SCHEME & SYLLABUS

B.Tech (Electrical Engineering)

Choice Based Credit System

Department of Electrical Engineering
University Institute of Engineering & Technology
Sant Baba Bhag Singh University
2020

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Course Scheme, B.Tech Electrical Engineering

Course Structure

Course Code and Definition

Course Code	Definition
BS	Basic Science
ES	Engineering Science
HS	Humanities Science
PC	Professional Core
PE	Professional Elective
OE	Open Elective
MC	Mandatory Course
SI	Summer Industry Internship
PROJ	Project

Course Scheme for B. Tech (Electrical Engineering)

SEMESTER I

Scheme for B. Tech. 1st Year (Common to all engineering disciplines) -Physics Group

I. Theory Subjects (including Non- Credit Courses)

S. No.	Type	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	BS	PHY105	Engineering Physics	3:0:0	3:0:0	3	3
2.	BS	MAT103	Engineering Mathematics-I/ Engineering Mathematics-II	4:1:0	4:1:0	5	5
3.	ES	EE101	Basic Electrical Engineering	2:0:0	2:0:0	2	2
4.	ES	CSE101	Fundamentals of Computer Technology	3:0:0	3:0:0	3	3

II. Practical Subjects

S. No.	Type	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	BS	PHY107	Engineering Physics Laboratory	0:0:2	0:0:1	2	1
2.	ES	EE103	Basic Electrical Engineering Laboratory	0:0:2	0:0:1	2	1
3.	ES	CSE103	Fundamentals of Computer Technology Laboratory	0:0:4	0:0:2	4	2
4.	ES	ME107	Engineering Workshop	0:0:6	0:0:3	6	3
5.	MC	PT101/PT103 /PT105	Physical Training-I (NSO/NCC/NSS)	0:0:2	NC	2	NC

Total Contact Hours:29
Total Credit Hours:20

SEMESTER II

Scheme for B. Tec h. 1st Year (Common to all engineering disciplines) -Chemistry Group

I. Theory Subjects (including Non- Credit Courses)

S. No.	Type	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	BS	CHM105	Engineering Chemistry	3:0:0	3:0:0	3	3
2.	BS	MAT104	Engineering Mathematics-II	4:1:0	4:1:0	5	5
3.	ES	ECE101	Basic Electronics & Communication Engineering	2:0:0	2:0:0	2	2
4.	HS	ENG121	Communication Skills-I	2:0:0	2:0:0	2	2
5.	ES	ME103	Engineering Drawing	1:0:6	1:0:3	7	4

II. Practical Subjects

S. No.	Type	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	BS	*CHM107	Engineering Chemistry Laboratory	0:0:2	0:0:1	2	1
2.	ES	ECE103	Basic Electronics & Communication Engineering Laboratory	0:0:2	0:0:1	2	1
3.	HS	ENG123	Communication Skills-I (Practical)	0:0:2	0:0:1	2	1
4.	MC	PT102/PT104 / PT106	Physical Training-II(NSO/NCC/NSS)	0:0:2	NC	2	NC

Total Contact Hours:27
Total Credit Hours:19

Semester-III

I. Theory Subjects

S No.	Type	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	PC	EE201	Electrical Machines-I	3:0:0	3:0:0	3	3
2.	PC	EE203	Circuit Theory	3:1:0	3:1:0	4	4
3.	PC	EE205	Analog Electronics	4:1:0	4:1:0	5	5
4.	PC	EE207	Digital Electronics	4:1:0	4:1:0	5	5
5.	ES	CSE203	Object Oriented Programming Systems	4:0:0	4:0:0	4	4

II. Practical Subjects

S No.	Type	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	PC	EE209	Electrical Machines- I Laboratory	0:0:2	0:0:1	2	1
2.	PC	EE211	Analog Electronics Laboratory	0:0:2	0:0:1	2	1
3.	PC	EE213	Digital Electronics Laboratory	0:0:2	0:0:1	2	1
4.	ES	CSE209	Object Oriented Programming systems Laboratory	0:0:2	0:0:1	2	1
5.	MC	PT201/PT203/ PT205	Physical Training-III NSO/NCC/NSS	0:0:2	NC	2	NC

Total Contact Hours:31
Total Credit Hours:25

Semester-IV

I. Theory Subjects

S No.	Type	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	PC	EE202	Electrical Machines- II	3:0:0	3:0:0	3	3
2.	PC	EE204	Linear Control System	4:1:0	4:1:0	5	5
3.	PC	EE206	Signal & System	2:1:0	2:1:0	3	3
4.	PC	EE208	Microprocessor & Interfacing Applications	4:1:0	4:1:0	5	5
5.	BS	MAT205	Engineering Mathematics-III	4:1:0	4:1:0	5	5
6.	MC	EVS101	Environmental Sciences	3:0:0	NC	3	NC

- **At least one Educational Tour must be carried out in the semester for practical exposure to the students. The tour must augment existing or previous lesson plans and synchronize with classroom learning.**

II. Practical Subjects

S No.	Type	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	PC	EE210	Electrical Machines -II Laboratory	0:0:2	0:0:1	2	1
2.	PC	EE212	Control System Laboratory	0:0:2	0:0:1	2	1
3.	PC	EE214	Microprocessor & Interfacing Applications Laboratory	0:0:2	0:0:1	2	1
4.	MC	*PT202/ PT204 /PT206	Physical Training-IV NSO/NCC/NSS	0:0:2	NC	2	NC

*****The students will undertake **4 Weeks Industrial/ Institutional Training** of course relevance after the completion of 4thsemester.The evaluation of the student will be done in 5th semester on the basis of report writing and presentation for the training done in Industry

Total Contact Hours:32
Total Credit Hours:24

Semester-V

I. Theory Subjects

S No.	Type	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	PC	EE301	Power System –I (Apparatus & Modelling)	4:0:0	4:0:0	4	4
2.	PC	EE303	Electromagnetic Fields	3:1:0	3:1:0	4	4
3.	PC	EE305	Measurements & Instrumentation	4:0:0	4:0:0	4	4
4.	PE		Professional Elective-I	3:0:0	3:0:0	3	3
5.	HS	SSC303	Human Values & Professional Ethics	3:0:0	3:0:0	3	3
6.	MC	PLS303	Constitution of India	3:0:0	NC	3	NC
7.	SI	EE307	*Industrial Training (undertaken after 4th semester)	4 weeks	3		3

II. Practical Subjects

S No.	Type	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	PC	EE309	Power System- I Laboratory	0:0:2	0:0:1	2	1
2.	PC	EE311	Measurements & Instrumentation Laboratory	0:0:2	0:0:1	2	1

III. Professional Elective-I

S. No.	Type	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	PE	EE313	Electrical Energy Conservation & Auditing	3:0:0	3:0:0	3	3
2.	PE	EE315	Industrial Electrical Systems	3:0:0	3:0:0	3	3
3.	PE	EE317	Digital Control System	3:0:0	3:0:0	3	3

*The students will undertake Training in Industry/ Insitute of course relevance for 4 weeks after the completion of 4thsemester.The evaluation of the student will be done in 5th semester on the basis of report writing and presentation for the training done in Industry.

Total Contact Hours:25
Total Credit Hours:23

Semester-VI

I. Theory Subjects

S No.	Type	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	PC	EE302	Power System-II (Operation & Control)	4:0:0	4:0:0	4	4
2.	PC	EE304	Power Electronics	3:0:0	3:0:0	3	3
3.	PC	EE318	Microcontroller and Interfacing Applications	3:0:0	3:0:0	3	3
4.	PE		Professional Elective-II	3:0:0	3:0:0	3	3
5.	PE		Professional Elective-III	3:0:0	3:0:0	3	3
6.	OE		Open Elective I	3:0:0	3:0:0	3	3
7.	OE		Open Elective-II	3:0:0	3:0:0	3	3

II. Practical Subjects

S No.	Type	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	PC	EE306	Power System-II Laboratory	0:0:2	0:0:1	2	1
2.	PC	EE308	Power Electronics Laboratory	0:0:2	0:0:1	2	1
3.	PC	EE328	Microcontroller and Interfacing Applications Laboratory	0:0:2	0:0:2	2	1
4.	PROJ	EE310	Minor Project	0:0:4	0:0:2	4	2

III. Professional Elective-II

S. No.	Type	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	PE	EE312	Electrical Machine Design	3:0:0	3:0:0	3	3
2.	PE	EE314	Electrical Drives	3:0:0	3:0:0	3	3
3.	PE	EE316	Digital Signal Processing	3:0:0	3:0:0	3	3

IV. Professional Elective-III

S. No.	Type	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	PE	EE326	Line commutated and Active PWM Rectifiers	3:0:0	3:0:0	3	3
2.	PE	EE320	Control Systems Design	3:0:0	3:0:0	3	3
3.	PE	EE322	Non-Conventional Energy Sources	3:0:0	3:0:0	3	3
4.	PE	EE324	Biomedical Instrumentation	3:0:0	3:0:0	3	3

Total Contact Hours: 32
Total Credit Hours: 27

Semester-VII

I. Theory Subjects (including Non-Credit Courses)

S No.	Type	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	PE		Professional Elective-IV	3:0:0	3:0:0	3	3
2.	OE		Open Elective –III	3:0:0	3:0:0	3	3
3.	OE		Open Elective-IV	3:0:0	3:0:0	3	3
4.	HS	MGT401	Organization Behavior	4:0:0	4:0:0	4	4
5.	PE		Professional Elective-V	3:0:0	3:0:0	3	3
6.	PE		Professional Elective-VI	3:0:0	3:0:0	3	3

II. Practical Subjects

S No.	Type	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	PC	EE401	Electronic Design Laboratory	1:0:4	1:0:2	5	3
2.	PROJ	403	Project Work	0:0:10	0:0:5	10	5

III. Professional Elective-IV

S. No.	Type	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	PE	EE405	High Voltage Engineering	3:0:0	3:0:0	3	3
2.	PE	EE407	High Voltage DC Transmission Systems	3:0:0	3:0:0	3	3
3.	PE	EE409	Computational Electromagnetics	3:0:0	3:0:0	3	3

IV. Professional Elective-V

S. No.	Type	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	PE	EE411	Power System Protection	3:0:0	3:0:0	3	3
2.	PE	EE413	Electromagnetic Waves	3:0:0	3:0:0	3	3
3.	PE	EE415	Power Quality And FACTS	3:0:0	3:0:0	3	3

V. Professional Elective-VI

S. No.	Type	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	PE	EE417	Electrical and Hybrid Vehicles	3:0:0	3:0:0	3	3
2.	PE	EE419	Advance Electric Drives	3:0:0	3:0:0	3	3
3.	PE	EE421	Power System Dynamics and Control	3:0:0	3:0:0	3	3

Total Contact Hours:34
Total Credit Hours: 27

SEMESTER VIII

I. Practical Subjects

S. No.	Type	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	SI	EE414	Six Months Industrial Training	(0:0:20)	(0:0:10)	20	10

Total Contact Hours: 20
Total Credit Hours: 10

Total Credits=175

List of Open Electives

Open Elective-I

S. No.	Type	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1	OE	CSE371	Basics of Database Design	3:0:0	3:0:0	3	3
2	OE	CSE373	Fuzzy Logic	3:0:0	3:0:0	3	3
3	OE	ME371	Total Quality Management	3:0:0	3:0:0	3	3
4	OE	ME373	Production Planning & Control	3:0:0	3:0:0	3	3
5	OE	EE371	Instrumentation in Power system	3:0:0	3:0:0	3	3
6	OE	EE373	Elements of power System	3:0:0	3:0:0	3	3
7	OE	ECE371	Mobile Communication	3:0:0	3:0:0	3	3
8	OE	ECE373	Speech Signal & Image Processing	3:0:0	3:0:0	3	3
9	OE	CE371	Renewable Energy Resources	3:0:0	3:0:0	3	3
10	OE	CE373	Architecture and Town Planning	3:0:0	3:0:0	3	3

Open Elective-II

S. No.	Type	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1	OE	CSE372	Communication Networks	3:0:0	3:0:0	3	3
2	OE	CSE374	Computer Organization	3:0:0	3:0:0	3	3
3	OE	ME372	Industrial Engineering Management	3:0:0	3:0:0	3	3
4	OE	ME374	Lean Manufacturing	3:0:0	3:0:0	3	3
5	OE	EE372	Electrical Generation & Economics	3:0:0	3:0:0	3	3
6	OE	EE374	Fundamentals of Electrical Machines	3:0:0	3:0:0	3	3
7	OE	ECE372	Analog & Digital Communications	3:0:0	3:0:0	3	3
8	OE	ECE374	Analog Circuits	3:0:0	3:0:0	3	3
9	OE	CE372	Construction of Metro System	3:0:0	3:0:0	3	3
10	OE	CE374	Traffic Engineering	3:0:0	3:0:0	3	3

Open Elective-III

S. No.	Type	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1	OE	CSE471	Concepts of Operating System	3:0:0	3:0:0	3	3
2	OE	CSE473	Data Warehouse & Data Mining	3:0:0	3:0:0	3	3
3	OE	ME471	Material Management	3:0:0	3:0:0	3	3
4	OE	ME473	Mechatronics	3:0:0	3:0:0	3	3
5	OE	EE471	Wind and Solar Energy System	3:0:0	3:0:0	3	3
6	OE	EE473	Instrumentation Engineering	3:0:0	3:0:0	3	3
7	OE	ECE471	Biomedical Electronics	3:0:0	3:0:0	3	3
8	OE	ECE473	VLSI Design	3:0:0	3:0:0	3	3
9	OE	CE471	Rural Technology and Community Development	3:0:0	3:0:0	3	3
10	OE	CE473	Waste Water Engineering	3:0:0	3:0:0	3	3

Open Elective-IV

S. No.	Type	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1	OE	CSE472	Image Analysis	3:0:0	3:0:0	3	3
2	OE	CSE474	Concepts of Cloud Computing	3:0:0	3:0:0	3	3
3	OE	ME472	Operations Management	3:0:0	3:0:0	3	3
4	OE	ME474	Industrial Safety	3:0:0	3:0:0	3	3
5	OE	EE472	Electrical Materials	3:0:0	3:0:0	3	3
6	OE	EE474	Electrical & Hybrid Vehicles	3:0:0	3:0:0	3	3
7	OE	ECE472	Embedded System	3:0:0	3:0:0	3	3
8	OE	ECE474	Advanced Optical Communication System	3:0:0	3:0:0	3	3
9	OE	CE472	Tall Building	3:0:0	3:0:0	3	3
10	OE	CE474	Remote Sensing and Geographical Information System	3:0:0	3:0:0	3	3

Range of credits

Minimum credits as per scheme are required by a student to be eligible to get Under Graduate degree in Electrical Engineering. A student will be eligible to get Under Graduate degree with Honours or additional Minor Engineering, if he/she completes an additional 20 credits. These could be acquired through MOOC courses as available during the period of his/her studies.

DETAIL OF COURSES UNDER B.TECH (EE)

Course	Credit			Total
	Lecture	Tutorial	Practical	
	(#Subject * Credit)	(#Tutorial * Credit)	(#Practical * Credit)	
I. PC (15 Papers)	1x1=1 1x2=2 6x3=18 7x4=28	7 x 1=7	11x1=11 1x2=2	69
II. PE (6 Papers)	6x3=18	-	-	18
III. ES (5 Papers)	1x1=1 2x2=4 1x3=3 1x4=4		3x1 = 3 1x2 = 2 2x3 = 6	23
IV. BS (5 Papers)	2x3= 6 3x4=12	3x1=3	2x1=2	23
V. HS (3 Papers)	1x2 = 2 1x3 = 3 1x4 = 4	-	1 x 1 = 1	10
VI. OE (4 Papers)	4x3=12	-	-	12
VII. SI (2 Papers)	1x3=3 1x10=10	-		13
VIII. PROJ (2 Papers)	1x2=2 1x5=5			7
Total				**175**

MC- 6 units

SUMMARY OF SCHEME

Sem	L	T	P	Contact hrs/wk	Credits	HS	BS	ES	PC	PE	OE	Project	Summer Internship	MC
1	12	1	16	29	20	--	9	11	--	--	--	--	--	1unit (NC)
2	12	1	14	27	19	3	9	7	--	--	--	--	--	1unit (NC)
3	16	1	10	27	25	--	--	5	20	-	-	--	--	1unit (NC)
4	18	3	8	29	24	--	5	--	19	-	--	--	--	2 units (NC)
5	21	1	4	26	23	3	--	--	14	3	--		3	1unit (NC)
6	16	--	8	24	27	--	--	--	13	6	6	2	--	--
7	14	--	4	18	27	4	--	--	3	9	6	5	--	--
8	11	--	10	21	10	--	--	--	--	--	--	--	10	--
Total	**120**	**7**	**74**	**201**	**175**	**10**	**23**	**23**	**69**	**18**	**12**	**7**	**13**	**6 units (NC)**

CHOICE BASED CREDIT SYSTEM

Sem	PC(69)	BS (23)	ES (23)	HS (10)	PE (18)	OE (12)	Project (7)	Training (13)	MC (6 units)
I		Engineering Physics	Basic Electrical Engineering						Physical Training-I
		Engineering Mathematics-I	Fundamentalsof ComputerTechnology						
			Engineering Workshop						
II		Engineering Chemistry	Basic Electronics & Communication Engineering	Communication Skills-I					Physical Training-II
		Engineering Mathematics-II	Engineering Drawing						
III	C1		Object Oriented Programming Systems						Physical Training-III
	C2								
	C3								
	C4								
	C5								
	C6								
	C7								
IV	C8	Engineering mathematics-III							Environmental Sciences
	C9								Physical Training-IV
	C10								
	C11								
	C12								
	C13								
	C14								
V	C15			Human Values & Professional Ethics/ Human Resources	PE-I			Industrial Training undertaken after 4th sem	Constitution of India
	C16								
	C17								
	C18								
	C19								
VI	C20				PE-II	OE-I	Minor Project		
	C21				PE-III	OE-II			
	C22								
	C23								
	C24								
	C25								
VII	C26			Organization Behaviour	PE-IV	OE-III	Project Work		

					PE-V	OE-IV			
					PE-VI				
VIII								Six months Industrial Training	

FIRST SEMESTER

Course Code	PHY105
Course Title	Engineering Physics
Type of course	Theory
L T P	3:0:0
Credits	3
Course prerequisite	+2 with Non-Medical
Course Objective (CO)	To provide high quality, comprehensive educational and training opportunities those are compatible to changing needs of the students. Engineering Physics is a field that provides broad training in physics and basic training in engineering and design. Our engineering physics program aims to educate students to become professionals with in-depth knowledge and skills in engineering to understand physical systems; to research, design, and solve problems; and to provide the foundation for graduate study and lifelong learning.

SYLLABUS

UNIT-I. Electromagnetics: Physical significance of Gradient, Divergence & Curl, Differential approach to Gauss Law, Ampere's law and Faraday's law, Stoke'stheorm, Gauss divergence theorem, Equation of continuity, Maxwell's Equations, Dielectric polarization, displacement Current.

Physics of Materials: Basic ideas of Dia, Para, Ferro &Ferri, Ferrites,Domaintheory,Magnetic Anisotropy, Magnetostriction, B-H curve, Hard and Soft magnetic materials, Superconductivity, Superconductors as ideal diamagnetic materials, Meissner Effect,Type I & Type II superconductors, London Equations, Introduction to BCS theory.

UNIT-II. Special Theory of Relativity: Concept of Ether, Michelson Morley experiment, Einstien's postulates, Lorentz transformation equations, lengh, time and simultaneity in relativity, Addition of velocity, Variation of mass with velocity,Energy momentum relations.

UNIT-III Lasers: Introduction, Spontaneous & Stimulated emissions, Einstein's Coefficients, Population Inversion, Pumping Mechanisms, Components of a laser System, Lasing action, properties of laser,Ruby, He-Ne, CO_2 and semiconductor Lasers, Characteristics of different types of lasers, Applications of lasers, Holography.

Fibre Optics: Introduction, Acceptance Angle, Numerical Aperture, Normalized Frequency, Modes of propagation, Losses in Optical Fibre, Applications of Optical Fibres.

UNIT-IV. Physics of crystallography: Unit cell, Basis, Space lattice, Crystal Systems, Miller Indices of Planes & Directions in cubic system, Continuous & Characteristic X-Rays, X-Ray Diffraction & Bragg's law in Crystals,

Nanophysics: Nanoscale, Nanoparticles(1D 2D 3D), Nanomaterials and their properties, Synthesis Methods- Ball milling and sol- gel techniques, Carbon nanotubes (Synthesis and properties), Applications of nanomaterials.

Recommended books:-

S. No	Name	Author(S)	Publisher
1	Physics for Scientists & Engineers (Vol. I &II),	Serway& Jewett, 6thEdition	Cengage Learning.
2	Engineering Physics,	Malik; HK, Singh; AK,	Tata McGraw Hill
3	Materials Science &Engg.,	Raghvan V.	Prentice Hall of India
4	Concepts of Modern Physics	Beiser; A., Mahajan; S., Choudhary; SR	Tata McGraw Hill
5	Solid State Physics	Dan Wei,	Cengage Learning
6	Introduction to Solids	Azaroff LV	Tata Mc Graw Hill
7	Introduction to Electrodynamics	Griffiths; DJ,	Prentice Hall
8	Lasers & Optical engineering	Dass; P,	Narosa Publishers
9	Optical Fibre system, Design & Applications	Kao; CK	McGraw Hill.

Course Code	MAT103
Course Title	Engineering Mathematics-I
Type of course	Engineering Mathematics for B.Tech-1st Sem.
L T P	4: 0: 0
Credits	4
Course prerequisite	+2 with Non- Medical
Course Objective (CO)	Mathematics is really a great tool to understand the things correctly. The aim of the course is to enable students : (1) To understand the theory knowledge as well as practical knowledge of different formulas.(2) To inculcate the skills to use different methods to solve the applied problems. (3) To check the accuracy of every formula by using different strategies. (4) To give them a sound foundation that eventually will help them in their coming technical futures.

UNIT-I Matrices: Basic concepts of matrices**,** Gauss Jordan Method,Rank of Matrices, reduction to normal form, Inverse of Matrices, Consistency and solution of linear algebraic system of equations, Orthogonal, Eigen values and Eigen vectors, Cayley Hamilton Theorem, Diagonalization of Matrix

UNIT-II Partial Derivatives: Function of two or more variables; Partial differentiation; Homogeneous functions and Euler's theorem ; Composite functions ; Total Derivative ; Derivative of an implicit function, Change of variable, jacobian, Applications of Partial Differentiation: Tangent and normal to a surface; Taylor's and Maclaurin's series for a function of two variables; Maxima and Minima of function of several variables; Lagrange's method of undetermined multipliers.

UNIT-III Multiple Integrals :. Double and triple integral and their evaluation

Vector Calculus: Scalar and vector fields, differentiation of vectors, velocity and acceleration. Vector differential operators: Del, Gradient, Divergence and Curl, Directional Derivatives and Work Done by Force, Line, surface and volume integrals

UNIT-IV Application of Vector Calculus: Solenoidal and irrotational vectors. Gauss Divergence Theorem, Green's Theorem in plane, Stoke's Theorem (without proof) and their applications.

Recommended books:-

S. No	Name	Author(S)	Publisher
1	Higher Engineering Mathematics	Dr. B.S. Grewal	Khanna Publishers
2	Fourier Series and Boundary Values Problems	Churchill	McGraw Hill.
3	Complex Variables & Applications	Churchill	McGraw Hill.
4	Engineering Mathematics	Bali &lyingar	Laxmi Publication.
5	Advanced Engineering Mathematics	Wylie and Barren	Mcgrawhill,6thedition,1995
6	Advanced Engineering Mathematics	Kreyszig, John Wiley	

Course Code	MAT104
Course Title	Engineering Mathematics -II
Type of course	Theory (Applied Mathematics for B.Tech-2nd Sem.)
L T P	4:1:0
Credits	5
Course prerequisite	+2 with Non-Medical
Course Objective (CO)	Mathematics is really a great tool to understand the things correctly. The aim of the course is to enable students : (1) To understand the theory knowledge as well as practical knowledge of different formulas.(2) To inculcate the skills to use different methods to solve the applied problems. (3) To check the accuracy of every formula by using different strategies. (4) To give them a sound foundation that eventually will help them in their coming technical futures.

UNIT I

Probability Distributions and Sampling Distributions: Random variables, Probability Distribution: Binomial, Poisson and Normal distributions. Fundamentals of Sampling, Large samples, Small samples; Sampling distribution of the means, t-Distribution, F-Distribution, Chi-square Distribution.

UNIT II

Ordinary Differential Equations of first order and Linear Ordinary Differential Equations of second & higher order: Exact Differential equations, Equations reducible to exact form by integrating factors; Equations of the first order and higher degree. Clairaut'sequation.Leibniz'slinearandBernoulli's equation Solution of linear Ordinary Differential Equations of second and higher order; methods of finding complementary functions and particular integrals.Method of variation of parameters, Cauchy's homogenous and Legendre's linear equation.

UNIT III

Complex Numbers and elementary functions of complex variable: De-Moivre'stheorem and its applications. Real and Imaginary parts of exponential, logarithmic, circular, inverse circular, hyperbolic, functions of complex variables. Summation of trigonometric series.(C+iS method)

UNIT IV

Measures of Central tendency and Dispersion: Measures of central tendancy: Arithmatic Mean, Geometric Mean, Harmonic Mean, Quartiles, Deciles, Percentiles. Median, Mode, Skewness, Kurtosis. Measures of dispersion: Range, Interquartile range, Variance and Standard Deviation.

Recommended books:-

S. No	Name	Author(S)	Publisher
1	Higher Engineering Mathematics	Grewal, B.S.	Khanna Publishers, Delhi.
2	Advanced Engineering Mathematics	Jain, R.K and Iyengar, S.R.K.	Narosa Publishing Company
3	Statistical Methods	S P Gupta	Sultan Chand & sons Publisher

Course Code	**EE101**
Course Title	**Basic Electrical Engineering**
Type Of Course	ES
L T P	2.0.0
Credits	2
Course Prerequisites	+2 with Non-Medical
Course objectives	To familiarize with AC, DC circuits & their fundamentals, Magnetic circuits & Transformer, Electrical Machines and Measuring Instruments

Syllabus

UNIT 1. DC Circuits
Circuits : Identifying the Elements and the Connected Terminology, Ohm's Law- Statement , Illustration and limitation, Kirchhoff's Laws –Statement and Illustration ,Method of solving a Circuits by Kirchhoff's Laws, Computation of Resistance at Constant temperature, Temperature Dependence of resistance, Computation of Resistance at different temperatures, Units – Work, Power and Energy (Electrical, Thermal and Mechanical).

UNIT-I
AC Fundamentals
Generation of Alternating Emf, Concept of 3-phase EMF Generation, Root Mean Square or Effective Value, Average value of AC, Phasor Representation of Alternating quantities, Representation of Alternating Quantities in Rectangular and Polar forms, Introduction of Resistors, Inductors and Capacitors, R-L Series Circuits, R-C Series Circuits, R-L-C Series Circuits, Admittance and its components, Resonance in Series and Parallel, Analysis of simple 3 phase system, star-delta connections and conversion.

UNIT-III Magnetic Circuits
Comparison between Magnetic and Electric circuits, Electromagnetic Induction, Magnetic Effects of Electric Current, Current carrying conductor in Magnetic field, Law of Electromagnetic Induction, Self Inductance, Mutual Inductance ,Coupling Coefficient between two magnetically coupled Circuits.

UNIT-IV
Electrical Machines Transformer: principle, construction, working, efficiency& applications. D.C. Generator: principle, construction, working & applications. D.C. Motor: principle, construction, working & applications. Three Phase Induction Motor: principle, construction, working & applications.

Measuring Instruments
Classification of Instruments, Basic Principles of indicating instruments, Moving Iron Instruments – Attraction and Repulsion Type, Moving Coil Instruments – Permanent Magnet - Dynamometer Type, Multimeters.

Recommended Books

Sr.No.	Name	Author	Publisher
1	Basic Electrical, Electronics and Computer Engg.	R muthusubramanian,SSalivahanan,K A Muraleedharan	Tata McgrawHill
2	A Textbook of Electrical Tech	B.L Theraja.& A.K Theraja	S Chand
3	Fundamentals of Electrical Engg	Vincent Deltoro	Prentice Hall.
4	A Course in electrical and electronic Measurements &Instumentation	A.K Sawhney	Dhanpat Rai & co.
5	Basic Electrical Engineering	H.M Rai and S.Marwaha	Satya Prakashan, Delhi

Course Code	**CSE101**
Course Title	Fundamentals of Computer Technology
Type of Course	ES
L T P	3.0.0
Credits	3
Course Prerequisites	Basics of computer
Course Objectives (CO)	To familiarize the students of all branches in engineering with computer organization, operating systems, problem solving and programming in C++.

SYLLABUS

UNIT I

Introduction to Computers: Define a Computer System, Block diagram of a Computer System and its working, associated peripherals, memories, RAM, ROM, secondary storage devices, Computer Software and Hardware.

Working Knowledge of Computer System and Office automation: Introduction to the operating system, its functions and types, working knowledge of GUI based operating system, introduction to word processors and its features, creating, editing, printing and saving documents, spell check, mail merge, creating power point presentations, creating spreadsheets and simple graphs

Problem Solving & Program Planning: Need for problem solving and planning a program; program design tools – algorithms, flow charts, and pseudo code; illustrative examples.

UNIT II

Overview of C++ Language: Introduction to C++ language, structure of a C++ program, concepts of compiling and linking, IDE and its features; Basic terminology - Character set, tokens, identifiers, keywords, fundamental data types, literal and symbolic constants, declaring variables, initializing variables, type modifiers.

Operators and expressions: Operators in C++, precedence and associativity of operators, expressions and their evaluation, type conversions.

Beginning with C++ program: Input/output using extraction (>>) and insertion (<<) operators, writing simple C++ programs, comments in C++, stages of program execution.

UNIT III

Control Structures and Functions: Decision making statements: if, nested if, if – else. Else if ladder, switch, Loops and iteration: while loop, for loop, do – while loop, nesting of loops, break statement, continue statement, goto statement, Advantages of using functions, structure of a function, declaring and defining functions, return statement, formal and actual arguments, const argument, default arguments,

Arrays and Strings: Declaration of arrays, initialization of array, accessing elements of array, I/O of arrays, passing arrays as arguments to a function, multidimensional arrays. String as array of characters, initializing string variables, I / O of strings, string manipulation functions (strlen, strcat, strcpy, strcmp), passing strings to a function. Use of arrays and strings through illustrative programming examples.

