemical Hazards Hazardous properties of chemicals and appreciation of information provided in Material safety data sheets. Classification of dangerous materials with pictorial symbols, common hazard and common precautions for each class

Control of Electrical Hazards Dangers from electricity. Safe limits of amperages, Voltages Safe distance from lines. Capacity and protection of conductors, Joints and connections, Means of cutting of power overload and short circuit protection. Statutory provisions regarding fire safety. Factors contributing towards fire. Chemistry of fire. Classification of fires. Common causes of industrial fires.

MODULE V: (10 HOURS)

Safety Legalisation: Legal Provisions regarding safety, Accident prevention & Compensation to affected employees as under Factories Act-1948, Factories Act (Amendment)1987, Maharashtra Factories Rule - 1963, The Mines Act-1952, Maharashtra Safety Officers Rule1982, The Workmen Compensation Act-1923, ESI Act, Public Liabilities Insurance Act-1991, Fatal Accident Act.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to:

- Explain the concept of safety and safety responsible agencies.
- Describe the occupational health hazards and human factors contributing to industrial accidents.
- Demonstrate the concepts of safety management.
- Illustrate the need for timely maintenance of equipment's, the need and measures for industrial safety control
- Extract the general laws and legislations applicable for an industrial safety practitioner.

Text Books:

1. Frank P. Lees, Loss of prevention in Process Industries, Vol. 1 and 2, Butterworth-Heinemann Ltd., London (1991).
2. Grimaldi and Simonds, Safety Management, AITBS Publishers, New Delhi (2001)
3. R.K.Jain and Sunil S.Rao, Industrial Safety, Health and Environment Management Systems, Khanna Publishers, New Delhi (2006).

Reference Books:

1. Industrial Safety -National Safety Council of India.
2. Slote.L. Handbook of Occupational Safety and Health, John Willey and Sons, New York
3. The Factories Act with amendments 1987, Govt. of India Publications DGFASLI, Mumbai

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).
PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC 19 606 (B)	SOFT SKILL & COMMUNICATION	3-1-0-3 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- Aims to increase learner's unique soft skills to develop attributes that enhance an individual's interactions, earning power and job performance.
- To understand and apply the principles of professional communication.
- To Understand the fundamentals of organizational behavior.
- To Strengthen skills in writing, research and presenting.
- Articulate oral and written messages in a clear, appropriate, and persuasive manner to suit specific purposes, audiences, and contexts at workplace.

SYLLABUS:

MODULE I: (10 hours)

Soft Skills: An Introduction – Definition and Significance of Soft Skills; Process, Importance and Measurement of Soft Skill Development. Self-Discovery: Discovering the Self; Setting Goals; Beliefs, Values, Attitude, Virtue. Positivity and Motivation: Developing Positive Thinking and Attitude; Driving out Negativity; Meaning and Theories of Motivation; Enhancing Motivation Levels. Emotional Intelligence: Meaning, History, Features, Components, Intrapersonal and Management Excellence; Strategies to enhance Emotional Intelligence.

MODULE II: (10 hours)

Importance of communication, Aspects of communication, communication through technology, Oral communication. Public Speaking: Skills, Methods, Strategies and Essential tips for effective public speaking. Group Discussion: Importance, Planning, Elements, Skills assessed; Effectively disagreeing, Initiating, Summarizing and Attaining the Objective. Non-Verbal Communication: Importance and Elements; Body Language.

MODULE III: (10 hours)

Importance of Interviewing - Types of Interviews - Structuring Effective Interviews-Interview Skills: Interviewer and Interviewee – in-depth perspectives. Before, During and After the Interview, Tips for Success. Presentation Skills: Types, Content, Audience Analysis. Personality Development – Meaning, Nature, Features, Stages, Models; Learning Skills; Adaptability Skills.

MODULE IV: (10 hours)

Written communication: Business and technical reports, Styles, Business correspondence: Memorandum writing, Notice, Agenda and Minutes, Research papers and articles, Advertising and job Description, Mechanics of Manuscript preparation. Email Etiquettes.

MODULE V: (12 hours)

Teamwork and Leadership Skills: Concept of Teams; Building effective teams; Concept of Leadership and practicing Leadership skills. Decision making - Team Communication. Managing Time, Managing Stress, Meditation. Improving personal memory, Study skills that include Rapid Reading, Notes Taking, Self-learning, Complex problem solving and creativity, listening skills and speaking skills, Corporate and Business Etiquettes.

