Institute Vision

To emerge as a Centre of Excellence for Learning and Research in the domains of engineering, computing and management.

Institute Mission

- Provide congenial academic ambience with state -of -art of resources for learning and research.
- Ignite the students to acquire self-reliance in the latest technologies.
- Unleash and encourage the innate potential and creativity of students.
- Inculcate confidence to face and experience new challenges.
- Foster enterprising spirit among students.
- Work collaboratively with technical Institutes / Universities / Industries of National and International repute

Department Vision

To impart innovative technical education with global standards, inculcate high pattern of discipline, thereby cultivating Electrical and Electronics Engineering students technologically prominent and ethically strong to meet the challenges of the society.

Department Mission

- Provide congenial academic ambience with necessary infrastructure and learning resources
- Inculcate confidence to face and experience new challenges.
- Ignite the students to acquire self reliance in State-of-the-Art Technologies
- Foster Enterprising spirit among students.

Program Educational Objectives (PEOs)

PEO1: To obtain Professional Competency through the application of knowledge gained through fundamental subjects like Mathematics, Physics, other basic courses and core subjects of Electrical and Electronics Engineering department. **(Professional Competency)**.

PEO2: T*o* excel in one's career by applying thoughts through critical thinking towards successful service and growth of an organization employed and higher education **(Successful Career Goals).**

PEO3: Enhance knowledge by updating the advanced technological concept to adopt the work environment for facing the scenario of international and rapidly changing world as well as the contribution to the society **(Continuing Education and Contribution to Society).**

Program Specific Outcomes (PSO's)

PSO1: Understand the Basic Science, Circuit Theory, Electro-Magnetic Field Theory, Control Theory and apply them to Electrical Engineering problems.

PSO2: Utilize Statistics, Probability, Transforms Methods, Discrete Mathematics, and Applied Differential equations in support of Electrical/Electronic systems.

PSO3: Analyze, design and apply innovative techniques in Control Systems, Power Systems, Instrumentation Systems, Embedded System and Communication Systems.

Program Outcomes

Engineering Graduates will be able to:

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

4.9# Core Electives

Students have to choose core electives CE-1 in III year, II semester, CE-II and CE-III in IV year I semester and core electives (CE-IV and V) in IV year II semester, from the list of core electives courses given. However, the students may opt for core elective subjects offered in the related area.

4.10# Open Electives (OEs)

The CBCS, also called as Open Electives (OEs) has been implemented during III Year, II semester and IV year first semester. The CBCS provides choice for students to select from the prescribed courses. In which students can take courses of their choice, learn at their own pace and adopt an interdisciplinary approach to learning. It is mandatory for Under Graduate (UG) students to study 2 CBCS courses. The students have to choose one open elective (OE-I) in III year II semester, and one (OE-II) in IV year I semester, from the list of open electives given. However, the student cannot opt for an open elective subject offered by their own (parent) department, if it is already listed under any category of the subjects offered by parent department in any semester.

4.11#Value Added Courses (VAC)

Every student to undergo one Value Added Course (VAC) per semester from third year first semester to fourth year first semester (IV-I). The details of the syllabus, time table and faculty may be sent to the Controller of Examinations after approval from the Head of the Institution concerned at-least one month before the course is offered. Students can take a minimum of 30 lectures / Practices / Training session per course.

4.12[#] Industrial Visit

Industrial Visit for every student is required to go for at least one Industrial Visit starting from the second year of the program. The Heads of Department shall ensure that necessary arrangements are made in this regard.

4.13 [#]Industrial Training / Industrial Internship

Industrial Training / Industrial Internship for every student is required to go for at least one Industrial Training / Industrial Internship starting from the third year of the program. The Heads of Departments shall ensure that necessary arrangements are made in this regard.

CURRICULUM and SYLLABUS – 2016

I B.Tech-I Semester(EEE)

S.No	Subject code	Subject	L	T	P	Credits
1	16SAH111	FUNCTIONAL ENGLISH-I	3	1	0	3
2	16SAH114	MATHEMATICS-I	3	1	0	3
3	16CSE111	COMPUTER PROGRAMMING	3	1	0	3
4	16SAH112	ENGINEERING PHYSICS	3	1	0	3
5	16SAH113	ENGINEERING CHEMISTRY	3	1	0	3
6	16MEC112	ENGINEERING WORKSHOP & IT WORKSHOP LAB	0	0	3	2
7	16CSE112	COMPUTER PROGRAMMING LAB	0	0	3	2
8	16SAH115	ENGINEERING PHYSICS AND ENGINEERING CHEMISTRY LAB	0	0	3	2
		Contact periods/Week	15	05	09	
			Total/Week 30			
Total credits(6 Theory+2 Labs)						21

I B.Tech-II Semester (EEE)

S.No	Subject code	Subject	L	T	P	Credits
1	16SAH121	FUNCTIONAL ENGLISH-II	3	1	0	3
2	16SAH122	MATHEMATICS-II	3	1	0	3
3	16CSE121	DATA STRUCTURES	3	1	0	3
4	16MEC111	ENGINEERING DRAWING PRACTICE	3	1	0	3
5	16EEE121	ELECTRICAL CIRCUITS	3	1	0	3
6	16EEE122	ELECTRICAL CIRCUITS LAB	0	0	3	2
7	16CSE122	DATA STRUCTURES LAB	0	0	3	2
8	16SAH116	ENGLISH COMMUNICATIONS SKILLS LAB	0	0	3	2
		Contact periods/Week	15	05	09	
			Total/Week 30			
Total credits(6 Theory+2 Labs)						**21**

II B.Tech-I Semester (EEE)

S.No	Subject code	Subject	L	T	P	Credits
1	16SAH211	MATHEMATICS-III	3	1	0	3
2	16MEC213	FLUID MECHANICS & MACHINERY	3	1	0	3
3	16ECE211	ELECTRONIC DEVICES & CIRCUITS	3	1	0	3
4	16EEE211	NETWORK THEORY	3	1	0	3
5	16EEE212	ELECTRICAL MACHINES-I	3	1	0	3
6	16EEE213	GENERATION OF ELECTRICAL POWER	3	1	0	3
7	16MEC217	FLUID MECHANICS & MACHINERY LAB	0	0	3	2
8	16ECE214	ELECTRONIC DEVICES & CIRCUITS LAB	0	0	3	2
		Contact periods/Week	18	06	06	
			Total/Week 30			
Total credits(6 Theory+2 Labs)						**22**

II B.Tech-II Semester (EEE)

S.No	Subject code	Subject	L	T	P	Credits
1	16SAH221	MATHEMATICS-IV	3	1	0	3
2	16EEE221	ELECTROMAGNETIC FIELDS	3	1	0	3
3	16ECE213	SWITCHING THEORY & LOGIC DESIGN	3	1	0	3
4	16EEE222	ELECTRIC MACHINES-II	3	1	0	3
5	16ECE227	ANALOG ELECRONIC CIRCUITS	3	1	0	3
6	16EEE223	CONTROL SYSTEMS	3	1	0	3
7	16EEE224	CIRCUITS & SIMULATION LAB	0	0	3	2
8	16EEE225	ELECTRICAL MACHINES-I LAB	0	0	3	2
9	16EEE226	COMPREHENSIVE ONLINE TEST - I	0	0	0	1
		Contact periods/Week	18	06	06	
			Total/Week 30			
Total credits(6 Theory+2 Labs)						**23**

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III B.Tech- I Semester

S.No	Subject Code	Subject	Category	Scheme of Instructions Periods per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1	16EEE311	TRANSMISSION OF ELCETRIC POWER	PC	3	1	0	3	30	70	100
2	16EEE312	POWER ELECTRONICS	PC	3	1	0	3	30	70	100
3	16EEE313	ELECTRICAL MACHINES-III	PC	3	1	0	3	30	70	100
4	16EEE314	SWITCHGEAR AND PROTECTION	PC	3	1	0	3	30	70	100
5	16EEE315	ELECTRICAL AND ELECTRONICS MEASUREMENTS	ES	3	1	0	3	30	70	100
6	16ECE318	LINEAR IC ' s AND APPLICATIONS	PC	3	1	0	3	30	70	100
7	16EEE316	ELECTRICAL MACHINES-II LAB	PC	0	0	3	2	30	70	100
8	16EEE317	CONTROL SYSTEM AND SIMULATION L AB	PC	0	0	3	2	30	70	100
Contact periods per week				18	06	06	-			
Total periods per week				30						
Total credits (5 Theory + 3 Labs)							22			
Total Marks								240	560	800

III B.Tech- II Semester

S.No	Subject Code	Subject	Category	Scheme of Instructions Periods per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1	16EEE321	POWER SYSTEM ANALYSIS	PC	3	1	0	3	30	70	100
2	16EEE322	POWER SEMOCONDUCTOR DRIVES	PC	3	1	0	3	30	70	100
3	16EEE323	DISTRIBUTION OF ELECTRIC POWER	PC	3	1	0	3	30	70	100
4	16ECE329	MICROPROCESSORS AND INTERFACING	PC	3	1	0	3	30	70	100
5	16EEE324	**Core Elective-I**	CE	3	1	0	3	30	70	100
6	OE-I	**Open Elective-I**	OE	3	1	0	3	30	70	100
7	16EEE325	POWER ELECTRONICS AND SIMULATION LAB	PC	0	0	3	2	30	70	100
8	16EEE326	ELECTRICAL & ELECTRONICS MEASUREMENTS LAB	PC	0	0	3	2	30	70	100
9	16EEE327	ON-LINE COMPREHENSIVE EXAM-II / MOOC COURSE	EEC/OE				1			
Contact periods per week				18	06	06	-			
Total periods per week				30						
Total credits (5 Theory + 3 Labs)							23			
Total Marks								240	560	800

IV B.Tech- I Semester

S.No	Subject Code	Subject	Category	Scheme of Instructions Periods per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1	16EEE411	POWER SYSTEM OPERATION AND CONTROL	PC	3	1	0	3	30	70	100
2	16EEE412	MODERN CONTROL THEORY	PC	3	1	0	3	30	70	100
3	16EEE413	FUNDAMENTALS OF HVDC AND FACTS	PC	3	1	0	3	30	70	100
4	OE-II	**Open Elective-II**	OE	3	1	0	3	30	70	100
5	16EEE414	**Core Elective-II**	CE	3	1	0	3	30	70	100
6	16EEE415	**Core Elective-III**	CE	3	1	0	3	30	70	100
7	16ECE418	MICROPROCESSORS AND INTERFACING LAB	PC	0	0	3	2	30	70	100
8	16EEE416	POWERSYSTEM AND SIMULATION LAB	PC	0	0	3	2	30	70	100
Contact periods per week				18	06	06	-			
Total periods per week				30						
Total credits (5 Theory + 3 Labs)							22			
Total Marks								240	560	800

IV B.Tech- II Semester

S.No	Subject Code	Subject	Category	Scheme of Instructions Periods per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1	16MBA	BUSINESS MANAGEMENT	ES	3	1	0	3	30	70	100
2	16HAS212	ENVIRONMENTAL SCIENCE	ES	3	1	0	3	30	70	100
3	16EEE421	**Core Elective-IV**	CE	3	1	0	3	30	70	100
4	16EEE422	**Core Elective-V**	CE	3	1	0	3	30	70	100
5	16EEE423	Project Work	EEC	18			10	30	70	100
Contact periods per week				30	4	0	-			
Total periods per week				34						
Total credits (5 Theory + 3 Labs)							22			
Total Marks								150	350	500

CORE ELECTIVES

III B.Tech- II Semester (Core Elective-I)

S.No	Subject Code	Subject	Subject Category	Scheme of Instructions Periods per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1	16EEE324A	POWER SYSTEM ECONOMICS	CE	3	1	-	3	30	70	100
2	16EEE324B	PLC and DCS APPLICATIONS	CE	3	1	-	3	30	70	100
3	16EEE324C	SOFT COMPUTING TECHNIQUES	CE	3	1	-	3	30	70	100
4	16EEE324D	COMPUTER NETWORKS	CE	3	1	-	3	30	70	100

IV B.Tech- I Semester (Core Elective-II)

S.No	Subject Code	Subject	Subject Category	Scheme of Instructions Periods per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1	16EEE414A	HIGH VOLTAGE ENGINEERING	CE	3	1	-	3	30	70	100
2	16EEE414B	PRINCIPLES OF POWER QUALITY	CE	3	1	-	3	30	70	100
3	16EEE414C	ADVANCED POWER SYSTEM PROTECTION	CE	3	1	-	3	30	70	100
4	16EEE414D	SMART GRID	CE	3	1	-	3	30	70	100

IV B.Tech- I Semester (Core Elective-III)

S.No	Subject Code	Subject	Subject Category	Scheme of Instructions Periods per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1	16EEE415A	DIGITAL SIGNAL PROCESSING	CE	3	1	-	3	30	70	100
2	16EEE415B	DYNAMICS OF ELECTRICAL MACHINES	CE	3	1	-	3	30	70	100
3	16EEE415C	RELIABILITY ENGINEERING AND APPLICATIONS TO POWER SYSTEMS	CE	3	1	-	3	30	70	100
4	16EEE415D	UTILIZATION OF ELECTRICAL ENERGY	CE	3	1	-	3	30	70	100

IV B.Tech- II Semester (Core Elective-IV)

S.No	Subject Code	Subject	Subject Category	Scheme of Instructions Periods per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1	16EEE421A	DIGITAL CONTROL SYSTEM	CE	3	1	-	3	30	70	100
2	16EEE421B	SPECIAL ELECTRICAL MACHINES	CE	3	1	-	3	30	70	100
3	16EEE421C	DESIGN OF PERMANENT MAGNET BRUSHLESS AND RELUCTANCE MOTORS	CE	3	1	-	3	30	70	100
4	16EEE421D	MODERN POWER ELECRONICS	CE	3	1	-	3	30	70	100

IV B.Tech- II Semester (Core Elective-V)

S.No	Subject Code	Subject	Subject Category	Scheme of Instructions Periods per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
1	16EEE422A	NETWORK ANALYSIS AND SYNTHESIS	CE	3	1	-	3	30	70	100
2	16EEE422B	DESIGN OF ELECTRICAL SYSTEMS	CE	3	1	-	3	30	70	100
3	16EEE422C	NONCONVENTIONAL ENERGY SOURCES	CE	3	1	-	3	30	70	100
4	16EEE422DD	EXTRA HIGH VOLTAGE AC TRANSMISSION	CE	3	1	-	3	30	70	100

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LIST OF OPEN ELECTIVES FOR EEE DEPARTMENT

III B.Tech- II Semester **Open Elective-I**

Offered Department	Course Code	Subject	Subject Category	Scheme of Instructions Periods per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
S&H	16OSAH321	LASER and Fiber Optics	OE	3	1	-	3	30	70	100
	16OSAH322	Advanced Mathematics	OE	3	1	-	3	30	70	100
	16OSAH323	Mathematical Modelling	OE	3	1	-	3	30	70	100
CSE	16OCSE321	Object Oriented Programming	OE	3	1	-	3	30	70	100
	16OCSE322	Python Programming	OE	3	1	-	3	30	70	100
	16OCSE323	Web Programming	OE	3	1	-	3	30	70	100
CIV	16OCIV321	ConstructionEquipment, Planning and Management	OE	3	1	-	3	30	70	100
	16OCIV322	Remote sensing and GIS	OE	3	1	-	3	30	70	100
	16OCIV323	Green Buildings and Energy Conservation	OE	3	1	-	3	30	70	100
MECH	16OMEC321	Industrial Robotics	OE	3	1	-	3	30	70	100
	16OMEC322	Optimization Techniques	OE	3	1	-	3	30	70	100
	16OMEC323	Mechatronics	OE	3	1	-	3	30	70	100
ECE	16OECE321	Machine Vision System	OE	3	1	-	3	30	70	100
	16OECE322	MEMS and Micro Systems	OE	3	1	-	3	30	70	100
	16OECE323	Foundation of Nano – Electronics	OE	3	1	-	3	30	70	100

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IV B.Tech- I Semester **Open Elective-II**

Offered Department	Subject Code	Subject	Subject Category	Scheme of Instructions Periods per Week				Scheme of Examination Maximum Marks		
				L	T	P/D	C	I	E	Total
S&H	16OSAH411	Applications of Graph Theory	OE	3	1	-	3	30	70	100
	16OSAH412	Introduction to Nano Science and Technology	OE	3	1	-	3	30	70	100
	16OSAH413	Entrepreneurship Development	OE	3	1	-	3	30	70	100
CSE	16OCSE411	Database Management Systems	OE	3	1	-	3	30	70	100
	16OCSE412	Internet of Things	OE	3	1	-	3	30	70	100
	16OCSE413	Information Security	OE	3	1	-	3	30	70	100
CIV	16OCIV411	Transport and Environment	OE	3	1	-	3	30	70	100
	16OCIV412	Disaster Management	OE	3	1	-	3	30	70	100
	16OCIV413	Air Pollution and Control Engineering	OE	3	1	-	3	30	70	100
MECH	16OMEC411	Quality Control and Reliability Engineering	OE	3	1	-	3	30	70	100
	16OMEC412	Industrial Engineering and Psychology	OE	3	1	-	3	30	70	100
	16OMEC413	Power Generation Technologies	OE	3	1	-	3	30	70	100
ECE	16OECE411	Medical Electronics	OE	3	1	-	3	30	70	100
	16OECE412	Fundamentals of Embedded Systems	OE	3	1	-	3	30	70	100
	16OECE413	Data Communication and Networks	OE	3	1	-	3	30	70	100

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S.No	Subject Code	Subject	Offered Semester	Category	Scheme of Instructions Periods per Week			
					L	T	P/D	C
1	P&T	English Communication Skills	II-I	EEC	2	-	-	-
2	P&T	Personality Development Program-I	II-I	EEC	2	-	-	-
3	P&T	Personality Development Program-II	II-II	EEC	2	-	-	-
4	16EEE226	ON-LINE COMPREHENSIVE EXAM-I	II-II	EEC	2	-	-	1
5	P&T	Reasoning and Aptitude-I	III-I	EEC	2	-	-	-
6	16EEE327	ON-LINE COMPREHENSIVE EXAM-II	III-II	EEC	2	-	-	1
7	P&T	Reasoning and Aptitude-II	III-II	EEC	2	-	-	-
8	16EEE423	PROJECT WORK	IV-II	EEC	18	-	-	10
				Total	32	-	-	12

SUMMARY OF CREDIT ALLOCATION

S.NO	Subject Area	Credits As Per Semester								Total Credits	Percentage – wise Credit Distribution
		I-I	I-II	II-I	II-II	III-I	III-II	IV-I	IV-II		
1.	SH	8	14	3	6	-	-	-	-	31	17.613
2.	ES	13	2	8	-	3	-	-	3	29	16.477
3.	PC	-	5	11	16	19	16	13	3	83	47.159
4.	CE	-	-	-	-	-	3	6	6	15	8.522
5.	OE	-	-	-	-	-	3	3	-	06	3.409
6.	EEC	-	-	-	1	-	1	-	10	12	6.818
7.	AC	-	-	-	-	-	-	-	-	0	0
Total		**21**	**21**	**22**	**23**	**22**	**23**	**22**	**22**	**176**	**100**

B.TECH III-I SEM (E.E.E)

L	T	P	C
3	1	0	3

SUB CODE: 16EEE311 TRANSMISSION OF ELECTRIC POWER

Course Educational Objectives:

CEO1: To make students capable to understand the electrical line parameters.

CEO2: To impart knowledge on short, medium and long transmission lines.

CEO3: To provide the knowledge about the system transients and transmission line parameters.

CEO4: To acquire knowledge on the concepts of corona, sag and tension calculations.

CEO5: To provide knowledge on the issues related to overhead line insulators and underground cables.

UNIT-I TRANSMISSION LINE PARAMETERS

Types of conductors - calculation of resistance for solid conductors - Calculation of inductance for single phase and three phase, single and double circuit lines, concept of GMR & GMD, symmetrical and asymmetrical conductor configuration with and without transposition, Numerical Problems- Calculation of capacitance for 2 wire and 3 wire systems, effect of ground on capacitance, capacitance calculations for symmetrical and asymmetrical single and three phase, single and double circuit lines, Numerical Problems.

UNIT-II PERFORMANCE OF SHORT, MEDIUM AND LONG TRANSMISSION LINES

Classification of Transmission Lines - Short, medium and long line and their model - representations - Nominal-T, Nominal-Pie and A, B, C, D Constants. Numerical Problems. Mathematical Solutions to estimate regulation and efficiency of all types of lines - Numerical Problems. Long Transmission Line-Rigorous Solution, evaluation of A,B,C,D Constants, Interpretation of the Long Line Equations – Representation of Long lines – Equivalent T and Equivalent – π – surge Impedance and surge Impedance loading – Ferranti effect , Charging current.

UNIT-III POWER SYSTEM TRANSIENTS

Types of system transients-Travelling or propagation of surges- attenuation, distortion , reflection and refraction coefficients- termination of lines with different types of conditions – open circuited line , short circuited line, T-junction (numerical problems)-Bewleys Lattice diagrams(for all cases mentioned with numerical examples)

UNIT-IV CORONA, SAG AND TENSION CALCULATIONS

Corona - Description of the phenomenon, factors affecting corona, critical voltages and power loss, Radio Interference. Sag and Tension Calculations with equal and unequal heights of towers, Effect of Wind and Ice on weight of Conductor, Numerical Problems - Stringing chart and sag template and its applications.

UNIT-V OVERHEAD LINE INSULATORS AND UNDERGROUND CABLES

Types of Insulators, String efficiency and Methods for improvement, Numerical Problems - voltage distribution, calculation of string efficiency, Capacitance grading and Static Shielding.Types of Cables, Construction, Types of Insulating materials, Calculations of Insulation resistance and stress in insulation, Numerical Problems. Capacitance of Single and 3-Core belted cables, Numerical Problems. Grading of Cables - Capacitance grading, Numerical Problems, Description of Inter-sheath grading.

Course Outcomes:

On successful completion of course, student will be able to

Course Outcomes		POs related to COs
CO1	Ability to do calculation of resistance, Inductance and Capacitance of Transmission Lines.	PO1, PO2
CO2	Ability to apply the knowledge on short, medium and long transmission lines..	PO1, PO2, PO3
CO3	Demonstrate knowledge onpower system transients.	PO1, PO2
CO4	Understand the concepts of corona, sag and tension calculations.	PO1, PO2, PO3
CO5	Able to analyze the overhead line insulators and underground cables.	PO1, PO2, PO3

TEXT BOOKS:

1. Electrical Power Systems, 6 /e2012 C.L.Wadwa, New Age International Publishers–New Delhi.
2. Principles of Power systems, 4/e 2005 V.K.Mehta, S.Chand Publications – New Delhi.

REFERENCE BOOKS:

1. Elements of Power systems–4/e 1982 William D Stevenson - Tata McGraw – Hill Education Pvt. Ltd.. Noida.
2. Power system analysis and design by B.R.Gupta,S.chand&co,6th revised edition
3. Power system analysis-by john j Grainger, William D Stevenson, TMC Companies,4th edition

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	2	3	2	-	-	-	-	-	-	-	-	-
CO5	2	3	2	-	-	-	-	-	-	-	-	-

B.TECH III-I SEM (E.E.E)

L	T	P	C
3	1	0	3

SUB CODE: 16EEE312 POWER ELECTRONICS

Course Educational Objectives:

CEO1. To impart knowledge on Different types of power semiconductor devices and their switching.

CEO2. To impart knowledge on Operation, characteristics and performance parameters of controlled rectifiers.

CEO3. To impart knowledge on Operation, switching techniques and basics topologies of DC-DC switching regulators.

CEO4. To impart knowledge on Different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.

CEO5. To impart knowledge on Operation of AC voltage controller and various configurations.

UNIT - 1: POWER SEMI-CONDUCTOR DEVICES AND COMMUTATION CIRCUITS

Thyristors – Silicon Controlled Rectifiers (SCR's) – BJT – Power MOSFET – Power IGBT and their characteristics and other thyristors – Basic theory of operation of SCR – Static characteristics – Turn on and turn off methods- Dynamic characteristics of SCR - Turn on and Turn off times -Salient points -Two transistor analogy – SCR – R and RC Triggering - UJT firing circuit - Series and parallel connections of SCR's – Snubber circuit details – Specifications and Ratings of SCR's - BJT - IGBT - Numerical problems – Line Commutation and Forced Commutation circuits.

UNIT - 2: SINGLE PHASE CONVERTERS

Phase control technique – Single phase Line commutated converters – Midpoint and Bridge connections – Half controlled converters with Resistive - RL loads and RLE load– Fully controlled converters with - Resistive - RL loads -Derivation of average load voltage and current -Active and Reactive power inputs to the converters without and with Freewheeling Diode- Effect of source inductance –Numerical problems.

UNIT - 3: THREE PHASE CONVERTERS

Three phase converters – Three pulse and six pulse converters – Mid point and bridge connections average load voltage With R and RL loads – Effect of Source inductance–Dual converters (both single phase and three phase) - Waveforms –Numerical Problems.

UNIT - 4: AC VOLTAGE CONTROLLERS AND CYCLO CONVERTERS

AC voltage controllers – Single phase two SCR's in anti parallel – With R and RL loads – modes of operation of Triac – Triac with R and RL loads – Derivation of RMS load voltage- current and power factor wave forms –Firing circuits -Numerical problems -Cyclo converters – Single phase mid-pointcyclo

converters with Resistive and inductive load (Principle of operation only) – Bridge configuration of single phase cyclo converter (Principle of operation only) – Waveforms.

UNIT - 5: CHOPPERS AND INVERTERS

Choppers – Time ratio control and Current limit control strategies – Step down choppers Derivation of load voltage and currents with R - RL and motor loads- Step up Chopper –four quadrant operation of dc drives-Morgan's chopper – Jones chopper (Principle of operation only), Switching regulators – buck, boost & buck-boost (continuous conduction mode only) -Inverters – Single phase inverter – Basic series inverter – Basic parallel Capacitor inverter bridge inverter – Waveforms – Simple forced commutation circuits for bridge inverters – Mc Murray and Mc Murray – Bedford inverters - Voltage control techniques for inverters Pulse width modulation techniques – Numerical problems.

Course Outcomes:

On successful completion of the course, students will be able to		**POs related to COs**
CO1	Understand the concepts on power semiconductor devices.	PO1,PO2
CO2	Analyze phase controlled converters and corresponding drives.	PO1,PO2,PO3,PO4, PO7
CO3	Analyze DC-DC converters and corresponding drives.	PO1,PO2,PO3,PO4, PO7
CO4	Analyze inverters and corresponding drives.	PO1,PO2,PO3,PO4, PO7
CO5	Choose the converters for real time applications.	PO1,PO2,PO3,PO4, PO7

Text Books:

1. M.H. Rashid, 'Power Electronics: Circuits, Devices and Applications', Pearson Education, Third Edition, New Delhi, 2004.
2. P.S.Bimbra "Power Electronics" Khanna Publishers, third Edition, 2003.
3. Ashfaq Ahmed 'Power Electronics for Technology', Pearson Education, Indian reprint, 2003.

Reference Books:

1. Joseph Vithayathil, 'Power Electronics, Principles and Applications', McGraw Hill Series, 6th Reprint, 2013.
2. Philip T. Krein, "Elements of Power Electronics" Oxford University Press, 2004 Edition.
3. L. Umanand, "Power Electronics Essentials and Applications", Wiley, 2010.
4. Ned Mohan Tore. M. Undel and, William. P. Robbins, 'Power Electronics: Converters, Applications and Design', John Wiley and sons, third edition, 2003.
5. S.Rama Reddy, 'Fundamentals of Power Electronics', Narosa Publications, 2014.
6. M.D. Singh and K.B. Khanchandani, "Power Electronics," McGraw Hill India, 2013.
7. JP Agarwal," Power Electronic Systems: Theory and Design" 1e, Pearson Education, 2002.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	2	2	3	3	-	-	3	-	-	-	-	-
CO3	2	2	3	3	-	-	3	-	-	-	-	-
CO4	2	2	3	3	-	-	3	-	-	-	-	-
CO5	3	3	3	3	-	-	3	-	-	-	-	-

B.TECH III-I SEM (E.E.E)

L	T	P	C
3	1	0	3

SUB CODE: 16EEE313 ELECTRICAL MACHINES III

Course Educational Objectives:

CEO1. To demonstrate knowledge on construction and performance of synchronous generators.

CEO2. To impart knowledge on methods of determining regulation of synchronous generators.

CEO3. To demonstrate knowledge on parallel operation of synchronous generators and analyze effect of change of excitation and mechanical power input.

CEO4. To impart knowledge on operation on synchronous motor,mathematical analysis for power developed andmethods of starting of synchronous motor.

CEO5. To impart knowledge on Construction, principle of operation and performance of single phase induction motors and Special machines.

UNIT - I: SYNCHRONOUS MACHINE & CHARACTERISTICS:

Constructional Features of round rotor and salient pole machines – Armature windings – Integral slot and fractional slot windings; Distributed and concentrated windings – distribution, pitch and winding factors – E.M.F Equation. Harmonics in generated EMF – suppression of harmonics – armature reaction - leakage reactance – synchronous reactance and impedance – experimental determination - phasor diagram – load characteristics.

UNIT - II: REGULATION OF SYNCHRONOUS GENERATOR:

Regulation by synchronous impedance method, M.M.F. method, Z.P.F. method and A.S.A. methods – salient pole alternators – two reaction analysis – experimental determination of X_d and X_q (Slip test) Phasor diagrams – Regulation of salient pole alternators.

UNIT - III: PARALLEL OPERATION OF SYNCHRONOUS GENERATOR:

Synchronizing alternators with infinite bus bars – synchronizing power torque – parallel operation and load sharing - Effect of change of excitation and mechanical power input. Analysis of short circuit current wave form – determination of sub-transient, transient and steady state reactance.

UNIT - IV: SYNCHRONOUS MOTORS:

Theory of operation – phasor diagram – Variation of current and power factor with excitation – synchronous condenser – Mathematical analysis for power developed.Excitation and power circles – hunting and its suppression – Methods of starting – synchronous induction motor-Power angle diagram.

UNIT - V:SINGLE PHASE MOTORS & SPECIAL MACHINES:

Constructional details of single phase induction motor – Double field revolving theory and operation – Equivalent circuit – No load and blocked rotor test – Performance analysis – Starting methods of single - phase induction motors – Capacitor-start capacitor run Induction motor-Shaded pole induction motor - Linear induction motor – Repulsion motor - Hysteresis motor - AC series motor- Servo motors-Stepper motors .

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Demonstrate knowledge on construction and performance of synchronous generators.	PO1, PO2, PO3, PO4
CO2	Acquire knowledge on methods of determining regulation of synchronous generators.	PO1, PO2, PO3, PO4
CO3	Demonstrate knowledge on parallel operation of synchronous generators and analyze effect of change of excitation and mechanical power input	PO1,PO2
CO4	Acquire knowledge on operation of synchronous motor, methodsof starting of synchronous motor and mathematical analysis for power developed.	PO1,PO2
CO5	Demonstrate knowledge on Construction, principle of operation and performance of single phase induction motors and Distinctive machines.	PO1, PO2, PO12

TEXT BOOKS:

1. Electrical Machines – by P.S. Bimbra, Khanna Publishers.
2. D.P. Kothari and I.J.Nagrath, 'Electric Machines', Tata McGraw Hill Publishing Company Ltd, 200
3. Principles of Electrical Machines, V. K. Mehta, Rohit Mehta, S. Chand Publishing.

REFERENCE BOOKS:

1. Electromachanics - III (Synchronous and single phase machines), S. Kamakashiah, Right Publishers..
2. Performance and Design of AC Machines, MG. Say, BPB Publishers.
3. Theory of Alternating Current Machinery, Langsdorf, Tata McGraw-Hill Companies.
4. Electric machinery, A.E. Fitzerald, C. Kingsley and S. Umans, McGraw Hill Companies.
5. Electric Machines, Mulukutla S. Sarma, Mukesh K. Pathak, Cengage Learning.
6. Fundamentals of Electric Machines, B. R. Gupta, VandanaSinghal, New Age International Publishers.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	-	-	-	-	-	-	-	-
CO2	3	3	2	2	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	2

B.TECH III-I SEM (E.E.E)

L	T	P	C
3	1	0	3

SUB CODE: 16EEE314 SWITCHGEAR AND PROTECTION

Course Educational Objectives:

CEO1. To provide the basic principles and operation of various types of circuit breakers.
CEO2. To study the classification, operation and application of different types of Electromagnetic protective relays.
CEO3. To instruct the ideas on protective schemes, for generator and transformers.
CEO4. To impart knowledge of various protective schemes used for feeders and busbars.
CEO5. To instruct the ideas on the principle and operation of different types of static relays.

UNIT - 1: CIRCUIT BREAKERS

Elementary principles of arc interruption –Restrikingvoltage & Recovery voltage – Rate of rise of recovery voltage –Numerical problems– Resistance switching– Current chopping - interruption of capacitive current.CB Specifications and Ratings –Autoreclosures - Types of Circuit Breakers – Air blast– Air break– Minimum oil- SF_6 and Vacuum circuit breakers – Comparative merits of different circuit breakers – Testing of circuit breakers.

UNIT - 2: RELAYS

Basic Requirements of Relays – Primary and Backup protection – Construction details of attracted armature –Balanced beam –Induction type and differential relays – Universal Torque equation – Characteristics of over current,Direction and distance relays. Static Relays –Types – Comparators – Amplitude and Phase comparators - Microprocessor based relays – Block diagram for over current (Definite,Inverse and IDMT) and Distance Relays and their Flow Charts.

UNIT - 3: GENERATOR PROTECTION AND TRANSFORMER PROTECTION

Protection of generators against Stator faults – Rotor faults and Abnormal Conditions - Restricted Earth fault and Inter-turn fault Protection - Numerical Problems on % Winding Unprotected - Protection of transformers –Percentage Differential Protection –Numerical Problem on Design of CT Ratios – Buchholtz relay Protection

UNIT - 4: PROTECTION OF FEEDER AND TRANSMISSION LINES

Principles and need for protective schemes –nature and causes of faults- Types of faults -Zones of protection and essential qualities of protection – Protection schemes-Protection of Feeder (Radial & Ring main) using over current Relays - Protection of Transmission line – 3 Zone protection using Distance Relays. Carrier current protection-Protection of Bus bars.