Classes and Objects: Concept of classes, Declaration of classes, Defining access specifier, Public, Private, Protected derivations, defining member functions in a class, use of scope resolution operator outside the class definition. Defining objects. Friend function.

UNIT IV

CAD/CAM: Introduction to the basics of CAD and CAM, Study 2-D sketching entities like lines, rectangle, parallelogram polygon, circle etc., under SKETCH ENTITY MENU.

Evolution of Internet and its applications and services.

RECOMMENDED BOOKS

Sr. no.	Name	Author(s)	Publisher
1.	Object-Oriented Programming with C++	E. Balagurusamy	Tata McGraw Hill
2.	Object-Oriented Programming with C++	Lafore R	Waite Group
3.	The C++ Programming Language	Bjarne Stroustrup	Addison Wesley
4.	Fundamentals of Computers	R. S. Salaria	Salaria Publishing House

Course Code	**PHY107**
Course Title	Engineering Physics laboratory
Type of course	Theory
L T P	0.0.2
Credits	1
Course prerequisite	Engineering Physics

1. To study the magnetic field of a circular coil carrying current.
2. To find out polarizability of a dielectric substance.
3. To study the laser beam characteristics like; divergence using diffraction grating aperture.
4. To study laser interference using Michelson‟s Interferometer.
5. Study of diffraction using laser beam and thus to determine the grating element.
6. To determine numerical aperture of an optical fibre.
7. To determine attenuation & propagation losses in optical fibres.
8. To find out the frequency of AC mains using electric-vibrator.
9. To find the refractive index of a material using spectrometer.
10. To find the refractive index of a liquid.
11. To study B-H curve using CRO.

Recommended Books		
Name	Author	Publisher
Basic Electrical, Electronics and Computer Engg.	Rmuthusubramanian,S.Salivahanan,K A Muraleedharan	Tata McgrawHill
A Textbook of Electrical Tech	B.L Theraja.& A.K Theraja	S Chand

Course Code	**EE-103**
Course Title	**Basic Electrical Engineering Laboratory**
Type Of Course	CORE
L T P	0:0:2
Credits	1
Course Pre-requisites	Basics of Electrical Engineering
Course objectives	To familiarize with various AC, DC circuits, Transformer , Electrical Machine and Measuring Instruments

Syllabus

1. To verify Ohm's Law and its limitations.
2. To verify Kirchhoff's Laws.
3. To find voltage, current relationship and power factor of a given R-L circuit.
4. To verify series and parallel resonance in AC circuits.
5. To perform open- circuit and short circuit test on a transformer and determine the following:
   a) The transformation ratio (b) the transformer efficiency.
6. To find out the line voltage, phase voltage relationship, line current and phase current relationship in case of star and delta connected 3- phase balanced load.
7. To connect 3 identical single phase transformers for three phase power transformations through following connections (a) star-delta (b) star-star(c) delta-star (d) delta-delta and to find phase and line voltage ratio.
8. To connect, start and reverse the direction of rotation of a 3- phase induction motor.
9. To perform the Block Rotor test of 3-phase induction motor test.
10. To study the speed control of characteristic of D.C. Motor.
11. To study various measuring instruments(Moving Iron Instruments – Attraction Type, Moving Iron Instruments – Repulsion Type, Moving Coil Instruments – Permanent Magnet Type, Moving Coil Instruments – Dynamometer Type).

Recommended Books

Name	Author	Publisher
Basic Electrical, Electronics and Computer Engg.	R muthusubramanian,SSalivahanan,K A Muraleedharan	Tata McgrawHill
A Textbook of Electrical Tech	B.L Theraja.& A.K Theraja	S Chand

Course Code	**CSE 103**
Course Title	Fundamental of Computer Technology Laboratory
Type of Course	ES
L T P	0:0:4
Credits	2
Course Prerequisites	Basics of computer
Course Objectives (CO)	To familiarize the students of all branches in engineering with computer organization, operating systems, problem solving and programming in C++.

SYLLABUS

Familiarization with the Computer System:

1. To explain the part of the computer system such as system unit, input devices, output devices connected to the computer.
2. To explore the outside view of the system unit that includes the panels on front and ports at the rear
3. To explore the inside view of the system unit that includes the motherboard, processor, expansion slots, various add-on cards, storage devices, power supply, fans.
4. To understand the booting process that includes switching on the system, execution of POST routine, then bootstrap loader, and loading of the operating system, and getting it ready for use.
5. To introduce the graphical user interface (desktop) of Windows operating System to explain the various elements of the desktop such as taskbar, icons (My Computer, Recycle Bin, etc.), short cuts, notification area.
6. To configure the desktop that includes selecting the wallpaper, selecting the screen saver with or without password protection, selecting the screen resolution and color quality.

Explore Office automation

1. Creating, Formatting documents with Word, explore the various toolbar options, Mail Merge, Spell Check, Word –Art.
2. Creating PowerPoint presentations with Power Point, Explore various views of PPT, Charts, Graphs, animation, multimedia.
3. Creating Sheets in Excel using formulas, chart and graphs.

Programming using C++

1. Implement programs using various operators in C++
2. Implement various Branch statements: if, if-else, nested if, switch
3. Implement various loop statements: for, while, do-while
4. Implement other control statements: go-to, exit function, continue
5. Implement various programs using arrays and string
6. Implement various programs classes and objects

Computer Aided Tools and Internet

1. Exercise with CAD/CAM
2. Internet surfing and E-mail

RECOMMENDED BOOKS

Sr. no.	Name	AUTHOR(S)	PUBLISHER
1.	Object-Oriented Programming with C++	E. Balagurusamy	Tata McGraw Hill
2.	Object-Oriented Programming with C++	Lafore R	Waite Group
3.	The C++ Programming Language	Bjarne Stroustrup	Addison Wesley.
4.	Fundamentals of Computers	R. S. Salaria	Salaria Publishing House

Course Code	ME107
Course Title	Engineering Workshop
Programme	ES
L T P	0:0:6
Credits	3
Course Prerequisites	NA
Course Objectives (CO)	To become aware of different manufacturing process in industry.

SYLLABUS

Carpentry and Pattern making: Various types of timber and practice boards, defects in timber, seasoning of wood, tools, wood operations and joints, exercises involving use of important carpentry tools to practice various operations and making joint.

Foundry Shop: Introduction to moulding material, mould, melting furnaces, foundry tools and equipment's used in foundry shops; firing of a cupola furnace, exercises involving preparation of small sand moulding and casting.

Forging practice: introduction to forging tools; equipment's and operations forge ability of metals; exercises on simple smithy; forging exercises.

Machine shop: Machines ; introduction to lathe and shaper machine and its operation performed on it.

5. Welding shop: introduction to different welding methods; welding equipment's; electrodes; welding joints; welding defects; exercises involving use of gas/electric arc welding.

6. Electrical and electronics shop: introduction to electrical wiring; preparation of PCBs involving soldering applied to electrical and electronic applications; exercises preparation of PCBs involving soldering applied to electrical and electronic applications.

7. Sheet metal shop: shop development of surfaces of various objects; sheet metal forming and joining operation, joints, soldering and brazing; exercises involving use of sheet metal forming operations for small joints.

8. Fitting shop: introduction of fitting practice and tool used in fitting shop; exercise involving marking cutting fitting practice (right angles) male female mating parts practice.

REFERNCES

S. No	Name	Author(S)	Publisher
1.	Workshop Technology	HS Bawa	McGraw-Hill Publishing Company Limited
2.	Workshop Technology I,II,III	S K Hajra, Choudhary and A K Choudhary	Media Promoters and Pu blishers Pvt. Ltd., Bombay
3.	Manual on Workshop Practice	K Venkata Reddy	MacMillan India Ltd. New Delhi
4.	Basic Workshop Practice Manual	T Jeyapoovan	VikasPublishing House (P) Ltd., New Delhi

SECOND SEMESTER

Course Code	CHM105
Course Title	Engineering Chemistry
Type of course	Theory
L T P	3:0:0
Credits	3
Course prerequisite	+2 with Non-Medical
Course Objective (CO)	The objectives of the engineering chemistry are to relate the students with basic concepts of chemistry. Some new topics have been introduced to the syllabus for the development of the right attitudes by the engineering students to cope with new technology

Syllabus

UNIT-I

Water and its Treatment: Boiler feed water: Specification, Scales and sludge formation; Priming & foaming; Different methods of the water purifications and softening; Water for domestic use; Specifications; Disinfection of water.
Corrosion and its Prevention: Introduction; Different types of corrosion ;Wet and Dry corrosion; Mechanisms of wet & Dry corrosion;Concentration cell corrosion and differential aeration corrosion; Soil and microbial corrosions; waterline, stress corrosions; Prevention measure against corrosion.

UNIT-II

Spectroscopy and its Applications: An introduction 1). UV/Visible Spectroscopy: Selection rules; Line widths and intensities Chromophores &auxochromes; Principle and instrumentation; Electronic Transitions lines; Franck Condon principle; Applications of UV/Visible spectroscopy.
2).I.R. spectroscopy: Fundamental modes of vibrations and types; Factors affecting vibration frequency; Applications of I.R. spectroscopy.
3). NMR Spectroscopy: Principle & instrumentation; Chemical shift; Spin-Spin Splitting; applications of N.M.R. spectroscopy.
Photochemistry: Introduction; Photophysical& photochemical processes; Light sources in photochemistry; Beer Lambert Law; Laws of Photochemistry; Quantum yield (primary and overall); Primary and secondary photochemical reactions; Jablonski diagram; Semiconductor photochemistry, Photovoltaic cells Introduction to optical sensors.

UNIT-III
Green Chemistry and its Applications: Introductory overview Definition and concepts of Green chemistry; Twelve principles of Green Chemistry with emphasis on the use of alternative feedstock (biofuels); Design of the safer chemicals; Microwave and ultrasonic radiation in Green synthesis minimizing energy consumption.
Polymers and Reinforced Composites: Introduction; Functionality; Types of polymerization;

Specific features of polymers; Tactility of polymers; Average molecular weights and size; polymers; Introduction: polymer reinforced composite; Effect of molecular weight on the properties of polymers; Biodegradable polymers.

UNIT-IV

Nanochemistry: Introduction; Materials self-assembly; Molecular vs. materials self assembly; Self-assembling materials; Two dimensional assemblies; Mesoscale self assembly; Coercing colloids; Nanocrystals; Super molecular structures Nanoscale materials; Future perspectives.

Petrochemicals: Introduction; First, second & third generation petrochemicals; Primary Raw Materials for Petrochemicals, Natural gas: Natural gas treatment processes; Natural gas liquids; Properties of natural gas; Crude oil: Composition of crude oil-Hydrocarbon compounds; Non-hydrocarbon compounds; Metallic Compounds, Crude oil classification Physical separation processes; Conversion processes; Renewable and non renewable source of energy.

Recommended books:-

S. No	Name	Author(S)	Publisher
1.	Engineering chemistry	J.C. Curiacose and J.Raja Ram,	Tata Mcgraw-HillCo.New Delhi.
2.	Chemical applications of infrared spectroscopy	CNR.Rao.	Acad.Pres, New York.
3.	Ultra violet and visible spectroscopy chemical applications	CNR,Rao	plenum press

Course Code	ECE 101
Course Title	Basic Electronics & Communication Engineering
Type of Course	ES
L T P	2:0:0
Credits	2
Course Assessment Methods	End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)
Course Prerequisite	+2 Physics
Course Objectives (CO) To introduce basic postulates of Electronics, Boolean algebra and basic gates, and Boolean expressions, To outline the formal procedures for the analysis and design of electronics and digital circuits. Introduction to basic fundamentals of communication engineering.	

SYLLABUS

UNIT 1: Semiconductor Diodes& Applications: Introduction, Semiconductor materials, Extrinsic materials: n type and p type, Semiconductor diodes, Biasing of diodes, Breakdown mechanisms, Ideal diode,Transition and diffusion capacitance, Reverse recovery time, Diode testing, Zener diode, Light emitting diodes (LEDs).Load line analysis, Half wave rectifications, full wave rectification, Clippers, Clampers, Zener diode as a voltage regulator, Voltage multiplier.

UNIT 2: Digital Electronics Fundamentals: Digital and Analog Quantities, Binary digits, Logic levels, Basic logic operations, Overview of basic logic functions, Number system: Decimal numbers, Binary numbers & its arithmetic operations, octal & Hexadecimal numbers, number system conversions, Logic gates: The inverter, The AND gate, The OR gate, The NAND gate, The NOR gate, The Exclusive OR and Exclusive NOR gates.

UNIT 3: Basic Signals & Systems: Introduction, Signals and classification of signals, Basic continuous time signals, Basic discrete time signals, System and classification of systems, Transducers.

UNIT 4: Communication Systems: Introduction, Elements of a communication system, Classification of communication systems, Modulation and coding, Need of modulation, Multiplexing, Analog and Digital communication, Advantages of digital communication over analog communication, Microwave communication, Satellite communication, Optical communication, Cellular Mobile communication:1G, 2G, 3G, GSM. (Basic introduction to all communication systems).

RECOMMENDED BOOKS

S. No	Name	Author(S)	Publisher
1	Electronics Devices & Circuits	Robert Boylested and Louise Nashelsky	Prentice Hall of India
2	Fundamental of Analog Circuits	Thomos L. Floyd and David buchla	Prentice Hall
3	Electronic Devices and Circuits	J.B Gupta	S K Kataria& Sons
4	Wireless Communications	T. L. Singal	Tata McGraw-Hill

Course Code	ENG121
Course Title	Communication Skills-I
Type of Course	Theory
L T P	2:0:0
Credits	2
Course pre-requisite	+ 2 English
Course Objectives	The objective of the course is to : 1.assist the students to acquire proficiency, both in spoken and written language 2. to develop comprehension, improve writing skills, and enhance skills in spoken English.

UNIT-I

Basics of Communication Skills:

Communication, Process of Communication, Types of Communication-Verbal and Non verbal communication, Channels of Communication- Upward, Downward, Horizontal, Barriers to Communication, Role of Communication in society.

UNIT-II

Listening Skills:

Listening Process, Hearing and Listening, Types of Listening, Effective Listening, Barriers of Effective Listening, Note Taking

Reading Skills:

Purpose of reading, Process of reading, reading skills Models and strategies, scanning, skimming, SQ3R, Approaches of Reading, Comprehension passages for practice.

UNIT III

Writing Skills:

Purpose of writing, Effective writing, Types of writing, Business Correspondence, Precise writing, Memo writing, minutes of meeting.

UNIT-IV

Speaking Skills:

Speech process, Skills of effective speaking, Role of audience, Feedback Skill, Oral Presentation.

Text and Reference Books:

Sr No	Author(s)	Title	Publisher
1.	BhupenderKour	Effectual Communication Skills	S.K. Kataria and Sons
2.	R. Datta Roy and K.K. Dheer	Communications Skills	Vishal Publishing Company
3	The Essence of Effective Communication	Ludlow and Panthon	Prentice Hall of India
4	Essentials of Business Comunication	Pal and Rorualling	S. Chand and Sons. New Delhi

Course Code	ME103
Course Title	Engineering Drawing
Programmme	ES
L T P	1:0:6
Credits	4
Course Prerequisites	Basic Mathematics
Course Objectives (CO)	Main objective of the Engineering Drawing is to introduce the students to visual science in the form of technical graphics. General instructions related to Theory of Orthographic Projection of points, lines, planes and solids as per the BIS codes prevalent to drawing practice will be introduced initially. Section of solids, intersection and development of surfaces, isometric projection and orthographic projection of simple solids/blocks will further upgrade the basic understanding and visualization of geometrical objects and to certain extent the machine parts.

SYLLABUS

UNIT I

Introduction: Introduction to drawing equipment and use of instruments. Symbols and conventions in drawing Practice. Types of lines and their use, BIS codes for lines, Technical lettering as per BIS codes, Introduction to Dimensioning. Basic Definition of geometrical objects: Points, lines, planes and solids.

Scales: Representative Fraction, Types of Scale, Plain and Diagonal Scale, Scale of chords

Projection: Introduction, Principle of Projection, Method of projection, Planes of projection, Four quadrant, First and Third angle projection, Reference line, symbols for methods of projection, Orthographic projection

UNIT II

Projection of Point: Introduction, Projection of Point situated in first, second, third & fourth quadrant.

Projection of lines: Introduction , Line parallel to One or both the planes, Line contained by one or both the planes, Line perpendicular to one of the planes, Line inclined to one plane and parallel to other . Line inclined to both the planes, True length.

Projection of Planes: Introduction, Types of planes, Difference between plane and lamina, Projection of planes, Projection of planes perpendicular to both the reference planes, Perpendicular to one plane and parallel to other plane, Perpendicular to one plane and inclined to the other plane, Inclined to both planes.

UNIT III

Projection of solids: Introduction, Type of solid, Projection of solids in first or third quadrant,

with axis parallel to one and perpendicular to other, axis parallel to one inclined to other, axis inclined to both the principle plane, axis perpendicular to profile plane and parallel to both H P and V P. Visible and invisible details in the projection. Use rotation and auxiliary plane method to draw the projections.

Section of Solids: Definition of Sectioning and its purpose. Procedure of Sectioning, Types of sectional planes. Illustration through examples.

Development of Surfaces: Purpose of development, Parallel line, radial line and triangulation method. Development of prism, cylinder, cone and pyramid surface for both right angled and oblique solids, and development of surface of sphere.

UNIT IV

Isometric Projection: Classification of pictorial views, Basic Principle of Isometric projection, Difference between isometric projection and isometric drawing. Isometric projection of solids such as cube, prism, pyramid and cylinder, and assignments on isometric projection of simple machine parts.

Orthographic Projection: Review of principle of Orthographic Projection, Sketch/drawing of blocks, and of simple machine parts.

Intersection of Surfaces/Solids: Purpose of intersection of surfaces, Intersection between the two cylinder, two prisms, prism and pyramid, pyramid and pyramid, cylinder and prism, cone and cylinder, sphere and cylinder etc., use of cutting plane and line method.

Recommended Books

S.No.	Name	Author(s)	Publisher
1.	Engineering Graphics	Narayana K L and Kanaiah P	Tata McGraw Hill Publishing Company Limited, New Delhi
2.	Engineering Graphics and Drafting	P S Gill	Katria and Sons, Delhi.
3.	Elementary Engineering Drawing-Plane and solid Geometry	ND Bhat	Chartotar Publishing House, Anand
4.	A Text Book of Engg Drawing	R. K. Dhawan	S. Chand and Co. Ltd
5.	"Engineering Graphics".	K.L. Narayana and P.Kannaiah	Scitech Publications (India)

Course Code	CHM107
Course Title	Engineering Chemistry Laboratory
Type of course	Practical
L T P	0:0:2
Credits	1
Course prerequisite	+2 with Non-Medical

SYLLABUS

1Analysis of Effluents

- Determination of hardness of water by EDTA method.
- Determination of C.O.D and B.O.D in water.
- Determination of Residual Chlorine.

2. Analysis of Fuels and Lubricants

- Determination of Moisture, Volatile and ash content by proximate analysis.
- Determination of acid value of oil
- Determination of the viscosity.

3. Instrumental Analysis

- Determination of surface –tension of given liquid
- Determination of the concentration of a solution conductometerically.
- Determination of the strength of a solution pH meterically.

4.Chromatography

- Determination of Rf value of amino acid by TLC and identification of the amino acid present.
- Separation of metallic ions by paper chromatography.
- Separation of Ions by using complexing agents

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5. Synthesis & Green Chemistry experiments

•Preparation of a polymer phenol/urea formaldehyde resin or •Preparation of aspirin.•Base catalyzed aldol condensation by Green Methodology•Acetylating of primary amines using ecofriendly method.

Recommended books:-

S. No	Name	Author(S)	Publisher
1.	Engineering chemistry	J.C. Curiacose and J.Raja Ram,	Tata Mcgraw-HillCo.New Delhi.
2.	Chemical applications of infrared spectroscopy	CNR.Rao.	Acad.Pres, New York.
3.	Ultra violet and visible spectroscopy chemical applications	CNR,Rao	plenum press
4.	Inorganic quantitative analysis	by A.I. Vogal	
5.	Engineering practical	Shashi Chawla	Dhanpat Rai and co.

Course Code	ECE103
Course Title	Basic Electronics & Communication Engineering Laboratory
Type of Course	ES
L T P	0:0:2
Credits	1
Course Prerequisites	Knowledge of Physics

SYLLABUS

List of Experiments

1. Identification of Basic components of Electronics.
2. Introduction to Multimeter.
3. Introduction to working of CRO & Function Generator.
4. Component Testing: Resistance, Capacitor and Inductance.
5. Component Testing: Diode, BJTs.
6. LED testing.
7. Calculate and verify the Resistance and capacitance in series and parallel combination.
8. Verification of Basic Logic gates (AND, OR, NOT).
9. Verification of Universal Logic gates (NAND, NOR).
10. Basics practice on soldering and general purpose PCB component installation.

Course Code	ENG123
Course Title	Communication Skills-1 (Practical)
Type of Course	Practical
L T P	0:0:2
Credits	1
Course pre-requisite	NA
Course Objectives	The objective of this course is to provide the students sufficient practice for speaking and writing English efficiently.

SYLLABUS

UNIT-I

Speaking and Discussion Skills:

Oral Presentation, Planning and organizing content for presentation, Use of audio /Visual Aids, Making Slides for presentation , Group Discussion ,Debate, Extempore speaking, Interview Skills, Mock interview, Mock Dialogues (Pair Speaking),Cue Card Speaking, Meeting/ Conferences.

UNIT-II

Listening Skills:

Listening to any recoded material and asking oral/written questions for listening comprehension.

Reading Skills:

Active Reading of passages for Reading comprehensions, paraphrase, Summary writing.

UNIT III

Writing Skills:

Guidelines of effective writing, Paragraph Writing, Email Writing.

UNIT-IV

Grammar and Vocabulary:

Parts Of Speech, Tenses, GRE words (List of 50 Words).

THIRD SEMESTER

Course Code	**EE201**
Course Title	Electrical Machines-I
Type of Course	Core
L T P	3:0:0
Credits	3
Course Prerequisites	To have knowledge about basic electrical engg
Course Objectives (CO)	To understand the concepts of magnetic circuits, operation of dc machines, analyse the differences in operation of different dc machine configurations, analyse single phase and three phase transformers circuits.

SYLLABUS

UNIT-I

Review of magnetic circuits - MMF, flux, reluctance, inductance; review of Ampere Law and Biot Savart Law; Visualization of magnetic fields produced by a bar magnet and a current carrying coil - through air and through a combination of iron and air; influence of highly permeable materials on the magnetic flux lines.

Electromagnetic force and torque: B-H curve of magnetic materials; flux-linkage vs current characteristic of magnetic circuits; linear and nonlinear magnetic circuits; energy stored in the magnetic circuit; force as a partial derivative of stored energy with respect to position of a moving element.

UNIT-II

Introduction to electrical machines: Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core, visualization of magnetic field produced by the field winding excitation with armature winding open, air gap flux density distribution, flux per pole, induced EMF in an armature coil. Armature winding and commutation –Elementary armature coil and commutator, lap and wave windings, construction of commutator, linear commutation Derivation of back EMF equation, armature MMF wave, derivation of torque equation, armature reaction, air gap flux density distribution with armature reaction.

UNIT-III

DCMotor: Working principle characteristics, starting of shunt and series motor, starters, speed control methods: field and armature control. Braking: plugging, dynamic and regenerative braking, Testing: Swinburn's test, Hopkinson test, Field test. Estimation of losses and Efficiency , Applications.

DC machine - motoring and generation

Armature circuit equation for motoring and generation, Types of field excitations – separately excited, shunt and series. Open circuit characteristic of separately excited DC generator, back EMF with armaturereaction, voltage build-up in a shunt generator, critical field resistance and critical speed. V-I characteristics and torque-speed characteristics of separately excited.

UNIT-IV

Transformers: Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagram, voltage regulation, losses and efficiency Testing - open circuit and short circuit tests, polarity test, back- to-back test, separation of hysteresis and eddy current losses Three-phase transformer - construction, types of connection and their comparative features, Parallel operation of single-phase and three-phase transformers, Autotransformers - construction, principle, applications and comparison with two winding transformer, Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current, Phase conversion - Scott connection, three-phase to six-phase conversion, Tap- changing transformers - No-load and on-load tap-changing of transformers, Three-winding transformers. Cooling of transformers.

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Electrical Machinery	Bimbhra P.S.	Khanna Publishers
2	Electrical Machines, 4th Edition	Nagrath I.J. and Kothari D.P.	Tata McGraw Hill
3	Electric Machinery, 6th Edition	Fitzgerald A.E., Kingsley C. and Umans S.D.	McGraw Hill

Course Code	EE203
Course Title	**CIRCUIT THEORY**
Type of Course	CORE
L T P	**3 10**
Credits	4
Course Prerequisites	Laplace transformation, Fourier transform & Basics of Electrical Engg.
Course Objectives (CO)	To introduce the fundamental of network analysis using matrices ,two port networks and filter designing & to impart knowledge about signal and systems and time and frequency domain analysis.

SYLLABUS

UNIT-I Circuit Concepts: Independent & Dependent Sources, Periodic and Singularity Voltages, Step, Ramp, Impulse, Doublet, Controlled sources, Nodal & loop analysis.
Network Theorems: Thevenin's, Norton's ,Superposition, Tellegen's , Reciprocity, Maximum Power Transfer Theorem & Compensation Theorem. (AC & DC)

UNIT-II Time and Frequency Domain Analysis: Representation of basic circuits in terms of generalized frequency and their response, Laplace transform of shifted function, transient and steady response, Time domain behavior from poles & Zeros.

UNIT –III Network Synthesis: Driving point and Transfer function, Calculations of network function Poles and Zeros and their significance, concept of stability of active networks, Relizability condition for impedance synthesis of RL & RC circuits, Network synthesis techniques for 2-terminal network, Foster and Cauer forms.

UNIT-IV Elements of Filter Design: Low-Pass, high pass and band-pass filters, composite filters, Characteristics impedance and propagation constant of pure reactive network, Pass Bands and Stop Bands.

RECOMMENDED BOOKS

S. No.	NAME	Author	Publisher
1	Electrical Circuit Theory and Technology	Bird John	Newness
2	Circuit Theory, 2nd Ed	Chakraborty, Abhijit	Dhanpat Rai
3	Circuits & Networks Analysis and Synthesis	Mohan, Sudhakar Sham	Tata Mc Graw Hill
4	Networks & Synthesis	Chaudhury D. Roy	New Age International.
5.	Theory and Problems of Electric Circuits	Edminister A. Joseph	Schaum's Outline Series

Course Code	EE205
Course Title	Analog Electronics
Type of Course	CORE
L T P	4:1:0
Credits	5
Course Prerequisites	Basic Electronics.
Course Objectives (CO)	To understand the characteristics of transistors design and analyse various rectifier and amplifier circuits, design sinusoidal and non-sinusoidal oscillators and understand the functioning of OP-AMP and design OP-AMP based circuits.

SYLLABUS

UNIT-IP-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuits.Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common-collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits

UNIT-II

MOSFET structure and I-V characteristics.MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuits - gain, input and output impedances, trans-conductance, high frequency equivalent circuit.

UNIT –III

Differential amplifier; power amplifier; direct coupled multi-stage amplifier; internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product)

UNIT-IV

Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, P, PI and PID controllers and lead/lag compensator using an op-amp, voltage regulator, oscillators (Wein bridge and phase shift).

RECOMMENDED BOOKS

S. No.	NAME	Author	Publisher
1	"Microelectronic Circuits", New York, Oxford University Press, 1998.	A. S. Sedra and K. C. Smith	New York, Oxford University Press, 1998.
2	"Introduction to Operational Amplifier theory and applications",.	J. V. Wait, L. P. Huelsman and G. A. Korn,	McGraw Hill U. S., 1992. 3
3	Microelectronics	J. Millman and A. Grabel,	McGraw Hill Education, 1988.

Course Code	EE207
Course Title	Digital Electronics
Type of Course	Core
L T P	4:1:0
Credits	5
Course Prerequisites	Physics, Basic Electronics
Course Objectives (CO)	To introduce basic postulates of Boolean algebra ,basic gates and Boolean expressions, study and analyze digital logic families and to outline the formal procedures for the analysis and design of combinational and sequential circuits

SYLLABUS

UNIT I: Introduction, Number system (Binary, Octal, Decimal and Hexadecimal), Signed and unsigned numbers, Binary operations: Addition, Subtraction, Multiplication and division. Subtractions using 1's and 2's compliment. Weighted & Non-weighted codes, ASCII Code, BCD Code and Gray code. Switching algebra. Theorems of Boolean algebra. Minimization of logic functions. Logic gates. Sum of products and product of sums. Canonical form. Minimization using K-Map and Q-M Method.

UNIT II: Design of combinational circuits: Introduction, Adders, Subtractors, Multiplexers, Demutiplexers, Decoders, Encoders, Parity generators and checkers, Magnitude comparators, Code converters. Implementation of combinational circuit using MUX.

UNIT III: Sequential Circuits: Basic Concepts, Flip Flops: S-R, J-K, D, Master Slave J-K (Truth Tables, Circuits, and Excitation Tables), and Conversion of Flip Flops. Triggered and Clocked Flip Flops. Registers and its types. Shift Register (types, circuit diagram, timing waveforms). Counter (types, counter design with state equation, state diagrams and timing waveforms).

UNIT IV: D/A and A/D Converters: Introduction. DAC (Principle, Types and Specifications).ADC (Principle, Types and Specifications). Memory Elements: Introduction, ROM, PROM, SRAM, DRAM and Flash Memories. Logic Families: TTL, ECL, I^2L, NMOS, CMOS, Comparison of Logic Families.

RECOMMENDED BOOKS

S. No	Name	Author(S)	Publisher
1	Digital Design	Mano, Morris	Prentice Hall of India
2	Digital Principle and Applications	Malvino	Tata McGraw-Hill
3	Modern Digital Electronics	R. P. Jain	Tata McGraw-Hill

Course Code	**CSE203**
Course Title	Object Oriented Programming Using C++
Type of Course	ES
L T P	4:0:0
Credits	4
Course Prerequisites	Basic Computer and C Language
Course Objectives (CO)	To understand the basic concepts of object oriented programming languages and to learn the techniques of software development in C++.

