KONGU ENGINEERING COLLEGE
PERUNDURAI ERODE – 638 052
(Autonomous)

VISION

To be a centre of excellence for development and dissemination of knowledge in Applied Sciences, Technology, Engineering and Management for the Nation and beyond.

MISSION

We are committed to value based Education, Research and Consultancy in Engineering and Management and to bring out technically competent, ethically strong and quality professionals to keep our Nation ahead in the competitive knowledge intensive world.

QUALITY POLICY

We are committed to

- Providing value based quality education for the development of students as competent and responsible citizens.
- Contributing to the nation and beyond through research and development
- Continuously improving our services

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

To be a centre of excellence for the development and dissemination of knowledge in Electrical and Electronics Engineering to benefit the society in the National and Global level.

MISSION

Department of Electrical and Electronics Engineering is committed to:

MS1: Develop innovative, competent, ethical and quality engineers to contribute for technical advancements to meet societal needs.

MS2: Provide state-of-the-art facilities for continual improvement in teaching-learning process and research activities.

MS3: Enrich the knowledge and skill of the students to cater to the industrial needs and motivate them to become entrepreneurs.

2014 REGULATIONS

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Graduates of Electrical and Electronics Engineering will

PEO1: Succeed in professional career by utilizing fundamental knowledge of basic sciences and engineering.

PEO2: Design, simulate, analyze and develop Electrical and Electronics Engineering based products which are reliable, cost effective and safe.

PEO3: Demonstrate communication skills, team work, ethics, codes of professional practice as well as an aptitude for continuous learning.

MAPPING OF MISSION STATEMENTS (MS) WITH PEOs

MS\PEO	PEO1	PEO2	PEO3
MS1	3	3	2
MS2	2	2	3
MS3	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO1 **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 **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.

PO3 **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.

PO4 **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.

PO5 **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.

PO6 **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.

PO7 **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.

PO8 **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 **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.

PO11 **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.

PO12 **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1 Comprehend, analyse and design products in core domains namely power, control and energy to meet the ever-changing demands of industry and society.

PSO2 Apply and control the conventional and non-conventional electrical systems for specific requirements.

MAPPING OF PEOs WITH POs AND PSOs

PEO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PEO1	3	2	2	2	2	1	2	1	2	1	1	2	3	2
PEO2	2	3	3	3	3	2	2	-	-	2	2	1	2	3
PEO3	-	-	-	-	-	3	3	3	3	3	2	3	-	-

1 – Slight, 2 – Moderate, 3 – Substantial

CURRICULUM BREAKDOWN STRUCTURE UNDER REGULATION 2014

Curriculum Breakdown Structure(CBS)	**Curriculum Content (% of total number of credits of the program)**	**Total number of contact hours**	**Total number of credits**
Basic Sciences(BS)	16.48	510	30
Engineering Sciences(ES)	17.03	615	31
Humanities and Social Sciences(HS)	9.34	315	17
Program Core(PC)	35.71	1275	65
Program Electives(PE)	9.89	270	18
Open Electives(OE)	4.94	135	9
Project(s)/Internships(PR)	6.59	360	12
Total			**182**

KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638 052
(Autonomous)

B.E. DEGREE IN ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM

(For the candidates admitted from academic year 2014 – 15 onwards)

SEMESTER – I

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
14EGT11	Communicative English I	3	0	0	3	40	60	100	HS
14MAT11	Mathematics I	3	1	0	4	40	60	100	BS
14PHT11	Applied Physics	3	0	0	3	40	60	100	BS
14CYT11	Applied Chemistry	3	0	0	3	40	60	100	BS
14CSC11	Problem Solving and Programming	3	0	3	4	40	60	100	ES
14EET11	Basics of Electrical and Electronics Engineering	3	0	0	3	40	60	100	ES
	PRACTICAL								
14PHL11	Physical Sciences Laboratory I	0	0	3	1	100	0	100	BS
14EEL11	Basics of Electrical and Electronics Engineering Laboratory	0	0	3	1	100	0	100	ES
				Total	**22**				

CA – Continuous Assessment, ESE – End Semester Examination
CBS – Curriculum Breakdown Structure

KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638 052
(Autonomous)

B.E. DEGREE IN ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM

(For the candidates admitted from academic year 2014 – 15 onwards)

SEMESTER – II

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
14EGT21	Communicative English II	3	0	0	3	40	60	100	HS
14MAT21	Mathematics II	3	1	0	4	40	60	100	BS
14PHT21	Materials Science	3	0	0	3	40	60	100	BS
14CYT21	Environmental Science	3	0	0	3	40	60	100	BS
14MET11	Basics of Civil and Mechanical Engineering	3	0	0	3	40	60	100	ES
14MEC11	Engineering Drawing	2	0	3	3	40	60	100	ES
14VEC11	Value Education	0	2	1	1	100	0	100	HS
	PRACTICAL								
14PHL21	Physical Sciences Laboratory II	0	0	3	1	100	0	100	BS
14MEL11	Basics of Civil and Mechanical Engineering Laboratory	0	0	3	1	100	0	100	ES
				Total	**22**				

CA – Continuous Assessment, ESE – End Semester Examination
CBS – Curriculum Breakdown Structure

KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638 052
(Autonomous)

B.E. DEGREE IN ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM

(For the candidates admitted from academic year 2014 – 15 onwards)

SEMESTER – III

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
14MAT31	Mathematics III	3	1	0	4	40	60	100	BS
14EET31	Electrical Machines I	3	1	0	4	40	60	100	PC
14EIT32	Electron Devices and Circuits	3	1	0	4	40	60	100	PC
14EET32	Circuits and Networks	3	1	0	4	40	60	100	PC
14CST35	Object Oriented Programming	3	0	0	3	40	60	100	ES
	PRACTICAL								
14EEL31	Electrical Machines I Laboratory	0	0	3	1	100	0	100	PC
14EEL32	Devices and Circuits Laboratory	0	0	3	1	100	0	100	PC
14CSL34	Object Oriented Programming Laboratory	0	0	3	1	100	0	100	ES
				Total	**22**				

CA – Continuous Assessment, ESE – End Semester Examination
CBS – Curriculum Breakdown Structure

KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638 052
(Autonomous)

B.E. DEGREE IN ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM

(For the candidates admitted from academic year 2014 – 15 onwards)

SEMESTER – IV

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
14MAT41	Numerical Methods	3	1	0	4	40	60	100	BS
14EET41	Electrical Machines II	3	1	0	4	40	60	100	PC
14EIT43	Digital Logic Circuits	3	1	0	4	40	60	100	PC
14EET42	Measurements and Instruments	3	0	0	3	40	60	100	ES
14EET43	Electromagnetic Theory	3	1	0	4	40	60	100	PC
14MET46	Applied Thermodynamics	3	0	0	3	40	60	100	ES
	PRACTICAL								
14EEL41	Electrical Machines II Laboratory	0	0	3	1	100	0	100	PC
14EEL42	Analog and Digital Electronics Laboratory	0	0	3	1	100	0	100	PC
14EEL43	Measurements and Instruments Laboratory	0	0	3	1	100	0	100	ES
				Total	**25**				

CA – Continuous Assessment, ESE – End Semester Examination
CBS – Curriculum Breakdown Structure

KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638 052
(Autonomous)

B.E. DEGREE IN ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM

(For the candidates admitted from academic year 2014 – 15 onwards)

SEMESTER – V

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
14ECT52	Linear Integrated Circuits	3	1	0	4	40	60	100	PC
14EET51	Transmission and Distribution	3	1	0	4	40	60	100	PC
14EET52	Microprocessors and Microcontrollers	3	0	0	3	40	60	100	PC
14EET53	Control Systems	3	1	0	4	40	60	100	PC
14EET54	Electrical Safety Engineering	3	0	0	3	40	60	100	PC
	Elective-I (Professional)	3	0	0	3	40	60	100	PE
	PRACTICAL								
14EEL51	Microprocessors and Microcontrollers Laboratory	0	0	3	1	100	0	100	PC
14EEL52	Control System and Simulation Laboratory	0	0	3	1	100	0	100	PC
14ECL51	Linear Integrated Circuits Laboratory	0	0	3	1	100	0	100	PC
				Total	**24**				

CA – Continuous Assessment, ESE – End Semester Examination
CBS – Curriculum Breakdown Structure

KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638 052
(Autonomous)

B.E. DEGREE IN ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM

(For the candidates admitted from academic year 2014 – 15 onwards)

SEMESTER – VI

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
14GET61	Economics and Management for Engineers	3	0	0	3	40	60	100	HS
14EET61	Power Electronics	3	0	0	3	40	60	100	PC
14EET62	Digital Signal Processing and Applications	3	1	0	4	40	60	100	ES
14EET63	Power System Analysis and Stability	3	1	0	4	40	60	100	PC
	Elective-II (Professional)	3	0	0	3	40	60	100	PE
	Elective-III (Open)	3	0	0	3	40	60	100	OE
	PRACTICAL								
14EEL61	Power Electronics Laboratory	0	0	3	1	100	0	100	PC
14EEL62	Digital Signal Processing and Applications Laboratory	0	0	3	1	100	0	100	ES
14EGL41	Communication Skills Laboratory	0	0	3	1	100	0	100	HS
				Total	**21**				

CA – Continuous Assessment, ESE – End Semester Examination
CBS – Curriculum Breakdown Structure

KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638 052
(Autonomous)

B.E. DEGREE IN ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM

(For the candidates admitted from academic year 2014 – 15 onwards)

SEMESTER – VII

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
14GET71	Total Quality Management	3	0	0	3	40	60	100	HS
14EET71	Electric Drives and Control	3	0	0	3	40	60	100	PC
14EET72	Power System Protection and Switchgear	3	0	0	3	40	60	100	PC
	Elective – IV (Professional)	3	0	0	3	40	60	100	PE
	Elective – V (Open)	3	0	0	3	40	60	100	OE
	Elective – VI (Open)	3	0	0	3	40	60	100	OE
	PRACTICAL								
14EEL71	Electric Drives Laboratory	0	0	3	1	100	0	100	PC
14EEL72	Power Systems Laboratory	0	0	3	1	100	0	100	PC
14EEP71	Design Project	0	0	6	3	50	50	100	PR
				Total	**23**				

CA – Continuous Assessment, ESE – End Semester Examination
CBS – Curriculum Breakdown Structure

KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638 052
(Autonomous)

B.E. DEGREE IN ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM

(For the candidates admitted from academic year 2014 – 15 onwards)

SEMESTER – VIII

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	THEORY								
14GET81	Professional Ethics and Human Values	3	0	0	3	40	60	100	HS
	Elective – VII (Professional)	3	0	0	3	40	60	100	PE
	Elective – VIII (Professional)	3	0	0	3	40	60	100	PE
	Elective – IX (Professional)	3	0	0	3	40	60	100	PE
	PRACTICAL								
14EEP81	Project Work	0	0	18	9	100	100	200	PR
				Total	**21**				

CA – Continuous Assessment, ESE – End Semester Examination
CBS – Curriculum Breakdown Structure

Total Credits: 182

LIST OF PROFESSIONAL ELECTIVES						
Course Code	**Course Title**	**Hours/Week**			**Credit**	**CBS**
		L	**T**	**P**		
SEMESTER V						
14ECT33	Communication Engineering	3	0	0	3	PE
14EEE01	Generalized Machine Theory	3	1	0	4	PE
14EEE02	Power Generation System	3	0	0	3	PE
14EEE03	Electronic Instrumentation	3	0	0	3	PE
SEMESTER VI						
14ECE08	Digital Image Processing	3	0	0	3	PE
14EIE03	Embedded Control	3	0	0	3	PE
14EIT63	VLSI Systems	3	0	0	3	PE
14EEE04	Design of Electrical Apparatus	3	0	0	3	PE
14EEE05	High Voltage Engineering	3	0	0	3	PE
14EEE06	Modern Control Theory	3	1	0	4	PE
SEMESTER VII						
14EIT71	PLC, SCADA and DCS	3	0	0	3	PE
14EEE07	Advanced Microprocessor and Micro Controller	3	0	0	3	PE
14EEE08	Advanced Power Electronics	3	0	0	3	PE
14EEE09	Pulse Width Modulation Techniques	3	0	0	3	PE
14EEE10	Design, Estimation and Maintenance of Electrical Equipment	3	0	0	3	PE
14EEE11	Special Electrical Machines	3	0	0	3	PE
14EEE12	Power System Operation and Control	3	0	0	3	PE
SEMESTER VIII						
14GEE81	Entrepreneurship Development	3	0	0	3	PE
14EEE13	Smart Grid	3	0	0	3	PE
14EEE14	Power Quality	3	0	0	3	PE
14EEE15	EHV AC Transmission Systems	3	0	0	3	PE
14EEE16	Static Relays	3	0	0	3	PE
14EEE17	Electricity Deregulation	3	0	0	3	PE
14EEE18	Bio Mass Energy Systems	3	0	0	3	PE
14EEE19	Energy Conservation and Management	3	0	0	3	PE
14EEE20	HVDC and FACTS	3	0	0	3	PE

LIST OF OPEN ELECTIVES						
Course Code	**Course Title**	**Hours/Week**			**Credit**	**CBS**
		L	**T**	**P**		
SEMESTER VI						
14EEO01	Electric Power Utilisation and Energy Auditing	3	1	0	4	OE
14EEO02	Solar and Wind Energy	3	0	0	3	OE
SEMESTER VII						
14EEO03	Computer Aided Simulation and Design of Electrical Machines	3	0	0	3	OE
14EEO04	Energy Storage Systems	3	0	0	3	OE
14EEO05	Industrial Automation and Control	3	0	0	3	OE
14EEO06	Neural Networks and Fuzzy Logic Systems	3	0	0	3	OE

14EGT11 COMMUNICATIVE ENGLISH I

(Common to all Engineering and Technology branches)

3 0 0 3

UNIT – I **9**

Functional Grammar: Basics of Vocabulary - Parts of speech or Word Classes including Determiners - Prefixes and Suffixes - Homonyms and Homophones - Connectives - Compound Nouns. **Listening:** Introduction to Listening / Types of Listening – Extensive / Intensive Listening - Listening Activities. **Speaking:** Verbal and non verbal communication – An introduction to speech sounds, syllables & word stress – Speaking Activities. **Reading:** Introduction to Skimming and scanning as reading techniques - understanding discourse coherence – sequencing of sentences – Reading activities. **Writing:** Introduction to aspects of technical writing – writing definitions and descriptions- Letter Writing – Informal letters-Punctuation in Letter Writing

UNIT – II **9**

Functional Grammar: Concord - Tenses - Voice - Use of Articles and prepositions. **Listening:** Listening Comprehension – Cloze Test - Extensive listening – listening for general information. **Speaking:** Role Play – Situational Conversations. **Reading:** Reading newspaper articles – global understanding skills and ability to infer, extract gist and understand main ideas. **Writing:** Letter Writing - Formal letters, Writing a Profile about an organization—Punctuation (General).

UNIT – III **9**

Functional Grammar: Phrasal verbs - Clauses - Simple, Compound and Complex Sentences - Synonyms and Antonyms. **Listening:** Listening Comprehension – Cloze Text - Intensive listening – listening for specific information. **Speaking:** Describing Places, People, Technical Processes. **Reading:** Reading different types of texts – Understanding general and specific information. **Writing:** Paragraph Writing – Writing reviews on short films and videos - Offering suggestions and recommendations

UNIT – IV **9**

Functional Grammar: Conditional clauses (If clause) - Adjectives, Compound Adjectives and Degrees of Comparison. **Listening:** Listening to different accents, listening to speeches / presentations. **Speaking:** Describing Technical Processes and Machines and Gadgets - Telephone Skills. **Reading:** Reading Texts with focus on use of verbs and verb phrases. **Writing:** Writing e-mails –Transcoding - Using Charts, pictures and tables for interpretations.

UNIT – V **9**

Functional Grammar: Modals – Types of Sentences – Idioms and Phrases and proverbs - identifying odd words. **Listening:** Retrieval of factual information – listening to identify topic, context, function, speaker's opinion, attitude, etc. **Speaking:** Interviews - Personal and Telephonic - Giving impromptu talks, making presentations on given topics. **Reading:** Reading for structure and detail – finding key information in a given text and finding topic sentences. **Writing:** Designing and Making Posters – Writing Advertisements-Free writing on any given topic (Technical and topics on current affairs)

TOTAL : 45

TEXT BOOKS :

1. "Learn English – A Fun Book of Functional Language, Grammar and Vocabulary", McGraw Hill Education [India] Pvt. Ltd., Santanu Sinha Chaudhuri, 2013.

REFERENCE BOOKS :

1. Raman, Meenakshi and Sangeetha Sharma, "Technical Communication: Principles and Practice", Oxford University Press, New Delhi, 2011.
2. Regional Institute of English, "English for Engineers", Cambridge University Press, New Delhi, 2006.
3. Rizvi, Ashraf M., "Effective Technical Communication", Tata McGrawHill, New Delhi. 2009.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: speak clearly, confidently, comprehensibly, and communicate with others using appropriate communicative strategies

CO2: write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide range of vocabulary, organizing their ideas logically on a topic

CO3: read different genres of texts adopting various reading strategies

CO4: listen/view and comprehend different spoken discourses / excerpts in different accents

CO5: use language effectively and accurately acquiring vocabulary from real-life context

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						1			2	3		2		
CO2						1			1	3		1		
CO3						1			1	3		2		
CO4						1			2	3		2		
CO5						2			2	3		2		

1 – Slight, 2 – Moderate, 3 – Substantial

14MAT11 MATHEMATICS I

(Common to all Engineering and Technology branches)

3 1 0 4

Pre-requisites: Basics concepts of matrices, Basic idea of differentiation, Knowledge of differential equations

UNIT – I **9**

Matrices: Eigenvalues and Eigenvectors of a real matrix – Properties of Eigenvalues and Eigenvectors (without proof) – Cayley-Hamilton Theorem (Statement and Applications) - Similarity transformation (concept only) – Orthogonal matrices – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form – Nature of quadratic forms – Reduction of a quadratic form to canonical form by orthogonal transformation.

UNIT – II **9**

Functions of Several Variables: Functions of two variables – Partial derivatives – Total differential – Taylor's Series expansion –Maxima and Minima – Constrained maxima and minima – Lagrange's multiplier method – Jacobians – Properties.

UNIT – III **9**

Ordinary Differential Equations of First Order: Solutions of equations in separable form – Exact differential equations – Integrating factors – Linear first order differential equations – Bernoulli's equation – Clairaut's equation.

UNIT – IV **9**

Ordinary Differential Equations of Higher Order: Linear differential equations of second and higher order with constant coefficients – Particular Integrals for the types: e^{ax} – cos(ax) / sin(ax) – x^n – $e^{ax}x^n$, e^{ax}sin(bx) and e^{ax}cos(bx) – x^nsin(ax) and x^ncos(ax) – Linear differential equations with variable coefficients: Euler-Cauchy's equation – Legendre's equation.

UNIT – V **9**

Applications of Ordinary Differential Equations: Method of variation of parameters – Simultaneous first order linear equations with constant coefficients – Simple harmonic motion – Deflection of beams – Electric circuits (Differential equations and associated conditions need to be given).