COURSE OUTCOMES:

The student will be able to:

- Explain the importance of Culture in organizational communication
- Manipulate effective presentations and group discussion
- Develop interview and presentation skills
- Develop technical writing skills
- Illustrate the concept of leadership skill and how to practice.

Textbooks:

1. Penrose, Business Communication for managers: An advanced approach, Cengage learning.
2. O'Rourke & Tuleja, Intercultural communication for business, Cengage learning

Reference Books:

1. H.E. Sales. Palgrave Macmillan, Professional Communication in Engineering. 2009.
2. Nawal, Business Communication, Cengage Learning Publishers
3. W. P. Scot,Bertil Billing. Thomas Telford, Communication for professional engineers, 1998

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).
PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC 19 606 (C)	ENTERTAINMENT ELECTRONICS	3-1-0-3 (L-T-P-C)

PRE-REQUISITES : NIL

COURSE OBJECTIVES:

- To understand and apply the theoretical knowledge of electronics in practical situations.
- To Understand the fundamentals and working of electronics devices and appliances

SYLLABUS:

MODULE I: (10 hours)

Recording and reproduction principles - Optical recording on compact disc , play back process, Advantage of compact disc. Hi-Fi Stereo reproducing system-Pre amplifiers, recording 42 amplifiers.

Microphones: construction, working principles and applications of Carbon, Moving coil and Crystal microphones.

Headphones: Principle of operation of crystal and dynamic headphones

MODULE II: (10 hours)

Loud Speakers: construction, working principles and applications of crystal, condenser and dynamic loudspeakers. Tweeters and Woofers.

Acoustics: reflection and absorption of sound, reverberation, acoustic design of auditorium. Principle of video recording on magnetic tapes, block diagram of VCR, VHS tape transport mechanism.

MODULE III: (10 hours)

Public address system - Block diagram, need and use, Requirements of Public Addressing system for public meeting in a park and for an auditorium

MODULE IV: (10 hours)

Television: Television standards, frequency bands, Scanning, interlacing and synchronization, bandwidth, block diagram of monochrome transmitter and receiver, color concepts, concepts of luminance, Hue and Saturation, Color TV (PAL Systems). Cable TV concepts, Closed Circuit Television

MODULE V: (12 hours)

Principle of operation of digital clocks, electronic calculator, microwave ovens,induction cooker, cellular phones, washing machines, air conditioners, ATMs and set-top-boxes.

COURSE OUTCOMES:

The student will be able to

- Explain the importance of Electronics in industry.
- Describe the role of electronics in consumer applications.
- Summarize various electronic audio systems.
- Demonstrate various electronic video systems.
- Identify the electronic equipment for entrainment applications.

Text Books:

1. S P Bali, Consumer Electronics, Pearson.

Reference Books:

1. Ajay Sharma, Audio video and TV Engineering-Consumer Electronics, Dhanpat Rai and co.
2. R.G. Gupta, Audio and Video systems, Tata Mc Graw Hill Publishing Co.Ltd.
3. R. Gulati, Monochrome and Color Television, New Age International (P) Ltd, New Delhi.

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).
PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC 19 606 (D)	IOT AND APPLICATIONS	3-1-0-3 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To make students know the IoT ecosystem.
- To provide an understanding of the technologies and the standards relating to the Internet of Things.
- To develop skills on IoT application.

SYLLABUS:

MODULE I: (11 hours)

Defininition and Characteristics of IoT, Physical design of IoT Functional blocks of IoT, Elements of an IoT ecosystem, Technology drivers, Business drivers, Trends and implications, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization.

MODULE II: (11 hours)

M2M to IoT –Definitions, Difference between IoT and M2M, M2M Value Chains, IoT Value Chains, an emerging industrial structure for IoT,. M2M to IoT- Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. Protocol Standardization for IoT –overview.

MODULE III: (10 hours)

IoT Architecture -OIC Architecture & Design principles- State of the Art – Introduction, State of the art, Architecture Reference Model- Introduction, Reference Model and architecture, Open source IoT stack, IoT reference Model, IoT Reference Architecture-Introduction, Functional View, Information View, Deployment and Operational View.

MODULE IV: (10 hours)

IoT applications - Home automation, Industry applications, Surveillance application, Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, case studies, IOT for smart cities, Opinions on IoT Application and Value for Industry, Home Management, eHealth.

MODULE V: (10 hours)

Evolution of Cloud Computation, Commercial clouds and their features, open source IoTplatforms, cloud dashboards, Introduction to big data analytics and Hadoop.Introduction to Python, Developing applications through IoT tools, Implementing IoT concepts with python, Study of existing IoT platforms /middleware, IoT- A, Hydra.