SYLLABUS

UNIT I. Introduction : What is object oriented programming? Why do we need object oriented. Programming characteristics of object-oriented languages. C and C++, C++ Programming basics: Output using cout. Directives. Input with cin. Type bool. The setw manipulator. Type conversions.

Functions, Arrays and Structures: Returning values from functions. Reference arguments. Overloaded function. Inline function. Default arguments. Returning by reference. Fundamentals of Arrays, string arrays. Arrays as class Member Data**,** Arrays of object, string, Structures, Array using structures.

UNIT II. Pointer: Addresses and pointers, Memory management: New and Delete, pointers to objects, debugging pointers. **Object and Classes:** Object oriented concepts- Encapsulation, Abstraction, Polymorphism, Classes, Messages Association, Interfaces, Implementation of class, Objects, C++ object as data types constructor. Object as function arguments, Constructor and its various types, Destructor.

UNIT III. Virtual Function: Virtual Function, friend function, Static function, Assignment and copy initialization, this pointer, dynamic type information.

Operator Overloading: Overloading unary operations. Overloading binary operators, data conversion, pitfalls of operators overloading and conversion keywords. Explicit and Mutable, overloading the extraction and insertion operators.

UNIT IV. Inheritance: Concept of inheritance. Derived class and based class. Derived class constructors, class hierarchies, public and private inheritance, aggregation: Classes within classes, inheritance and program development.

Streams and Files: Streams classes, Stream Errors, Disk File I/O with streams, file pointers, error handling in file I/O with member function.

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Object Oriented Programming in C++	Robert Lafore	Tech media Publication
2	The complete reference C	Herbert shield	Tata McGraw Hill Publication
3	Object Oriented Programming in C++	SauravSahay	Oxford University Press
4	Object Oriented Programming in C++	R Rajaram	New Age International Publishers 2nd
5	OOPS C++ Big C++	Cay Horstmann	Wiley Publication

Course Code	**EE209**
Course Title	**Electrical Machines-I Lab**
Type of Course	Core
L T P	0:0:2
Credits	1
Course Prerequisites	ELECTRICAL MACHINES-I
Course Objectives (CO)	1. To understand testing of transformer. 2. To understand parallel operation of transformer. 3. To study DC Machines.

1. To perform load test on a single phase transformer.
2. To perform open circuit and short circuit tests on a single phase transformer and hence find equivalent circuit, voltage regulation and efficiency.
3. To find the efficiency and voltage regulation of single phase transformer under different loading conditions.
4. To perform parallel operation of two single phase transformers.
5. To study the various connections of three phase transformer.
6. To perform Scott connections on three phase transformer to get two phase supply.
7. To study the constructional details of direct current DC machine and to draw sketches of different components.
8. To measure armature and field resistance of DC shunt generator and to obtain its open circuit characteristics.
9. To obtain load characteristics of DC shunt/series/compound generator.
10. To draw speed-torque characteristics of DC shunt/series /compound generator.
11. To study DC motor starters.
12. To perform Swinburne's test (no load test) to determine losses of DC shunt motor.

Course Code	**EE211**
Course Title	**Analog Electronics Lab**
Type of Course	Core
L T P	0:0:2
Credits	1
Course Prerequisites	Analog Electronics Lab.
Course Objectives (CO)	1. To understand applications of Diodes, Transistors and amplifier.

1. To draw I-V characteristics of PN junction diode (Ge, Si, switching and signal).
2. To design half wave rectifier.
3. To design full wave and bridge rectifiers.
4. To study transistor characteristics in common base, common collector, and common emitter configurations.
5. To study the I-V characteristics of MOSFET.
6. To design various clippers and clampers using diodes.
7. To obtain the frequency response of an amplifier and calculate the gain bandwidth of the amplifier.
8. To design a transistor series voltage regulator with current limits and observes current feedback characteristics.
9. To study the characteristics of a complementary symmetry amplifier.
10. Application of Op-Amp (741) as inverting and non-inverting amplifier.
11. To use the OP-AMP as summing, scaling and averaging amplifier.

Course Code	**EE213**
Course Title	**Digital ElectronicsLab**
Type of Course	Core
L T P	0:0:2
Credits	1
Course pre-requisites	Digital Electronics

SYLLABUS

1. To study the logic gates and verify the truth tables of OR, AND, NOT, XOR, X-NOR, NAND & NOR Gates.
2. Realization of Half adder & Full adder using basic gates and universal gates.
3. Realization of Half subtractor& Full subtractor using basic gates and universal gates.
4. Truth table verification and realization of half adder and full adder using MUX.
5. Truth table verification and realization of half subtractor and full subtractor using DE-MUX.
6. Truth table verification of flip-flops: T, RS, D, JK, MASTER SLAVE JK FLIP FLOPS.
7. Design a 4-bit Magnitude comparator using logic gates.
8. Design a 4-bit Binary to Gray and Gray to Binary code converter.
9. Shift Registers: Study of SISO, SIPO, PISO, PIPO shift registers.

Course Code	CSE209
Course Title	Object Oriented Programming Using C++ Lab
Type of Course	ES
L T P	0:0:2
Credits	1
Course Prerequisites	Fundamentals of C language and Knowledge of computer
Course Objective	This course work is to help the students to give the practical implementation of the C++ programs

List of Practical's

1: Classes and Objects

1.1: Write a program that uses a class where the member functions are defined inside aclass

1.2: Write a program that uses a class where the member functions are defined outside aclass.

1.3: Write a program to demonstrate the use of static data members. Practical

1.4: Write a program to demonstrate the use of const data members.

2: Constructors and Destructors

2.1: Write a program to demonstrate the use of zero argument and parameterized constructors.

2.2: Write a program to demonstrate the use of dynamic constructor. Practical

2.3: Write a program to demonstrate the use of explicit constructor.

3: Operator Overloading

3.1: Write a program to demonstrate the overloading of increment and decrement operators.

3.2: Write a program to demonstrate the overloading of binary arithmetic operators.

3.3: Write a program to demonstrate the overloading of memory management operators.

4: Typecasting

4.1: Write a program to demonstrate the typecasting of basic type to class type.

4.2: Write a program to demonstrate the typecasting of class type to basic type.

4.3: Write a program to demonstrate the typecasting of class type to class type.

5: Inheritance

5.1: Write a program to demonstrate the multilevel inheritance.

5.2: Write a program to demonstrate the multiple inheritance.

5.3: Write a program to demonstrate the virtual derivation of a class.

6: Polymorphism

6.1: Write a program to demonstrate the runtime polymorphism.

7: Exception Handling

7.1: Write a program to demonstrate the exception handling.

8: File Handling

8.1: Write a program to demonstrate the reading and writing of mixed type of data.

8.2: Write a program to demonstrate the reading and writing of objects.

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Object Oriented Programming in C++	Lafore R.	Waite Group
2	Object Oriented Programming with C++	E. Balagurusamy	Tata McGraw

FOURTH SEMESTER

Course Code	EE202
Course Title	Electrical Machines- II
Type of Course	Core
L T P	3:0:0
Credits	3
Course Prerequisites	To have knowledge about basic electrical engg
Course Objectives (CO)	Understand the concepts of rotating magnetic fields, operation of ac machines and analyse performance characteristics of ac machines

SYLLABUS

UNIT I: Fundamentals of AC machine windings : Physical arrangement of windings in stator and cylindrical rotor; slots for windings; single-turn coil - active portion and overhang; full-pitch coils, concentrated winding, distributed winding, winding axis, Air-gap MMF distribution with fixed current through winding - concentrated and distributed, Sinusoidal distributed winding, winding distribution factor.

UNIT II: Pulsating and revolving magnetic fields Constant magnetic field, pulsating magnetic field - alternating current in windings with spatial displacement, Magnetic field produced by a single winding - fixed current and alternating current Pulsating fields produced by spatially displaced windings, Windings spatially shifted by 90 degrees, Addition of pulsating magnetic fields, Three windings spatially shifted by 120 degrees (carrying three-phase balanced currents), revolving magnetic field

UNIT III: Induction Machines: Construction, Types (squirrel cage and slip-ring), Torque Slip Characteristics, Starting and Maximum Torque. Equivalent circuit. Phasor Diagram, Losses and Efficiency. Effect of parameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, frequency). Methods of starting, braking and speed control for induction motors. Generator operation. Self-excitation. Doubly-Fed Induction Machines**.**Single-phase induction motors.Constructional features, double revolving field theory, equivalent circuit, determination of parameters. Split-phase starting methods and applications.

UNIT IV: Synchronous machines: Constructional features, cylindrical rotor synchronous machine - generated EMF, equivalent circuit and phasor diagram, armature reaction, synchronous impedance, voltage regulation. Operating characteristics of synchronous machines, V-curves. Salient pole machine - two reaction theory, analysis of phasor diagram, power angle characteristics. Parallel operation of alternators - synchronization and load division

RECOMMENDED BOOKS

S. No	Name	Author(S)	Publisher
1	"Electric Machinery, 2011.	A. E. Fitzgerald and C. Kings ley	McGraw Hill Education, 2013.
2	“Performance and design of AC machines.	M. G. Say,	CBS Publishers, 2002
3	“Electrical Machinery	P. S. Bimbhra,	Khanna Publishers

Course Code	EE204
Course Title	Linear Control Systems
Type of Course	Core
L T P	4:1:0
Credits	5
Course Prerequisites	Laplace Transforms and Basics of Electrical Engineering
Course Objectives (CO)	To understand different types of Signals, Systems and their examples in real life situations, study solution of Block Diagram and Signal flow graph, study Time Domain Analysis and Frequency Domain Analysis.

SYLLABUS

UNIT I: Open loop control system, closed loop control systems, linear and non-linear systems, time variant and invariant, continuous and sampled-data control systems. Error detectors – potentiometers and synchronous, servo motors, a.c. And d.c. Techno generators, Magnetic amplifiers.

UNIT II: Formulation of equation of linear electrical, mechanical, thermal, pneumatic and hydraulic system, electrical, mechanical analogies. Transfer function, Block diagram representation, some illustrative examples. Signal flow graphs and associated algebra, characteristics equation.

UNIT III: Time domain specifications, Dominant closed loop poles of higher order systems. Steady State error and coefficients, pole-zero location and stability, Routh-Hurwitz Criterion. The extreme points of the root loci for positive gain. Asymptotes to the loci, Breakaway points, intersection with imaginary axis, location of roots with given gain and sketch of the root locus plot.

UNIT IV: Bode plots, Nyquist plot, polar plot, stability and loop transfer function. Frequency response specifications, Relative stability, Relation between time and frequency response for second order systems Necessity of compensation, series and parallel compensation, compensating networks, applications of lag and lead- compensation.

RECOMMENDED BOOKS

S. No	Name	Author(S)	Publisher
1	Modern Control System,	Dorf Richard C. And Bishop Robert H	Pearson Education
2	Modern Control Engineering	Ogata K.	Prentice Hall
3	Automatic Control System	Kuo B. C	Prentice Hall
4	Control System Engineering	Nagrath I.J. and Gopal M	Wiley Eastern Ltd
5	Modern Control Engineering,	Singh / Janardhanan	Cengage Learning

Course Code	EE206
Course Title	Signal & System
Type of Course	Core
L T P	2:1:0
Credits	3
Course Prerequisites	Mathematics
Course Objectives (CO)	Understand the concepts of continuous time and discrete time systems, analyze systems in complex frequency domain and sampling theorem and its implications.

SYLLABUS

UNIT I: Introduction to Signals and Systems : Signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift invariance, causality, stability, reliability.

UNIT II: Behavior of continuous and discrete-time LTI systems : Impulse response and step response, convolution, input-output behavior with a periodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. State space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response

UNIT III: Fourier, Laplace and z- Transforms: Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis

UNIT IV: Sampling and Reconstruction (4 hours) The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems

RECOMMENDED BOOKS

S. No	Name	Author(S)	Publisher
1	Signals and systems.	V. Oppenheim, A.S. Willsky& S.H. Nawab,	Prentice Hall, 1997.
2	Principles, Algorithms, and Applications",	G. Proakis and D. G. Manolakis	Pearson, 2006
3	"Signals and systems",	. P. Hsu,	McGraw Hill Education, 2010

Course Code	**EE208**
Course Title	**Microprocessor & Interfacing Applications**
Type of Course	Core
L T P	4: 1:0
Credits	5
Course Prerequisites	The students should have good background on digital circuits and computer knowledge.
Course Objectives (CO)	1. To understand microprocessor based computer system. 2. To study 8085 & 8086 internal architecture and pin diagram. 3. To understand Assembly Language Programming of 8085 & 8086. 4. To understand interfacing with external devices.

SYLLABUS

UNIT-I

8085 Microprocessor: Introduction to Microprocessor, Difference between Microprocessor and CPU, Evolution & history of microprocessors, application areas of microprocessors, 8085 architecture, pin diagram, demultiplexing of address and data bus, addressing modes, 8085 instruction set, programming of 8085, stack and subroutines, interrupts of 8085.

UNIT-II

8086 Microprocessor: 8086 internal architecture, 8086 pin configuration and timing, memory segmentation, minimum and maximum mode configuration, interrupts, instruction set of 8086, programming of 8086

UNIT-III

Microprocessor system peripheral and interface **:** Introduction to interfacing, memory mapped I/O and I/O mapped I/O, block diagram and modes of operation of interfacing devices like 8255,8254,8259,USART.

UNIT-IV

Microprocessor applications**:** Interfacing of single and multiple digit seven-segment LED output display. Interfacing of DAC & ADC. Applications like Temperature measurement and control, water level indicator, measurement and display of motor speed and traffic light control system.

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Microprocessor Architecture, Programming and application with 8085	Gaonkar	Penram International
2	Fundamentals of Microprocessors and Microcomputers,	B. Ram	Dhanpat Rai and Sons,
3	Microprocessor Interfacing, programming and hardware	D. V. Hall	McGraw Hill
4	Introduction to Microprocessors	Mathur,A	Tata McGraw Hill

Course Code	MAT205
Course Title	Engineering Mathematics-III
Type of Course	Core
L T P	4:1:0
Credits	5
Course Prerequisites	Basic Mathematics
Course Objectives (CO)	This course is an introduction to a broad range of mathematical techniques for solving problems that arise in Science and Engineering. The goal is to provide a basic understanding of the derivation, analysis and use of these techniques along with a detailed understanding of Transforms in engineering applications

SYLLABUS

UNIT –I Fourier Series Periodic functions, Euler's formula. Even and odd functions, Point of Discontinuous Function, Change of interval halfrange expansions, Fourier series of different wave forms. **Fourier Transforms:** Fourier Integral Theorem (statement only), Fourier Transform of a function, Fourier Sine and Cosine Integral Theorem(statement only), Fourier Cosine & Sine Transforms. Fourier, Fourier Cosine & Sine Transforms of elementary functions. Properties of Fourier Transform: Linearity, Shifting, Change of scale, Modulation. Examples, Fourier Transform of Derivatives. Examples. Convolution Theorem (statement only), Inverse of Fourier Transform, Examples**.**

UNIT –II Laplace Transforms: Laplace transforms of various standard functions, properties of Laplace transforms, inverse Laplace transforms, transform of derivatives and integrals, Laplace transform of unit step function, impulse function, periodic functions, applications to solution of ordinary linear differential equations with constant coefficients, and simultaneous differential equations.

UNIT –III Partial Differential Equations Formation of partial differential equations, Linear partial differential equations, homogeneous partial differential equations with constant coefficients Applications: Wave equation and Heat conduction equation in one dimension. Two dimensional Laplace equation, solution by the method of separation of variables. Laplacian in polar coordinates.

UNIT –IV Functions of Complex Variable Limits, continuity, derivative of complex functions, analytic function, Cauchy-Riemann equation, conjugate functions, harmonic functions; Conformal Mapping: Mapping of a complex function, conformal mapping, standard transforms, mapping of standard elementary transformations, complex potential, applications to fluid flow problems; Complex Integration : Line integrals in the complex plane, Cauchy's theorem, Cauchy's integral formula and derivatives of analytic function. Taylor's and Laurent's expansions, singular points, poles, residue, complex integration using the method of residues, evaluation of real integrals by
contour integration

RECOMMENDED BOOKS

S. No	Name	Author(S)	Publisher
1	Fourier Series& Boundary Value Problems	R.V. Churchill & J.W. Brown	McGraw-Hill – 2006
2	Higher Engineering Mathematics	Dr. B.S. Grewal. Publisher	Khanna, New Delhi.
3	Elementry Differential Equations	W.E Boyce and R. Diprima	John Wiley-2005

Course Code	EVS101
Course Title	Environmental sciences
Type of Course	Core
L T P	3:0:0
Credits	3
Course Prerequisites	Basic Sciences
Course Objectives (CO)	To make students aware about environment and need of maintaining it with best possible knowledge

SYLLABUS

UNIT-I:Introduction to Environment and Ecosystem: Definition and scope and importance of multidisciplinary nature of environment. Need for public awareness, Concept of Ecosystem, Structure, interrelationship, producers, Consumers and decomposers, ecological pyramids-biodiversity and importance. Hot spots of biodiversity.

UNIT II:Environmental Pollution & Natural Resources: 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 measure of urban and industrial wastes.Role of an individual in prevention of pollution. Pollution case studies.Disaster Management: Floods, earthquake, cyclone and landslides, Natural Resources and associated problems, use and over exploitation, case studies of forest mresources and water resources.

UNIT-III:Social Issues and the Environment :From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Case studies. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland reclamation.Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of pollution) Act. Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation

UNIT-IV:Human Population and the Environment & Field Work: Population growth, variation among nations. Population explosion –Family Welfare Programme. Environment and human health, Human Rights, Value Education, HIV/AIDS. Women and child Welfare. Role of Information Technology in Environment and human health. Case studies
Visit to a local area to document environemntalassetsriver/forest/grassland/hill/mountain;Visit to a local polluted site-Urban/Rural/Industrial/Agricultural;Study of common plants, insects, birds;Study of simple ecosystems-pond, river, hill slopes, etc.

RECOMMENDED BOOKS

S. No	Name	Author(S)	Publisher
1	A Textbook for Environmental Studies	ErachBharucha	Orient BlackSwan
2	Environmental Biology,	Agarwal, K.C. 2001	Nidi Publ. Ltd. Bikaner.
3	Environmental Science,	Miller T.G. Jr.	Wadsworth

Course Code	EE210
Course Title	Electrical Machines -II Lab
Type of Course	Core
L T P	0:0:2
Credits	1
Course Prerequisites	Electrical Machine –II (Theory)
Course Objectives (CO)	Construct equivalent circuits of induction motors by routine tests. Study the requirement of starting and speed control methods of induction motors in the various applications of industry and construct equivalent circuits of synchronous generator and motor.

SYLLABUS

To perform load-test on three-phase Induction motor and to plot torque versus speed characteristics.

a) To perform no-load and blocked–rotor tests on three-phase Induction motor to obtain equivalent circuit.
b) To develop an algorithm (Matlab/C/C++) for speed torque characteristics using calculated equivalent circuit parameters.

2. To study the speed control of three-phase Induction motor by Kramer's Concept.

3. To study the speed control of three-phase Induction motor by cascading of two induction motors, i.e. by feeding the slip power of one motor into the other motor.
4. To study star- delta starters physically and
a) to draw electrical connection diagram

b) to start the three-phase Induction motor using it.
c) to reverse the direction of three-phase Induction motor

5. To start a three-phase slip –ring induction motor by inserting different levels of resistance in the rotor circuit and plot torque –speed characteristics.

6. To perform no-load and blocked–rotor test on single-phase Induction motor and to determine the parameters of equivalent circuit drawn on the basis of double revolving field theory.

7. To perform no load and short circuit. Test on three-phase alternator and draw open and short circuit characteristics.
8. To find voltage regulation of an alternator by zero power factor (ZPF.) method.

9. To study effect of variation of field current upon the stator current and power factor with synchronous motor running at no load and draw Voltage and inverted Voltage curves of motor.

10. To study synchroscope physically and parallel operation of three-phase alternators using synchroscope.
11. Starting of synchronous motors using:
(i) Auxiliary motor (ii) Using Damper windings

Course Code	EE212
Course Title	Control System Lab
Type of Course	Core
L T P	0:0:2
Credits	1
Course Prerequisites	Control System
Course Objectives (CO)	To apply various programs to control electrical systems. Systems and their examples.

SYLLABUS

1. To study the characteristics of potentiometers and to use 2- potentiometers as an error detector in a control system.
2. To study the synchro Transmitter-Receiver set and to use it as an error detector
3. To study the Speed – Torque characteristics of an AC Servo Motor and to explore its applications.
4. To study the Speed – Torque characteristics of an DC Servo Motor and explore its applications.
5. To study the variations of time lag by changing the time constant using control engineering trainer
6. To simulate a third order differential equations using an analog computer and calculate time response specifications
7. To obtain the transfer function of a D.C. motor – D.C. Generator set using Transfer Function Trainer
8. To study the speed control of an A.C. Servo Motor using a closed loop and an open loop systems
    a) To study the operation of a position sensor and study the conversion of position in to corresponding voltage
    b) To study an PI control action and show its usefulness for minimizing steady state error of time response.
9. To measure Force / Displacement using Strain Gauge in a wheat stone bridge
10. To design a Lag compensator and test its performance characteristics.

Course Code	**EE214**
Course Title	**Microprocessor & Interfacing Applications Lab**
Type of Course	PC
L T P	0:0:2
Credits	1
Course Prerequisites	Readers should have had an introductory digital course.and Assembly language experience
Course Objectives (CO)	1. To study 8085 kit. 2. To study 8086 kit. 3. To study various programs in assembly language using 8085/ 8086 kits.

SYLLABUS

List of Experiments: **8085**

1. Study of 8085 Microprocessor kits.
2. Write a program to add two 8 bit no's numbers .
3. Write a program to add two 16 bit no's.
4. Write a program to subtract two 8 bit no's..
5. Write a program to subtract two 16 bit no's..
6. Write a program to multiply two 8 bit no's using repetitive addition method.
7. Write a program to multiply two 8 bit no's by rotation method.
8. Write a program to multiply 16 bit no. with 8 bit no.
9. Write a program to control traffic light system.
10. Write a program to control speed of DC motor using 8255 PPI.

List of Experiments: **8086**

11. Study of 8086 microprocessor kit.
12. Write a program to copy 12 bytes of data from source to destination .
13. Write a program to find maximum and minimum from series.
14. Write a program to for division of a defined double word by another word and verify.
15. Write a program to control the operation of a stepper motor using 8086.

FIFTH SEMESTER

Course Code	EE301
Course Title	Power System –I (Apparatus & Modelling)
Type of Course	Core
L T P	3:0:0
Credits	3
Course Prerequisites	Basic Electrical Engineering
Course Objectives (CO)	Understand the concepts of power systems. Understand the various power system components. Evaluate fault currents for different types of faults. Understand the generation of over-voltages and insulation coordination.

SYLLABUS

UNIT I: Evolution of Power Systems and Present-Day Scenario. Structure of a power system: Bulk Power Grids and Micro-grids. Generation: Conventional and Renewable Energy Sources. Distributed Energy Resources. Energy Storage. Transmission and Distribution Systems: Line diagrams, transmission and distribution voltage levels and topologies (meshed and radial systems). Synchronous Grids and Asynchronous (DC) interconnections. Review of Three-phase systems. Analysis of simple three-phase circuits. Power Transfer in AC circuits and Reactive Power.

UNIT II:**Overhead Transmission Lines and Cables**: Electrical and Magnetic Fields around conductors, Corona. Parameters of lines and cables. Capacitance and Inductance calculations for simple configurations. Travelling-wave Equations. Sinusoidal Steady state representation of Lines: Short, medium and long lines. Power Transfer, Voltage profile and Reactive Power. Characteristics of transmission lines. Surge Impedance Loading. Series and Shunt Compensation of transmission lines.

Transformers: Three-phase connections and Phase-shifts. Three-winding transformers, auto-transformers, Neutral Grounding transformers. Tap-Changing in transformers. Transformer Parameters. Single phase equivalent of three-phase transformers.

Synchronous Machines: Steady-state performance characteristics. Operation when connected to infinite bus. Real and Reactive Power Capability Curve of generators. Typical waveform under balanced terminal short circuit conditions – steady state, transient and sub-transient equivalent circuits. Loads: Types, Voltage and Frequency Dependence of Loads. Per-unit System and per-unit calculations. UNDERGROUND CABLES: Classification of cables

UNIT III: Generation of Over-voltages: Lightning and Switching Surges. Protection against Over-voltages, Insulation Coordination. Propagation of Surges. Voltages produced by traveling surges. Bewley Diagrams.

Fault Analysis and Protection Systems Method of Symmetrical Components (positive, negative and zero sequences). Balanced and Unbalanced Faults. Representation of generators, lines and transformers in sequence networks. Computation of Fault Currents. Neutral Grounding. Switchgear: Types of Circuit Breakers. Attributes of Protection schemes, Back-up Protection. Protection schemes (Over-current, directional, distance protection, differential protection) and their application.

UNIT IV:DC Transmission Systems: Line-Commutated Converters (LCC) and Voltage Source Converters (VSC). LCC and VSC based dc link, Real Power Flow control in a dc link. Comparison of ac and dc transmission. Solar PV systems: I-V and P-V characteristics of PV panels, power electronic interface of PV to the grid.

RECOMMENDED BOOKS

S. No	Name	Author(S)	Publisher
1	"Power System Analysis"	J. Grainger and W. D. Stevenson,	McGraw Hill Education,
2	"Electric Energy Systems Theory	O. I. Elgerd	McGraw Hill Education
3	Power System Analysis	A. R. Bergen and V. Vittal	Pearson Education Inc

Course Code	EE303
Course Title	Electromagnetic Fields
Type of Course	Core
L T P	3:1:0
Credits	4
Course Prerequisites	Fundamentals of Mathematics & Physics
Course Objectives (CO)	To understand the relationship between the electricity, magnetism, electric fields, magnetic fields and electromagnetic waves, study Maxwell equations, deal with the application of electromagnetic waves i.e. Reflection and refraction of plane electromagnetic waves and to discuss the need of field theory approach of electromagnetic in understanding the waveguides.

SYLLABUS

UNIT I: Introduction: Review of scalar & vector field, Dot & cross products, Physical interpretation of gradient, divergence & curl, Gauss divergence theorem, Stroke's Theorem, Electric flux, Gauss's law for electrostatics, uniqueness theorem, boundary conditions for the electrostatic field, magnetic flux density, faraday's law of EMI, Biot-savartlaw, ampere circuital law.

UNIT II: Electromagnetic Waves: Equation of continuity, Maxwell's equation in differential and integral form, concept of conduction current and displacement current. Wave equation and its solution in different media, concept of plane waves, polarization and its types, reflection of waves by dielectric and insulator, Surface impedance, Poynting theorem &Poynting vector.

UNIT III: Guided Waves: Waves between parallel plane, TE and TM waves and their characteristics, TEM waves and characteristics, velocities of propagation, attenuation in parallel plane guides, wave impedance. Wave guides: Rectangular and circular wave guides, TE and TM waves in rectangular wave guides, wave impedance and characteristics impedance, transmission lines analogy for wave guides, attenuation factor of wave guides.

UNIT IV: Transmission lines: Introduction, Circuit representation of parallel plane Transmission lines, Parallel plane Transmission lines with losses, Low loss RF & UHF Transmission lines, Transmission line Equations, lossless Transmission lines, Distortion less lines, Standing waves, smith chart, impedance matching.

RECOMMENDED BOOKS

S. No	Name	Author(S)	Publisher
1	Electromagnetic Waves & Radiation System	E.C. Jordan & K. G. Balmain	Prentice Hall India
2	Electromagnetic	Krauss	Tata McGraw-Hill
3	Antennas and Wave Propagation	G S N Raju	Pearson publications
4	Antennas and Radio Wave Propagation	K D Prasad	Satya Prakashan
5	Antenna and Radio Wave Propagation	Collin R.E.	Tata McGraw-Hill
6	Concepts of Electromagnetic Field Theory	Amit sarin	Tata McGraw-Hill
7	Engineering Electromagnetics	John Buck and William H. Hayt	Tata McGraw-Hill

Course Code	EE305
Course Title	Measurements & Instrumentation
Type of Course	Core
L T P	4:0:0
Credits	4
Course Prerequisites	**BEEE**
Course Objectives (CO)	To Design and validate DC and AC bridges. To Analyze the dynamic response and the calibration of few instruments. To Learn about various measurement devices, their characteristics, their operation and their limitations. To Understand statistical data analysis. To Understand computerized data acquisition.

SYLLABUS

UNIT-I

Concepts relating to Measurements: True value, Accuracy, Precision, Resolution, Drift, Hysteresis, Dead-band, Sensitivity. Errors in Measurements. Basic statistical analysis applied to measurements: Mean, Standard Deviation, Six-sigma estimation, Cp (Capability process), Cpk (Capability process index).

UNIT-II

Sensors, actuators and Transducers for physical parameters: temperature, pressure, torque, flow. Speed and Position Sensors.

UNIT-III

Current and Voltage Measurements. Shunts, Potential Dividers. Instrument Transformers, Hall Sensors. Measurements of R, L and C.

UNIT-IV

Digital Multi-meter, True RMS meters, Clamp-on meters, Meggers. Digital Storage Oscilloscope.

RECOMMENDED BOOKS

S. No	Name	Author(S)	Publisher
1	Electronics Instrumentation and Measurements	Bell David	APrentice Hall, India
2	Electrical and Electronics Measurement and Instrumentation	Sawhney A. K	Dhanpat Rai and Sons
3	Electrical Measurements and Measuring instruments	Golding Edward William	Charles Wheelers India

Course Code	EE313
Course Title	Electrical Energy Conservation & Auditing
Type of Course	PE
L T P	3:0:0
Credits	3
Course Prerequisites	Basic Electrical Engineering
Course Objectives (CO)	Understand the current energy scenario and importance of energy conservation, energy management, methods of improving energy efficiency in different electrical systems.

SYLLABUS

UNIT I: Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2003 and its features.

UNIT II: Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion

UNIT III: Energy Management & Audit (6 Hours) Definition, energy audit, need, types of energy audit. Energy management (audit) approach understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments. Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams

UNIT IV: Energy Efficiency in Electrical Systems (7 Hours) Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses. Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors.