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

1. Kandasamy P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics For First Year B.E/B.Tech", Reprint Edition 2014, S.Chand and Co., New Delhi.
2. Veerarajan T., "Engineering Mathematics, (for first year)", Reprint Edition 2013, Tata McGraw-Hill, New Delhi.

REFERENCE BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publications, New Delhi, 2011.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", 4th Edition, Narosa Publishing House, New Delhi, Reprint 2014.
3. Bali N.P. and Manish Goyal, "Text Book of Engineering Mathematics", 8th Edition, Laxmi Publications, New Delhi, 2011.
4. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2011.
5. Kreyszig E., "Advanced Engineering Mathematics", 10th Edition, John Wiley Sons, 2010.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Solve engineering problems which needs matrix computations.
CO2: Solve extremal problems which arise in function of several variables.
CO3: Identify the appropriate method for solving first order ordinary differential equations.
CO4: Classify and find the solution of ordinary differential equations of higher order.
CO5: Apply the concept of ordinary differential equations for modeling and finding solutions to engineering problems.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1								1		
CO2	3											1		
CO3	3	3	1	1								1		
CO4	3	3	1	1								1		
CO5	3	3	2	1								1		

1 – Slight, 2 – Moderate, 3 – Substantial

14PHT11 APPLIED PHYSICS

(Common to all Engineering and Technology branches)

3 0 0 3

UNIT – I **9**

Properties of Matter: Elasticity – Hooke's law – Modulus of elasticity (qualitative) – Stress-strain diagram – Poisson's ratio – Bending moment – Depression of a cantilever (theory) – Derivation of Young's modulus of the material of the beam – Uniform and non-uniform bending – I-shaped girders. **Thermal Physics:** Modes of heat transfer – Thermal conductivity – Derivation of rectilinear flow of heat along a bar – Radial and cylindrical heat flow – Conduction through compound media (series and parallel).

UNIT – II **9**

Acoustics: Classification of sound – Weber–Fechner law – Sabine's formula- derivation using growth and decay method – Absorption coefficient and its determination –Factors affecting acoustics of buildings and their remedies. **Ultrasonics:** Production – Magnetostrictive generator – Piezoelectric generator – Determination of velocity using acoustic grating – Cavitation – Industrial applications – Drilling, welding, soldering and cleaning – Non destructive testing – Ultrasonic pulse echo system.

UNIT – III **9**

Laser and Applications: Spontaneous emission and stimulated emission – Population inversion – Pumping methods – Derivation of Einstein's coefficients (A&B) – Types of lasers – Nd:YAG laser, CO_2 laser, Semiconductor lasers: homojunction and heterojunction – Laser Applications – Industrial applications: laser welding, laser cutting, laser drilling – Holography – Construction and reconstruction of images.

UNIT – IV **9**

Fiber Optics and Applications: Principle and propagation of light through optical fibers – Derivation of numerical aperture and acceptance angle – Classification of optical fibers (based on refractive index, modes and materials) – Crucible-crucible technique for fiber fabrication – Sources (LED and LASER) and detectors (p-i-n photodiode and avalanche photodiode) for fiber optics - Fiber optical communication links – Losses in optical fibers – Fiber optic sensors – Temperature and displacement sensors.

UNIT – V **9**

Quantum Physics and Applications: Black body radiation – Planck's theory (derivation) – Compton effect (theory) – Matter waves – Uncertainty principle (qualitative) – Schroedinger's wave equations – Time independent and time dependent wave equations – Physical significance of wave function – Particle in a box (One dimensional) – Electron microscopes – Scanning electron microscope – Transmission electron microscope.

TOTAL : 45

TEXT BOOKS:

1. Tamilarasan K and Prabu K, "Engineering Physics-I", Tata McGraw Hill Education Private Limited, New Delhi, 2014.

REFERENCE BOOKS:

1. Gaur R.K. and Gupta S.L., "Engineering Physics", Dhanpat Rai and Sons, New Delhi, 2009.
2. Uma Mukherji, "Engineering Physics", Narosa Publishing House, New Delhi, 2011.
3. Laud B.B., "Lasers and non- linear optics", New Age International (p) Limited Publishers, New Delhi, 1996.
4. Ajoy Ghatak and Thyagarajan K., "Introduction to Fiber Optics", Cambridge University Press, New York, USA, 2000
5. Mehta and Neeraj, "Applied Physics for Engineers", Prentice-Hall of India Private Limited, New Delhi, 2011.
6. Douglas Brandt and Douglas C. Giancoli, "Physics for Scientists and Engineers", Prentice-Hall of India Private Limited, New Delhi, 2000.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Infer the extensive properties of matter and heat conduction in metal.
CO2: Demonstrate acoustically good buildings and non-destructive testing using ultrasonic waves.
CO3: Employ the laser in engineering and technology.
CO4: Sketch the principle of fiber optics and fiber optic communication link.
CO5: Interpret the concepts of quantum physics to optical phenomena and electrons in a metal.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		2						1		1		
CO2	3	3		2						1		1		
CO3	3	3		2						1		1		
CO4	3	3		2						1		1		
CO5	3	3		2						1		1		

1 – Slight, 2 – Moderate, 3 – Substantial

14CYT11 APPLIED CHEMISTRY

(Common to all Engineering and Technology branches)

3 0 0 3

UNIT – I **9**

Water: Introduction - Sources of water - Impurities in water - Types of water - Water quality standards - Water quality parameters (Brief discussion only) - Hardness of water- Expression of hardness - Units of hardness –Estimation of Hardness of water by EDTA method – Determination of alkalinity - Disadvantages of using hard water - Boiler troubles due to hard water - scale and sludge formation – boiler corrosion – caustic embrittlement- priming and foaming- Softening of water- External treatment methods - zeolite and demineralization process (principle, process, advantages and disadvantages only) - Internal treatment process - colloidal, carbonate, calgon and phosphate conditioning (brief discussion only) - desalination by reverse osmosis method

UNIT – II **9**

Electrochemistry: Introduction – Electrolytic and Electrochemical Cells – Representation of a galvanic cell - Reversible and Irreversible cells - EMF and its determinations – Electrode potential - Nernst Equation – Reference electrodes (hydrogen and calomel electrodes) – Electrochemical series and its applications – Conductometric titrations (strong acid vs strong base only) - Batteries (Lead Acid battery, NICAD, Lithium battery, Lithium Sulphur battery) – Proton exchange membrane cells.

UNIT – III **9**

Corrosion and Its Control: Introduction – Mechanism of chemical and electrochemical corrosion – galvanic corrosion - concentration cell corrosion – Galvanic series - Factors influencing rate of corrosion – corrosion control methods - Sacrificial anode and impressed current cathodic protection methods – Corrosion inhibitors - Protective coatings - classifications - Pretreatment of metal surface - Metallic coating -electroplating and electrolessplating (General discussion) - Hot dipping (Tinning and galvanising) - Non-metallic coating - surface conversion coating (phosphate coating and anodized coating) - Organic coating - paints – constituents and their function – Special paints (Fire retardant, temperature indicating, water repellant and luminescent paints)

UNIT – IV **9**

Fuels: Coal and its varieties – proximate and ultimate analysis – their significance – metallurgical coke - Otto-Hoffman byproduct method - Liquid fuel - refining of petroleum – Manufacture of synthetic petrol – Cracking - Polymerization - Hydrogenation of coal (Fisher Tropsch and Bergius methods) - knocking - octane number – improving octane number by additives – Diesel – cetane number – Gaseous fuels (Water gas and LPG).

Combustion: Introduction – Calorific Values – Gross and Net Calorific Values – Dulong's formula (simple problems)- Flue gas analysis by Orsat's method - Explosive range and Spontaneous Ignition Temperature

UNIT – V **9**

Polymers: Introduction – Nomenclature of polymers – functionality – polymerization - types – addition, condensation and co-polymerization with examples – Effect of polymer structure on properties (strength, plastic deformation, glass transition temperature and melting point of polymers (Tg and Tm), crystallinity and chemical resistance) - plastics – types (thermo and thermosetting plastics) - individual polymers - Polyethylene, Polypropylene, PVC, Teflon and Bakelite (preparation, properties and uses only) - Compounding of plastics- Fabrication of plastics (compression, injection and extrusion moulding methods) – conducting polymers

TOTAL : 45

TEXT BOOKS:

1. Palanisamy P.N, Geetha A, Manjula Rani K, "Applied Chemistry", 2nd Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2013.
2. Jain P C and Monica Jain, "Engineering Chemistry", 15th Edition, Dhanpat Rai Publication Co., New Delhi, 2008.

REFERENCE BOOKS:

1. Sharma B.K., "Engineering Chemistry", Krishna Prakasan Media (P) Ltd., Meerut, 2001.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill, New Delhi, 2008.
3. Krishnamurthy N., "Engineering Chemistry", 2nd Edition, PHI Learning Private Limited, New Delhi, 2008.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Get the basic knowledge of water quality parameters and treatment methods
CO2: Obtain the principles of electrochemical cells, EMF series and energy storing devices
CO3: Acquire the knowledge of the types and prevention methods of corrosion
CO4: Know the concepts and developments in combustion and various types of fuels.
CO5: Understand the knowledge about the types of polymers, plastics and moulding methods

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		2	1	2	3			3		3		
CO2	3	2		2	1	2	3			3		3		
CO3	3	2		2	1	2	3			3		3		
CO4	3	2		2	1	2	3			3		3		
CO5	3	2		2	1	2	3			3		3		

1 – Slight, 2 – Moderate, 3 – Substantial

14CSC11 PROBLEM SOLVING AND PROGRAMMING

(Common to all Engineering and Technology branches)

3 0 3 4

UNIT – I **9**

Introduction to Computer and Problem Solving: Overview of computers – Applications of computers-Characteristics of computer - Basic computer Organization – Number System - Problem solving: Planning the computer program – Algorithms - Flowcharts – Pseudo codes – Structuring the logic - Top-Down design.

UNIT – II **9**

Case Study on Problem Solving: Algorithm, Flowchart and Pseudo code for the problems: Exchanging the values of two variables – Finding the biggest number - Counting – Summation of numbers – Factorial computation – Generation of Fibonacci Sequence - Summation of series – Base Conversion - Reversing the digits of an Integer.

UNIT – III **9**

Introduction to C and Control Statements: Overview of C – Basic structure of a C Program – Executing a C Program – C Character set – Tokens – Keywords and Identifiers – Constants – Variables – Data types - Storage classes - Managing Input and Output operations – Operators and Expressions - Decision making and Branching - Looping – break and continue statements.

UNIT – IV **9**

Arrays, Strings and Functions: Arrays – One dimensional and Two dimensional arrays - Handling of character strings: Declaring and initializing string variables – String handling functions - Library functions – User defined functions: Elements of User defined Functions – nesting of functions – passing arrays to function – passing strings to functions - recursion.

UNIT – V **9**

Structures, Unions and Pointers: Structure definition – Structure declaration – Accessing a structure member- Structure initialization – Array of Structures - Arrays within structures –Structures within Structures – Structures and Functions , Unions. Understanding pointers – Accessing address of a variable – Declaring pointer variables – Initialization of pointer variables – accessing a variable through its pointer – Pass by value vs. Pass by pointers.

Lecture: 45, Practical: 45, TOTAL: 90

REFERENCE BOOKS:

1. Dromey R.G., "How to Solve it by Computer", Pearson Education, 2009.
2. Balagurusamy E., "Fundamentals of Computing and Programming", Tata McGraw-Hill Education Pvt. Ltd, 2010.
3. Stephen G. Kochan, "Programming in C", 3rd Edition, Pearson Education, 2005.
4. Yashavant P. Kanetkar, " Let Us C", BPB Publications, 2011.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: apply fundamental principles of problem solving techniques
CO2: develop algorithm, flowchart and pseudo code to provide solutions to problems
CO3: develop programs using basic programming principles of C language
CO4: implement modular programming concepts using functions
CO5: design simple applications using arrays, structures and pointers

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3		2							2		
CO2	3	3	1		2							2		
CO3	3	3	2	1	2							2		
CO4	3	3	3	2								2		
CO5	3	3	3	2	2							2		

1 – Slight, 2 – Moderate, 3 – Substantial

14EET11 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

(Common to all Engineering and Technology branches)

3 0 0 3

UNIT- I **9**

Introduction to Power Systems: Introduction: Electric Potential, Current, Power and Energy. Generation of Electrical Energy: Sources of Energy - Renewable and Non Renewable - Power Generation: Thermal, Hydro and Nuclear Power plants - Solar and Wind (schematic arrangement and operation) Power plants - Structure of Electric Power System - Transmission and Distribution Voltages. Electrical Safety Aspects - Phase-Neutral - Earthing: Need for Earthing and Types - Domestic Wiring (Simple and staircase) - Energy Conservation and Sustainability.

UNIT - II **9**

DC Circuits and AC Circuits: Resistance: Resistors in Series and Parallel - Network Reduction - Voltage and Current Division Rule - Ohm's Law- Kirchhoff's Laws - Mesh Analysis of Simple Resistive Networks.

Single phase systems: Alternating (Sinusoidal) Voltage and Current, R.M.S and Average Value, Power Factor, Form Factor and Peak Factor - AC Series Circuits (RL, RC & RLC). Three phase Systems (Qualitative only): Star and Delta Connected Systems - Line and Phase Voltage/Current - Three Phase Power Measurement by Two Wattmeter Method.

UNIT - III **9**

Electrical Machines: DC Machines: Construction, Principle of Operation of DC Motor-Torque Equation, Types and Applications. AC Machines: Construction and Working Principle of AC Generator , Single Phase Transformer, Three Phase Induction Motor and Single Phase Induction Motor (Split Phase and Capacitor Start Induction Motor) - Applications.

UNIT - IV **9**

Basic Electronics: PN Junction Diode - Operation of Rectifiers (Half wave, Full wave - Bridge Rectifiers with waveforms) and Filters - Zener Diodes - Zener Diode as Voltage Regulator - IC Voltage Regulators (78XX & 79XX) - Transistors: Types - Operation of NPN Transistor - Transistor as an Amplifier - Operation and Characteristics of SCR - UPS and SMPS (Block Diagram approach).

UNIT - V **9**

Digital Electronics: Introduction – Binary Number Systems and Conversions - Binary Addition and Subtraction - Logic Gates and Truth tables - Boolean Algebra - Basic Laws and Demorgan's theorem - Simplification of Boolean Functions - Full Adder and Full Subtractor - Flip Flops - Counters: Asynchronous Binary Ripple Counter .

TOTAL: 45

TEXT BOOKS:

1. Prasad P.V., Sivanagaraju S. and Prasad R., "Basics of Electrical and Electronics Engineering", 1st Edition, Cengage Learning, 2013.
2. Muthusubramanian R. and Salivahanan S., "Basics of Electrical and Electronics Engineering", 1st Edition ,Tata McGraw Hill, 2009.

REFERENCE BOOKS:

1. Jegathesan V., Vinoth Kumar K. and Saravanakumar R., "Basic Electrical and Electronics Engineering", 1st Edition, Wiley India, 2011.
2. Sukhija M.S. and Nagsarkar T.K., "Basics of Electrical and Electronics Engineering", 1st Edition ,Oxford University Press, 2012.
3. Smarajit Ghosh, "Fundamentals of Electrical and Electronics Engineering", 2nd Edition, PHI Learning, 2007.
4. Edward Hughes, Ian McKenzie Smith, Dr. John Hiley and Keith Brown, "Electrical and Electronics Technology", 8th Edition, Pearson Education, 2012.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: develop a basic understanding of the concept of electrical systems
CO2: analyze the DC and AC circuits
CO3: interpret the construction and working of different types of electric machines
CO4: discuss the basic electronic components
CO5: distinguish analog and digital electronics

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3									1		
CO2	3	3	3									1		
CO3	3	3	3									1		
CO4	3	3	3									1		
CO5	3	3	3									1		

1 – Slight, 2 – Moderate, 3 – Substantial

14PHL11 PHYSICAL SCIENCES LABORATORY I

(Common to all Engineering and Technology branches)

0 0 3 1

PART-A: APPLIED PHYSICS LABORATORY

(Any five experiments)

LIST OF EXPERIMENTS:

1. Determination of Young's modulus of a given material using uniform bending.
2. Determination of thermal conductivity of bad conductor using Lee's disc arrangement.
3. Determination of velocity of ultrasonic waves in liquid and compressibility of liquid using ultrasonic interferometer.
4. (a) Particle size determination using diode laser.

(b) Determination of wavelength of laser

5. Determination of specific resistance of a given coil of wire using Carey Foster bridge.
6. Determination of wavelength of Hg spectrum using spectrometer and grating.

Demonstration

1. Measurement of efficiency of a solar cell
2. Non destructive testing
3. Tyndall effect

PART-B: APPLIED CHEMISTRY LABORATORY

(Any five experiments)

LIST OF EXPERIMENTS:

1. Estimation of Total, Temporary and Permanent hardness of water by EDTA method.
2. Estimation of Ca^{2+} and Mg^{2+} hardness separately by EDTA method.
3. Estimation of Alkalinity of the given water sample.
4. Conductometric titration - Mixture of acids.
5. Estimation of Hydrochloric acid using pH meter.
6. Estimation of Ferrous ion by potentiometric titration.

Demonstration

1. Distillation system
2. RO water treatment system
3. UV Spectrophotometer

REFERENCES / MANUALS / SOFTWARE:

1. Physics Laboratory Manual –Dr.K.Tamilarasan and Dr.K.Prabu
2. Chemistry Laboratory Manual- Dr.P.N.Palanisamy, P.Manikandan, A.Geetha and K.Manjularani

TOTAL : 45

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Describe the basics of modulus of elasticity, thermal conductivity, ultrasonics and compressibility of water, laser parameters, specific resistance of electrical conductors, and interference and diffraction of light waves.

CO2: Operate thebasic measuring devices, travelling microscope, Lee's disc arrangement, ultrasonic interferometer, Carrey Foster bridge and spectrometer, and to measure the related physical parameters.

CO3: Analyze the hardness, amount of Ca^{2+} and Mg^{2+} ions, and presence of alkalinity in water.