UNIT - 5: PROTECTION AGAINST OVER VOLTAGES AND EARTHING

Protection Against Over Voltages -Generation of Over Voltages in Power Systems– Protection against Lightning Over Voltages –Valve type and Zinc– Oxide Lighting Arresters – Insulation Coordination –BIL.Power system Earthing –Method of Neutral Earthing.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Understand the principles of arc interruption for application to high voltagecircuit breakers of air, oil, vacuum, SF6 gas type.	PO1
CO2	Understand the working principle and operation of different types ofelectromagnetic protective relays.	PO1
CO3	Acquire knowledge of faults and protective schemes for high powergenerator and transformers.	PO1
CO4	Improves the ability to understand various types of protective schemes used forfeeders and bus bar protection.	PO1, PO2, PO3, PO4
CO5	Understand different types of static relays and their applications.	PO1

TEXT BOOKS:

1. Switchgear and Protection ,10/e 2009, Sunil S Rao , Khanna Publishers - New Delhi.
2. Power System Protection and Switchgear , 1/e 2007 , Badri Ram and D.N Viswakarma , Tata McGraw – Hill Education Pvt. Ltd. Noida.

REFERENCE BOOKS:

1. A Text Book on Power System Engineering , 1/e 1998, M.L.Soni, P.V.Gupta, V.S.Bhatnagar and A. Chakrabarti – DhanpatRai and Co – New Delhi.
2. Fundamentals of Power System Protection ,2/e 2010 , Y. G. Paithankar and S. R. Bhide , PHI Learning Pvt Ltd – New Delhi.
3. Switch Gear Protection, 1/e 2009, J. B. Gupta , S. K. Kataria and Sons – New Delhi.
4. Power System Protection& Switch Gear ,1/e 1977 (Reprint 2005) , B. Ravindranath, M. Chander , New Age International Pvt .Ltd – New Delhi.
5. Protection & Switch Gear , 4/e 2009 U. A. Bakshi and M. V. Bakshi , Technical Publications – Pune.

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	1	1	3	3	-	-	-	-	-	-	-	-
CO5	2	-	-	-	-	-	-	-	-	-	-	-

B.TECH III-I SEM (E.E.E)

L	T	P	C
3	1	0	3

SUB CODE: 16EEE315 ELECTRICAL AND ELECTRONIC MEASUREMENTS

Course Educational Objectives:

CEO1. To demonstrate knowledge on measuring instruments, analyze errors and its compensation.

CEO2. To demonstrate knowledge on power and energy measuring instruments, analyze errors and its compensation.

CEO3. To impart knowledge on instrument transformers, PF meters and analyze errors and its compensation.

CEO4. To impart knowledge on potentiometers, DC and AC bridges

CEO5. To demonstrate knowledge on CRO and digital meters.

UNIT - 1: INTRODUCTION

Classification- Deflecting - Control and damping torques-Ammeters and voltmeters-PMMC - Dynamometer - Moving Iron type instruments- Expression for deflecting and controlling torques- Errors and compensations -Extension of range using shunt and series resistances.

UNIT - 2: MEASUREMENT OF POWER AND ENERGY

Principle of Operation of EDM type Wattmeters - Errors and compensations - LPF and UPF types - Measurement of Three phase power by two and three wattmeters - Single phase induction type Energy meter-Principle of operation - Errors and compensations in energy meters - Three phase Energy meter.

UNIT - 3:INSTRUMENT TRANSFORMERS AND PF METERS

CT & PT-Phasor diagrams - Errors occurring in instrument transformers and compensations - Different types of PF meters-MI and ElectroDynamometer types - 1-phase and 3-phase meters - Frequency meters.

UNIT - 4: POTENTIOMETERS -DCANDAC BRIDGES

D.C potentiometers –Principle and operation - Standardization- DC Crompton's Potentiometers- Applications. A.C potentiometers- Polar and coordinate type - Standardization.- Method of measuring low - Medium and high resistance- Sensitivity of Wheatstone's bridge – Kelvin's double bridge for measuring low resistance - Measurement of high resistance - Loss of charge method - Measurement of inductance - Maxwell's bridge - Anderson's bridge - Measurement of capacitance and loss angle - Desauty bridge - Wien's bridge - Schering Bridge.

UNIT - 5: CRO- DIGITAL METERS - TRANSDUCERS AND DATA ACQUISITION SYSTEMS

Cathode Ray Oscilloscope- Cathode Ray tube-Time base generator –Deflection system -Horizontal and Vertical amplifiers - Application of CRO – Lissajous Patterns -Digital Meters - DVMs-Digital Frequency meters - Classification of transducers- Selection of transducers -Resistive- capacitive & inductive transducers - Piezoelectric - Optical and digital transducers - Elements of data acquisition system – A/D - D/A converters.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Demonstrate knowledge measuring instruments, analyze errors and its compensation.	PO1,PO2
CO2	Demonstrate knowledge on power and energy measuring instruments, analyze errors and its compensation.	PO1,PO2
CO3	Demonstrate knowledge on instrument transformers and PF meters and analyze errors and its compensation.	PO1,PO2
CO4	Demonstrate knowledge on potentiometers, DC and AC bridges	PO1
CO5	Demonstrate knowledge on CRO and digital meters.	PO1

TEXT BOOKS:

1. Electrical & Electronic Measurement & Instruments – 18/e – 2010 A.K.SawhneyDhanpatRai& Co. Publications – New Delhi.

2. Electrical Measurements and measuring Instruments – by E.W. Golding and F.C. Widdis, 5th Edition, Reem Publications.

REFERENCE BOOKS:

1. Electrical Measurements: Fundamentals - Concepts - Applications– 1/e 2006 - Reissland - M.U - New Age International (P) Limited - Publishers – New Delhi.
2. Electrical Measurements – by Buckingham and Price, Prentice – Hall

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	1	2	-	-	-	-	-	-	-	-	-	-
CO3	1	2	-	-	-	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-
CO5	2	-	-	-	-	-	-	-	-	-	-	-

III Year B.Tech I semester **L T P C**
3 1 0 3

16ECE318 LINEARICs AND APPLICATIONS

Course Educational Objectives:

CEO1. To introduce the basic building blocks of linear integrated circuits
CEO2. To teach the linear and non - linear applications of operational amplifiers
CEO3. To teach the theory of ADC and DAC
CEO4. To introduce the theory and applications of analog multipliers and PLL
CEO5. To introduce the concepts of waveform generation and introduce some special function ICs

UNIT-1: IC FABRICATION
IC Classificatoin,chip size and circuit complexity ,fundamentals of monolithic IC technology,epitaxialgrowth,masking and etching,diffution of impurities**.**realiztion ofmonolithic ICs and packaging.

UNIT-2:CHARACTERISTICS OF OP-AMP
Ideal & practical Op-ampCharacteristics,DC and AC characteristics-Offset voltage and current :voltage series feedback and shunt feedback amplifiers,differentialamplifier,frequency response of op -amp -Basic Application of op-amp –Summer,differentiator and integrator.

UNIT-3:APPLICATIONS of OP-AMP
Instrumentation amplifier-first and second order active filter to I-I to V converters- Multiplier and dividers-comparators-multivibrators,waveformgenerators,clippers,clampers,peakdetectors,S/H
circuit, D/A converter (R-2R ladder & weighted resistor types), A/D converter-dual slope, successive approximation and flash type.
.

UNIT-4: SPCIAL ICS
Introduction to 555 timer- functional diagram- Monostable and Astable operations and Schmitt Trigger.566 voltage control oscillator circuit,565 PLL –Introduction, block diagram,principles and description of individual blocks of 565 functioning and application, analog multiplier ICS.

UNIT-5:APPLICATION ICS
IC regulators –LM317,LM 723 regulator,switching regulator, MA 7840,LM 380 power amplifier ,ICL 8038 function generator IC,Isolationamplifiers,optocoupler,opto electronic ICs.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Understand introduce the basic building blocks of linear integrated circuits.	PO1,PO2
CO2	Remember the linear and non - linear applications of operational amplifiers.	PO1,PO2
CO3	Remember the theory of ADC and DAC.	PO1,PO2
CO4	Remember the theory of analog multipliers and PLL and analyze its applications.	PO1
CO5	Understand the concepts of waveform generation and introduce some special function ICs	PO1

TEXT BOOKS :

1. Op-Amps & Linear ICs, 4th Edition, 1987,Ramakanth A. Gayakwad,PHI,New Delhi.
2. Linear Integrated Circuits, 2nd Edition,2003,D. Roy Chowdhury,New Age International (p)Ltd,Mumbai.

REFERENCES:

1. Design with Operational Amplifiers & Analog Integrated Circuits, 3rd Edition.- 2002,Sergio Franco, McGraw Hill, New Delhi.
2. Linear IC and Applications, 1st Edition,2005,U.A.Bakshi and A.P.Godse,Technical Publications,Pune.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-

B.TECH III-I SEM (E.E.E)

L	T	P	C
0	0	3	2

SUB CODE:16EEE316 ELECTRICAL MACHINES LAB– II

Course Educational Objectives:

CEO1. To provide practical experience for the determination of efficiency of transformers.

CEO2. To Evaluate the regulation of alternators by conducting suitable tests.

CEO3. To analyze the performance characteristics of induction motors

CEO4. To obtain the equivalent circuit parameters of transformers and induction motors.

CEO5. To determine various losses of AC machines by conducting suitable tests.

Any 10 of following experiments

The following experiments are required to be conducted as compulsory experiments

1. Open circuit and short circuit tests on single phase transformer
2. Sumpner's test on transformers
3. Regulation of three phase alternator by emf and mmf methods
4. Determination of Xd and Xq of salient pole synchronous machines
5. V and inverted v curves of three phase synchronous motor.
6. No load and blocked rotor test on single-phase induction motor.
7. Brake test on three-phase induction motor.
8. No load and blocked rotor test on three-phase induction motor.

Any two of the following experiments are required to be conducted in addition to above

.

9. Scott Connection of transformer
10. Separation of no-load losses in single phase transformer
11. Separation of no-load losses of three-phase induction motor.
12. Parallel operation of single-phase transforner
13. Regulation of three phase alternator by zpf and asa methods
14. Load test on single-phase transformer and three phase transformer connections

Course Outcomes:

On successful completion of course, student will be able to

Course Outcomes		POs related to COs
CO1	Demonstrate knowledge on various parts of AC machine.	PO1
CO2	Analyze the performance of various AC machines.	PO2
CO3	Determine various losses of AC machines by conducting suitable test	PO4
CO4	Select appropriate design tools and procedure to evaluate performance of AC machines	PO5
CO5	Follow ethical principles to evaluate performance of AC machines.	PO8
CO6	Do experiments effectively as an individual and as a member in a group.	PO9
CO7	Communicate verbally and in written form, the understandings about the experiments.	PO10
CO8	Continue updating their skill related to electronic devices and their applications during their life time	PO12

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	3	-	-	-	-	-	-	-	-
CO4	-	-	-	-	3	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	-	-	-
CO7	-	-	-	-	-	-	-	-	-	3	-	-
CO8	-	-	-	-	-	-	-	-	-	-	-	-
CO9	-	-	-	-	-	-	-	-	-	-	-	3

B.TECH III-I SEM (E.E.E)

L	T	P	C
0	0	3	2

SUB CODE: 16EEE317 CONTROL SYSTEMS AND SIMULATION LAB

Course Educational Objectives:

CEO1. To demonstrate knowledge on different types of controllers.
CEO2. To determine the characteristics of DC and AC servomotors.
CEO3. To apply skills in DC position control and temperature control systems.
CEO4. To obtain the transfer function of DC motors by conducting suitable tests.
CEO5. To evaluate stability of Control system by different methods using MATLAB.

Any 10 of following experiments

Any Eight of the following experiments are required to be conducted as compulsory experiments

1. Time Response of Second Order System.
2. Characteristics of Synchros.
3. Transfer Function Of Armature Controlled DC Machine.
4. Transfer Function Of Separately Excited DC Generator.
5. Effect of P - PD - PI - PID Controller on A Second Order Systems
6. Lag And Lead Compensation – Magnitude And Phase Plot
7. Characteristics Of Magnetic Amplifiers
8. Effect of feedback on DC Servo Motor
9. Characteristics Of AC Servo Motor
10. Transfer Function Of Field Controlled DC Machine

Any Two of the Following Experiments are required to be Conducted In Addition To Above.

11. Programmable logic controller- study and verification of truth tables of logic gates, simple Boolean expressions and application of speed control of motor.
12. Temperature control using PID controller.
13. PSPICE Simulation of OP-Amp based Integrator and Differentiator circuits
14. Linear System Analysis (Time Domain Analysis - Error Analysis) Using MATLAB.
15. Stability Analysis Of Control System - Bode Plot, Root Locus And Nyquist Plot Using MATLAB
16. State Space Model For Classical Transfer Function Using MATLAB

Course Outcomes:

On successful completion of course, student will be able to

Course Outcomes		POs related to COs
CO1	Demonstrate knowledge on different types of controllers.	PO1
CO2	Analyze the characteristics of DC and AC servomotors	PO2
CO3	Determine the transfer function of DC motors by conducting suitable tests.	PO4
CO4	Select appropriate design tools and procedure to evaluate stability of Control system	PO5
CO5	Follow ethical principles to evaluate performance of AC machines.	PO8
CO6	Do experiments effectively as an individual and as a member in a group.	PO9
CO7	Communicate verbally and in written form, the understandings about the experiments.	PO10
CO8	Continue updating their skill related to electronic devices and their applications during their life time	PO12

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	3	-	-	-	-	-	-	-	-
CO4	-	-	-	-	3	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	-	-	-
CO7	-	-	-	-	-	-	-	-	-	3	-	-
CO8	-	-	-	-	-	-	-	-	-	-	-	-
CO9	-	-	-	-	-	-	-	-	-	-	-	3

B.TECH III-II SEM (E.E.E)

L	T	P	C
3	1	0	3

SUB CODE:16EEE321 POWER SYSTEM ANALYSIS

Course Educational Objectives:

CEO1. To provide basic knowledge on Fault studies Per unit system.
CEO2. To provide knowledge about unsymmetrical faults.
CEO3. To provide good knowledge on load flow studies.
CEO4. To provide basic knowledge on stability studies and classification of stability studies.
CEO5. To provide good knowledge on Transient stability analysis

UNIT I POWER SYSTEM NETWORK MATRICES

Representation of Power system elements - Essential characteristics of a good Algorithm - Steps involved in solving a problem using Digital computer - Graph Theory: Definitions - Bus Incidence Matrix - Y_{bus} formation by Direct and Singular Transformation Methods - Numerical Problems. Formation of Z_{Bus}: Partial network - Algorithm for the Modification of Z_{Bus} Matrix for addition element for the following cases: Addition of element from a new bus to reference - Addition of element from a new bus to an old bus - Addition of element between an old bus to reference and Addition of element between two old busses (Derivations and Numerical Problems).- Modification of $Z_{Bus}$for the changes in network (Problems)

UNIT II POWER FLOW STUDIES

Necesity of Power Flow Studies – Data for Power Flow Studies – Derivation of Static load flow equations – Load flow solutions using Gauss Seidel Method: Acceleration Factor - Load flow solution with and without P-V buses - Algorithm and Flowchart. Numerical Load flow Solution for Simple Power Systems (Max. 3-Buses): Determination of Bus Voltages - Injected Active and Reactive Powers (Sample One Iteration only) and finding Line Flows/Losses for the given Bus Voltages. Newton Raphson Method in Rectangular and Polar Co-Ordinates Form: Load Flow Solution with or without PV Busses- Derivation of Jacobian Elements - Algorithm and Flowchart. Decoupled and Fast Decoupled Methods.- Comparison of Different Methods – DC load Flow

UNIT III SHORT CIRCUIT ANALYSIS

Per-Unit System of Representation. Per-Unit equivalent reactance network of a three phase Power System - Numerical Problems. Symmetrical fault Analysis: Short Circuit Current and MVA Calculations - Fault levels - Application of Series Reactors - Numerical Problems. Symmetrical Component Theory: Symmetrical Component Transformation - Positive - Negative and Zero sequence components:

Voltages - Currents and Impedances. Sequence Networks: Positive - Negative and Zero sequence Networks - Numerical Problems. Unsymmetrical Fault Analysis: LG - LL - LLG faults with and without fault impedance - Numerical Problems

UNIT IVPOWER SYSTEM STEADY STATE STABILITY ANALYSIS

Elementary concepts of Steady State - Dynamic and Transient Stabilities. Description of: Steady State Stability Power Limit - Transfer Reactance - Synchronizing Power Coefficient - Power Angle Curve and Determination of Steady State Stability and Methods to improve steady state stability.

UNIT V POWER SYSTEM TRANSIENT STATE STABILITY ANALYSIS

Derivation of Swing Equation. Determination of Transient Stability by Equal Area Criterion - Application of Equal Area Criterion - Critical Clearing Angle Calculation. Solution of Swing equation by 4^{th} order Range – Kutta Method (up to 2 iterations) - Methods to improve Stability - Application of Auto Reclosing and Fast Operating Circuit Breakers.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Able to draw impedance diagram for a power system networkand to understand perunit quantities.	PO1,PO2,PO3,PO4
CO2	Able to form a$Y_{bus}$and $Z_{bus}$for a power system networks.	PO1,PO2,PO3,PO4
CO3	Able to understand the load flow solution of a power system using different methods	PO1,PO2,PO3,PO4
CO4	Able to find the fault currents for all types faults to provide data for the design ofprotective devices.	PO1,PO2,PO3,PO4
CO5	Able to analyze the steady state, transient and dynamic stability concepts of a powersystem.	PO1,PO2

TEXT BOOKS:

1. C. L. Wadhwa, Electrical Power Systems, New Age International (P) Limited publishers, New Delhi, 6th edition, 2010.
2. Modern Power system Analysis – 2011 - 4th edition - by I.J.Nagrath&D.P.Kothari: Tata McGraw-Hill Publishing Company.

REFERENCE BOOKS:

1. Power System Analysis by Grainger and Stevenson - 2003 - Tata McGraw Hill Edition - 10th Reprint 2008, Delhi.

2. Computer Techniques in Power System Analysis - 2005 –Second Edition – by M A Pai- TMH, , Delhi.

3. Computer Methods in Power Systems - 1968 – by Stagg El – Abiad& Stags - McGraw-hill Edition

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	-	-	-	-	-	-
CO2	2	2	3	3	-	-	-	-	-	-	-	-
CO3	3	3	3	3	-	-	-	-	-	-	-	-
CO4	2	2	3	3	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-

B.TECH III-II SEM (E.E.E)

L	T	P	C
3	1	0	3

SUB CODE: 16EEE322 POWER SEMICONDUCTOR DRIVES

Course Educational Objectives:

CEO1. To understand the knowledge ondynamics of electrical drives
CEO2. To apply the skill on operation and speed control of various DC drives
CEO3. To evaluate the control of different chopper fed DC Drives
CEO4. To study the different speed control methods of various induction motor drives
CEO5. To develop application skills on single and multi-quadrant operations of AC drives

UNIT I CONTROL OF DC MOTORS BY SINGLE PHASE CONVERTERS

Single Phase semi and Fully controlled converters connected to d.c separately excited and d.c series motors – Continuous current operation – Output voltage and current waveforms – Speed and Torque expressions – Speed – Torque Characteristics - Problems on Converter fed d.c motors.

UNIT II CONTROL OF DC MOTORS BY THREE PHASE CONVERTERS

Three phase semi and fully controlled converters connected to d.c separately excited and d.c series motors – Output voltage and current waveforms – Speed and Torque expressions – Speed – Torque characteristics – Problems. . Four quadrant operation of D.C motors by dual converters – Closed loop operation of DC motor (Block Diagram Only).

UNIT III CHOPPER FED DC MOTORS

Electric braking –Plugging, Dynamic and Regenerative braking operations. Single Quadrant, Two –Quadrant and Four Quadrant Chopper Fed DC Separately Excited and Series Excited Motors – Continuous Current Operation – Output Voltage and Current Wave Forms – SpeedTorque Expressions – Speed Torque Characteristics – Problems on Chopper Fed D.C Motors – Closed Loop Operation (Block Diagram Only)

UNIT IV CONTROL OF INDUCTION MOTORS

Variable voltage characteristics- Control of Induction Motor by AC Voltage Controllers - Waveforms – Speed torque characteristics.Variable frequency characteristics-Variable frequency control of induction motor by Voltage source and current source inverter and cyclo converters-PWM control – Comparison of VSI and CSI operations – Speed torque characteristics – Numerical problems on induction motor drives -Static rotor resistance control – Slip power recovery – Static Scherbius drive – Static Kramer Drive – Their performance and speed torque characteristics – Advantages - Applications – Problems.

UNIT V CONTROL OF SYNCHRONOUS MOTORAND SPECIAL MOTOR DRIVES

Separate control &self control of synchronous motors – Operation of self controlled synchronous motors by VSI and CSI cycloconverters. Load commutated CSI fed Synchronous Motor – Speed torque characteristics and Numerical Problems – Closed Loop control operation of synchronous motor drives (Block Diagram Only). Stepper motor drives - torque vs stepping rate characteristics, drive circuits. Switched reluctance motor drives - converter circuits, modes of operation and closed loop speed control.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Ability to understand various control strategies and controllers for DC Motor Drive systems	PO1,PO2
CO2	Ability to understand various control strategies and controllers for Induction Motor Drive systems	PO1,PO2
CO3	Ability to understand various control strategies and controllers for Synchronous Motor Drive systems	PO1,PO2
CO4	Ability to understand various control strategies and controllers for SRM and BLDC Motor Drive systems	PO1, PO2, PO12
CO5	Ability to understand Digital control strategies of DC Drive	PO1

TEXT BOOKS:

1. Fundamentals of Electric Drives , 2/e 2001 , G K Dubey , Tata McGraw – Hill Education Pvt. Ltd.. Noida
2. Modern Power Electronics and AC drives , 1/e 2002, B.K Bose , Pearson Publications– India.

REFERENCE BOOKS:

1. Thyristor Control of Electric drives , 1/e2008, VedamSubramanyam ,Tata McGraw – Hill Education Pvt. Ltd. Noida.
2. Power Semiconductor Drives, 1/e 2009 ,S. Sivanagaraju , H. Balasubbareddy and A. Mallikarjuna Prasad , PHI Learning Pvt Ltd – New Delhi.
3. Electrical Motors & Drives Fundamentals, Types and Applications , 4/e 2013 , Austin Huges and Bill Drury, Newnes publications –New Delhi.
4. Power Electronics, 2/e 2007 (3rd Reprint 2008) , M. D. Singh and K. B. Khanchandani ,Tata McGraw – Hill Education Pvt. Ltd. – New Delhi.
5. Power Electronics Circuits, Devices and Applications , 3/e 2004 , Mohammad H. Rashid , Dorling KinderslyPvt Ltd – New Delhi.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	2
CO5	3	-	-	-	-	-	-	-	-	-	-	-

B.TECH III-II SEM (E.E.E)

L	T	P	C
3	1	0	3

SUB CODE:16EEE323 DISTRIBUTION OF ELECTRIC POWER

Course Educational Objectives:

- **CEO1.** Acquaintance with distribution System planning, load modeling and Different types of loads.
- **CEO2.** Familiarity of different types of distribution transformers and feeders and design practice of secondary distribution system
- **CEO3.** Identify the types of distribution substations and equipments used in Substations
- **CEO4.** Find out the types of faults and types of protective devices used in distribution system.
- **CEO5.** Information on power factor improvement and voltage control methods

UNIT I GENERAL CONCEPTS

Introduction to distribution systems, Load modeling and characteristics.Coincidence factor, contribution factor loss factor - Relationship between the load factor and loss factor.Classification of loads (Residential, commercial, Agricultural and Industrial) and their characteristics.

UNIT II GENERAL ASPECTS OF D.C.and A.C. DISTRIBUTION SYSTEMS

Classification of Distribution Systems - Comparison of DC vs AC and Under-Ground vs Over - Head Distribution Systems- Requirements and Design features of Distribution Systems- Voltage Drop Calculations in D.C Distributors for the following cases: Radial D.C Distributor fed one end and at the both the ends and Ring Main Distributor. Design Considerations of Distribution Feeders: Radial and loop types of primary feeders, voltage levels, feeder loading; basic design practice of the secondary distribution system. Voltage Drop Calculations in A.C. Distributors .

UNIT III SUBSTATIONS

Location of Substations: Rating of distribution substation, service area within primary feeders. Benefits derived through optimal location of substations. Classification of substations: Air insulated substations - Indoor & Outdoor substations: Substations layout showing the location of all the substation equipment. Bus bar arrangements in the Sub-Stations: Simple arrangements like single bus bar, Double bus bar, sectionalized single bus bar, main and transfer bus bar Double breaker – One and half breaker system with relevant diagrams.

UNIT – IV POWER FACTOR AND VOLTAGE CONTROL

Causes of low p.f -Methods of Improving p.f -Phase advancing and generation of reactive KVAR using static Capacitors-Most economical p.f. for constant KW load and constant KVA type loads, Numerical Problems. Dependency of Voltage on Reactive Power flow.- Methods of Voltage Control: Shunt Capacitors, Series Capacitors, Synchronous Capacitors, Tap changing and Booster Transformers.

UNIT – V COMPENSATION FOR POWER FACTOR IMPROVEMENT PROTECTION AND COORDINATION OF DISTRIBUTION SYSTEMS

Capacitive compensation for power-factor control - effect of shunt capacitors (Fixed and switched), Power factor correction- Economic justification - Procedure to determine the best capacitor location.Objectives of distribution system protection, types of common faults and procedure for fault calculations. Protective Devices: Principle of operation of Fuses, Circuit Reclosures, line sectionalizes, and circuit breakers Coordination of Protective Devices: General coordination procedure.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Understand the overall view of distribution system and steps involved in distribution system planning.	PO1,PO2
CO2	Make out types of loads involved in distribution system and modelling of loads.	PO1,PO2
CO3	Have awareness of transformers used in practical distribution system	PO1,PO2
CO4	Learn the steps involved for design of secondary distribution system	PO1,PO2
CO5	Have good knowledge on the types of power capacitors used and their allocation in distribution systems.	PO1,PO2

Text books:

1. Electrical Power Systems , 6 /e2012 C.L.Wadwa , New Age International Publishers–New Delhi.
2. Principles of Power systems ,4/e 2005 V.K.Mehta, S.Chand Publications – New Delhi.

Reference books:

1. Elements of Power systems–4/e 1982 William D Stevenson - Tata McGraw – Hill Education Pvt. Ltd.. Noida
2. Electrical Power Distribution system by V.Kamaraju , Right Publishers
3. ElectricalPower systems for industrial plants, Kamalesh Das , JAICO publishing House

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-

B.TECH III-II SEM (E.E.E)

16ECE329	MICROPROCESSORS AND INTERFACING	L	T	P	C
		3	1	0	3

Course Educational Objectives:

CEO1. Todemonstrate knowledge onthe architecture of 8086 Microprocessor
CEO2. To apply the skill on various 8086 Instruction set and Assembler Directives
CEO3. To study the different interfacing methods to 8086 Microprocessor
CEO4. To understand programmable peripheral devices and their Interfacing
CEO5. To develop application skills on different programming techniques of 8086 Microprocessor

UNIT I INTRODUCTION TO 8085 MICROPROCESSOR

Architecture Of 8085 Microprocessor- The 8085 Programming Model- Pin diagram Of 8085- Machine Cycle Status And Control Signals- Addressing Modes- Instruction Classification- Instruction Format- Simple Programs Involving Logical- Branch And Call Instructions.

UNIT II INTRODUCTION TO 8086 MICROPROCESSOR

Architecture of 8086 Microprocessor- Special functions of General Purpose register- 8086 flag register and function of 8086 Flags- Addressing modes of 8086- Instruction set of8086- Assembler directives- simple programs- procedures- and macros

UNIT III ASSEBLY LANGUAGE PROGRAMMING & TIMING DIAGRAMS

Assembly Language Programs Involving Logical- Branch & Call Instructions- Sorting- Evaluation Of Arithmetic expressions- String Manipulation- Pin Diagram Of 8086-Minimum Mode And Maximum Mode Of Operation- Timing Diagram- Memory interfacing To 8086 (Static RAM&EPROM)- Need For DMA- Interfacing With8237/8257.

UNIT IV PROGRAMMABLE INTERFACING DEVICES & INTERRUPT STRUCTURE

8255 PPI – Various Modes Of Operation And Interfacing To 8086- Interfacing Keyboard- Displays- 8279- Stepper Motor - D/A And A/D Converter Interfacing,Interrupt Structure Of 8086- Vector Interrupt Table- Interrupt Service Routines- Introduction to Dos and Bios interrupts- 8259 PIC Architecture And Interfacing and its importance.

UNIT V SERIAL DATA TRANSFER SCHEMES

Serial data transfer schemes- Asynchronous and Synchronous data transfer schemes- 8251 USARTarchitecture and interfacing- TTL to RS 232C and RS232C to TTL conversion- Sample program of serialdata transfer- Introduction to High-speed serial communications standards- USB-features of advanced microprocessors(80286,80386, Pentium)-features of 8051 microcontroller.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Demonstrate knowledge onthe architecture of 8086 Microprocessor.	PO1
CO2	Apply the skill on various 8086 Instruction set and Assembler Directives	PO1
CO3	Study the different interfacing methods to 8086 Microprocessor	PO1
CO4	Understand programmable peripheral devices and their Interfacing	PO1, PO2
CO5	Develop application skills on different programming techniques of 8086 Microprocessor	PO1, PO2, PO3

TEXT BOOKS :

1. Advanced microprocessor and Peripherals ,2nd edition,2000,A,K,Ray and K,M,Bhurchandi, TMH, New Delhi.
2. Microprocessor architecture, programming and applications with 8085/8080A 2nd edition,1996, Ramesh S,Goankar, New age international Publishers, New Delhi.

REFERENCES:

1. Micro Processors &Interfacing , revised 2nd edition,2007, Douglas U, Hall ,TMH, New Delhi.
2. The 8088 and 8086 microprocessors, 1st edition,2003, Walter A,Triebel, Avtar Singh, PHI,,New Delhi.
3. Micro Computer System 8086/8088 Family Architecture, Programming and Design, 2nd Ed,2000, By Liu and GA Gibson, PHI,New Delhi.
4. The X8086 microprocessor architecture, programming and interfacing, 1st edition, 2010, l,das,pearson education india limited, New Delhi.
5. The 8086 microprocessor programming and interafacing, 1/e ,2007, Kenneth J,Ayala, Cenange learning private limited, New Delhi.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	3	-	-	-	-	-	-	-	-
CO5	3	3	2	3	-	-	-	-	-	-	-	-

CORE ELECTIVE - I

B.TECH III-II SEM (E.E.E)

L	T	P	C
3	1	0	3

SUB CODE:16EEE324A POWER SYSTEM ECONOMICS

Course Educational Objectives:

CEO1. To understand the importance of cost, pfimprovement , size of generating units and Tariff.
CEO2. To acquire knowledge on economic load dispatch problems.
CEO3. To understand Artificial Intelligence Techniques for solving ELD problems.
CEO4. To afford knowledge on interconnected systems
CEO5. To provide knowledge on optimal power flow problem

UNIT I ECONOMIC CONSIDERATIONS

Cost of electrical energy - Expressions for cost of electrical energy – Capital-interest – Depreciation - Different methods - Factors affecting cost of operation - Number and size of generating units - Importance of high load factor - Importance of power factor improvement - Most economical power factor - Meeting the KW demand on power stations – Power system tariffs – Regions and structure of Indian Power System.

UNIT II ECONOMIC DISPATCH

Modeling of Cost Rate Curves – Economic Dispatch Calculation - Losses neglected - with generator Real and Reactive power limits; Losses included - Losses of economy in incremental cost data - Problems - Generator Capability Curve – Effect of Ramping rates – Prohibited Operating Zones - Automatic Load dispatch in Power Systems.

UNIT III ECONOMIC OPERATION

General loss formula - Evolution of incremental transmission loss rate - Method of calculation of loss coefficients – Systematic development of transmission loss formula - Transmission loss as a function of plant generation – Participation Factor - Non – Smooth Fuel Functions (Quadratic - Valve point loading - CCCP - Multiple Fuel) – Problems - Introduction to Artificial Intelligence Techniques for solving ELD problems.

UNIT IV INTERCONNECTED SYSTEMS

Interconnected operation - Economic operation of hydro thermal power plants – Iteration scheme - Gradient approach – Newton's method - Modeling and solution approach to short term and long term Hydro-Thermal scheduling problem using Dynamic Programming.

UNIT V OPTIMAL POWER FLOW AND FUNDAMENTALS OF MARKETS

Problem formulation - Cost minimization - Loss minimization - Solution using NLP and successive LP methods – Constraints - DC and AC OPF (Real and Reactive Power Dispatch) – Effect of Contingencies - Voltage and Phase angle - Transient Voltage Dip/Sag Criteria. Fundamentals of Markets – Introduction to Efficiency and Equilibrium - Modeling of consumers and producers – Single and Double Auction mechanism - Global welfare – Dead Loss – Spot and Forward Markets.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	To understand the importance of cost, pfimprovement , size of generating units and Tariff.	PO1,PO2,PO3,PO4, PO12
CO2	To acquire knowledge on economic load dispatch problems.	PO1,PO2,PO3,PO4, PO12
CO3	To understand Artificial Intelligence Techniques for solving ELD problems.	PO1,PO2
CO4	To afford knowledge on interconnected systems	PO1,PO2,PO3,PO4
CO5	To provide knowledge on optimal power flow problem	PO1,PO2,PO3,PO4

TEXT BOOKS

1. Allen J Wood and B F Wollenberg- "Power Generation - Operation and Control" - John Wiley & Sons - New York - 2004.
2. D. P. Kothari and I. J. Nagrath - " Modern Power System Analysis " - Tata McGraw Hill Publishing Company - New Delhi - 2006.
3. Power System Economics- Designing Markets for Electricity, 2003, by Steven Stoft, Wiley-Interscience, USA.

REFERENCE BOOKS

1. Kirchmayer. L.K - "Economic operation of power system" - John Wiley & Sons - 1953.
2. Fundamentals of Power System Economics, 2 e/d, 2010, by Daniel S Kirschen, John Wiley & Sons, New Jersy.
3. Market Operations in Electric Power Systems: Forecasting, Scheduling, and Risk Management, 1st e/d, 2002, by M. Shahidehpour, John Wiley & Sons, New York.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	3	-	-	-	-	-	-	-	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3
CO3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	2	1	2	2	-	-	-	-	-	-	-	-
CO5	2	2	3	3	-	-	-	-	-	-	-	-

B.TECH III-II SEM (E.E.E)

L	T	P	C
3	1	0	3

SUB CODE: 16EEE324B PLC & DCS - ITS APPLICATIONS

Course Educational Objectives:

CEO1. To Gain the Knowledge of various skills necessary for Industrial applications of Programmable logic controller(PLC).

CEO2. To Understand the basic programming concepts and various logical Instructions used in Programmable logic controller (PLC).

CEO3. To Gain the Knowledge on PLC Timers and Counters.

CEO4. To Solve the problems related to I/O module, Data Acquisition System and Communication Networks using Standard Devices.