RECOMMENDED BOOKS

S. No	Name	Author(S)	Publisher
1	" of Electrical Energy and Conservation",	S. C. Tripathy,	McGraw Hill, 1991
2	Guide books for National Certification Examination for Energy Manager / Energy	Auditors Book-1,	General Aspects (available online)
3	Guide books for National Certification Examination for Energy Manager / Energy	Auditors Book-3,	Electrical Utilities (available online

Course Code	EE315
Course Title	Industrial Electrical Systems
Type of Course	PE
L T P	3:0:0
Credits	3
Course Prerequisites	Power System
Course Objectives (CO)	Understand the electrical wiring systems for residential, commercial and industrial consumers, representing the systems with standard symbols and drawings, SLD, components of industrial electrical systems,analyze and select the proper size of various electrical system components.

SYLLABUS

UNIT I: Electrical System Components (8 Hours) LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices.

UNIT II: Residential and Commercial Electrical Systems (8 Hours) Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.

UNIT III: Illumination Systems (6 Hours) Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premise, flood lighting.Industrial Electrical Systems I (8 Hours) HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components.

UNIT IV: Industrial Electrical Systems II DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks. Industrial Electrical System Automation : Study of basic PLC, Role of in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation

RECOMMENDED BOOKS

S. No	Name	Author(S)	Publisher
1	"Electrical Wiring, Estimating & Costing"	S. L. Uppal and G. C. Garg,	Khanna publishers
2	Electrical Design, Estimating & Costing	K. B. Raina	New age International, 2007.
3.	Electrical estimating and costing	S. Singh and R. D. Singh,	Dhanpat Rai and Co.,

Course Code	EE317
Course Title	Digital Control System
Type of Course	PE
L T P	3:0:0
Credits	3
Course Prerequisites	Control System
Course Objectives (CO)	Understand the electrical wiring systems for residential, commercial and industrial consumers, representing the systems with standard symbols and drawings, SLD, components of industrial electrical systems,analyze and select the proper size of various electrical system components.

SYLLABUS

UNIT-I: STATE VARIABLE ANALYSIS State variable representation of systems by various methods, solution of state variable model. Controllability and observability.

UNIT-II:PHASE PLANE ANALYSIS Features of linear and non-linear systems, Common physical non-linearities, Concept of phase portraits, Singular points, Limit cycles, Construction of phase portraits.

UNIT-III:DESCRIBING FUNCTION ANALYSIS Basic concepts, limitations, use of describing function for stability analysis, derivation of describing functions for common non-linearities, .

UNIT-IV: STABILITY ANALYSIS Introduction, Lyapunov's direct method, generation of Lyapunov's function by Krasovskii's and Variable Gradient methods, Popov's criterion.

UNIT V :OPTIMAL CONTROL:- Optimal Control versus Conventional Control, Types of Optimal Control Problems , Basic Concepts of Calculus of Variation, Finding Minima of function, Linear Quadratic Regulator (LQR) Problem

RECOMMENDED BOOKS			
S. No	**Name**	**Author(S)**	**Publisher**
1	Control Systems Engineering	I.J. Nagrath and M. Gopal	New Age International Publishers,
2	Modern control system theory	M.Gopal	New Age International Publishers
3.	Automatic Control Systems	George J. Thaler	Jaico Publishers

Course Code	SSC303
Course Title	Human values & Professional Ethics
Type of Course	HS
L T P	3:0:0
Credits	3
Course Prerequisites	Nil
Course Objectives (CO)	To help the students to discriminate between valuable and superficial in the life. To help students develop sensitivity and awareness; leading to commitment and courage to act on their own belief. This Course will encourage the students to discover what they consider valuable. Accordingly, they should be able to discriminate between valuable and the superficial in real situations in their life. This course is an effort to fulfill our responsibility to provide our students significant input about understanding

SYLLABUS

UNIT-I:Course Introduction-Need, Basic Guidelines, Content and Process for Value Education : Understanding the need, basic guidelines, content and process for Value Education, Understanding Happiness and Prosperity correctly.
Understanding Harmony in the Human Being : Understanding the harmony with self and the Body: Sanyam and Swasthya.

UNIT II:Harmony in Human Relationship: Understanding harmony in the Family- the basic unit of human interaction, visualizing a universal harmonious order in society **Understanding Harmony in the Nature and Existence:** Understanding the harmony in the Nature, Holistic perception of harmony at all levels of existence

UNIT III: Understanding of Harmony on Professional Ethics: Ability to utilize the professional competence for augmenting universal human order, Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems
.
UNIT IV:Strategy for transition from the present state to Universal Human Order: At the level of individual, at the level of society. **Case studies**: typical holistic technologies, management models and production systems

Recommended Books

S. No.	Author(S)	Year	Publisher
1	A Foundation Course in Value Education	R R Gaur, R Sangal	Excel Books Publishers
2	Energy & Equity	Ivan Illich	.The Trinity Press, Worcester, and HarperCollins, USA
3	Human Values and Professional Ethics	RishabhA nand	Satya Prakashan, New Delhi
4	Jeevan VidyaekParichay.	A Nagraj	Divya Path Sansthan,Amarkantak.

Course Code	PLS303
Course Title	Constitution of India
Type of Course	MC
L T P	3:0:0
Credits	NC
Course Prerequisites	Nil
Course Objectives (CO)	To enable the students to study and understand the basics of Indian Constitutions, aware the learners about the duties of Citizens. Also to aware about roots of Indian constitution and its relevance in present scenario.

SYLLABUS

UNIT I: Course Introduction- Need, Basic Guidelines, Content and Process for Value Education: Understanding the need, basic guidelines, content and process for Value Education, Understanding Happiness and Prosperity correctly.
Understanding Harmony in the Human Being: Understanding the harmony with self and the Body: Sanyam and Swasthya.

UNIT II: Harmony in Human Relationship: Understanding harmony in the Family- the basic unit of human interaction, visualizing a universal harmonious order in society
Understanding Harmony in the Nature and Existence: Understanding the harmony in the Nature, Holistic perception of harmony at all levels of existence

UNIT III: Understanding of Harmony on Professional Ethics: Ability to utilize the professional competence for augmenting universal human order, Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems.

UNIT IV: Strategy for transition from the present state to Universal Human Order: At the level of individual, at the level of society.
Case studies: typical holistic technologies, management models and production systems

RECOMMENDED BOOKS			
S. No	**Name**	**Author(S)**	**Publisher**
1	A Foundation Course in Value Education	R R Gaur, R Sangal, G P Bagaria	Excel Books Publishers
2	Energy & Equity	Ivan Illich	The Trinity Press, Worcester, and HarperCollins, USA
3	Human Values and Professional Ethics	RishabhAnand	Satya Prakashan, New Delhi
4	Jeevan VidyaekParichay	A Nagraj	Divya Path Sansthan,Amarkantak.

Course Code	EE309
Course Title	Power System- I Lab
Type of Course	PC
L T P	0:0:2
Credits	1
Course Prerequisites	Readers should have an introductory knowledge of switchgear and protection.
Course Objectives (CO)	1. To study different types of substation equipments . 2. To study different types of relays. 3. To study characteristics of fuse and MCB.

SYLLABUS

1. To measure negative sequence and zero sequence reactance of Synchronous Machines.

2. Design of transmission systems for given power and distance.

3. Fault analysis for line-to-line (L-L), Line-to-Ground (L-G) and double line to ground fault.

4. a) To study the performance of a transmission line.

b) Compute its ABCD parameters.

5. To study the earth resistance using three spikes.

6. To study the Scott connections using three-phase transformers.

7. To demonstrate the series compensation using Matlab/PSCAD/Power world.

8. To demonstrate the shunt compensation using Matlab/PSCAD/Power world.

Course Code	EE311
Course Title	Measurements & Instrumentation Lab
Type of Course	PC
L T P	0:0:2
Credits	1
Course Prerequisites	Basic Electrical Engineering
Course Objectives (CO)	Design and validate DC and AC bridges, analyze the dynamic response and the calibration of few instruments, learn about various measurement devices, their characteristics, their operation and their limitations.

SYLLABUS

1. Measurement of a batch of resistors and estimating statistical parameters.
2. Measurement of L using a bridge technique as well as LCR meter.
3. Measurement of C using a bridge technique as well as LCR meter.
4. Measurement of Low Resistance using Kelvin's double bridge.
5. Measurement of High resistance and Insulation resistance using Megger.
6. Usage of DSO for steady state periodic waveforms produced by a function generator.Selection of trigger source and trigger level, selection of time-scale and voltage scale.Bandwidth of measurement and sampling rate.
7. Download of one-cycle data of a periodic waveform from a DSO and use values to computethe RMS values using a C program.
8. Usage of DSO to capture transients like a step change in R-L-C circuit.
9. Current Measurement using Shunt, CT, and Hall Sensor.

SIXTH SEMESTER

Course Code	EE302
Course Title	Power System-II (Operation & Control)
Type of Course	Core
L T P	4:0:0
Credits	4
Course Prerequisites	BEE, CT and Power System –I
Course Objectives (CO)	Understand methods to control the voltage, frequency and power flow, monitoring and control of a power system and basics of power system economics.

SYLLABUS

UNIT-I:

Review of the structure of a Power System and its components. Analysis of Power Flows: Formation of Bus Admittance Matrix. Real and reactive power balance equations at a node. Load and Generator Specifications. Application of numerical methods for solution of non-linear algebraic equations – Gauss Seidel and Newton-Raphson methods for the solution of the power flow equations. Computational Issues in Large-scale Power Systems.

UNIT-II:

Stability Constraints in synchronous grids.

Swing Equations of a synchronous machine connected to an infinite bus. Power angle curve. Description of the phenomena of loss of synchronism in a single-machine infinite bus system following a disturbance like a three--phase fault. Analysis using numerical integration of swing equations (using methods like Forward Euler, Runge-Kutta 4th order methods), as well as the Equal Area Criterion. Impact of stability constraints on Power System Operation. Effect of generation rescheduling and series compensation of transmission lines on stability.

UNIT-III:Control of Frequency and Voltage

Turbines and Speed-Governors, Frequency dependence of loads, Droop Control and Power Sharing. Automatic Generation Control. Generation and absorption of reactive power by various components of a Power System. Excitation System Control in synchronous generators, Automatic Voltage Regulators. Shunt Compensators, Static VAR compensators and STATCOMs. Tap Changing Transformers.
Power flow control using embedded dc links.

UNIT-IV:Monitoring and Control

Overview of Energy Control Centre Functions: SCADA systems. Phasor Measurement Units and Wide-Area Measurement Systems. State-estimation. System Security Assessment. Normal, Alert, Emergency, Extremis states of a Power System. Contingency Analysis. Preventive Control and Emergency Control.

RECOMMENDED BOOKS

S. No	Name	Author(S)	Publisher
1	Switchgear and Protection	Rao S.	Khanna Publishers
2	A Textbook on Power System Engineering a Course in Electrical Power	Chakrabarti A., Soni, M.L. Gupta P.V. and Bhatanagar U.S Wadhawa C.L	Dhanpat Rai and Co
3	Elect A Course in Electrical Power	Wadhawa C.L	New Age international Pvt. Ltd

Course Code	EE304
Course Title	Power Electronics
Type of Course	PC
L T P	3:0:0
Credits	3
Course Prerequisites	Analog Electronics
Course Objectives (CO)	1. To became familiar with Thyristor . 2. To became familiar with Rectifiers. 3. To understand the operation of choppers, Cyclo-Converters & Inverters.

SYLLABUS

UNIT-I:

Half-wave diode rectifier with RL and RC loads; 1-phase full-wave diode rectifier with L, C and LC filter; 3-phase diode rectifier with L, C and LC filter; continuous and discontinuous conduction, input current waveshape, effect of source inductance; commutation overlap.

Thyristor rectifiers with passive filtering : Half-wave thyristor rectifier with RL and RC loads; 1-phase thyristor rectifier with L and LC filter; 3-phase thyristor rectifier with L and LC filter; continuous and discontinuous conduction, input current waveshape.

UNIT-II:

Thyristor commutation techniques: Multi-Pulse converter

Review of transformer phase shifting, generation of 6-phase ac voltage from 3-phase ac, 6-pulse converter and 12-pulse converters with inductive loads, steady state analysis, commutation overlap, notches during commutation.

Single-phase ac-dc single-switch boost converter

Review of dc-dc boost converter, power circuit of single-switch ac-dc converter, steady state analysis, unity power factor operation, closed-loop control structure.

UNIT-III

Ac-dc bidirectional boost converter

Review of 1-phase inverter and 3-phase inverter, power circuits of 1-phase and 3-phase ac-dc boost converter, steady state analysis, operation at leading, lagging and unity power factors. Rectification and regenerating modes. Phasor diagrams, closed-loop control structure.

UNIT-IV

Isolated single-phase ac-dc flyback converter

Dc-dc flyback converter, output voltage as a function of duty ratio and transformer turns ratio. Power circuit of ac-dc flyback converter, steady state analysis, unity power factor operation, closed loop control structure.

RECOMMENDED BOOKS

S. No	Name	Author(S)	Publisher
1	Power Electronics	Bimbhra, P.S	Khanna Publishers.
2	Power Electronics	Singh M.D. and Khanchandani K.B	Tata Mc Graw Hill Publishing company limited
3.	Power Electronics, Circuits Devices and Applications.	Rashid M.H.	Prentice Hall (India)

Course Code	EE318
Course Title	Microcontroller and Interfacing Applications
Type of Course	Core
L T P	3:0:0
Credits	3
Course Prerequisites	Basics of Digital Electronics
Course Objectives (CO)	The course has been planned to know the architecture, instruction sets and various techniques for the interfacing of 8051 with different real world I/O devices to accomplish certain tasks.

SYLLABUS

UNIT I: Introduction to 8085 Microprocessor: Difference between Microprocessor and CPU, Evolution &history of microprocessors, application areas of microprocessors,8085 Microprocessor architecture, Pin diagram of 8085.

UNIT II: Introduction to 8051 Microcontrollers and assembly language programming: Basic differences and similarities between Microprocessor and Microcontroller, Overview of 8051 family, Intel 8051 history, Pin diagram of 8051, 8051-Architecture, Additional features in 8052.Introduction to 8051 Assembly programming, Assembling and running an 8051 program, Data Types and directives, 8051 flag bits and PSW register. Register banks and stack.

UNIT III: Instruction Set of 8051: Addressing modes and accessing memory using various addressing modes, Jump, Loop and Call instructions, Arithmetic instructions and programs, Logic instructions and programs, Single bit instructions and programming, Timer/counter programming in the 8051

UNIT IV: Serial Communication: 8051 connection to RS 232, 8051 serial communication programming. Hardware interfacing: Interfacing to a LCD, Keyboard, ADC, DAC , Stepper Motors and sensors.

RECOMMENDED BOOKS

S. No	Name	Author(S)	Publisher
1	Microprocessor Architecture, Programming and Applications with the 8085	Ramesh S. Gaonkar	Penram International
2	The 8051 Mi/roller and embedded Systems	Ali Mazidi	Pearson Education
3	The PIC Microcontroller and Embedded Systems	Ali Mazidi	Ali Mazidi
	An Embedded Software Primer	David e Simon	Pearson Education

Course Code	EE312
Course Title	Electrical Machine Design
Type of Course	PE
L T P	3:0:0
Credits	3
Course Prerequisites	Electrical Machine
Course Objectives (CO)	Understand the construction and performance characteristics of electrical machines , factors which influence the design: electrical, magnetic and thermal loading of electrical machines.

SYLLABUS

UNIT-I: Major considerations in electrical machine design, electrical engineering materials, space factor, choice of specific electrical and magnetic loadings, thermal considerations, heat flow, temperature rise, rating of machines.

UNIT-II: Sizing of a transformer, main dimensions, kVA output for single- and three-phase transformers, window space factor, overall dimensions, operating characteristics, regulation, no load current, temperature rise in transformers, design of cooling tank, methods for cooling of transformers.

UNIT-III: Sizing of an induction motor, main dimensions, length of air gap, rules for selecting rotor slots of squirrel cage machines, design of rotor bars & slots, design of end rings, design of wound rotor, magnetic leakage calculations, leakage reactance of polyphase machines, magnetizing current, short circuit current, circle diagram, operating characteristics.

UNIT-IV Sizing of a synchronous machine, main dimensions, design of salient pole machines, short circuit ratio, shape of pole face, armature design, armature parameters, estimation of air gap length, design of rotor, design of damper winding, determination of full load field mmf, design of field winding, design of turbo alternators, rotor design.

RECOMMENDED BOOKS

S. No	Name	Author(S)	Publisher
1	A Course in Electrical Machine Design	A. K. Sawhney	Dhanpat Rai and Sons
2	Theory & Performance & Design of A.C. Machines	M.G. Say	ELBS London.
3.	Design of Rotating Electrical Machines	Juha Pyrhonen, Tapani Jokinen	Wiley

Course Code	EE314
Course Title	Electrical Drives
Type of Course	PE
L T P	3:0:0
Credits	3
Course Prerequisites	Electrical Machines
Course Objectives (CO)	Understand the characteristics of dc motors and induction motors,principles of speed-control of dc motors and induction motors, power electronic converters used for dc motor and induction motor speed control.

SYLLABUS

UNIT-I: DC motor characteristics: Review of emf and torque equations of DC machine, review of torque-speed characteristics of separately excited dc motor, change in torque-speed curve with armature voltage, example load torque-speed characteristics, operating point, armature voltage control for varying motor spee

d, flux weakening for high speed operation.

UNIT-II: Chopper fed DC drive :Review of dc chopper and duty ratio control, chopper fed dc motor for speed control, steady state operation of a chopper fed drive, armature current waveform and ripple, calculation of losses in dc motor and chopper, efficiency of dc drive, smooth starting

UNIT-III:: Closed-loop control of DC Drive :structure of DC drive, inner current loop and outer speed loop, dynamic model of dc motor – dynamic equations and transfer functions, modeling of chopper as gain with switching delay, plant transfer function, for controller design, current controller specification and design, speed controller specification and design.

UNIT-IV:: Induction motor characteristics :Review of induction motor equivalent circuit and torque-speed characteristic, variation of torque-speed curve with (i) applied voltage, (ii) applied frequency and (iii) applied voltage and frequency, typical torque-speed curves of fan and pump loads, operating point, constant flux operation, flux weakening .Scalar control or constant V/f control of induction motor operation. Control of slip ring induction motor

RECOMMENDED BOOKS			
S. No	**Name**	**Author(S)**	**Publisher**
1	Power Semiconductor Controlled Drives	G. K. Dubey,	Prentice Hall,
2	“Electric Motor Drives: Modeling, Analysis and Control	. R. Krishnan,	Prentice Hall,
3.	Fundamentals of Electrical Drives	. G. K. Dubey	CRC Press

Course Code	EE316
Course Title	Digital Signal Processing
Type of Course	PE
L T P	3:0:0
Credits	3
Course Prerequisites	Mathematics & linear control system.
Course Objectives (CO)	Represent signals mathematically in continuous and discrete-time, and in the frequency domain, analyze discrete-time systems using z-transform. Understand the Discrete-Fourier Transform (DFT) and the FFT algorithms.

SYLLABUS

UNIT-I:Introduction: Signals, Systems and Signal processing, Classification of Signals, Concept of frequency in continuous time and discrete time signals. **Discrete Time Signals and Systems:** Discrete time signals, Discrete time systems, Analysis of discrete time linear time-invariant systems, Discrete time systems described by difference equations, Implementation of discrete system, Correlation of discrete time signals.

UNIT-II:Z-Transform: The Z-transformation, properties of Z-transformation, Rational Z-transformation, Inversion of Z-transform, Analysis of linear time invariant systems in Zdomain. **Frequency Analysis of Signals and Systems:** Frequency analysis of continuous time signals, Frequency analysis of discrete time signals, Properties of Fourier Transform for discrete time signals, Frequency domain characteristics of linear time invariant systems, linear invariant systems as frequency selective filters, Inverse systems and de-convolution.

UNIT-III:The Discrete Fourier Transform: Frequency domain sampling, Properties of Discrete Fourier Transform (DFT), Linear filtering methods based on DFT, Frequency analysis of signals using the DFT.

UNIT-IV:Design of Digital Filters: General considerations, Design of Finite Impulse Response (FIR) filters, Design of Infinite Impulse Response (IIR) filters from analog filters, Frequency transformations, Design of digital filters based on least-square method and window method, Comparison of IIR and FIR filters.

RECOMMENDED BOOKS

S. No	Name	Author(S)	Publisher
1	Kuo, Sen-Maw and Gan	Digital Signal Processing architectures, Implementations, and Applications	McGraw Hill
2	Digital Signal Processing	Oppenheim A.V. and Schafer, R.W	Prentice Hall (India)
3.	Digital Signal Processing: Principles, Algorithms, and Applications	Proakais John G	Pearson Education 4th Ed

Course Code	EE326
Course Title	Line commutated and Active PWM Rectifiers.
Type of Course	PE
L T P	3:0:0
Credits	3
Course Prerequisites	Circuit Theory, Basic Electronics
Course Objectives (CO)	Analyse controlled rectifier circuits. Understand the operation of line-commutated rectifiers – 6 pulse and multi-pulse configurations. Understand the operation of PWM rectifiers – operation in rectification and regeneration modes and lagging, leading and unity power factor mode.

SYLLABUS

UNIT-I:

Diode rectifiers with passive filtering

Half-wave diode rectifier with RL and RC loads; 1-phase full-wave diode rectifier with L, C and LC filter; 3-phase diode rectifier with L, C and LC filter; continuous and discontinuous conduction, input current waveshape, effect of source inductance; commutation overlap.

UNIT-II:

Thyristor rectifiers with passive filtering

Half-wave thyristor rectifier with RL and RC loads; 1-phase thyristor rectifier with L and LC filter; 3-phase thyristor rectifier with L and LC filter; continuous and discontinuous conduction, input current waveshape

UNIT-III:

Review of transformer phase shifting, generation of 6-phase ac voltage from 3-phase ac, 6-pulse converter and 12-pulse converters with inductive loads, steady state analysis, commutation overlap, notches during commutation.

Single-phase ac-dc single-switch boost converter: Review of dc-dc boost converter, power circuit of single-switch ac-dc converter, steady state analysis, unity power factor operation, closed-loop control structure.

UNIT-IV

Ac-dc bidirectional boost converter

Review of 1-phase inverter and 3-phase inverter, power circuits of 1-phase and 3-phase ac-dc boost converter, steady state analysis, operation at leading, lagging and unity power factors. Rectification and regenerating modes. Phasor diagrams, closed-loop control structure.

Isolated single-phase ac-dc flyback converter

Dc-dc flyback converter, output voltage as a function of duty ratio and transformer turns ratio. Power circuit of ac-dc flyback converter, steady state analysis, unity power factor operation, closed loop control structure.

RECOMMENDED BOOKS

S. No	Name	Author(S)	Publisher
1	"Principles of Thyristorised Converters",	G. De,	Oxford & IBH Publishing Co, 1988.
2	"Principles of Power Electronics",	J.G. Kassakian, M. F. Schlecht and G. C. Verghese,	Addison-Wesley, 1991
3.	"Power Electronics: Essentials and Applications",	L. Umanand	Wiley India, 2009.

Course Code	EE320
Course Title	**Control Systems Design**
Type of Course	PE
L T P	3:0:0
Credits	3
Course Prerequisites	Control Systems
Course Objectives (CO)	i. Understand various design specifications. ii. Design controllers to satisfy the desired design specifications using simple controller structures (P, PI, PID, compensators). iii. Design controllers using the state-space approach.

SYLLABUS

UNIT-I:Design Specifications

Introduction to design problem and philosophy. Introduction to time domain and frequency domain design specification and its physical relevance. Effect of gain on transient and steady state response. Effect of addition of pole on system performance. Effect of addition of zero on system response.

Module 2: Design of Classical Control System in the time domain

Introduction to compensator. Design of Lag, lead lag-lead compensator in time domain. Feedback and Feed forward compensator design. Feedback compensation. Realization of compensators.

UNIT-II:

Design of Classical Control System in frequency domain

Compensator design in frequency domain to improve steady state and transient response.
Feedback and Feed forward compensator design using bode diagram.

Module 4: Design of PID controllers

Design of P, PI, PD and PID controllers in time domain and frequency domain for first, second and third order systems. Control loop with auxiliary feedback – Feed forward control.

UNIT-III:

Control System Design in state space

Review of state space representation. Concept of controllability & observability, effect of pole zero cancellation on the controllability & observability of the system, pole placement design through state feedback. Ackerman's Formula for feedback gain design. Design of Observer. Reduced order observer. Separation Principle.

UNIT-IV

Nonlinearities and its effect on system performance

Various types of non-linearities. Effect of various non-linearities on system performance.
Singular points. Phase plot analysis.

RECOMMENDED BOOKS

S. No	Name	Author(S)	Publisher
1	"Control system Engineering",	N. Nise,	John Wiley, 2000..
2	"Control system engineering",	I. J. Nagrath and M. Gopal,	Wiley, 2000
3.	"Linear control system analysis and design (conventional and modern)"	J. J. D'Azzo and C. H. Houpis,	McGraw Hill, 1995.

Course Code	**EE322**
Course Title	**Non Conventional Energy Sources**
type of Course	PE
L T P	3 0 0
Credits	3
Course Prerequisites	Power Electronics, Physics
Course Objectives (CO)	The class will explore society's present needs and future energy demands, examine conventional energy sources and systems, then focus on alternate, renewable energy sources such as solar and wind power.

SYLLABUS

UNIT-I

History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics-probability distributions, Wind speed and power-cumulative distribution functions.

UNIT II:

Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent-Magnet Synchronous Generators, Power electronics converters. Generator-Converter configurations, Converter Control.

UNIT III:

Introduction, MHD, Biomass, Fuel Cell, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solarday length, Estimation of solar energy availability.

UNIT IV:

Technologies-Amorphous, monocrystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array, Power Electronic Converters for Solar Systems

Recommended Books

S.No.	Name	Author(s)	Publisher
1	Non-Conventional Energy Sources	G.D. Rai	Khanna Publishers
2	Renewable Energy Resources	Twidell&Wier	CRC Press(Taylor & Francis)
3	Solar Energy: Principles of Thermal Collection and Storage.	S. P. Sukhatme	McGraw Hill, 1984.
4	Wind Power in Power Systems	T. Ackermann	John Wiley and Sons Ltd., 2005.

Course Code	EE324
Course Title	Biomedical Instrumentation
Type of Course	PE
L T P	3:0:0
Credits	3
Course Prerequisites	Instrumentation
Course Objectives (CO)	To understand various bio-electric signals and their utilization for recording various parameters using biomedical instruments.

UNIT-I Physiological Transducers: Introduction to physiological systems, Pressure transducers, Transducer for body temperature measurement. Pulse sensors, Respiration sensors.

UNIT-II Bio-Electric Signals and Electrodes: Origin of bio-electric signals (ECG, EEG, EMG), Recording electrodes, Electrical conductivity of electrode jellies and creams.

UNIT-III Assistive devices for human body: Stimulator, defibrillator, pacemaker, diathermy. Prosthetics: Upper and lower extremity prostheses, harness control, EMG-controlled externally powered prosthesis, basic concept of mono functional and multifunctional devices.

UNIT-IV Biotelemetry: Physiological parameters adaptable to bio-telemetry, Components of a biotelemetry system, Implantable units, Application of telemetry in patient care.

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Biomedical Instrumentation and Measurements,	Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer	PHI, 2nd Edition, 2004
2	Hand book of Biomedical Instrumentation ,	Khandpur R.S	Tata McGraw Hill, 2004.
3	Principles of Applied Biomedical Instrumentation ,	L.A. Geddes and L.E. Baker,	John Wiley

Course Code	EE306
Course Title	POWER SYSTEM-II LAB
Type of Course	PC
L T P	0:0:2
Credits	1
Course Prerequisites	Power System-II
Course Objectives (CO)	To understand MATLAB/PSCAD/POWER WORLD and its applications

SYLLABUS

1. Short circuit calculations and calculation of circuit breaker ratings for a power system network.
2. (a) Y-bus formation using MATLAB/PSCAD/POWER WORLD
   (b) Z-bus formulation using MATLAB/PSCAD/POWER WORLD
3. Load flow analysis by Gauss Seidal Method.
4. Load flow analysis by Newton Raphson Method.
5. To obtain power system stability on High Voltage Alternating Current (HVAC) system with the help of Flexible Alternating Current Transmission Systems (FACTS) devices using MATLAB/PSCAD/POWER WORLD.
6. Optimal Capacitor placement on a system having variable reactive power and low voltage profile.
7. To obtain relay co-ordination on a power system.
8. To find synchronous reactances (transient, sub-transient) during fault analysis.
9. To study the characteristics of a distance relay.
10. To study and design a synchronous machine for stability study using swing equation with the help of MATLAB/PSCAD/POWER WORLD.

Course Code	**EE308**
Course Title	**Power Electronics Lab.**
Type of Course	**PC**
L T P	**0:0:2**
Credits	**1**
Course Prerequisites	**Power Electronics**
Course Objectives (CO)	**TO understand the characteristics of POWER ELECTRONICS components.**

SYLLABUS

1. To plot V-I characteristics and study the effect of gate triggering on turning on of SCR.
2. To draw V-I characteristics of an UJT and to use UJT as relaxation oscillator.
3. To study the effect of free-wheeling diode on power factor for single phase half-wave rectifier with R-L load.
4. To plot waveforms for output voltage and current, for single phase full-wave, fully controlled bridge rectifier, for resistive and resistive cum inductive loads.
5. Study of the microprocessor-based firing control of a bridge converter.
6. To study three phase fully controlled bridge converter and plot waveforms of output voltage, for different firing angles.
7. To study Jones chopper or any chopper circuit to check the performance.
8. Thyristorised speed control of a D.C. Motor.
9. Speed Control of induction motor using thyristors.
10. Study of series inverter circuit and to check its performance.
11. Study of a single-phase cycloconverter.
12. To check the performance of a McMurray half-bridge inverter.

Course Code	EE328
Course Title	Microcontroller & Interfacing Applications Lab
Type of Course	Core
L T P	0:0:2
Credits	1
Course Prerequisites	Microprocessor
Course Objectives (CO)	To apply various programs to control electrical machines using microprocessor and microntroller.