CO4: Employ the instruments like pH meter, conductivity meter and potentiometer for the estimation of unknown concentration of acids and ferrous ion.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		2						1		1		
CO2	3	3		2						1		1		
CO3	3	2		2						3		3		
CO4	3	2		2						3		3		

1 – Slight, 2 – Moderate, 3 – Substantial

14EEL11 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

(Common to all Engineering and Technology branches)

0 0 3 1

LIST OF EXPERIMENTS:

1. Control of incandescent and fluorescent lamp by simple and stair-case wiring
2. Resistor color coding and verification of Ohm's Law and Kirchhoff's Laws
3. Measurement of real power, reactive power, power factor and impedance of RC, RL and RLC circuits.
4. Measurement of Earth's resistance
5. Load test on DC shunt motor
6. Performance characteristics of single phase Transformer
7. Load test on single phase induction motor.
8. Verification of basic logic gates and their truth tables.
9. Implementation of Half wave and Full wave Rectifier with simple Capacitor Filter
10. Study of Mixie, Ceiling Fan and Vacuum Cleaner

TOTAL : 45

REFERENCES / MANUALS / SOFTWARE:

1. Lab Manuals

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: create a basic electrical connections for domestic applications
CO2: test basic electrical machines like transformer and DC motors
CO3: construct and analyze basic electronic circuits
CO4: measure the various electrical parameters of the circuit
CO5: explain the working of various domestic appliances

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3									2		
CO2	3	3	3									2		
CO3	3	3	3						2			2		
CO4	3	3	3									2		
CO5	3	3	3					1				2		

1 – Slight, 2 – Moderate, 3 – Substantial

14EGT21 COMMUNICATIVE ENGLISH II

(Common to all Engineering and Technology branches)

3 0 0 3

UNIT – I **9**

Functional Grammar: Sentences – Affirmative / Negative – Asking questions in the simple present – Using reference words - Cause and Effect expressions. **Listening:** Listening practice - listening to different types of conversation and answering questions - listening to Audio texts and completing cloze exercises. **Speaking:** Opening a conversation and getting acquainted with people. **Reading:** Reading excerpts from a novel, itinerary, magazine and news paper articles. **Writing:** Formal Letter writing – Job Application Letter – CV and Resume – Writing Instructions

UNIT – II **9**

Functional Grammar: Sentences – Interrogative & WH questions - SI units – Numerical Adjectives

Listening: Listening to situation based dialogues – listening to short and long conversations in different domains of activity. **Speaking** : Conversation practice in real life situations, describing places, narration, introducing ideas. **Reading:** Reading historic writing – biographical writing – Non fictional book extracts and news feeds. **Writing:** Filling Forms – Academic Writing - Basics of Business Writing – Calling for Quotation, Placing Orders, Letter of Complaint

UNIT – III **9**

Functional Grammar: Sentences – Imperative – Gerunds & Infinitives - Commonly confused words. **Listening:** Understanding the structure of conversations - Listening to academic lectures and live speech – advertisements and announcements. **Speaking:** Giving and Justifying opinions – apologizing – extempore. **Reading:** Reading Blogs - Website articles – e-mails. **Writing:** e-mails – Tweets – Texting and SMS language

UNIT – IV **9**

Functional Grammar: Transformation of Sentences – Simple, Compound and Complex - Vocabulary (single word substitute) – conjunctions - reporting verbs – Direct and Indirect speech. **Listening:** Listening to a telephone conversation, viewing of model interviews (face–to–face, telephonic and video conferencing). **Speaking:** Giving instructions – Role play – Interviews. **Reading:** Reading job advertisements and profile of the company concerned **Writing:** Writing Reports - Preparing a Check list

UNIT – V **9**

Grammar: Analyzing sentence structures in a given short passage - Identifying parts of speech in a given short passage. **Listening:** Viewing a model group discussion and reviewing the performance of each participant – identifying the characteristics of a good listener – casual conversation. **Speaking:** Group discussion skills – initiating, turn taking and concluding the discussion. **Reading:** Making notes from long passages or any form of written materials – providing a suitable title – identifying main points, supporting points. **Writing:** Email writing – Effective use of email.

TOTAL: 45

TEXT BOOKS :

1. Dr. Elango et al. "Resonance: English for Engineers and Technologists", Foundation, Chennai, 2013.

REFERENCE BOOKS:

1. Anderson, Paul V., " Technical Communication **:** A Reader–Centered Approach", Cengage.
2. Muralikrishna and Sunita Mishra, "Communication Skills for Engineers", Pearson, New Delhi, 2011.
3. Sharma, Sangeetha and Binod Mishra, "Communication Skills for Engineers and Scientists", PHI Learning, New Delhi, 2009.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: speak effectively, express their opinions clearly, initiate and sustain a discussion and also negotiate using appropriate communicative strategies

CO2: write effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing

CO3: read different genres of texts, infer implied meanings and critically analyze and evaluate them for ideas as well as for method of presentation

CO4: listen and comprehend different spoken excerpts critically and infer unspoken and implied meanings

CO5: use functional grammar for improving employment oriented skills

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						2			2	3		2		
CO2						1			1	3		1		
CO3						2			1	3		2		
CO4						1			2	3		2		
CO5						1			1	3		1		

1 – Slight, 2 – Moderate, 3 – Substantial

14MAT21 MATHEMATICS II

(Common to all Engineering and Technology branches)

3 1 0 4

Pre-requisites: Basic ideas of integration, Basic ideas of vectors and complex numbers

UNIT – I **9**

Multiple Integrals: Double integration in Cartesian coordinates – Change of order of integration – Area between two curves – Triple integration in Cartesian coordinates –Volume as Triple integrals (Simple problems only).

UNIT – II **9**

Vector Calculus: Gradient of a scalar point function – Directional derivative – Divergence of a vector point function – Curl of a vector – Irrotational and Solenoidal vectors – Line Integral, Surface integral and Volume integral (Concept only) – Green's, Stoke's and Gauss divergence theorems (Statement only) – Verification of the above theorems and evaluation of integrals using them (Simple problems only).

UNIT – III **9**

Analytic Functions: Functions of a complex variable – Analytic functions – Necessary conditions and Sufficient conditions (excluding proofs) – Cauchy– Riemann equations (Statement only) – Properties of analytic function (Statement only) – Harmonic functions – Construction of Analytic functions – Conformal mapping: $w = z + a$, az, $1/z$ – Bilinear transformation.

UNIT – IV **9**

Complex Integration: Cauchy's theorem and Cauchy's integral formula (Statement and applications) – Taylor's and Laurent series – Singularities – Classification – Cauchy's Residue theorem (Statement only) – Contour integration – circular and semi-circular contours (excluding poles on real axis).

UNIT – V **9**

Laplace Transform: Conditions for existence – Transform of elementary functions – Basic properties – Derivatives and integrals of transforms – Transforms of derivatives and integrals – Initial and final value theorems – Transform of unit step function – Transform of periodic functions - Inverse Laplace transform of elementary functions – Partial fraction method – Convolution theorem (Statement only) – Solution of linear ODE of second order with constant coefficients.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

1. Kandasamy P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics For First Year B.E/B.Tech", Reprint Edition 2014, S.Chand and Co., New Delhi.
2. Veerarajan T., "Engineering Mathematics", (for first year), Reprint Edition 2013, Tata McGraw-Hill, New Delhi.

REFERENCE BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publications, New Delhi, 2011.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", 4th Edition, Narosa Publishing House, New Delhi, Reprint 2014.
3. Bali N.P. and Manish Goyal, "Text Book of Engineering Mathematics", 8th Edition, Laxmi Publications, New Delhi, 2011.
4. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2011.
5. Kreyszig E., "Advanced Engineering Mathematics", 10th Edition, John Wiley Sons, 2010.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Solve problems involving double and triple integrals.
CO2: Apply the concept of vectors in engineering problems.
CO3: Have a clear idea about functions of complex variables and analytic function which are widely used in study of fluid and heat flow problems.
CO4: Evaluate complex integrals which is extensively applied in engineering.
CO5: Handle Laplace transforms to solve practical problems.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1								1		
CO2	3	3	1	1								1		
CO3	3	3										1		
CO4	3	3	1	1								1		
CO5	3	3	1	1								1		

1 – Slight, 2 – Moderate, 3 – Substantial

14PHT21 MATERIALS SCIENCE

(Common to all Engineering and Technology branches)

3 0 0 3

UNIT – I **9**

Crystal Physics: Crystalline and amorphous solids – Lattice – Unit cell – Crystal systems – Bravais lattice – Lattice planes – Miller indices – Derivation of '*d*' spacing in cubic lattice – Atomic radius – Coordination number– Packing factor for SC, BCC, FCC and HCP structures – Crystal imperfections: Point and line imperfections.

UNIT – II **9**

Conducting Materials: Conductors – Classical free electron theory of metals – Electrical and thermal conductivities – Wiedemann–Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi function – Density of energy states – Carrier concentration in metals.

UNIT – III **9**

Semiconducting Materials: Intrinsic semiconductor – Carrier concentration derivation – Electrical conductivity and band gap (theory) – Extrinsic semiconductors – Carrier concentration derivation in n-type and p-type semiconductors – Hall effect – Determination of Hall coefficient – Applications –Solar cell – LDR.

UNIT – IV **9**

Magnetic and Superconducting Materials: Magnetic materials - Types of magnetic materials (qualitative) – Domain theory – Hysteresis – Soft and hard magnetic materials – Applications - Transformer core – Magneto optical recording – Superconductors – Properties – Types of superconductors – BCS theory of superconductivity (qualitative) – Josephson effect - Applications of superconductors – SQUID – Cryotron – Magnetic levitation. **Dielectric Materials:** Dielectric constant – Qualitative study of polarization – Frequency and temperature dependence of polarization – Dielectric loss – Dielectric breakdown – Uses of dielectric materials (capacitor) – Ferro electric materials (qualitative).

UNIT – V **9**

Smart Materials: Metallic glasses: Preparation (Melt spinning method only), properties and applications – Shape memory alloys (SMA): Characteristics and applications. **Nano Materials:** Low dimensional structures (quantum dot, wire and well) – Features of nano materials – Synthesis: top down and bottom up approaches – Ball milling and lithographic methods – Physical and chemical vapor phase depositions – Sol gel method – Carbon nanotubes: Structures – Properties – Fabrication by laser ablation – Applications.

TOTAL : 45

TEXT BOOKS:

1. Tamilarasan K. and Prabu K., "Engineering Physics-II", Tata McGraw Hill Education Private Limited, New Delhi, 2014.

REFERENCE BOOKS:

1. Mehta and Neeraj, "Applied Physics for Engineers", Prentice-Hall of India Private Limited, New Delhi, 2011.
2. Raghavan V., "Materials Science and Engineering: A first course", 5th Edition, Prentice-Hall of India, New Delhi, 2009.
3. Poole Charles P. and Ownen Frank J., "Introduction to Nanotechnology", Wiley India, 2007.
4. William Fortune Smith and Javad Hashemi, "Foundations of Materials Science and Engineering", McGraw-Hill Education, 2006, New Delhi.
5. Pillai S.O., "Solid State Physics", 5th Edition, New Age International, New Delhi, 2003.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Explain the various crystal systems and crystal defects.
CO2: Comprehend the theory of conducting materials.
CO3: Classify the types of semiconducting materials and to illustrate the device applications.
CO4: Summarize the theory and applications of magnetic, superconducting and dielectric materials.
CO5: Outline the properties and applications of smart materials and nano materials.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		2						1		1		
CO2	3	3		2						1		1		
CO3	3	3		2						1		1		
CO4	3	3		2						1		1		
CO5	3	3		2						1		1		

1 – Slight, 2 – Moderate, 3 – Substantial

14CYT21 ENVIRONMENTAL SCIENCE

(Common to all Engineering and Technology branches)

3 0 0 3

UNIT – I **9**

Introduction to Environmental Studies and Natural Resources: Introduction to Environmental Science – Forest resources: Use and over-exploitation, deforestation, case studies. – Water resources: Use and over-utilization of surface and ground water, dams - benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture - effects of modern agriculture, fertilizer and pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies – Land resources: Land as a resource – Conservation Practices - Role of an individual in conservation of natural resources.

UNIT – II **9**

Ecosystems: Concept of an ecosystem – Components of an ecosystem - Structural and functional features – Functional attributes (Food chain and Food web only) –Ecological Succession- Introduction, types, characteristic features, structure and functions of the (a) Forest ecosystem (b) Aquatic ecosystems (ponds, rivers and oceans). **Biodiversity:** Introduction – Classification: genetic, species and ecosystem diversity – Bio geographical classification of India- Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic, option values and ecosystem service value – Biodiversity at global, national and local level- Hotspots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – In-situ and Ex-situ conservation of biodiversity.

UNIT – III **9**

Environmental Pollution: Definition – Causes, effects and control measures of: (a) Air pollution - Climate change, global warming, acid rain, ozone layer depletion (b)Water pollution (c) Soil pollution - Solid waste Management - Disaster management: floods, earthquake, cyclones and landslides - Role of an individual in prevention of pollution - Case studies. **Water Treatment methods:** Treatment of Water for Domestic Supply (Screening, Aeration, Sedimentation with Coagulation, Filtration and Disinfection methods) - Break point chlorination- Estimation of dissolved oxygen, BOD and COD - Sewage treatment (Primary, Secondary & Tertiary methods) – Introduction to industrial wastewater treatment using Reverse Osmosis Technology- Membrane Technology for wastewater treatment - Activated carbon in pollution abatement of wastewater.

UNIT – IV **9**

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation– Environmental ethics - Wasteland reclamation – Environment Production Act – Air (Prevention and control of pollution) Act – Water (Prevention and control of pollution) Act – Wildlife protection Act – Forest conservation Act – Issues involved in enforcement of environmental legislation – Public awareness. **Human Population and the Environment:** Introduction - Population growth - Variation of population based on age structure - Variation among nations – Population explosion – Family welfare programme – Value Education – HIV / AIDS – Women and Child welfare – Role of Information Technology in Environment and human health – Case studies.

UNIT – V **9**

Green Chemistry for Sustainable Future: Water the greenest solvent – Role of catalyst – Biopolymers – Biofertilizers – Principle and applications of green chemistry. **Food and Human Health:** Introduction – Classification and applications of carbohydrates, amino acids, proteins, lipids and vitamins – Food additives – Balanced food – Minerals rich, carbohydrates rich and proteins rich – Chemistry of soft drinks – Oils and fats – Simple tests for identification of adulterants in food stuffs – Impacts of fluoride and arsenic on human health – Fluoride and arsenic removal methods – Significance of iodine, iron and calcium content in human health.

TOTAL : 45

TEXT BOOKS:

1. Palanisamy P.N., Manikandan P., Geetha A., Manjula Rani K., "Environmental Science", Pearson Education, New Delhi, Revised Edition 2014.
2. Anubha Kaushik, and Kaushik C.P., "Environmental Science and Engineering", 4th multicolour Edition, New Age International (P) Ltd., New Delhi, 2014.

REFERENCE BOOKS:

1. Erach Bharucha, "Textbook of Environmental Studies for Undergraduate Courses", 2005, University Grands Commission, Universities Press India Private Limited, Hyderguda, Hyderabad.
2. Uppal M.M. revised by Bhatia S.C., "Environmental Chemistry", 6th Edition, Khanna Publishers, New Delhi, 2002.
3. Bahl B.S. and Arun Bahl, "Advanced Organic Chemistry", 3rd Edition, S. Chand & Co., New Delhi, 2005.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Know the types of natural resources and the individual role in conserving the resources
CO2: Understand the ecological balance and the preservation of biodiversity
CO3: Gain the knowledge of the various types of pollution and the waste water treatment methods
CO4: Attain the knowledge of various social issues and impact of population explosion on environment
CO5: Know about the green chemistry for sustainable future, food and human health

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1					2	3	3		3		2		
CO2	3	2				2	3	3		3		2		
CO3	3	2				2	3	3		3		2		
CO4	3	2				2	3	3		3		2		
CO5	3	2				2	3	3		3		2		

1 – Slight, 2 – Moderate, 3 – Substantial

14MET11 BASICS OF CIVIL AND MECHANICAL ENGINEERING

(Common to all Engineering and Technology branches)

3 0 0 3

PART-A: CIVIL ENGINEERING

UNIT – I **5**

Introduction: History of civil engineering - Role and Functions of civil engineer - Fields of civil engineering

UNIT– II **5**

Building Materials: Introduction – Properties and applications of Construction Materials – bricks – stones – sand – cement – mortar- concrete – steel – glass-wood –plastics- ceramics -rubber- FRP – Non ferrous materials - Geosynthetics – Smart materials.

UNIT – III **4**

Sub Structure: Soil **–** classification- bearing capacity- foundation -function- requirements- types-failures -remedial measures- machine foundation

UNIT – IV **4**

Super Structures: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering- damp proofing- weathering course

UNIT – V **4**

Interior design and Landscaping: History of Interior design-Importance of Interior design- Basic elements of Interior design. Landscape Architecture-Elements of Landscaping- Green Engineering

PART-B: MECHANICAL ENGINEERING

UNIT – I **5**

Thermal Science: Laws of thermodynamics and their applications – Principle of operation of Steam, Diesel, Hydro-electric and Nuclear power plants - Classification of internal combustion engines and their working principles – Components of basic Vapour Compression Refrigeration system.

UNIT – II **4**

Fluid Science: Properties of fluids – Classification of hydraulic turbines, working principle of Pelton turbine – Applications of steam and gas turbines. Classification of pumps, working principle of centrifugal and reciprocating pump

UNIT – III **4**

Mechanics and Materials: Classification of engineering materials - Mechanical properties of engineering materials- Definition and importance of stress and strain - Definition and importance of centre of gravity and moment of inertia.

UNIT – IV **5**

Mechanical Components And Their Applications: Basic principles and applications of power transmission systems such as belt, rope, chain and gear drives – Function and principles of coupling, clutch, brake, flywheel and governor

UNIT – V **5**

Manufacturing Technology: Principle and applications of Metal forming process – Foundry, Forging. Principle and applications of Metal Joining process – Welding, Soldering and Brazing, Basics of CAD/CAM/CIM.

TOTAL : 45

TEXT BOOKS:

1. Palanichamy M.S., "Basic Civil Engineering", Tata McGraw-Hill, New Delhi, 2006.
2. Pravin Kumar, "Basic Mechanical Engineering", Pearson Publishers, New Delhi, 2013.

REFERENCE BOOKS:

1. Rangawala S.C., "Engineering Materials" Charotor Publishing House(P) Ltd., Anand, 2013.
2. Punmia B.C., Ashok Kumar Jain, Arun Kumar Jain, "Building Construction," Laximi Publications (P) Ltd., NewDelhi, 2005.
3. Shanmugam G., "Basic Mechanical Engineering", Tata McGraw-Hill, New Delhi, 2005.
4. Venugopal K. and Prabhu Raja V., "Basic Mechanical Engineering", 6th Edition, Anuradha Publishers, Kumbakonam, 2005.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: select the suitable materials and components required for building construction
CO2: demonstrate an understanding of basic concepts in thermal engineering
CO3: demonstrate an understanding of basic concepts in fluid mechanics and fluid machines
CO4: demonstrate an understanding of basic concepts in engineering mechanics and materials
CO5: demonstrate an understanding of principles and applications of different mechanical components.
CO6: demonstrate an understanding of principles and applications of various manufacturing process

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2		2	1	2			2		2		
CO2	3	2	2		2	1	2			2		2		
CO3	3	2	2		2	1	2			2		2		
CO4	3	2	2		2	1	2			2		2		
CO5	3	2	2		2	1	2			2		2		
CO6	3	2	2		2	1	2			2		2		

1 – Slight, 2 – Moderate, 3 – Substantial

14MEC11 ENGINEERING DRAWING

(Common to all Engineering and Technology branches)

2 0 3 3

Pre-requisites: Basic knowledge in practical geometry construction and mathematics

UNIT – I **9**

General Principles of Orthographic Projection: Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning. Projections of Points, Lines and Planes. General principles of orthographic projection – First angle projection – Layout of views – Projection of points, located in all quadrant and straight lines located in the first quadrant – Determination of true lengths and true inclinations and location of traces – Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT – II **9**

Projections of Solid: Projections of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

UNIT – III **9**

Sectioning of Solids: Sectioning of solids- prisms, pyramids, cylinder and cone in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other – Obtaining true shape of section.

UNIT – IV **9**

Development of Surfaces: Development of lateral surfaces of simple and truncated solids – prisms, pyramids, cylinders and cone with cutout, perpendicular and inclined to the horizontal axis.