CEO5. To provide knowledge on DLC and its applications

UNITII/O MODULES

PLC Basics: PLC system - I/O modules and interfacing - CPU processor - programming Equipment - programming formats - construction of PLC ladder diagrams - Devices connected to I/O modules.PLC Programming: Input instructions - outputs - operational procedures - programming examples using contacts and coils. Drill press operation.

UNIT IIDESIGN AND PROGRAMMING

Digital logic gates - programming in the Boolean algebra system - conversion examples. Ladder Diagrams for process control: Ladder diagrams & sequence listings - ladder diagram construction and flowchart for spray process system.

UNIT IIIPLC REGISTERS

PLC Registers: Characteristics of Registers - module addressing - holding registers - Input Registers - Output Registers.PLC Functions: Timer functions & Industrial applications - counter function & industrial applications - Arithmetic functions - Number comparison functions - number conversion functions

UNIT IVPLC APPLICATIONS

Data Handling functions: SKIP - Master control Relay - Jump - Move - FIFO - FAL - ONS - CLR & Sweep functions and their applications. Bit Pattern and changing a bit shift register - sequence functions and applications - controlling of two-axis & three axis Robots with PLC - Matrix functions.

UNIT VDCS AND ITS APPLICATIONS

Distributed Control System (DCS) – Evolution – Different Architectures – Logical Control Unit – Operator Interface – Display – Engineering Interface.DCS Applications to Power Plant – Iron and Steel Plants – Chemical Industries – Paper and Pulp Industries.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Have knowledge of Programmable Logic Controller domain on various Logical Operation and Various Advanced Logical Instruction, I/O Module, Sensor, Actuator, Communication and Measurement System.	PO1,PO12
CO2	Understand the basic programming concepts and various logical Instructions used in Programmable logic controller (PLC).	PO1,PO2,PO3,PO4,PO5,PO11,PO12
CO3	Understand the operation of Timers and Counters in Programmable logic controller (PLC).	PO1, PO11,PO12
CO4	Compute the extent and nature of electronic circuitry in Programmable logic controller (PLC) and SCADA including monitoring and control circuits for Communication and Interfacing.	PO1,PO2,PO3,PO4,PO5,PO11,PO12
CO5	Provide knowledge on DLC and its applications	PO1,PO3,PO4,PO11,PO12

TEXT BOOKS

1. Programmable Logic Controllers by W. Bolton - 5th Edition - Elsevier - 2010
2. Programmable Logic Controllers- Principles and Applications by John W. Webb & Ronald A. Reiss - Fifth Edition - PHI
3. Distributed Control Systems by Michal P. Lucas - Vannostrand - Reinhold Co. - 1986.

REFERENCE BOOKS

1. Programmable Logic Controllers- Programming Method and Applications –JR. Hackworth &F.D Hackworth Jr. –Pearson - 2004.
2. Distributed Computer Control of Industrial Automation by Popovic D and Bhatkar V. P - MarcelDekkar Inc. - 1990.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	3
CO2	3	2	2	2	2	-	-	-	-	-	3	2
CO3	3	-	-	-	-	-	-	-	-	-	3	2
CO4	3	3	3	3	3	-	-	-	-	-	3	2
CO5	3	-	2	2	-	-	-	-	-	-	3	3

B.TECH III-II SEM (E.E.E)

L	T	P	C
3	1	0	3

SUB CODE:16EEE324C SOFT COMPUTING TECHNIQUES

Course Educational Objectives:

CEO1. To understand the fundamental theory and concepts of neural networks, neuro modeling, several neural network paradigms and its applications.

CEO2. To understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic control and other machine intelligence applications of fuzzy logic.

CEO3. To understand the basics of an evolutionary computing paradigm known as genetic algorithms and its application to engineering optimization problems.

UNIT I ARTIFICIAL NEURAL NETWORKS

Introduction - biological neuron - artificial neuron - basic concepts of neural networks - basic models of ANN connections - Mc-Culloch-pitts model - characteristics of ANN. Artificial neuron model - operations of artificial neuron - types of neuron activation function - ANN Architectures - classification taxonomy of ANN- Connectivity - neural dynamics(Activation and Synaptic) - learning strategy (supervised - unsupervised - reinforcement) - learning rules - types of application.

UNIT II SUPERVISED LEARNING NETWORKS

Perceptron network - perceptron learning rule - Architecture - perceptron training algorithm - ADALINE - MADALINE - Back propogation network - BP Learning rule - input layer computation - hidden layer computation - output layer computations - radial basis function.

UNIT III ASSOCIATIVE MEMORY NETWORK

Training algorithm for pattern association - Auto associative memory network - Hetero associative memory network - BAM - Hopfield network.

UNIT IV FUZZY LOGIC

Introduction to classical sets – properties - operations and relations; fuzzy sets - member ship - uncertainty - operations - properties - fuzzy relations - cardinalities - membership functions.
Fuzzification - member ship value assignment - development of rule base and decision making system - Defuzzification to crisp sets - Defuzzification methods.

UNIT V GENETIC ALGORITHMS AND PARTICLE SWARM OPTIMIZATION

Introduction - basic operators and terminology in GA - Traditional Vs Genetic Algorithm - encoding - fitness function - reproduction - cross over - Mutation operator-Introduction to particle swarm optimization.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Understand importance of soft computing.	PO1,PO12
CO2	Understand different soft computing techniques like Genetic Algorithms, Fuzzy Logic, Neural Networks and their combination.	PO1,PO2,PO3,PO4, PO5,PO11,PO12
CO3	Implement algorithms based on soft computing.	PO1, PO11,PO12
CO4	Acquire knowledge on decision making in Fuzzy Logic.	PO1,PO2,PO3,PO4, PO5,PO11,PO12
CO5	Apply soft computing techniques to solve engineering or real life problem	PO1,PO3,PO4,PO11 ,PO12

TEXT BOOKS

1. Introduction to Artificial Neural systems,2/e -2012 , jacek M Zurada-west publishing company USA
2. Neural networks - fuzzy logic - genetic algorithms: synthesis and applications ,1/e - 2003, rajasekharan and pai -PHI publications-new Delhi.

REFERENCE BOOKS:

1. Principles of- soft computing ,2/e, S. N. Sivanandam and S.N.Deepa - Wiley indiapvt ltd-new Delhi.
2. Nueral Networks and Learning Machines ,3/e,2009,Simon Haykin Phi Learning -new delhi.
3. Soft Computing & Intelligent Systems ,1/e,2007,Madan M Gupta ,Naresh K Sinha ,Elsevier India Pvt Ltd -new delhi.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	3
CO2	3	2	2	2	3	-	-	-	-	-	3	3
CO3	2	2	-	-	-	-	-	-	-	-	3	3
CO4	3	2	3	3	3	-	-	-	-	-	3	3
CO5	3	2	3	3	3	-	-	-	-	-	3	3

B.TECH III-II SEM (E.E.E)

L	T	P	C
3	1	0	3

SUB CODE:16EEE324D COMPUTER NETWORKS

Course Educational Objectives:

CEO1. To Explain fundamentals of physical layer and data base layer.
CEO2. To Explain the concepts of medium access control sub layer
CEO3. To Explain the basics of network layer
CEO4. To Explain the overview of transport layer
CEO5. To Explain the concept of application layer.

UNIT I FUNDAMENTALS, PHYSICAL LAYER AND DATA LINK LAYER

Network Hardware - Network software – OSI & TCP/IP References models - Guided transmission media - Communication satellites - The public switched telephone network – Switching - Data link layer design issues - Elementary data link protocols – Stop and Wait Protocol - Sliding window protocol.

UNIT II THE MEDIUM ACCESS CONTROL SUBLAYER

The channel allocation problem - Multiple access protocols - Ethernet- Ethernet cabling - Manchester encoding - Ethernet MAC sub layer protocol - Switched Ethernet - Fast Ethernet - Wireless LANS - The 802.11 protocol stack - The 802.11 physical layer – The 802.11 MAC sub layer protocol - The 802.11 frame structure.

UNIT III THE NETWORK LAYER

Network layer design issues - Routing algorithms (DSDV, RIP, OSPF, DSR) – Congestion control algorithms – Internetworking – Internet Protocols : IPv4 , IPv6 - Addresses.

UNIT IV THE TRANSPORT LAYER

Overview of Transport layer - Elements of transport protocols - The internet transport protocols: UDP and TCP.

UNIT V THE APPLICATION LAYER

Traditional applications: DNS- Electronic mail (SMTP, POP3, IMAP, MIME) - WWW – HTTP – FTP - Web Services – SNMP

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Understand the network software, communication satellite, and data link protocol	PO1,PO12
CO2	Understand channel allocation ,multi-access protocol and wireless lans	PO1,PO2,PO12
CO3	Understand Routing algorithm, Internet protocol and address	PO1,PO2
CO4	Understand elements of transport protocol.	PO1,PO2
CO5	Understand the electronic mails, WWW,HTTP and web services.	PO1,PO2

Text Books:

1. Computer Networks, 4/e, Andrew S. Tanenbaum, 2008,Pearson Education, New Jersey.
2. Data Communications and Networking, 4/e, Behrouz A. Forouzan, 2006,Tata McGraw Hill, New Delhi.

Reference Books:

1. Computer Communications and Networking Technologies,1/e, Michael A.Gallo, William M. Hancock, 2001, Cengage Learning, New Delhi.
2. Computer Networks: Principles, Technologies and Protocols for Network Design,1/e, Natalia Olifer, Victor Olifer, 2006,Wiley India, New Jersey.
3. Computer and Communication Network,1/e, Nader F. Mir, 2007,Pearson Education, New Jersey.
4. Computer Networking: A Top-Down Approach Featuring the Internet, 3/e, James F.Kurose - K.W.Ross,2005, Pearson Education, New Jersey.
5. Data and Computer Communications,1/e, G.S.Hura and M.Singhal,2001, CRC Press, Taylor and Francis Group, FL United States.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	3
CO2	3	2	-	-	-	-	-	-	-	-	-	2
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-

OPEN ELECTIVE - I

III B.Tech II-Semester	L	T	P	C
	3	1	0	3

16OSAH321 LASERS AND FIBER OPTICS

Course Educational Objectives:

CEO1: To acquire knowledge on fundamentals of LASERS

CEO2: To study the working of different types of LASERS

CEO3: To develop knowledge on applications of LASERS in various fields

CEO4: To gain knowledge in fundamentals of Optical fiber, construction, types and attenuations

CEO5: To develop knowledge on applications of Optical fibers in various fields

Unit- I

LASERS INTRODUCTION: Introduction to Lasers, Properties of lasers, Spontaneous Emission , Stimulated Absorption and stimulated Emission ,Population Inversion, Conditions to achieve population inversion, Different pumping mechanisms, Einstein Coefficients.

Unit – II

TYPES OF LASERS: Ruby Laser, Helium – Neon Laser, Semi Conductor Laser, Dye Laser

Unit – III

APPLICATIONS OF LASERS: Holography, Laser Fusion reaction , Light wave Communication using Lasers(Block Diagram), Stimulated Raman Effect, lasers in Industry-Laser Welding, Hole drilling, Laser Cutting, Lasers in Medicine.

Unit – IV

OPTICAL FIBERS : Introduction to Optical fibers, Principle of Optical fiber, Construction of Fiber, Propagation of Light through the fibers, Fiber Types-Step Index and graded Index Fibers, Attenuation in Fibers, Dispersion-

Unit – V

APPLICATION OF FIBERS : Fiber optic Communication System(Block Diagram), Pressure Sensor, Liquid Level Sensor, Fiber optic Endoscope, Optical Fibers in Computer Networks(Block Diagram).

On successful completion of the course the student will be able to,

Course Outcomes		POs related to COs
CO1	**Acquire**the basic knowledge on LASERS	PO1, PO12
CO2	**Identify** different types of LASERS	PO1, PO12
CO3	**Develops**knowledge on different applications of LASERS	PO1, PO12
CO4	**Acquire**the basic knowledge on Optical Fibers	PO1,PO12
CO5	**Develops**knowledge on different applications of Optical Fibers	PO1,PO12

CO-PO Mapping

Course	PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
16OSAH321-LASERS AND FIBER OPTICS	**CO1**	3	-	-	-	-	-	-	-	-	-	-	1
	CO2	3	-	-	-	-	-	-	-	-	-	-	1
	CO3	3	-	-	-	-	-	-	-	-	-	-	1
	CO4	3	-	-	-	-	-	-	-	-	-	-	1
	CO5	3	-	-	-	-	-	-	-	-	-	-	1
	CO1	3	-	-	-	-	-	-	-	-	-	-	**1**

Reference Books:

1 .Lasers Theory and Applications By K.Thyagarajan and A.K.Ghatak: Macmillan India Limited, New Delhi.,

2.Lasers And non-Linear Opics, second edition,By BBLaud. NewAge International(P) limited,Publishers,New Delhi,

3.An Introduction to Fiber Optic Systems ,Second Edition,By John Powers,Richard D Irwin ,a Times Mirror Higher education,Inc Company,USA,

III B.Tech II Sem

L	T	P	C
3	1	0	3

16OSAH322 ADVANCED MATHEMATICS (Common to all Branches)

Course Educational Objectives:

CE01: The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course.
CEO2: To provide knowledge on

- Numerical methods to find a root of an equation
- Analyzing the consistency, stability and convergence of a numerical scheme.
- Number of numerical methods for solving integral equations.
- The relations ship between differential and integral equations, and how to change from one to another.

CEO3: To learn different iterative methods which can be used to solve algebraic and transcendental equations. .
CEO4: To understand, Integral Equations ,Integral Equations come from real life physical problems
CEO5: To explore the practical Knowledge, for each type of PDEs (hyperbolic, parabolic and elliptic), what kind of numerical methods are best suited for and the reasons behind these choices
CEO6: To Learn the principles for designing numerical schemes for PDEs, in particular, finite difference schemes.
CEO7: To learn Differential Equations and Partial Differential Equations that can be transformed into Integral and integro- differential equations

Unit-1 Solutions Of Algebraic And Transcendental Equations:

Introduction -Secant Method Or Chord Method -Newton Raphson Extended Formula: Chebyshev Method – Horner's Method - Muller's Method

Unit-2 Partial differential equations:

Introduction – Formation of partial differential equations – solution of a partial differential – equations solvable by direct integration – linear equation of first order- non linear equation of first order – Charpit's method – homogenous linear equations with constant coefficient – Rules of finding complementary function – rules of finding particular integral – working procedure to solve homogeneous linear equations of any order.

Unit-3 Numrical solution of partial differential equations:

Introduction-Solution of Laplace equation, Solution of poisons equation,solution of heatequation(crank-Nicolson method) -Solution of wave equation

Unit- 4 Numerical Solution ofMatrix Computation :

Algebraic Equations – Numerical Solution -Matrix Computation: Iterative Methods - Jacobi Method - Gauss-Seidel Method – Successive Over Relaxation method

Unit-5 Integral Equations

Introduction- Definition- conversion of a linear Differential equation to an Integral equation and vice versa- conversion of boundary value problem into integral equation using Green's function – Solution of an integral equation – Abel's Integral equation.

Course Outcomes:

After the completion of this course, a successful student is able to

Course Outcomes		POs related to COs
CO1	Acquireknowledge in necessity and techniques of advanced mathematical methods, to develop analytical and designing skills in mathematical models through numerial techniques.	PO1,PO2
CO2	Demonstrateknowledge in Partial differential equations of higher order, mathematical modelling through partial differential equations,	PO1,PO2,
CO3	Demonstrateknowledge in Numrical solution of partial differential equations.Develop analytical and numerical skillsin solving Partial Differential Equations	PO1,PO2,P03
CO4	Acquire knowledge in Numerical Solution of Matrix Computation. Develop designingand analytical skills in applications of Advanced Numerical Techniques for solving system of equations by matrix computations.	PO1,PO2
CO5	Acquire knowledge in solving Integral equation and developdesigningand analyticalskill in conversion of boundary value problem into integral equation	PO1,PO2,PO3 PO4

Text Books:

1. Numerical Methods for Scientific and Engineering. Computation , M.K. Jain, S.R.K. Iyengar R.K. Jain, New Age international Publishers.
2. Higher Engineering Mathematics - Dr.B.S.Grewal - Khanna Publishers

References:

1. Mathematical Methods – Pal – Oxford.
2. Introduction to Numerical Analysis – S.S. SastryPh - I
3. Mathematical Methods, S.K.V.S. Sri Ramachary, M. BhujangaRao, P.B. BhaskarRao& P.S. Subramanyam, BS Publications.
4. "Linear Integral Equations ,Theory and Technique ", 1st ed.,Ram P .Kanwal, Academic press, New York,1971.
5. "Numerical Methods of Engineers" by D V Griffiths and I M Smith

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2	3	2										
CO3	2	3	2									
CO4	3	2										
CO5	2	3	2	2								
CO*	2.6	2.4	2	2								

III B.Tech IISem	L	T	P	C
	3	1	0	3

16OSAH323 MATHEMATICAL MODELLING
(Common to all Branches)

Course Educational Objectives:

CE01: The course is designed to equip the students with the necessary mathematical skills and techniques thatare essential for an engineering course.
CEO2: To provide knowledge on

- Mathematical modelling through trigonometry
- Designing mathematical models through Ordinary differential equations
- Mathematical modelling through Linear Programming
- Designing mathematical models through Difference equations
- Partial differential equations based mathematical models

CEO3: To learn the needand techniquesof mathematical modelling, to design mathematical models through trigonometry.
CEO4: To understand, familiarize the knowledge of the significance of ordinary differential equations based mathematical models through linear growth and decay models, compartment models and geometrical problems.
CEO5: To explore the practical utility of mathematical models through linear programming including transportation and assignment models.
CEO6: To learn the concepts of linear difference equations with constant coefficients and understand some simple models through difference equations
CEO7: To learn the concepts of Partial differential equations and its nature. To explore the knowledge on practical utility of mathematical models through mass balance equations and momentum balance equations

UNIT-I Mathematical Modelling: Need, Techniques, Classifications And Simple Illustrations

The Technique of Mathematical Modelling - Classification of Mathematical Models - Some Characteristics of Mathematical Models - Mathematical Modelling Through Trigonometry, Calculus - Limitations of Mathematical Modelling

UNIT-2 Mathematical Modelling Through Ordinary Differential Equations of First Order

Mathematical Modelling Through Differential Equations – Linear Growth and Decay Models - Compartment Models - Mathematical Modelling in Dynamics Through Ordinary Differential Equations of First Order - Mathematical Modelling of Geometrical Problems Through Ordinary Differential Equations of First Order

UNIT-3 Mathematical Modelling Through Linear Programming

Mathematical Modelling through Linear Programming - Graphical Method - Simplex Method - Transportation and Assignment Models

UNIT-4 Mathematical Modelling through Difference Equations

The Need for Mathematical Modeling Through Difference Equations: Some Simple Models - Basic Theory of Linear Difference Equations with Constant Coefficients - Solution by Z-transformation - Mathematical Modeling Through Difference Equations in Probability Theory

UNIT-5 Mathematical Modelling Through Partial Differential Equations

Mass-Balance Equations: The First Method of Getting PDE Models - Momentum-Balance Equations: The Second Method of Obtaining PDE Models - Nature of Partial Differential Equations

Course Outcomes:

After the completion of this course, a successful student is able to

Course Outcomes		POs related to COs
CO1	Acquire knowledge in necessity and techniques of mathematical modelling, to develop analytical and designing skillsin mathematical models through trigonometry.	PO1,PO2
CO2	Demonstrate knowledge in Ordinary differential equations of first order, mathematical modelling through differential equations, Linear growth and decay modelsand Develop analytical skills in modelling geometrical problems through Ordinary differential equations of first order	PO1,PO2
CO3	Demonstrate knowledge in Linear programming and various techniques including Graphical method and Simplex method. Develop analytical and designing skillsin modelling and solving Transportation and assignment models	PO1,PO2,P03
CO4	Acquire knowledge in difference equations, theory of difference equations with constant coefficients. Develop designing and analytical skills in modelling and solving mathematical models difference equations in probability theory.	PO1,PO2
CO5	Acquire knowledge in partial differential equations and develop designing and analytical skills in modeling and solving mathematical models through Mass-Balance equations and Momentum-Balance equations	PO1,PO2,PO3 PO4

Text Books:

1. Mathematical Modelling, J.N. Kapur, New Age International (P) Limited Publishers, New Delhi
2. Advanced Engineering Mathematics, Kreysig, , John Wiley, NewYork, 1999.

Reference Books:

1. Principles of Mathematical Modelling (2004)-Clive L. Dyne, Elsevier Publication
2. Mathematical Modelling – A case study approach , R Illner, C Sean Bohun, S McCollum, T van Roode, AMS publication, 2005
3. Mathematical Modelling , D N P Murthy, N W Page, E Y Rodin, Pergamon Press,1990
4. OR Theory & Applications, J.K. Sharma , Mac Milian India Ltd., 1998
5. Mathematical Modelling(A Comprehensive Introduction), Gerhard Dangelmayr and Michael Kirby, Prentice Hall,New Jersey

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2	3	2										
CO3	2	3	2									
CO4	3	2										
CO5	2	3	2	2								
CO*	2.6	2.4	2	2								

III B. TECH II-SEMESTER

L	T	P	C
3	1	0	3

16OCSE321 OBJECT ORIENTED PROGRAMMING

Course Educational Objectives:

CEO1: To study the syntax, semantics and features of Java Programming Language.
CEO2: To understand the principles of packages and inheritance.
CEO3: Todevelop Java application programs using exceptions and interfaces.
CEO4: To gain knowledge on multithreading and applets
CEO5: To create GUI applications & perform event handling.

UNIT – 1: BASICS OF JAVA

History of Java - Java Buzzwords - Overview of Java - Data Types - Variables - Arrays - Operators - Control Statements – Introducing Classes &Objects - Constructors - Methods - Access Control - this Keyword - Garbage Collection - Overloading Methods and Constructors - Parameter Passing - Recursion – Exploring the String Class.

UNIT – 2: INHERITANCE AND PACKAGES:

Inheritance: Basics of Inheritance - Base Class Object - Subclass - Forms of Inheritance - Extension-Limitation - Benefits of Inheritance - Costs of Inheritance - Member Access Rules – Using Super - Using Final - Polymorphism- Method Overriding - Abstract Classes.
Packages: Defining - Creating and Accessing a Package - Understanding CLASSPATH – Importing Packages - Exploring Packages.

UNIT - 3: INTERFACES AND EXCEPTION HANDLING

Interfaces: Differences between Classes and Interfaces - Defining an Interface – Implementing Interface - Applying Interfaces - Variables in Interfaces and Extending Interfaces.
Exception Handling: Concepts of Exception Handling - Benefits of Exception Handling – Exception Hierarchy - Usage of Try - Catch - Throw - Throws and Finally - Built in Exceptions - Creating own Exception Sub Classes - Checked and Unchecked Exceptions.

UNIT – 4: MULTI THREADING AND APPLETS

Multi-Threading: Differences between Multi-Threading and Multitasking - Thread Life Cycle -Creating Threads - Synchronizing Threads.
Applets: Concepts of Applet - Differences between Applet and Application - Life Cycle of an Applet-Types of Applets - Creating Applet - Passing Parameters to Applet.

UNIT - 5: EVENT HANDLING AND AWT AND SWINGS

EVENT HANDLING AND AWT: Events - Event Sources - Event Listeners - Event Classes – DelegationEvent Model - Handling Mouse and Keyboard Events - Adapter Classes - Inner Classes - The AWT Class Hierarchy - AWT Components - Layout Managers - Graphics.
Swings - Introduction - Limitations of AWT - MVC Architecture - Components - Containers -Exploring Swing - JApplet - JFrame and JComponent - JLabel and Imageicon - JTextfield - JButton - Check Boxes - Radio Buttons - JCombobox - JTabbedpane - JScrollpane - Trees - JTable.

Course Outcomes:

On Successful completion of this course student should be able to :

Course Outcomes		POs related to COs
CO1	Understand the basic principles of object oriented programming	PO1, PO2, PO3, PO4, PO5,
CO2	Develop Java programs with the concepts of inheritance and packages	PO1, PO2, PO3, PO4, PO5, PO12
CO3	Build Java applications using exceptions and interfaces	PO1, PO2, PO3, PO4, PO5,
CO4	Use multithreading and applet concepts in developing the object oriented programming	PO1, PO2, PO3, PO5
CO5	Develop the interactive Java programs using event handling and swings	PO1, PO2, PO3, PO5

CO-PO Mapping

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	3	2	2	-	-	-	-	-	-	2
CO2	3	3	3	3	3	-	-	-	-	-	-	2
CO3	3	3	2	3	3	-	-	-	-	-	-	2
CO4	3	3	2	-	3	-	-	-	-	-	-	-
CO5	3	3	2	-	3	-	-	-	-	-	-	-
CO*	**3**	**3**	**2.4**	**2.6**	**2.8**	**-**	**-**	**-**	**-**	**-**	**-**	**2**

Text Books:

1. Java; The complete reference, Herbert schildt, 7th editon, TMH.
2. Beginning Java2 JDK , Ivor Horton's, 5th Edition, WILEY Dream Tech.

Reference Books:

1. An Introduction to programming and OO design using Java, J.Nino and F.A. Hosch, John wiley& sons.
2. An Introduction to OOP, T. Budd, second edition, Pearson education.
3. Introduction to Java programming ,Y. Daniel Liang, 6 th edition, Pearson education.
4. An introduction to Java programming and object oriented application development, R.A. Johnson-Thomson.
5. Core Java 2, Vol 1, Fundamentals, Cay.S.Horstmann and Gary Cornell, 7 th Edition, Pearson Education.

III B. Tech II Semester

16OCSE322	PYTHON PROGRAMMING	L	T	P/D	C
		3	1	-	3

Course Educational Objectives:

CEO1: To understand the basics of problem solving and python programming.
CEO2: To develop the basic skills of Python program in interactive and script mode.
CEO3: To design control structure like selection control and iterative control statement.
CEO4: To construct Python programs using Lists, Dictionaries and sets
CEO5: To build Python Programs using functions, software object, turtle graphics, file handling to read and write data from/to files.

UNIT- 1: INTRODUCTION TO PROBLEM SOLVING

Fundamentals: what is computer science - Essence of computational problem solving - Limits of computational problem solving - Computer Algorithms - Computer Hardware - Computer software - Computational problem solving.**Python programming language:** IDLE python development environment - python standard library - Bit of python - learning how to use IDLE - First program in Python. **Problem solving example:** Calculating the Drake Equation.

UNIT- 2: DATA AND EXPRESSIONS

Literals: Numeric literals - String literals - Control characters - String formatting - Implicit and explicit line joining. **Variables and Identifiers:** Variable assignment and keyboard input – Identifiers - keywords and other predefined identifiers. **Operators, Expressions and Data types**: Operators - Arithmetic Operators – Expressions - Operator precedence - Operator Associativity - Data type - Multi-type expression. **Computational Problem solving:** Restaurant Tab calculation and Age in seconds.

UNIT- 3: CONTROL STRUCTURES

Control Structures and Boolean expressions: Control structures - Relational operators - Membership operators - Boolean operators - Operator precedence and Boolean Expressions - Short-Circuit Evaluation - Logically Equivalent Boolean Expression. **Selection Control:** If statement - Indentation in python - Multi-Way Selection. **Iterative Control:** While statement - Infinite Error Checking - Infinite loops - Definite Vs Infinite loops - Boolean Flags and Indefinite loops. **Problem Solving:** Numbers of days in month and Calendar month programs.

UNIT-4: LISTS, DICTIONARIES AND SETS

Lists: List structures - Common list operations - List traversal - Lists in Python - Python list type –Tuples – sequences - Nested lists - Iterating over lists in python - For loop - Built-in range function - Iterating over list elements vs. List index values - While loops and lists - More on Python lists. **Dictionaries and Sets**: Dictionary types in Python - Set data type. **Problem solving:** Chinese Zodiac Program - Password Encryption/Decryption Program - Calendar Month program and A Food Co-op's Worker Scheduling Simulation.

UNIT-5: FUNCTIONS, SOFTWARE OBJECTS AND TEXT FILES

Functions: Function routines - Defining Functions - Calling Value-Returning Functions - Calling Non-Value-Returning Functions - Parameter Passing -Keyword Arguments in Python - Default Arguments in Python - Variable Scope. **Software Objects:** Object references - Turtle graphics - creating a Turtle

Graphics Window - the "Default" Turtle - Fundamental Turtle Attributes and Behavior - Additional Turtle Attributes - Creating Multiple Turtles. **Text Files:** Fundamentals – opening - reading and writing text files - string processing – traversal - operations and methods. **Problem solving:** Temperature conversion - GPA calculation and Credit card calculation.

Course Outcomes

On successful completion of this course the students should be able to		POs related to COs
CO1	Demonstrate problem approaches techniques and acquire knowledge in IDLE development environment in interactive and script mode	PO1, PO2,PO5
CO2	Indentify computational problem solving approaches to solve problems using python variables, expression and operators	PO1, PO2, PO5
CO3	Identify and develop python programs using control structures like selection control and iterative control statements.	PO1, PO2, PO3, PO5
CO4	Analyze lists, set, tuples and dictionaries to develop python program.	PO1, PO2, PO3, PO5
CO5	Understand and Build Python Programs using functions, software objects, turtle graphics and file handling to read and write data from/to files.	PO1, PO2, PO3, PO4,PO5

CO-PO Mapping

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	-	-	2	-	-	-	-	-	-	-
CO2	3	3	-	-	2	-	-	-	-	-	-	-
CO3	3	2	2	-	2	-	-	-	-	-	-	-
CO4	3	3	2	-	2	-	-	-	-	-	-	-
CO5	3	3	3	2	2	-	-	-	-	-	-	-
CO*	**3**	**2.8**	**2.3**	**2**	**2**	-	-	-	-	-	-	-

Text Books:

1. Charles Dierbach, Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2016.
2. Mark Lutz, "Programming Python," O'Reilly Publications, Fourth Edition, 2011.

Reference Books:

1. Kenneth Lambert and B.L. Juneja, Fundamentals of Python, Cengage Learning, Third Edition, 2012.
2. Python Programming: A Modern Approach, VamsiKurama, Pearson.
3. Learning Python, Mark Lutz, Orielly.
4. Introduction to Python, Kenneth A. Lambert, Cengage

III B.Tech II Semester

L	T	P	C
3	1	0	3

16OCSE323 WEB PROGRAMMING

Course Educational Objectives:

CEO1: To understand how to write a valid HTML document involving a variety of element types, including hyperlinks, images, lists, tables, and forms.
CEO2: To Analyzeadvanced concepts of HTML5 and use CSS to implement a variety of presentation effects in HTML documents.
CEO3: To develop client-side scripting on web pages to provide interactivity and rapid response to user actions at client side.
CEO4: Tounderstand basics of server side scripting language.
CEO5: To gain knowledge about sending the data from client side to server, creating sessions and interactwith database.

UNIT – 1: INTRODUCTION TO INTERNET AND WORLD WIDE WEB
Introduction to networks, LAN, MAN and WAN, history of the internet, E-mail concepts, sending and receiving files by E-mail, intranet, web system architecture, exploring HTTP, URL, domain name system, web browsers, web pages.

UNIT – 2: HYPERTEXT MARKUP LANGUAGE AND WEB DESIGN
Basics of HTML, HTML document display, formatting text, link, lists, images, tables, forms, frames, website design consideration.

UNIT – 3: USAGE OF CASCADING STYLE SHEET
Syntax of CSS, style sheets types, properties and text attributes padding, list properties, list properties, positioning, margins, colors, properties and table attributes.

UNIT – 4: FUNDAMENTALS OF JAVA SCRIPT
DHTML, HTML and JavaScript, JavaScript elements, variables, operators, flow control statements, arrays, functions, event handling, browsers and JavaScript, web pages and JavaScript, frames and JavaScript, validation of user form.

UNIT – 5: SERVER-SIDE PROGRAMMING
PHP: client-side scripting and server-side scripting, introduction to PHP, data types, variables, constants, expressions, string interpolation, control structures, functions, arrays, embedding PHP code in web pages.

Course Outcomes:

After completion of this course student will be able to :

Course Outcomes		POs related to COs
CO1	Create web pages using different elements of HTML	PO1,PO2,PO5
CO2	Apply styles to the HTML elements in web pages using CSS	PO1,PO2,PO3,PO5
CO3	Use client side scripting to make the web pages responsive and interactive.	PO1,PO2,PO3,PO5
CO4	Demonstrate knowledge on basics of server side scripting language: PHP	PO1,PO2,PO3,PO5
CO5	Develop web applications with database interaction	PO1,PO2,PO4,PO5

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	-	-	3	-	-	-	-	-	-	-
CO2	2	3	3	-	3	-	-	-	-	-	-	-
CO3	2	3	3	-	3	-	-	-	-	-	-	-
CO4	2	3	3	-	3	-	-	-	-	-	-	-
CO5	3	3	-	2	3	-	-	-	-	-	-	-
CO*	**2.4**	**2.8**	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Text Books:

1. A Complete Guide to Internet and Web Programming, Deven N. Shah, 2012, Dream Tech Press, New Delhi.
2. Beginning PHP and MySQL, W. Jason Gilmore, 4/e, 2011, Apress.

References Books:

1. Web Programming, Building Internet Applications, Chris Bates, 3/e, Dream Tech Press, New Delhi.
2. Internet and Web Technologies, Raj Kamal, Tata McGraw Hill, New Delhi.
3. Internet: The Complete Reference, Margaret Levine Young, 2/e, Tata McGraw Hill, New Delhi.

III B.Tech II Semester

L	T	P	C
3	1	0	3

16OCIV321 CONSTRUCTION EQUIPMENT, PLANNING AND MANAGEMENT

(OPEN ELECTIVE – I)

Course Educational Objectives:

CEO1: To learn basics of construction management

CEO2: To learn various equipment and financial aspects involved in construction project management

CEO3: To develop ability to analyze and develop network diagrams for better monitoring of the project

UNIT – 1: FUNDAMENTALS OF CONSTRUCTION TECHNOLOGY

Fundamentals of Construction Technology: Definitions and discussion – Construction activities – Construction processes – Construction works – Construction estimating – Construction schedule – Productivity and mechanized construction – Construction documents – Construction records – Quality – Safety – Codes and regulations. **Preparatory Work and Implementation:** Site layout – Infrastructure development – Construction methods – Construction materials – Deployment of construction equipment – Prefabrication in construction – False work and temporary works.

UNIT – 2: EARTHWORK AND CONSTRUCTION EQUIPMENT

Earthwork: Classification of soils – Project site – Development – Setting out – Mechanized excavation – Groundwater control – Trenchless (no-dig) technology – Grading – Dredging. **Construction Equipment:** Introduction to construction equipment: their contribution and importance inconstruction industry classification of construction equipment – Earth moving equipment – Excavation equipment – Hauling equipment – Earth-compaction equipment – Hoisting equipment – Concreting plant and equipment – Selection of equipment – Task consideration – Cost consideration – Factors affecting the selection – Factors affecting cost owning and operating the equipment – Equipment maintenance.