SYLLABUS

1. Study of 8051/8031 Micro-controller kits.

2. Write a program to add two numbers lying at two memory locations and display the result.

3. Write a program for multiplication of two numbers lying at memory location and display the result.

4. Write a program to check a number for being ODD or EVEN and show the result on display.

5. Write a program to split a byte in two nibbles and show the two nibbles on display.

6. Write a program to arrange TEN numbers stored in memory location in ascending and descending order.

7. Write a program to find a factorial of a given number.

8. Study of interrupt structure of 8051/8031 micro-controllers.

9. Write a program to show the use of INT0 and INT1.

10. Write a program of flashing LED connected to port 1 of the micro-controller.

11. Write a program to control a stepper motor in direction, speed and number of steps.

12. Write a program to control the speed of DC motor.

SEVENTH SEMESTER

Course Code	**EE401**
Course Title	Electronic Design Laboratory
Type of Course	Core
L T P	1:0:4
Credits	3
Course Prerequisites	Measurements And Instrumentation
Course Objectives (CO)	i. Understand the practical issues related to practical implementation of applications using electronic circuits. ii. Choose appropriate components, software and hardware platforms. iii. Design a Printed Circuit Board, get it made and populate/solder it with components. iv. Work as a team with other students to implement an application.

Syllabus:-

Basic concepts on measurements; Noise in electronic systems; Sensors and signal conditioning circuits; Introduction to electronic instrumentation and PC based data acquisition; Electronic system design, Analog system design, Interfacing of analog and digital systems, Embedded systems, Electronic system design employing microcontrollers, CPLDs, and FPGAs, PCB design and layout; System assembly considerations. Group projects involving electronic hardware (Analog, Digital, mixed signal) leading to implementation of an application.

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Microelectronic circuits	A. S. Sedra and K. C. Smith,	Oxford University Press, 2007.
2	The Art of Electronics	P. Horowitz and W. Hill,	Cambridge University Press, 1997

Course Code	**EE405**
Course Title	**High Voltage Engineering**
Type of Course	PE
L T P	3:0:0
Credits	3
Course Prerequisites	Power System
Course Objectives (CO)	To be familiar with components used in HVDC and HVAC transmission system with their constructional detail/layout.

SYLLABUS

UNIT-I

Extra (EHV) Transmission and Corona Loss: Need for EHV Transmission. Use of bundled conductors, corona characteristics of smooth bundled conductors with different configurations, Corona loss. Factors affecting the corona loss. Radio interference due to corona. Shunt and series compensation in EHV lines. Tuned power lines. Insulation Co-ordination.

UNIT-II

High Voltage Direct Current (HVDC) Transmission: Advantages, disadvantages and economics of HVDC Transmission system. Types of Direct Current (DC) links, converter station equipment, their characteristics. Insulating materials for High Voltage Applications of insulating materials used in power transformers rotating machines, circuit breakers, cables, power capacitors.

UNIT-II

Conduction and breakdown in Gases, Liquids and Solid Dielectrics: Solids - Intrinsic, electromechanical and thermal breakdown composite dielectrics, solid dielectrics used in practice. Liquids:-Conduction and breakdown in pure and commercial liquids, suspended particle theory, cavitation and bubble theory, stressed oil volume theory, Liquids used in practice. Gases:-Ionization process, Townsend's current growth equations, Ist and 2nd ionization coefficients. Townsend's criterion for breakdown. Streamer theory of breakdown, Pashen's law of Gases. Gases used in practice.

UNIT-IV

Generation of High Voltages: High Voltage Direct Current (HVDC), High Voltage Alternating Current (HVAC), Power frequency and High frequency: Impulse voltage and impulse current Generation, Tripping and contact of Impulse Generator. Measurement of voltage and current: High voltage direct current, Alternating current and Impulse voltage and currents.

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Extra High Voltage A.C. Transmission Engineering,	Bagamudre, Rakesh Das	New Age International Publishers
2	High Voltage Direct Current Transmission	Kimbark E.W	Wiley-Interscience
3	High Voltage Engineering	Kamaraju V. and Naidu M.S	Tata McGraw-Hill Education

Course Code	**EE407**
Course Title	**High Voltage DC Transmission Systems**
Type of Course	PE
L T P	3:0:0
Credits	3
Course Prerequisites	Power System
Course Objectives (CO)	i. Understand the advantages of dc transmission over ac transmission. ii. Understand the operation of Line Commutated Converters and Voltage Source Converters. iii. Understand the control strategies used in HVdc transmission system. iv. Understand the improvement of power system stability using an HVdc system.

SYLLABUS

UNIT-IDC Transmission Technology Comparison of AC and dc Transmission (Economics, Technical Performance and Reliability). Application of DC Transmission. Types of HVdc Systems. Components of aHVdc system. Line Commutated Converter and Voltage Source Converter based systems.

UNIT-II

Analysis of Line Commutated and Voltage Source Converters.

Line Commutated Converters (LCCs): Six pulse converter, Analysis neglecting commutation overlap, harmonics, Twelve Pulse Converters. Inverter Operation. Effect of Commutation Overlap. Expressions for average dc voltage, AC current and reactive power absorbed by the converters. Effect of Commutation Failure, Misfire and Current Extinction in LCC links. Voltage Source Converters (VSCs): Two and Three-level VSCs. PWM schemes: Selective Harmonic Elimination, Sinusoidal Pulse Width Modulation. Analysis of a six pulse converter. Equations in the rotating frame. Real and Reactive power control using a VSC.

UNIT-II

Control of HVdc Converters: (10 hours)

Principles of Link Control in aLCCHVdc system. Control Hierarchy, Firing Angle Controls – Phase-Locked Loop, Current and Extinction Angle Control, Starting and Stopping of a Link. Higher level Controllers Power control, Frequency Control, Stability Controllers. Reactive Power Control. Principles of Link Control in a VSC HVdc system: Power flow and dc Voltage Control. Reactive Power Control/AC voltage regulation.

UNIT-IV

Stability Enhancement using HVdc Control

Basic Concepts: Power System Angular, Voltage and Frequency Stability. Power Modulation: basic principles – synchronous and asynchronous links. Voltage Stability Problem in AC/dc systems.**MTdc Links** Multi-Terminal and Multi-Infeed Systems. Series and Parallel MTdc systems using LCCs. MTdc systems using VSCs. Modern Trends in HVdcTechnology. Introduction to Modular Multi-level Converters.

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	HVDC Power Transmission Systems	K. R. Padiyar.	New Age International Publishers, 2011.
2	High Voltage Direct Current Transmission	J. Arrillaga	Peter Peregrinus Ltd., 1983
3	Direct Current Transmission.	E. W. Kimbark.	Vol.1, Wiley-Interscience, 1971.

Course Code	**EE409**
Course Title	**Computational Electromagnetics**
Type of Course	Core
L T P	3:0:0
Credits	3
Course Prerequisites	**Electromagnetic theory**
Course Objectives (CO)	i. Understand the basic concepts of electromagnetics. ii. Understand computational techniques for computing fields. iii. Apply the techniques to simple real-life problems.

SYLLABUS

UNIT-I

Conventional design methodology, Computer aided design aspects – Advantages. Review of basic fundamentals of Electrostatics and Electromagnetics. Development of Helmhotz equation, energy transformer vectors- Poynting and Slepian, magnetic Diffusion-transients and time-harmonic.

UNIT-II

Analytical Methods (6 hours)

Analytical methods of solving field equations, method of separation of variables, Roth's method, integral methods- Green's function, method of images.

Module 3: Finite Difference Method (FDM)

Finite Difference schemes, treatment of irregular boundaries, accuracy and stability of FD solutions, Finite-Difference Time-Domain (FDTD) method- Uniqueness and convergence.

UNIT-III

Finite Element Method (FEM)

Overview of FEM, Variational and Galerkin Methods, shape functions, lower and higher order elements, vector elements, 2D and 3D finite elements, efficient finite element computations.

UNIT-IV

Special Topics

Background of experimental methods-electrolytic tank, R-C network solution, Field plotting (graphical method), hybrid methods, coupled circuit - field computations, electromagnetic - thermal and electromagnetic - structural coupled computations, solution of equations, method of moments, Poisson's fields.

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Finite Element for Electrical Engineers	P. P. Silvester and R. L. Ferrari	Cambridge University press, 1996.
2	Numerical Techniques in Electromagnetics	M. N. O. Sadiku,	CRC press, 2001.

Course Code	**MGT401**
Course Title	Organization Behavior
Type of Course	HS
L T P	4:0:0
Credits	4
Course Prerequisites	Nil
Course Objectives (CO)	The aim is to enable the student to know about the behavior of Individual in the organization.

SYLLABUS

UNIT-I

Organization Behavior: its Concepts, Features and Importance, Challenges and Opportunities for OB. Foundations of Individual Behavior. Learning, Concept, Theories and Principles of learning, Reinforcement. Perception**,** Concept, Perceptual Process, Factors in Interpersonal perception. Attitude**,** Concept, Components, Attitude formation, Values & Beliefs.

Unit II

Leadership, Concept, Theories and Leadership Styles in Management.
Transactional Analysis: Life positions, Levels of Self Awareness-Johari window Model, Ego States. Motivation: Nature, importance, process, Theories of Motivation, Application of Motivation Perception: Concept, Theories of Personality, Determinants of Personality

Unit-III

Group Dynamics: Concept and nature of group formation, Models of Group formation, Theories of group formation. Group decision making techniques. Difference between group and team, Types of Teams, Power and Politics: Concept, Bases of power, Tactics to gain Power, Techniques of politics. Stress Management: Meaning, Concept, Causes of Organization Stress, Stress Management.

Unit-IV

Organization Change: Concept, Change Agents, Resistance to change, Overcoming resistance to change, Organization Culture: Concept, functions of Organization Culture, Development and implications of Organization Culture, Creating and sustaining Organization Culture.

Organization Development: Concept, Interventions of Organization Development

RECOMMENDED BOOKS

Sr. no.	Name	AUTHOR(S)	PUBLISHER
1	Organizational Behavior	Luthans,F	McGraw –Hill Inc.
2	Understanding Organizational Behaviour	Pareek, U	Oxford University Press, Delhi.

Course Code	EE411
Course Title	Power System Protection
Type of Course	PE
L T P	3:0: 0
Credits	3
Course Prerequisites	Power System
Course Objectives (CO)	i. Understand the different components of a protection system. ii. Evaluate fault current due to different types of fault in a network. iii. Understand the protection schemes for different power system components. Understand the basic principles of digital protection. iv. Understand system protection schemes, and the use of wide-area measurements.

SYLLABUS

UNIT-I

Introduction and Components of a Protection System : Principles of Power System Protection, Relays, Instrument transformers, Circuit Breakers

Faults and Over-Current Protection :Review of Fault Analysis, Sequence Networks. Introduction to Overcurrent Protection and overcurrent relay co-ordination.

UNIT-II

Equipment Protection Schemes:Directional, Distance, Differential protection. Transformer and Generator protection. Bus bar Protection, Bus Bar arrangement schemes.

Digital Protection: Computer-aided protection, Fourier analysis and estimation of Phasors from DFT. Sampling, aliasing issues.

UNIT-III

Modeling and Simulation of Protection Schemes (8 hours) CT/PT modeling and standards, Simulation of transients using Electro-Magnetic Transients (EMT) programs. Relay Testing.

UNIT-IV

System Protection:Effect of Power Swings on Distance Relaying. System Protection Schemes. Under-frequency, under-voltage and df/dt relays, Out-of-step protection, Synchro-phasors, Phasor Measurement Units and Wide-Area Measurement Systems (WAMS). Application of WAMS for improving protection systems.

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Fundamentals of power system Protection	Y. G.Paithankar and S. R. Bhide,	Y.G.Prentice Hall, India, 2010.
2	A. G. Phadke and J. S. Thorp,	A. G. Phadke and J. S. Thorp	John Wiley & Sons, 1988.
3	Synchronized Phasor Measurements and their Applications	A. G. Phadke and J. S. Thorp	Springer, 2008.

Course Code	EE413
Course Title	**Electromagnetic waves**
Type of Course	PE
L T P	3: 0:0
Credits	3
Course Prerequisites	Electromagnetic Field Theory.
Course Objectives (CO)	i. Analyze transmission lines and estimate voltage and current at any point on transmission line for different load conditions. ii. Provide solution to real life plane wave problems for various boundary conditions. iii. Analyze the field equations for wave propagation in special cases such as lossy and low loss dielectric media. iv. Visualize TE and TM mode patterns of field distributions in a rectangular wave-guide. v. Understand and analyse radiation by antennas.

SYLLABUS

UNIT-I

Introduction, Concept of distributed elements, Equations of voltage andcurrent, Standing waves and impedance transformation, Lossless and low-loss transmission lines, Power transfer on a transmission line, Analysis of transmission line in terms of admittances, Transmission line calculations with the help of Smith chart, Applications of transmission line, Impedance matching using transmission lines.

UNIT-II

Basic quantities of Electromagnetics, Basic laws of Electromagnetics: Gauss's law, Ampere's Circuital law, Faraday's law of Electromagnetic induction. Maxwell's equations, Surface charge and surface current, Boundary conditions at media interface.

Homogeneous unbound medium, Wave equation for time harmonic fields, Solution of the wave equation, Uniform plane wave, Wave polarization, Wave propagation in conducting medium, Phase velocity of a wave, Power flow and Poynting vector.

UNIT-III

Plane wave in arbitrary direction, Plane wave at dielectric interface, Reflection and refraction of waves at dielectric interface, Total internal reflection, Wave polarization at media interface, Brewster angle, Fields and power flow at media interface, Lossy media interface, Reflection from conducting boundary.

UNIT-IV

Parallel plane waveguide: Transverse Electric (TE) mode, transverse Magnetic(TM) mode, Cut-off frequency, Phase velocity and dispersion. Transverse Electromagnetic (TEM) mode, Analysis of waveguide-general approach, Rectangular waveguides.

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Electromagnetic Waves	R. K. Shevgaonkar,	Tata McGraw Hill, 2005.
2	Field and Wave Electromagnetics	D. K. Cheng	Addison-Wesley, 1989.
3	Advanced Engineering Electromagnetics	C. A. Balanis	John Wiley & Sons, 2012.

Course Code	EE415
Course Title	**Power Quality and FACTS**
Type of Course	PE
L T P	3:0:0
Credits	3
Course Prerequisites	Power System, Power Electronics.
Course Objectives (CO)	i. Understand the characteristics of ac transmission and the effect of shunt and series reactive compensation. ii. Understand the working principles of FACTS devices and their operating characteristics. iii. Understand the basic concepts of power quality. iv. Understand the working principles of devices to improve power quality.

SYLLABUS

UNIT-I

Basics of AC Transmission. Analysis of uncompensated AC transmission lines. Passive Reactive Power Compensation. Shunt and series compensation at the mid-point of an AC line. Comparison of Series and Shunt Compensation. Description and Characteristics of Thyristor-based FACTS devices: Static VAR Compensator (SVC), Thyristor Controlled Series Capacitor (TCSC), Thyristor Controlled Braking Resistor and Single Pole Single Throw (SPST) Switch. Configurations/Modes of Operation, Harmonics and control of SVC and TCSC. Fault Current Limiter.

UNIT-II

Voltage Source Converters (VSC): Six Pulse VSC, Multi-pulse and Multi-level Converters, Pulse-Width Modulation for VSCs. Selective Harmonic Elimination, Sinusoidal PWM and Space Vector Modulation. STATCOM: Principle of Operation, Reactive Power Control: Type I and Type II controllers, Static Synchronous Series Compensator (SSSC) and Unified Power Flow Controller (UPFC): Principle of Operation and Control. Working principle of Interphase Power Flow Controller. Other Devices: GTO Controlled Series Compensator. Fault Current Limiter.

UNIT-III

Application of FACTS devices for power-flow control and stability improvement. Simulation example of power swing damping in a single-machine infinite bus system using a TCSC. Simulation example of voltage regulation of transmission mid-point voltage using a STATCOM.

UNIT-IV

Reactive Power Compensation, Harmonics and Unbalance mitigation in Distribution Systems using DSTATCOM and Shunt Active Filters. Synchronous Reference Frame Extraction of Reference Currents. Current Control Techniques in for DSTATCOM.

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	FACTS Controllers in Power Transmission and Distribution"	K. R. Padiyar,	", New Age International (P) Ltd. 2007.
2	Understanding FACTS: Concepts and Technology of FACTS Systems.	N. G. Hingorani and L. Gyugyi	Wiley-IEEE Press, 1999.
3	Electrical Power Systems Quality.	R. C. Dugan,	McGraw Hill Education, 2012.

Course Code	EE417
Course Title	Electrical and Hybrid Vehicles
Type of Course	PE
L T P	3: 0: 0
Credits	3
Course Prerequisites	Power Sources, Electric Drives and Control System
Course Objectives (CO)	i. Understand the models to describe hybrid vehicles and their performance. ii. Understand the different possible ways of energy storage. iii. Understand the different strategies related to energy storage systems.

SYLLABUS

UNIT-I

Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, mathematical models to describe vehicle performance.

Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, 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.

UNIT-II

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 hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

UNIT-III

Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. 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, Communications, supporting subsystems

UNIT-IV

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, implementation issues of energy management strategies.

Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives	C. Mi, M. A. Masrur and D. W. Gao	John Wiley & Sons, 2011.
2	Hybrid Electric Vehicles: Energy Management Strategies	S. Onori, L. Serrao and G. Rizzoni	Springer, 2015.
3	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design	M. Ehsani, Y. Gao, S. E. Gay and A. Emadi,.	CRC Press, 2004.

Course Code	**EE419**
Course Title	Advance Electric Drives
Type of Course	PE
L T P	3:0:0
Credits	3
Course Prerequisites	Power electronics & electrical machines.
Course Objectives (CO)	i. Understand the operation of power electronic converters and their control strategies. ii. Understand the vector control strategies for ac motordrives iii. Understand the implementation of the control strategies using digital signal processors.

SYLLABUS

UNIT-I

PWM control of inverter, selected harmonic elimination, space vector modulation, current control of VSI, three level inverter, Different topologies, SVM for 3 level inverter, Diode rectifier with boost chopper, PWM converter as line side rectifier, current fed inverters with self-commutated devices. Control of CSI, H bridge as a 4-Q drive.

UNIT-II

Different transformations and reference frame theory, modeling of induction machines, voltage fed inverter control-v/f control, vector control, direct torque and flux control(DTC).

Modeling of synchronous machines, open loop v/f control, vector control, direct torque control, CSI fed synchronous motor drives.

UNIT-III

Introduction to various PM motors, BLDC and PMSM drive configuration, comparison, block diagrams, Speed and torque control in BLDC and PMSM.

UNIT-IV

Evolution of switched reluctance motors, various topologies for SRM drives, comparison, Closed loop speed and torque control of SRM.

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Modern Power Electronics and AC Drives	B. K. Bose,	Asia, 2003.
2	Analysis of Electric Machinery and Drive Systems	P. C. Krause, O. Wasynczuk and S. D. Sudhoff	John Wiley & Sons, 2013.
3	DSP based Electromechanical Motion Control	H. A. Taliyat and S. G. Campbell	CRC press, 2003.

Course Code	EE421
Course Title	Power System Dynamics and Control
Type of Course	PE
L T P	3:0:0
Credits	3
Course Prerequisites	Power Systems
Course Objectives (CO)	To Understand the problem of power system stability and its impact on the system,analyse linear dynamical systems and use of numerical integration methods, model different power system components for the study of stability and understand the methods to improve stability.

SYLLABUS

UNIT-IIntroduction to Power System Operations (3 hours)

Introduction to power system stability.Power System Operations and Control, Stability problems in Power System, Impact on Power System Operations and control.Analysis of dynamical System, Concept of Equilibrium, Small and Large Disturbance Stability,Modal Analysis of Linear System, Analysisusing Numerical Integration Techniques and Issues in Modeling: Slow and Fast Transients, Stiff System.

UNIT-II Modeling of synchronous machine: Physical Characteristics. Rotor position dependentmodel. D-Q Transformation, Model with Standard Parameters, Steady State Analysis of Synchronous Machine, Short Circuit Transient Analysis of a Synchronous Machine, Synchronization of Synchronous Machine to an Infinite Bus. Modeling of Excitation andPrime Mover Systems.Physical Characteristics and Models.Excitation System Control.Automatic Voltage Regulator.Prime Mover Control Systems. Speed Governors.

UNIT –III Modeling of Transmission Lines and Loads.Transmission Line Physical Characteristics. Transmission Line Modeling. Load Models - induction machine model. Frequency andVoltage Dependence of Loads. Other Subsystems – HVDC and FACTS controllers, WindEnergy Systems.

UNIT-IV Angular stability analysis in Single Machine Infinite Bus System.Angular Stability in multimachine systems – Intra-plant, Local and Inter-area modes. Frequency Stability: Centre ofInertia Motion. Load Sharing: Governordroop. Single Machine Load Bus System: VoltageStability. Introduction to Torsional Oscillations and the SSR phenomenon. Stability AnalysisTools:Transient Stability Programs, Small Signal Analysis Programs

RECOMMENDED BOOKS

S. No.	NAME	Author	Publisher
1	Power System Dynamics, Stability and Control	K.R. Padiyar	B. S. Publications, 2002.
2	Power System Stability and Control	P. Kundur	McGraw Hill, 1995
3	Power System Dynamics and Stability	P. Sauer and M. A. Pai	Prentice Hall, 1997

Open Electives

Course Code	**CSE371**
Course Title	**Basics Of Database Design**
Type of Course	**OE**
L T P	3: 0: 0
Credits	3
Course Prerequisites	Elementary knowledge about computers including some experience using Windows. Basic knowledge about programming in some common programming language.
Course Objectives (CO)	This subject assesses new developments in database technology. It Interpret and explain the impact of emerging database standards and Evaluate the contribution of database theory to practical implementations of database management systems

SYLLABUS

UNIT-I

Introduction to Databases and Transactions: Basic concepts **of** database, Need of database system, File based system, view of data, database architecture,**Data Models:** The importance of data models, Basic building blocks, Business rules, The evolution of data models, Degrees of data abstraction.**Database Design ER-Diagram:** Database design and ER Model: overview, ER-Model, Constraints, ER-Diagrams, ERD Issues, weak entity sets, Codd's rules, Relational Schemas.

UNIT-II

Relational database Model: Logical view of data, keys, integrity rules. Relational Database design: features of good relational database design, atomic domain and Normalization.**Relational Algebra and Calculus:** Relational algebra: introduction, Selection and projection, set operations, renaming, Joins, Division, syntax, semantics. Operators, grouping and ungrouping, relational comparison. Calculus: Tuple relational calculus, Domain relational Calculus, calculus vs algebra, computational capabilities.

UNIT-III

Constraints, Views and SQL: Database Languages, Constraints and its types, Integrity constraints, Views: Introduction to views, updates on views, comparison between tables and views SQL: data definition, aggregate function, Null Values.

UNIT-IV

Transaction management and Concurrency control: Transaction management: ACID properties, serializability and concurrency control, Lock based concurrency control (2PL, Deadlocks),Time stamping methods, optimistic methods, database recovery management

Database Security and Authorization: Introduction to Database Security Issues, Discretionary Access Control Based on Granting/Revoking of Privileges.

RECOMMENDED BOOKS

Sr. no.	Name	Author(S)	Publisher
1	Fundamentals of Database Systems, Third Edition	Elmasri/Navathe	Addison Wesley
2	Database Concepts	Korth and Silberschatz Abraham,	McGraw Hall
3	An introduction to Database Systems	C.J.Date.	Addison Wesley
4	An introduction to Database Systems	Bipin C. Desai.	West Publishing
5	SQL,PL/SQL ,The programming language of oracle	Ivan Bayross	BPB Publication

Course Code	**CSE373**
Course Title	**Fuzzy logic**
Type of Course	OE
L T P	3:0: 0
Credits	3
Course Prerequisites	Basic knowledge about programming in some common programming language.
Course Objectives (CO)	To use Fuzzy logic in Design and Manufacture.

SYLLABUS

UNIT-I

Introduction, Classical Sets and Fuzzy Sets

Background, Uncertainty and Imprecision, Statistics and Random Processes, Uncertainty in Information, Fuzzy Sets and Membership, Chance versus Ambiguity. Classical Sets - Operations on Classical Sets, Properties of Classical (Crisp) Sets, Mapping of Classical Sets to Functions Fuzzy Sets - Fuzzy Set operations, Properties of Fuzzy Sets. Sets as Points in Hypercubes

UNIT-II

Classical Relations and Fuzzy Relations Cartesian Product, Crisp Relations- Cardinality of Crisp Relations, Operations on Crisp Relations, Properties of Crisp Relations, Composition. Fuzzy Relations - Cardinality of Fuzzy Relations, Operations on Fuzzy Relations, Properties of Fuzzy Relations, Fuzzy Cartesian Product and Composition.

UNIT-III

Membership Functions Features of the Membership Function, Standard Forms and Boundaries, Fuzzification, Membership Value Assignments – Intuition, Inference, Rank Ordering, Angular Fuzzy Sets, Neural Networks, Genetic Algorithms, Inductive Reasoning.

UNIT-IV

Fuzzy-to-Crisp Conversions, Fuzzy Arithmetic, Defuzzification Methods Extension Principle - Crisp Functions, Mapping and Relations, Functions of fuzzy Sets.**Fuzzy Rule- Based Systems**Rule-Based Systems - Canonical Rule Forms, Decomposition of Compound Rules, Likelihood and Truth Qualification, Aggregation of Fuzzy Rules, Graphical Techniques of Inference **Fuzzy Classification** Classification by Equivalence Relations - Crisp Relations, Fuzzy Relations. Cluster Analysis, Cluster Validity, c-Means Clustering - Hard c-Means (HCM), Fuzzy c-Means (FCM). Classification Metric, Hardening the Fuzzy c-Partition.

RECOMMENDED BOOKS

S.No.	Name	Author(s)	Publisher
1	Fuzzy Sets And Fuzzy Logic	Klir.G, Yuan B.B	Prentice Hall Of India Private Limited, 1997
2	Fundamentals Of Neural Networks	LauranceFausett	Prentice Hall

Course Code	**ME371**
Course Title	**Total Quality Management**
type of Course	OE
L T P	3 0 0
Credits	3
Course Prerequisites	Nil
Course Objectives (CO)	This subject provides students with the knowledge to understand the philosophy and core values of Total Quality Management (TQM), determining the voice of the customer and the impact of quality on economic performance and long-term business success of an organization; apply and evaluate best practices for the attainment of total quality.

SYLLABUS

UNIT-I

Quality and Total Quality Management: Excellence in manufacturing/service, factors of excellence, relevance of TQM.

Concept and definition of quality: Total quality control (TQC) and Total Quality Management (TQM), salient features of TQC and TQM. Total Quality Management Models, benefits of TQM.

Just-in-time (JIT): Definition: Elements, benefits, equipment layout for JIT system, Kanban system MRP (Material Requirement planning) vs JIT system, Waste elimination, workers involvement through JIT: JIT cause and effect chain, JIT implementation.

UNIT-II

Customer: Satisfaction, data collection and complaint, redressal mechanism.

Planning Process: Policy development and implementation; plan formulation and implementation. **Process Management:** Factors affecting process management, Quality function development (QFD), and quality assurance system.

UNIT-III

Total Employees Involvement (TEI): Empowering employees: team building; quality circles; reward and Recognition; education and training, Suggestion schemes. **Problems solving:** Defining problem, Problem identification and solving process, QC tools.

Benchmarking: Definition, concept, process and types of benchmarking.

UNIT-IV

Quality Systems: Concept of quality system standards: relevance and origin of ISO 9000; Benefits; Elements of ISO 9001, ISO 9002, ISO 9003. **Advanced techniques of TQM:** Design of experiments: failure mode effect analysis: Taguchi methods.

RECOMMENDED BOOKS

S.No.	Name	Author(s)	Publisher
1	Total Quality Management	Sunder Raju	Tata McGraw Hill.
2	TQM for engineers	M.Zairi	Aditya Books.
3	Total Quality Management Handbook	J.L. Hradeskym	McGraw Hill.
4	Total Quality Key terms and concepts	William L.Duncan	Amacom
5	Total Quality Management and Operational Excellence Text with Cases	John S. Oakland	Routledge

Course Code	**ME373**
Course Title	**Production Planning & Control**
Type of Course	**OE**
L T P	3:0:0
Credits	3
Course pre-requisite	NA
Course Objectives	The objective of this course is to Assist the students to acquire proficiency concept of planning and control of production.

Syllabus

UNIT-I

Production Planning & Control: Importance, Objectives, and Functions Types of Production Systems. Production Procedure: Production Cycle, Planning & Control in the Production Procedure. Production Organization: Organization Structure, Sections of Planning & Control Department. Product Selection, Process Selection, Plant Location, Plant Layout, Operations Capacity Planning.

UNIT-II

Production Order: Process Charts, Production Master Programmes, Operation & Route Sheets, Breakdown of the Production Order & preparation of various Cards. Production Planning: Operations Planning and Scheduling Systems, Aggregate Planning Process, Strategies for Aggregate Planning, Disaggregation of Aggregate Plans, Master Production Schedule (MPS), Material Requirement Planning (MRP), Rough Cut Capacity Planning.

UNIT-III

Production Control: Machine Loading; Infinite and Finite Loading, Gantt Load Chart, Visual Load Profiles; Detailed Scheduling: Gantt Scheduling Chart, Forward and Backward Scheduling, Forms Schedules, Inputs of Schedule, Drawing a Job Schedule, Factors influencing Scheduling, Procedure Scheduling, Reducing Scheduling Problems; Dispatching; Expediting; recording Progress; Input / Output Control.

UNIT-IV

Production Control for Mass Production: Design of Production Line, Assembly Line Balancing. Production Control for Batch production: Inventory Control for Single and Multiple Products, Line of Balance. Production control for Job Shop Production: Jumbled Flow in a Job Shop, Job Sequencing for Machine Limited Scheduling Systems, Job Sequencing for Men and Machine Limited Scheduling Systems.

RECOMMENDED BOOKS			
Sr No	**Author(s)**	**Title**	**Publisher**
1.	Bhupender Kour	Effectual Communication Skills	S.K. Kataria and Sons
2.	R. Datta Roy and K.K. Dheer	Communications Skills	Vishal Publishing Company
3	The Essence of Effective Communication	Ludlow and Panthon	Prentice Hall of India
4	Essentials of Business Comunication	Pal and Rorualling	S. Chand and Sons. New Delhi

Course Code	**EE371**
Course Title	Instrumentation in power system.
Type of Course	Open Elective
L T P	3:0:0
Credits	3
Course pre-requisite	Power System
Course Objectives	To be familiar with instruments used in power system, its types, techniques and working.

SYLLABUS

UNIT-I Measurement of electrical quantities, Active and reactive power in power plants, Energy meters, Instrument transformers and their transient response. **Instrumentation Techniques:** Telemetry, Remote Control, remote signaling and supervisory control and data acquisition (SCADA), signal formation, conversion and transmission.