UNIT – V **9**

Isometric and Perspective Projection: Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones Conversion of isometric projection into orthographic projection. Perspective projection of prisms, pyramids and cylinders by visual ray method.

TOTAL : 45

TEXT BOOKS:

1. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw-Hill, New Delhi, 2008.
2. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, New Delhi, 2008.

REFERENCE BOOKS:

1. Bhatt N.D., "Engineering Drawing", 46th Edition, Charotar Publishing House, Anand, 2003.
2. Gopalakrishnana K.R., "Engineering Drawing", Volume. I & II, Subhas Publications, Bangaluru, 2006.
3. Dhananjay A. Jolhe, "Engineering Drawing with an introduction to AutoCAD", Tata McGraw Hill, New Delhi, 2008.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: gain knowledge on international standards of drawings and to draw the different types of projections for points, lines and planes

CO2: draw the different positions of 3D primitive objects like cube, cone, cylinder, etc.

CO3: draw sections of solids including prisms, pyramids, cylinders and cones

CO4: understand the concepts of development of surfaces of simple and truncated solids

CO5: draw the isometric and perspective projections for the given object

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3		2	1				2		2		
CO2	3	2	3		2	1				2		2		
CO3	3	2	3		2	1				2		2		
CO4	3	2	3		2	1				2		2		
CO5	3	2	3		2	1				2		2		

1 – Slight, 2 – Moderate, 3 – Substantial

14VEC11 VALUE EDUCATION

(Common to all Engineering and Technology branches)

0 2 1 1

UNIT – I **6**

Philosophy of Life Science: Life – Purpose of life (four stages of life) – Philosophy of life (who am 'I') – Law of nature (cause of the life and body) – Content of the Life (five sheaths) – Goal of life. Five duties in life.
Methodology: Life and messages of spiritual and national leaders– The forgotten hero, etc.
Project report: Complementing with happiness - Every soul is potentially divine

UNIT – II **6**

Human Values-Moral foundation: Truth, forgiveness, compassion, endurance, humility, non violence, moderate diet, non stealing, self purification, self discipline, self study, content, cleanliness, honesty, and totality in faith– Good habits – Attitude forming for Individual peace.
Practical Methods: Personal experience with above characters, Puranic Stories - Self resolve diary maintenance

UNIT – III **6**

Social Values: Family – Family System - Greatness of women – World brotherhood (vasudeiva kudumbagam) – Glorious Bharath - Bharathian systems - Past –Present – Future - Team spirit - Goal setting – Economics – Education – Politics – Responsibilities of people – Preserving natural resources.
Methodology: Preparing an album on glorious Bharath Past, Present and Future Plans. Goal setting - Management Games. Team Spirit - Yogic Games.

UNIT – IV **6**

Development of Mental Prosperity: Prosperity of mind – Functions of mind - Obstacles of mind - Practical method to perfect mind is yoga – Types – Uses – Precaution – Contradiction – Kriyas - Asanas – Pranayamas – Meditative techniques.
Methodology: Asana - Pranayama – Cyclic meditation – Nada anu sandhana – Meditation – Yogic games for memory. Album on asanas , pranayama and mantra.

UNIT – V **6**

Maintenance of Physical Health: Human body – Structure - Ten Systems of the body as per modern science. Five elements - Harmonious relationship – Life force – Conserving vitality & health through natural life – Pranic food and its importance – Uses of herbs - Right way of cooking to preserve nutrients - Cause of the disease – Acute and chronic - Disease - Life and death.
Methodology: Natural food making, traditional millet dishes. Asanas, pranayamas, cleansing procedures, Quiz on healthy living, Uses of herbs or kitchen garden.

TOTAL : 30

TEXT BOOK:

1. "Value Education", compiled by Vethathiri Maharishi Institute for Spiritual and Intuitional Education, Aliyar, Pollachi, for Kongu Engineering College.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: understand the purpose and value of life
CO2: exhibit positive human values
CO3: understand social values
CO4: take steps to develop mental and physical health

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14PHL21 PHYSICAL SCIENCES LABORATORY II

(Common to all Engineering and Technology branches)

0 0 3 1

PART-A: APPLIED PHYSICS LABORATORY

(Any five experiments)

LIST OF EXPERIMENTS:

1. Determination of band gap of a semiconductor material using post office box.
2. Determination of dispersive power of a prism using spectrometer.
3. Determination of viscosity of liquid - Poiseuille's method.
4. Determination of thickness of a thin wire – air wedge method.
5. Determination of AC frequency using Melde's string experiment.
6. Determination of hysteresis loss in a ferromagnetic material.

Demonstration

1. Thin film deposition using RF magnetron sputtering technique
2. Synthesis of nano-particles
3. Phase change memory materials - RW CD / DVD

PART - B: APPLIED CHEMISTRY LABORATORY

(Any five experiments)

LIST OF EXPERIMENTS:

1. Estimation of Chloride in the given water sample.
2. Determination of Dissolved Oxygen in the given wastewater sample.
3. Estimation of Ferrous ion in the given solution.
4. Estimation of Copper in the given solution by Iodometric method.
5. Estimation of Chromium (Cr^{6+}) in the wastewater.
6. Estimation of copper content of the given solution by EDTA method.

Demonstration

1. Turbidity measurement using Nephelometer
2. COD analyzer
3. Dissolved Oxygen measurement using DO analyzer

TOTAL : 45

REFERENCES / MANUALS / SOFTWARE:

1. Physics Laboratory Manual –Dr.K.Tamilarasan and Dr.K.Prabu
2. Chemistry Laboratory Manual- Dr.P.N.Palanisamy, P.Manikandan, A.Geetha and K.Manjularani

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Describe **t**he basics of band gap of semiconductors, dispersive power of a prism, viscosity of liquids, interference of light, AC frequency and hysteresis of ferromagnetic materials.

CO2: Operate the instruments like post office box, air wedge arrangement, Melde's string apparatus and hysteresis arrangement, and to measure the related parameters

CO3: Estimate the amount of DO and chloride in a given water sample

CO4: Determine the amount of chromium, ferrous ion and copper in waste water

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		2						1		1		
CO2	3	3		2						1		1		
CO3	3	2		2						3		3		
CO4	3	2		2						3		3		

1 – Slight, 2 – Moderate, 3 – Substantial

14MEL11 BASICS OF CIVIL AND MECHANICAL ENGINEERING LABORATORY

(Common to all Engineering and Technology branches)

0 0 3 1

LIST OF EXPERIMENTS:

1. To prepare a square or rectangular shaped two identical MS plates by cutting and filing operations
2. To prepare a square/rectangular/circular/trapezoidal/Vshaped projection and its counterpart formating from the given square or rectangular MS plates.
3. To carryout drilling, tapping and assembly on the given MS plates.
4. To carryout thread forming on a GI and PVC pipes and cut to the required length.
5. To use various pipe fitting accessories and prepare water leak proof water line from overhead tank.
6. To prepare a T/L/Lap joint from the given wooden work pieces.
7. To prepare a plywood box/tray to the given dimensions.
8. To prepare a leak proof sheet metal tray/box/funnel to the given dimensions.
9. Cutting of MS plates by gas cutting method and arc weld joining by Lap/Butt/T joint method
10. Preparing a simple PVC window/door frame assembly.
11. Preparing a simple memento or similar articles using wood/sheet metal
12. Preparing innovative articles involving waste metals.

TOTAL : 45

REFERENCES / MANUALS / SOFTWARE:

1. Introduction to basic manufacturing processes and workshop technology by Rajender Singh, New Age International (P) Limited, 2006.
2. Elements of Workshop Technology by S.K.Hajra Choudhury, Media Promoters, 2009.

CO1: demonstrate knowledge on safety and adhere to safety features

CO2: mark the given dimensions accurately and execute cutting and joining operations

CO3: select methods and tools and execute the given experiments

CO4: finish the job to the requirements and quantify the accuracy

CO5: plan and complete simple and innovative articles

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2		2	2	1		2	2		2		
CO2	3	1	2		2	2	1		2	2		2		
CO3	3	1	2		2	2	1		2	2		2		
CO4	3	1	2		2	2	1		2	2		2		
CO5	3	1	2		2	2	1		2	2		2		

1 – Slight, 2 – Moderate, 3 – Substantial 1

14MAT31 MATHEMATICS III

(Common to all Engineering and Technology Branches)

3 1 0 4

UNIT – I **9**

Fourier Series: Dirichlet's conditions – General Fourier series – Change of interval - Odd and even functions – Half range Sine series – Half range Cosine series – Harmonic analysis.

UNIT – II **9**

Partial Differential Equations: Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Lagrange's linear equation – Homogeneous linear partial differential equations of higher order with constant coefficients.

UNIT – III **9**

Applications of Partial Differential Equations: Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two dimensional heat equation (excluding insulated edges).

UNIT – IV **9**

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

UNIT – V **9**

Z - Transform: Definition – Elementary properties – Z-transform of some basic functions – Inverse Z-transform – Partial fraction method – Residue method – Convolution theorem – Applications of Z-transforms – Solution of difference equations.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

1. Kandasamy P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics, Volume - III", Reprint Edition, S.Chand & Co., New Delhi, 2014.
2. Veerarajan T., "Transforms and Partial Differential Equations", 3rd Reprint, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2013.

REFERENCE BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, Delhi, 2014.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Reprint Edition, Narosa Publishing House, New Delhi, 2014.
3. Bali N.P. and Manish Goyal, "A Text Book of Engineering Mathematics", 9th Edition, Laxmi Publications, New Delhi, 2014.
4. Ramana B.V., "Higher Engineering Mathematics", 11th Reprint, Tata McGraw Hill Publishing Company, New Delhi, 2010.
5. Erwin Kreyzig, "Advanced Engineering Mathematics", 10th Edition, Wiley & Co, 2011.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: expand a function in terms of Fourier series and apply it for solving engineering problems

CO2: model and solve higher order partial differential equations

CO3: apply the methods of solving PDE in practical problems

CO4: gain knowledge on Fourier transforms

CO5: handle problems in Z transforms and apply it to solve difference equations

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1								1	2	
CO2	3	3	1	1								1	1	
CO3	3	3	1	1								1	1	
CO4	3	3	1	1								1	2	1
CO5	3	3	1	1								1	2	1

1 – Slight, 2 – Moderate, 3 – Substantial

14EET31 ELECTRICAL MACHINES I

3 1 0 4

Pre-requisites: Basics of Electrical and Electronics Engineering

UNIT – I **9**

DC Generators: Constructional Details – Working Principle – Types of Armature Winding and Connections – EMF Equation – Methods of Excitation – Characteristics of Series, Shunt and Compound Generators – Armature Reaction and Commutation – Parallel Operation – Losses, Efficiency and Power Stages in DC Generator – Condition for Maximum Efficiency – Applications.

UNIT – II **9**

DC Motors: Principle of Operation – Back EMF and Torque Equations – Types of DC Motors – Characteristics of Series, Shunt and Compound Motors – Losses, Efficiency and Power Stages in DC Motor – Condition for Maximum Efficiency – Applications.

UNIT – III **9**

Speed Control and Testing of DC Machines : Starters – Speed Control Methods – Separation of No Load Losses – Testing of DC Machines – Brake Test, Swinburne's Test, Retardation Test and Hopkinson's Test.

UNIT – IV **9**

Transformers: Constructional Details – Types – Principle of Operation – EMF Equation – Transformation Ratio – Phasor Diagram – Transformer on No Load and Load – Equivalent Circuit – OC and SC Test – Regulation – Parallel Operation – Auto Transformer – Saving of Copper.

UNIT – V **9**

Testing of Transformer: Losses and Efficiency in Transformers – Condition for Maximum Efficiency – Testing of Transformers – Polarity Test, Load Test – Phasing out Test – Sumpner's Test – Separation of Losses – All day Efficiency – Instrument Transformers – Three Phase Transformers – Types of Connections.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

1. Rajput R.K.," Electrical Machines", 5th Edition, Laxmi Publications, New Delhi, 2008.
2. Gupta J.B., "Electrical Machines", 4th Edition, S.K. Kataria & Sons, New Delhi, 2011, Reprint 2014.

REFERENCE BOOKS:

1. Kothari, D. P and Nagrath, I. J, "Electric Machines", 4th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2010.
2. Fitzgerald, A.E., Kingsley and Stephen Umans, "Electric Machinery", 6th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2010.
3. Bimbra P.S., "Electrical Machinery", 7th Edition, Khanna Publishers, New Delhi, 2011.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: illustrate the construction and working principle of DC machines

CO2: explain the construction and working principle of transformers

CO3: assess the various testing methods of DC machines

CO4: distinguish various starting and speed control methods of DC motors

CO5: elaborate the various testing methods of Transformer

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		3									1	
CO2	3	1		3									1	
CO3	3	3	1	3								1	2	
CO4	3	3	1	3								1	2	2
CO5	3	1		3						1		1	2	

1 – Slight, 2 – Moderate, 3 – Substantial

14EIT32 ELECTRON DEVICES AND CIRCUITS

(Common to EIE & EEE branches)

3 1 0 4

Pre requisite: Basics of Electrical and Electronics Engineering.

UNIT – I **9**

Diodes and Special Devices: Semiconductors – Intrinsic and Extrinsic semiconductor – Theory of PN junction diode – Current equation – Volt-Ampere characteristics – Transition and Diffusion Capacitances – Clipping and Clamping Circuits – Voltage multipliers using diodes – Characteristics of Zener Diode – Tunnel Diode – PIN Diode – Varactor Diode – Photodiodes – LED and LCD – Solar Cell.

UNIT – II **9**

Bipolar Junction Transistor: Construction and operation of a Transistor – Currents in transistor – Input and Output characteristics of a transistor in CE, CB and CC configurations– Current gain in CE, CB and CC configurations – Operating point – Stability and stability factor: Fixed bias circuits and Voltage-divider bias - Hybrid model of BJT.

UNIT – III **9**

FET, MOSFET and UJT: Construction and characteristics of JFET – Parameters of JFET – FET in CS, CD and CG Configurations – Construction, characteristics of MOSFET in Depletion and Enhancement mode – Applications of MOSFET – Construction, theory of operation and characteristics of UJT – UJT as relaxation oscillator.

UNIT – IV **9**

Differential, Tuned and Power Amplifiers: Differential amplifier using BJT– Differential and common mode gain, CMRR – Characteristics of Tuned Amplifiers – Frequency response of single and double tuned amplifier – Classification of power amplifiers – Transformer coupled Class A, Class B and Push Pull amplifiers.

UNIT – V **9**

Feedback Amplifiers and Oscillators: Principle, advantages of negative feedback amplifiers – Types of feedback connections: Voltage / current, series/shunt feedback. Theory of sinusoidal oscillators – Stability of feedback circuits using Barkhausen criteria – Phase shift and Wien bridge oscillators – Colpitts, Hartley and Crystal oscillators. Multivibrators: Astable and Monostable – Schmitt triggers.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

1. R.S.Sedha, "A Textbook of Applied Electronics", 4th Edition, S.Chand & Co., Ltd., New Delhi, 2009.
2. Salivahanan. S, Suresh Kumar. N and Vallavaraj A., "Electronic Devices and Circuits", 3rd Edition, Tata McGraw Hill Publishing Company, New Delhi, 2014.

REFERENCE BOOKS:

1. Bell, David A., "Electronic Devices and Circuits", 4th Edition, Prentice Hall of India, New Delhi, 2003.
2. Allen Mottershead, "Electronic Devices and Circuits– An Introduction", 1st Edition, Prentice Hall of India, New Delhi, 1996.
3. Millman Jacob, Christos CHalkias and Satyabrata JIT, "Electronic Devices and Circuits", 3rd Edition, Tata McGraw Hill Publishing Company, New Delhi, 2008.
4. Robert L. Boylestad and Louis Nashelsky, "Electronics Devices and Circuit Theory", 8th Edition, Pearson Education, New Delhi, 2002.
5. B.P.Singh, Rekhasingh, "Electronic Devices and Circuits", 2nd Edition, Pearson Education, 2013.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: understand the basic characteristics and applications of diodes
CO2: gain knowledge on the basic characteristics and applications of BJT
CO3: acquire knowledge about the operation and characteristics of FET and UJT
CO4: analyze the characteristics of BJT as amplifier
CO5: know the characteristics of feedback amplifiers and oscillators

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3		1									2	2
CO2	2	3		1									2	1
CO3	2	3		1									2	1
CO4	2	3		1										
CO5	2	3		1										

1 – Slight, 2 – Moderate, 3 – Substantial

14EET32 CIRCUITS AND NETWORKS

(Common to EEE & ECE branches)

3 1 0 4

Pre-requisites: Basics of Electrical and Electronics Engineering

UNIT – I **9**

Single Phase Circuits: Voltage, Current, Power and Powerfactor. Dependent and Independent Sources-Source Transformation. **Three Phase Circuits:** Review of Star and Delta Systems: Line, Phase Quantities- Three Phase Power - Star Delta Transformation. Three Phase Balanced and Unbalanced Circuit- Three Wire and Four Wire Systems.

UNIT – II **9**

Circuit Analysis (DC and AC): Mesh Analysis and Nodal Analysis-Super Position Theorem-Thevenin's Theorem-Norton's Theorem- Maximum Power Transfer Theorem

UNIT – III **9**

DC Response Analysis: Steady State Analysis of R-L and R-C circuits, Transient Analysis of RL RC and RLC circuits. **Resonance Circuits:** Resonant Frequency, Current and Voltage Variations, Bandwidth, Q factor for Series and Parallel Resonance Circuits.

UNIT – IV **9**

Network Topology: Introduction - Tree and Co-tree - Twigs and Links - Incidence Matrix (A) - Properties of Incidence Matrix A- Link Currents - Cut-set and Tree Branch voltages – Tie-set Matrix – Duality

UNIT – V **9**

Coupled Circuits: Mutual inductance -Dot Convention -Coefficient of Coupling – Analysis of Simple Coupled Circuits. **Two-Port Networks:** Open Circuit Impedance (Z) Parameter - Short Circuit Admittance (Y) Parameter- Transmission (ABCD) Parameters - T and Π Representation.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

1. Sudhakar A. and Shyammohan S. Palli, "Circuits and Networks Analysis and Synthesis", 4th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2010.
2. Chakrabarti A., "Circuit Theory: Analysis and Synthesis", 6th Edition, Dhanpath Rai & Sons, New Delhi, Reprint 2012.

REFERENCE BOOKS:

1. Domkundwar and Arora, "Circuit Theory: Analysis and Synthesis", 6th Edition, Dhanpat Rai & Co, 2014.
2. Edminister Joseph A. and Nahvi Mahmood, "Schaum's Outline of Electrical Circuits", 6th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2013.
3. Gupta B.R., "Network Analysis and Synthesis", 3rd Edition, S.Chand & Co., 2013.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: explain the basics of DC and AC circuits

CO2: apply various theorems for the analysis of DC and AC circuits

CO3: analyze the basics of DC transient response and resonating circuits

CO4: elaborate the concepts of different network topologies

CO5: interpret the concepts of two port networks and coupled circuits

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1		2										2
CO2	3	2		3										3
CO3	3	2		3										3
CO4	2	1		2										2
CO5	3	2		3										3

1 – Slight, 2 – Moderate, 3 – Substantial

14CST35 OBJECT ORIENTED PROGRAMMING

(Common to Mechanical, EEE, EIE & ECE branches)

3 0 0 3

Pre-requisites: Problem Solving and Programming

UNIT – I **9**

Principles of Object Oriented Programming: Object Oriented Programming Paradigm - Basic concepts and benefits of OOP - Object Oriented Languages - Applications of OOP - Structure of C++ - Tokens - Expressions and Control Structures - Operators in C++. Function Prototyping - Call by Reference - Return by Reference - Inline Functions – Default and const Arguments - Function Overloading**.**

UNIT – II **9**

Classes and Objects: Specifying a Class – Defining Member Functions - Nesting of Member Functions - Private Member Functions - Memory Allocation for Objects - Static Data Members - Static Member Functions - Array of Objects - Objects as Function Arguments - Friendly Functions - Returning Objects - const Member Functions - Pointers to Members.