UNIT – 3: PROJECT MANAGEMENT

Project Management: Introduction – Project planning – Scheduling – Controlling – Role of decision in project management – Techniques for analyzing alternatives operation research – Methods of planning and programming problems – Development of bar chart – Illustrative examples – Shortcomings of bar charts and remedial measures – Milestone charts – Development of PERT net work problems. **Elements of Network and Development of Network:** Introduction – Event – Activity – Dummy – Network rules – Graphical guidelines for network – Common partial situations in network – Numbering the events – Cycles problems – Planning for network construction – Modes of network construction – Steps in development of network – Work breakdown structure – Hierarchies – Illustrative examples – Problems.

UNIT – 4: PERT

Time Estimates and Time Computations: Introduction – Uncertainties: Use of PERT – Time estimates – Frequency distribution – Mean, variance and standard deviation – Probability distribution – Beta distribution – Expected time Problems – Earliest expected time – Formulation for TE - Latest allowable occurrence time – Formulation for TL - Combined tabular computations for TE and TL problems.

UNIT – 5: CPM

Network Analysis: Introduction - Slack – Critical path – Illustrative examples – Probability of meeting scheduled date Problems – CPM : process – CPM : Networks –Activity time estimate – Earliest event time – Latest allowable occurrence time – Combined tabular computations for TE and TL – Start and finish times of activity – Float – Critical activities and critical path – Illustrative examples Problems.

Course Outcomes:

On successful completion of the course, students will be able to

Course Outcomes		POs related to COs
CO1	Describe fundamentals of construction technology and preparatory works	PO1, PO6, PO7
CO2	List various construction equipment and explain associate factors in	PO1, PSO2
CO3	Analyze and develop network diagrams	PO1, PO2, PO3, PO11
CO4	Apply PERT and compute required parameters	PO1, PO2, PO3, PO11
CO5	Analyze network diagrams using CPM	PO1, PO2, PO11

CO – PO MAPPING

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	2	1	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	2	-	-	-	-	-	-	-	3	-
CO4	2	2	2	-	-	-	-	-	-	-	3	-
CO5	2	2	-	-	-	-	-	-	-	-	3	-
CO*	2	2	2	-	-	2	1	-	-	-	3	-

Text Books:

1. Construction Technology, SubirK.Sarkar and SubhajitSaraswati, Oxford Higher Education Univ.Press, Delhi.
2. Project Planning and Control with PERT and CPM, Dr.Punmia, B.C, Khandelwal, K.K., Lakshmi Publications New Delhi.
1. Construction Project Management, Jha, Pearson publications, New Delhi.

Reference Books:

1. Optimal Design of Water Distribution Networks, Bhave, P.R., 2003, Narosa Publishing house.
2. Operations Research, SankarIyer, P., TMH Pubilications, New Delhi.
3. Operations Research, Ramanathan, N., TMH Pubilications, New Delhi.
4. Total Project Management, The Indian Context, Joy, P.K., Mac Millan Publishers India Limited.
5. Construction Planning, Equipment and Methods, Robert L.Peurifoy, Mcgraw Hill publishing company.

III B.Tech II Semester

L	T	P	C
3	1	0	3

16OCIV322 REMOTE SENSING AND GIS (OPEN ELECTIVE – I)

Course Educational Objectives:

CEO1: To know the basics, importance, analysis and applications of RS and GIS
CEO2: To study the various types of operating systems of RS and GIS
CEO3: To know the applications of RS and GIS

UNIT – 1: EMR AND ITS INTERACTION WITH ATMOSPHERE AND EARTH MATERIAL

Definition of remote sensing and its components – Electromagnetic spectrum – Wavelength regions important to remote sensing – Wave theory, particle theory, Stefan-Boltzman and Wein's displacement law – Atmospheric scattering, absorption – Atmospheric windows – Spectral signature concepts – Typical spectral reflective characteristics of water, vegetation and soil.

UNIT – 2: PLATFORMS AND SENSORS

Types of platforms – Orbit types, sun-synchronous and geosynchronous – Passive and active sensors – Resolution concept – Pay load description of important earth resources and meteorological satellites – Airborne and space borne TIR and microwave sensors.

UNIT – 3: IMAGE INTERPRETATION AND ANALYSIS

Types of data products – Types of image interpretation – Basic elements of image interpretation – Visual interpretation keys – Digital image processing – Pre-processing – Image enhancement techniques – Multispectral image classification – Supervised and unsupervised.

UNIT – 4: GEOGRAPHIC INFORMATION SYSTEM

Introduction – Maps – Definitions – Map projections – Types of map projections – Map analysis – GIS definition – Basic components of GIS – Standard GIS softwares – Data type – Spatial and non-spatial (attribute) data – Measurement scales – Data Base Management Systems (DBMS).

UNIT – 5: DATA ENTRY, STORAGE AND ANALYSIS

Data models – Vector and raster data – Data compression – Data input by digitization and scanning – Attribute data analysis – Integrated data analysis – Modeling in GIS highway alignment studies – Land information system.

Course Outcomes:

On successful completion of the course, students will be able to

Course Outcomes		POs related to COs
CO1	List various theories associated with remote sensing and spectral reflective characteristics	PO1
CO2	Discuss various types of platforms and sensors used in remote sensing applications	PO1
CO3	Know various data interpretation techniques and perform basic analysis	PO1, PO2
CO4	Explain basic features and components of GIS	PO1
CO5	Analyze the data for GIS	PO1, PO2, PO5

CO – PO MAPPING

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	-	-	3	-	-	-	-	-	-	-
CO*	2	2	-	-	3	-	-	-	-	-	-	-

Text Books:

1. Remote Sensing and Image Interpretation, Lillesand,T.M., Kiefer, R.W. and J.W.Chipman, 5/e, 2004, John Willey and Sons Asia Pvt. Ltd., New Delhi.
2. Textbook of Remote Sensing and Geographical Information System, Anji Reddy, M. 2/e, 2001, BS Publications, Hyderabad.

Reference Books:

1. Concepts and Techniques of Geographic Information Systems,Lo. C.P.andA.K.W.Yeung, 2002, Prentice Hall of India Pvt. Ltd., New Delhi.
2. Principles of GIS, Peter A.Burrough, Rachael A. McDonnell, 2000, Oxford University Press.
3. An Introduction to GIS, Ian Heywood, 2000, Pearson Education Asia.

III B.Tech II Semester

L	T	P	C
3	1	0	3

16OCIV323 GREEN BUILDINGS AND ENERGY CONSERVATION

(OPEN ELECTIVE – I)

Course Educational Objectives:

CEO1: Explore alternate building materials for sustainability

CEO2: Learn mechanism of thermal flow in buildings

CEO3: Learn various governing codes and guidelines for the green buildings

UNIT – 1: GREEN BUILDING CONCEPTS

Orientation – Introduction to bioclimatic architecture, sustainability in building science functional planning – Elements of building design and drawing, regulations and bylaws –Traditional Vs vernacular architecture – Climate zones, design charts, sun path diagram, solar angles, indices of thermal comfort, vernacular buildings in different climate zones.

UNIT – 2: CLIMATE RESPONSIVE SCIENTIFIC PROCESS OF DESIGN

Introduction, various steps, site planning , plan form building envelope landform, topography, vegetation, water bodies; orientation, S/V ratio, P/A ratio, walls, fenestration, roof and floors active Vs passive, passive solar architecture.

UNIT – 3: THERMAL FLOW IN BUILDINGS

Calculation of thermal conductance, heat flow through different building elements; various software ventilation and day lighting – Design and placement of openings – Water management in buildings techniques to recycle, reuse and harvest water.

UNIT – 4: GREEN BUILDING MATERIALS AND CONSTRUCTION

Material properties, energy efficiency using various materials, emerging new materials construction techniques – Techniques for roof, wall and foundations.

UNIT – 5: ECONOMY OF GREEN BUILDING

Cost of building, operation and maintenance – Green building rating system, evaluation criteria of LEED, TERI GRIHA case studies, case studies in different climate zones.

Course Outcomes:

On successful completion of the course, students will be able to

Course Outcomes		POs related to COs
CO1	Explain the basic features of green buildings	PO1, PO6, PO7
CO2	Describe various architectural features of green buildings	PO1, PO6, PO7
CO3	Analyze thermal flow in buildings and compute basic computations relevant to thermal flow	PO1, PO2, PO6, PO7
CO4	Name various green building materials and describe their basic properties	PO1, PO6, PO7, PSO2
CO5	Explain economy aspects of green buildings and Analyze case studies	PO1, PO2, PO6, PO7, PO9

CO – PO MAPPING

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	2	3	-	-	-	-	-
CO2	2	-	-	-	-	2	3	-	-	-	-	-
CO3	2	2	-	-	-	2	3	-	-	-	-	-
CO4	2	-	-	-	-	2	3	-	-	-	-	-
CO5	2	2	-	-	-	2	2	-	2	-	-	-
CO*	2	2	-	-	-	2	2	-	2	-	-	-

Text books:

1. Climate Responsive Architecture, A Design Handbook For Energy Efficient Buildings, Krishnan, A., Baker, N., Yannas, S., and Szokolay, S., Eds., 2001, Tata McGraw–Hill Publishing Company, New Delhi.
2. Sustainable building design manual (Vol.II), TERI & ICAEN (InstitutCataladEnergia), 2004, The Energy and Resources Institute (TERI) Press, New Delhi.

Reference Books:

1. Bureau of Indian Standards, SP:41, Handbook on Functional Requirements of Buildings (Other Than Industrial Buildings) 1/e rp,1995, Bureau of Indian Standards, New Delhi.
2. Indian Green Building Council, LEED-India, 2011, LEED 2011 for India- Green building Rating system, abridged reference guide for new construction and major renovations (LEED India NC). Hyderabad: Indian Green Building Council.
3. Manual of Tropical Housing and Building, Koenigsberger, O., ingersoll, T. G., Mayhew, A., &Skozolay, S. V., 2011, Universities Press, Hyderabad.
4. Building Design and Drawing, Prabhu, Balagopal T S, K Vincent Paul, and C Vijayan, 2008, Calicut:Spades Publishers.

III B.Tech II Semester

L	T	P	C
3	1	0	3

16OMEC321 INDUSTRIAL ROBOTICS

Course Educational Objectives:

CEO1: To understand the basic concepts associated with the design and functioning of robots.
CEO2: To know the robot drive systems and design of internal grippers and external grippers
CEO3: To study about the sensors used in robots and its applications .
CEO4: To learn about analyzing robot kinematics and robot programming.
CEO5: To study about the Implementation of robots in industries and Safety considerations.

UNIT – 1: FUNDAMENTALS OF ROBOT

Definition – Robot anatomy – Co-ordinate systems, work envelope, types and classification – Specifications – Pitch, yaw, roll, joint notations, speed of motion, pay load – Robot parts and functions – Need for robots – Different applications.

UNIT – 2:

Pneumatic drives – Hydraulic drives – Mechanical drives – Electrical drives – D.C. servo motors, stepper motor, A.C. servo motors – Salient features, applications and comparison of drives end effectors – Grippers – Mechanical grippers, pneumatic and hydraulic grippers, magnetic grippers, vacuum grippers, two fingered and three fingered grippers, internal grippers and external grippers, selection and design considerations.

UNIT – 3: ROBOT SENSORS AND MACHINE VISION

Requirements of a sensor, principles and applications of the following types of sensors – Position of sensors (piezo electric sensor, LVDT, resolvers, optical encoders, pneumatic position sensors), range sensors (triangulation principle, structured, lighting approach, time of flight range finders, laser range meters), proximity sensors (inductive, Hall effect, capacitive, ultrasonic and optical proximity sensors), touch sensors, (binary sensors, analog sensors), wrist sensors, compliance sensors, slip sensors. camera, frame grabber, sensing and digitizing image data – Signal conversion, image storage and lighting techniques - Image processing and analysis – Data reduction – Edge detection, segmentation feature extraction and object recognition – Algorithms – Applications – Inspection, identification, visual serving and navigation.

UNIT – 4: ROBOT KINEMATICS AND ROBOT PROGRAMMING

Robot Kinematics: Forward kinematics, inverse kinematics and differences –Forward kinematics and reverse kinematics of manipulators with two, three degrees of freedom (in 2 dimensional), four degrees of freedom (in 3 dimensional) – Deviations and problems. **Robot Programming:** Teach pendant programming –Lead through programming– Robot programming languages – VAL programming – Motion commands, sensor commands, end effecter commands, and simple programs.

UNIT – 5: IMPLEMENTATION, ROBOT ECONOMICSAND APPLICATIONS

Implementation and Robot Economics:RGV, AGV – Implementation of robots in industries – Various steps – Safety considerations for robot operations – Economic analysis of robots – Pay back method – EUAC method – Rate of return method.**Applications:**Material transfer – Material handling – Loading

and unloading - Processing - Spot and continuous arc welding and spray painting – Assembly and inspection.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand the basic concepts associated with the design and functioning of robots.	PO1,PO2,PO3
CO2	Demonstrate the robot drive systems and design of internal grippers and external grippers	PO1,PO2,PO3
CO3	Explain the basic concepts associated with the sensors used in robots and its applications .	PO1,PO2,
CO4	Understand about analyzing robot kinematics and robot programming.	PO1, PO2, PO3
CO5	Explain the implementation of robots in industries and Safety considerations in workplace	PO1, PO2, PO6

Text Books:

1. Industrial Robotics-Technology, Programming and Applications, M.P.Groover, 2001, McGraw-Hill.
2. Robotics Control, Sensing, Vision and Intelligence, Fu.K.S. Gonzalz.R.C., and Lee C.S.G., 1987, McGraw-Hill Book Co.

Reference Books:

1. Fundamentals of Robotics Analysis and Control, C Robert J Schilling, 2009, Pearson Education.
2. Introduction to Robotics Mechanics and Education, Craig J.J., 2008.
3. Robotics Technology and Flexible Automation, Deb S.R. and Deb S., 2010, McGraw Hill Education.
4. The Robotics Primer, Maja J Mataric, 2009, Universities Press.
5. Foundation of Robotics: Analysis and Control, Yoshikawa, 2004, Prentice Hall of India.

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO.1	3	3	2	-	-	-	-	-	-	-	-	-
CO.2	3	2	1	-	-	-	-	-	-	-	-	-
CO.3	3	2		-	-	-	-	-	-	-	-	-
CO.4	3	2	2	-	-	-	-	-	-	-	-	
CO.5	3	1	-	-	-	1	-	-	-	-	-	
CO	**3**	**2**	**1.7**	-	-	**1**	-	-	-	-	-	-

III B.Tech II Semester

L	T	P	C
3	1	0	3

16OMEC322 OPTIMIZATION TECHNIQUES

Course Educational Objectives:

CEO1: To introduce the fundamental concepts of optimization techniques and linear programming.
CEO2: To provide the concepts of various transportation models and network models
CEO3: To understand the importance and solution of inventory and queuing models
CEO4: To solve the problem related to decision theory
CEO5: To provide knowledge on classical and modern methods of constrained and unconstrained problems in both single and multivariable

UNIT – 1: OPTIMIZATION TECHNIQUE AND LINEAR PROGRAMMING

Optimization Technique: Introduction **–** Single variable optimization **–** Multivariable optimization with no constraints **–** Multivariable optimization with equality constraints **–** Multivariable optimization with inequality constraints **–** Convex programming problem.**Linear Programming**: The phase of an operation research study – Linear programming – Graphical method – Simplex algorithm – Duality formulation – Sensitivity analysis.

UNIT – 2: TRANSPORTATION MODELS AND NETWORK MODELS

Transportation assignment models –Traveling salesman problem **–** Networks models – Shortest route – Minimal spanning tree – Maximum flow models –Project network – CPM and PERT networks – Critical path scheduling – Sequencing models.

UNIT – 3: INVENTORY MODELS AND QUEUEING MODELS

Inventory Models: Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice. **Queueing Models:** Queueing models **–** Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

UNIT – 4: DECISION MODELS

Decision models – Game theory – Two person zero sum game – Graphic solution **–** Property of dominance – Algebraic solution **–** Replacement models – Items that deteriorate with time **–** When money value changes – Items that fail completely – Individual replacement and group replacement.

UNIT – 5: CLASSICAL OPTIMIZATION TECHNIQUES

Unconstrained problems **–** Unconstrained algorithms **–**Karush-Kuhn-Tucker (KKT) conditions **–** Quadratic programming.**Nontraditional Optimization Techniques:** Genetic algorithms **–**Simulated annealing – Neural network based optimization **–** Optimization of fuzzy systems.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Illustrate the fundamental concepts of optimization techniques and linear programming.	PO1,PO2,PO3
CO2	Explain the concepts of various transportation models and network models	PO1,PO3,PO4
CO3	Understand the importance and solution of inventory and queuing models	PO1,PO2,PO3
CO4	Provide solution for the problem related to decision theory	PO1, PO2,PO3, PO4
CO5	Express the knowledge on classical and modern methods of constrained and unconstrained problems in both single and multivariable	PO1, PO2, PO5

Text Books:

1. Operation Research, H.A. Taha, 2002, Prentice Hall of India.
2. Engineering Optimization: Theory and Practice Singiresu S. Rao, A Wiley, 3/e, Interscience Publication.

Reference Books:

1. Operations Research, Paneer Selvam, 2002, Prentice Hall of India.
2. Quantitative Methods for Business, Anderson, 8/e, 2002, Thomson Learning.
3. Operations Research Applications and Algorithms, Wayne.L.Winston, 4/e, 2007, Thomson learning.
4. Quantitative Techniques in Management, Vohra, 2002, Tata Mc Graw Hill.
5. Operations Research Theory and Applications, J.K.Sharma, 3/e, 2007, Macmillan India.

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO.1	3	3	2	-	-	-	-	-	-	-	-	-
CO.2	3		2	1	-	-	-	-	-	-	-	-
CO.3	3	2	2	-	-	-	-	-	-	-	-	-
CO.4	3	2	2	2	-	-	-	-	-	-	-	
CO.5	3	1	-	-	1	-	-	-	-	-	-	
CO	**3**	**2**	**2**	1.5	1	-	-	-	-	-	-	-

III B.Tech II Semester

L	T	P	C
3	1	0	3

16OMEC323 MECHATRONICS (OPEN ELECTIVE - I)

Course Educational Objectives:

- **CEO1**: To understand the fundamentals of Mechatronics, Control Systems, Transducers and Sensors
- **CEO2**: To know the functions of Mechanical, Electrical, Hydraulic, and Pneumatic Actuators in mechatronics systems
- **CEO3**: To demonstrate the Basic system models and Controller used in Mechatronic systems
- **CEO4**: To understand the applications of microprocessors and programmable logic controller in Mechatronic system
- **CEO5**: To recognize the elements of Robotic system in mechatronics Engineering

UNIT – 1: MECHATRONICS, SENSORS AND TRANSDUCERS

Introduction to mechatronics systems. **Control systems:** Open loop, closed loop, automatic control, block diagram, pneumatic control and hydraulic control systems. **Transducers:** Terminology and mechanism – Classifications: Resistance, variable inductance, capacitive, piezoelectric, Hall effect and photoelectric transducers – Strain gauge (theory only). **Sensors:** Proximity, light and pneumatic sensors – Load cells – Digital optical encoders – Selection of sensors.

UNIT – 2: ACTUATION SYSTEMS

Mechanical Actuator: Types – Gear drive, belt drive, chain drive and bearings. **Electrical Actuator:** Types – Mechanical and solid state switches – Construction and working principle of stepper motor and servo motor. **Hydraulic Actuators:** Hydraulic systems – Pumps – Regulator – Valves – Linear and rotary actuator. **Pneumatic Actuators:** Pneumatic systems – Valves – Linear and rotary actuator.

UNIT – 3: SYSTEM MODELS AND CONTROLLERS

System Models: Basic system models – Mechanical system buildings – Electrical system buildings – Fluid system buildings – Thermal system buildings – Rotational-translational systems – Electro mechanical systems – Hydraulic mechanical systems.**Controller:** Control modes – Two step mode – Proportional mode – Derivative mode – Integral mode – PID controllers – Digital controllers – Adaptive control systems.

UNIT – 4: MICROPROCESSORS AND PROGRAMMABLE LOGIC CONTROLLER

Microprocessors: Introduction – Pin configuration – Architecture of 8085 – Addressing modes – Instruction set, timing diagram of 8085. **Data Acquisition:** Data acquisition systems – Analog-to- digital conversion (ADC) – Digital-to-analog conversion (DAC). **Programmable Logic Controller:** Introduction – Architecture – Input / output processing – Programming with timers, counters and internal relays – Data handling – Selection of PLC.

UNIT – 5: MECHATRONIC SYSTEMS

Robotic Systems: Definition – Laws of robotics – Types of industrial robotics – Robotic systems – Classification – End effectors – Robot sensors (touch, position, force, proximity and range sensors) – Robot control system – Robot drives – Industrial robots – Applications. **Mechatronics Systems:**

Design process – Embedded systems –Design process of engine management system, automatic camera, automatic washing machine, pick and place robot, automatic car park barrier, wireless surveillance balloon and uninterruptible power supply.

Course Outcomes:

On successful completion of the course, Students will be able to

Course Outcomes		POs related to COs
CO1	Understand the fundamentals of Mechatronics, Control Systems, Transducers and Sensors	PO1,PO2, PO4
CO2	Illustrate the functions of Mechanical, Electrical, Hydraulic, Pneumatic Actuators in mechatronics systems	PO1,PO2,PO3, PO4
CO3	demonstrate the Basic system models and Controller used in Mechatronic systems	PO1,PO2,PO4
CO4	Understand the applications of microprocessors and programmable logic controller in mechatronic system	PO1, PO2, PO4
CO5	Recognize the elements of Robotic system in mechatronics Engineering	PO1, PO2, PO5

CO – PO MAPPING

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	-	2	-	-	-	-	-	-	-	-
CO2	3	2	2	2	-	-	-	-	-	-	-	-
CO3	3	2	-	2	-	-	-	-	-	-	-	-
CO4	3	2	-	2	-	-	-	-	-	-	-	
CO5	3	1	-	-	1	-	-	-	-	-	-	
CO*	**3**	**2**	**2**	2	1	-	-	-	-	-	-	-

Text Books:

1. A Textbook of Mechatronics, Rajput. R.K, 2007, S. Chand and Co.
2. Mechatronics, Bolton,W, 2/e, 2003, Pearson education.

Reference Books:

1. Mechatronics Systems Design, Devadas Shetty and Richard A. Kolk, 2010, Cengage Learning.
2. Mechatronics Integrated Technologies for Intelligent Machines, Smaili.A and Mrad.F, 2007, Oxford University Press.
3. Mechatronics Principles, Concepts and Applications, NitaigourPremchandMahalik, 2015, McGraw Hill Education.
4. Introduction to Mechatronics and Measurement Systems, Michael B. Histand and David G. Alciatore, 2000, McGraw-Hill International Editions.
5. Understanding Electro-Mechanical Engineering: An Introduction to Mechatronics, Lawrence J. Kamm, 2000, Prentice Hall of India Pvt., Ltd.

III Year B.Tech II semester	L	T	P	C
	3	1	0	3

16OECE321 MACHINE VISION SYSTEM (Open Elective I)

CEO1: To introduce theory, applications and techniques of machine vision to students
CEO2: Provide the students with an understanding of the problems involved in the development of machine vision systems.
CEO3: Introduces the "low-level" algorithms of image processing that are necessary for the "mid-level" vision or feature extraction.
CEO4: To describe and analyze the pattern recognition, and 3D analysis and modeling of objects and scenes.
CEO5: lay emphasis on the practical integration of machine vision systems, and the related applications in real time.

UNIT 1: INTRODUCTION
Human vision – Machine vision and Computer vision – Benefits of machine vision – Block diagram and function of machine vision system implementation of industrial machine vision system – Physics of Light – Interactions of light – Refraction at a spherical surface – Thin Lens Equation

UNIT 2: IMAGE ACQUISITION
Scene constraints – Lighting parameters – Lighting sources, Selection – Lighting Techniques – Types and Selection – Machine Vision Lenses and Optical Filters, Specifications and Selection – Imaging Sensors – CCD and CMOS, Specifications – Interface Architectures – Analog and Digital Cameras – Digital Camera Interfaces – Camera Computer Interfaces, Specifications and Selection – Geometrical Image formation models – Camera Calibration

UNIT 3: IMAGE PROCESSING
Machine Vision Software – Fundamentals of Digital Image – Image Acquisition Modes – Image Processing in Spatial and Frequency Domain – Point Operation, Thresholding, Grayscale Stretching – Neighborhood Operations, Image Smoothing and Sharpening – Edge Detection – Binary Morphology – Colour image processing.

UNIT 4: IMAGE ANALYSIS
Feature extraction – Region Features, Shape and Size features – Texture Analysis – Template Matching and Classification – 3D Machine Vision Techniques – Decision Making.

UNIT 5: MACHINE VISION APPLICATIONS
Machine vision applications in manufacturing, electronics, printing, pharmaceutical, textile, applications in non-visible spectrum, metrology and gauging, OCR and OCV, vision guided robotics – Field and Service Applications – Agricultural, and Bio medical field, augmented reality,surveillance, bio-metrics.

Course Outcomes:

On successful completion of the course the student will be able to		**POs related to COs**
CO1	Formulate the concepts of machine vision system and its applications	PO1, PO2
CO2	Determine the geometrical image formation model and analyze the lighting effects for image acquisition	PO1,PO2, PO3
CO3	Demonstrate various the image acquisition and processing techniques in spatial and frequency domain	PO1, PO2,PO3
CO4	Analyze the digital image for feature extraction and 3D vision techniques for decision making.	PO1, PO2,PO3, PO4
CO5	Apply machine vision concepts and visual sensing technologies in real time applications	PO1, PO2, PO3,PO4

TEXT BOOKS:

1. Alexander Hornberg, "Handbook of Machine Vision", First Edition, Wiley VCH, 2006.
2. Davis E.R., "Machine Vision Theory, Algorithms and Practicalities," Elsevier, 2005.

REFERENCE BOOKS:

1. Nello Zuech, "Understanding and Applying Machine Vision", Marcel Decker, 2000.
2. Emanuele Trucco, Alessandro Verri, "Introductory Techniques For 3D Computer Vision", first Edition.
3. Rafael C.Gonzales, Richard.E.Woods, "Digital Image Processing Using MATLAB", Mc. Graw Hill Education, 2014.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2	3	3	2									
CO3	2	3	2									
CO4	3	3	2	2								
CO5	2	3	2	2								
CO*	2.6	2.8	2	2								

III Year B.Tech II semester	L	T	P	C
	3	1	0	3

16OECE322 MEMS and MICROSYSTEMS(Open Elective I)

OBJECTIVES:

CEO1: To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.

CEO2: To educate on the rudiments of Micro actuators, micro accelerometers.

CEO3: To introduce various Materials of Mems and Microsystems.

CEO4: To provide knowledge on deposition of Epitoxy & etching

CEO5: To provide knowledge on Process design, Mechanical desing , Computer aided design.

UNIT-1: Overview of MEMS and Microsystems

MEMS and Microsystems.Typical MEMS and Microsystems Products.Evolution of Microfabrication.Microsystems and Microelectronics.The Multidisciplinary Nature of Microsystems Design and Manufacture.Microsystems and Miniaturization.Application of Microsystems in Automotive Industry.Application of Microsystems in Other Industries Introduction.Microsensors.Microactuation.MEMS with Microactuators.Microaccelerometers. Microfluidics..Markets for Microsystems.

UNIT-2: Working Principles of Microsystems

Introduction.Microsensors.Microactuation.MEMS with Microactuators.Microaccelerometers.Microfluidics.

UNIT-3: Materials for MEMS and Microsystems

Introduction.Substrates and Wafers.Active Substrate Materials.Silicon as a Substrate Material.Silicon Compounds.Silicon Piezoresistors.Gallium Arsenide.Quartz.Piezoelectric Crystals.Polymers.Packaging Materials.

UNIT-4: Microsystems Fabrication Processes

Introduction.Photolithography.Ion Implantation.Diffusion.Oxidation.Chemical Vapor Deposition.Physical Vapor Deposition - Sputtering.Deposition by Epitaxy.Etching.Summary of Microfabrication.

UNIT-5: Microsystem Design

Introduction. Design Considerations. Process Design.Mechanical Design.Mechanical Design Using Finite Element Method.Design of Silicon Die of a Micropressure Sensor.Design of Microfluidics Network Systems.Computer-Aided Design.

Course Outcomes:

On successful completion of the course the student will be able to		POs related to COs
CO1	Be familiar with the important concepts applicable to MEMS, their fabrication.	PO1, PO2
CO2	Be fluent with the design, working principles of micro systems	PO1, PO2, PO3
CO3	To educate on the rudiments of materials of Mems and micro systems	PO1, PO2, PO4
CO4	To introduce the fabrication concepts of micro systems and Etching.	PO1, PO2,PO4
CO5	Apply the MEMS for different applications including process desing and Mechanical design	PO1,PO2,PO3

TEXT BOOKS

1. MEMS and MICROSYSTEMS Design and Manufacture-Tai-Ran Hsu-Tata McGraw-Hill Edition 2012.
2. Design and Manufacturing of Active Microsystems (Microtechnology and MEMS) Paperback – Import, 21 Mar 2014 by Stephanus Büttgenbach , Arne BurischJürgen Hesselbach
3. Radioisotope Thin-Film Powered Microsystems (MEMS Reference Shelf) Paperback – Import, 7 Nov 2012 by Rajesh Duggirala , Amit Lal , Shankar Radhakrishnan

REFERENCES

1. Francis E.H. Tay and Choong .W.O, "Micro fluidics and Bio mems application", IEEE Press New York, 1997.
2. Trimmer William S., Ed., "Micromechanics and MEMS", IEEE Press New York, 1997.
3. Maluf, Nadim, "An introduction to Micro electro mechanical Systems Engineering", AR Tech house, Boston 2000.
4. Julian W.Gardner, Vijay K.Varadan, Osama O. Awadel Karim, "Micro sensors MEMS and Smart Devices", John Wiby & sons Ltd., 2001.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2	3	2	2									
CO3	2	3		2								
CO4	3	3		2								
CO5	2	3	2									
CO*	2.6	2.6	2	2								

IIIYear B.Tech II semester	L	T	P	C
	3	1	0	3

16OECE323 FOUNDATION OF NANO-ELECTRONICS

Course Objectives:

CEO1:To learn and understand basic concepts of Tunneling and applications
CEO2:To know the techniques of Tunneling Microscope, Double Barrier Tunneling .
CEO3:To gain knowledge about Resolution Enhancement, Electron Lithography, micro machining.
CEO4: To acquire knowledge on Mems Devices , working principles and thermo electricity.
CEO5: TOobtain knowledge on FET, SET structures, Nano wire concepts.

UNIT-1: INTRODUCTION TO TUNNELING

Tunnel junction and applications of tunneling, Tunneling Through a Potential Barrier, Metal-Insulator, Metal-Semiconductor, and Metal-Insulator-Metal Junctions, Coulomb Blockade, Tunnel Junctions, Tunnel Junction Excited by a Current Source.

UNIT-2: TUNNELING DEVICES

Field Emission, Gate—Oxide Tunneling and Hot Electron Effects in nano MOSFETs, Theory of Scanning Tunneling Microscope, Double Barrier Tunneling and the Resonant Tunneling Diode.

UNIT-3: LITHOGRAPHY TECHNIQUES

Introduction to lithography- Contact, proximity printing and Projection Printing, Resolution Enhancement techniques, Positive and negative photoresists, Electron Lithography, Projection Printing. Lithography based on Surface Instabilities: Wetting, De-wetting, Adhesion, Limitations, Resolution and Achievable / line widths, Lift off process, Bulk Micro machining.

UNIT-4: MEMS DEVICES

Introduction to MEMS and NEMS, working principles, micro sensors, micro actuation- thermal actuation, piezoelectric actuation and electrostatic actuation–micro gripers, motors, valves, pumps, accelerometers, fluidics and capillary electrophoresis, active and passive micro fluidic devices, Pizoresistivity, Pizoelectricity and thermoelectricity.

UNIT-5: NANOELECTRONIC DEVICES

Scaling of physical systems – Geometric scaling & Electrical system scaling. The Single-Electron Transistor: The Single- Electron Transistor Single-Electron Transistor Logic, Other SET and FET Structures, Carbon Nanotube Transistors (FETs and SETs), Semiconductor Nanowire FETs and SETs, Molecular SETs and Molecular Electronics.

Course Outcomes:

On successful completion of the course the student will be able to		POs related to COs
CO1	To understand and analyze the fundamental physics of nano electronics	PO1
CO2	Describe deep insight techniques of Tunneling Microscope, Double Barrier Tunneling	PO1,PO2
CO3	Discuss various Properties of Resolution Enhancement, Electron Lithography, micro machining	PO1,PO2
CO4	Familiarize with concepts of MEMS devices	PO1
CO5	Acquire the knowledge on FET, SET and Molecular Electronics	PO1,PO2,PO4

TEXT BOOK:

1. Stephen D. Senturia, "Microsystem Design, Springer Verlag", 2001.
2. Marc Madou, "Fundamentals of microfabrication & Nano Technology", Taylor and Francis, 2011.
3. T. Fukada & W.Mens, "Micro Mechanical system Principle & Technology", Elsevier, 1998.
4. Julian W.Gardnes, Vijay K. Varda, "Micro sensors MEMS & Smart Devices", 2001.

Reference Books:

1. Nano Terchnology and Nano Electronics – Materials, devices and measurement Techniques by WR Fahrner – Springer.
2. Nano: The Essentials – Understanding Nano Scinece and Nanotechnology by T.Pradeep; Tata Mc.Graw Hill.
3. Nanoelectronics and Nanosystems – From Transistor to Molecular and Quantum Devices by Karl Goser, Peter Glosekotter, Jan Dienstuhl
4. Quantum-Based Electronic Devices and Systems by M. Dutta and M.A. Stroscio, World Scientific.
5. Micro sensors MEMS& Smart Devices, Julian W.Gardnes, Vijay K. Varda, 2001

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2	3	2										
CO3	3	1										
CO4	3											
CO5	3	2		1								
CO*	3	1.6		1								

B.TECH III-II SEM (E.E.E)

L	T	P	C
0	0	3	2

SUB CODE: 16EEE325 POWER ELECTRONICS AND SIMULATION LAB

Course Educational Objectives:

CEO1. To demonstrate knowledge on operation and characteristics of power semiconductor devices.

CEO2. To design different triggering and commutation circuits for SCR.