COURSE OUTCOMES:

The student will be able to:

- Identify the technology and standards relating to IoTs.
- Explain the critical ecosystem required to mainstream IoTs.
- Describe skills on developing their own national and enterprise level technical strategies.
- Summarize the interaction between web technology and IOT.
- Apply the operation of IOT at micro level.

Text Books:

1. Dr. Jeeva Jose, Internet of Things, Khanna Publishing House.
2. Nitesh Dhanjani, Abusing the Internet of Things, Shroff Publisher/O'Reilly Publisher.
3. Internet of Things, RMD Sundaram Shriram K Vasudevan, Abhishek S Nagarajan, John Wiley and Sons.
4. Internet of Things, Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram, John Wiley & Sons.
5. Vijay Madisetti , Arshdeep Bahga, Adrian McEwen (Author), Hakim Cassimally "Internet of Things A Hands-on-Approach" Arshdeep Bahga & Vijay Madisetti, 2014.
6. RonaldL. Krutz, Russell Dean Vines,Cloud Security: A Comprehensive Guide to Secure Cloud Computing,Wiley-India, 2010

Reference Books:

1. Cuno Pfister, "Getting Started with the Internet of Things", Shroff Publisher/Maker Media.
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1 st Edition, Apress Publications.
3. Massimo Banzi, Michael Shiloh Make: Getting Started with the Arduino, Shroff Publisher/Maker Media Publishers

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).
PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC 19 606 (E)	PROJECT MANAGEMENT	3-1-0-3 (L-T-P-C)

PRE-REQUISITES : NIL

COURSE OBJECTIVES:

- The student is introduced to the concepts of project management which becomes back bone knowledge for an engineer to have a holistic view of executing a project.

SYLLABUS:

MODULE I: (11 hours)

Introduction to Project management: Characteristics of projects, Definition and objectives of Project Management, Stages of Project Management, Project Planning Process, Establishing Project organization.

MODULE II: (11 hours)

Work definition: Defining work content, Time Estimation Method, Project Cost Estimation and budgeting, Project Risk Management, Project scheduling and Planning Tools: Work Breakdown structure, LRC, Gantt charts, CPM/PERT Networks.

MODULE III: (11 hours)

Developing Project Plan (Baseline), Project cash flow analysis, Project scheduling with resource constraints: Resource Levelling and Resource Allocation. Time Cost Trade off: Crashing Heuristic.

MODULE IV: (11 hours)

Project Implementation: Project Monitoring and Control with PERT/Cost, Computers applications in Project Management, Contract Management, Project Procurement Management.

MODULE V: (8 hours)

Post-Project Analysis.

COURSE OUTCOMES:

The student will be able to:

- Explain the concept of project management
- Demonstrate project planning.
- Apply network analysis models of PERT and CPM under different situations.
- Familiarise the concept of project implementation
- Organize post project analysis.

Text Books:

1. Shtub, Bard and Globerson, Project Management: Engineering, Technology, and Implementation, Prentice Hall, India
2. Lock, Gower, Project Management Handbook.
3. Cleland and King, VNR Project Management Handbook.
4. Wiest and Levy, Management guide to PERT/CPM, Prentice Hall. Ibdia
5. Horald Kerzner, Project Management: A Systemic Approach to Planning, Scheduling and Controlling, CBS Publishers, 2002.
6. S. Choudhury, Project Scheduling and Monitoring in Practice.
7. P. K. Joy, Total Project Management: The Indian Context, Macmillan India Ltd.

Reference Books:

1. John M Nicholas, Project Management for Business and Technology: Principles and Practice, Prentice Hall, India, 2002.
2. N. J. Smith (Ed), Project Management, Blackwell Publishing, 2002.
3. Robert K. Wysocki, Robert Back Jr. and David B. Crane, Effective Project Management, John Wiley, 2002.
4. Jack R Meredith and Samuel J Mantel, Project Management: A Managerial Approach, John Wiley, 2000.

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).
PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

EC 19 606 (F)	DISASTER MANAGEMENT	3-1-0-3 (L-T-P-C)

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To provide basic conceptual understanding of disasters and its relationships with development.
- To understand approaches of Disaster Risk Reduction and the relationship between vulnerability, disasters, disaster prevention and risk reduction.
- To understand Medical and Psycho-Social Response to Disasters.
- To enhance awareness of Disaster Risk Management institutional processes in India
- To build skills to respond to disasters.