UNIT – III **9**

Constructors and Destructors: Constructors - Parameterized Constructors – Multiple Constructors in a Class – Constructors with Default Arguments – Dynamic Initialization of Objects - Copy and Dynamic Constructors – Destructors. **Overloading:** Defining Operator Overloading - Overloading Unary and Binary Operators – Overloading Binary Operators using Friend Functions.

UNIT – IV **9**

Inheritance: Defining Derived Classes – Single Inheritance – Making a Private Member Inheritable – Multilevel Inheritance - Multiple Inheritance – Hierarchical Inheritance - Hybrid Inheritance - Virtual Base Classes – Abstract Classes. **Pointers, Virtual functions and Polymorphism:** Pointers to Objects - this Pointer - Pointers to Derived Classes - Virtual Functions - Pure Virtual Functions.

UNIT – V **9**

Managing Console I/O Operations: Introduction – C++ Streams – C++ Stream Classes – Unformatted I/O Operations- Formatted Console I/O Operations- Managing Output with Manipulators. **Working with Files:** Introduction- Classes for File Stream Operations- Opening and Closing a File- Detecting End-of-File - File Modes- File Pointers and Manipulations- Sequential File- Random Access File- Command line Arguments.

TOTAL: 45

TEXT BOOKS:

1. Balagurusamy E., "Object Oriented Programming with C++", 6th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2013.

REFERENCE BOOKS:

1. Hubbard John R., "Schaum's Outline Programming with C++", Tata McGraw Hill Publishing Company, New Delhi, 2003.
2. Venugopal.K.R. and Raj Buyya, "Mastering C++", Tata McGraw Hill, Oxford, 2009.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: use the C++ object oriented programming language and associated class libraries to develop object oriented programs

CO2: use constructor and destructor functions to initialize and destroy class objects

CO3: apply operator overloading to overload operators for user defined types

CO4: identify the differences between private, public and protected members of a class and use inheritance and virtual functions to build class hierarchies

CO5: develop simple application using files

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		3						2				
CO2	3	2		3						2				
CO3	3	3	1	3						2			1	
CO4	3	3	1	3						2			1	
CO5	3	2		3						2				2

1 – Slight, 2 – Moderate, 3 – Substantial

14EEL31 ELECTRICAL MACHINES I LABORATORY

0 0 3 1

LIST OF EXPERIMENTS / EXERCISES:

1. Open Circuit and Load Characteristics of DC Shunt Generator
2. Load Characteristics of DC Series Generator
3. Load Characteristics of DC Series Motor
4. Swinburne's Test
5. Speed control of DC Shunt Motor
6. Hopkinson's Test
7. Testing of Transformers (Direct and Indirect Methods)
8. Sumpner's Test
9. Load Test on Three Phase Transformer
10. Computer Aided Design of Electrical Machines
11. Armature Winding and its Connections

TOTAL: 45

REFERENCES / MANUALS / SOFTWARE:

1. Lab Manual
2. ANSYS Software

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: get exposure to the operation of DC machines and transformers

CO2: select the rotating machines based on their performance curves

CO3: Estimate the performance of rotating machines by conducting suitable load tests

CO4: test the transformers with different methods

CO5: utilize the computer aided tools for machine design

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2								2	1				
CO2	3	3							2	1			3	2
CO3	2			2					2	1				2
CO4	3	3		2					2	1			3	
CO5	3	3	3		3				2	1			3	

1 – Slight, 2 – Moderate, 3 – Substantial

14EEL32 DEVICES AND CIRCUITS LABORATORY

0 0 3 1

Pre requisites : Circuits and Networks, Electron Devices and Circuits

LIST OF EXPERIMENTS / EXERCISES:

Electron Devices:

1. Characteristics of PN Junction Diode and Zener Diode
2. Characteristics of BJT (Common Emitter Configuration)
3. Characteristics of UJT
4. Measurement of Hybrid Parameters
5. Calculation of Transfer Parameters of a Two Port Network

Electric Circuits:

6. Verification of Thevenin's and Norton's Theorem
7. Verification of Superposition Theorem
8. Verification of Maximum Power Transfer Theorem
9. Transient Response of RL and RC circuits (using PSPICE).
10. Frequency Response of Series and Parallel Resonance Circuits (also using PSPICE).

TOTAL: 45

REFERENCES / MANUALS / SOFTWARE:

1. Lab Manual
2. Software-PSPICE

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: experiment the electric circuits by applying various theorems

CO2: model DC and AC circuits using Simulation tools

CO3: analyze the characteristics of Semiconductor devices

CO4: select suitable semiconductor device for specific application

CO5: infer the different parameters for the given network

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		3										3
CO2	3	3	1	3	2							2	1	3
CO3	3	2		3										3
CO4	2	1		2										2
CO5	2	1		2										2

1 – Slight, 2 – Moderate, 3 – Substantial

14CSL34 OBJECT ORIENTED PROGRAMMING LABORATORY

(Common to EEE, EIE & ECE branches)

0 0 3 1

Pre requisites : Object Oriented Programming

LIST OF EXPERIMENTS:

1. Develop C++ functions with default arguments.
2. Implement call by value, call by reference and call by address.
3. Develop a C++ program to demonstrate the use of function overloading.
4. Design C++ classes with data members and member functions.
5. Develop a C++ program to demonstrate the use of friend function.
6. Implement matrix class with dynamic memory allocation and necessary methods.
7. Develop a C++ program using array of objects.
8. Design classes with constructors and destructor.
9. Implement unary and binary operator overloading.
10. Implement multiple and multilevel inheritance.
11. Implement virtual functions.
12. Develop a program to manipulate text file.

TOTAL: 45

REFERENCES / MANUALS / SOFTWARE:

1. Linux Operating System
2. C ++ Compiler

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: declare member functions inside and outside the class definition

CO2: demonstrate the use of friend function, constructor and destructor

CO3: design a simple C++ program with function and operator overloading

CO4: build class hierarchies with virtual functions and inheritance

CO5: develop simple applications using files

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1			1					1	2				
CO2	3	2		3					1	2				
CO3	3	3	2	3	2				1	2			2	
CO4	3	2		3					1	2				
CO5	3	3	2	3	2				1	2			2	2

1 – Slight, 2 – Moderate, 3 – Substantial

14MAT41 NUMERICAL METHODS

(Common to Civil, EEE, EIE, ECE, CSE, IT, Chemical & Food Technology)

3 1 0 4

UNIT – I **9**

Solution to Algebraic and Transcendental Equations: Iteration method – Method of false position – Newton-Raphson method – Solution of linear system of equations – Direct methods: Gauss elimination method and Gauss - Jordan method – Iterative methods: Gauss Jacobi and Gauss – Seidel methods.

UNIT – II **9**

Interpolation: Interpolation with equal intervals: Newton's forward and backward difference formulae – Central difference interpolation formulae: Gauss forward and backward interpolation formulae – Interpolation with unequal intervals: Lagrange's interpolation formula – Newton's divided difference formula.

UNIT – III **9**

Numerical Differentiation and Integration: Differentiation using Newton's forward, backward and divided difference formulae – Numerical integration: Trapezoidal rule – Simpsons $1/3^{rd}$ rule – Double integrals using Trapezoidal and Simpson's rules.

UNIT – IV **9**

Numerical Solution of First order Ordinary Differential Equations: Single step methods**:** Taylor series method – Euler method – Modified Euler method – Fourth order Runge-Kutta method – Multi step methods: Milne's predictor corrector method – Adam's Bashforth method.

UNIT – V **9**

Solutions of Boundary Value Problems in PDE: Solution of one dimensional heat equation – Bender -Schmidt recurrence relation – Crank - Nicolson method – One dimensional wave equation – Solution of two dimensional Laplace equations – Solution of Poisson equation.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

1. Kandasamy P., Thilakavathy K. and Gunavathy K., "Numerical Methods", Reprint Edition, S.Chand & Co, New Delhi, 2014.
2. Veerarajan T., Ramachandran T., "Numerical Methods with Programming C", 2^{nd} Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2008.

REFERENCE BOOKS:

1. Balagurusamy E., "Numerical Methods", Reprint Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2007.
2. Jain M.K., Iyengar S.R.K. and Jain R.K., "Numerical Methods for Scientific and Engineering Computation", 6^{th} Reprint, New Age International Pvt. Ltd., New Delhi, 2014.
3. Sankara Rao K., "Numerical Methods for Scientists and Engineers", 3^{rd} Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2008.
4. Gerald C.F. and Wheatley P.O., "Applied Numerical Analysis", 7^{th} Edition, Pearson Education, Asia, New Delhi, 2006.
5. Grewal B.S., "Numerical Methods in Engineering and Science", 9^{th} Edition, Khanna Publishers, 2007.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: know the various methods of solving algebraic and transcendental equations numerically

CO2: understand the concept of interpolation

CO3: gain knowledge on the concepts of numerical differentiation and integration

CO4: obtain the solution of ordinary differential equations numerically

CO5: apply various numerical techniques in solving complex partial differential equations

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1								1	1	1
CO2	3	3										1	1	
CO3	3	3	1	1								1	1	
CO4	3	3	1	1								1	1	1
CO5	3	3	1	1								1	1	

1 – Slight, 2 – Moderate, 3 – Substantial

14EET41 ELECTRICAL MACHINES II

3 1 0 4

Pre-requisites: Electrical Machines I

UNIT – I **9**

Alternator: Constructional Details – Types of Rotors – EMF Equation – Synchronous Reactance – Armature Reaction – Voltage Regulation – EMF, MMF and ZPF Methods – Synchronizing and Parallel Operation – Synchronizing Power - Power Output Equations - Change of Excitation and Mechanical Input.

UNIT – II **9**

Synchronous Motor: Principle of Operation – Torque Equation – Starting Methods -Operation on Infinite Busbars – V and Inverted V Curves – Input and Output Power Equations – Power/Power Angle Relations – Hunting - Synchronous Condenser - Applications.

UNIT – III **9**

Three Phase Induction Motor: Constructional Details – Types of Rotors – Squirrel Cage and Slip Ring – Principle of Operation – Slip –Torque Equations -Slip-Torque Characteristics – Losses and Efficiency – Load Test - No Load and Blocked Rotor Tests - Equivalent Circuit- Circle Diagram – Separation of No Load Losses – Crawling and Cogging – Double Cage Rotors – Induction Generator.

UNIT – IV **9**

Starting and Speed Control of Three Phase Induction Motor: Need for Starters – Types of Starters – Stator Resistance, Rotor Resistance, Autotransformer, Star-Delta Starters and DOL Starters - Speed Control by Varying Voltage, Frequency, Poles and Rotor Resistance – Slip Power Recovery Scheme.

UNIT – V **9**

Single Phase Induction Motors and Special Machines: Constructional Details – Double Revolving Field Theory – Equivalent Circuit – Starting Methods – Applications – Reluctance Motor, Servo Motor, Stepper Motor and Universal Motor and Switched Reluctance Motor and Linear Induction Motor.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

1. Rajput R.K., "Electrical Machines", 5th Edition, Laxmi Publications, New Delhi, 2008.
2. Gupta J.B., "Electrical Machines (AC & DC Machines)", 4th Edition, S K Kataria & Sons, New Delhi, 2012.

REFERENCE BOOKS:

1. Kothari D.P., Nagrath I.J., "Electric Machines", 4th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2010.
2. Langsdeof, Alexander S., "Theory of Alternating Current Machinery", 2nd Edition, Tata McGraw Hill Publishing Company, New Delhi, 2004.
3. Fitzgerald A.E., Kingsley, Charles and Umans, Stephen D., "Electric Machinery", 6th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2010.
4. http://nptel.ac.in/courses/108106072/

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: explain the basic constructional and working principle of synchronous and induction machines

CO2: relate the performance of AC machines with different parameters

CO3: analyze the performance characteristics of induction machines

CO4: apply starting and speed control methods to AC motors

CO5: realize the working of single phase induction machine and special electrical machines

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	1		2				1		1	1
CO2	3	2	1	1	2		1				1		2	2
CO3	3	2	1	1	2		1				1		2	2
CO4	2	1	2	1			1				1		2	2
CO5	3	1	2	2			2				1		1	1

1 – Slight, 2 – Moderate, 3 – Substantial

14EIT43 DIGITAL LOGIC CIRCUITS

(Common to EIE & EEE branches)

3 1 0 4

Pre-requisites: Basics of Electrical and Electronics Engineering

UNIT – I **9**

Boolean Algebra and Minimization of Boolean Expressions: Axioms and Laws of Boolean Algebra – Reducing Boolean Expressions – Boolean Functions and their representation- Expansion of a Boolean Expression in SOP Form to the standard SOP Form- Expansion of a Boolean Expression in POS Form to standard POS Form- Boolean Expressions and Logic Diagrams- Converting AND/OR/INVERT Logic to NAND/NOR Logic. Minimization of Switching Functions: Two Variable K Map- Three Variable K Map - Four Variable K Map – Implementation of Logic Functions-Quine McCluskey Method: Don't care conditions.

UNIT – II **9**

Combinational Logic Design: Design Procedure: Adders - Subtractors. Code converters: Binary to Gray - Gray to Binary - BCD to Excess 3 - BCD to Gray. Parity bit generators/Checkers - Comparators: 2 bit Magnitude Comparator - Encoders: Octal to Binary Encoder - Decoders: 3 Line to 8 Line Decoder - 2 Line to 4 Line Decoder with NAND Gates- Multiplexers – Demultiplexers

UNIT – III **9**

Synchronous Sequential Circuits: Latches and Flipflops: Triggering and Characteristics equations of Flipflops. Race around condition-Master slave J-K Flipflop - Flipflop Excitation Tables –Conversion of Flipflops - Synchronous Sequential Logic: Analysis of Clocked Sequential Circuits-State Reduction and Assignment – Design Procedure. Synchronous Counters: Design of Synchronous counters – Design of a Synchronous 3-bit Up-down Counter Using J-K FFs- Ring counter. Registers: Universal shift registers.

UNIT – IV **9**

Asynchronous Sequential Logic: Analysis Procedure- Design Procedure – Reduction of State and Flow Tables- State Assignments – Hazards and Hazard Free Realizations: Static Hazards- Dynamic Hazards – Hazard free Realization- Essential Hazards.

UNIT – V **9**

Logic Families and Memory: Digital IC Specification Terminology: Propagation Delay - Noise Margin –Speed Power Product. Transistor Transistor Logic (TTL): Two-input TTL NAND Gate – Three-input TTL NAND Gate. Emitter Coupled Logic (ECL): Inverter. Complementary Metal Oxide Semiconductor (CMOS) Logic: CMOS Inverter- CMOS NAND Gate- CMOS NOR Gate. Memory Types and Terminology: Memory Organization and operation - Semiconductor RAMs: Static RAMs (SRAMs)- Dynamic RAMs(DRAMs). Read-Only Memory (ROM)-ROM organization – Types of ROMs- Programmable ROM (PROM)

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

1. Anand Kumar A., 'Fundamentals of Digital Circuits', 2nd Edition, Prentice Hall of India, 2013.
2. Morris Mano M., 'Digital Design with an Introduction to the Verilog', 5th Edition, Pearson Education, 2013.

REFERENCE BOOKS:

1. Salivahanan, S and Arivazhagan, "Digital Circuits and Design", 4th Edition, Vikas Publishing House Pvt. Ltd., New Delhi, 2012.
2. Donald Leach, Albert Malvino and Goutam Saha, "Digital Principles and Applications", 8th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2014.
3. Charles H.Roth,Jr and Lizy Kurian John, "Digital System Design using VHDL", 2nd Edition, Cengage Learning, 2012.
4. http://web.iitd.ac.in/~shouri/eel201/lectures.php
5. http://www.nptel.ac.in/courses/106108099//Digital%20Systems.pdf

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: simplify the boolean expressions
CO2: design and implement the combinational circuits
CO3: implement circuits using synchronous techniques
CO4: implement circuits using asynchronous techniques
CO5: identify the logic families and memory devices

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2	3	1	3											2
CO3	3	1	3											2
CO4	3	1	3											2
CO5				2										2

1 – Slight, 2 – Moderate, 3 – Substantial

14EET42 MEASUREMENTS AND INSTRUMENTS

3 0 0 3

UNIT – I **9**

Science of Measurements: Science of measurements: Importance of Measurement – Purpose of Measurement – Methods of Measurement – Functional blocks of a Measurement system – Types of Errors – Error Analysis – Units and Standards-Static and Dynamic Characteristics. Calibration of Instruments.

UNIT – II **9**

Measurement of Voltage and Current: Galvanometers: Introduction - Construction of d'Arsonval Galvanometer-Torque Equation. Permanent Magnet Moving Coil (PMMC): Construction of PMMC Instruments - Torque Equation- Ammeter Shunts- Voltmeter Multipliers. Moving Iron Instruments: General Torque Equation - Classification – Construction - Comparison between Attraction and Repulsion types of Instruments – Errors - Advantages and Disadvantages. (Problems in torque equation and Range Extension).

UNIT – III **9**

Measurement of Power, Power factor and Energy: Electrodynamometer Wattmeter: Construction –Theory- Errors - Low Power Factor Wattmeter- Three Phase Wattmeter. Power Factor Meters: Single Phase Electrodynamometer Power Factor Meter. Single Phase Induction Type Meters: Construction –Theory and Operation of Single Phase Induction Type Energy Meters. Instrument Transformers: Construction of C.T and P.T- Applications.

UNIT – IV **9**

Transducers: Classification of Transducers**:** Principle of Transduction- Primary and Secondary –Passive and Active- Analog and Digital-Inverse Transducers. Resistive Transducers: Strain Gauges-Theory of Strain Gauge-Types: Semiconductor strain gauge. Thermistor: Construction of Thermistor. Thermocouple: Construction of Thermocouple. Linear Variable Differential Transformers (LVDT): Construction – Advantages and Disadvantages. Piezoelectric Transducers: Modes of operation of Piezoelectric Crystals.

UNIT – V **9**

Bridges and Digital Instruments: Classification of Resistances- Measurement of Medium Resistance - Wheatstone Bridge - Limitations of Wheatstone Bridge. Low Resistance- Kelvin's Double Bridge. High Resistance – Meggar (Earth tester). **A.C.Bridges:** Introduction - Sources and Detectors - Measurement of Self Inductance & Capacitance: Maxwell's Inductance Bridge - Capacitance Bridge - Wien's Bridge. Block diagram of digital multi meters - Block diagram of Oscilloscope- Digital Storage Oscilloscope.