CEO3. To analyze physical variations of various power electronic converters

CEO4. To Evaluate and compare various parameters from the operation of converters

CEO5. To design and simulate different power electronic circuits using MATLAB

Any 10 of following experiments

Any Eight of the following experiments are required to be conducted as compulsory experiments

1. Study Of Characteristics Of SCR- MOSFET& IGBT
2. Gate Firing Circuits For SCR's
3. Single Phase Ac Voltage Controller with R and Rl Loads
4. Single Phase Fully Controlled Bridge Converter with R and Rl Loads
5. Forced Commutation Circuits (Class A- Class B - Class C - And Class D & Class E)
6. Dc Jones Chopper With R And Rl Loads
7. Single Phase Series Inverter With R And Rl Loads
8. Single Phase Parallel- Inverter With R And Rl Loads
9. Single Phase Half Controlled Converter With R Load
10. Three Phase Half Controlled Bridge Converter With R-Load

Any two of the following experiments are required to be conducted in addition to above.

11. Single Phase Cycloconverter Controller With R And RL Loads
12. Single Phase Dual Convereter Controller With R And RL Loads
13. Pspice Simulation Of Single-Phase Half and Full Bridge Inverter Using RLE Loads.
14. Pspice Simulation Of Resonant Pulse Commutation Circuit and Buck Chopper
15. Pspice Simulation Of Single-Phase Inverter Using RLE Loads.

Course Outcomes:

On successful completion of course, student will be able to

Course Outcomes		POs related to COs
CO1	Demonstrate knowledge on operation and characteristics of power semiconductor devices.	PO1
CO2	Analyze the physical variations of various power electronic converters.	PO2
CO3	Design different triggering and commutation circuits for SCR.	PO3
CO4	Select appropriate design tools and procedure to evaluate performance of various power electronic converters.	PO5
CO5	Follow ethical principles to evaluate performance of AC machines.	PO8
CO6	Do experiments effectively as an individual and as a member in a group.	PO9
CO7	Communicate verbally and in written form, the understandings about the experiments.	PO10
CO8	Continue updating their skill related to electronic devices and their applications during their life time	PO12

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	3	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	-	-	-
CO7	-	-	-	-	-	-	-	-	-	3	-	-
CO8	-	-	-	-	-	-	-	-	-	-	-	3

B.TECH III-II SEM (E.E.E)

L	T	P	C
0	0	3	2

SUB CODE: 16EEE326 ELECTRICAL AND ELECTRONICS MEASUREMENTS LAB

Course Educational Objectives:

CEO1. To provide practical experience on procedures for measuring Resistance, Inductance and Capacitance of different ranges.

CEO2. To evaluate the three phase power, frequency, core losses.

CEO3. To design experiments for calibration of measuring instruments, LVDT and resistance strain gauge.

CEO4. To determine the resistance, inductance and capacitance parameters using DC and AC brides.

CEO5. To know the industrial practices of Measuring earth resistance, dielectric strength of transformer oil & Testing of underground cables.

Any 10 of following experiments

Any Eight of the following experiments are required to be conducted as compulsory experiments

1. Calibration And Testing of Single Phase Energy Meter
2. Crompton D.C. Potentiometer – Calibration of PMMC Ammeter And PMMC Voltmeter
3. Kelvin's Double Bridge – Measurement of Resistance – Determination of Tolerance.
4. Measurement of Unknown Inductance Using Anderson's Bridge
5. Measurement of 3 Phases Reactive Power with Single-Phase Wattmeter.
6. Measurement of Parameters of A Choke Coil Using 3 Voltmeter And 3 Ammeter Methods.
7. Calibration LPF Wattmeter – By Phantom Testing
8. Measurement of 3 Phase Power with Two Watt Meter Method (Balanced &UnBalanced).
9. Wheatstone's Bridge For Measurement Of Medium Resistance
10. Dielectric Oil Testing Using H.T. Testing Kit

Any two of the following experiments are required to be conducted in addition to above.

11. Measurement of Unknown Capacitance Using Schering Bridge
12. Calibration of Dynamometer Power Factor Meter.
13. Resistance Strain Gauge – Strain Measurements and Calibration.
14. LVDT and Capacitance Pickup – Characteristics and Calibration.
15. Testing of Numerical Relay.

Course Outcomes:

On successful completion of course, student will be able to

Course Outcomes		POs related to COs
CO1	Demonstrate knowledge on procedures for measuring Resistance, Inductance and Capacitance of different ranges.	PO1
CO2	Analyze and evaluate the three phase power, frequency, core losses	PO2
CO3	Design and calibrate of various measuring instruments	PO3
CO4	Determine the resistance, inductance and capacitance parameters using DC and AC brides	PO4
CO5	Follow ethical principles to evaluate performance of AC machines.	PO8
CO6	Do experiments effectively as an individual and as a member in a group.	PO9
CO7	Communicate verbally and in written form, the understandings about the experiments.	PO10
CO8	Continue updating their skill related to electronic devices and their applications during their life time	PO12

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	-	-	-
CO7	-	-	-	-	-	-	-	-	-	3	-	-
CO8	-	-	-	-	-	-	-	-	-	-	-	3

B.TECH IV-I SEM (E.E.E)

L	T	P	C
3	1	0	3

SUB CODE: 16EEE411 POWER SYSTEM OPERATION AND CONTROL

Course Educational Objectives:

- **CEO1.** To understand optimal dispatch of generation with and without losses.
- **CEO2.** To study the optimal scheduling of hydro thermal systems.
- **CEO3.** To study the optimal unit commitment problem.
- **CEO4.** To study the load frequency control for single and Two area system with and withoutControllers
- **CEO5.** To understand the reactive power control and compensation of transmission lines.

UNIT – I ECONOMIC OPERATION OF POWER SYSTEMS

Optimal operation of Generators in Thermal Power Stations - - heat rate Curve – Cost Curve – Incremental fuel and Production costs - input-output characteristics - Optimum generation allocation with line losses neglected. Optimum generation allocation including the effect of transmission line losses – Loss Coefficients

UNIT – II HYDROTHERMAL SCHEDULING

Optimal scheduling of Hydrothermal System: Hydroelectric power plant models - Scheduling problems-Short term hydrothermal scheduling problem.

UNIT –III MODELING OF TURBINE - GOVERNOR

Modeling of Turbine: First order Turbine model - Block Diagram representation of Steam Turbines and Approximate Linear Models. Modeling of Governor: Mathematical Modeling of Speed Governing System – Derivation of small signal transfer function – Block Diagram.

UNIT – IV LOAD FREQUENCY CONTROL

Necessity of keeping frequency constant. Definitions of Control area – Single area control – Block diagram representation of an isolated power system – Steady state analysis – Dynamic response – Uncontrolled case. Load frequency control of 2-area system – uncontrolled case and controlled case - tie-line bias control. Proportional plus Integral control of single area and its block diagram representation - steady state response – Load Frequency Control and Economic dispatch control.

UNIT – V REACTIVE POWER CONTROL & POWER SYSTEM RESTRUCTERING

Overview of Reactive Power control – Reactive Power compensation in transmission systems – advantages and disadvantages of different types of compensating equipment for transmission systems; load compensation – Specifications of load compensator - Uncompensated and

compensated transmission lines: shunt and Series Compensation. Introduction-Need for regulation-Motivation for power system restructuring - key issues in deregulation.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Compute optimal scheduling of Generators.	PO1,PO2
CO2	Understand hydrothermal scheduling.	PO1,PO2
CO3	Understand the unit commitment problem.	PO1,PO2
CO4	Understand importance of the load frequencycontrollers in single area and two area systems	PO1,PO2
CO5	Understand reactive power control and compensation for transmission line.	PO1,PO2

TEXT BOOKS:

1. Modern Power System Analysis – by I.J.Nagrath & D.P.Kothari Tata M Graw – Hill Publishing Company Ltd - 2nd edition.
2. Power System Analysis Operation and Control – A. Chakravarthi and S. Halder, 3rd Edition, PHI.
3. Electric Energy Systems by O I Elgerd - Mc Graw-hill Edition.

REFERENCE BOOKS:

1. Power System Analysis and Designby J.Duncan Glover and M.S.Sarma. - THOMPSON - 3rd Edition.
2. Electric Power Generation, Transmission and Distribution by S. N.Singh, 2nd Edition, PHI.
3. Electric Power Systems by S. A. Nasar, Schaum's Outline Series,Revised 1st Edition, TMH.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-
CO5	2	2	-	-	-	-	-	-	-	-	-	-

B.TECH IV-I SEM (E.E.E)

L	T	P	C
3	1	0	3

SUB CODE:16EEE412 MODERN CONTROL THEORY

Course objectives:

CEO1 To provide the knowledge on need for control system design, model and optimal control.

CEO2 To supply the knowledge on determining state transition matrix.

CEO3 To afford the knowledge on identifying the controllability and observability condition of a system.

CEO4 To give the knowledge on Non-linear systems.

CEO5 To offer the information on advanced stability analysis for systems.

UNIT – ISTATE VARIABLE ANALYSIS

Introduction - concept of state - state variables and state model - state modeling of linear systems - linearization of state equations. State space representation using physical variables - phase variables & canonical variables

UNIT – IIEIGEN VALUES & STATE TRANSITION MATRIX:

Derivation of transfer function from state model - digonalization - Eigen values - Eigen vectors - generalized Eigen vectors. Solution of state equation - state transition matrix and its properties - computation using Laplace transformation - power series method - Cayley-Hamilton method

UNIT – IIICONTROLLABILITY &OBSERVABILITY :POLE PLACEMENT TECHNIQUES

Concept of controllability & observability - stability improvements by state feedback - necessary & sufficient conditions for arbitrary pole placement - and design of state observer - Introduction to optimal control – Formulation of optimal control problems

UNIT – IV NON-LINEAR SYSTEMS

Introduction to nonlinear systems - behavior of non-linear system - common physical non linearity-saturation - friction - backlash - dead zone - relay –Concept of describing functions. Describing function for dead zone saturation - friction - backlash . Phase plane method - singular points - stability of nonlinear system - limit cycles - construction of phase trajectories.

UNIT – V STABILITY ANALYSIS AND OPTIMAL CONTROL

Lyapunov stability criteria - Hurwitz criterion & Lyapunov's direct method - construction of Lyapunov functions for nonlinear system by Krasvskii's method & variable gradient method. Introduction to optimal control, formulation of optimal control problems, calculus of variations, minimization of functionals of single function, constrained minimization, Controlvariable inequality

Course Outcomes:

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On successful completion of the course, students will be able to		POs related to COs
CO1	Able to design control system with optimal control.	PO1,PO2,PO3,PO4
CO2	Able to evaluate state transition matrix for non-linear system	PO1,PO2,PO3,PO4
CO3	Able toidentify the controllability and observability condition of a system.	PO1,PO2,PO3,PO4
CO4	Able toanalyze the performance ofNon-linear systems	PO1,PO2,PO3,PO4
CO5	Able toinvestigate the stability analysis of systems.	PO1,PO3,PO4

TEXT BOOKS:

1. **Control system Engineering-** I. J. Nagarath & M. Gopal - - 3rd edition - New Age International (P) Ltd.
2. **Modern Control Engineering**- Katsuhiko Ogata- PHI 2010 - 5th Edition.

REFERENCE BOOKS:

1. **Automatic Control Systems-** Benjamin C. Kuo & Farid Golnaraghi - 8th edition - John Wiley & Sons 2003.
2. **Modern Control Engineering-** 2005 Roychoudhury, PHI New delhi - 1/e Edition.
3. **Modern Control Theory -2008 U.A Bakshi ,V. U. Bakshi ,Technical Publications Pune.**

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	-	-	-	-	-	-	-	-
CO2	2	3	2	2	-	-	-	-	-	-	-	-
CO3	2	3	3	2	-	-	-	-	-	-	-	-
CO4	2	3	3	2	-	-	-	-	-	-	-	-
CO5	2	-	3	3	-	-	-	-	-	-	-	-

B.TECH IV-I SEM (E.E.E)

L	T	P	C
3	1	0	3

SUB CODE: 16EEE413 FUNDAMENTALS OF HVDC & FACTS DEVICES

Course objectives:

CEO1 To understand the types and application of HVDC links in practical power systems.
CEO2 To understand the concepts of HVDC systems control
CEO3 To afford the knowledge on Reactive power control
CEO4 To acquire knowledge on the different types of FACTS controllers
CEO5 To know operation and control of UPFC and IPFC.

UNIT-I INTRODUCTION

Comparison of AC and DC Transmission systems - Application of D.C. Transmission - Types or DC links - Typical layout of a HVDC converter station. HVDC converters - pulse number - Analysis of & phase Bridge circuit with and without overlap - converter Bridge characteristics - equivalent circuits or Rectifier and inverter configurations Twelve pulse converters.

UNIT -II CONVERTER AND HVDC SYSTEM CONTROL

Principles of DC links control - converter control characteristics - system control Hierarchy - Firing angle control - current and extinction Angle control starting and stopping of DC link.

UNIT -III HARMONICS - FILTERS AND REACTIVE POWER CONTROL - POWER FLOW ANALYSIS IN AC/DC SYSTEMS

Introduction - generation of Harmonics - AC and DC Filters - Reactive power requirements at steady state - sources of Reactive power static Var systems. Introduction - Modeling of DC/AC converters - controller equations - solutions of AD/DC load flow- simultaneous approach and sequential approach.

UNIT – IV FACTS CONCEPTS - STATIC SHUNT & SERIES COMPENSATORS

Flow of power in AC parallel paths and Meshed systems - Basic types of FACTS controllers - Brief description and Definitions of FACTS controllers. Methods of controllable VAR generation - Static VAR compensators - SVC and STATCOM - comparison. variable impedance type-thyristor switched series capacitors (TCSC) - switching converter type series compensators – static series synchronous compensator (SSSC) – power angle characteristics – Basic operating control Schemes.

UNIT - VCOMBINED COMPENSATORS

Introduction - unified power flow controller (UPFC) - Basic operating principle - Independent real and reactive power flow controller - control structure.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Understand the types and application of HVDC links in practical power systems.	PO1,PO2
CO2	Understand the concepts of HVDC systems control	PO1,PO2
CO3	Afford the knowledge on Reactive power control	PO1,PO2
CO4	Acquire knowledge on the different types of FACTS controllers	PO1
CO5	Know operation and control of UPFC and IPFC.	PO1

TEXT BOOKS:

1. HVDC power Transmission systems by K.R. Padiyar - Wiley Eastern Limited
2. Understanding of FACTS by N.G. Hingorani & L. Gyugyi - IEEE Press.
3. Flexible AC Transmission Systems (FACTS) Young Huasong & Alian T. hons, The Institution of Electrical Engineers, IEE Power and Energy Series 30.

REFERENCE BOOKS:

1. EHV - AC, HYDC Transmission & Distribution Engineering, S.Rao,Khannapublishers, 3rd edition 2003.
2. An Introduction to: Reactive Power Control and Voltage Stability inPower Transmission Systems by Abhijit Chakrabarti, D. P. Kothari,A. K. Mukhopadhyay and Abhinandan De, Eastern EconomyEdition, 2010.
3. HVDC and FACTS Controllers: Applications of Static Converters in Power systems, 1/e,2004 by Vijay K. Sood Springer publications-Banglore.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-

OPEN ELECTIVES – II

IV B.Tech I-Semester

L	T	P	C
3	1	0	3

16OSAH411 APPLICATIONS OF GRAPH THEORY
(Common to all Branches)

Course Educational Objectives:

CE01: The course is designed to equip the students with the necessary mathematical skills and techniques thatare essential for an engineering course.
CEO2: To provide knowledge on

- Graph Theory, Graph coloring
- Matrix Representation of Graphs
- Graph Based Electrical Networks
- Applications in Operations Research

CEO3: To learn the representation of graphs and understanding the Graph Isomorphism, Sub graph-Vertex degrees, Walk, Paths, Cycles-graph connection, Bipartite graphs, Trees
CEO4: To understand the Chromatic number, partitioning, Matching, covering and four colorproblem and to familiarize the knowledge of graph theory
CEO5: To understand the matrix representation of graphs, designing incidence matrix, Adjacency matrix and circuit matrix
CEO6:To identify the important graph based real time applications of electrical networks such as PLC Networks with Independent sources, LOOP circuits
CEO7: To explore the use of graphs in various applications in Operations Research such as Shortest Path between Two Points, The Travelling Salesman and Chinese Postman Problems

UNIT – 1: Graph Theory Introduction

Graph and simple graphs (Complete graphs, Complement of graph)-graph isomorphim–Sub graph-vertex degrees, walk, paths, cycles-graph connection and components-Bipartite graphs-Trees – cut edges- cut vertices-Blocks

UNIT – 2: Colouring and Directed graphs

Chromatic number-chromatic- partitioning- chromatic polynomial-Matching-covering-four

color problem

Directed graphs types of directed graphs-digraphs and binary realtions –directed paths and connectedness

UNIT – 3: Matrix Representation of graphs

Introduction - Adjency matrix -Applications of Adjancy matrix-sufficient condition for isomorphism of graphs-power of an adjacency matrix-Adjacency matrix of a digraph-incidence matrix-circuit matrix-cut set matrix.

UNIT – 4: Electrical Network analysis

Introduction - Kirchhoff's current and Voltage laws-Loop currents and Node Voltages- PLC Networks with Independent sources: Nodal analysis , Loop analysis .

UNIT – 5: Applications in Operation research

Introduction- Shortest Route Problems: Shortest Path between Two Points-The shortest path Problem: General case . The Travelling Salesman and Chinese Postman Problems

Reduction Based Methods for solving TSP- The Chinese Postman Problem and Matching.

Course Outcomes:

After the completion of this course, a successful student is able to

Course Outcomes		POs related to COs
CO1	Demonstrateknowledge in reading and writing rigorous mathematical proofs involving introductory aspects of graphs and develop analytical skills in solving graph theoretic problems	PO1,PO2
CO2	Demonstrateknowledge in chromatic number, partitioning, matching, graph coloring, directed graphsand Develop analytical skills in solving problems involving graph coloring, partitioning and directed graphs	PO1,PO2
CO3	Demonstrateknowledge in matrix representation of graphs, designing incidencematrix, Adjacency matrix and circuit matrixand explore analytical skills in solving problems involving adjacency matrix and incidence matrix	PO1,PO2,P03
CO4	Demonstrate knowledge in significant real time applications of electrical networks such as PLC Networks Independent sources, explore analytical skills in solving practical problems involving using graph theory conceptsand Develop skills in designing Mathematical models for real time electrical networks.	PO1,PO2
CO5	Demonstrate knowledge in significant practical applications of graphs in Operations Research, explore analytical skills in solving practical problems involving using graph theory concepts and Develop skills in designing Mathematical models for real time applications including shortest path problem, Travelling Salesman problem, and The Chinese Postman Problem.	PO1,PO2,PO3 PO4

Text Books:

1. Discrete mathematical structures with applications to computer science. J.P.Trimblay and R.Manohar , 27/e, Tata Mc Graw Hill Publications , 2006, New Delhi.

2. Graph Theory with applications to engineering and computer Science, Narasingh Deo, 25/e, Printice – Hall of India Private Limited, 2003, New Delhi

References:

1. Clark J. And Holton D.A., " A first look at Graph theory", Allied Publishers, 199
2. R.B.Bapat , Graphs and Matrices, Springer, London Dordrecht Heidelberg, New York, 2010 .
3. Gary Haggard John Schlipf, Sue Whitesides, Discrete Mathematics for Computer Science, 4/e, 2007, Thomson Publication, 2008, New Delhi.
4. S.D Sharma , Kedar Nath Ram Nath Operation Research & Co, Meerut . 2007.
5. J.A.Bonday and U.S.R. Murty, Graph Theory with application (2nd Edition), North Holland, 1976 .

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2	3	2										
CO3	2	3	2									
CO4	3	2										
CO5	2	3	2	2								
CO*	2.6	2.4	2	2								

IV B.Tech I-Semester	L	T	P	C
	3	1	0	3

16OSAH412 INTRODUCTION TO NANOSCIENCE AND NANOTECHNOLOGY
(OPEN ELECTIVE – II)

Course Educational Objectives:

CEO1: To Understand the basic scientific concepts of Nanoscience, and various types of Nanomaterials

CEO2: To study various methods of synthesising Nanomaterials

CEO3: To identify different characterisation techniques for Nanomaterials

CEO4: To Understand the properties of Nanomaterials and the applications of Nanomaterials in various fields

CEO5: To study various carbon Nanomaterials

UNIT-I : Introduction to Nano Science: Definition of NanoScale,-Significance of Nanoscale–Surface to Volume Ratio-Quantum Confinement-Types of Nanomaterials-Zero.One,Two and Three Dimentional Nano materials.

UNIT-II : Preparation Of Nanomaterials: Top-Down approach- Bottom-Up Approach- Sol gel Method-Physical Vapour Deposition – Chemical Vapour Deposition- Plasma Arching-Ball milling-Electro-Chemical Deposition.

UNIT-III : Characterization of Nanomaterials: Surface Characterization- SEM,FFSEM ,AFM.Structural Characterization, XRD,UV-VIS,FTIR,TEM.

UNIT-IV: Properties And Applications Of Nano materials:
Physical and Chemical Properties: Mechanical properties-Electrical properties-Thermal properties-Magnetic properties- Applications in material science, biology and medicine, surface science, energy and environment.

UNIT-V : Carbon Nanomaterials: Nanowires and Nanotubes- Different Types of Carbon Nanotubes - Single walled Carbon Nanotubes- Multiwalled Nanotubes- Fabrication of Caron Nanotubes using Plasma Arching Method- Graphene- Fullerences.

On successful completion of the course the student will be able to,

Course Outcomes		POs related to COs
CO1	Acquire the basic knowledge on Nanoscience, and various types of Nanomaterials .	PO1, PO12
CO2	Identify appropriate method for the preparation of Nanomaterials	PO1, PO12
CO3	Develops skill to characterize Nanomaterials by various techniques	PO1, PO4,PO12
CO4	Analyze the different properties of Nanomaterials and identify their applications in various fields	PO1,PO12
CO5	Develop Knowledge on carbon Nanomaterials	PO1,PO12

CO-Mapping

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	-	-	-	-	-	-	-	-	-	-	1
CO2	3	-	-	-	-	-	-	-	-	-	-	1
CO3	3	-	-	2	-	-	-	-	-	-	-	1
CO4	3	-	-	-	-	-	-	-	-	-	-	1
CO5	3	-	-	-	-	-	-	-	-	-	-	1
CO*	3	-	-	2	-	-	-	-	-	-	-	**1**

Text Books:

1. Engineering Physics, 2011, M.R. Srinivasan, New Age International, Chennai.
2. Engineering Physics, First Edition 2014, K. Thyagarajan, Mc Graw Hill Publishers, New Delhi.

Reference Books:

1. Nanotechnology- A Gentle Introduction to the Next Big Idea. 2003,Dorling Kindersely (India .Pvt), New Delhi.
2. Nano- The Essentials(Understanding nano Science and Nanotechnology),2010,Tata MaGraw-Hill Publications

IV B.Tech I-Semester	L	T	P	C
	3	1	0	3

16OSAH413 ENTREPRENEURSHIP DEVELOPMENT(Open Elective – II)

Course Educational Objectives:

CEO1: To understand the concepts of entrepreneurship and role of government in the promotion of entrepreneur
CEO2: To understand idea generation, intellectual property rights, financing of enterprises and Government grants & subsidies
CEO3: To elucidate the process of project planning and report preparation
CEO4: To understand the scope and objectives of micro and small enterprises and their promotional measures
CEO5: To understand rural entrepreneurship and evaluation of entrepreneurship development programmes

UNIT - 1: Nature of Entrepreneurship:
Meaning and Concepts, Intrapreneurship -Entrepreneur's competencies, attitudes, Qualities, functions - Types of Entrepreneurs - Barriers to Entrepreneurship - Entrepreneurial scenario in India and Abroad - Forms of Entrepreneurship - Small business, Types of ownership - Role of Government in the promotion of Entrepreneur.

UNIT - 2: Promotion & Financial aspects of the entrepreneurship:
Idea generation - Intellectual property rights – Financing of Enterprises - Government grants & subsidies.

UNIT - 3: Project Planning and Feasibility Studies:
The concept of Project - Project life cycle - Project Planning - Feasibility- Project proposal & Report preparation.

UNIT - 4: Micro and Small Enterprises:
Meaning and Definitions – Micro and Macro Units – Essentials, Features and Characteristics – Relationship between Micro and Macro Enterprises – Rational behind Micro and Small Enterprises – Scope and Objectives of Micro and Small Enterprises – Enterprise and Society – Role of Micro Enterprises in Economic Development – Package for Promotion of Micro and Small-Scale Enterprises – Problems of Micro and Small Enterprises.

UNIT - 5: Rural Entrepreneurship and EDPs:
Need - Rural Industrialization- Role of NGOs- Organizing EDPs-Need, objectives, Evaluation of EDPs.

On successful completion of the course the students will be able to,

Course Outcomes		POs related to COs
CO1	Learn entrepreneurship and role of government in the promotion of entrepreneurship	PO3, PO7, PO12
CO2	Understand an idea generation, intellectual property rights, financing of enterprises and Government grants & subsidies	PO3, PO6, PO7, PO8, PO11, PO12
CO3	Prepare project report to start a business	PO10, PO11, PO12
CO4	Choose a particular form of enterprise	PO9, PO12
CO5	Start rural entrepreneurship and learn the importance of entrepreneurship development programmes	PO9, PO12

CO – PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	2	-	-	-	3	-	-	-	-	1
CO2	-	-	2	-	-	3	3	2	-	-	3	1
CO3	-	-	-	-	-	-	-	-	-	2	3	1
CO4	-	-	-	-	-	-	-	-	2	-	-	1
CO5	-	-	-	-	-	-	-	-	2	-	-	1
CO*	-	-	2	-	-	3	3	2	2	2	3	1

Text Books

1. The Dynamics of Entrepreneurial Development and Management, 6/e, 2010, Vasanth Desai, Himalaya Publishing House, Mumbai.
2. Entrepreneurial Development, 4/e, 2012, S.S. Khanka, S.Chand and Company Limited, New Delhi.

References

1. Fundamentals of Entrepreneurship, 2/e, 2011, H.Nandan, PHI publications, New Delhi.
2. Entrepreneurship, 2/e, 2011, Rajeev Roy, Oxford University Press, New Delhi.
3. Entrepreneurship, 6/e, 2010, Robert D Hirsrich, Michael P Peters, Dean A Shepherd, TMH, New Delhi.
4. Entrepreneurship Management- text and cases, 1/e, 2010, Bholanath Dutta, Excel Books, New Delhi.

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16OCSE411 FUNDAMENTAL OF DBMS

Course Educational Objectives:

CEO1: To discuss the basic database concepts, applications, data models, schemas and instances and design Entity Relationship (E-R) model for a database.
CEO 2: To demonstrate the use of integrity constraints, relational algebra operations and relational calculus.
CEO 3: To describe the basics of SQL, construct queries using SQL, SQL functions, trigger and cursor concepts in PL/SQL
CEO 4: Tounderstand reasoning about functional dependency and to make the students to identify the role of normalization in database management systems
CEO 5: To gain knowledge of Transaction, concurrency and recovery strategies of DBMS.

UNIT – 1: DATABASE SYSTEMS AND ENTITY RELATIONSHIP MODELING
Database system applications – Purpose of database systems – View of data – Database languages – Database users and administrators – The entity–Relationship model – Attributes and entity sets – Relationship sets – Entity – Relationship diagrams.

UNIT – 2: RELATIONAL DATA MODEL AND LANGUAGE
Introduction to the relational model – Integrity constraints –Fundamental relational algebra operations – Tuple relational calculus – Domain relational calculus.

UNIT – 3: INTRODUCTION TO SQL
Characteristics of SQL – Advantages of SQL –SQL data types and literals – Types of SQL Commands – SQL operators and their procedures –Form of basic SQL query – Examples of basic SQL queries – Introduction to nested queries – Views – Indexes – SQL functions – Database triggers.

UNIT – 4: NORMALIZATION
Introduction to schema refinement – Properties of decompositions – Functional dependencies – Reasoning about functional dependencies – Normal forms – First – Second – Third – BCNF –MVD– Fourth normal form.

UNIT – 5: TRANSACTION PROCESSING CONCEPTS AND CONCURRENCY CONTROL TECHNIQUES
Transaction concept – Transaction states – Implementation of atomicity and durability – Serializability – Recoverability – Concurrent executions –Lock-based protocols for concurrency control– Time stamp-based protocol for concurrency control.

Course Outcomes:

On successful completion of the course the student will be able to,

Course Outcomes		POs related to COs
CO1	Demonstrate knowledge on Data models and Database LanguagesandDesign Entity Relationship model for a database	PO1, PO3
CO2	Analyze the relational database theory, and be able to write relational algebra and relational calculus expressions for queries.	PO1, PO2
CO3	Analyze and evaluate the databases using SQL DML/DDL Commands	PO1, PO2, PO3, PO5
CO4	Analyze databases using normal forms to provide solutions for real time applications.	PO1, PO2
CO5	Understand the properties of transactions in a database system, Analyze concurrency control techniques for handling concurrent transactions and understand recovery of data from failures	PO1, PO3,PO4

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	-	3	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-
CO3	2	2	3	-	2	-	-	-	-	-	-	-
CO4	2	3	-	-	-	-	-	-	-	-	-	-
CO5	3	-	2	2	-	-	-	-	-	-	-	-
CO*	**2.6**	**2.6**	**2.6**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Text Books:

2. Database System Concepts, Korth, Silberschatz, Sudarshan, 5/e, 2006, Tata McGrawHill, New York.
3. Database Management System, Raghu Ramakrishnan, 2/e, 2000, Tata McGrawHill, New York.

Reference Books:

1. Fundamentals of Database Systems, Elmasri, Navathe, 5/e, 2008, Pearson Education, USA.
2. Database Management Systems, Peter Rob, A.Ananda Rao, Carlos Coronel, 5/e, 2003, Cengage Learning, USA.
3. SQL, PL/SQL Programming, Ivan Bayross, 2/e, 2011, BPB Publications, New Delhi, India.
4. Introduction to Database Systems, C.J.Date, 8/e, 2004, Pearson Education, USA.
5. Fundamentals of Database Management Systems, .L. Gillenson, 1/e, 2006, MWiley, New Delhi, India.

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16OCSE412 BASICS OF IOT

Course Educational Objectives:

CEO1: To understand the fundamentals of internet of things.
CEO2: To learn about the basics of IoT protocols.
CEO3: To learn about building state of the art architecture in IoT.
CEO4: To learn use of devices, gateways and data management in IoT.
CEO5: To build a small low cost embedded system using raspberry Pi.

UNIT - 1: INTRODUCTION TO IOT

Introduction to internet of things – Definition and characteristics of IoT, physical design of IoT – IoT protocols, logical design of IoT – IoT communication models – IoT communication APIs – IoT enabled technologies – Wireless sensor networks – Cloud computing – Communication protocols – Embedded systems.

UNIT - 2: IOT AND M2M

The Vision – Introduction – From M2M to IoT – M2M towards IoT **-** The global context – A use case example – Differing characteristics. A market perspective – Introduction – Some definitions – M2M value chains – IoT value chains – An emerging industrial structure for IoT

UNIT - 3: IOT ARCHITECTURE

M2M high – IETF architecture for IoT – OGC architecture – IoT reference model – Domain model – Information model – Functional model – Communication model – IoT reference architecture.

UNIT - 4: M2M AND IOT TECHNOLOGY FUNDAMENTALS

Devices and gateways – Local and wide area networking – Data management – Business processes in IoT – Everything as a service (XaaS) – M2M and IoT analytics – Knowledge management.

UNIT - 5: BUILDING IOT WITH ARDUINO AND RASPBERRY PI

Building IOT with arduino – Building IoT with rasperry Pi – IoT systems – Logical design using python – IoT physical devices and endpoints – IoT device – Building blocks – Pi – Raspberry Pi interfaces.

Case study: Smart home and smart industry.

Course Outcomes:

On successful completion of the course the student will be able to,

Course Outcomes		POs related to COs
CO1	Analyze various protocols for IoT.	PO1, PO2, PO3
CO2	Building state of the art architecture in IoT.	PO1, PO2
CO3	Design a portable IoT using rasperry Pi.	PO1, PO2, PO3,
CO4	Use of devices, gateways and data management in IoT.	PO1, PO2
CO5	Deploy an IoT application and connect to the cloud.	PO1, PO3,PO4

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	3	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-
CO3	2	2	3	-	-	-	-	-	-	-	-	-
CO4	2	3	-	-	-	-	-	-	-	-	-	-
CO5	3	-	2	2	-	-	-	-	-	-	-	-
CO*	**2.6**	**2.6**	**2.6**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Text Books:

1. Internet of Things – A Hands-On Approach, ArshdeepBahga, Vijay Madisetti, 2015, Universities Press.
2. From Machine-To-Machine To The Internet Of Things: Introduction To A New Age Of Intelligence, Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, 1/e, 2014, Academic Press.

Reference Books:

1. Internet of Things (A Hands-on-Approach), Vijay Madisetti and Arshdeep Bahga, 1/e, VPT, 2014.
2. Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, Francis da Costa, 1/e, 2013, Apress Publications.
3. Architecting the Internet of Things, Bernd Scholz-Reiter, Florian Michahelles,ISBN 978- 3842-19156-5, Springer.
4. The Internet of Things-Key Applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi, ISBN 978-1-119-99435-0, Wiley Publications.
5. The Internet of Things in the Cloud: A Middleware Perspective - Honbo Zhou – CRC Press – 2012.

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16OCSE413 INFORMATION SECURITY

Course Educational Objectives:

CEO1: To understand basics of Cryptography and Network Security. Identify computer and network security threats, classify the threats and develop a security model to prevent, detect and recover from the attacks.
CEO2: Encrypt and decrypt messages using block ciphers, sign and verify messages using well known signature generation and verification algorithms.
CEO3: Analyze existing authentication and key agreement protocols; identify the weaknesses of these protocols.
CEO4: Download and install an e-mail and file security software, PGP, and efficiently use the code to encrypt and sign messages.
CEO5: Develop SSL or Firewall based solutions against security threats, employ access control techniques.

UNIT – 1: NUMBER THEORY FOR INFORMATION SECURITY

Introduction – Modular arithmetic – Prime numbers and factoring – Groups and fields defined mod primes – Euler totient function – euler's theorem – Fermat's theorem – Chinese Remainder theorem – Bit complexity.

UNIT – 2: CLASSICAL ENCRYPTION TECHNIQUES

Security attacks – Security services and mechanisms – A model for network security – Classical encryption techniques – Symmetric cipher model – Substitution techniques – Caesar cipher – Mono alphabetic cipher – Play fair cipher – Hill cipher – Transposition techniques.

UNIT – 3: BLOCK CIPHERS, DATA ENCRYPTION STANDARDS AND PUBLIC KEY CRYPTOGRAPHY

Block cipher principles – DES – AES – Block cipher design principles – Block cipher modes of operation – Public key cryptography – Principles of public key cryptosystems – RSA algorithm – Diffie-Hellman key exchange.