UNIT-II Signal Transmission Techniques: Analog pulse and digital modulation, Amplitude modulation(AM) and Frequency modulation (FM), AM and FM Transmitter and Receiver, Phase Modulation, Pulse modulation, Digital transmission techniques, error detection and correction. **Telemetry:** Telemetry errors, DC, pulse and digital telemetry methods and systems.

UNIT-III Supervisory Control and Data Acquisition: Function of SCADA system remote terminal unit (RTU) details, Control center details, Communication between control centers, control center and remote terminal unit.

UNIT-IV Power Plant Instrumentation:, Thermal power plant instrumentation, Nuclear Power plant Instrumentation. Applications of SCADA system to Indian Power Systems.

RECOMMENDED BOOKS

Sr. no.	Name	AUTHOR(S)	PUBLISHER
1	Power System Control Technology	T. Cegrell	Prentice-Hall of India Private Limited
2.	Power Plant Control and Instrumentation	D.M Lindsley	IEEE Press (2000).
3	Modern Power Station Practice: Control and Instrumentation	E.W Jarvis	British Electricity International (1980)

Course Code	**EE373**
Course Title	**Elements of tPower System**
Type of Course	**OE**
L T P	3:0:0
Credits	3
Course Prerequisites	Basic electrical.
Course Objectives (CO)	To familiarize with concept of power system transmission and distribution.

SYLLABUS

UNIT-I

Power System Components: Single line Diagram of Power system, Brief description of power system Elements: Synchronous machine, transformer, transmission line, bus bar, circuit breaker and isolator Supply System Different kinds of supply system and their comparison, choice of transmission voltage

Transmission Lines: Configurations, types of conductors, resistance of line, skin effect, Kelvin's law. Proximity effect.

UNIT-II

Over Head Transmission Lines:-Calculation of inductance and capacitance of single phase, three phase, single circuit and double circuit transmission lines, Representation and performance of short, medium and long transmission lines, Ferranti effect. Surge impedance loading

Overhead line Insulators: Type of insulators and their applications, potential distribution over a string of insulators, methods of equalizing the potential, string efficiency

UNIT-III

Mechanical Design of transmission line: Catenary curve, calculation of sag & tension, effects of wind and ice loading, sag template, vibration dampers Insulated cables: Type of cables and their construction, dielectric stress, grading of cables, insulation resistance, capacitance of single phase and three phase cables, dielectric loss, heating of cables

UNIT-IV

EHV AC and HVDC Transmission: Introduction to EHV AC and HVDC transmission and their comparison, use of bundle conductors, kinds of DC links, and incorporation of HVDC into AC system.

RECOMMENDED BOOKS

Sr. no.	Name	AUTHOR(S)	PUBLISHER
1	Electrical Power Systems.	WadhwaC. L.	New age international Ltd.
2	Power System Analysis and Design.	GuptaB. R.	S. Chand & Co
3	Electric Power	Uppal S. L.	Khanna Publishers

Course Code	**ECE371**
Course Title	Mobile Communication
Type of Course	**OE**
L T P	3:0:0
Credits	3
Course Prerequisites	NA
Course Objectives (CO)	To build an understanding of the fundamental concepts and basic taxonomy of computer mobile communication area,to study architecture of GSM and CDMA technology, to explain the need and significance of different types of networks, topologies and protocols, to study and understand how mobile and rest of the world do actually communicates with each other.

SYLLABUS

UNIT I: Introduction to Cellular systems: Basic Cellular systems, Performance criteria, uniqueness of mobile radio environment, operation of cellular systems, concept of frequency reuse, cochannel interference reduction factor, desired C/I from a normal case in an omnidirectional antenna system, handoff mechanism, cell splitting, consideration of the components of cellular systems, different cellular systems and B3G systems.

UNIT II: Cochannel and Code channel interference reductions: Cochannel interference, exploring cochannel interference areas in a system, real time cochannel interference measurement at mobile radio transceivers, design of an omni-directional antenna system in worst case. Design of directional antenna system, lowering antenna height, reduction of cochannel interference by means of a notch in the tilted antenna pattern, umbrella pattern effect, use of parasitic elements, power control.

UNIT III: Handoff and Dropped Calls: Value of implementing handoffs, initiation of a hard handoff, delaying a handoff, forced handoffs, queuing of handoffs, power difference handoffs, MAHO and soft handoff, cell site handoff only, intersystem handoff, introduction to dropped call rate. GSM core network, GSM, BSS, NSS, OSS core and architecture overview, MSC (Mobile Switching Center), HLR (Home Location register), VLR (Visitor Location Register)

UNIT IV: Connectivity and interfaces, GSM subscriber services, Huawei GSM core network product, product introduction, Structure, logical structure etc. General call flows in Core network, Overview of GPRS/UMTS network, SGSN, GGSN, GPRS/UMTS network components. General call flows in Core network, Overview of GPRS/UMTS network, SGSN, GGSN, GPRS/UMTS network components. 3G Systems: WCDMA-UMTS (UTRA-FDD) physical layer, WCDMA-ARIB physical layer, WCDMA-TDD physical layer, UMTS network architecture, Evolution of UMTS-3GPP release 4 and beyond (release 5, 6,7)

RECOMMENDED BOOKS

S. No	Name	AUTHOR(S)	PUBLISHER
1.	Principle of Mobile Communication	Gordan L. Stuber	Springer
2.	Wireless communications	Theodore S. Rappaport	Tata McGraw Hill
3.	Wireless communication and networking	Vijay Garg	Elesvier

Course Code	**ECE373**
Course Title	Speech Signal & Image Processing
Type of Course	**OE**
L T P	3:0:0
Credits	3
Course Prerequisites	Microprocessor
Course Objectives (CO)	To provide the student with an appreciation to understand the concepts of Speech Signals and their processing and To analyze the different types of images and how can we apply different methods on images in order to enhance the different types of images.

SYLLABUS

UNIT I: Introduction to Image Processing Historical background, visual perception, image formation, Elements of Storage, sampling & Quantization, Relationships between pixels-neighbors of pixel, connectivity labeling of connected components, Relations, equivalence and Transitive closure, Distance measures, Arithmetic/ Logic operation, Imaging Geometry Basic and perspective transformation stereo imaging, application of image Processing.

UNIT II: Image Enhancement Spatial and frequency domain methods point processing, intensity transformation, Histogram processing image substation and Averaging spatial filtering, LP, HP and homomorphic
felling, generation of spatial marks, Color image processing.

UNIT III: The Fundamentals of Digital Speech Processing. A Review of Discrete-Time Signal &Systems, Fourier transfer, DFT, FFT Fundamental of Digital Filters, FIR system, IIR Systems. 2. Time –Domain Methods for Speech Processing. Time-Dependent Processing of speech, short-time energy and Average Magnitude, Short time Average Zero- Crossing Rate. 3. Digital Representation of speech Waveform Sampling speech signals, statistical model, Instantaneous quantization, Instantaneous companding, quantization for optimum SNR, Adaptive quantization, Feed-forward Feedback adaptions.

UNIT IV: Speech Processing Review of human speech and Acoustic theory, nature of sound, harmonics, resonance measurement, virtual display. Music theory, pitch, duration, intervals, rhythm. Human speech production, the vocal tract, the Larynx, the source filter. Speech signal processing-the phasor mode. Software, Elements of speech Synthesis speech Recognition-speech in the computer-human interface

RECOMMENDED BOOKS			
S. No	**Name**	**Author(S)**	**Publisher**
1	Digital Image Processing	Rafact Gonzalez and Richard E. Woods	Pearson Education
2	Digital Image Processing	Keenneth R Castleman	Pearson Education
3	Speech and Audio Processing for multimedia PC's	Iain Murray	Pearson Education

Course Code	**CE371**
Course Title	**Renewable Energy Resources**
Type of Course	**OE**
L T P	3:0:0
Credits	3
Course Prerequisites	NA
Course Objectives (CO)	The class will explore society's present needs and future energy demands, examine conventional energy sources and systems, including fossil fuels and nuclearenergy, and then focus on alternate, renewable energy sources such as solar, biomass (conversions), wind power, geothermal, and hydro.

SYLLABUS

UNIT-I

Principles of solar radiation: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

UNIT-II

Solar energy collection: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

Solar energy storage and applications: Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

UNIT-III

Wind energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria**Bio-mass:** Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engine operation and economic aspects.

UNIT-IV

Geothermal energy: Resources, types of wells, methods of harnessing the energy, potential in India. **Ocean energy:** OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics. **Direct energy conversion:** Need for DEC, Carnot cycle, limitations, principles of DEC

Recommended Books			
S.No.	**Name**	**Author(s)**	**Publisher**
1	Non-Conventional Energy Sources	G.D. Rai	Khanna Publishers
2	Renewable Energy Resources	Twidell&Wier	CRC Press(Taylor & Francis)
3	Renewable energy resources	Tiwari and Ghosal	Narosa.
4	Renewable Energy Technologies	K Mittal	Wheeler

Course Code	**CE373**
Course Title	**Architecture & Town Planning**
Type of Course	OE
L T P	3:0:0
Credits	3
Course Prerequisites	NIL
Course Objectives (CO)	To enable the students to relate the architectural projects in context of planning in rural, urban and regional context.

SYLLABUS

UNIT-I

Elements of Design:

Line direction. Shape, size, texture, value and colour, balance, scale and proportion.

Principles of Design: Repetition, gradation, harmony, contrast and unity, creation of 2 D and 3 D compositions.

UNIT-II

The Industrial Revolution: The age of revivals, the emergence of engineer, new materials and techniques and the evolution of balloon frame and steel frame. **Origin of Modern Architecture**: Definition and concept of modern architecture, various pioneers of modern architecture.

UNIT-III

Town Planning:

Definition and meaning, age of planning, scope and motives of planning, brief history of town planning – its origin and growth, historically development of town planning in ancient valley civilizations. Indus Nile Tigris and Euphrates, Greek Roman, Medieval and Renaissance town planning **New Concepts**: Garden city movement, Linear city and concentric city concepts, Neighbourhood and Radburm, La-cite industrial, Radiant city to present day planning.

UNIT-IV

Planning Principles: Types of town and their functions, types of town planning – Grid Iron, Radial, Spider webs, Irregular and Mixed, their advantages and disadvantages. **Planning Practice and Techniques**:

Zoning – its definition, procedure and districts, height and bulk zoning, F. A. R., Master Plan – Meaning, preparation and realization, the scope of city planning – city rehabilitation and slum clearance.

RECOMMENDED BOOKS

Sr. no.	Name	Author(s)	Publisher
1	Urban Planning Problems	Cherry, Gordon	Board Hill, London
2	Urban and Regional Planning in India	Sundaram,K V	Vikas Publishing house(P) Ltd.,New Delhi
3	The Urban Pattern	Gallion A B,Eisner S,	Van Nostrandreinhold,New York

Course Code	**CSE372**
Course Title	**Communication Networks**
Type of Course	**OE**
L T P	3:0:0
Credits	3
Course Prerequisites	Basic knowledge of Computer, Digital Circuits and Network Arrangement.
Course Objectives (CO)	To be familiar with various computer network architectures and to identify the infrastructure components, design Infrastructure including devices, topologies and protocols.

SYLLABUS

UNIT-I

Introduction to Computer Networks: Computer network and its goals, Types of computer networks: LAN, MAN, WAN, Wireless and wired networks, broadcast and point to point networks, Network topologies, Network software: concept of layers, protocols, interfaces and services, ISO-OSI reference model, TCP/IP reference model.

UNIT-II

Physical Layer: Concept of Analog & Digital Signal, Bandwidth, Transmission Impairments: Attenuation, Distortion, Noise, Data rate limits : Nyquist formula, Shannon Formula, Multiplexing : Frequency Division, Time Division, Wavelength Division, Introduction to Transmission Media : Twisted pair, Coaxial cable, Fiber optics, Wireless transmission (radio, microwave, infrared), Switching: Circuit Switching, Message Switching ,Packet Switching & their comparisons.

Data Link Layer: Design issues, Framing, Error detection and correction codes: checksum, CRC, hamming code, Data link protocols for noisy and noiseless channels, Sliding Window Protocols: Stop & Wait ARQ, Go-back-N ARQ, Selective repeat ARQ, Data link protocols: HDLC and PPP.
Medium Access Sub-Layer: Static and dynamic channel allocation, Random Access: ALOHA, CSMA protocols, Controlled Access: Polling, Token Passing, IEEE802.3 frame format, Ethernet cabling, Manchester encoding, collision detection in 802.3, Binary exponential back off algorithm.

UNIT-III

Network Layer: Design issues, IPv4 classful and classless addressing, subnetting, Routing algorithms: distance vector and link state routing, Congestion control: Principles of Congestion Control, Congestion prevention policies, Leaky bucket and token bucket algorithms.
Transport Layer: Elements of transport protocols: addressing, connection establishment and release, flow control and buffering, multiplexing and de-multiplexing, crash recovery, introduction to TCP/UDP protocols and their comparison.

UNIT-IV

Application Layer: World Wide Web (WWW), Domain Name System (DNS), E-mail, File Transfer Protocol (FTP), Network security.
Session & Presentation Layering and de-multiplexing, crashrecovery

RECOMMENDED BOOKS			
Sr. no.	**Name**	**Author(S)**	**Publisher**
1	Communication Networks: Fundamentals and Concepts and Key Architectures	Leon Garrcia and IndraWidjaja	TMH
2	Computer Networks.	A.S. Tanenbaum	PHI
3	Introduction to Data Communication and Networks	Forouzan, Coombs and Fagan	TMH
4	Data and Communication	William Stallings	PHI

Course Code	**CSE374**
Course Title	**Computer Organization**
Type of Course	**OE**
L T P	3:0:0
Credits	3
Course Prerequisites	Basic knowledge of computer and its components.
Course Objectives (CO)	This subject gives the basic knowledge to analyse architectures and computational designs and synthesize new and better architectures.

SYLLABUS

UNIT-I

Introduction: Introduction to Number System and Representation of information.

Register Transfer and Micro operations: Register transfer language & operations, arithmetic micro operations, logic micro operations, shift micro operations, arithmetic logic shift unit. Design of a complete basic computer and it's working.

UNIT-II

Basic Computer Organisation and Design: Instruction codes, Computer registers, Computer Instructions, Timing and control, Instruction Cycle, Memory reference instructions, Input/ Output and Interrupt, Design of basic Computer, Design of Accumulator Logic.

Design of Control Unit: Control memory, Hardwired control CPU design, Micro-programmed control CPU design and their comparative study.

UNIT-III

Central Processing Unit: General Register Organisation, Stack Organisation, Instruction formats, Addressing Modes, Data transfer and manipulations, Program control, RISC and CISC architecture.

Input-Output Organisation: Peripheral devices, I/O Interface, asynchronous data transfer, modes of transfer, priority interrupt, DMA, I/O processor, serial communication.

Memory Organisation: Memory hierarchy, main memory, auxiliary memory, associative memory, cache memory, virtual memory, memory management hardware.

UNIT-IV

Pipelining: Introduction to pipelining and pipeline hazards, design issues of pipeline architecture. **Introduction to Parallel Processing**: Inter-process or communication & synchronization.

RECOMMENDED BOOKS			
Sr. no.	**Name**	**Author(S)**	**Publisher**
1	Advanced Computer Architecture	Kai Hawang	Tata McGraw Hill
2	Computer Organization and Design	P.PalChoudhary	PHI
3	Computer System Architecture	M.Moris Mano	Pearson
4	Computer Organization and Architecture	William Stallings	Pearson

Course Code	**ME372**
Course Title	**Industrial Engineering Management**
Type of Course	OE
L T P	3:0:0
Credits	3
Course pre-requisite	None
Course Objectives	To familiarize the students with management of industrial resources and production operations

Syllabus

UNIT-1

Introduction: Definition and scope of industrial engineering Role of an industrial engineering Role of an industrial engineer in industry, Functions of industrial engineering department and its organization, Qualities of an industrial engineer. Plant Layout and Material Handling: Different types of layouts viz. Product, process and combination layouts, Introduction to layouts based on the GT, JIT and cellular manufacturing systems, Development of plant layout. Types of material handling equipment, relationship of material handling with plant layouts.

UNIT -2

Work-study: Areas of application of work study in industry; Method study and work measurements and their inter-relationship. Reaction of management and labour to work study; Role of work study in improving plant productivity and safety. Method Study: Objectives and procedure for methods analysis: Select, Record, Examine, Develop, Define, Install and Maintain. Recording techniques, Micromotion and macro-motion study: Principles of motion economy, Normal work areas and work place design.

UNIT-3

Work Measurement: Objectives, Work measurement techniques - time study, work sampling, pre-determined motion time standards (PMTS) Determination of time standards. Observed time, basic time, normal time, rating factors, allowances, standard time. Value Engineering: Types of values, concept of value engineering, phases of value engineering studies, application of value engineering.

UNIT-4

Work Design: Concepts of job enlargement, job enrichment and job rotation. Effective job design considering technological and behavior factors. Ergonomics: Introduction to ergonomic considerations in designing man-machine systems with special reference to design of displays and controls.

S. No	Author	Title	Publisher
1	GaylerShotbolt	Introduction to Work study	Tata McGraw Hill
2	H.S. Shan	Work Study and Ergonomics	Dhanpat Rai and Co.Ltd
3	R. Bernes	Motion and time study by	John-Wiley
4	D.J. Oborne	Ergonomics at work	John Wiley
5	D. Miles	Techniques of Value Analysis and Engineering	McGraw Hill

Course Code	**ME374**
Course Title	**Lean Manufacturing**
Type of Course	**OE**
L T P	3:0:0
Credits	3
Course pre-requisite	NIL
Course Objectives	Implement lean manufacturing concepts in the factories.

Syllabus

UNIT- I

INTRODUCTION: The mass production system – Origin of lean production system – Necessity – Lean revolution in Toyota – Systems and systems thinking – Basic image of lean production – Customer focus – Muda (waste).

UNIT- II

STABILITY OF LEAN SYSTEM: Standards in the lean system – 5S system – Total Productive Maintenance – standardized work – Elements of standardized work – Charts to define standardized work – Man power reduction – Overall efficiency - standardized work and Kaizen – Common layouts.

UNIT- III

JUST IN TIME: Principles of JIT – JIT system – Kanban – Kanban rules – Expanded role of conveyance – Production leveling – Pull systems – Value stream mapping.

UNIT- IV

JIDOKA (AUTOMATION WITH A HUMAN TOUCH): Jidoka concept – Poka-Yoke (mistake proofing) systems – Inspection systems and zone control – Types and use of Poka-Yoke systems – Implementation of Jidoka. **WORKER INVOLVEMENT AND SYSTEMATIC PLANNING METHODOLOGY:** Involvement – Activities to support involvement – Quality circle activity – Kaizen training - Suggestion Programmes – Hoshin Planning System (systematic planning methodology) – Phases ofHoshin Planning – Lean culture

RECOMMENDED BOOKS

Sr. no.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1.	How to implement lean manufacturing	Lonnie Wilson	Toyota Production
2.	Lean thinking: banish Waste and create wealth in your corporation	Daniel T. Jones and James P.Womack.	McGraw Hill
3	Statistics for six sigma	Warren Brussee	Made Easy

Course Code	**EE372**
Course Title	Electrical Generation & Economics
Type of Course	**OE**
L T P	3:0:0
Credits	3
Course Prerequisites	Electrical machine, Power system
Course Objectives (CO)	1. To became familiar with Economics of Power Plants. 2. To became familiar with Tariff & Power Factor.

SYLLABUS

UNIT-I

LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices.

UNIT-II

Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.

UNIT-III

Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premise, flood lighting.

UNIT-IV

DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks. Study of basic PLC, Role of in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation.

RECOMMENDED BOOKS

Sr. no.	Name	AUTHOR(S)	PUBLISHER
1	Electrical Power Systems.	WadhwaC. L.	New age international Ltd.
2	Power System Analysis and Design.	GuptaB. R.	S. Chand & Co
3	Electric Power	Uppal S. L.	Khanna Publishers

Course Code	**EE374**
Course Title	**Fundamentals of Electrical Machines**
Type of Course	OE
L T P	3:0:0
Credits	3
Course Prerequisites	Basic electrical.
Course Objectives (CO)	To became familiar with single phase and three phase transformer, DC and AC machines, parallel operation of machines& to calculate the efficiency of machines.

SYLLABUS

UNIT-I

Introduction

Basic Principle, Types and constructional features of electrical machines, torque, and torque angle, basic electromagnetic laws, Induced EMF.

UNIT-II

Transformers

Basic principle, turns ratio, types and parts of a transformer, ideal transformer, transformer on no-load and on-load, phasor diagram, transformer reactance and equivalent circuit, losses, efficiency, all day efficiency, regulation, basic concept of three-phase transformer and auto transformer (excluding analysis).

UNIT-III

Direct Current (DC) Machines

Principle, Constructional features, Types of direct current (DC) machines, Electromotive force (EMF) and torque equations, circuit model, armature reaction, commutation, Types of armature winding(no detailed diagram), characteristics of dc motors, characteristics of dc generators, starting (three point and four point starters), speed control methods, efficiency and applications.

UNIT-IV

A.C MOTORS

Three-phase Induction Machines: Concept of rotating magnetic field in three phase, Construction and principle of operation. slip frequency, rotor currents, rotor Magneto motive force (MMF) and torque production, equivalent circuit; torque slip characteristics, power output, starting; **Single-phase Induction Motors:** Principle of single phase induction motors, double field revolving theory, types of single phase induction motors.**Synchronous Machines:** Construction and types, Electromotive force (EMF) equation, synchronous reactance. **Principle of Special Motors:** Alternating current (AC) series motor, universal motor, reluctance motor, hysteresis motor, stepper motor, Brushless Motors, Switched reluctance motor and their Applications.

RECOMMENDED BOOKS			
Sr. no.	**Name**	**Author(s)**	**Publisher**
1	Electrical Machines, VOL II	Thareja B.L	S.Chand
2	Bimbhra P.S.	Electrical Machinery,	Khanna Publishers
3	Electrical Machines	Nagrath I.J. and Kothari D.P	Tata McGraw Hill

Course Code	ECE372
Course Title	Analog and Digital Communication
Type of Course	OE
L T P	3:0:0
Credits	3
Course Prerequisites	Electronics Devices
Course Objectives (CO)	To study the fundamentals, mathematical analysis, generation, reception and considerations for various types of modulation techniques and impart practical knowledge of different communication systems.

SYLLABUS

UNIT- I

Review of Fundamental Concepts and Mathematical preliminaries: Elements of an electrical communication system; Characteristics of communication channel and their mathematical modeling; Signal models: deterministic and random; signal classification; Convolution Integral and response of LTI system; Fourier series representation, Parseval's theorem; Fourier transform; Hilbert transform.

UNIT- II

Analog communication systems: Concept of modulation and demodulation, Continuous wave (CW) modulation: amplitude modulation (AM) - double sideband (DSB); double sideband suppressed carrier (DSBSC); single sideband suppressed carrier (SSBSC) and vestigial sideband (VSB) modulation, angle modulation - phase modulation (PM) & frequency modulation (FM); narrow and wideband FM. Representation of narrowband noise; receiver model, signal to noise ratio (SNR), noise figure, noise temperature, noise in DSB-SC, SSB, AM & FM receivers, pre-emphasis and de-emphasis.

UNIT- III

Pulse Modulation: Sampling process, sampling theorem for band limited signals; pulse amplitude modulation (PAM); pulse width modulation (PWM); pulse position modulation (PPM) ; pulse code modulation (PCM); line coding; differential pulse code modulation; delta modulation and adaptive delta modulation, Basics of time division multiplexing, noise consideration in PAM and PCM systems..

UNIT- IV

Basic digital modulation schemes: Overview of geometric representation of signals, Gram-Schmidt Orthogonalization procedure; Basic digital modulations schemes: Phase shift keying (PSK), amplitude shift keying (ASK), frequency shift keying (FSK) and Quadrature amplitude modulation (QAM); coherent demodulation and detection; probability of error.

RECOMMENDED BOOKS

S. No	Name	Author(S)	Publisher
1	Communication Systems	Simon Haykin	Wiley India
2	Modern Digital and Analog Communication Systems	B P Lathi, Zhi Ding	Oxford University Press
3	Principles of Communication Systems	H. Taub, D. L. Schilling, G. Saha	Tata McGraw-Hill
4	Digital Communications	Bernard Sklar	Prentice Hall of India
5	Principles of Communication Systems	Taub and Schilling	Tata McGraw-Hill

Course Code	**ECE374**
Course Title	**Analog Circuits**
Type of Course	**OE**
L T P	3:0:0
Credits	3
Course Prerequisites	Circuit models of CMOS, and BJT, Electronic circuit analysis
Course Objectives (CO)	The course has been planned to Introduce the principles of analog circuits and apply the techniques for the design of analog integrated circuit (Analog IC's).

SYLLABUS

UNIT- I

Low Frequency Transistor Amplifier: Equivalent circuit of BJT using h-parameter for CB, CE and CC & configuration, calculation of transistor parameter for CB, CE & CC using h-parameters, comparison of transistor amplifier configuration.

UNIT- II

Multistage and Large Signal Amplifiers: General cascaded system, RC coupled amplifier and its frequency response, merits and demerits, cascade amplifier, Darlington compound configuration, multistage frequency effect. Large Signal Amplifier Analysis and design of class A, B, AB, C amplifiers, push pull amplifiers, transformer less output stages, distortion calculations.

UNIT-III

Feedback Amplifier Feedback concept, characteristics of negative and positive feedback. Effect of negative and positive feedback on input impedance, output impedance, gain, and noise and frequency response..

UNIT-IV

Oscillators Classification of Oscillators, frequency and frequency stability of oscillatory circuits, Tuned based Oscillators, Hartley Oscillator, Colpitts Oscillators Clapp Oscillator, Crystal Oscillator, Phase Shift Oscillator, Wein Bridge Oscillator

RECOMMENDED BOOKS

S. No	Name	Author(S)	Publisher
1	Analysis and Design of Analog Integrated Circuits	P.R. Gray and R.G. Meyer	John Wiley and Sons
2	Integrated Electronics	Millman & Halkias	Tata McGraw Hill.
3	Electronic Circuit: Discrete & Integrated	Schilling & Belone	Tata McGraw Hill.
4	OpAmps and Linear IC's	Gayakwad R.A	PHI

Course Code	**CE372**
Course Title	**Construction of Metro System**
Type of Course	**OE**
L T P	3:0:0
Credits	3
Course Prerequisites	NONE
Course Objectives (CO)	Study of metro systems

SYLLABUS

UNIT- I

Overview of Metro System, Need for metro.

UNIT- II

Routing Studies, Basic Planning and Financials, Intial Surveys and investigations, Basics Of construction planning and management

UNIT-III

Construction Methods for elevated and underground stations, via duct spans & bridges , underground tunnels , Depots commercial and service buildings

UNIT-IV

Construction quality and safety systems , traffic integration , multi modal transfers and pedestrians facilities , environment and social safeguards

Track system – permanent way, facilities management

RECOMMENDED BOOKS			
Sr. no.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1	Metro rail projects in INDIA	M.Ramachandran	Oxford University Press
2	Underground Infrastructures	RK Goel, Bhawani Singh and Jian Zhao	Imprint: Butterworth-Heinemann, Elsevier Inc.
3	Construction Safety activity book(METRO)	Crenshaw and LAX Transit	Metro

Course Code	**CE374**
Course Title	**Traffic Engineering**
Type of Course	OE
L T P	3:0:0
Credits	3
Course Prerequisites	Transportation Engineering-I,II
Course Objectives (CO)	The objective of the course is to give knowledge about the design of flexible and rigid pavements and basic knowledge of docks, harbor & tunnels.

SYLLABUS

UNIT-I

Introduction: Types of pavement structure. Importance and functions of various components of pavement structures, design factors, Factors affecting pavement design, Design wheel load, equivalent single wheel load, repetition of loads climate variation.

UNIT-II

Design of Flexible Pavements:

Flexible pavement design methods: CBR method, group index method , IRC method of design of flexible pavement.**Design of Rigid Pavements:** General design considerations, Wheel load stresses, Westergard's stress equation for wheel load, evaluation of wheel load stress, temperature stresses, design of joints, design of dowel and tie bars, IRC method of design of rigid pavements, CRCP(Continuously Reinforced concrete pavements) FRC (Fibre reinforced concrete pavements), pre stressed concrete pavements

UNIT-III

Design of Bituminous Mixes: Requirements of bituminous mixes, Marshall Method of Bituminous Mix Design **Harbor and Docks** Harbours and ports, water transportation, natural phenomenon: tides, wind & waves, classification, facilities at major port, protection facilities: wall type & special break waters**,** planning & layout of ports, classification of docks, docking facilities, repairing facilities-fixed form & movable form , approach facilities, loading and unloading facilities, guiding facilities- light house & signal, storing facilities.

UNIT-IV

Tunnels General, basic definition, merits & demerits of tunnels & open cuts, selection of alignment of tunnel, classification of tunnels, tunnel approaches. **Problems in Tunneling** Introduction to various stages in tunnel construction, methods of tunneling in soft soil & rock, tunnel lining necessity & material used, drainage in tunnels, health protection in tunnels.

RECOMMENDED BOOKS			
Sr. no.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1	Docks and harbor engineering	Bindra S.P	Dhanpat rai
2	Principles, practices and design highway engineering	Sharma S.K	S chand& company ltd 1995
3	Highway engineering	Khanna S.K & Justo CEG	Nemchand and brother roorkee

Course Code	**CSE471**
Course Title	**Concepts of Operating Systems**
Type of Course	OE
L T P	3:0:0
Credits	3
Course Prerequisites	NONE
Course Objectives (CO)	This course provides the knowledge about the role of an operating system, issues in the management of resources like processor, memory and input-output, design of an operating system.

SYLLABUS

UNIT-I

Introduction: Operating Systems functions, Types of operating systems, Multiprogramming systems, Batch systems, Time-sharing systems, Operating system operations, Special purpose operating systems, distributed systems, Different computing environments.

UNIT-II

Operating System Organization: Processor and user modes, user operating system interface, Kernels, System calls and its types, System programs, Operating system structures, Virtual machines.

Process Management: Process states, Process Scheduling, Process hierarchy, Threads, Threading issues, Multi-threading models, Non-pre-emptive and pre-emptive scheduling algorithms, Concurrent processes, Critical section, Semaphores, methods for inter-process communication, Deadlocks.

UNIT-III

Memory Management: Physical and virtual address space, Memory allocation strategies, Paging, Segmentation, Virtual memory and Demand paging, Page replacement algorithms.