TOTAL: 45

TEXT BOOKS:

1. Sawhney A.K, "Electrical and Electronic Measurements and Instrumentation", 19th Revised Edition, Dhanpath Rai & Co., New Delhi, 2013 (Reprint).
2. Kalsi H.S., "Electronic Instrumentation", Tata McGraw Hill Publishing Company, New Delhi, 2012.

REFERENCE BOOKS:

1. Anand M.M.S., "Electronic Measurement and Instrumentation Technology", Prentice Hall of India, New Delhi, 2007.
2. Gupta J.B, "A Course in Electronic and Electrical Measurements and Instrumentation", S. K. Kataria & Sons, New Delhi, 2003.
3. Edward William Golding and Frederick Charles Widdis, "Electrical Measurements and Measuring Instruments", Reem Publications, 2011.
4. Banerjee G.K., "Electrical and Electronic Measurements", Prentice Hall of India,New Delhi, 2012.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: categorize the Characteristics of instruments and the Errors occurring in an Instrument
CO2: understand the concept of measuring Instruments
CO3: make use of the instruments for measuring electrical parameters
CO4: select appropriate Transducer for different applications
CO5: utilize the bridges and oscilloscopes for measuring quantities

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		1									1	1
CO2	3	2		1									1	1
CO3	3	3		1									1	2
CO4	3	3		1									1	2
CO5	3	3		1									1	2

1 – Slight, 2 – Moderate, 3 – Substantial

14EET43 ELECTROMAGNETIC THEORY

3 1 0 4

Pre-requisites: Material Science and Mathematics I

UNIT – I **9**

Electrostatics: Review of Vector Algebra – Vector Calculus- Divergence Theorem-Stoke's Theorem. – Coordinate Systems: Cartesian, Cylindrical and Spherical Coordinate System-Differential Length, Area, Volume. Electric Charge –Types of Charge Distribution – Coulomb's Law – Electric Field Intensity: Point Charge, Line Charge, Surface Distribution - Electric Flux Density – Gauss's Law – Application of Gauss's Law.

UNIT – II **9**

Dielectrics, Conductors and Capacitors: Potential Difference – Potential – Conservative Property – Potential Gradient-Conduction Current, Displacement Current -Polarization –Dipole Moment – Energy Density in Electrostatic Field –E and V due to Dipole– Law of Continuity– Boundary Condition: Conductor-Dielectric and Dielectric- Dielectric. Capacitors: Parallel Plate, Coaxial Cable, Spherical, Transmission Line – Energy Stored- Poisson's and Laplace's Equations.

UNIT – III **9**

Magnetostatics: Biot-Savart's Law, Magnetic Field due to Straight Conductors –Ampere's Circuital Law, Magnetic Field due to Circular Loop, Cable– Gauss's Law for Magnetic Flux - Scalar and Vector Magnetic Potential –Magnetic Force, Torque –Magnetic Boundary Conditions .

UNIT – IV **9**

Magnetic Inductance and Maxwell's Equations: Self Inductance – Inductance of Infinite Length of Conductor, Solenoid, Toroid and Co-axial Cable – Mutual Inductance: Transmission Line - Energy Stored in Magnetic Field. Time Varying Fields – Transformer and Rotational EMF - Maxwell's Equation in Point Form and Integral Form –- Comparison of Circuit Theory and Field Theory.

UNIT – V **9**

Electro Magnetic Waves: Electromagnetic Waves (Elementary Ideas only) **:** Introduction – Wave Equations and Parameters – Wave Propagation in Lossless Dielectrics and Lossy Dielectric, Conductors - Poynting Theorem –Numerical Methods-FDM,FEM and Moment Method.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

1. Sadiku, Matthew N.O., "Principles of Electromagnetics", 4th Edition, Oxford University Press, New Delhi, 2010.
2. Meenakumari, R and Subasri, R., "Electromagnetic Fields", 2nd Edition, New Age International Publishers Pvt. Ltd., New Delhi, 2007.

REFERENCE BOOKS:

1. Kraus John. D and Fleishch, Daniel., "Electromagnetics", 5th Edition, McGraw Hill, New York, 2010.
2. Ashutosh Pramanik, "Electromagnetism: Theory and Applications", 2nd Edition, Prentice Hall of India, New Delhi, 2009.
3. Edminister and Joseph A., "Theory and Problems of Electromagnetics", Revised 2nd Edition, Tata McGraw Hill Publishing Company, New Delhi, 2010.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: analyze the behavior of electrostatic fields for different configurations

CO2: distinguish flux density and field intensity for different medium

CO3: analyze magneto static fields for different configurations

CO4: estimate the capacitance, inductance, energy stored in electric and magnetic fields

CO5: classify the electromagnetic wave propagation in different mediums

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1		2					1				2	
CO2	2	1		2					1					
CO3	3	2		3					1				2	
CO4	3	2		3					1				1	2
CO5	2	1		1					1				1	

1 – Slight, 2 – Moderate, 3 – Substantial

14MET46 APPLIED THERMODYNAMICS

(Common to EEE & EIE branches)

(Use of Steam Table with Mollier Diagram and Psychrometric Chart are Permitted)

3 0 0 3

Pre-requisites: Basics of Mechanical Engineering.

UNIT – I **9**

Laws of Thermodynamics: Thermodynamic Systems – Macroscopic and Microscopic - Boundary –- Control Volume – System and Surroundings – Properties – State - Process – Cycle - Point and Path Functions – Equilibrium – Zeroth Law of Thermodynamics. Work and Heat Transfer - First Law of Thermodynamics for Open and Closed Systems – Steady Flow Energy Equation (SFEE). Second Law of Thermodynamics– Kelvin-Planck and Clausius Statements – Heat Engine, Refrigerator, Heat Pump.

UNIT – II **9**

Internal Combustion Engines: Classification - Components of Internal Combustion Engines - Two Stroke and Four Stroke Engines, Valve Timing and Port Timing Diagrams, Comparison of Petrol and Diesel Engines. Ignition System – Types. Cooling System – Types. Lubricating System – Types. **Fuels and Combustion:** Introduction to Fuels – Physical and Chemical Properties of Liquid, Solid and Gaseous Fuels. Combustion: Principle of Combustion – Combustion of Oil, Coal, Gas.

UNIT – III **9**

Boiler and Furnaces: Introduction **–** Formation of Steam – Thermodynamic Properties of Steam, Use of Steam Tables and Charts. Basic Steam Power Cycle (Simple Rankine Cycle). **Boiler:** Boiler - Classifications: Fire Tube, Water Tube and Packaged Boiler – Boiler Efficiency Calculation: Direct Method and Indirect Method – Boiler Blowdown and Boiler Water Treatment – Boiler Mountings and Accessories. Elements of Pulverised Fuel System and Fluidized Bed Combustion. **Furnaces:** Types and Classification of Different Furnaces – Various Losses in Furnaces – Furnace Efficiency Calculation.

UNIT – IV **9**

Air Compressors: Positive Displacement Compressors – Classifications - Reciprocating Compressors –Indicated Power – With and Without Clearance Volume – Various Efficiencies – Multi Stage with Inter-Cooling, Conditions for Perfect and Imperfect Inter-Cooling. Rotary Compressor - Types - Roots Blower, Sliding Vane, Centrifugal Compressor.

UNIT – V **9**

Refrigeration and Air-Conditioning: Unit of Refrigeration – Components of Refrigeration System- Vapour Compression Refrigeration Cycle with (p-h) and (T-s) Diagrams – Subcooling and Superheating. Working of Vapour Absorption Refrigeration System, Air-Conditioning Systems. Basic Psychrometric Terms and Psychrometric Processes. Types of Air-Conditioning Systems – Summer, Winter and Year Round Air-Conditioning Systems.

TOTAL: 45

TEXT BOOKS:

1. Rajput R.K., "Thermal Engineering", 9th Edition, Laxmi Publications Pvt. Ltd., New Delhi, 2013.
2. Nag P.K., "Power Plant Engineering", 3rd Edition, Tata McGraw Hill Publishing Company, New Delhi, 2011.

REFERENCE BOOKS:

1. Nag P.K., "Basic and Applied Engineering Thermodynamics", Tata McGraw Hill Publishing Company, New Delhi, 2012.
2. Ballaney P.L., "Thermal Engineering", 24th Edition, Khanna Publishers, New Delhi, 2012.
3. Cengel Y., "Thermodynamics: An Engineering Approach", 7th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2011.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: apply the laws of thermodynamics in various thermal equipments
CO2: recognize the various components of internal combustion engines and concept of fuels and combustion
CO3: identify the different types of boilers and furnaces
CO4: get the working principle of air compressor with their different types
CO5: familiarize the concept of refrigeration and air-conditioning systems

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1											
CO2	3	2	1											
CO3	3	2	1											
CO4	3	2	1											
CO5	3	2	1											

1 – Slight, 2 – Moderate, 3 – Substantial

14EEL41 ELECTRICAL MACHINES II LABORATORY

0 0 3 1

LIST OF EXPERIMENTS / EXERCISES:

1. Regulation of three-phase alternator by EMF, MMF and ZPF methods.
2. Load test on three-phase alternator.
3. V and inverted V curves of three phase synchronous motor.
4. Load test on three phase induction motor (squirrel cage)
5. Load test on three phase induction motor (slip ring)
6. No load and blocked rotor test on three phase induction motor
7. Parallel operation of alternator
8. Determination of equivalent circuit of single phase induction motor
9. Performance study of induction generator
10. Design of AC machines using software tools

TOTAL: 45

REFERENCES / MANUALS / SOFTWARE:

1. Lab Manual
2. ANSYS Software

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: evaluate the performance of AC machines

CO2: examine the characteristics of AC machines

CO3: predetermine the regulation of three phase alternators

CO4: demonstrate the synchronization of two alternators for its power sharing

CO5: utilize the knowledge on computer-aided engineering design of machines

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	2		1		1			1	3	3
CO2	3	3	1	3	1				1				3	3
CO3	3	3	2	3	2				1				3	3
CO4	2	1		2			2		1				2	1
CO5	3	2		3	3							1	3	2

1 – Slight, 2 – Moderate, 3 – Substantial

14EEL42 ANALOG AND DIGITAL ELECTRONICS LABORATORY

0 0 3 1

Pre requisites : Basics of Electrical and Electronics Engineering Laboratory & Electron Devices and Circuits

LIST OF EXPERIMENTS / EXERCISES:

Analog Electronics

1. Transfer characteristics of differential amplifier using BJT.
2. Design of RC phase shift oscillators using BJT.
3. Design and analysis of Schmitt trigger using hysteresis curve.
4. Design an astable multivibrators using BJTs.
5. Design and analysis of complementary symmetry class B power amplifier.

Digital Electronics

6. Design and implement adders and subtractors.
7. Implementation of BCD to seven segment code converter.
8. Realization of JK flip-flop operation and implement D and T flip flop using JK flip flop.
9. Design and implementation of synchronous up and down counters using flip flops.
10. Realization of running LED system using counters.
11. Implementation of mini-project using discrete analog and digital components.

TOTAL: 45

REFERENCES / MANUALS / SOFTWARE:

1. Lab Manual

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: discuss the basic concepts of various analog and digital circuits

CO2: design oscillator and multivibrator circuits

CO3: distinguish combinational and sequential logic circuits

CO4: construct and analyze the behaviour of flipflops

CO5: design and implement mini project based on the experimental understanding

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1		2					1					2
CO2	3	3	3	3	3				1				3	3
CO3	2	1		2					1					2
CO4	3	3	1	3	1				1				1	3
CO5	3	3	1	3	1				1				1	3

1 – Slight, 2 – Moderate, 3 – Substantial

14EEL43 MEASUREMENTS AND INSTRUMENTS LABORATORY

0 0 3 1

Pre requisites : Measurements and Instruments

LIST OF EXPERIMENTS / EXERCISES:

1. Calibration of single phase energy meter by direct / phantom loading
2. Extension of DC voltmeter and DC ammeter ranges.
3. Calibration of current transformer and potential transformer.
4. Measurement of DC resistance by Wheatstone and Kelvin double bridge
5. Measurement of inductance and capacitance using Maxwell's bridge
6. Measurement of temperature using RTD / thermo couple / thermistor in Lab VIEW Programming
7. Measurement of strain using Lab VIEW
8. Measurement of torque using strain gauge
9. Measurement of position using hall effect sensor
10. Determination of LVDT characteristics using Lab VIEW

TOTAL: 45

REFERENCES / MANUALS / SOFTWARE:

1. Lab Manual

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: measure unknown resistance, capacitance and inductance

CO2: measure different physical parameters by suitable circuits

CO3: test and extend the range of meters

CO4: design circuits in Lab VIEW

CO5: calibrate CT,PT and energy meter

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	2	2							1	3
CO2	3	3	1	1	2	2							1	3
CO3	3	3	1	1	3	2							1	3
CO4	3	3	2	2	3	3							2	3
CO5	2	2			1	1							2	3

1 – Slight, 2 – Moderate, 3 – Substantial

14ECT52 LINEAR INTEGRATED CIRCUITS

(Common to ECE, EEE & EIE branches)

3 1 0 4

UNIT – I **9**

Introduction to Operational Amplifier: Basics of operational amplifier - Ideal and practical characteristics of Op-Amp – Block schematic of Operational amplifier - Differential amplifier – Transfer characteristics – Low frequency small signal analysis using 'h' parameters – Circuits for improving CMRR: Constant current sources, Widlar and Wilson current sources.

UNIT – II **9**

Characteristics of Operational Amplifiers: DC Characteristics: Input bias current- Input offset current- Input offset voltage - Thermal drift – AC characteristics: Frequency response- Stability and slew rate – Frequency compensation methods.

UNIT – III **9**

Applications of Operational Amplifier: Adder - Subtractor- Instrumentation amplifier – Differentiator – Integrator –V/I and I/V converter - Comparator- Signal generators: Astable and monostable multivibrator - Schmitt trigger- Sinewave generators: RC phase shift oscillator and Wien bridge oscillator- Triangular wave generator.

UNIT – IV **9**

Operational Amplifier in Signal Conditioning Circuits: Active Filter: I and II order low pass and high pass filters – Switched capacitor filter - Analog to digital Converter: Flash type, Integrating type and successive approximation type- Digital to analog converter: Weighted resistor type, R-2R ladder type and inverted R-2R ladder type.

UNIT – V **9**

Special ICs: Timer (IC 555): Functional block diagram - Astable and monostable operation – Applications. Voltage controlled oscillator (IC 566) – Phase locked loop (IC 565) - Functional block diagram, Application: AM,FM demodulators and Frequency synthesizers – Voltage regulator IC: Series op-amp regulator (78XX) – Switching regulator - Switching voltage regulator IC

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

1. Roy Choudhry D. and Shail Jain, "Linear Integrated Circuits", 4th Edition, New Age International, New Delhi, 2010, Reprint 2014.

REFERENCE BOOKS:

1. Gaykwad, Ramakant A., "OP-AMP and Linear IC's", 4th Edition, PHI Learning, New Delhi, 2009.
2. Salivahanan S. and Kanchana Bhaaskaran V.S., "Linear Integrated Circuits", 2nd Edition, McGraw Hill Education Pvt. Ltd., India, 2014.
3. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 3rd Edition, McGraw-Hill, New York, 2008.
4. Coughlin Robert and Driscoll F., "Operational Amplifiers and Linear Integrated Circuits", 6tn Edition, Pearson Education Asia, 2001.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: evaluate the characteristics and basic applications of operational amplifier

CO2: design electronic circuits with operational amplifier

CO3: implement A/D and D/A converters for various applications

CO4: realize the applications of PLL and special function ICs

CO5: design power supply circuits with special function ICs

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		1										2	2
CO2	3		3										2	2
CO3	3		3										1	1
CO4	3		3										1	2
CO5	3		3										2	2

1 – Slight, 2 – Moderate, 3 – Substantial

14EET51 TRANSMISSION AND DISTRIBUTION

3 1 0 4

Pre-requisites: Circuits and Networks, Electromagnetic Theory

UNIT – I **9**

Introduction: Structure of Electric Power System- Transmission and Distribution systems – Overhead Transmission, Underground Transmission – Comparison - Concept of Grid - Current Power System Scenario. **Electrical Design of Transmission Lines:** Parameters of Transmission Line - Resistance - Skin and Proximity Effects - Inductance and Capacitance of Single and Three Phase Transmission Lines with Single Circuit - Double Circuits – Solid, Stranded and Bundled Conductors – Symmetrical and Unsymmetrical Spacing and Transposition.

UNIT – II **9**

Mechanical Design of Transmission Lines: Insulators: Types, Voltage Distribution in Insulator String and Grading, Improvement of String Efficiency – Failure of Insulators. **Sag and Tension Calculations:** Classification of towers, Sag and Tension in OH lines – Equation of Sag- Calculation of Sag – Towers at Equal Heights – Unequal Heights – Effect of Wind and Ice loading.

UNIT – III **9**

Analysis of Transmission Lines: Classification of Lines: Short Line, Medium Line and Long Line; Equivalent Circuits, Attenuation Constant, Phase Constant, Surge Impedance; Transmission Efficiency and Voltage Regulation; Real and Reactive Power Flow in Lines: Power-Angle Diagram; Surge-Impedance Loading - Ferranti Effect. **Corona:** Phenomena of Corona- Factors Affecting Corona- Disruptive Critical Voltage- Visual Critical Voltage- Corona Loss

UNIT – IV **9**

Distribution Systems: Components of Distribution System – Types – DC Distribution: DC Distributor – Concentrated and Uniform Loading. AC Distribution: AC Distributor – Concentrated Load – Three Phase Four Wire Distribution System – Sub-Mains – Stepped and Tapered Mains - Kelvin's Law. **Underground Cables:** Constructional Features of LT and HT Cables, Capacitance, Dielectric Stress and Grading, Thermal Characteristics-Cable Faults and Testing.

UNIT – V **9**

Recent Trends in Transmission Systems: Fundamentals of AC Power transmission – Transmission problems and needs - Shunt and Series Compensation - FACTS: Basic FACTS controllers - TCSC, SVC, STATCOM, UPFC- Introduction, Application, Merits and Demerits of HVDC and EHV AC Transmission.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

1. Gupta J.B., "A Course in Power Systems", 11th Edition, S.K.Kataria & Sons, New Delhi, Reprint 2015.
2. Wadhwa C.L., "Electrical Power Systems", 6th Edition, New Age International Publishers, New Delhi, 2010.

REFERENCE BOOKS:

1. Soni M.L., Gupta, Bhatnagar, and Chakrabarthy, "A Textbook on Power Systems Engineering", Dhanpat Rai & Sons, New Delhi, 2007.
2. Luces M. Fualken Berry, Walter Coffer, "Electrical Power Distribution and Transmission", Pearson Education, 2007.
3. Metha V.K. and Rohit Mehta, "Principles of Power System", S. Chand & Company Ltd., Ramnagar, New Delhi, 2006.
4. http://nptel.ac.in/courses/108102047/
5. http://www.nptelvideos.in/2012/11/power-sys-generation-transmission.html

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: model the transmission line to evaluate the performance indices
CO2: examine the voltage distribution in insulator strings and sag
CO3: analyze the performance of transmission lines
CO4: identify the various distribution schemes and features of cables
CO5: list out various facts devices, effects of corona

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2											1	
CO2	3	3	1	3									2	
CO3	3	3	1	3									2	
CO4	3	2		3									1	
CO5	1	1										1	1	

1 – Slight, 2 – Moderate, 3 – Substantial

14EET52 MICROPROCESSORS AND MICROCONTROLLERS

(Common to EEE & EIE branches)

3 0 0 3

Pre-requisites: Digital Logic Circuits

UNIT – I **9**

8085 Microprocessor: History and Evolution of 8085 Microprocessor-Architecture-Pin configuration-Registers-Timing Diagrams-Interrupts-Memory Mapping- Instruction Set-Addressing Modes- Assembly Language Programs.