SYLLABUS:

MODULE I: (12 hours)

Introduction- Hazard, Vulnerability, Risk, Disaster, classification of disasters, Risk and vulnerability analysis. Risk reduction-strategic development for vulnerability reduction, Disaster prevention and mitigation.
Natural disasters: water and climate based disasters-Earthquakes, Tsunami, Floods, Drought, Landslides, Cyclones and Volcanic eruptions, flood-hail storms, cloudburst, cyclones, heat and snow avalanches, cold waves, droughts, sea erosion, thunder and lightning. Geological disaster: landslides, earthquakes, Tsunami, mine fires, dam failures and general fires. Biological disaster: pest attacks, cattle epidemic and food poisoning, nuclear accidents, and industrial disaster: chemical and industrial disasters. Do's and Don'ts in various disasters. Accidental disaster: urban and forest fires, oil spill, mine flooding incidents, collapse of huge building structures and bridges. Accidents: Air, Sea, Rail & Road.
Note: (Basic concepts only and explanation can be done with discussing case studies)

MODULE II: (10 hours)

Disaster preparedness and response concept and nature disaster preparedness plan prediction, role of information, education, communication, and training. Disaster management: Role of Government, international and NGO bodies, Role of it in disaster preparedness role of engineers on disaster management. Disaster response: Rescue, Evacuation and Logistic Management, Psychological Response and Management (Trauma, Stress, Rumor and Panic) relief and recovery medical health response to different disasters. Rehabilitation: Reconstruction and recovery, Reconstruction and rehabilitation as a means of development, dealing with victims' psychology, long term counter disaster planning role of educational institute. The vulnerability atlas of India, Disaster prevention and mitigation, Agencies involved in disaster management.
Note: (Basic concepts only and explanation can be done with discussing case studies)

MODULE III: (10 hours)

Disaster profile of India – Mega disasters of India and lessons learnt disaster management act 2005 – Institutional and financial mechanism, National guidelines and plans on disaster management; Applications of science and technology for disaster management-geo-informatics in disaster management (RS, GIS, GPS and RS) Disaster Communication System (Early warning and its dissemination), Disaster safe designs and constructions, Structural and non-structural mitigation of disasters science & technology institutions for disaster management in India
Note: (Basic concepts only and explanation can be done with discussing case studies)

MODULE IV: (10 hours)

First Aid, Basic life support and causality handling, Basics- Triage- CPR, Chocking, breathing difficulties, bleeding, burns, electric shock, animal bites, fractures, bandaging, splints and slings, Hazardous chemicals-HazcHEMCODE, TREMCARD, Response in tanker lorry accidents
Basics of Firefighting- Operation of fire extinguishers' and fire protection systems in buildings. Transportation of causality-methods of rescue, two hand seat, three hand seat, four hand seat, human crutch, pick a back, fire man lift, improvised stretchers
Note: (Help of Medical professionals and staff from Fire and safety department/ safety professionals can be sought for giving proper practical training to the students in the specific topics mentioned in module 4. Students can also develop their own innovative devices/ methods to help the fire & safety dept. in rescue operations. After successful training in rescue operations the students can form a student volunteer group in each college to associate with the with the activities of Fire & Safety/NDRF officials to help the society during an emergency)

MODULE V: (10 hours)

Flood Rescue, making of improvised floating aids, use of life buoy and life jacket, rope rescue, common rescue knots, chair knot, bow line etc.
Note: (Help of staff from Fire and safety department/safety professionals can be sought for giving practical training to the students in the specific topics mentioned in module 4. Students may come up with their ideas to develop innovative tools/techniques/methods/software's for helping various Govt. departments/Fire & safety/NDRF teams and society during the occurrence of any disasters)

COURSE OUTCOMES:

Upon completion of the course the students will be able to:

- Explain the basics concepts and types of disasters and accidents
- Describe the basics of disaster preparedness and response
- Summarize the basics of disaster management Act and its features
- Familiarize the basics of first aid and the usage of lifesaving equipment's
- Build skills to manage flood disaster.

TEXT BOOKS:

1. S.C. Sharma, Disaster Management, 1st edition, Khanna Publishing House, 2018.
2. Ghosh G.K., Disaster Management, 1st edition, APH Publishing Corporation, 2006.
3. Singh B.K., Handbook of Disaster Management, 1st edition, Rajat Publication, 2008.
4. A.K. Singh, Disaster Management in India, 1st edition, New Royal Book Company, 2007.
5. D. Mondal, D. Basu, Disaster Management Concepts and Approach, CBS Publishers and Distributers, 2020.
6. R. Subramanian, Disaster Management, Vikas Publishing House, 2018.
7. M. M. Sulphy, Disaster Management, PHI Learning, 2017.
8. Satish Modh, Introduction to Disaster Management, Macmillan, 2009.