UNIT – 4: HASH FUNCTIONS AND DIGITAL SIGNATURES

Hash functions – Security of hash functions and MACs – Hash algorithms – SHA – HMAC – Digital signatures, digital signature standard (DSS) – Kerberos – X.509 authentication service.

UNIT – 5: IP SECURITY, INTRUDERS AND FIREWALLS

IPsec overview – Architecture – Authentication header – Encapsulating security pay load – Intruders – Intrusion detection – Firewall design and principles.

Course Outcomes:

On successful completion of this course the students should be able to:

Course Outcomes		POs related to COs
CO1	Understand basics of Cryptography and Network Security.	PO1, PO2
CO2	Encrypt and decrypt messages, sign and verify messages using well known signature generation and verification algorithms.	PO1, PO2
CO3	Analyze existing authentication and key agreement protocols.	PO1, PO2, PO3, PO4
CO4	Use e-mail and file security software's.	PO1, PO2, PO3, PO5
CO5	Develop SSL/Firewall.	PO1, PO2, PO3, PO4

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-
CO3	2	2	3	3	-	-	-	-	-	-	-	-
CO4	2	3	2	-	3	-	-	-	-	-	-	-
CO5	3	2	2	2	-	-	-	-	-	-	-	-
CO*	**2.6**	**2.4**	**2.3**	**2.5**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Text Books:

1. Cryptography and Network Security: Principles and Practices, William Stallings, 4/e, 2008, Low Price Edition, Pearson Education.
2. Network Security and Cryptography, Bernard Menezes, 1/e, 2010, Thomson Press Ltd, USA.

Reference Books:

1. Principles and Practices of Information Security, Michal E. Whitman and Herbert J. Mattord, 4/e, 2012, Cengage Learning, New Delhi.
2. Network Security Essentials (Applications and Standards), William Stallings, 4/e, Pearson Education.
3. Hack Proofing Your Network, Ryan Russell, Dan Kaminsky, Rain Forest Puppy, Joe Grand, David Ahmad, Hal Flynn IdoDubrawsky, Steve W.Manzuik and Ryan Permeh, 2/e, 2002, wileyDreamtech.
4. Fundamentals of Network Security, Eric Maiwald 1/e, 2008, Dreamtech press.
5. Network Security - Private Communication in a Public World, Charlie Kaufman, Radia Perlman and Mike Speciner, 2/e, 2002, Pearson/PHI.

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16OCIV411 TRANSPORT AND ENVIRONMENT

Course Educational Objectives:

PEO1: To impart knowledge on different concepts of Environmental Impact Assessment.
PEO2: To learn the EIA methodologies and the criterion for selection of EIA methods.
PEO3: To identify impact of air, water and land due to developmental activities
PEO 4: To know the procedures for environmental audit and some case studies.

UNIT – 1: INTRODUCTION

Environmental inventory, environmental assessment, environmental impact assessment (EIA), environmental impact of transportation projects, need for EIA, EIA guidelines for transportation project, historical development.

UNIT – 2: METHODOLOGIES

Elements of EIA – Screening and scoping – Methods of impact analysis – Applications – appropriate methodology.

UNIT – 3: ENVIRONMENTAL IMPACT, PREDICTION AND ASSESSMENT

Prediction and assessment of impact of transportation project at various stages on water, air, noise, land acquisition and resettlement, socio economic impact, indigenous people, aesthetics, health and safety, energy studies, IRC guidelines.

UNIT – 4: ENVIRONMENTAL MITIGATION AND MANAGEMENT PLAN

Mitigation of the impact on natural and man-made environment, health, water, land, noise, air, public participation, environmental management plan, energy conservation, methods to reduce global warming.

UNIT – 5: EIA CASE STUDIES

EIA case studies on highway, railway, airways and waterways projects.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Understand the basic concept of EIA	PO1
CO2	Analyse and Select the appropriate EIA methodology	PO1
CO3	Learn the impact of soil ,air and water due to developmental activities and analyze guidelines	PO1,PO3
CO4	Understand environmental audit procedure	PO1, PO3,PO6, PSO2
CO5	Analyze case studies and Apply concepts of EIA	PO1, PO2, PSO2

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2													
CO2	2													
CO3	2		2											
CO4	2		2			2								2
CO5	2	2												2

Text Books:

1. Environmental Impact Assessment, Canter, L.R., 1996, McGraw Hill, New Delhi.
2. Indian Road Congress (IRC), Environmental Impact of Highway Projects, IRC, 1998, Delhi.
3. Elements of Environmental Science and Engineering, P. Meenakshi, 2006, Prentice Hall of India, New Delhi.
4. Introduction to Environmental Science and Management, Thirumurthy A.M., 2005, Shroff Publishers, Bombay.

Reference Books:

1. John G.Rau and David, C.Hooten, Environmental Impact Analysis Handbook, McGraw Hill Book Company, 1995.
2. James H.Banks, Introduction to Transportation Engineering, McGraw Hill Book Company, 2000.
3. A Handbook on Roads and Environment, World Bank, Vol.I and II, 1997, Washington DC.
4. International Encyclopedia of Ecology and Environment – EIA, Indian Institute of Ecology and Environment, PriyaRanjanTrivedi, 1998, New Delhi, Hyderabad: Indian Green Building Council.

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16OCIV412 DISASTER MANAGEMENT

Course Educational Objectives:

CEO1: Learn various hazards and vulnerabilities in India

CEO2: Lear scientific approach to manage disasters

CEO3: Understand various disaster mitigation and management plans in India

UNIT – 1: INTRODUCTION TO DISASTERS

Definition: Disaster, hazard, vulnerability, resilience, risks – Disasters: types of disasters – Earthquake, landslide, flood, drought, fire etc – Classification, causes, impacts including social, economic, political, environmental, health, psychosocial, etc. – Differential impacts in terms of caste, class, gender, age, location, disability – Global trends in disasters: urban disasters, pandemics, complex emergencies, climate change – Dos and don'ts during various types of disasters.

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UNIT – 2: APPROACHES TO DISASTER RISK REDUCTION (DRR)

Disaster cycle – Phases, culture of safety, prevention, mitigation and preparedness community based DRR, structural – Nonstructural measures, roles and responsibilities of community, panchayat raj institutions/urban local bodies (PRIs/ULBs), states, centre, and other stakeholders – Institutional processes and framework at state and central level – State disaster management authority (SDMA) – Early warning system – Advisories from appropriate agencies.

UNIT – 3: INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT

Factors affecting vulnerabilities, differential impacts, impact of development projects such as dams, embankments, changes in land use etc. – Climate change adaptation – IPCC scenario and scenarios in the context of India – Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT – 4: DISASTER RISK MANAGEMENT IN INDIA

Hazard and vulnerability profile of India, components of disaster relief: water, food, sanitation, shelter, health, waste management, institutional arrangements (mitigation, response and preparedness, disaster management act and policy – Other related policies, plans, programmes and legislation – Role of GIS and information technology components in preparedness, risk assessment, response and recovery phases of disaster – Disaster damage assessment.

UNIT – 5: DISASTER MANAGEMENT: APPLICATIONS, CASE STUDIES AND FIELDWORKS

Landslide hazard zonation: case studies, earthquake vulnerability assessment of buildings and infrastructure: case studies, drought assessment: case studies, coastal flooding: storm surge assessment, floods: fluvial and pluvial flooding: case studies; forest fire: case studies, man made

disasters: case studies, space based inputs for disaster mitigation and management and field works related to disaster management.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Describe basic features of disasters and classify them	PO1, PO7
CO2	Explain scientific approach to disaster risk reduction	PO1, PO7
CO3	Express the relation between the disaster and development	PO1, PO7
CO4	Describe disaster mitigation plan in India	PO1, PO7
CO5	Analyze case studies related to disaster and draw conclusions	PO1, PO2, PO7, PSO2

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2						2							
CO2	2						2							
CO3	2						2							
CO4	2						2							
CO5	2	2					2							2

Text Books:

1. Disaster Management, Singhal J.P. 2010, Laxmi Publications, ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Disaster Science and Management, Tushar Bhattacharya, 2012, McGraw Hill India Education Pvt. Ltd., ISBN-10: 1259007367, ISBN-13: 978-1259007361

Reference Books:

1. Govt. of India: Disaster Management Act, Government of India, 2005, New Delhi.
2. Government of India, National Disaster Management Policy, 2009.
3. Environmental Knowledge for Disaster Risk Management, NIDM, Gupta Anil K, Sreeja S. Nair.2011, New Delhi.
4. Vulnerable India: A Geographical Study of Disasters, KapurAnu 2010, IIAS and Sage Publishers, New Delhi.

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16OCIV413 AIR POLLUTION AND CONTROL ENGINEERING

Course Educational Objectives:

CEO 1:To provides the knowledgeabout the various sources of Airpollution and itseffects on humanbeings , Vegetation and Materials.

CEO 2: To Analyse various the air pollutant dispersion models

CEO 3: To provideknowledgeaboutcontrolmethods and details of control equipments

CEO 4: To demonstrateVarious sources of Noisepolltion and controlmeasures

UNIT – 1: INTRODUCTION

Structure and composition of atmosphere – Definition, scope and scales of air pollution – Sources and classification of air pollutants and their effect on human health, vegetation, animals, property, aesthetic value and visibility – Ambient air quality and emission standards – Ambient and stack sampling and analysis of particulate and gaseous pollutants.

UNIT – 2: METEOROLOGY

Effects of meteorology on air pollution – Fundamentals, atmospheric stability, inversion, wind profiles and stack plume patterns – Atmospheric diffusion theories – Dispersion models, plume rise.

UNIT – 3: CONTROL OF PARTICULATE CONTAMINANTS

Factors affecting selection of control equipment – Gas particle interaction – Working principle, design and performance equations of gravity separators, centrifugal separators fabric filters, particulate scrubbers, electrostatic precipitators – Operational considerations.

UNIT – 4: CONTROL OF GASEOUS CONTAMINANTS

Factors affecting selection of control equipment – Working principle, design and performance equations of absorption, adsorption, condensation, incineration, bio scrubbers, bio filters – Process control and monitoring – Operational considerations.

UNIT – 5: INDOOR AIR QUALITY MANAGEMENT

Sources types and control of indoor air pollutants, sick building syndrome types – Radon pollution and its control – Sources and effects of noise pollution – Measurement – Standards – Control and preventive measures

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO 1	Identify the major sources of air pollution and understand their effects on health and environment.	PO1, PO7
CO 2	Evaluate the dispersion of air pollutants in the atmosphere and to develop air quality models	PO2, PO3
CO 3	Design the control techniques for particulate and gaseous emissions	PO1, PO3
CO 4	Understand the standards of air quality and legal framework	PO1, PO6
CO 5	Identify the major sources of noise pollution, effects and control measures	PO1, P07

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2						3							
CO2	2	2												
CO3	2		2											
CO4	2					2								
CO5	2						3							

Text Books:

1. Air Pollution Control Engineering, Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, 2004, Tokyo.
2. Air Pollution and Control Technologies, Anjaneyulu. Y, 2002, Allied Publishers (P) Ltd., India.

Reference Books:

1. Air Pollution, David H.F. Liu, Bela G. Liptak, 2000, Lweis Publishers.
2. Air Pollution (Vol.I – Vol.VIII), Arthur C.Stern, 2006, Academic Press.
3. Air Pollution Engineering Manual, Wayne T.Davis, 2000, John Wiley & Sons, Inc.
4. Air Pollution Control Engineering, Noel de Nevers, 1995, Mc Graw Hill, New York.

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16OMEC411 QUALITY CONTROL AND RELIABILITY ENGINEERING

Course Educational Objectives:

CEO1: To understand basic TQM Principles adopted in statistical process control engineering.
CEO2: To estimate the quality control of a product by using control charts and Process capability.
CEO3: To know the techniques involved in the acceptance sampling and procedure
CEO4: To learn the concepts of Reliability engineering and Failure data analysis.
CEO5: To understand the fundamental principles of reliability estimation and product development.

UNIT – 1: TQM PRINCIPLES AND STATISTICAL PROCESS CONTROL

Introduction – Need for quality – Definition of quality – Dimensions of manufacturing and service quality – Basic concepts of TQM – Definition of TQM – TQM frame work – Contributions of Deming – Leadership – Strategic quality planning – Quality cost – Quality statements – Customer focus, customer orientation, customer satisfaction, customer complaints and customer retention – Employee involvement – Motivation – Empowerment – Team and teamwork – Recognition and reward – Performance appraisal – Seven SPC tools – Histogram, check sheets, Ishikawa diagrams, pareto, scatter diagrams, control charts and flow chart.

UNIT – 2: QUALITY CONTROL

Control chart for attributes – Control chart for non-conforming – p chart and np chart – Control chart for nonconformities – C and U charts, Control chart for variables – X chart, R chart and σ chart – State of control and process out of control identification in charts, pattern study and process capability studies - Concepts in six sigma.

UNIT – 3: ACCEPTANCE SAMPLING

Lot by lot sampling – Types – Probability of acceptance in single, double, multiple sampling techniques – OC curves – Producer's risk and consumer's risk – AQL, LTPD, AOQL concepts – Standard sampling plans for AQL and LTPD – Uses of standard sampling plans.

UNIT – 4: RELIABILITY CONCEPTS

Reliability engineering – Fundamentals – Failure data analysis, mean failure rate, mortality curve concept of burn – In period, useful life and wear out phase of a system, mean time to failure, mean time between failure, hazard rate – Failure density and conditional reliability –Maintainability and availability – Simple problems.

UNIT – 5: RELIABLITY ESTIMATION

System reliability – Series, parallel and mixed configurations, reliability improvements techniques use of pareto analysis – Design for reliability – Redundancy unit and standby redundancy – Fault tree analysis – Optimization in reliability – Product design – Product analysis – Product development – Product life cycles.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand basic TQM Principles adopted in statistical process control engineering	PO1,PO2, PO3
CO2	Demonstrate the quality control of a product by using control charts and Process capability.	PO1,PO2,PO3, PO4
CO3	Understand the techniques involved in the acceptance sampling and procedure	PO1,PO2,PO4
CO4	Explain the concepts of reliability engineering and failure data analysis.	PO1, PO2, PO4
CO5	Understand the fundamental principles of reliability estimation and product development	PO1, PO2, PO3, PO5

Text Books:

1. Quality Control, Besterfield D.H., 8/e, 2009, Prentice Hall.
2. Reliability Engineering, Srinath. L.S., 4/e, 2005, Affiliated East west press.

Reference Books:

1. Statistical Quality Control, Monohar Mahajan, 2001, Dhanpat Rai &and Sons.
2. Practical Reliability Engineering, Connor, P.D.T.O., 2008, Wiley India.
3. Introduction to Statistical quality control, Douglas.C. Montgomery, 7/e, 2012, John Wiley.
4. Reliability Engineering, Kailash C. Kapur and Michael Pecht, 2014, John Wiley.
5. Statistical Process Control, John.S. Oakland. 5/e, 2005, Elsevier.

Codes/Tables: Use of approved statistical control table permitted in the examination.

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO.1	3	3	2	-	-	-	-	-	-	-	-	-
CO.2	3	2	2	2	-	-	-	-	-	-	-	-
CO.3	3	2	-	2	-	-	-	-	-	-	-	-
CO.4	3	2	-	2	-	-	-	-	-	-	-	
CO.5	3	1	2	-	2	-	-	-	-	-	-	
CO	**3**	**2**	**2**	2	2	-	-	-	-	-	-	-

IV B.Tech I Semester

L	T	P	C
3	1	0	3

16OMEC412 INDUSTRIAL ENGINEERING AND PSYCHOLOGY

Course Educational Objectives:

CEO1: To understand basic concepts of management and contributions of management gurus.
CEO2: To recognize the types of organizations and plant layout
CEO3: To know the techniques involved in the Work study in industry perspective.
CEO4: To learn the concepts of production planning and control in an industry.
CEO5: To learn the fundamental concepts of industrial psychology and personnel management.

UNIT – 1: CONCEPTS OF MANAGEMENT

Management: Administration – Organization – Importance and characteristics – Managerial skills – Differences between polices, goal and objectives – Scientific management – Management contribution of FW Taylor, Henry Foyal and Gilberth – Principles of management – Process of management – Functions of management – Levels and types management – Management chart – Management development – Project management – Management information system – Industrial ownership – Responsibilities of supervisor/foreman – Leadership concepts and qualities.

UNIT – 2: ORGANIZATIONS AND PLANT LAYOUT

Organization: Concept, importance, characteristics, elements and process of organization – organization theory – Principle of organization – Organization structure and chart – Types of organization – Committees – Project and matrix organization – Departmentation – Authority and delegation – Group dynamics – Organizational change, conflict and development – Managerial leadership and Communication system. **Plant Layout:** Types of layout – Flow pattern – Storage space – Plant layout procedure – Consideration in building design – Production and productivity.

UNIT – 3: WORK STUDY

Definition and need – Advantages and objectives – Method study – Process chart symbols – Flow process chart – Flow diagram – String diagram – Multiple activity chart – Operation analysis – Principles of motion economy – Design of work place – Therbligs – SIMO chart – Time study – Standard data – Analytical estimating – PMTS – Ergonomics.

UNIT – 4: PRODUCTION PLANNING AND CONTROL

Introduction – Continuous and intermittent production – Job, open and closed job shop – One time large projects – Forecasting – Process planning – Economical batch quantity – Tool control – Loading – Scheduling – Control of production – Dispatching – Routing – Progress control – Flow control – Line of balance.

UNIT – 5: INDUSTRIAL PSYCHOLOGY AND PERSONNEL MANAGEMENT

Industrial Psychology: Definition and concept – Aim, scope and objectives – Individual and group – Group dynamics – Hertzberg's two factor theory of motivation - Maslow's hierarchy of human needs – Theory of X and Y – Hawthorne experiment – Morale – Motivation – Working and environmental condition – Industrial fatigue. **Personnel Management:** Definition and concept – Objectives and

principles of personnel – Recruitment and selection – Training – Safety and welfare –measures – Housekeeping – Communication – Promotion, lay-off, transfer and discharge.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Demonstrate the basic concepts of management and contributions of management gurus	PO6, PO12
CO2	Recognize the types of organizations and plant layout	PO1,PO6,PO7
CO3	Understand the techniques involved in the Work study in industry perspective.	PO1,PO2,PO5
CO4	Explain the concepts of production planning and control in an industry.	PO1, PO2, PO4
CO5	Understand the fundamental concepts of industrial psychology and personnel management	PO6, PO8, PO9, PO12

Text Books:

1. Industrial Engineering and Management, O.P. Khanna, 17/e, 2010, Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
2. Manufacturing Organization and Management, Amrine, 2/e, 2004, Pearson Education, New Delhi.

Reference Books:

1. Industrial Engineering and Organization Management, S.K.Sharma, Savita Sharma, 1/e, 2011, S.K.Kataria and Sons Publications, New Delhi.
2. Industrial Engineering and Management, RaviShankar, 2/e, 2009, Galgotia Publications, New Delhi.
3. Production and Operations Management, PanneerSelvam, 3/e, 2012, Pearson Education, New Delhi.
4. Motion and Time Study: Design and Measurement of work, Ralph M Barnes, 7/e, 2009, Wiley India Pvt, Ltd., New Delhi.
5. Operations Management, Chase, Jacobs, Aquilano, 10/e, 2003, Tata McGraw-Hill Education Pvt. Ltd., Noida.

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO.1						3						**2**
CO.2	3					3	**2**					
CO.3	2	2			2							
CO.4	3	3		2								
CO.5						3		1	**2**			2
CO	**2.6**	**2.5**		2	2	**2**	**2**	1	2			**2**

IVB.Tech I Semester

L	T	P	C
3	1	0	3

16OMEC413 POWER GENERATION TECHNOLOGIES

Course Educational Objectives:

CEO1: To understand working principles of steam power plant & working circuits of the plant .
CEO2: To recognize plant layout of Hydro electric, Diesel and Gas turbine power plants
CEO3: To know the safety measures & environmental aspects of nuclear power plant
CEO4: To learn the concepts of all types of renewable energy power plants.
CEO5: To learn the economics of power generation

UNIT – 1: STEAM POWER PLANTS

Plant layout – Working of different circuits – Types of coal – Properties of coal – Coal handling system – Ash handling system – Feed water treatment – Stages of combustion – Pulverized coal firing system – Cyclone furnace – Fluidized bed combustion system – Cooling towers and heat rejection.

UNIT – 2: HYDRO ELECTRIC, DIESEL AND GAS TURBINE POWER PLANTS

Hydro Electric Power Plants: Energy scenario – Global and national – Essential elements and classification of hydro power plants – Typical layout and associated components – Selection of turbines – Pumped storage plants. **Diesel and Gas Turbine Power Plants**: Layout and functioning – Environmental impact and control.

UNIT – 3: NUCLEAR POWER PLANTS

Layout and subsystems – Fuels and nuclear reactions – Boiling water reactor, pressurized water reactor, fast breeder reactor, gas cooled and liquid metal cooled reactors – Working and comparison – Safety measures – Environmental aspects.

UNIT– 4: RENEWABLE ENERGY POWER PLANTS

Solar power plants – Photovoltaic and thermal – Wind energy – Horizontal and vertical axis wind turbine (HAWT & VAWT) – Geo thermal– Tidal energy – Ocean thermal – Biogas – Fuel cell, thermoelectric and thermionic generation.

UNIT – 5: ECONOMICS OF POWER GENERATION

Load and load duration curves – Electricity billing – Costing of electrical energy – Tariff structures – Economics of power plant – Fixed and variable cost – Payback period – Net present value, internal rate of return – Emission calculation and carbon credit.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Understand working principles of steam power plant & working circuits of the plant	PO1, PO2
CO2	Recognize plant layout of Hydro electric, Diesel and Gas turbine power plants	PO1,PO2,PO3
CO3	Explain the safety measures & environmental aspects of nuclear power plant	PO1,PO6,PO7
CO4	Discover the concepts of all types of renewable energy power plants.	PO1, PO4, PO5
CO5	Learn the economics of power generation	PO1, PO6

Text books:

1. Power Plant Engineering, P.K.Nag, 4/e, 2015, McGraw-Hill Education Pvt. Ltd., New Delhi.
2. A Course in Power Plant Engineering, Arora and S. Domkundwar, 6/e, 2012, Dhanpat Rai Publishing Company (P) Ltd., New Delhi.

Reference books:

1. Text of Power Plant Engineering, P.C.Sharma, 9/e, 2013, S.K.Kataria and Sons Publications, New Delhi.
2. A Text Book of Power Plant Engineering, Rajput. R.K., 4/e, 2012, Laxmi Publications (P) Ltd., New Delhi.
3. Power Plant Engineering, K.K.Ramalingam, 1/e, 2010, Scitech Publishers, Chennai.
4. Power Plant Engineering, Nagpal G. R., n/e, 2004, Khanna Publisher, New Delhi.
5. Introduction to Power Plant Technology, G.D.Rai, 3/e, 2012, Khanna Publishers, New Delhi.

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO.1	3	2	-	-	-	-	-	-	-	-	-	-
CO.2	3	2	2	-	-	-	-	-	-	-	-	-
CO.3	3	-	-	-	-	2	**2**	-	-	-	-	-
CO.4	3	-	-	2	2	-	-	-	-	-	-	
CO.5	3	-	-	2	2	-	-	-	-	-	-	
CO	**3**	**2**	**2**	2	2	**2**	**2**	-	-	-	-	-

IV Year B.Tech I semester	L	T	P	C
	3	1	0	3

16OECE411 MEDICAL ELECTRONICS

Course Educational objectives:

CEO:1 To gain knowledge and analyze the various Measurement such as ECG, EEG and trouble shooting.
CEO:2 To understand the trasnducers for Bio medical , featuers applicable for Bio medical instrumentation.
CEO:3 To study about the various signal conditioning and recording devices, Bio telemetry.

CEO:4 To gain knowledge about equipment used for physical medicine and the various recently developed diagnostic and therapeutic techniques.
CEO:5 To Know the recent trends in digital filtering and data reduction techniques.

UNIT 1: INTRODUCTION
Cell structure – electrode – electrolyte interface, electrode potential, resting and action potential electrodes for their measurement, ECG, EEG, EMG – machine description – methods of measurement – three equipment failures and trouble shooting.

UNIT 2: TRANSDUCERS FOR BIO-MEDICAL INSTRUMENTATION
Basic transducer principles Types – source of bioelectric potentials – resistive, inductive, capacitive, fiber-optic, photoelectric and chemical transducers – their description and feature applicable for biomedical instrumentation – Bio & Nano sensors & application

UNIT 3: SIGNAL CONDITIONING, RECORDING AND DISPLAY
Input isolation, DC amplifier, power amplifier, and differential amplifier – feedback, op-Ampelectrometer amplifier, carrier Amplifier – instrument power supply. Oscillagraphic – galvanometric - X-Y, magnetic recorder, storage oscilloscopes – electron microscope – PMMC writing systems – Telemetry principles – Bio telemetry.

UNIT 4: MEDICAL SUPPORT
Electrocardiograph measurements – blood pressure measurement: by ultrasonic method – plethysonography – blood flow measurement by electromagnetic flow meter cardiac output measurement by dilution method – phonocardiography – vector cardiography. Heart lung machine – artificial ventilator – Anesthetic machine – Basic ideas of CT scanner – MRI and ultrasonic scanner –Bio-telemetry – laser equipment and application – cardiac pacemaker – DC– defibrillator patient safety - electrical shock hazards. Centralized patent monitoring system.

UNIT 5: BIO-MEDICAL DIAGNOSTIC INSTRUMENTATION
Introduction – computers in medicine – basis of signal conversion and digital filtering data reduction technique – time and frequency domain technique – ECG Analysis.

Course outcomes:

On successful completion of the course the student will be able to		POs related to COs
CO1	Distinguish and analyze the various physiological parameters and its recording methods, signal characteristics.	PO1,PO2
CO2	Describe the transducers and their description along with the feature applicable for Bio medical.	PO1,PO2
CO3	Analyze function of telemetry and Bio telemetry principles.	PO1,PO2, PO4
CO4	Demonstrate knowledge about equipment used for physical medicine and the various recently developed diagnostic and therapeutic techniques.	PO1,PO2, PO5
CO5	Extend knowledge on time and frequency domain techniques and analysis.	PO1,PO2

Text Books:

1. Siamak Najarian " Mechatronics in Medicine – A Bio medical engg approach" , McGraw – Hill Education , 2011
2. Cromwell, Weibell and Pfeiffer, "Biomedical Instrumentation and Measurements", 2nd Edition, Printice Hall of india , 1999
3. Khandpur, R.S., "Handbook of Biomedical Instrumentation", TMH, 1989.

Reference Books:

1. Arumugam M., "Bio Medical Instrumentation", Anuradha agencies Pub., 2002.
2. Geddes L.A., and Baker, L.E., "Principles of Applied Bio-medical Instrumentation", 3rd Edition,John Wiley and Sons, 1995.
3. Tompkins W.J., "Biomedical Digital Signal Processing", Prentice Hall of India, 1998

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2	3	2										
CO3	2	3		2								
CO4	3	2			2							
CO5	2	3										
CO*	2.6	2.4		2	2							

IV B.Tech I semester

L	T	P	C
3	1	0	3

16OECE412 FUNDAMENTALS OF EMBEDDED SYSTEMS

Course Educational Objectives:

CE01: To provide a basic knowledge like characteristics, classification and Application areas of Embedded systems.

CE02: Students learn the Architecture, Memory Interfacing and Interrupt Structures of 8051.

CE03: By learning instruction sets we can write the Assembly Language Programs and get knowledge in Interfacing techniques.

CE04: Students will learn the Real time operating systems.

CE05: To learn Communication and Interfacing Techniques and its buses.

UNIT 1:INTRODUCTION

History of Embedded Systems- Major Application Areas of Embedded Systems- Purpose of Embedded Systems- Core of the Embedded System- Sensors and Actuators- Embedded Firmware.

UNIT 2:THE 8051 ARCHITECTURE

Introduction- 8051 Micro controller Hardware- Register set of 8051-Input/Output Ports and Circuits-External Memory- memory and I/O interfacing of 8051Counter and Timers- Serial data Input/Output-Interrupt structure of 8051.

UNIT 3:BASIC ASSEMBLY LANGUAGE PROGRAMMING CONCEPTS

The Assembly Language Programming Process- Programming Tools and Techniques- Programming the 8051. Data Transfer and Logical Instructions. Arithmetic Operations- Decimal Arithmetic.Jump and Call Instructions.

APPLICATIONS: Interfacing with Keyboards- Displays- D/A and A/D Conversions- MultipleInterrupts

UNIT 4 :REAL-TIME OPERATING SYSTEMS (RTOS):

Operating System Basics- Types of Operating Systems- Tasks- Process and Threads-Multiprocessing and Multitasking- Task Scheduling- Threads- Processes and Scheduling:Putting them Altogether- Task Communication- Task Synchronization- Device Drivers- How to Choose an RTOS.

UNIT 5: COMMUNICATION INTERFACE AND COMMUNICATION BUSES.

Communication interface- (Board level communication interfaces- Product level communication interfaces) - - Timing -and Counting Devices- Watchdog Timer- Real Time Clock- Networked Embedded Systems- Serial Bus Communication Protocols- Parallel Bus Device Protocols- Parallel Communication Network Using ISA- PCI- PCI-X and Advanced Buses.

Course Outcomes:

On successful completion of course, student will be able to:		**P0s related to C0s**
C01	Understanding and designing of embedded systems	P01, P02
C02	Learning the Architecture and its functions	PO1,P02
C03	Knowledge to write the programs in Assembly Language programs	P01, P02, P03, Po4
C04	Knowledge in real time operating systems	P01, P02,P04,P05
C05	Understanding the transmissions through different types of buses	P01, PO2,P04

TEXT BOOKS:

1. Introduction to Embedded System-2nd edition- 2003-Shibu KV- Mc-Graw Hill -New Delhi.
2. The 8051 Microcontroller-3rd Edition-2007- Kenneth J.Ayala- Thomson DelmarLearning- New Delhi.
3. Embedded system architecture- programming and design-sixthreprint- 2005- Rajkamal- TMH- New Delhi.

REFERENCES :

1. Micro Controllers(theory and applications)seventh reprint-2005-Ajay V Deshmukhi- TMH- New Delhi.
2. An Embedded Software Primer- fifth impression- 2007- David E. Simon- Pearson Education private limited- New Delhi.
3. Microcontrollers architecture- programming and design- 1st edtion- 2007- Raj kamal- Pearson Education- New Delhi.
4. Embedded System Design- Frank Vahid- Tony Givargis- John Wiley-TMH- New delhi.
5. The 8051 microcontroller and embedded systems- 2nd editon- 2002- Muhammad ali mazdi- Janice Gillispie Mazidi- pearson edition private limited- New Delhi.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2	3	2										
CO3	2	3	2	2								
CO4	3	2		3	2							
CO5	2	3		2								
CO*	2.6	2.4	2	2.3	2							

IV Year B.Tech I semester	L	T	P	C
	3	1	0	3

16OECE413 DATA COMMUNICATION AND NETWORKS

Course EducationalObjectives:

CEO1: Build an understanding of the fundamental concepts of computer networking.
CEO2: Familiarize the student with the basic taxonomy and terminology of the computer networking area.
CEO3: Introduce the student to advanced networking concepts, preparing the student for entry Advanced courses in computer networking.
CEO4: Allow the student to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.
CEO5: Obtain the knowledge about recent web based protocols.

UNIT – I

Introduction: Network Topologies, Protocols & Standards, Layered Architecture LAN, WAN, MAN. OSI Reference Model, TCP/IP Reference Model, Guided and Unguided Media.

UNIT – II

Data Link Layer: Design Issues, Framing – Error Control – Flow Control, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols, ARQ schemes, HDLC. PPP. Ethernet- IEEE 802.3,4,5 Protocols, Wireless LAN- The 802.11 Architecture and Protocol Stack-The 802.11 Physical Layer-The802.11 MAC Sublayer Protocol-The 805.11 Frame Structure-Services

UNIT – III

The Medium Access Control Sublayer-The Channel Allocation Problem-Static Channel Allocation-Assumptions for Dynamic Channel Allocation, Multiple Access Protocols-Aloha-CSMA Protocols-Collision-Free Protocols,
Need for Internetworking, Design Issues, Addressing, Internet Protocol (IPv4/IPv6), Virtual Circuit and Datagram Networks, Routing Algorithms, Congestion Control Algorithms.

UNIT – IV

Transport layer: UDP, TCP, Congestion Control mechanisms, QOS, Techniques to improve QOS

UNIT – V

Application Layer: Cryptography, DNS, Electronic Mail, FTP, HTTP, SNMP, DHCP

Course Outcomes:

Course Outcomes		POs related to COs
CO1	Independently understand basic computer network technology	PO1, PO2
CO2	Understand and explain Data Communications System and its components..	PO1, PO2,PO4
CO3	Analysis the different types of network topologies and protocols. And Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer	PO1, PO2,PO3,
CO4	Identify the different types of network devices and their functions within a network.	PO1, PO2,PO4
CO5	Familiarity with the basic protocols of computer networks, and how they can be used to assist in network design and implementation.	PO1,PO2

TEXT BOOKS:

1. Computer Networks, Tanenbaum and David J Wetherall, 5th Edition, Pearson Edu, 2010
2. Computer Networks: A Top Down Approach, Behrouz A. Forouzan, Firouz Mosharraf, McGraw Hill Education.

REFERENCE BOOKS:

1. Larry L. Peterson and Bruce S. Davie, "Computer Networks - A Systems Approach" (5th ed), Morgan Kaufmann/ Elsevier, 2011
2. William Stallings, "Data & Computer Communication", Pearson Education India, 10th Edition, 2014.
3. James F. Kurose, Keith W. Ross, "Computer Networking: A Top–Down Approach Featuring the Internet", Pearson Education,6th Edition, 2013.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2	3	2		2								
CO3	2	3	2									
CO4	3	2		3								
CO5	2	3										
CO*	2.6	2.4	2	2.5								

CORE ELECTIVE - II

B.TECH IV-I SEM (E.E.E)

L	T	P	C
3	1	0	3

SUB CODE: 16EEE414A HIGH VOLTAGE ENGINEERING

Course objectives:

CEO1 To Explain the basics HV technology different equipments in HV labs
CEO2 To Explain the basic concepts break down in gaseous liquid and solid dielectrics
CEO3 To Explore the knowledge of generation of HVAC and DC voltage
CEO4 To Explain the generation of Impulse voltage and current.
CEO5 To Enhance knowledge on the different types of testing and measurement techniques.

UNIT-I INTRODUCTON

Introduction to HV technology –Equipments in H.V Labs - need for generating high voltages in laboratory - industrial applications of high voltage - electrostatic precipitation - separation.