UNIT – II **9**

Peripheral Interfaces: Serial Communication Interface-Parallel communication Interface-Timer Interface-DMA controller Interface-Keyboard/Display Interface.

UNIT – III **9**

8051 Microcontroller: History and Evolution of 8051 Microcontroller- Functional block diagram- Memory Organization-Special function registers – Program Counter – PSW register –Stack - Instruction set-Addressing modes.

UNIT – IV **9**

8051 Programming: I/O Ports – Timer – Interrupt – Serial Port -I/O port programming- Timer programming-counter programming-Serial Communication-Interrupt programming.

UNIT – V **9**

Peripheral Interfacing: Keypad-LCD -Sensors- A/D and D/A converters- DC Motor speed control-stepper motor control – Washing Machine Control.

TOTAL: 45

TEXT BOOKS:

1. Krishna Kant, "Microprocessors and Microcontrollers Architecture, Programming and System Design 8085,8086,8051,8096", 8th Edition, PHI Learning Pvt. Ltd., New Delhi, 2011.
2. Soumitra Kumar Mandal, "Microprocessors and Microcontrollers Architecture, Programming and System Design 8085,8086 and 8051", 8th Edition, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2013.

REFERENCE BOOKS:

1. Senthil Kumar N., Saravanan M., Jeevananthan S., "Microprocessor and Microcontroller", 12th Impression, Oxford University Press, 2015.
2. Mazidi Muhammad Ali, Mazidi Janice Gillispie and McKinlay Rolin, "The 8051 Microcontroller and Embedded Systems", 2nd Edition, Prentice Hall of India, New Delhi, 2012.
3. Ayala Kenneth J., "The 8051 Microcontroller", 3rd Edition, Thomson Delmer Learning, Singapore, 2004.

Course Outcomes:

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: demonstrate knowledge on the architectural functions of 8085

CO2: classify the different addressing modes and instruction sets

CO3: develop basic and advanced programs for 8085 and 8051

CO4: utilize the on chip peripherals for the specific applications

CO5: integrate the input/output devices in real time using 805

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1		2										
CO2	2	1		2										
CO3	3	3	2	3	2				2	2		2	2	2
CO4	3	2		3									2	2
CO5	3	3	2	3	2				2	2		2	2	2

1 – Slight, 2 – Moderate, 3 – Substantial

14EET53 CONTROL SYSTEMS

(Common to EEE, EIE, ECE & Mechatronics branches)

3 1 0 4

UNIT – I **9**

Mathematical Modeling: History of Control Systems - Classification of Control Systems - Basic Structure: Open Loop and Closed Loop Systems - Transfer Function and State Space Models (Physical and Phase Variable Model): Electrical Systems, Mechanical Systems, Electromechanical Systems: Gear Trains and DC Motor - Electrical Analogy of Mechanical Systems - Reduction of Multiple Subsystems: Block Diagram Reduction, Signal Flow Graphs.

UNIT – II **9**

Time Response of Systems: Poles, Zeros and System Response -Type and Order of System - Significance of Test Signals - First Order System - Second Order System: Classification and Nature of Response - Step Response of Second Order Underdamped System - Time Domain Specifications - Steady State Error and Error Constant - Generalized Error Series.

UNIT – III **9**

Stability Analysis: Concepts of Stability - Pole Location and Stability - Routh Hurwitz Criterion - Root Locus Technique - Effect of Addition of Poles and Zeros on Stability.

UNIT – IV **9**

Frequency Response of Systems: Concept of Frequency Response - Frequency Response Analysis: Bode Plot and Polar Plot - Stability Analysis in Frequency Domain: Nyquist Stability Criterion - Frequency Domain Specifications.

UNIT – V **9**

Compensator and Controller: Need for Compensator - Types of Compensation - Cascade Compensators: Types, Transfer Function and Physical Realization - Effect of Ideal Compensation on Time Response: P, PI, PD and PID - Design of Lag and Lead Compensator via Root Locus.

Lecture:45, Tutorial:15, TOTAL: 60

TEXT BOOKS:

1. Nagrath I.J. and Gopal M., "Control Systems Engineering", 5th Edition, New Age International Publishers, New Delhi, 2011.
2. Norman S. Nise, "Control Systems Engineering", 6th Edition, Wiley Publishers, 2011.

REFERENCE BOOKS:

1. Gopal M., "Control Systems; Principles and Design", 4th Edition, Tata McGraw-Hill, New Delhi, 2012.
2. Kuo B.C., "Automatic Control Systems", 9th Edition, John Wiley and Sons, New York, 2009.
3. Ogata K.,"Modern Control Engineering", 5th Edition, Pearson Education/ PHI, New Delhi, 2010.
4. http://www.nptelvideos.in/2012/11/control-engineering.html
5. http://www.nptelvideos.in/2012/11/control-engineeringprof-gopal.html

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: identify various components of the control system

CO2: analyze various steady state errors for the continuous systems

CO3: estimate the time and frequency response of the systems

CO4: examine the stability of the systems

CO5: design the compensator and controllers for real time applications

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1		2										2
CO2	3	2		3										3
CO3	3	2		3										3
CO4	3	2		3										3
CO5	3	3	1	3									1	3

1 – Slight, 2 – Moderate, 3 – Substantial

14EET54 ELECTRICAL SAFETY ENGINEERING

3 0 0 3

UNIT – I **9**

Concepts in Safety : Introduction – electrostatics, electro magnetism, stored energy, energy radiation and electromagnetic interference – Working principles of electrical equipment-Indian electricity act and rules-statutory requirements from electrical inspectorate-international standards on electrical safety – first aid-cardio pulmonary resuscitation(CPR).

UNIT – II **9**

Electrical Hazards and Safety Equipments: Primary and Secondary Hazards- Arc, Blast, Shocks-Causes and Effects-Safety Equipment- Person Protection Equipment(PPE), Head and Eye Protection, Flash and Thermal Protection, -Rubber Insulating Equipment , Hot Sticks, Insulated Tools, Barriers and Signs, Safety Tags, Locking Devices- Voltage Measuring Instruments-Proximity and Contact Testers-Safety Electrical One Line Diagram- Electrician's Safety Kit.

UNIT – III **9**

Grounding and Bonding Techniques: General Requirements for Grounding and Bonding- Definitions- Grounding of Electrical Equipment- Bonding of Electrically Conducting Materials and Other Equipment- Connection of Grounding and Bonding Equipment- System Grounding- Purpose of System Grounding- Grounding Electrode System- Grounding Conductor Connection to Electrodes-Use of Grounded Circuit Conductor for Grounding Equipment- Grounding of Low Voltage and High Voltage Systems.

UNIT – IV **9**

Safety Methods of Equipments: The Six Step Safety Methods- Pre Job Briefings- Hot -Work Decision Tree-Safe Switching of Power System- Lockout-Tag Out- Flash Hazard Calculation and Approach Distances- Calculating the Required Level of Arc Protection-Safety Equipment , Procedure for Low, Medium and High Voltage Systems- The One Minute Safety Audit.

UNIT – V **9**

Safety Schedule and Maintenance: Safety Related Case for Electrical Maintenance- Reliability Centered Maintenance (RCM) - Eight Step Maintenance Programme- Frequency of Maintenance- Maintenance Requirement for Specific Equipment and Location- Regulatory Bodies- National Electrical Safety Code- Standard for Electrical Safety In Work Place-Occupational Safety and Health Administration Standards.

TOTAL : 45

TEXT BOOKS:

1. Dennis Neitzel, Al Winfield, "Electrical Safety Handbook", 4th Edition, McGraw-Hill Education, 2012.
2. Fortham Cooper W., "Electrical Safety Engineering", 1st Edition, Butterworth and Company, London, 1986.

REFERENCE BOOKS:

1. John Cadick, 'Electrical Safety Handbook', 4th Edition, Tata Mc Graw-Hill Education,2012.
2. Maxwell Adams.J, "Electrical safety- a guide to the causes and prevention of electric hazards",1st Edition, The Institution of Electric Engineers, 1994.
3. Ray A. Jones, Jane G. Jones, 'Electrical safety in the workplace', 1st Edition,Jones & Bartlett Learning, 2000.
4. http://nptel.ac.in/courses/103106071/

Course Outcomes:

COURSE OUTCOMES

On completion of the course the students will be able to

- CO1: develop basic knowledge on safety
- CO2: describe electrical hazards and safety equipment
- CO3: analyze and apply various grounding and bonding techniques
- CO4: select appropriate safety method for low, medium and high voltage equipment
- CO5: carry out proper maintenance of electrical equipment by understanding various standards

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1				1	1	1	1	1				1
CO2	3	1		1		1	1		1		1			1
CO3	3	3	2			1	1	1	1		1	1		1
CO4	3	2				1	2							1
CO5	3		1			1	1	1	2	1				2

1 – Slight, 2 – Moderate, 3 – Substantial

14EEL51 MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

0 0 3 1

LIST OF EXPERIMENTS:

1. Study of 8085 Microprocessor Kits.
2. Arithmetic operations using 8085
3. Study of 8051/8031 Microcontroller Kits
4. Arithmetic functions using 8051
5. LCD Interfacing
6. DC motor speed control
7. Stepper motor control
8. Hex code conversion using Keil compiler and burning into the microcontroller
9. Build your own Project-1 using 8051 Microcontroller
10. Build your own Project-2 using 8051 Microcontroller

TOTAL: 45

REFERENCES / MANUALS / SOFTWARE:

1. Krishna Kant, "Microprocessors and Microcontrollers Architecture, Programming and System Design 8085,8086,8051,8096", 8th Edition, PHI Learning Pvt. Ltd., New Delhi, 2011.
2. Keil Software

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: demonstrate the instructions in 8085 and 8051

CO2: execute the programming skills in 8085 and 8051

CO3: interface peripheral devices with processor and controller in real time

CO4: develop control over peripheral devices using 8085&8051

CO5: develop, build and burn the coding in Keil Environment

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1		2										
CO2	3	3	2	3	2				2	2	1	1	3	3
CO3	3	3	1	3	1									
CO4	3	3	2	3	2				2	2	1	1	3	3
CO5	3	3	2	3	2				2	2	1	1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial

14EEL52 CONTROL SYSTEM AND SIMULATION LABORATORY

0 0 3 1

LIST OF EXPERIMENTS:

1. Digital simulation of second order linear and non-linear systems
2. Determination of Transfer Function Parameters of DC Servomotor.
3. Determination of Transfer Function Parameters of AC Servomotor
4. Effect of P, PI, PID Controller on DC Motor Speed Control.
5. Frequency Response of Second Order System.
6. Stability Analysis of Linear Systems Using Bode Plot And Root Locus
7. Effect of Addition of Poles and Zeros on System Stability.
8. Design of Compensators Using Matlab
9. Design and implementation of simple controller for real time application.

TOTAL: 45

REFERENCES/MANUAL/SOFTWARE:

1. Lab Manual

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: write MATLAB coding to find various control system parameters

CO2: analyze the stability of the systems

CO3: derive transfer function for DC and AC Servomotors

CO4: analyze the frequency response of system

CO5: design a controller for real time application

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		2	3								3	1
CO2	3	3		1	2								3	2
CO3	3	3											3	1
CO4	3	3		2	2								3	2
CO5	3	3		3	2								3	2

1 – Slight, 2 – Moderate, 3 – Substantial

14ECL51 LINEAR INTEGRATED CIRCUITS LABORATORY

(Common to ECE & EEE branches)

0 0 3 1

LIST OF EXPERIMENTS:

Design and implementation of

1. Linear Op-Amp circuits- Inverting and non-inverting amplifiers, Voltage follower, Differentiator and integrator.
2. Design of half-wave and full wave rectifiers using Op-Amps.
3. RC phase shift oscillator using Op-Amps.
4. Wien bridge oscillator using Op-Amps.
5. Active filters using Op-Amps-2^{nd} order LPF, BPF.
6. Applications of comparator: Zero crossing detector and Window detector.
7. Monostable multivibrator using Op-Amps and IC 555.
8. Astable multivibrator using Op-Amps and IC 555.
9. Schmitt trigger circuit using IC 555
10. Design of R-2R ladder type DAC.
11. Voltage regulator using 78XX
12. Application of instrumentation amplifier using sensors

TOTAL: 45

REFERENCES/MANUAL/SOFTWARE:

1. Lab Manual

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: design oscillator circuits

CO2: design filters and multivibrators

CO3: develop circuits for real time applications

CO4: design power supply circuits using ICs

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		1										2	2
CO2	2		3										2	1
CO3	3		3										3	
CO4	3		3										3	2

1 – Slight, 2 – Moderate, 3 – Substantial

14GET61 ECONOMICS AND MANAGEMENT FOR ENGINEERS

(Common to all Engineering and Technology branches)

3 0 0 3

UNIT – I **9**

Economics – Basics Concepts and Principles – Demand and Supply – Law of demand and Supply – Determinants – Market Equilibrium – Circular Flow of Economic activities and Income.

UNIT – II **9**

National Income and its measurement techniques. Inflation - Causes of Inflation – Controlling Inflation – Business Cycle. Forms of business – Management Functions: Planning, Organizing, Staffing, Leading and Controlling - Managerial Skills - Levels of Management - Roles of manager.

UNIT – III **9**

Marketing - Core Concepts of Marketing - Four P's of Marketing - New product development - Product Life Cycle - Pricing Strategies and Decisions.

UNIT – IV **9**

Operations Management - Resources - Types of Production system - Site selection, Plant Layout, Steps in Production Planning and Control - Inventory - EOQ Determination.

UNIT – V **9**

Accounting Principles – Financial Statements and its uses – Depreciation: Straight Line and Diminishing Balance Method – Break Even Analysis – Capital Budgeting: Meaning – Types of decisions – Methods (Theory).

TOTAL : 45

TEXT BOOK:

1. "Economics and Management for Engineers", Complied by Department of Management Studies, Kongu Engineering College, McGraw-Hill Education, India, 2013.

REFERENCE BOOKS:

1. Geetika, Piyali Ghosh and Purba Roy Choudhury, "Managerial Economics", 1st Edition, Tata McGraw-Hill, New Delhi, 2008.
2. Jeff Madura, "Fundamentals of Business", Cengage Learning Inc., India, 2007.
3. Stanley L. Brue and Campbell R. Mcconnell, "Essentials of Economics", Tata McGraw-Hill, New Delhi, 2007.
4. Jain S.P., Narang K.L. and Simi Agrawal, "Accounting for Management", 1st Edition, Tata McGraw-Hill, New Delhi, 2009.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: estimate market equilibrium and interpret national income calculation and inflation issues

CO2: categorize the forms of business and analyse the functions of management

CO3: appraise marketing management decisions

CO4: apply appropriate operation management concept in business situations

CO5: interpret financial and accounting statements

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	2			3		2	2	2	3	2		2
CO2		1	2			2	2	2	2	2	3	2		2
CO3	1	2	1			2		2	2	2	3	2	1	2
CO4	1	2	1			2		2	2	2	3	2		2
CO5	2	2				2		2	2	2	3	2		2

1 – Slight, 2 – Moderate, 3 – Substantial

14EET61 POWER ELECTRONICS

(Common to EEE & EIE branches)

3 0 0 3

Pre-requisites: Electron Devices and Circuits, Electrical Machines

UNIT – I **9**

Power Semi-Conductor Devices: History, Evolution and Symbols of Power Electronic devices - Construction, Principle of Operation**,** Static and Dynamic Characteristics of SCR, TRIAC, MOSFET, IGBT and GTO – Safe Operating Area, Two transistor analogy of thyristor- Thyristor Protection – Series and Parallel Connections of thyristors- Loss calculations and data sheet specification of MOSFET (Quantitative analysis only)

UNIT – II **9**

Phase Controlled Converters: Single Phase and Three Phase Controlled Rectifiers With R, RL and RLE Load – Estimation of RMS Load Voltage, RMS Load Current and Input Power Factor, DPF - Effect of Source Inductance – Gating Circuits for Single Phase Converters

UNIT – III **9**

DC to DC Converters: DC Choppers using devices other than Thyristors – Chopper Control Strategy – Time Ratio Control – Current Limit Control – Principle of Step Up and Step Down Operation – Single Quadrant DC Chopper, Two Quadrant and Four Quadrant DC Choppers – Voltage and Current Commutated Choppers – Introduction To Buck, Boost, Cuk, Buck–Boost Regulators

UNIT – IV **9**

Inverters: Inverters – Types – Single Phase Bridge Inverters – Three Phase Bridge Inverters – 180^o and 120^o Mode – PWM Inverters – Sinusoidal PWM, Multiple PWM and Space Vector PWM– Voltage Control of Single Phase Inverters – Harmonic Reduction – Single Phase Current Source Inverters – Basic Series Inverter

UNIT – V **9**

AC to AC Converters: Single Phase and Three Phase AC voltage Controllers – Control Strategy , Single Phase Transformer Tap Changers – Cycloconverter –Step up and Step down – Single Phase to Single Phase Cycloconverter – Three Phase to Single Phase Cycloconverter, Applications: UPS,

TOTAL: 45

TEXT BOOKS:

1. Rashid M.H., "Power Electronics: Circuits Devices and Applications", 3rd Edition, Pearson Education, New Delhi, 2014.
2. Bimbra P.S., "Power Electronics", 5th Edition, Khanna Publishers, 2012.

REFERENCE BOOKS:

1. Singh M.D. and Kanchandani, "Power Electronics", 2nd Edition, Tata McGraw-Hill, New Delhi, 2013.
2. Ned Mohan, Undeland and Robbins, " Power Electronics: Converters, Applications and Design", 3rd Edition, John Wiley and Sons, Wiley India Limited, 2007.
3. Joseph Vithayathil, "Power Electronics - Principles and Applications", 1st Edition, McGraw Hill Education (India) Pvt. Ltd., 2010.
4. http://nptel.ac.in/downloads/108105066/

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: choose various power semiconductor devices based on their construction and characteristics

CO2: categorize and explain the working principle of rectifiers

CO3: determine the principle of operation of DC to DC converters

CO4: analyze the different types of inverters and their working principle

CO5: interpret the principle of operation of cycloconverter and ac voltage controllers

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2											1	3
CO2	2	2		2									1	3
CO3	2	2		2									1	3
CO4	3	3	2	3									1	2
CO5	2	2		2									1	3

1 – Slight, 2 – Moderate, 3 – Substantial

14EET62 DIGITAL SIGNAL PROCESSING AND APPLICATIONS

3 1 0 4

Pre-requisites: Mathematics III

UNIT – I **9**

Classification of Signals and Systems: Introduction: Need and advantages of digital signal processing, Applications of DSP - Classification of signals: Continuous-Time and Discrete-Time, Deterministic , Periodic, Symmetric, Causal, Energy and Power - Signal representation by singularity functions: Unit - Impulse, Step, Ramp and Exponential – Simple manipulations of discrete-time signals: Shifting, Folding and Time scaling - Classification of systems: Static, Linear, Time-variant, Causal and Stable- Analog to Digital conversion: Sampling , Quantization, Aliasing effect.