File and I/O Management: Directory structure, File operations, Files system mounting, File allocation methods, Device management, Disk scheduling algorithms.

UNIT-IV

OS and Security: Security breaches, types of attacks, attack prevention methods, security policy and access control, OS design considerations for security, access control lists and OS support, internet and general network security, Policy mechanism, Program, network and system threats, Authentication.

RECOMMENDED BOOKS

Sr. no.	Name	Author(S)	Publisher
1	Operating Systems Concepts	A Silberschatz, P.B. Galvin, G. Gagne	John Wiley Publications
2	Operating Systems: A Modern Perspective	G. Nutt	Pearson Education
3	Modern Operating Systems	A.S. Tanenbaum	Pearson Education
4	Operating Systems, Internals & Design Principles	W. Stallings	Prentice Hall of India

Code	**CSE473**
Course Title	**Data Warehousing And Data Mining**
Type of Course	**OE**
L T P	3:0:0
Credits	3
Course Prerequisites	NONE
Course Objectives (CO)	Students will be enabled to understand and implement classical models and algorithms in data warehousing and data mining.

SYLLABUS

UNIT-I

Data Warehouse Fundamentals: Introduction to Data Warehouse, OLTP Systems; Differences between OLTP Systems and Data Warehouse: Characteristics of Data Warehouse; Functionality of Data Warehouse: Advantages and Applications of Data Warehouse;

Data Warehouse Architecture: Introductions, Components of Data warehouse Architecture: Technical Architectures; Data warehouse architectures 1: Data warehouse architecture 2: Data warehouse architecture 3: Tool selection: Federated Data Warehouse Architecture:

UNIT-II

Data Warehouse & OLAP: Introduction: What is OLAP?; Characteristics of OLAP, Steps in the OLAP Creation Process, Advantageous of OLAP: What is Multidimensional Data: OLAP Architectures; MOLAP, ROLAP, HOLAP: Data Warehouse and OLAP: Hypercube &Multicubes

Meta data Management in Data Warehouse: Introductions to Metadata: Categorizing Meta data: Meta data management in practice; Meta data requirements gathering, Meta data classification, Meta data collection strategies: Meta Data Management in Oracle and SAS: Tools for Meta data management

UNIT-III

Introduction to Data Mining: Introduction: Scope of Data Mining: What is Data Mining; How does Data Mining Works, Predictive Modeling: Data Mining and Data Warehousing: Architecture for Data Mining: Profitable Applications: Data Mining Tools: Data Preprocessing: Introduction, Data Preprocessing Overview, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.

Data Mining Techniques- An Overview: Introduction, Data Mining, Data Mining Versus Database Management System, Data Mining Techniques- Association rules, Classification, Regression, Clustering, Neural networks.
Clustering: Introduction, Clustering, Cluster Analysis, Clustering Methods- K means, Hierarchical clustering, Agglomerative clustering, Divisive clustering, clustering and segmentation software, evaluating clusters.

UNIT-IV

Web Mining: Introduction, Terminologies, Categories of Web Mining – Web Content Mining, Web Structure Mining, Web Usage Mining, Applications of Web Mining, and Agent based and Data base approaches, Web mining Software.

Applications of Data mining: Introduction, Business Applications Using Data Mining- Risk management and targeted marketing, Customer profiles and feature construction, Medical applications (diabetic screening), Scientific Applications using Data Mining, Other Applications.

RECOMMENDED BOOKS			
Sr. no.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1	Data Warehousing And Data Mining	Varsha V. Bhosale	Wiley India
2	Data Warehousing: OLAP and Data Mining	Amos Gilat	Wiley India
3	Introduction to Data Mining	Pang-Ning Tan, Michael Steinbach, Vipin Kumar	**Pearson Education India**
4	Data Mining	Pieter Adrians, Dolfzantinge	**Pearson Education India**
5	Database Management Systems	R. Ramakrishnan, J. Gehrke,	McGraw Hill

Course Code	**ME471**
Course Title	**Material Management**
Type of Course	**OE**
L T P	3:0:0
Credits	3
Course pre-requisite	NA
Course Objectives	To introduce to the students the various concepts of materials management

Syllabus

UNIT I

Introduction to materials management – Objectives – Functions – Operating Cycle – Value analysis – Make or buy decisions.

UNIT II

Management of purchase: Purchasing policies and procedures – Selection of sources of supply – Vendor development – Vendor evaluation and rating – Methods of purchasing – Imports – Buyer – Seller relationship – Negotiations.

UNIT III

Management of stores and logistics 12 Stores function – Location – Layout – Stock taking – Materials handling – Transportation – Insurance – Codification – Inventory pricing – stores management – safety – warehousing – Distribution linear programming – Traveling Salesman problems – Network analysis – Logistics Management.

UNIT IV

Materials plan for forecasting – Materials requirements planning – Quantity – Periodic – Deterministic models – Finite production. Inventory management 10 ABC analysis – Aggregate planning – Lot size under constraints – Just in Time (JIT) system.

RECOMMENDED BOOKS

Sr No	**Name**	**AUTHOR(S)**	**PUBLISHER**
1.	Engineering Management	Dr. R. Kesavan, C.Elanchezian and T.SundarSelwyn.	Eswar Press
2.	Purchasing and Material Management,	Lamer Lee and Donald W. Dobler	Tata McGraw Hill, 200
3	Handbook of Materials Management	Gopalakrishnan.P	Prentice Hall of India.

Course Code	**ME473**
Course Title	**Mechatronics**
Type of Course	**OE**
L T P	3:0:0
Credits	3
Course pre-requisite	NA
Course Objectives	To understand the structure of microprocessors and their applications in mechanical devices, the principle of automatic control and real time motion control systems, with the help of electrical drives and actuators, use of micro-sensors and their applications in various fields .

Syllabus

UNIT-I

Introduction: Definition of Mechanical Systems, Philosophy and approach; Systems and Design: Mechatronic approach, Integrated Product Design, Modelling, Analysis and Simulation, Man-Machine Interface; Sensors and transducers: classification, Development in Transducer technology,

UNIT-II

Optoelectronics- Shaft encoders, CD Sensors, Vision System, Drives and Actuators: Hydraulic and Pneumatic drives, Electrical Actuators such as servo motor and Stepper motor, Drive circuits, open and closed loop control; Embedded Systems

UNIT-III

Hardware Structure, Software Design and Communication, Programmable Logic Devices, Automatic Control and Real Time Control Systems; Smart materials: Shape Memory Alloy, Piezoelectric and Magnetostrictive Actuators: Materials, Static and dynamic characteristics, illustrative examples for positioning, vibration isolation.

UNIT-IV

Micromechatronic systems: Micro sensors, Micro actuators; Micro-fabrication techniques
LIGA Process: Lithography, etching, Micro-joining etc. Application examples; Case studies
Examples of Mechatronic Systems from Robotics Manufacturing, Machine Diagnostics,
Road vehicles and Medical Technology.

RECOMMENDED BOOKS

Sr No	**Author(s)**	**Title**	**Publisher**
1	,Devdas Shetty & Richard A. Kolk	Mechatronics System Design	PWS Publishing Company
2	R.K.Rajput	A Textbook of Mechatronics	S. Chand & Company Private Limited

Course Code	**EE471**
Course Title	**Wind and Solar energy system**
Type of Course	**OE**
L T P	3:0:0
Credits	3
Course Prerequisites	NA
Course Objectives (CO)	The class will explore society's present needs and future energy demands, examine conventional energy sources and systems, then focus on alternate, renewable energy sources such as solar and wind power.

SYLLABUS

UNIT-I

History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics-probability distributions, Wind speed and power-cumulative distribution functions.

UNIT-II

Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent-Magnet Synchronous Generators, Power electronics converters. Generator-Converter configurations, Converter Control.

UNIT-III

Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability.

UNIT-IV

Technologies-Amorphous, monocrystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array, Power Electronic Converters for Solar Systems

RECOMMENDED BOOKS

S.No.	Name	Author(s)	Publisher
1	Non-Conventional Energy Sources	G.D. Rai	Khanna Publishers
2	Renewable Energy Resources	Twidell&Wier	CRC Press(Taylor & Francis)
3	Solar Energy: Principles of Thermal Collection and Storage.	S. P. Sukhatme	McGraw Hill, 1984.
4	Wind Power in Power Systems	T. Ackermann	John Wiley and Sons Ltd., 2005.

Course Code	**EE473**
Course Title	**Instrumentation Engineering**
Type of Course	**OE**
L T P	3:0:0
Credits	3
Course Prerequisites	NA
Course Objectives (CO)	To understand the principle and working of electronic instruments and their application. 2. To understand the concept of digital instruments and their comparison. 3. To be able to inculcate the knowledge regarding different types of transducers. 4. To identify the details of instrumentation and devices intended for a particular application.

SYLLABUS

UNIT-I

ELECTRONIC INSTRUMENTS:-Electronic Voltmeter and Current Probes, Tuned Type and Sampling type Voltmeter, Current Probes for D.C. and A.C. Measurements, Electronic Multimeter - Construction, Measurement of D.C. and A.C. Voltage and Current, Measurement of Resistance. CRO- Construction, Synchronization, Measurement of Voltage, Current, Phase and Frequency, DSO- Working and Operation

UNIT-II

Comparison of Analog and Digital Instruments, Digital Voltmeter, Multimeter and Frequency Meter.

UNIT-III

TRANSDUCERS:-Block Diagram Representation of Instrumentation System, Terminology and Definition, Classification, Transducing Principles and Elements, Ultrasonic, Optical and Infrared Sensors, Inductive, Capacitive and Resistive Transducers for Measurements of Length, Thickness, Displacement, Velocity, Torque, Level, Pressure, Temperature, Flow, Humidity, Moisture and ph.

UNIT-IV

Recorders: X-Y Recorders, Strip-Chart Recorder, Magnetic and Potentiometric Recorder, Digital Displays- LED and LCD, Introduction to Data Acquisition Systems.

Recommended Books

S.No.	**Name**	**Author(s)**	**Publisher**
1	A course in Electrical & Electronic Instrumentation,	Sawhney A.K.,	Dhanpat Rai and Sons.
2	Electronics Instrumentation and Measurements,	Bell David A	Prentice Hall, India
3	Electrical Measurements Fundamentals, Concepts, Applications,	Reissl and Martin V	Wiley Eastern Limited, New Delhi.

Course Code	**ECE471**
Course Title	**Biomedical Electronics**
Type of Course	**OE**
L T P	3:0:0
Credits	3
Course Prerequisites	Applications Of Electronics In Medical Field.
Course Objectives (CO)	To study the methods of recording various bio-potentials, how to measure various physiological information, understand the working of biotelemetry and understand the practical application of electronics in biomedical.

SYLLABUS

UNIT I

Introduction to Biomedical Signals: The origin of Bio-potential, biological amplifiers, ECG, EMG, PCG, EOG, lead systems and recording methods, typical waveforms and signal characteristics. Electrode theory and Different types of Electrodes. Polarization, Electrode behavior, Electrode-skin interface.

UNIT II

Cardio Vascular Measurement: Measurement of blood pressure, balloon flow, cardiac output and cardiac rate. Assist Devices and bio-telemetry: Cardiac pacemakers, DC Defibrillator, Telemetry principles, frequency selection, Biotelemetry, radio-pill and tele-stimulation.

UNIT III

Neurological Signal Processing :Modeling of EEG Signals, Detection of spikes and spindles, Detection of Alpha, Beta and Gamma Waves, Auto Regressive (A.R.) modeling of seizure EEG, Sleep Stage analysis, Inverse Filtering, Least squares and polynomial modeling.

UNIT IV

Radiological Equipment: Ionizing radiation, Diagnostic x-ray equipment, use of Radio Isotope in diagnosis, Radiation Therapy. Recent trends in medical instrumentation: Thermograph, endoscopy unit, Laser in medicine, Diathermy units, Electrical safety in medical equipment.

RECOMMENDED BOOKS

S. No	**Name**	**Author(S)**	**Publisher**
1	Biomedical Signal Processing: Principles and techniques	D.C.Reddy	Tata McGraw-Hill
2	Willis J Tompkins	Biomedical Signal Processing	Prentice Hall
3	Khandpur, R.S.	Handbook of Biomedical Instrumentation	Tata McGraw-Hill
4	Introduction to Biomedical equipment Technology	Joseph J.Carr and John M.Brown	John Wiley and Sons
5	Biomedical Signal Processing & Signal Modeling	Bruce	John Wiley and Sons

Course Code	**ECE473**
Course Title	**VLSI Design**
Type of Course	**OE**
L T P	3:0:0
Credits	3
Course Prerequisites	Knowledge of Microprocessor 8085 and Microcontroller 8051.
Course Objectives (CO)	To introduce Microprocessor Architectural Concepts, Instructions & communications and latest microcontrollers.

SYLLABUS

UNIT I: Introduction: Introduction to Computer-aided design tools for digital systems. Hardware description languages, Introduction to VHDL, Data objects, Classes and data types, Operators, Overloading, Logical operators. Types of delays, Entity and Architecture

UNIT II: VHDL Statements: Assignment statements, sequential Statements and process, Conditional statements, Case statements, Array and loops, Resolution functions, Packages & Libraries, Concurrent statements.

UNIT III: Combinational Circuit and Sequential Circuit Design: VHDL models and simulation of combinational circuits such as Multiplexers, Encoders, Decoders, Code converters, Comparators, Implementation of Boolean functions etcVHDL Models and simulation of sequential circuits, Shift registers, Counters etc.

UNIT IV: Design of Microcomputer: Basic components of a computer, Specifications, Architecture of a simple Microcomputer system, Implementation of a simple microcomputer system using VHDL. Design with CPLDs and FPGAs: Programmable logic devices : ROM, PLAs, GAL, PEEL, CPLDs and FPGA. Design and implementation using CPLDs and FPGA

RECOMMENDED BOOKS

S. No	Name	Author(S)	Publisher
1	A VHDL Primmer	Bhasker	Prentice Hall
2	"Digital System Design using VHDL	Charles. H. Roth	PWS
3	VDHL-Analysis & Modelling of Digital Systems	Navabi Z	McGraw Hill
4	Fundamentals of Digital Logic with VHDL Design.	Brown and Vranesic;	TMH

Course Code	**CE471**
Course Title	**Rural Technology & Community Development**
Type of Course	OE
L T P	3:0:0
Credits	3
Course Prerequisites	NA
Course Objectives (CO)	The objective of this course is to make students aware of the various elements of rural technology and community development.

SYLLABUS

UNIT-I

Data analysis and measures of central tendency

Meaning nature scope and limitations of statistics, collection of statistical data, classification, tabulation and diagrammatic representation of data, measures of central tendency : statistical averages means, media and mode.

UNIT-II

Data Information and Knowledge

Concept of information, need of information(professional education, research), qualities of information, value of information, difference between data and information, properties of the needed information, information and management, planning organizing, Coordinating and controlling

UNIT-III

Concept of Marketing

Difference between marketing selling and retailing, marketing mix, market segmentation, marketing planning, strategy and approaches; modern concept of marketing

Community Development

Concept, definition, meaning, need, history, principles objectives and scope. Community building: coming age, regenerating community, community model

UNIT-IV

Consensus Organizing model

What's behind building healthy communities, participatory democracy. The role of various NGOs in community development. The role of business and government in community development initiatives, how to form a non profit corporation fund raising and grant writing.

RECOMMENDED BOOKS			
Sr. no.	**Name**	**Author(s)**	**Publisher**
1	Encouraging community development	Biddle William wishart	Mcgraw hill
2	Sustainable rural technology	M.S Virdi	Daya publishing house
3	Rural technology	Punia RD Roy	Satyaparkashan
4	Rural education and technology	S.B Verma, S.K Jiloka	Deep and deep publication

Course Code	**CE473**
Course Title	**Waste Water Engineering**
Type of Course	**OE**
L T P	3:0:0
Credits	3
Course Prerequisites	Environmental Engineering
Course Objectives (CO)	It is the branch of environmental engineering in which the basic principles of science and engineering are applied to the problems of water pollution control. So, as an overview, this wastewater engineering includes wastewater treatment, sludge disposal and reuse, wastewater reclamation and reuse, effluent disposal and the role of engineer.

SYLLABUS

UNIT I

Introduction: Terms & definitions, systems of sanitation and their merits and demerits, system of sewerage, choice of sewerage system and suitability to Indian conditions.**Design Of Sewers:**Quantity of sanitary and storm sewage flow, forms of sewers. Conditions of flow in sewers, sewers of equivalent section, self cleansing and limiting velocity, hydraulic formulae for flow of sewerage in sewers and their design.

UNIT II

Construction & Maintenance Of Sewers: Sewer appurtenances, materials for sewers. Laying of sewers, joints in sewers, testing of sewers pipes. Maintenance, operation and precaution before entering a sewer.**House Drainage**: Principles of house drainage, traps, inspection chamber Indian and European type W.C. flushing cisterns, soil-waste and anti-syphonage pipes, plumbing system.

UNIT III

Characteristics & Testing Of Sewage:

Composition of sewage, sampling, physical & chemical analysis of sewerage, biological decomposition of sewage, kinetics of organic waste stabilization.**Treatment Of Sewage**: Unit processes of waste water treatment, importance of environmental sanitation, treatment of water; impurities in water-processes for their removal – typical flow-sheets. Sedimentation: factors affecting efficiency, design values of various parameters, tube settlers. Coagulation and flocculation: mechanisms, common coagulants, rapid mixing and flocculating devices screens, grit chambers, detritus tank, skimming tank, grease traps, sedimentation, chemical treatment, aerobic biological treatment, trickling filter (lrtf&hrtf), activated sludge processes, anaerobic treatment, units-sludge digesters and biogas plant.

UNIT IV

Low Cost Waste Water Treatment Units:

Theory, design, advantages & disadvantages of oxidation's ponds, lagoons, ditches, septic tanks and imhoff tanks.

RECOMMENDED BOOKS

Sr. no.	Name	AUTHOR(S)	PUBLISHER
1	"Water Supply Engineering" Vol. II	Garg S K	Khanna Publishers, New Delhi, 2003
2	Environmental Engg. - A design Approach	Arcadio P. Sincero and Gregoria P. Sincero	Prentice Hall of India, New Delhi
3	Waste Water Engineering - Treatment and Reuse	Metcalf & Eddy	McGraw Hill, New Delhi, 2003
4	Waste Water Engg. (Environmental Engg.-II)	Punmia B C	Laxmi Publication, New Delhi, 2002

Course Code	**CSE472**
Course Title	**Image Analysis**
Type of Course	**OE**
L T P	3:0:0
Credits	3
Course Prerequisites	Computer fundamentals
Course Objectives (CO)	To make students familiar with the various fundamentals & and processes involved in the processing of an image.

SYLLABUS

UNIT –I

Digital Image Fundamentals & Transforms: Introduction, Background, Digital Image Representation, Fundamental Steps in Image Processing, Elements of a Digital Image Processing System. Elements of Visual Perception, Sampling and Quantization, Basic Relationships between Pixels, Imagining Geometry. Introduction to the Fourier Transform, The Discrete Fourier Transform, Some Properties of the Two-Dimensional Fourier Transform.

UNIT-II

Image Enhancement: Spatial Domain Methods, Frequency Domain Methods, Some Simple Intensity Transformations, Histogram Processing, Image Subtraction, Image Averaging, Smoothing Filters, Sharpening Filters, Low pass Filtering, High pass Filtering.

UNIT-III

Image Restoration & Compression: Degradations Model - Definitions, Degradation Model for Continuous, Restoration in the Spatial Domain, Geometric Transformation. Error free compression, Variable-Length Coding, Bit-Plane Coding, Lossless Predictive Coding. Lossy Compression – Lossy Predictive Coding, Transform Coding.

UNIT-IV

Image Segmentation &Representation: Edge Detection, Thresholding, Region-Based Segmentation. Image Representation, Boundary and Regional Descriptors, Relational Descriptors. Object Recognition: Pattern and pattern classes, recognition based on Decision Theoretic Methods, Structural Methods.

RECOMMENDED BOOKS

S. No	Name	Author(S)	Publisher
1	Digital Image Processing	Rafael. C. Gonzalez & Richard E.Woods	Pearson Education
2	Digital Image Processing	W.K.Pratt.	John Wiley & sons
3	Image Processing Analysis and Machine Vision	M. Sonka	Thomson Learning

Course Code	**CSE474**
Course Title	**Concepts of Cloud Computing**
Type of Course	**OE**
L T P	3:0:0
Credits	3
Course Prerequisites	NONE
Course Objectives (CO)	This Course work provides the complete understanding of Cloud system, its implementation techniques and its various applications in the field of computer Science.

SYLLABUS

UNIT-I

Introduction: Principles and characteristics of cloud computing- IaaS, PaaS, SaaS; service oriented computing and cloud environment. Cloud Computing Technology: Client systems, Networks, server systems and security from services perspectives; Accessing the cloud with platforms and applications; cloud storage.

UNIT-II

Working with Cloud: Infrastructure as a Service–conceptual model and working Platform as a Service – conceptual model and functionalities. Software as a Service: conceptual model and working.

UNIT-III

Using Cloud Services: Cloud collaborative applications and services–case studies with calendars, schedulers and event management; cloud applications in project management. Case studies: Microsoft Azure, Google App Engine and Open source clouds- Open-Nebula and Eucalyptus.

UNIT-IV

Virtualization Technology, Creating VMs, Hypervisor. Storage Technology, types of Storage Devices, RAID Tech Practical Session for RAID (Hands on) File system, DAS, NAS & SAN Tech.

RECOMMENDED BOOKS			
Sr. no.	**Name**	**Author(s)**	**Publisher**
1	Cloud Computing – A Practical Approach	Anthony T.Velte, Toby J.Velte and Robert E	TMH
2	Cloud Computing – Web based Applications	Michael Miller	Pearson Publishing

Course Code	**ME472**
Course Title	**Operations Management**
Type of Course	OE
L T P	3:0:0
Credits	3
Course pre-requisite	None
Course Objectives	Students will familiar with the management operations

Syllabus

UNIT- I

Operations management: Concept, Functions. Product Design and development: Product design and its characteristics: Product development process (Technical): Product development techniques. Process selection- Project, job, Batch, Mass and Process types of Production Systems.

UNIT-II

Facility Location: importance, Factors in Location Analysis: Location Analysis Techniques. Facility Layout: Objectives: Advantages: Basic types of layouts. Capacity Planning: Concepts: Factors Affecting Capacity Planning, Capacity Planning Decisions. Production Planning & Control (PPC): Concepts, Objectives, Functions. Work Study: Productivity: Method Study; Work Measurement.

UNIT- III

Introduction to modern productivity techniques: just in time, Kanban system. Total Quality Management & six sigma. Functions of Purchasing Management: Objectives, Functions: Methods: Procedure. Value analysis : Concepts. Stock control systems. Virtual factory concept. Production worksheets.

UNIT- IV

Inventory Management : Concepts, Classification: Objectives: Factors Affecting Inventory Control Policy: Inventory costs: Re-order Level, Quality Management - Quality Concepts, Difference between Inspections, Quality Control, Quality Assurances, Total Quality Management: Control Charts: acceptance Sampling.

Recommended Text Book

S. No	Author	Title	Publisher
1	El Wakil M.M	Power Plant Technology	McGraw Hill, 2010.
2	Elliot T.C&Chen K	Power Plant Engineering	McGraw Hill, 1998.
3	Nag P.K.,	Power Plant Engineering	Tata McGraw Hill,2008

Course Code	ME474
Course Title	Industrial Safety
Type of Course	OE
L T P	3:0:0
Credits	3
Course Prerequisites	EVS
Course Objectives (CO)	To aware the students with potential Risks in operations and their Management.

SYLLABUS

UNIT- 1

Introduction Growing concern for safety and health, Safety terminology. Health and safety regulations: International and National scenario : National policy: Product and system liability, Safety cost and losses: Cost of accidents and hidden costs, Growing awakening and concern for environment: Environment protection Act 1986 (amended 1991) : Global warming . Principles of total safety and environment management: Goal, synergy and differences between safety and environment, Synergy of quality with safety, health and environment, Safety . Safety and health hazards, Types of hazards, . Measuring performance of safety and health systems : Indices, and their computation . Safety hazards: Safety in construction, Machine guards & machine tools safety, Safety in material handling.

UNIT- II

Fire safety and industrial security, Principles of fire safety : Occupational injuries and precaution, Characteristics and nature of fire : Fire hazards . Types of fires and ways of extinguishing: Automatic sprinklers : Portable extinguisher : Extinguishing agents . Fire prevention techniques: Building codes & regulation : Building materials and internal finishes . Electrical fire safety: Problems and facts : Electrical distribution and earthing : FRLS wiring : Portable genset and appliances : Electrical processes like welding & cutting . Fire regulations: Standards : Occupancy & egress : Escape plans & displays : Protective clothing : Protective strategies : Emergency preparedness . Fire losses and assessment: After effect & plan of action.

UNIT- III

Health, Industrial hygiene, Loss control and productivity, Application of occupational hygiene, Health hazard agents: Chemical agents like toxic compounds and materials: Physical agents like noise, vibration & radiation: Biological hazards. Exposure risk assessment: Routes of exposure Measurement of exposure: Exposure factors. Pulmonary diseases due to environment pollution. Respiratory and personal protective equipment, Development and administering medical surveillance system, Environmental management. Sustainable development planning: National policy Environmental damage and costs : Deteriorating impact on environment . Environmental factors and safety. Environmental design of work place: Location: Work direction walkways: Area allocation and sitting/working plan . Illumination: Types of lighting (natural vs artificial): Luminous level: Glare. Ventilation: Types (natural and mechanical): Heat calculation: Measurements.Noise: Types: Protection: Effects & productivity. Drinking water: Contamination: Causes: Precaution: Preventive maintenance Industrial pollution hazards. Air pollution: Types: Causes: Prevention and control Water pollution: Categories: Causes: Prevention and control .Soil and ground pollution: Categories: Causes: Prevention and control . Noise pollution: Causes: Prevention: Acoustic design: Monitor and controls. Industrial waste: Types: Control: Reuse. Environmental impact assessment: Objective: Environment impact in India: Other efforts in Conserving nature.

UNIT-IV

Compliance of environmental laws: Guidelines for location of industries: Compliance of water & air pollution acts, and other environmental laws, Imperative for sustainable development. Green house gases: Composition: Effect . Carbon emission: Kyoto protocol: Carbon credits: Emission trading: Carbon credit scenario in India : Corporate social responsibility . Carbon foot print: Measures to reduce: Initial investment . Ozone layer depletion. Mutual agreements: Member states: Scope: Responsibilities . Rain water harvesting: India's tradition in water harvesting : Rainfall data: Catch water practice and policy : Basic design : Making a mass movement. Wasteland reclamation and reforestation: Restoration of ecology: Restoration of water logged soil : Mine rehabilitation : Managed reforestation : Tree plantation : Climatic change mitigation EHS regulations and disaster management . Introduction to disaster management.

RECOMMENDED BOOKS

S. No.	AUTHOR(S)	NAME	PUBLISHER
1	L M Deshmukh	Industrial Safety Management	McGraw Hill, 2010.
2	A.K. DAS	Principles of Fire Safety Engineering: Understanding Fire and Fire Protection	PHI
3.	R.K. Mishra	Safety Management	AITBS Publishers India

Course Code	**EE472**
Course Title	**Electrical Materials**
type of Course	OE
L T P	3:0:0
Credits	3
Course Prerequisites	Basic electrical.
Course Objectives (CO)	To familiarize about Materials used in Electrical Engineering

SYLLABUS

UNIT-I

Dielectric Materials: Static dielectric constant, Polarization, atomic interpretation of the dielectric constant of mono-atomic and poly atomic gases, internal fields in the solids and liquids, static dielectric constants of solids, ferroelectric materials and spontaneous polarization, piezo- electricity. Frequency dependence of electronics, ionic and orientational polarization, complex dielectric constant and dielectric losses.

UNIT-II

Conductivity of Metals: Ohm's Law and relaxation time of electrons, collision time and mean free path. Electron scattering and resistivity of metals. Heat developed in current carrying conductor, thermal conductivity of metals, superconductivity.

UNIT-III

Magnetic Materials : Magnetization from microscopic view point, orbital magnetic dipole movement and angular momentum materials, diamagnetism, origin of permanent magnetic dipoles in material. Paramagnetic spin systems.

UNIT-IV

Properties of ferromagnetic materials: Spontaneous magnetization and the curie-Weils Law. Ferromagnetic Domains and coercive force, anti-ferromagnetic and ferromagnetic materials, magnetic materials for electrical devices, introduction to permanent magnets.

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Electrical Engineering materials	A.J. Dekker.	Englewood Cliffs, NJ: Prentice Hall
2	Electrical Engineering Materials	G.P. Chhalotra.	Khanna
3	Electrical Engineering materials	S.P. Seth and P.V. Gupta.	Dhanpat Rai

Course Code	**EE474**
Course Title	**Electrical & Hybrid Vehicles**
type of Course	**OE**
L T P	3:0:0
Credits	3
Course Prerequisites	Applied mechanics & Basic Electrical.
Course Objectives (CO)	Understand the models to describe hybrid vehicles and their performance. Understand the different possible ways of energy storage. Understand the different strategies related to energy storage systems.

SYLLABUS

UNIT-I

Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics. Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

UNIT-II

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 hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

UNIT-III

Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis,

UNIT-IV

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, implementation issues of energy management strategies.

RECOMMENDED BOOKS

S.No.	Name	**Author(s)**	**Publisher**
1	Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives.	C. Mi, M. A. Masrur and D. W. Gao.	John Wiley & Sons, 2011.
2	Hybrid Electric Vehicles: Energy Management Strategies.	S. Onori, L. Serrao and G. Rizzoni, “	Springer, 2015.
3	Electric and Hybrid Vehicles.	T. Denton	Routledge, 2016.

Course Code	**ECE472**
Course Title	**Embedded Systems**
Type of Course	**OE**
L T P	3:0:0
Credits	3
Course Prerequisites	Basics Knowledge of Microprocessor and Microcontroller and its Programming
Course Objectives (CO)	The goal of the course is to teach the concepts C Language and object oriented programming, ARM architecture and peripheral interfacing. To read and understand the C and C++ programming, ARM processor architecture and programming The course focuses on how to write program and peripheral interfacing of ARM processor and develop the applications.

SYLLABUS

UNIT-I

Embedded system introduction: Introduction to embedded system, embedded system architecture, classification of embedded system, challenges and design issues in embedded system, introduction to the register bank, families of the ARM processor, interrupt and vector table & other features of ARM: JTAG, I2C bus.