UNIT-II BREAK DOWN IN GASEOUSLIQUID AND SOLIDDIELECTRICS

Gases as insulating media - collision process - ionization process - Townsend's criteria of break down in gases - paschen's law - liquid as insulator - pure and commercial liquids - break down in pure and commercial liquids.

Intrinsic breakdown - electro mechanical breakdown - thermal break down - break down of solid dielectrics in practice - break down in composite dielectrics - solid dielectrics used in practice.

UNIT-III GENERATION OF HV AC AND DC VOLTAGE

HV AC-HV transformer: Need for cascade connection and working of transformer units connected in cascade - series resonant circuit - principle of operation and advantages-Tesla coil - HV DC-voltage doubler circuit - cockroft-Walton type high voltage DC set- calculation of high voltage regulation - ripple and optimum number of stages for minimum voltage drop.

UNIT-IV GENERATION OF IMPULSE VOLTAGE AND CURRENT:

Introduction to standard lightning and switching impulse voltages - analysis of single stage impulse generator- expression for output impulse voltage-multi stage impulse generator - working of marx impulse generator - rating of impulse generator-components of multi stage impulse generator - Triggering of impulse generator by three electrode gap arrangement- Trigatron gap and oscillograph time sweep circuits - generation of switching impulse voltage- generation of high impulse current.

UNTI-V MEASURMENT OF HIGH VOLTAGES AND TESTING TECHNIQUES

Electrostatic voltmeter-principle - construction and limitation- chubb and fortescue method for HV AC measurement - Generating voltmeter - principle construction - series resistance micro ammeter for HV DC measurements - standard sphere gap measurements for HVAC - HVDC and impulse voltages- factors affecting the measurments - potential dividers - measurement of high impulse currents.

Dielectric loss and loss angle measurements using schering bridge - Transformer ratio Arms bridge - need for discharge detection and PD measurement aspects- factors affecting the discharge detection - discharge detection methods - straight and balanced methods - tests on isolators - circuit breakers - cables - insulators and transformers.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Able to understand the H.V Technology and used in different lab equipment.	PO1,PO2,,PO4,PO12
CO2	Able to understand the collision and ionization at the time of break down	PO1,PO2,PO3,PO4,, PO12
CO3	Able to understand the cascade connection, calculation of voltage regulation in generation of AC and DC voltage	PO1,PO2,PO4,PO12
CO4	Able to understand lightening ,switching and triggering the generation of impulse voltage and current.	PO1,PO2,PO3,PO4, ,PO12
CO5	Able to understand electrostatic voltmeter ,construction of measurement of HV currents	PO1,PO3,PO4,PO12

TEXT BOOKS :

1. High voltage engineering - 4th edition by M.S. Naidu and V.Kamaraju- TMH publications.
2. High voltage engineering - 1997 by C.L. Wadhwa - New age internationals (p) limited.

REFERENCE BOOKS :

1. High voltage engineering problems and solutions - 1st edition - 2010 - R.D. Begamudre - New age international publishers.
2. High voltage engineering Fundamentals - 2nd Edition - by E.Kuffel - W.S.Zaengi - J. Kuffel by Elsevier.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	-	-	-	-	-	-	-	-	2
CO2	2	2	3	3	-	-	-	-	-	-	-	2
CO3	2	2	-	-	-	-	-	-	-	-	-	2
CO4	2	2	3	3	-	-	-	-	-	-	-	2
CO5	2	-	-	3	-	-	-	-	-	-	-	3

B.TECH IV-I SEM (E.E.E)

L	T	P	C
3	1	0	3

SUB CODE:16EEE414B PRINCIPLES OF POWER QUALITY

Course Educational Objectives:

CEO1. To introduce the fundamental of electric power quality phenomena.
CEO2. To make students learn the voltage variations.
CEO3. To provide detailed analysis of Transients.
CEO4. To make students learn about Harmonics.
CEO5. To learn the power quality conditioners.

UNIT-I INTRODUCTION

What is power quality? Power quality – voltage quality - why are we concerned about power quality? - the power quality Evaluation procedure - Terms and Definitions - Transients - Long-duration voltage variations - short-voltage variations - voltage imbalance - wave form distortion - voltage fluctuation - power frequency variations - power quality terms CBEMA and ITI curves.

UNIT-II VOLTAGE SAGS AND INTERRUPTIONS

Sources of sags and interruptions - Estimating voltage sag performance - fundamental principles of protection - solutions at the end-use level - Motor-starting sags - utility system fault-clearing issues.

UNIT-III TRANSIENT OVER VOLTAGES

Sources of over voltages - principles of over voltage protection - devices for over voltage protection - utility capacitor-switching transients - utility system lightning protection.

UNIT-IV FUNDAMENTALS OF HARMONICS& APPLIED HARMONICS

Harmonic Distortion - Voltage versus current distortion - Harmonics versus Transients - power system qualities under non sinusoidal conditions - Harmonic indices - Harmonic sources from commercial loads - Harmonic sources from Industrial loads

Effects of Harmonics - Harmonic distortion evaluations - Principles of Controlling Harmonics - Devices for Controlling Harmonic Distortion

UNIT-V LONG-DURATION VOLTAGE VARIATIONS& POWER QUALITY BENCH MARKING AND MONITORING

Principles of regulating the voltage - Devices for voltage regulation - utility voltage regulator Application - capacitors for voltage regulation flicker. Benchmarking process - RMS Voltage variation Indices - Power Quality Contracts. Monitoring considerations - power quality measurement equipment - Power quality Monitoring standards

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Able to understand voltage sag, swell, long and short duration voltage variations.	PO1,PO2,,PO4,PO12
CO2	Able to understand the sources ,principle of protection of voltage sag and interruption.	PO1,PO2,PO3,PO4,,PO12
CO3	Able to understand the concept of capacitor switching and lightning.	PO1,PO2,PO4,PO12
CO4	Able to understand the controlling of harmonic distortion.	PO1,PO2,PO3,PO4,,PO12
CO5	Able to understand various power quality monitoring equipment and benchmarking process.	PO1,PO3,PO4,PO12

TEXT BOOKS:

1. Electrical Power Systems Quality - Roger C. Dugan - Mark F. McGranaghan - Surya Santoso - H.Wayne Beaty - 2nd Edition - TMH Education Pvt. Ptd.

REFERENCE BOOKS:

1. Electrical systems quality Assessment by J. Arrillaga - N.R. Watson - S. Chen - John Wiley & Sons
2. Understanding Power quality problems by Math H. J. Bollen IEEE Press

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	3	-	-	-	-	-	-	-	3
CO2	2	2	3	3	-	-	-	-	-	-	-	3
CO3	2	2	-	3	-	-	-	-	-	-	-	3
CO4	2	2	3	3	-	-	-	-	-	-	-	3
CO5	2	-	3	3	-	-	-	-	-	-	-	3

B.TECH IV-I SEM (E.E.E)

L	T	P	C
3	1	0	3

SUB CODE:16EEE414C ADVANCED POWER SYSTEM PROTECTION

Course objectives:

CEO1 To understand the concept and construction of static relays.
CEO2 To analyze principles of different static relays
CEO3 To analyze multi input comparators and importance.
CEO4 To familiarize digital and numerical relays advantages and types
CEO5 To study the microprocessor based numerical relays and characteristics

UNIT - 1: **STATIC RELAYS**

Advantages of static relays- Basic construction of static relays – Level detectors – Replica impedance-mixing circuits - General equation for two input phase and amplitude comparators – Duality between amplitude and phase comparator.

UNIT - 2: DIFFERENT STATIC RELAYS

Introduction-Instantaneous over current relay – Time over current relays - Basic principles-Definite time and Inverse definite time over current relays -Analysis of static differential relays – Static relay schemes –Duo bias transformer differential protection – Harmonic restraint relay. Static distance Relays: Static impedance –reactance-MHO and angle impedance relay sampling comparator – Realization of reactance and MHO relay using a sampling comparator.

UNIT - 3: MULTI –INPUT COMPARATORS

Conic section characteristics – Three input amplitude comparator – Hybrid comparator – switched distance schemes – Polyphase distance schemes-Phase fault scheme – Three phase scheme – Combined and ground fault scheme. **Power Swings:** Effect of power swings on the performance of Distance relays- Power swing analysis – Principle of out of step tripping and blocking relays – Effect of line length and source impedance on distance relays.

UNIT - 4: DIGITAL/NUMERICAL RELAYS

Principles of digital/Numerical Relays-Advantages of Numerical Relays-Processing unit-man – machine interface (MMI) –communication in protection relays. Information handling with substation monitoring system-different types of Numerical Relays.Reliability, testing and maintenance for Numerical Relays.

UNIT - 5: MICROPROCESSOR BASED PROTECTIVE RELAYS

Over current relays – Impedance relays – Directional relay – Reactance relay Generalized mathematical expression for distance relays - Measurement of resistance and reactance – MHO and offset MHO relays –Realization of MHO characteristics – Realization of offset MHO characteristics (Block diagram and flow chart approach only).

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Ability to uunderstand the static relay and its construction.	PO1,PO2,,PO4,PO12
CO2	Able to attain knowledge about different static rerlays performance.	PO1,PO2,PO3,PO4,,PO12
CO3	Ability to understand the multi input comparators design and principles	PO1,PO2,PO4,PO12
CO4	Able to acquire knowledge on Numerical Relays.	PO1,PO2,PO3,PO4,,PO12
CO5	Able to know the concepts of different types of Microprocessor Based Relays.	PO1,PO3,PO4,PO12

TEXT BOOKS:

1. "Power system Protection static relay", 2nd Edition, 2004, T.S.Madhava Rao, Tata McGraw Hill Publishing Company limited, New Delhi.
2. "Power system Protection and Switchgear", 2nd Edition, 2011, Badri Ram and D.N.Vishwakarma - Tata McGraw Hill Publication company limited, New Delhi.
3. "Digital/Numerical Relays",2005, T.S.Madhava Rao, Tata McGraw Hill Publishing Company limited, New Delhi.

REFERENCE BOOKS:

1. "Power System Protection", 1/e, 1998, P.M.Anderson, Mc Graw Hill IEEE Power Engineering Series, New York.
2. "Protective Relays Their Theory and Practice: Volume Two", 3/e, 1977, A.R. van C. Warrington, kluwer Publications, John Wiley and Sons, New York.
3. "The Art & Science of Protective Relaying", 1/e, 1956, C.R.*Mason*, John Wiley & Sons, New Delhi.
4. Power System Relaying, 4/e, 2013, Stanley H. Horowitz, Arun G. Phadke, James K. Niemira, Wiley Publications, New Delhi.
5. "Switchgear Protection And Power Systems", 3/e, 2007, Sunil.S.Rao, Kanna Publications, 2007.

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	2	-	-	-	-	-	-	-	2
CO2	3	2	3	2	-	-	-	-	-	-	-	3
CO3	2	2	-	2	-	-	-	-	-	-	-	2
CO4	3	2	3	2	-	-	-	-	-	-	-	3
CO5	2	-	2	2	-	-	-	-	-	-	-	2

B.TECH IV-I SEM (E.E.E)

L	T	P	C
3	1	0	3

SUB CODE:16EEE414D SMART GRID

Course Educational Objectives:

CEO1. To understand the concept and evolution of electric grid.
CEO2. To understand the schemes and technologies of Smart Grid.
CEO3. To provide adequate knowledge on different smart meters and advanced metering infrastructure.
CEO4. To provide adequate knowledge in the power quality management issues in Smart Grid.
CEO5. To accord basic knowledge in high performance computing for Smart Grid applications.

UNIT I INTRODUCTION TO SMART GRID

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, National and International Initiatives in Smart Grid

UNIT II SMART GRID TECHNOLOGIES (Transmission)

Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control

UNIT III SMARTGRID TECHNOLOGIES (Distribution)

DMS, Volt/ VAr control, Fault Detection, Isolation and service restoration, Outage management, High – Efficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV)

UNIT IV SMART METERS

Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU), Intelligent Electronic Devices(IED) & their application for monitoring & protection.

UNIT V HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS

Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Develop more understanding on the concepts of Smart Grid and its present developments.	PO1,PO8,PO9
CO2	Study about different Smart Grid technologies.	PO1,PO2,PO3, PO12
CO3	Acquire knowledge about different smart meters and advanced metering infrastructure.	PO1,PO2,PO3,PO8, PO9,PO12
CO4	Acquire knowledge on power quality management in Smart Grids	PO1,PO2,PO3,PO8, PO9,PO12
CO5	Develop more understanding on LAN, WAN and Cloud Computing for Smart Grid applications.	PO1, PO8,PO9,PO12

TEXT BOOKS

1. Stuart Borlase "Smart Grid :Infrastructure, Technology and Solutions",CRC Press 2012.

2.Janaka Ekanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley.

REFERENCES:

1. Vehbi C. Gün gör , DilanSahin, TaskinKocak,Salih Ergüt, Concettina Buccella , Carlo Cecati , and Gerhard P. Hancke , Smart Grid Technologies: Communication Technologies and Standards IEEE Transactions OnIndustrial Informatics, Vol. 7, No. 4, November 2011.

2. Xi Fang, Satya jayant Misra, Guoliang Xue,and Dejun Yang " Smart Grid – the new and Improved Power Grid: A Survey" , IEEETransaction on Smart Grids.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	3	3	-	-	
CO2	2	2	3	-	-	-	-	-	-	-	-	3
CO3	2	2	3	-	-	-	-	3	3	-	-	2
CO4	2	2	3	-	-	-	-	3	3	-	-	2
CO5	3	-	-	-	-	-	-	3	3	-	-	3

CORE ELECTIVE - III

B.TECH IV-I SEM (E.E.E)

L	T	P	C
3	1	0	3

16EEE415A **Digital Signal Processing**

Course Objectives:

- **CEO1** To provide knowledge on fourier transform analysis
- **CEO2** To study the designs and structures of digital (IIR and FIR) filters from analysis to synthesis for a given specifications.
- **CEO3** To acquaint in FFT algorithms and finite word length effects.
- **CEO4** The study about multirate digital signal processing and structures.

UNIT-1: Discrete Fourier Transform

Discrete time Signals and Systems - A Review, Classification, Operation, Introduction to DFT – Properties of DFT – Linear Convolution - Circular Convolution – Methods to evaluate Circular Convolution - Linear Convolution from Circular Convolution, Computation of DFT – Fast Fourier Transform – Radix 2 DIT and DIF FFT algorithms – Inverse FFT

UNIT- 2: IIR Filter Design

Analog filter approximations – Butterworth and Chebyshev – Design of IIR Digital filters from Analog filters - Impulse Invariance and Bilinear transformation - Design Examples: Analog to Digital Transformations – Illustrative Examples – Realization using Direct-Cascade and Parallel Forms

UNIT -3: FIR Filter Design

Characteristics of FIR Filters (Symmetric and Antisymmetric) - Linear Phase FIR filters – Frequency response – Design of FIR Filters – Frequency Sampling Method and Window Method – Design Problems – Realization using Transversal – Linear Phase – Poly Phase Structures

UNIT-4: Finite Word length Effects

Fixed point and Floating point Number Representations – Quantization Noise - Truncation and Rounding - Quantization noise – Coefficient quantization error – Product quantization error - Overflow error – Round off noise power - limit cycle oscillations due to product round off and overflow errors – Principle of scaling

UNIT-5: Multirate Digital Signal Processing

Multirate signal processing: Decimation and Interpolation by Integer Factor - Sampling Rate Conversion by a Rational Factor – Multistage Implementation of Multirate System – Filter Implementation for Sampling Rate Conversion – Direct Form FIR Structures and Polyphase Structures

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Able to analyse concept and different methods of fourier transform	PO1,PO2, PO3, PO12
CO2	Ability to design various IIR filter structures and different types	PO2,PO3, PO4
CO3	Ability to design various FIR filter structures and different types	PO3,PO5
CO4	Able to understand the significance of effects of finite word length and effects of round off errors.	PO2,PO3
CO5	Able to understand the fast computation of DFT and appreciate the FFT processing.	PO1,PO2,PO3, PO12

Text Book:

1. John G. Proakis & Dimitris G.Manolakis, "Digital Signal Processing – Principles, Algorithms & Applications", Fourth Edition, Pearson Education / Prentice Hall, 2007.

Reference Books:

1. Emmanuel C..Ifeachor, & Barrie.W.Jervis, "Digital Signal Processing", Second Edition, Pearson Education / Prentice Hall, 2002.
2. Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach", Tata Mc Graw Hill, 2007.
3. A.V.Oppenheim, R.W. Schafer and J.R. Buck, "Discrete-Time Signal Processing", 8th Indian Reprint, Pearson, 2004.
4. Andreas Antoniou, "Digital Signal Processing", Tata Mc Graw Hill, 2006.

S.NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	-	-	-	-	-	-	-	-	2
CO2	-	2	3	3	-	-	-	-	-	-	-	-
CO3	-	-	3	-	2	-	-	-	-	-	-	-
CO4	-	2	3	-	-	-	-	-	-	-	-	-
CO5	2	3	3	-	-	-	-	-	-	-	-	3

B.TECH IV-I SEM (E.E.E)

L	T	P	C
3	1	0	3

SUB CODE: 16EEE415B DYNAMICS OF ELECTRICAL MACHINES

Course objectives:

CEO1 To explain basic concept of 3-phase synchronous machines with and without damper bars.

CEO2 To explain the dynamic modeling, simulation and control of 3-phase induction machines.

CEO3 To explain theoperation of symmetrical and unsymmetrical 2 phase induction machine.

CEO4 To explain the mathematical model of a separately excited DC motor and DC Series motor.

CEO5 To explain dynamic performance of synchronous machine under 3-phase fault.

UNIT-I: MODELING CONCEPTS

Basic Two-pole machine representation of commutator machines, 3-phase synchronous machine with and without damper bars and 3-phase induction machine, Kron'sprimitive machine-voltage, current and torqueequations. Real time model of a two phase induction machine-transformation to obtain constant matrices-thee phase to two phase transformation- power equivalence.

UNIT-II MODELING OF THREE PHASE INDUCTION MACHINE

Generalized model in arbitrary reference frame- Electromagnetic torque– Derivation of commonly used induction machine models- Stator reference frame model-Rotor reference frame model- Synchronously rotating frame model- Equations in flux linkages- per unit model-Dynamic Simulation- Small signal equations of induction machine –derivation DQ flux linkage model derivation – control principle of Induction machine.

UNIT-III SYMMETRICAL AND UNSYMMETRICAL TWO PHASE INDUCTION MACHINE

Analysis of symmetrical 2 phase induction machine-voltage and torque equations for unsymmetrical 2 phase induction machine voltage and torque equations in stationary reference

frame variables for unsymmetrical 2 phase induction machine-analysis of steady state operation of unsymmetrical 2 phase induction machine- single phase induction motor - Cross field theory of single-phase induction machine.

UNIT-IV SYNCHRONOUS MACHINE MODELING

Mathematical model of a sep. excited DC motor- steady state and transient analysis - Transfer function of a sep. excited DC motor – Mathematical model of a DC series motor shunt motor-linearization techniques for small perturbations. Synchronous machine inductances – voltage equations in the rotor's DQ0 reference frame- electromagnetic torque-current in terms of linkages.

UNIT-V DYNAMIC ANALYSIS OF SYNCHRONOUS MACHINE

Dynamic performance of synchronous machine, three-phase fault, comparison of actual and approximate transient torque characteristics, Equal area criteria- simulation of three phase synchronous machine – modeling of PMSM.

Course Outcomes:

On successful completion of the course, students will be able to		**POs related to COs**
CO1	Able to understand the Kron's Primitive machine as an unified electrical machine model.	PO1,PO2, PO3
CO2	Ablility to analyze mathematical model and control of 3- phase Induction motor	PO1, PO2,PO3, PO4
CO3	Able to understand function of symmetrical and unsymmetrical2-phase induction motor	PO1
CO4	Ablility to analyze the mathematical model of a separately excited DC motor and DC Series motor	PO2,PO3
CO5	Able to understand the three phase synchronous machine under transient conditions.	PO1,PO2,PO3

TEXT BOOKS:

1. R.Krishnan "Electric Motor Drives - Modeling, Analysis& control" -PearsonPublications-1st edition -2002(For chapter III,IV,V)

2. P.C.Krause, Oleg Wasynczuk, Scott D. Sudhoff "Analysis ofElectrical Machinery and Drive systems" — Second Edition-IEEE Press (for ChaptersVI, VII,VIII)

REFERENCES:

1. Chee Mun Ong "Dynamic simulation of Electric machinery using Matlab / Simulink" – Prentice Hall

2. D.P.Sengupta &J.B.Lynn :"Electrical Machine Dynamics",TheMacmillan Press Ltd.

3. C.V. Jones :"The Unified Theory of Electrical Machines"Butterworth, London.

4. Woodson & Melcher, "Electromechanical Dynamics", John Wiley& Sons.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	-	-	-	-	-	-	-	-	-
CO2	3	3	3	3	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	-	3	3	-	-	-	-	-	-	-	-	-
CO5	2	3	3	-	-	-	-	-	-	-	-	-

B.TECH IV-I SEM (E.E.E)

L	T	P	C
3	1	0	3

SUB CODE:16EEE415C

RELIABILITY ENGINEERING AND APPLICATIONS TO POWER SYSTEMS

Course Educational Objectives:

CEO1. To explain the Reliability functions of complex networks and reliability measures.

CEO2. To explain the concept of stochastic transitional probability Matrix in Markov chains.

CEO3. To explain the concept of frequency and duration techniques.

CEO4. To explain the reliability indices at various hierarchical levels.

CEO5. To explain the Reliability functions of complex networks and reliability measures.

UNIT – I BASICS OF PROBABILITY THEORY & DISTRIBUTION

Basic probability theory – rules for combining probabilities of events – Bernoulli's trials – probability density and distribution functions – binomial distribution – expected value and standard deviation of binomial distribution.

UNIT – II NETWORK MODELLING AND RELIABILITY ANALYSIS & FUNCTIONS

Analysis of Series - Parallel - Series-Parallel networks – complex networks – decomposition method. Reliability functions f(t) - F(t) - R(t) - h(t) and their relationships – exponential distribution – Expected value and standard deviation of exponential distribution – Bath tub curve – reliability analysis of series parallel networks using exponential distribution – reliability measures MTTF - MTTR - MTBF.

UNIT – III MARKOV MODELLING

Markov chains – concept of stochastic transitional probability Matrix - Evaluation of limiting state Probabilities. – Markov processes one component repairable system – time dependent probability evaluation using Laplace transform approach – evaluation of limiting state probabilities using STPM – two component repairable models.

UNIT – IV FREQUENCY & DURATION TECHNIQUES

Frequency and duration concept – Evaluation of frequency of encountering state - mean cycletime - for one - two component repairable models – evaluation of cumulative probability and cumulative frequency of encountering of merged states.

UNIT – V GENERATION - COMPOSITE&DISTRIBUTION SYSTEM RELIABILITY ANALYSIS:

Reliability model of a generation system– recursive relation for unit addition and removal – load modeling - Merging of generation load model – evaluation of transition rates for merged state model – cumulative Probability - cumulative frequency of failure evaluation – LOLP - LOLE - LOEE.System and Load Point Reliability Indices – Weather Effects on Transmission Lines - Weighted Average rate and Markov Model. Basic Techniques - Radial Networks – Evaluation of Basic Reliability Indices - Performance Indices – Load Point and System Reliability Indices – Customer oriented - Loss and Energy oriented indices -Examples.

Course Outcomes:

On successful completion of the course, students will be able to		**POs related to COs**
CO1	Able to understand the reliability concepts to electrical power systems	PO1,PO2, PO3, PO12
CO2	Able to understand the functional zones and hierarchical levels for electrical power system reliability analysis	PO2,PO3, PO4
CO3	Ability to understand the basis of power system reliability indices for generation,transmission and distribution adequacy	PO3,PO5
CO4	Ability to analyze and evaluate the reliability indices at various hierarchical levels.	PO2,PO3
CO5	Ability to understand the assess reliability worth as a function of investment.	PO1,PO2,PO3, PO12

TEXT BOOKS:

1. Reliability Evaluation of Engg. System – R. Billinton - R.N.Allan - Plenum Press - New York - reprinted in India by B.S.Publications - 2007.
2. Reliability Evaluation of Power systems – R. Billinton - R.N.Allan - Pitman Advance Publishing Program - New York - reprinted in India by B.S.Publications - 2007

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	-	-	-	-	-	-	-	-	2
CO2	-	3	3	-	-	-	-	-	-	-	-	3
CO3	-	-	3	-	3	-	-	-	-	-	-	-
CO4	-	3	3	-	-	-	-	-	-	-	-	-
CO5	2	2	3	-	-	-	-	-	-	-	-	2

B.TECH IV-I SEM (E.E.E)

L	T	P	C
3	1	0	3

SUB CODE: 16EEE415D UTILIZATION OF ELECTRICAL ENERGY

Course Educational Objectives:

CEO1. To study the generation, conservation of electrical power and energy efficient equipments.
CEO2. To understand the principle, design of illumination systems and energy efficiency lamps.
CEO3. To study the methods of industrial heating and welding.
CEO4. To understand the electric traction systems and their performance.

UNIT - 1: ELECTRIC DRIVES

Introduction - Advantages and disadvantages of electrical drives - Type of electric drives - Selection of electrical drives - Types of industrial loads - Continuous - Intermittent and variable loads - Starting and running characteristics - Speed control of motors - Size and rating of motors - Temperature rise - Load equalization - Selection of electric motor for any application - Motors for particular application. .

UNIT - 2: ELECTRIC HEATING AND WELDING

Electric Heating- Advantages and methods of electric heating - Resistance heating - Arc heating - Induction heating and dielectric heating - Infrared or radiant heating - power factor correction on utility

Electric Welding-Electric Welding- Definition of welding - Welding process - Resistance and arc welding – electric welding equipment, comparison between AC and DC welding

UNIT - 3: ILLUMINATION

Introduction - Terms used in illumination -Laws of illumination - Polar curves - Photometry - Sources of light - Lamps:Incandescent lamps - Discharge lamps - SV and MV lamps - Lighting schemes- Requirement of good lighting scheme –Types and design of lighting schemes - calculation of illumination-Numerical problems.

UNIT - 4: ELECTRIC TRACTION-I

Introduction- Systems of electric traction - Comparison between A.C. and D.C. traction - Special features of traction motor- Methods of electric braking- Rheostat braking and regenerative braking - Speed-time curves for different services – Trapezoidal and quadrilateral speed time curves - Numerical problems.

UNIT - 5: ELECTRIC TRACTION-II

Mechanics of train movement- Adhesive weight and coefficient of adhesion – Problems - Calculations of tractive effort - Power - Specific energy consumption - Factors affecting specific

energy consumption of an electric train operating on a given schedule - Control of traction motors.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Understand the main aspects of generation, utilization and conservation.	PO1,PO7,PO12
CO2	Identify an appropriate method of heating for any particular industrial application.	PO1,PO3, PO4, PO7, PO12
CO3	Evaluate domestic wiring connection and debug any faults occurred.	PO1, PO2, PO3,PO7,PO12
CO4	Construct an electric connection for any domestic appliance like refrigerator as well as to design a battery charging circuit for a specific household application.	PO1,PO3, PO4,PO7, PO12
CO5	Realize the appropriate type of electric supply system as well as to evaluate the performance of a traction unit.	PO1,PO2,PO3, PO4,PO7, PO12

Text books:

1. Utilization of Electrical Energy , 1/e 2007 ,Open Shaw Taylor , Orient Longman-Hyderabad.
2. Utilization of Electric power , 1/e 2006 ,R K Rajput , Lakshmi Publications – New Delhi.

Reference books:

1. Utilization of Electric power and Electric traction , 10 /e 2009 J B Gupta , S Kkataria and sons Publications – New Delhi.
2. Utilization of Electrical Energy ,1/e 2010 ,Tarlok Singh, S. K. Kataria and Sons - New Delhi.
3. Generation & Utilization of Electrical Energy , 1/e 2010,S. Sivanagaraju, M. Balasubba Reddy and D. Srilatha , Dorling Kindersly.Pvt Ltd – UP, INDIA.
4. Generation Distribution & Utilization of Electrical Energy ,3/e 2012 , C. L. Wadhwa , New Age Publications ,New Delhi.
5. Utilization of Electrical Power Including Electrical Power &Electric Traction ,1/e 1994, N. V. Suryanarayana ,New Age Publications – New Delhi.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	3	-	-	-	-	3
CO2	2	-	3	3	-	-	3	-	-	-	-	3
CO3	2	2	3	-	-	-	3	-	-	-	-	3
CO4	2	-	3	3	-	-	3	-	-	-	-	3
CO5	2	2	3	3	-	-	3	-	-	-	-	2

B.TECH IV-I SEM (E.E.E)

L	T	P	C
0	0	3	2

16ECE418 MICROPROCESSORS AND INTERFACING LAB

Course Educational Objective:

- **CEO1** To demonstrate knowledge on 8086 Assembly Language programming Techniques.
- **CEO2** To develop skill on Signed and Unsigned Arithmetic Operations.
- **CEO3** To design different interfacing models of 8086 microprocessor.
- **CEO4** To understand various Logical Operationsof 8086 microprocessor.
- **CEO5** To apply different arithmetic operations using 8051 microcontroller

LIST OF EXPERIMENTS:

I. MICROPROCESSOR 8086:

1. INTRODUCTION TO MASM/TASM
2. Arithmetic Operation-Multibyte Addition and Subtraction, Multiplication and Division, Signed and Unsigned Arithmetic Operation, ASCII-Arithmetic Operations.
3. Logic Operations-Shift Rotate-Converting Packed BCD to Unpacked BCD, BCD to ASCII Conversion
4. By using string operation and instruction prefix: move block, reverse string, Sorting, inserting, deleting, length of string, string comparison.
5. DOS/BIOS programming: Display Characters, Strings

II.INTERFACING

1. 8279-Keyboard display: write a small program to display a string of characters.
2. 8259- Interrupt controller: Generate an Interrupt using 8259
3. 8255-Interfacing with DAC to generate Triangular and Square waveform.
4. 8251- USART program to establish communication between two processors.

III.MICROCONTROLLER 8051:

1. Arithmetic operations using 8051 microcontroller(addition,subtraction, multiplication, division)
2. Reading and writing on parallel port

EQUIPMENT REQUIRED FOR LABORATORY:

1.8086 MICROPROCESSOR KITS
2.8051 MICROCONTROLLER KITS
3. INTERFACES/PERIPHERAL SUBSYSTEMS
   1) 8259 PIC
   2) 8279 KB/DISPLAY
   3/8255 PPI
   4)8251 USART

Course Outcome:

On successful completion of the course, students will be able to		POs related to COs
CO1	To demonstrate knowledge on 8086 Assembly Language programming Techniques.	PO1,PO3.PO4,PO10 ,PO11,PO12
CO2	To develop skill on Signed and Unsigned Arithmetic Operations.	
CO3	To design different interfacing models of 8086 microprocessor.	
CO4	To understand various Logical Operationsof 8086 microprocessor.	
CO5	To apply different arithmetic operations using 8051 microcontroller	

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	**3**	-	-	-	-	-	-	-	-	-
CO4	-	-	-	**3**	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-
CO7	-	-	-	-	-	-	-	-	3	-	-	-
CO8	-	-	-	-	-	-	-	-	-	3	-	-
CO9	-	-	-	-	-	-	-	-	-	-	-	3

B.TECH IV-I SEM (E.E.E)

L	T	P	C
0	0	3	2

SUB CODE: 16EEE416 POWER SYSTEMS AND SIMULATION LAB

Course Educational Objectives:

CEO1. To study the modelling and parameter estimation of transmissions lines
CEO2. To study the various methods used for solving load flow analysis.
CEO3. To study the stability, dynamics and transient analysis of power systems.
CEO4. To understand the concept of economic dispatch.
CEO5. To study modelling, simulation and analysis of AVR

Any 10 of following experiments

The following experiments are required to be conducted as compulsory experiments

1. DETERMINATION OF SUB-TRANSIENT REACTANCE OF SALIENT POLE SYNCHRONOUS MACHINE.
2. DETERMINATION OF SEQUENCE IMPEDANCES OF CYLINDRICAL ROTOR SYNCHRONOUS MACHINE.
3. FAULT ANALYSIS OF **LG FAULT** ON A THREE-PHASE ALTERNATOR.
4. FAULT ANALYSIS OF **LL FAULT** ON A THREE-PHASE ALTERNATOR.
5. FAULT ANALYSIS OF **LLG FAULT** ON A THREE-PHASE ALTERNATOR.
6. FAULT ANALYSIS OF **LLLG FAULT** ON A THREE-PHASE ALTERNATOR
7. EQUIVALENT CIRCUIT OF A THREE WINDING TRANSFORMER.
8. POWER ANGLE CHARACTERISTICS OF SALIENT POLE SYNCHRONOUS MACHINE.

Any two of the following experiments are required to be conducted in addition to above.

1) Y-BUS FORMATION FOR A GIVEN POWER SYSTEM LINE DATA.
2) Z-BUS FORMATION FOR A GIVEN POWER SYSTEM LINE DATA..
3) GAUSS-SEIDAL LOAD FLOW ANALYSIS FOR A GIVEN POWER SYSTEM LINE AND LOAD DATA.
4) NEWTON-RAPHSON LOAD FLOW ANALYSIS FOR A GIVEN POWER SYSTEM LINE AND LOAD DATA.
5) REACTIVE POWER COMPENSATION OF POWER SYSTEM

Course Outcomes:

On successful completion of the course, student will be able to

Course Outcomes		POs related to COs
CO1	Understand power system planning and operational studies	PO1
CO2	Analyze and acquire knowledge on formation of Bus Admittance and Impedance Matrices and Solution of Networks	PO2
CO3	Design Bus Admittance and Impedance Matrices	PO3
CO4	Analyse and simulate the power flow using GS and NR method	PO5
CO5	Follow ethical principles to evaluate Symmetric and Unsymmetrical fault.	PO8
CO6	Do experiments effectively as an individual and as a member in a group.	PO9
CO7	Communicate verbally and in written form, the understandings about the experiments.	PO10
CO8	Continue updating their skill related to electronic devices and their applications during their life time	PO12

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	3	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-
CO7	-	-	-	-	-	-	-	-	3	-	-	-
CO8	-	-	-	-	-	-	-	-	-	3	-	-
CO9	-	-	-	-	-	-	-	-	-	-	-	3

IV B.Tech II Sem	L	T	P	C
	3	1	0	3

16MBA 214 BUSINESS MANAGEMENT

Course Educational Objective:

CEO1 To understand the various business economics, demand analysis and demand
CEO2 To study the production management, quality management
CEO3 To overview business organization
CEO4 To understand the concept of HR and Marketing
CEO5 To gain knowledge of the Short-Term Finance and various capital budgeting techniques

UNIT - 1: Business Economics

Nature and scope of business economics - **Demand analysis**: Demand Determinants, Law of Demand - **Elasticity of demand:** Types, Measurement and Significance of Elasticity of Demand

UNIT - 2: Production and Cost Analysis

Cost concepts - Production Function - Laws of Returns- Production Management-Plant Layout - Basic concepts of MIS and ERP- Total Quality Management (TQM), Six Sigma, Business Process Re-Engineering.