***REFERENCE BOOKS*:**

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. World Disasters Report, 2009. International Federation of Red Cross and Red Crescent, Switzerland
5. Encyclopedia of disaster management, Vol I, II and IIIL Disaster management policy and administration, S L Goyal, Deep & Deep, New Delhi, 2006
6. Encyclopedia of Disasters – Environmental Catastrophes and Human Tragedies, Vol. 1 & 2, Angus M. Gunn, Greenwood Press, 2008
7. Disasters in India Studies of grim reality, Anu Kapur & others, 2005, 283 pages, Rawat Publishers, Jaipur
8. Management of Natural Disasters in developing countries, H.N. Srivastava, G.D. Gupta, Daya Publishers, Delhi, 2006, 201 pages
9. Natural Disasters, David Alexander, Kluwer Academic London, 1999, 632 pages
10. Disaster Management Act 2005, Publisher by Govt. of India
11. Publications of National Disaster Management Authority (NDMA) on Various

Templates and Guidelines for Disaster Management (eg. Disaster Management for NDRF Commanders, Flood Risk Mitigation and Management, Village Disaster Management Plan etc)
12. NIDM Publications
13. High Power Committee Report, 2001, J.C. Pant
14. Disaster Mitigation in Asia & Pacific, Asian Development Bank
15. National Disaster Management Policy, 2009, GoI
16. Disaster Preparedness Kit, American Red Cross
17. Introduction to Incident Command System, First Edition, Centre for Disaster Management, Lal Bhadur Sasthri National Academy of Administartion.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class

University Examination Pattern *(Maximum Marks-100)*

PART A**: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B**: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks

Two questions from each module with choice to answer one question.

EC 19 607 (P)	DIGITAL COMMUNICATION LAB	0-0-3-1 (L-T-P-C)

PRE-REQUISITES : DIGITAL COMMUNICATION

COURSE OBJECTIVES:

- The purpose of this lab is to explore digital communications with a software to understand how each component works together. The lab will cover Sampling and reconstruction, different modulation schemes, and line coding schemes.

List of Experiments

(A minimum of 10 experiments must be conducted)

1. Sampling and reconstruction of low pass signals and verification of Sampling theorem
2. Pulse code modulation and demodulation.
3. Delta modulation and demodulation
4. Adaptive Delta modulation and demodulation
5. Generation and detection of BASK signal
6. Generation and detection of BFSK signal
7. Generation and detection of BPSK signal
8. Matched filter receiver
9. Generation of Manchester and Differential codes
10. Generation of Gold Sequence.
11. Spreader and De-spreader
12. Generation of Hamming codes and cyclic codes
13. ASK, FSK, PSK and DPSK schemes (Simulation)

COURSE OUTCOMES:

On completion of this lab the students will be able to:

- Implement basics of Digital communication system in practical.
- Design and implement different digital modulation and demodulation techniques.
- Generate and detect various modulated signal.
- Implement various coding schemes
- Simulate various digital modulation schemes.

Internal Continuous Assessment (Maximum Marks-50).
60% - Laboratory practical, record and Viva voce.
30% - Tests.
10% - Regularity in the lab.

Semester-end Practical Examinations(Maximum Marks-100).
10% - Record of works done
20% - Vivavoce
70% - Procedure and tabulation form, Conducting experiment, results and inference

EC 19 608 (P)	**MINI PROJECT**	**0-0-3-1 (L-T-P-C)**

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To estimate the ability of the student in transforming the theoretical knowledge studied so far into a working model of an electronic system.
- For enabling the students to gain experience in organisation and implementation of a small project and thus acquire the necessary confidence to carry out main project in the final year.

In this practical course, each group consisting of three/four members is expected to design and develop a moderately complex electronic system for practical applications; this should be a working model. The basic concepts of product design may be taken into consideration while designing the project.
A committee consisting of minimum three faculty members specialized in Electronics and Communication engineering will perform assessment of the mini project. Students have to submit a report on the mini project and demonstrate the working model before the evaluation committee.

Internal Continuous Assessment *(Maximum Marks-100)*

30% - Design
30% - Implementation and Result Analysis
10% - Report
20% - Viva voce
10% - Regularity

Course Outcome:

The student will be able to:

- Design and analyze a practical electronic circuit.
- Build an electronic product.
- Demonstrate the product and its applications.
- Inculcate group management and leadership skills.
- Develop documentation skills