UNIT-II

ARM Programming Instructions Introduction to the instruction set of the ARM processor, Addressing modes, load store instruction, PSR (Program Status Register) instructions, conditional instructions, and interrupt instructions.

UNIT-III

C Programming Integrated Development Environment (IDE) for C/C++ Programming, C/C++ Programs using Function Calls, Structures, Pointers, Integers & Floating Point Arithmetic, and Assembly Code using Instruction Scheduling, Register Allocation, and Conditional Execution Loops.

UNIT- IV

Interfacing Peripherals ARM processor interfacing with ADC, DAC, Sensors, Memory, LCD Display, Stepper Motor, DC Motor, SD-MMC Card, Biometric & RFID, ZIGBEE, GSM Interfaces, and Debugging Tools.

RECOMMENDED BOOKS

S. No	Name	Author(S)	Publisher
1	Radio Frequency & Microwave Electronics	Mathew. M. Radmanesh	Pearson Education Asia
2	Foundation of Microwave Engineering	RE Collin	Prentice Hall of India
3	Antenna and Radio Wave Propagation	RE Collin	Prentice Hall of India
4	Antennas: Theory and Practice	R Chatterjee	Pearson Education Asia

Course Code	**ECE474**
Course Title	**Advanced Optical Communication System**
Type of Course	**OE**
L T P	3:0:0
Credits	3
Course Prerequisites	Electromagnetic Theory, Communication Engineering, Digital Communication
Course Objectives (CO)	To explain the need and significance of Optical Communication System and impart knowledge of types, basic laws, and transmission characteristics, components of optical fibres.

SYLLABUS

UNIT-I

Overview: The Electromagnetic Spectrum, Properties of Light, Dual Nature of Light, Concept of a photon, Wave Model, Characteristics of light waves, general communication systems, evolution of Basic Fiber Optic Communication System, Benefits and disadvantages of Fiber Optics, Transmission Through Optical Fiber, The Laws of Reflection and Refraction, Light rays and light waves, Reflection of light from optical surfaces, Refraction of light from optical interfaces, The Numerical Aperture (NA), The Optical Fiber, Types of Fiber.

UNIT-II

Losses In Optical Fiber: Attenuation, Material absorption losses, linear and non linear scattering losses, fiber bend loss, dispersion viz. inter modal dispersion and intra modal dispersion, overall fiber dispersion and polarization, Dispersion shifted and dispersion flattened fibers, attenuation and dispersion limits in fibers, Kerr nonlinearity, self phase modulation, combined effect of dispersion and self phase modulation.

UNIT-III

Optical Sources And Detectors : Sources: Basic principle of surface emitter LED and edge emitter LED- material used, structure, internal quantum efficiency and characteristics, LASER Diode - material used, structure, internal quantum efficiency and characteristics, working Principle and characteristics of Distributed feedback (DFB) laser. Detectors: PIN photodiode - material used, working principle & characteristics, Avalanche Photodiode: - material used, working principle and characteristics

UNIT-IV

Advanced Topics: Optical TDM, SCM, WDM and Hybrid multiplexing methods, Fiber Optic Networks, Transreceivers for Fiber-Optic Networks, Semiconductor Optical Amplifiers, Erbium Doped Fiber Amplifiers (EDFAs).

RECOMMENDED BOOKS

S. No	Name	Author(S)	Publisher
1	Optical Fiber Communication Principles & Practice.	John M.Senior	PHI Publication
2	Optical Communication Systems	John Gowar	PHI Publications.
3	Optical Fiber Communication	Gerd Keiser.	Mc Graw Hill International Publications

Course Code	**CE472**
Course Title	**Tall Buildings**
Type of Course	**OE**
L T P	3:0:0
Credits	3
Course Prerequisites	None
Course Objectives (CO)	The objective of the study is to identify the structural systems for various combinations of gravity and horizontal loading considering their functional use and heights. The students Should be able to analyze the behaviour and drift capacities of various high rise structural forms.

UNIT-I

Definition of tall building-need for constructing tall building-Historic background-factors affecting growth. Design Criteria, Design Philosophy of High Rise structures, Materials, Loading gravity loading- Dead and live load, live load reduction techniques-sequential loading, Impact loading, Wind Loading, Wind Characteristics, Static and Dynamic wind Effects.

UNIT-II

Analytical and wind tunnel experimental method, Earthquake loading-equivalent lateral force method, modal analysis, Introduction to Performance based seismic design. Structural form, Floor systems, Rigid frame Structures- rigid frame behaviour –approximate determination of member forces by gravity loading- two cycle moment distribution, approximate determination of member forces by lateral loading- Portal method, Cantilever method, approximate analysis of drift.

UNIT-III

Structural design of tall concrete and masonry buildings: commentary structure a standards, plastic analysis-strength of members and correction, non-linear analysis and limit design, stability, stiffness and crack control creep shrinkage and temperature effects. Limit state design, masonry structures.

UNIT-IV

Frame-shear wall systems: Twist of frame. Analysis of shear wall, frame wall interaction, analysis of coupled shear wall, computation of earthquake load dynamic analysis of tall building

Suggested textbooks			
S. No	**Name**	**Author(S)**	**Publisher**
1	High rise Building Structures"	Schumelles W	John Wiley and Sons, New York
2	Structural Analysis and Design of Tall Buildings	TaranathBungale	McGraw Hall
3	Tall Building structures: Analysis and Design	Smith Bryan Stafford, Coull Alex.	New York Wiley-Inter science, , 1991.

Course Code	**CE474**
Course Title	**Remote Sensing And Geographical Information System**
Type of Course	**OE**
L T P	3:0:0
Credits	3
Course Prerequisites	Basic computer knowledge
Course Objectives (CO)	To introduce the principles and basic concepts of Remote Sensing and GIS To introduce the remote sensing systems, data products and analysis. To introduce the spatial data models, analysis and presentation techniques. To study the applications of Remote Sensing and GIS in agriculture, soil and water resources

SYLLABUS

UNIT– I

Introduction

Basic principles of remote sensing; Conventional aerial photography; Non-conventional photography; Non-photographic sensors; Rocket and earth orbital imagery; Energy sources and radiation principles; Energy interaction in the atmosphere and with earth surface; Nature of electromagnetic radiation; Active and passive remote sensing systems; Earth resource satellite.

Photographic Systems for Remote Sensing

Fundamental consideration; Aerial photographic film, cameras and filters.

UNIT– II

Imaging and Nonimaging Sensors

Sensor fundamentals; Nonimaging sensors; Optical mechanical scanners; Radiometric calibration.

Remote Sensing Data Systems Processing and Management

Information system; Image data storage and retrieval; Image data input and output; Image processing principles; Image processing implementation; Pattern recognition.

UNIT-–III

Ground Investigations in Support of Remote Sensing

Test sites; Common measurements; Geologic investigations; Agriculture and Forestry investigations; Atmospheric investigation.

Image Interpretation

Activities of image interpretation; Elements of image interpretation; Techniques of Image interpretation; Visual requirements for image interpretation; Image interpretation equipment.

UNIT-– IV

Digital Image Processing and Geographic Information System

Image rectification and restoration; Image enhancement; Contrast manipulation; Multi image manipulation; Image classification; Post classification smoothing; Classification accuracy assessment; Basic concepts of GIS; Data imagery and GIS application for land and water resources.

RECOMMENDED BOOKS			
Sr. no.	**Name**	**Author(s)**	**Publisher**
1	Introduction to Environmental Remote Sensing	Barret, E.C. and Curits, L.F.	John Wiley and Sons Inc. New York
2	Space Remote Sensing System Introduction	Chern, H.S.	Academic Press Inc. New York
3	Remote Sensing and Image Interpretation	Lillesand, T.M. and Kiefer, R.W.	John Wiley and Sons Inc. New York
4	Remote Sensing: Methods and Applications	Hard, R.M.	John Wiley and Sons Inc. New York
5	Manual of Remote Sensing	Reeves, R.G., Ansom, A. and David Landen	Kendall/Hunt Publishing Co mpany

Course Code	**CSE476**
Course Title	**Big Data**
Type of Course	OE
L T P	3:0:0
Credits	3
Course Prerequisites	None
Course Objectives (CO)	To understand big data analytics as the next wave for businesses looking for competitive advantage, To understand the financial value of big data analytics, To explore tools and practices for working with big data, To understand how big data analytics can leverage into a key component, To understand how to mine the data, To learn about stream computing, To know about the research that requires the integration of large amounts of data.

SYLLABUS

UNIT I

Introduction to Big Data

Analytics, Nuances of big data, Value, Issues, Case for Big data, Big data options Team challenge, Big data sources, Acquisition, Nuts and Bolts of Big data. Features of Big Data, Security, Compliance, auditing and protection, Evolution of Big data.

UNIT II

Data Analysis

Evolution of analytic scalability, Convergence, parallel processing systems, Cloud computing, grid computing, map reduce, enterprise analytic sand box, analytic data sets, Analytic methods, analytic tools, Cognos, Microstrategy, Pentaho. Analysis approaches, Statistical significance, business approaches, Analytic innovation, Traditional approaches

UNIT III

Stream Computing

Introduction to Streams Concepts, Stream data model and architecture, Stream Computing, Sampling data in a stream, Filtering streams, Counting distinct elements in a stream, Estimating moments, Counting oneness in a window, Decaying window.

UNIT IV

Predictive Analytics And Visualization

Predictive Analytics, Supervised, Unsupervised learning, Neural networks, Kohonen models, Normal, Deviations from normal patterns, Normal behaviours, Expert options, Variable entry, Mining Frequent itemsets, Market based model, Apriori Algorithm, Handling large data sets in Main memory, Limited Pass algorithm, Counting frequent itemsets in a stream, Clustering Techniques, Hierarchical, K- Means, Clustering high dimensional data Visualizations, Visual data analysis techniques, interaction techniques; Systems and applications:

RECOMMENDED BOOKS			
Sr. no.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1	Big Data Analytics: Turning Big Data into Big Money	Frank J Ohlhorst	Wiley and SAS Business Series
2	Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis	Colleen Mccue	Elsevier
3	Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics	Bill Franks	Wiley and SAS Business Series
4	Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data	Paul Zikopoulos, Chris Eaton, Paul Zikopoulos	McGraw Hill
5	Data Mining Concepts and Techniques	Jiawei Han, Micheline Kamber	Elsevier

Course Code	**CSE478**
Course Title	**Network Security**
Type of Course	OE
L T P	3:0:0
Credits	3
Course Prerequisites	Computer Networks
Course Objectives (CO)	It aims to introduce students to the fundamental techniques used in implementing secure network communications, and to give them an understanding of common threats and attacks.

SYLLABUS

UNIT- I

Introduction to Network Technology: SLIP/PPP Dedicated lines, BOOTP, DHCP, Domain management (DNS), Transport Layer issues, TCP/IP, Gateway, Dial-up, Internet networking TCP/IP protocols, IP addressing.

UNIT-II

Basics of Network security- Fundamentals of network security, Basics of IPv6, IPsec: overview of IPsec, IP and IPv6, Authentication header (AH), Encapsulating Security Payload (ESP).

Security Trends – Attacks and services, Classical crypto systems, Different types of ciphers, LFSR sequences, Basic Number theory, Congruences, Chinese Remainder theorem, Modular exponentiation, Fermat and Euler's theorem, Legendre and Jacobi symbols, Finite fields, continued fractions.

UNIT-III

Model of Network security- Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Block Cipher and the Data Encryption Standard - Modes of operation, Triple DES, AES, RC4, RSA, Attacks, Primality test, Factoring.

Discrete Logarithms –Digital signatures, RSA, ElGamal, DSA, Unwanted traffic: denial of service attacks.

UNIT-IV

Authentication applications – Kerberos, X.509, PKI, Electronic Mail security, PGP, S/MIME, IP security, Web Security, SSL, TLS, SET.

System Security – Intruders, Malicious software, viruses, Firewalls and filters, Security Standards.

RECOMMENDED BOOKS			
Sr. no.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1	Network Security and EthicalHacking	RajatKhare	Luniver Press
2	Cryptography and Network Security	AtulKahate	Tata Mc-Graw Hill
3	Computer Networks	A.S Tanenbaum	Pearson

Course Code	**ME476**
Course Title	**IC Engines**
Type of Course	OE
L T P	3:0:0
Credits	3
Course pre-requisite	None
Course Objectives	The students will learn to classify different types of internal combustion engines and their applications.

SYLLABUS

UNIT-I

Introduction to IC Engines: Definition of engine; Heat Engine, Historical Development of IC Engines, Classification & Nomenclature, Application of IC Engines, Air Standard Cycle, Carnot Cycle, Sterling Cycle, Ericson Cycle, Otto Cycle, Diesel cycle, Dual Cycle, Thermodynamics Analysis of these cycle Actual Working of I.C. Engine: Working of 4 stroke petrol & diesel engines and their valve timing diagram, working of 2-stroke petrol & diesel engines & their valve timing diagrams, comparison of two stroke & four stroke engines, Actual working of 2 & 4 stroke gas engine and their valve diagram.

UNIT-II

Fuel Air Cycles and their analysis: Introduction to fuel air cycles and their significance, composition of cylinder gases, variable specific heats, Dissociation, effect of no. of moles, comparison of air standards & fuel air cycles, effect of operating variable like compression ratio, fuel air ratio, actual cycles and their analysis; Difference between Actual and Fuel-Air Cycle, Actual and Fuel-Air Cycles for S.I. and C.I. Engines. IC Engine Fuels: Introduction, types of fuels, solid, liquid and gaseous fuels, chemical structure of petroleum, petroleum refining process, important qualities of S.I. & C.I. Engine fuels and their rating. Combustion of fuels; Calorific valves of fuels, theoretical determination of CV of fuel, combustion equation for hydrocarbon fuels, determination of minimum air required for combustion, conversions of volumetric analysis of mass analysis, Determination of air supplied from volumetric analysis of Dry flue gases, Determination of excess air supplied , Determination of % of carbon in fuel burning to CO & CO2 , Determination of minimum quantity of air supplied to gaseous.

UNIT-III

Fuel Supply System: Fuel Supply System and fuel pumps, properties of air fuel mixture, a sample carburetor an its working, approximate analysis of simple carburetor, Actual air fuel ratio of single jet carburetor, Exact analysis of single jet carburetor, ideal requirements from a carburetor, limitations of single jet carburetor, different devices used to meet the requirements of an ideal carburetor. Different modern carburetors, introduction to petrol injection, fuel injection systems for C.I. Engines: classification of injection systems, injection pump, injection pump governor, mechanical governor, fuel injection systems, injection pump Governor, Mechanical Governor, Fuel Injector, Nozzle, Injection of S.I. Engines, Fuel Filters. Introduction, Stages of Combination in S.I. Engine, Flame font propagation, factor influencing the flame speed, ignition

lag and factors affecting the lag, Abnormal combustion and knocking, control and measurement of knock, rating of S.I. Engine fuels and anti knock agents, combustion chambers of S.I. Engines.

UNIT-IV

Supercharging: Introduction, purpose of supercharging, type of superchargers, analysis of superchargers, performance of superchargers, Arrangement of Supercharger and its installation, Turbo charged engines, supercharging of S.I. & C.I. Engines. Limitations of supercharging. Measurement and Testing: Measurement of friction horse power, brake horse power, indicated horse power, measurement of speed, air consumption, fuel consumption, heat carried by cooling water, heat carried by the exhaust gases, heat balance sheet, governing of I.C. Engines, performance characteristics of I.C. Engines: Performance parameters, performance of S.I. Engines, performance of C.I. Engine, Engine performance maps

Recommended Books

S. No	Name	Author	Publisher
1	Internal Combustion Engines	V. Ganesan	Prentice Hal
2	A Course in Internal Combustion Engines.	M. Damundwar	Dhanpat Rai
3	Internal combustion engine fundamentals	John B. Heywood	McGraw-Hil

Course Code	**ME478**
Course Title	**Power Plant engineering**
Type of Course	OE
L T P	3:0:0
Credits	3
Course pre-requisite	Applied thermodynamics
Course Objectives	To provide an overview of power plants and the associated energy conversion issues.

Syllabus

UNIT-I

Coal based thermal power plants, basic Rankine cycle and its modifications, layout of modern coal power plant, super critical boilers, FBC boilers, turbines, condensers, steam and heating rates, subsystems of thermal power plants, fuel and ash handling, draught system, feed water treatment, binary cycles and cogeneration systems Gas turbine and combined cycle power plants, Brayton cycle analysis and optimization, components of gas turbine power plants, combined cycle power plants, Integrated Gasifier based Combined Cycle (IGCC) systems.

UNIT-II

Basics of nuclear energy conversion, Layout and subsystems of nuclear power plants, Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANDU Reactor, Pressurized Heavy Water Reactor (PHWR), Fast Breeder Reactors (FBR), gas cooled and liquid metal cooled reactors, safety measures for nuclear power plants.

UNIT-III

Hydroelectric power plants, classification, typical layout and components, principles of wind, tidal, solar PV and solar thermal, geothermal, biogas and fuel cell power systems.

UNIT-IV

Energy, economic and environmental issues, power tariffs, load distribution parameters, load curve, capital and operating cost of different power plants, pollution control technologies including waste disposal options for coal and nuclear plants.

Recommended Text Books

S. No	Author	Title	Publisher
1	El Wakil M.M	Power Plant Technology	McGraw Hill, 2010.
2	Elliot T.C&Chen K	Power Plant Engineering	McGraw Hill,1998.
3	Nag P.K.,	Power Plant Engineering	Tata McGraw Hill,2008

Course Code	**EE476**
Course Title	Utilization of Electrical Energy
Type of Course	Open Elective
L T P	3:0:0
Credits	3
Course Prerequisites	Electrical machines, Power system
Course Objectives (CO)	To understand utilization of electrical power in industrial, Domestic, commercial, Agricultural and railway loads.

SYLLABUS

UNIT-I

Electric Drives: Electrical drives & Mechanical drives, Concept of electrical drives, Basic features of industrial drives, review of operating and starting characteristics of different types of electric motors for various drives (AC and DC motors). Estimation of rating and heating of motors, Load equalization (Fly wheel effect), Drives for particular services. Electric Traction: Introduction to Indian railways system , Electric Locomotive Classes, Various types of Traction system, single phase feeding arrangement prevalent in India. Substation. arrangements, Different Types of Catenary construction and line insulation, Span and dropper design Calculations.

UNIT-II

Electric Heating and Welding: Methods of electric heating, types of electric heating, constructional details and performance of resistance heating furnace. Dielectric heating, Alternating current (AC).and Direct current (DC) Welding, Resistance and Arc Welding. Electric Beam Welding, Laser Welding. Typical construction of electrical welding AC and DC set.

UNIT-III

Illumination: Production of light by different methods, terms used, laws of illumination, Different Artificial light sources, their construction and operating principles, Design of lighting schemes and equipment used for indoor, industrial and flood lighting.

UNIT-IV

Electrolysis: Laws of Electrolysis, Process voltage, current, energy, efficiency, Applications of electrolysis. Refrigeration and Air conditioning: Refrigeration system, Domestic refrigeration, Air conditioner, Comfort Air conditioning, Effective temperature.

RECOMMENDED BOOKS

Sr. no.	Name	AUTHOR(S)	PUBLISHER
1	Utilization of Electric Power and Electric Traction	J.B Gupta	S.K. Kataria and Sons
2	Modern Electric Traction	H.Partab	Dhanpat Rai
3	Electric Energy Utilization and Conservation	S.C Tripathy	Tata McGraw Hill
4.	Electric Motor Drives.	M.S Berde	Khanna Publishers

Course Code	**EE478**
Course Title	**Energy Auditing & Management**
Type of Course	Open Elective
L T P	3:0:0
Credits	3
Course Prerequisites	Basic electrical.
Course Objectives (CO)	To understand how energy is used within the plant and to find opportunities for improvement, energy saving, energy audits concepts to evaluate the effectiveness of an energy efficiency project or program.

SYLLABUS

UNIT-I

Energy Scenario: Energy needs of growing economy, Long term energy scenario, Energy pricing, Energy sector reforms, Energy and environment: Air pollution, Climate change, Energy security, Energy conservation and its importance, Energy strategy for the future, Energy conservation Act-2001 and its features.

UNIT-II

Energy Management and Audit: Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments

UNIT-III

Financial Management: Investment-need, Appraisal and criteria, Financial analysis techniques-Simple payback period, Return on investment, Net present value, Internal rate of return, Cash flows, Risk and sensitivity analysis, Financing options, Energy performance contracts and role of energy savings companies (ESCOs).

UNIT-IV

Electrical system: Electricity tariff, Load management and maximum demand control, Power factor improvement, Distribution and transformer losses. Losses in induction motors, Motor efficiency, Factors affecting motor performance, Rewinding and motor replacement issues, energy efficient motors. Light source, Choice of lighting, Luminance requirements, and Energy conservation avenues Compressed air system: Types of air compressors, Compressor efficiency, efficient compressor operation, Compressed air system components, Capacity assessment, Leakage test Factors affecting the performance and efficiency.

RECOMMENDED BOOKS

Sr. no.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1	Solar Energy and Energy Conservation.	Sawhney and Maheshwari	Prentice Hall (India)
2	Energy Technology	Rao S. and B. B. Parulkar	Khanna Publishers
3	Solar Energy	Sukhatme S. P	Tata McGraw Hill

Course Code	**ECE476**
Course Title	Digital System Design
Type of Course	OE
L T P	3:0:0
Credits	3
Course Prerequisite	Basic Electronics, Digital Electronics, VHDL
Course Objectives (CO)	To provide the knowledge of designing various combinational and Sequential circuits using VHDL. To introduce the concept of Finite state machine and use it for minimization of specified synchronous and asynchronous sequential circuits

SYLLABUS

UNIT-I

Review of Digital Electronic concepts: Basic gates, Adder, Subtractor, Multipliers, Multiplexers, ROM, PLA, PAL, and PLD, Minimization techniques: optimal combinational with K Map and tabular methods. Simplification and minimization.

UNIT- II

Synchronous Sequential Logic: The Concept Of Memory, The Binary Cell, The Cell and the Bouncing Switch, Set /Reset, Design of sequential modules – SR, D, T and J-K Flip-flops, Flip-flop applications – Clock generation, Counters, Registers, Triggering of flip-flops, State reduction and assignment, Flip-flop excitation tables, Design procedure.

UNIT-III

Finite State Machines: Finite state model, Memory elements and their excitation functions, Synthesis of Synchronous sequential circuits, Capabilities and limitations of FSM, Design, Modeling and Simulation of Moore and Mealy machines. Design and VHDL implementation of FSMs.

UNIT IV

Asynchronous Sequential Logic: Analysis Procedure, Circuits with latches, Design procedure, Reduction of state and flow tables, Race-free state assignment, Hazards, Design examples. Design issues like metastability, synchronizers, clock skew and timing Considerations. Designing with Programmable Logic Devices and Programmable Gate Arrays: Read only memories, Programmable logic arrays, Programmable array logic.

RECOMMENDED BOOKS

S. No	Name	Author(S)	Publisher
1	VHDL	Douglas Perry	TMH
2	An Engineering Approach to Digital Design	William I. Fletcher	Prentice Hall of India
3	Digital System Design using VHDL	Charles H.Roth	Thomson
4	Fundamentals of Digital Logic with VHDL design	Stephen Brown, ZvonkoVranesic	TMH
5	Digital Design	John Wakerley	Prentice Hall

Course Code	**ECE478**
Course Title	**Broadband Communication**
Type of course	OE
L T P	3:0:0
Credits	3
Course prerequisites	Knowledge of Analog and Digital Communication.
Course objectives (CO)	Study the principles and features of various possible alternatives for realizing high speed communication systems. Analyze and identify the suitability of a specific broadband system from the available alternatives depending on the geographical location, subscriber density.

SYLLABUS

UNIT I

Mobile and Satellite Communication - Mobile Communication Principles, Architecture of GSM, Introduction to 2G to 4G Systems such as GSM, HSCSD, GPRS, EDGE etc, Principles of CDMA. Satellite technology evolution, LEO, MEO, GEO satellites and their special services, orbital equations, link budget for C- band satellite, impact of satellite in Indian scenario.

UNIT II

Fixed Wireless System and Wireless System-Microwave Links, Private Unlicensed links(Spread Spectrum), MMDS(Multi channel Multi- point distribution service), LMDS (Local multipoint Distribution Service), Introduction to Wi- Fi and Wi- MAX , Principles and Parameters for Wireless LAN (IEEE 802.11 Standards), Operating Principles for Wi- MAX(IEEE 802.16 standard) , Comparison of Wi- Fi and Wi- MAX.

UNIT III

Optical Fiber Communication**.**-Principles of optical fiber communication, significant features and advantages of optical fiber communications, Recent trend- FTTH(Fiber – to –the – Home) System.

UNIT IV

Quality of Service (Qos) in Broadband. Qos issues in broadband communication.

RECOMMENDED BOOKS

S. No.	**Name**	**Author(S)**	**Publisher**
1	Mobile Communication Design Fundamentals	William C.Y. Lee	John Wiley & Sons
2	Satellite Communications	Timothy Pratt	John Wiley & Sons
3	Wireless Communications	T.L Singhal	Tata McGraw-Hill
4	Optical Fibre Communications	Senior.John.M	Prentice Hall

Course Code	**CE476**
Course Title	**Infrastructure and Real Estate Management**
Type of Course	**OE**
L T P	3:0:0
Credits	3
Course Prerequisites	Engineering Economics
Course Objectives (CO)	The objective of this course is to make students aware of the various elements of infra structure and real estate management.

SYLLABUS

UNIT- I

Introduction:
Impact of Infrastructure development on economic development, standard of livingand environment. Reasons for rise of public sector and government in infrastructural activities. Changed socio-economic scenario and current problems and related issues.

Infrastructure Management:
Importance, scope and role in different sectors of construction.

- **Highway Sector:**
  Repayment of Funds, Toll Collection Strategy, Shadow tolling, and directtolls, Maintenance strategy, Review of toll rates & structuring to suit the traffic demand
- **Irrigation Projects:**
  Large / Small Dams - Instrumentation, monitoring of water levels,catchments area, rainfall data management, prediction, land irrigation planning &policies,processes Barrages, Canals.
- **Power Projects:**
  Power scenario in India, Estimated requirement, Generation of Powerdistribution strategies, national grid, load calculation & factors, Hydropower - day to dayoperations, management structures, maintenance, Thermal Power, Nuclear Power.
- **Airports:**
  Requisites of domestic & International airports & cargo & military airports, facilitiesavailable, Terminal management, ATC.
- **Railways:** Mass Rapid Transport System MRTS, LRT, Multi-modal Transport System.

UNIT- II

Real estate management
Introduction, functions of real estate project management.

Project management –I
Project management processes and organizational pattern, work breakdown structure, time scheduling techniques, CPM/PERT network analysis, resource management and scheduling techniques, material management, time cost analysis, project organization, project peculiarities, good practices and managerial responsibilities, project cost control.

Project management II
The application of management processes such as scope management, cost management, risk management, communication management and time management during the different construction phases. Some of the major techniques to be discussed are value engineering, quality function deployment, cost benefit analysis, risk identification and its quantification.

UNIT- III

Operation management

Introduction , nature & scope of operation/production management, relationship with other functional areas, recent trends in operation management, manufacturing & theory of constraints, types of production system, just in time(JIT) and lean system

Product design and process selection

Stages in product design processes, value analysis, facility location and layout: types characteristics, merits and demerits, work measurement, job design

UNIT- IV

Forecasting and capacity planning

Method of forecasting, overview of operation planning, aggregate production planning, production strategies, capacity requirement planning, MRP, scheduling supply chain management, purchase management, inventory management.

Quality management

Definition, dimension, cost of quality, continuous improvement(kaizen), ISO (9000&14000 series), quality awards, statistical quality control, variable and attribute, process control, control chart(X,R,P,np and C Charts) acceptance sampling operating characteristic curve(AQL, LTPD, a & b risk) total quality management(TQM)

RECOMMENDED BOOKS			
Sr. no.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1	Project planning analysis, selection, financing, implementation and review	Chandra, prassanna	Tata McGraw Hill.Pub
2	Infrastructure development & financing towards a public private partnership	Raghuram.G& Jain R	Macmillan India ltd
3	Production and operation management, concepts methods & strategy	Charry S.N(2005)	John willy &sons asiapvt ltd

Course Code	**CE478**
Course Title	**Site Investigation**
Type of Course	**OE**
L T P	3:0:0
Credits	3
Course Prerequisites	None
Course Objectives (CO)	The course is intended for geotechnical engineers/engineering geologists to gain a practical understanding of the planning and design of site investigations, the spectrum of investigation techniques available, laboratory test scheduling, and interpretation of result

UNIT-I

Introduction: Soil formation Processes – Characteristics of major soil deposits of India. Necessity and Importance of soil exploration Method of sub surface exploration Test pits , Trenches, Caissons, Tunnels and drifts, Wash boring , Percussion drilling , Rotary drilling, Factors affecting the selection of a suitable method of boring. Extent of boring, Factors controlling spacing and depth of bore holes, Spacing and depth for various Civil engineering structures.

UNIT-II

Indirect method of exploration, Seismic method, Electrical resistivity, Resistivity sounding and profiling, Qualitative and quantitative interpretation of test results, Comparison of resistivity and seismic surveys, Shortcomings.

Ground water Observation: Different method of ground water observation: Time lag in observation, Sampling of ground water.

UNIT-III

Sampling: Source of disturbance and their influence, Type of sampler, Principle of design of sampler, Representative and undisturbed sampling in various types of soils, Surface sampling, Amount of sampling, Boring and sampling record, Preservation and shipment of sample preparation of bore log. Standard penetration test

UNIT-IV

Investigation below sea/river bed – methods and equipment's – interpretation of offshore exploration, Instrumentation in soil engineering - strain gauges - resistance and inductance type.

Suggested textbooks

S. No	Name	Author(S)	Publisher
1	Site investigation"	Simon and Cayton	
2	Foundation Analysis and Design	Bowles J E	McGraw Hill, New York

List of Suitable virtual Labs for Electrical Engineering Department

S. No.	Name of the lab	SEMESTER
1	Electrical Machines Lab	III/IV
2	Electrical Machines Laboratory	III/IV
3	Virtual Power Laboratory	V/VI
4	Industrial Electric Drives And Substation Automation Lab	VI
5	Electrical Machines	IV
7	Electromechanical Energy Conversion Laboratory	III