Unit – 3: Business Organisation and Management

Features of Business, Types of Business Organizations: Sole proprietorship, Partnership, Joint Stock Company, and Public enterprises.
Management:Nature, significance and functions of Management.

Unit – 4: HR and Marketing

Introduction to HR, Functions of HR Manager, (Manpower Planning Recruitment, Selection, Training & Development, Performance Appraisal), Grievances handling and negotiations.

Marketing**:** Functions of Marketing- Marketing Mix- Pricing methods- Promotional practices and Channels of distribution - Product Life Cycle - Basic concepts of Advertising-Marketing Research - e-Marketing - Marketing through social media, pricing strategies in internet era.

Unit – 5: Financial Management

Objectives and Functions of Financial Management - Sources of Long-term and Short-Term Finance - Capital Budgeting Techniques (Payback Period Method, ARR, NPV, IRR).

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs related to COs
CO1	Ability to to understand the various business economics, demand analysis and demand.	PO1,PO2,,PO3,PO12
CO2	Able to study the production management, quality management	PO1,PO2,PO3,PO4,,PO12
CO3	Ability to overview business organization.	PO1,PO2,PO3,PO12
CO4	To interpret the concept of HR and Marketing	PO1,PO2,PO3,PO4,,PO12
CO5	Expertise in Short-Term Finance and various capital budgeting techniques	PO1,PO3,PO4,PO12

Text Books:

1. Managerial Economics and Financial Analysis, 4/e, 2011, Dr.A.R.Aryasri, TMH, New Delhi.
2. Management Science, 1/e, 2009, Dr. G. Sreenivasa Rao, High tech Publishers, Hyderabad.
3. Management Science, 3/e, 2008, A.R.Aryasri, TMH, New Delhi.
4. Introduction to Management Science, 1/e, 2011, P.Vijaykumar, Cengage Learning India, New Delhi

Reference Books:

1. Managerial Economics, Analysis, Problems and Cases, 17/e, 2011, P.L.Mehta, Sultan Chand & Sons, New Delhi.
2. Marketing Management, 4/e, 2010, Rajan Saxena, TMH, New Delhi.
3. Personnel and Human Resource Management, 2009, Subba Rao, HPIL.
4. Financial Management, 2011, I.M. Pandey, Vikas Publishers, Hyderabad.
5. Entrepreneurship Development, 2009, S.S.Khanka, S.Chand and Company Limited, New Delhi.

CO-PO Mapping

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	3	-	-	-	-	-	-	-	-	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3
CO3	3	3	3	-	-	-	-	-	-	-	-	3
CO4	3	3	3	3	-	-	-	-	-	-	-	3
CO5	3	-	3	3	-	-	-	-	-	-	-	3
CO*	3	3	3	3	-	-	-	-	-	-	-	3

IV B.Tech II Sem	T	P	C
16HAS212	3	0	3

ENVIRONMENTAL SCIENCE

Course Educational Objectives

- **CEO1.** To get knowledge about scope and environment
- **CEO2.** To get awareness of eco system and biodiversity
- **CEO3.** To be able to understand about hazards of pollution and waste management
- **CEO4.** To gain knowledge of various social issues related to sustainability
- **CEO5.** To understand environmental acts and case studies

UNIT – 1: Introduction to Environmental Science and Natural Resources

Introduction: Definition - Scope and importance of environment - Need for public awareness - Natural Resources: Forest resources: Use and over-exploitation - Deforestation - Conservation of forests.
Mineral resources: Use and exploitation - Environmental effects of extracting mineral resources - Case studies.
Energy resources: Conventional energy resources - Natural gas and Nuclear fuels - Non-conventional energy resources - Solar energy - Wind energy - Tidal energy - Geothermal energy and Biogas energy - Use of alternate energy sources - Case studies.

UNIT – 2: Ecosystem and Biodiversity

Ecosystem: Concept of an ecosystem - Structure and function of an ecosystem - Energy flow in the ecosystem - Food chains - Food webs - Ecological pyramids - Types - Characteristic features - Structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (Ponds - Streams - Lakes - Rivers - Oceans - Estuaries).

Biodiversity: Introduction to biodiversity - Genetic - Species and Ecosystem diversity - Value of biodiversity: Consumptive value - Productive value - Social value - Ethical value - Aesthetic and Option values -Endangered and endemic species of India - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – 3: Pollution and Waste Management

Definition - Causes - Effects - Control measures of pollution.
Air Pollution: Types of pollutants - Their sources and impacts - Air pollution control
Noise Pollution: Impacts of noise - Permissible limits of noise pollution - Measurement of noise - Control of noise pollution.
Soil Pollution: Causes of soil degradation - Excessive use of fertilizers - Problems with pesticide use - Excess salt and water.
Solid waste management: Characteristics - Generation - Collection and transportation of solid wastes - Engineered systems for solid waste management (reuse, recycle, energy recovery, treatment and disposal).

UNIT – 4: Social Issues and the Environment

Water conservation measures - Rain water harvesting and water shed management - Resettlement and rehabilitation of people - Its problems and concerns - Case studies - Role of NGO's - Climate change - Global warming (Green house effect) - Ozone layer depletion - Acid rain - Nuclear accidents.

Sustainable development: Definition - Objectives - Environmental dimensions of sustainable development

UNIT– 5: Environmental Legislation and Human Population

Environmental acts: The water (Prevention and control of pollution) Act - The air (Prevention and control of pollution) act - The wild life (protection) act - The forest conservation act - The environmental protection act.

Case studies: Chipko movement - Narmada bachao andolan - Silent valley project - Chernobyl nuclear disaster - and Bhopal gas tragedy

Population growth: Variation among nations - Population explosion - Value education - HIV/AIDS - Role of information technology in environment and human health - Case studies.

Field Work

Visit to a local area to document environmental assets: River/ Forest/ Grasslands/ Mountains

Visit to local polluted site: Urban/ Rural/ Industrial/ Agriculture

Study of simple ecosystems: Pond/ River/ Hill slope etc.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Able to get knowledge about scope and environment	PO1,PO2,,PO3,PO12
CO2	Enrich knowledge about awareness of eco system and biodiversity	PO1,PO2,PO3,PO4,,PO12
CO3	Understands various hazards of pollution and and gains knowledge waste management	PO1,PO2,PO3,PO12
CO4	Gains knowledge of various social issues related to sustainability	PO1,PO2,PO3,PO4,,PO12
CO5	Understands environmental acts and case studies and human population	PO1,PO3,PO4,PO12

Text books:

1. Text book of Environmental Studies, 4/e, 2012, C.P. Kaushik and Anubha Kaushik, New Age International (P) Ltd., Publishers, New Delhi.
2. Text book of Environmental Studies, 1/e, 2008, Erach Bharucha, University Press (India) Private Ltd. Hyderabad.

Reference books:

1. Environmental Studies-From Crisis to Cure, 2/e, 2012, R. Rajagopalan, Oxford University Press , New Delhi.
2. A Text Book of Environmental science and Technology ,1/e, 2008, Dr.M.Anji Reddy, B.S. Publications, Hyderabad.
3. Principles of Environmental Science and Engineering, 1/e, 2005, Keerthinarayana and Daniel Yesudiam, Hi –Tech Publications , Chennai.
4. Glimpses of Environment , 1/e, 2005, Dr. KVSG Murali Krishna, Environmental Protection Society, Kakinada, India.
5. Environmental Studies, 1/e, 2009, Anindita Basak , Pearson Education, New Delhi.

CO-PO Mapping

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	3	-	-	-	-	-	-	-	-	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3
CO3	3	3	3	-	-	-	-	-	-	-	-	3
CO4	3	3	3	3	-	-	-	-	-	-	-	3
CO5	3	-	3	3	-	-	-	-	-	-	-	3
CO*	3	3	3	3	-	-	-	-	-	-	-	3

CORE ELECTIVE - IV

B.TECH IV-II SEM (E.E.E)

L	T	P	C
3	1	0	3

SUB CODE: 16EEE421A DIGITAL CONTROL SYSTEMS

Course objectives:

CEO1 To provide the knowledge on sampling and reconstruction.
CEO2 To offer the knowledge on Dicrete time control and state space analysis.
CEO3 To afford the knowledge oncontrollability and observability.
CEO4 To provide the knowledge on stability analysis.
CEO5 To offer knowledge on design of state feedback controllers and observers.

UNIT – I: SAMPLING AND RECONSTRUCTION & Z-TRANSFORMS

Introduction - Examples of Data control systems – Digital to Analog conversion and Analog to Digital conversion - sample and hold operations. Linear difference equations - pulse response - Z – transforms - Theorems of Z – Transforms - the inverse Z – transforms - Modified Z-Transforms

UNIT-II : Z-PLANE ANALYSIS OF DISCRETE TIME CONTROL SYSTEM AND STATE SPACE ANALYSIS

Z-Transform method for solving difference equations; Pulse transforms function - block diagram analysis of sampled – data systems - mapping betweens-planeandz-plane. State Space Representation of discrete time systems - Pulse Transfer Function Matrix solving discrete time state space equations - State transition matrix and it's Properties - Methods for Computation of State Transition Matrix - Discretization of continuous time state – space equations

UNIT–III: CONTROLLABILITY AND OBSERVABILITY

Concepts of Controllability and Observability - Tests for controllability and Observability. Duality between Controllability and Observability - Controllability and Observability conditions for Pulse Transfer function.

UNIT–IV: STABILITY ANALYSIS

Mapping between the s-Plane and the z-Plane – Primary strips and Complementary Strips – Constant frequency loci - Constant damping ratio loci - Stability Analysis of closed loop systems in the Z-Plane. Jury and stablility test – Stability Analysis by use of the Bilinear Transformation and Routh stability criterion.

UNIT–V: STATE FEEDBACK CONTROLLERS AND OBSERVERS

Design of state feedback controller through pole placement – Necessary and sufficient conditions - Ackerman's formula. State Observers – Full order and Reducedorderobservers.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Able to analyze sampling and reconstruction.	PO1,PO2,,PO3,PO12
CO2	Able to analyze Discrete time control and state space analysis.	PO1,PO2,PO3,PO4,,PO12
CO3	Able to identify controllability and observability of systems.	PO1,PO2,PO3,PO12
CO4	Able to evaluate stability of different systems.	PO1,PO2,PO3,PO4,,PO12
CO5	Able to design state feedback controllers and observers.	PO1,PO3,PO4,PO12

TEXTBOOKS:

1. Discrete-Time Control systems - K. Ogata - Pearson Education/PHI - 2nd Edition

REFERENCEBOOKS:

1. Digital Control Systems - Kuo - Oxford University Press - 2nd Edition - 2003.
2. Digital Control and State Variable Methods by M.Gopal - TMH

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	-	-	-	-	-	-	-	-	2
CO2	2	3	3	3	-	-	-	-	-	-	-	3
CO3	2	3	3	-	-	-	-	-	-	-	-	2
CO4	2	3	3	3	-	-	-	-	-	-	-	3
CO5	2	-	3	3	-	-	-	-	-	-	-	2

B.TECH IV-II SEM (E.E.E)

L	T	P	C
3	1	0	3

SUB CODE: 16EEE421B SPECIAL ELECTRICAL MACHINES

Course objectives:

CEO1. To enhance the knowledge on single phase machines.

CEO2. To offer knowledge on drive system and circuit control of stepper motor.

CEO3. To provide knowledge on drive system and circuit control of switched reluctance motor.

CEO4. To afford knowledge on drive system and circuit control of PMBLDC motor.

CEO5. To supply knowledge on drive system and circuit control of permanent magnet synchronous motor

UNIT - I: SINGLE PHASE MACHINES

Principle and construction of split phase motors - Shaded Pole motor - Repulsion motor – Universal motor – unexcited synchronous single phase motor – Reluctance and Hysteresis motor – Applications.

UNIT - II: STEPPER MOTORS

Constructional features; principle of operation; Types of motors – Modes of operation – Drive system and circuit control of Stepper motor –Static and Dynamic Characteristics and Applications.

UNIT – III: SWITCHED RELUCTANCE MOTORS

Constructional details - principles of operation - Static and dynamics Torque production – drive circuits – Current regulation – Torque speed characteristics – Speed and torque control – Static observers for rotor position sensing – volt-ampere requirements – Applications.

UNIT - IV: PERMANENT MAGNET BRUSH LESS DC MOTORS

Commutation in DC motors – Difference between mechanical and electronic commutators – Principle of operation - Construction and – drive circuits – Torque and emf equation – Torque and Speed characteristics – sensors and sensorless systems – controllers and applications.

UNIT V: PERMANENT MAGNET SYNCHRONOUS MOTORS

Principles of operation – Constructional features – Phasor diagram – torque speed characteristics – torque and emf equations – vector controllers - applications. Linear Synchronous Motor (LSM): Construction, types, principle of operation, thrust equation, control and applications.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Able to Understand single phase machines.	PO1, PO12
CO2	Able to analyze and understand drive system and circuit control of stepper motor.	PO1,PO2
CO3	Able to analyze and understand drive system and circuit control of switched reluctance motor.	PO1,PO2
CO4	Able to analyze and understand drive system and circuit control of PMBLDC motor.	PO1,PO2
CO5	Able to analyze and understand the performance of permanent magnet synchronous motor.	PO1,PO2

TEXT BOOKS

1. Venkataratnam K- "Special Electrical Machines" - Universities Press - Hyderabad - 2008.
2. P.P.Acarnley- "Stepping Motors - A Guide to Modern theory and practice" - PeterPeregrines - London - 2002.

REFERENCE BOOKS

1. T.J.E. Miller- "Brush less Permanent Magnet and reluctance Motor Drives" - ClarendonPress - Oxford - 1989.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	2
CO2	2	3	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	2	3	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-

B.TECH IV-II SEM (E.E.E)

L	T	P	C
3	1	0	3

SUB CODE: 16EEE421C

DESIGN OF PERMANENT MAGNET BRUSHLESS AND RELUCTANCE MOTORS

Course objectives:

- **CEO1** To enhance the knowledge on synchronous reluctance motors.
- **CEO2** To offer knowledge on drive system and circuit control of stepper motor.
- **CEO3** To provide knowledge on drive system and circuit control of switched reluctance motor.
- **CEO4** To afford knowledge on drive system and circuit control of PMBLDC motor.
- **CEO5** To supply knowledge on drive system and circuit control of permanent magnet synchronous motor.

UNIT I: SYNCHRONOUS RELUCTANCE MOTORS

Constructional features – Types – Axial and Radial flux motors – Operating principles – Variable Reluctance and Hybrid Motors – SYNREL Motors – Voltage and Torque Equations - Phasor diagram - Characteristics.

UNIT II : STEPPING MOTORS

Constructional features – Principle of operation – Variable reluctance motor – Hybrid motor – Single and multi stack configurations – Torque equations – Modes of excitations – Characteristics – Drive circuits – Microprocessor control of stepping motors – Closed loop control.

UNIT III: SWITCHED RELUCTANCE MOTORS

Constructional features – Rotary and Linear SRMs - Principle of operation – Torque production – Steady state performance prediction- Analytical method -Power Converters and their controllers – Methods of Rotor position sensing – Sensorless operation – Closed loop control of SRM - Characteristics.

UNIT IV : PERMANENT MAGNET BRUSHLESS D.C. MOTORS

Permanent Magnet materials – Magnetic Characteristics – Permeance coefficient -Principle of operation – Types – Magnetic circuit analysis – EMF and torque equations –Commutation - Power controllers – Motor characteristics and control.

UNIT V : PERMANENT MAGNET SYNCHRONOUS MOTORS

Principle of operation – Ideal PMSM – EMF and Torque equations – Armature reaction MMF – Synchronous Reactance – Sinewave motor with practical windings - Phasor diagram – Torque/speed characteristics - Power controllers - Converter Volt-ampere requirements.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Able to Understandsynchronous reluctance motors.	PO1
CO2	Able to analyze and understand drive system and circuit control of stepper motor.	PO1,PO2
CO3	Able to analyze and understand drive system and circuit control of switched reluctance motor.	PO1,PO2
CO4	Able to analyze and understand drive system and circuit control of PMBLDC motor.	PO1,PO2
CO5	Able to analyze and understand the performance of permanent magnet synchronous motor.	PO1, PO2

TEXT BOOKS:

1. T.J.E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press, Oxford, 1989.
2. T. Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press London, 1984.

REFERENCES:

1. R.Krishnan, 'Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application', CRC Press, New York, 2001.

2. P.P. Aearnley, 'Stepping Motors – A Guide to Motor Theory and Practice', Peter Perengrinus London, 1982.
3. T. Kenjo and S. Nagamori, 'Permanent Magnet and Brushless DC Motors', Clarendon Press, London, 1988.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-

B.TECH IV-II SEM (E.E.E)

L	T	P	C
3	1	0	3

SUB CODE: 16EEE421D MODERN POWER ELECTRONICS

Course objectives:

CEO1	To understand basic devices and its characteristics
CEO2	To understand design of resonant converters.
CEO3	To understand design of multilevel inverter and its performances.
CEO4	To understand the principle and operation of AC and DC power supplies.
CEO5	To design the DC and AC power supplies using advanced techniques

.

UNIT - 1: MODERN POWER SEMICONDUCTOR DEVICES

Modern power semiconductor devices- MOS Turn Off Thyristor (MTO) – Emitter Turn Off Thyristor (ETO) – Integrated Gate – Commutated thyristor (IGCTs) – MOS – Controlled thyristors (MCTs) – Static induction Thyristors (SITHs) – Power integrated circuits (PICs) – Symbol - Structure and equivalent circuit- Comparison of their features.

UNIT - 2: RESONANT PULSE INVERTERS

Resonant pulse inverters – Series resonant inverters- Series resonant inverters with unidirectional switches – Series resonant inverters with bidirectional switches- Analysis of half bride resonant inverter-– Analysis of half bridge and full bridge resonant inverter with bidirectional switches – Frequency response of series resonant inverter- series loaded inverter – parallel resonant inverters – Voltage control of resonant inverters-Class E resonant inverter –

UNIT – 3: MULTILEVEL INVERTERS

Multilevel concept- Classification of multilevel inverters – Diode clamped Multilevel inverter- Principle of operation – Main features- Improved diode clamped inverter – Principle of operation – Flying capacitors multilevel inverter – Principle of operation – Main features - Cascaded multilevel inverter – Principle of operation – Main features- Multilevel inverter applications – Reactive power compensation – Back to back intertie system – Adjustable drives – Switching device currents – DC link capacitor voltage balancing –Features of Multilevel inverters – Comparisons of multilevel converters.

UNIT - 4: DC POWER SUPPLIES

DC power supplies – Classification- switched mode dc power supplies – Fly back Converter- Forward converter- Push –Pull converter – Half bridge converter –Full bridge converter – Resonant DC power supplies- Bidirectional power supplies- Application.

UNIT - 5: AC POWER SUPPLES AND UNINTERRUPTIBLE POWER SUPPLIES

AC power supplies – Classification – Switched mode ac power supplies Resonant AC power supplies-Bidirectional ac power supplies – Multistage conversions- Control circuits- Applications - Introduction- Power line disturbances – Power conditioners- Uninterruptible power supplies- Applications.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Able to design the electronic devices and circuits.	PO1,PO2,PO12
CO2	Able to understand the Static and dynamic characteristics of all modern power semiconductor devices.	PO1,PO2
CO3	Able to understand types of resonant pulse inverters and its working characteristics	PO1,PO2,PO12
CO4	Able to Know the operation of multi level inverters and its applications	PO1,PO2
CO5	Able to design the DC and AC power supplies using advanced techniques.	PO1,PO2

TEXT BOOKS:

1. "Power Electronics" - 3rd Edition - 2004 - Md.H.Rashid –Pearson Education – USA
2. "Power Electronics: Converters, Applications" - 3nd Edition-2009 - N.Mohan - Tore.M.Undeland - W.P.Robbins –John Wiley &Sons – Singapore.

REFERENCES:

1. Electrical Motors & Drives Fundamentals, Types and Applications , 4/e 2013 , Austin Huges and Bill Drury, Newnes publications –New Delhi.
2. Power Electronics, 2/e 2007 (3rd Reprint 2008) , M. D. Singh and K. B. Khanchandani ,Tata McGraw – Hill Education Pvt. Ltd. – New Delhi.
3. Power Electronics Circuits, Devices and Applications , 3/e 2004 , Mohammad H. Rashid , Dorling KindersIyPvt Ltd – New Delhi.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	-	-	-	2
CO2	2	2	-	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	-	-	2
CO4	3	3	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-

CORE ELECTIVE - V

B.TECH IV-II SEM (E.E.E)

L	T	P	C
3	1	0	3

SUB CODE: 16EEE422A NETWORK ANALYSIS AND SYNTHESIS

Course objectives:

CEO1	To impart knowledge on systems and their response
CEO2	To introduce state variable concept
CEO3	To learn to apply Laplace transform to electrical systems
CEO4	To know how to synthesize the electric network

UNIT-I INTRODUCTION

Analogous systems-Classification of system-Linear, nonlinear, dynamic and static-Time invariant systems-Mechanical systems-translational and rotational systems-D'Alemberts principle-Force voltage analogy-force current analogy-Mechanical coupling devices-Gears-Mathematical representation-State Variable representation-Simple Problems

UNIT-II STATE VARIABLE ANALYSIS OF ELECTRICAL NETWORKS

Choice of state variables in Electrical networks-Formulation of state equations for Electrical networks-Equivalent source method-Network topological method-Solution of state equations-Analysis of simple networks with state variable approach.

UNIT-III APPLICATION OF LAPLACE TRANSFORM METHODS OF ANALYSIS

Response of RL, RC and RLC networks to step, ramp, pulse and impulse functions shifting and scaling theorems- Laplace transform of Periodic functions-Convolution theorem-Convolution integral-Applications.

UNIT-IV APPLICATION OF FOURIER SERIES

RMS, average value of a non-sinusoidal periodic waveform-Expression for power with non-sinusoidal voltage and current-power factor-Effect of harmonics-Analysis of simple circuits with non sinusoidal inputs.Representation of non-periodic functions-Fourier intergral-Fourier transform-Graphical Representation-Properties of Fourier transforms-Persaval's theorem-Fourier transform of constant, unit step, unit impulse, unit ramp signals and exponential functions-relationshsip with Laplace transform.

UNIT-V NETWORK SYNTHESIS:

Elements of reliability-Hurwitz polynomials-positive real functions-Properties-Testing-Sturm's Test-Synthesis one port LC networks-Foster and Cauer methods.Synthesis of RL and RC one port networks-Foster and Cauer methods.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Analyze electrical systems using Fourier and Laplace methods	PO1,PO2,PO4,PO12
CO2	Understand concept of Fourier series and applications.	PO1,PO2,PO3,PO4
CO3	Understand concept of Laplace transform of Periodic functions	PO1,PO2,PO3,PO4
CO4	Understand state variable concept	PO1,PO2,PO3,PO4
CO5	Understand to synthesis electrical networks	PO1,PO2

On successful completion of course, student will be able to

TEXT BOOKS:

1. Linear system Analysis-A. Chang.
2. Network Analysis and Synthesis-B C Kuo
3. Network analysis and Systhesis-Umesh Sinha-Satya Prakashan Publications.

REFEREMCE BOOKS:

1. Linear System Analysis-A N Sripathi, New age International.
2. Network and Systems-D Roy Chowdhary, New Age International.
3. Engineering Network Analysis and Fiter Design-Gopal G Bhisk & Umesh.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	3	-	-	-	-	-	-	-	2
CO2	3	3	2	3	-	-	-	-	-	-	-	-
CO3	3	3	2	3	-	-	-	-	-	-	-	-
CO4	3	3	2	3	-	-	-	-	-	-	-	-
CO5	2	2	-	-	-	-	-	-	-	-	-	-

B.TECH IV-II SEM (E.E.E)

L	T	P	C
3	1	0	3

SUB CODE:16EEE422B DESIGN OF ELECTRICAL SYSTEMS

Course objectives:

CEO1 To provide the students the fundamental concepts of electric wiring, Design Aspects of Lighting and Pre-commissioning.

CEO2 To comprehend the different issues related to Industrial Installation , types of Faults and protecting schemes.

CEO3 Power quality issues, earthing and power factor improvements

UNIT – I DESIGN ASPECTS OF ELECTRICAL SYSTEMS

Role of Statutes in Electrical System Design - Classification of Building Services - Design Aspects of Lighting - Design Aspects of Ventilation - Design Aspects of Climate Control - Design Aspects of Vertical Transportation - Design Aspects of Minor Building Services.Classification - Estimation of Load Requirements - Selection of Type of Wiring - Special Features Applicable for High-Rise Apartment Buildings - Pre-commissioning Tests.

UNIT – II INDUSTRIAL INSTALLATIONS

Classification of Industrial Installation - General Characteristics - Selection of Distribution Architecture - Selection of Transformers and Sub Stations .Short Circuit Studies - Fault Current Calculations - Earthing Design - Selection of Switch Gears: Electrical Protection - Protection of Circuit Elements - Persons & Life stack - Equipment - Electrical Isolation - Switch Gear Control - Switching Devices - Uses - Selective Co-ordination - Circuit Breakers and Their Selection.

UNIT – III POWER FACTOR IMPROVEMENT &POWER SYSTEM EARTHING

Nature of Reactive Energy - Power Factor - How to Improve Power Factor? - Economics of Power Factor Improvement - Location of Capacitors - Installation Precautions - Optimal Compensation - PF Correction of Induction Motors - Protection and Control - Voltage Transients - Switching Considerations. Introduction - Earthing - Types of System Earthing - Reasons for Grounding/ Earthing - TN System - TT System - IT System - Protective Measures and Protective Devices in IT System - Main Characteristics of Earthing Systems - Selection Criteria for Earthing - Design Considerations of Earting - Measurement of Earth Resistance - Earth Leakage Protection - Neutral Earthing for Generators and Transformers. lighting protection systems

UNIT – IV POWER QUALITY ISSUES AND RESONANCE PROBLEMS IN SYSTEMS DESIGN

Power Quality Issues - Harmonics - Sources of Harmonics - Disturbances Caused by Harmonics - Methods to reduce the Impact of Harmonics - Design the Detuned Capacitor Bank - IEEE Standard 519-1992 and Limits.

UNIT – V ENERGY ECONOMICS IN SYSTEM DESIGN

Introduction - Time Value of Money - Single Payment Compound Amount Model (SPCA) - Uniform Series Compound Amount Model (USCA) - Uniform Series Present Worth Model (USPW) - Depreciation - Tax Considerations - After Tax Analysis.

Course outcomes

On successful completion of the course, students will be able to		POs related to COs
CO1	Able to apply electrical design and installation concepts.	PO1,PO2
CO2	Able to understand Earthing schemes of different electrical equipments	PO1,PO2
CO3	Able to acquire knowledge on Fault Current Calculations	PO1,PO2
CO4	Ability to describe Sources of Harmonics, Design the Capacitor Bank	PO1,PO2,PO3
CO5	Able to Understand the economics of Power Factor improvement.	PO1,PO2,PO12

TEXT BOOK:

1. Electrical Systems Design – by M. K. Giridharan - I. K. International Publishing House Pvt. Ltd.
2. Design of Electrical Installations – by Er. V. K. Jain and Er. Amitabh Bajaj - University Science Press.

REFERENCE BOOKS:

1 Electrical Power system design, 1/e ,2001,by M.V.Deshpande Tata McGraw – Hill Education Pvt. Ltd.. NewDelhi.
2 Efficient Electrical system Design 1/e 2008,Harry Franz, Albert Thumann Fairmont Press –USA.
3 Design of Electrical systems for Large Projects, 1/e 1991,Balasubramanyan,The Rukmini Studies – NewDelhi.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	-	-	-	-	-	-	-	-	-
CO5	2	2	-	-	-	-	-	-	-	-	-	3

B.TECH IV-II SEM (E.E.E)

L	T	P	C
3	1	0	3

SUB CODE:16EEE422C NONCONVENTIONAL ENERGY SOURCES

Course objectives:

CEO1	To demonstrate knowledge on different non conventional Energy sources
CEO2	To study various solar energy plants
CEO3	To design location of site selection for Wind Energy Conversion System
CEO4	To evaluate the economic aspects and operation of Bio mass Energy systems
CEO5	To estimate potential and conversion techniques of Geothermal energy systems

UNIT – I INTRODUCTION

Principles of solar radiation: Role and potential of renewable source, 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

Solar energy collection: Flat plate and concentratingcollectors, classification of concentrating collectors, orientation and thermal analysis, solar energy storage and applications: Differentmethods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications-solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

UNIT-IIIWIND ENERGY

Sources and potentials, the nature of the wind, Site Selection Considerations, Basic Components of a Wind Energy Conversion System, Classification of WEC Systems: horizontal and vertical axiswindmills, Schemes for Electric Generation using Synchronous Generator and Induction Generator, performance characteristics, Betz criteria, Wind energy Storage

UNIT-IV BIO MASS ENERGY

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-V

Geothermal energy: Resources, types of wells, methods ofharnessing the energy, potential in India.

Ocean energy: OTEC, Principles utilization, setting of OTECplants, thermodynamic cycles.

Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Demonstrate knowledge on different non conventional Energy sources	PO1,PO12
CO2	Study various solar energy plants	PO1,PO2
CO3	Design location of site selection for Wind Energy Conversion System	PO1,PO2
CO4	Evaluate the economic aspects and operation of Bio mass Energy systems	PO1,PO2
CO5	Estimate potential and conversion techniques of Geothermal energy systems	PO1,PO2

On successful completion of course, student will be able to

.**TEXT BOOKS:**

1. Non-Conventional Energy Sources by G.D. Rai, Khanna Publishers
2. Renewable Energy Resources – Twidell & Wier, CRC Press(Taylor & Francis)

REFERENCE BOOKS:

1. Renewable energy resources by Tiwari and Ghosal, Narosa.
2. Renewable Energy Technologies by Ramesh & Kumar, Narosa.
3. Non-Conventional Energy Systems by K Mittal, Wheeler
4. Renewable energy sources and emerging technologies by D.P.Kothari,K.C.Singhal, PHI.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	3
CO2	2	3	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-

B.TECH IV-II SEM (E.E.E)

L	T	P	C
3	1	0	3

SUB CODE: 16EEE422D EHVAC TRANSMISSION

Course objectives:

CEO1 To understand the various types of transmission line trends
CEO2 To be able to study electrostatic field and voltage gradients
CEO3 To gain knowledge of electrostatic induction, voltage control and various compensation techniques
CEO4 Expertise about corona and its effects
CEO5 To be able to design the EHV lines

UNIT – 1:INTRODUCTION

E.H.V.A.C. Transmission line trends and preliminary aspect standard transmission voltages – Estimation at line and ground parameters - Bundle conductor systems inductance and capacitance of E.H.V. lines – Positive - Negative and zero sequence impedance – Line Parameters for Modes of Propagation.

UNIT - 2: ELECTROSTATIC FIELD AND VOLTAGE GRADIENTS

Electrostatic field and voltage gradients – Calculations of electrostatic field of AC lines – Effect high electrostatic field on biological organisms and human beings surface voltage gradients and maximum gradients of actual transmission lines – Voltage gradients on sub conductor

UNIT - 3: ELECTROSTATIC INDUCTION IN UN-ENERGIZED LINES

Electrostatic induction in un-energized lines – Measurements of field and voltage gradients for three phase single and double circuit lines – Un-energized lines - Power Frequency Voltage control and over voltages in EHV lines : No load voltage – Charging currents at power frequency - Voltage control – Shunt and series compensation – Static VAR compensation.

UNIT - 4: CORONA IN E.H.V. LINES

Corona in E.H.V. lines – Corona loss formulae attention of traveling waves due to Corona – Audio noise due to Corona - Generation - Characteristic and limits - Measurements of audio noise radio interference due to Corona RF properties of radio noise – Frequency spectrum of RI fields – Measurements of RI and RIV.

UNIT - 5:DESIGN OF EHV LINES

Design of EHV lines based on steady state and transient limits. EHV cables and their characteristics.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to COs
CO1	Acquire knowledge about various types of transmission line and EHV Transmission methods	PO1
CO2	Study electrostatic field and voltage gradients	PO1
CO3	Attain knowledge of electrostatic induction, voltage control and various compensation techniques	PO1
CO4	Analyze corona and its effects	PO1
CO5	Design the EHV lines	PO1,PO3

.**TEXT BOOKS:**

1. EHVAC transmission Engineering by R.D.Begamudre, new age international (p)Ltd
2. HVAC &DC transmission by S.Rao

REFERENCE BOOKS:

1. "Extra High Voltage AC Transmission Engineering", 4th Edition, 2012, By Rokosh Das Begamudre , Wiley EASTERN LTD, NEW DELHI.
2. "EHV Transmission line reference Books "– Edison Electric Institution (GEC 1968).

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-

B.TECH IV-II SEM (E.E.E)

L	T	P	C
18	0	0	10

SUB CODE: 16EEE423 **PROJECT WORK**

Course Educational Objectives:

CEO1. To develop the ability to undertake problem identification, formulation and solution.

CEO2. To demonstrate the ability to engage in design and to execute designs to an appropriate professional standard.

CEO3. To develop the capacity to undertake lifelong learning.

CEO4. To develop the ability to communicate effectively, not only with engineers but also with the community at large.

CEO5. To develop an understanding of the social, cultural, global and environmental responsibilities of the professional Engineer, and the principles of sustainable design and development

PROJECT WORK

The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design / fabrication / analysis for a specific application, a research project with a focus on an application needed by the industry / society, a computer project, a management project or a design and analysis project. A project topic must be selected by the students in consultation with their guides.

To train the students in preparing project reports and to face reviews and viva voce examination. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report.

Course Outcomes:

On successful completion of the course, students will be able to		POs related to Cos
CO1	Acquire the ability to make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.	PO1, PO2, PO3, PO4, PO5, PO6, PO7
CO2	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	PO8
CO3	Acquire the skills to communicate effectively and to present ideas clearly and coherently to specific audience in both the written and oral forms.	PO10
CO4	Aquire collaborative skills through working in a team to achieve common goals.	PO9,PO11
CO5	Learn on their own, reflect on their learning and take appropriate actions to improve it.	PO12

CO-PO Mapping

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	3	3	3	3	3	-	-	-	-	-
CO2	-	-	-	-	-	-	-	3	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	3	-	-
CO4	-	-	-	-	-	-	-	-	3	-	3	-
CO5	-	-	-	-	-	-	-	-	-	-	-	3
CO*	**3**	**3**	**3**	**3**	3	3	3	3	3	**3**	**3**	**3**