UNIT – II **9**

Z-Transform: Z-Transform:Definition, ROC, Properties - Inverse z-transform : Long division method, Partial fraction method - Solution of difference equation by z-transform- Linear and circular Convolution – Convolution by Z transform .

UNIT – III **9**

Discrete Fourier Transform and Computation: Discrete Fourier Transform: Definition, Relationship of DFT to Z-transform, Properties- FFT: Radix-2 FFT, Decimation In Time and Decimation In Frequency algorithms- DFT using FFT algorithms – IDFT- Computation of IDFT using FFT.

UNIT – IV **9**

Digital Filters: FIR Filter (Low and High Pass Filters): Linear Phase Filters - Windowing Technique for Design of Linear Phase Filters: Rectangular, Hamming and Hanning – Structure Realization: Direct and Cascaded Form. IIR Filter (Low and High Pass Filters): Analog Filter Design - Butterworth and Chebyshev Approximations- Digital Filter Design Using Impulse Invariant and Bilinear Transformation- Pre-Warping – Frequency Transformation – Structure Realization: Direct , Cascaded and Parallel Form.

UNIT – V **9**

DSP Processors: Architecture and Features of TMS320F2812 DSP Processor, Instruction set, Addressing Modes, Event Manager**,** Architecture and Features of TMS320F28374D, Addressing Modes - DSP Applications: Harmonic Analysis, Motor Control, Power line communication.

Lecture:45, Tutorial:15, TOTAL: 60

TEXT BOOKS:

1 S.Salivahanan, "Digital Signal Processing",3rd Edition, Tata Mc-Graw Hill, 2013.

2. John G. Proakis, Dimitris G.Manolakis, "Digital Signal Processing: Principles, Algorithms and Applications", 4th Edition, Prentice Hall of India, 2007.

REFERENCE BOOKS:

1. Ashok Ambardar, "Digital Signal Processing: A Modern Introduction", Thomson, 2007.
2. Alan V.Oppenheim, Ronald W. Schafer & John R.Buck , " Discrete Time Signal Processing", 3rd Edition, Pearson,2014.
3. Texas Instrument TMS320F28374D & TMS320F2812 User's Guide

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: analyze the properties of signals and systems

CO2: implement various transform techniques for signal processing applications

CO3: design and realize various digital filters

CO4: illustrate the operation of basic and advanced DSP Processors

CO5: understand the various applications of DSP processor

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	2	1							1		3
CO2	3	2	1	1	1							1		2
CO3	3	2	1	1	1							1	1	3
CO4	1				1							1		1
CO5	1				1							1		2

1 – Slight, 2 – Moderate, 3 – Substantial

14EET63 POWER SYSTEM ANALYSIS AND STABILITY

3 1 0 4

Pre-requisites: Circuits and Networks**,** Numerical Methods, Transmission and Distribution

UNIT – I **9**

Modeling of Power System: Need for System Analysis in Planning and Operation of Power System - Necessity of Modeling - Types of Modeling – Different Models for Generator, Load, and Transmission Line based on the analysis - Single Line Diagram – Per Phase Representation – Per Unit Representation. Primitive Network And its Matrices - Bus Incidence Matrix - Formation of Bus Admittance by Two-Rule Method and Singular Transformation.

UNIT – II **9**

Power Flow Analysis: Problem definition – Bus classification – Derivation of power flow equation – Methods of Power flow analysis - Algorithm and flowchart for Gauss Seidel, Newton Raphson method - Computation of slack bus power, transmission loss and line flows – Comparision of power flow methods-Numerical solution of power flow problem by GS method not more than three buses.

UNIT – III **9**

Symmetrical Short Circuit Analysis: Need for short circuit study - Representation of generator, transformer, and transmission line for short circuit study –Formation of bus impedance matrix - Z-bus by building algorithm - Symmetrical short circuit analysis – Thevenin's equivalent representation – Fault MVA - Fault calculation using Z bus.

UNIT – IV **9**

Unsymmetrical Short Circuit Analysis: Unsymmetrical Fault Analysis – Review of transformation – sequence impedances – sequence networks of loads, Transmission lines, rotating machines and transformers. Types of unsymmetrical fault - Unsymmetrical fault analysis on an Unloaded generator- single line to ground fault, double line to ground fault, line to line fault – computation of fault currents - unsymmetrical analysis on power system.

UNIT – V **9**

Stability Analysis: Introduction to power system stability – Definition: steady state, quasi steady state, transient state - Development of Swing equation– Solution of Swing Equation by step by step method - Modified Euler's method – Range Kutta method (Qualitative analysis) – Synchronous machine representation by Classical machine model – power angle equation –- Equal area Criterion – Determination of critical clearing angle and time – Small signal stability of SMIB system.

Lecture:45, Tutorial:15, TOTAL: 60

TEXT BOOKS:

1. Grainger John J. and Stevenson W.D., "Power System Analysis", 1st Edition, Tata McGraw- Hill, New Delhi, 2003.
2. Kimbark E.W., "Power System Stability – Part I and II", 4th Edition, John Wiley, 2004.

REFERENCE BOOKS:

1. Nagrath I.J. and Kothari D.P., "Modern Power System Analysis", 4th Edition, Tata McGraw- Hill, New Delhi, 2011.
2. Wadhwa C.L., "Electrical Power Systems", 6th Edition, New Age International Publishers Pvt. Ltd., 2012.
3. Duncan J. Glover, Mulukutla S. Sarma and Thomas J. Overbye, " Power System Analysis and Design", 5th Edition, Thomas Learning, 2011.
4. http://nptel.ac.in/courses/108105067/

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: model various power system components

CO2: determine the bus parameters under steady state condition

CO3: calculate the symmetrical fault currents

CO4: analyze the different types of unsymmetrical faults

CO5: predict the stability of the power system

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		3										3
CO2	2	3		2										2
CO3	2	3		2									2	2
CO4	2	3		2									2	2
CO5	3	2		3	1									3

1 – Slight, 2 – Moderate, 3 – Substantial

14EEL61 POWER ELECTRONICS LABORATORY

0 0 3 1

LIST OF EXPERIMENTS:

1. Steady state and Switching characteristics of SCR
2. Single Phase half controlled and fully controlled Rectifiers
3. Step up and Step down chopper
4. Three phase inverters - 180° and 120° mode of operation
5. Three phase AC voltage controllers
6. Firing Circuits for thyristors
7. PWM signal generation using DSPACE
8. Build your own Converter

TOTAL: 45

REFERENCES / MANUALS / SOFTWARE:

1. Power Electronics Laboratory manual
2. DSPACE

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: appraise the characteristics of power semiconductor devices

CO2: examine the working of various power converters

CO3: construct a suitable firing circuit for converters

CO4: interpret the need of protection circuits for thyristors

CO5: develop a power converter

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1		2									2	2
CO2	3	3		3	2								3	3
CO3	2	3		3	2								3	3
CO4	1	3		3	2								3	3
CO5	3	3		3	2								3	3

1 – Slight, 2 – Moderate, 3 – Substantial

14EEL62 DIGITAL SIGNAL PROCESSING AND APPLICATIONS LABORATORY

0 0 3 1

LIST OF EXPERIMENTS:

1. Generation and analysis of Continuous and Discrete time Signals.
2. Verification of Sampling theorem.
3. Linear and Circular Convolution.
4. Determination of LTI system responses
5. Analysis of signals using various frequency transforms.
6. Design and analysis of FIR filters (Low Pass and High Pass).
7. Design and analysis of IIR filters (Low Pass and High Pass) and realize its structure
8. Implement multirate digital signal processing
9. Pulse generation using DSP Processor
10. Pulse width modulation using DSP Processor

TOTAL: 45

REFERENCES / MANUALS / SOFTWARE:

1. MATLAB 7.1
2. TMS320F2812 DSP Trainer Kit

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: develop program using MATLAB for processing the signals

CO2: determine the response for various digital systems

CO3: analyze the signals using transforms

CO4: design and realize the structure of digital filters

CO5: generate and analyze signals using DSP processor kit

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		1	2							1		3
CO2	2	1		1	2							1		1
CO3	3	2	1	1	2							1		2
CO4	3	2	1	1	2							1	1	2
CO5	3	3	1	1	2							1		2

1 – Slight, 2 – Moderate, 3 – Substantial

14EGL41 COMMUNICATION SKILLS LABORATORY

(Common to all Engineering and Technology branches)

0 0 3 1

LIST OF EXPERIMENTS:

1. Listening Skills: Listening activity using software package in the communication laboratory - Listening to native speakers - Developing oral communication by imitating the model dialogues. Listening for specific information – Listening to improve pronunciation – Listening and typing – Filling the blanks–TV programmes and News.

Audio Visual Lab: Activity based learning

2. Activity based Reading Skills: Reading for getting information and understanding; scanning, skimming and identifying topic sentences – Reading for gaining knowledge-Group activity.

3. Activity based Writing Skills: Preparing a draft – Word editing features, editing and proof reading; Writing a short essay using the draft prepared - Group activity.

4. Speaking Skills: Verbal and Non-Verbal Communication; Introducing oneself -Describing a place, Expressing views and opinions; Giving a presentation on a Topic - eye contact, speaking audibly, clearly and with confidence; Group discussion.Conversations – Face-to-Face conversation – Simulated Telephonic Conversation.

Career Lab

5. Interview Skills: Introducing oneself – Answering other FAQ's. Presentation Skills: Elements and structure of effective presentation – Presentation Tools – Voice modulation – Body language –Video samples. Group Discussion: Structure of Group Discussion – Strategies in group discussion - Team work – Video Samples. Soft Skills: Fundamentals of Soft Skills – Work Place Culture and Inter-Personal Relationships.

TOTAL : 45

REFERENCES / MANUALS / SOFTWARE:

1. Orell Digital Language Lab Software

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: communicate efficiently in real life and career related situations

CO2: demonstrate good Presentation skills and team skills

CO3: familiarize in using modern communication software packages to enhance their soft skills

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1									3	3		2		
CO2									2	3		1		
CO3									1	3		2		

1 – Slight, 2 – Moderate, 3 – Substantial

14GET71 TOTAL QUALITY MANAGEMENT

(Common to all Engineering and Technology branches)

3 0 0 3

UNIT – I **9**

Quality (Basic concepts and principles) : Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs, Basic concepts of Total Quality Management, Historical Review. Principles of TQM, Leadership – Concepts, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT – II **9**

TQM Principles and strategies : Customer satisfaction – Customer Perception of Quality, Customer Complaints, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits. Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development

UNIT – III **9**

TQM Tools (Process Control): The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

UNIT – IV **9**

TQM Tools: Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA, Poka Yoke.

UNIT – V **9**

Quality Systems -Need for ISO 9000 and Other Quality Systems, ISO 9000:2008 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, Introduction to TS 16949, QS 9000, ISO 14000, ISO 18000, ISO 20000, ISO 22000.

TOTAL : 45

TEXT BOOKS:

1. Besterfield, Dale H. et al., "Total Quality Management", 3rd Edition (Revised), Pearson Education, 2011.
2. Subburaj Ramasamy, "Total Quality Management", Tata McGraw Hill, New Delhi, 2008.

REFERENCE BOOKS:

1. Feigenbaum A.V., "Total Quality Management", 4th Edition, Tata McGraw Hill, New Delhi, 2004.
2. Suganthi L. and Samuel A. Anand, "Total Quality Management", PHI Learning, New Delhi, 2011.
3. Evans James R. and Lindsay William M., "The Management and Control of Quality", 7th Edition, South-Western (Thomson Learning), 2011.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: understand the meaning of quality and its importance

CO2: know the principles of total quality management and peculiarities of their implementation

CO3: develop in-depth knowledge on various tools and techniques of quality management

CO4: learn the applications of quality tools and techniques in both manufacturing and service industry

CO5: develop analytical skills for investigating and analyzing quality management issues in the industry and suggest implement able solutions to those

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						2	2	3	2	2	2	3		
CO2						3	2	3	3	3	2	3		
CO3	3	2	2	2	2	2		1	2	2	3	2		
CO4	2	2	2	2	2	2		1	2	2	3	2		
CO5						3	3	2	3	2	2	2		

1 – Slight, 2 – Moderate, 3 – Substantial

14EET71 ELECTRIC DRIVES AND CONTROL

(Common to EEE & EIE branches)

3 0 0 3

Pre-requisites: Electrical Machines, Power Electronics

UNIT – I **9**

DC Drives: Fundamentals of Electrical Drives-Block Diagram, Elements– Classes of Motors Duty - Speed Control Of DC Motors – Ward–Leonard Scheme – Drawbacks – Thyristorized Converter Fed Dc Drives: - Single, Two And Four Quadrant Operations – Chopper Fed DC Drives: Single, Two and Four Quadrant Operations – Effect Of Ripples- Closed Loop Control Of DC Drive

UNIT – II **9**

Induction Motor Drives: Speed Control Of three Phase Induction Motors – AC Chopper, Inverter And Cycloconverter Fed Induction Motor Drives. Rotor Control: Rotor Resistance Control– Static Control Of Rotor Resistance Using DC Chopper – Slip Power Recovery Schemes - Static Krammer and Scherbius Drives – Effect Of Harmonics- Closed Loop Control Of Induction Motor Drive .

UNIT – III **9**

Synchronous Machine Drives: Speed control of three phase Synchronous Motors – True synchronous and self controlled modes of operations – Voltage source Inverter fed Synchronous Motor drive - Current source Inverter fed Synchronous Motor – cycloconverter fed Synchronous Motor –Closed loop control of synchronous motor drive- Effect of harmonics.

UNIT – IV **9**

PMSM Drives and Variable Reluctance Motor Drive: Characteristics of permanent magnet synchronous machines - Drive characteristics and control principles- Variable Reluctance motor drives- Torque production -Drive characteristics and control principles -Microprocessor based control of PMSM & variable reluctance motor.

UNIT – V **9**

Vector Control: Basic Principle of Vector Control–Direct and Quadrature-Axis Transformation-Indirect Vector control and Direct Vector Control of Induction motor- vector control of PMSM -Advantages and limitations- PLC based control schemes, Selection of drives for Steel rolling mills, Paper mills.

TOTAL: 45

TEXT BOOKS:

1. Dubey G.K., "Fundamentals of Electrical Drives", Narosa Publishing House, New Delhi, 2013.
2. Bose B.K., "Modern Power Electronics and AC Drives", Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.

REFERENCE BOOKS:

1. Vedam Subramanian, "Electric Drives: Concepts and Applications", Tata McGraw-Hill, New Delhi, 2007.
2. Bose B.K., "Power Electronics and Variable Frequency Drives: Technology and Applications", Wiley India Pvt. Ltd., 2010.
3. Sen P.K., "Electrical Drives", Prentice Hall of India Pvt. Ltd., New Delhi, 2006.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: evaluate the performance of D.C. drives

CO2: understand the operation and control of AC drives

CO3: choose the various control techniques employed for synchronous motor drives

CO4: identify modern control technique for industrial drives

CO5: analyze the equations governing the vector control

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1		1								1	2
CO2	3		1		1							1		2
CO3	3	1	1		1									2
CO4	3	2	1		2								1	2
CO5	2	1		1									1	

1 – Slight, 2 – Moderate, 3 – Substantial

14EET72 POWER SYSTEM PROTECTION AND SWITCHGEAR

3 0 0 3

Pre-requisites: Transmission and Distribution

UNIT – I **9**

Introduction: Need for protection - Basic requirements and components of protection- Power system earthing –Types of earthing - Concepts of Step potential and Touch potential- Effect of electric shock on human beings -Types of isolators - Zones of protection – Fuse: Definitions, types – HRC Fuse: Construction ,working and characteristics- I_s limiter

UNIT – II **9**

Protective Relays: Basic terminology: Pickup value, current setting, Plug setting multiplier, Time setting multiplier, Time/ P.S.M curve, timing characteristics: instantaneous, Definite time lag, inverse time lag, IDMT lag relay – Classification of relay: Electromagnetic Relay, Induction relay – Construction, operation of induction type: directional and non directional over current relays – Universal relay torque equation – Distance relay: Impedance, Reactance, Mho Relay - Differential relays - Negative phase sequence relay. – Introduction of microprocessor based protective relay - ANSI/IEEE standard device numbering for power system protection – Introduction to Relay Co-ordination: time discrimination principle.

UNIT – III **9**

Apparatus Protection: Generator protection - Stator protection: Percentage differential protection –Restricted Earth fault Protection- stator inter-turn protection - Stator overheating protection. Rotor protection: Earth fault protection - Loss of excitation - Rotor overheating protection. **Transmission line protection:** Protection of feeder and ring main system - Pilot wire protection - Carrier current protection - **Transformer protection** - Incipient fault Protection- Differential protection – over fluxing protection.

UNIT – IV **9**

Theory of Circuit Interruption: Physics of arc phenomena and arc interruption – Methods of arc Extinction- Theories of Arc interruption- Arc voltage - Restriking voltage and recovery voltage –Expression for Restriking voltage and Rate of Rise of Restriking Voltage - Current chopping- interruption of capacitive currents - Resistance switching.

UNIT – V **9**

Circuit Breakers: Classification of circuit breakers – Electrical Breakdown properties of liquid, gases - Circuit breaker operating mechanism: Oil, Air Blast, SF6, Vacuum - Selection of C.B. - Comparative merits of different circuit breakers- Testing of C.B: Type test and Routine test- Direct testing - Indirect testing.

TOTAL: 45

TEXT BOOKS:

1. Gupta J.B.,"A Course in Power Systems", 11th Edition, S.K.Kataria & Sons, New Delhi, Reprint 2015.
2. Rao Sunil S., "Switchgear Protection and Power Systems", 13th Edition, Khanna Publishers, New Delhi, 2008.

REFERENCE BOOKS:

1. Badri Ram and Vishwakarma, "Power System Protection and Switchgear", 2nd Edition, Tata McGraw-Hill, New Delhi, 10th Reprint 2015.
2. Les Hewitson, Mark Brown, Ben Ramesh, "Practical Power Systems Protection", 1st Edition, Newnes Publisher, Burlington, 2005.
3. Paithankar Y.G., Bhide S.R., "Fundamentals of Power System Protection", 2nd Edition, New PHI Learning, 2010.
4. http://www.nptel.ac.in/courses/108101039/20#
5. https://www.youtube.com/watch?v=TNjBKTijmPw

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: outline the basic concepts of protection
CO2: explain the working and tripping characteristics of various relays
CO3: select and Design the protection schemes for power system components
CO4: analyze the various problems in circuit interruption
CO5: compare the operation of various circuit breakers

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1		1		2				1		1	1	1
CO2	1	2		1			3					1		
CO3	3	3	2	3			3			1		1	2	
CO4	3	3	1	3								1	2	1
CO5	3	1		3			3					1	2	1

1 – Slight, 2 – Moderate, 3 – Substantial

14EEL71 ELECTRIC DRIVES LABORATORY

0 0 3 1

Pre-requisites: Electrical Machines I & II Laboratory, Power Electronics Laboratory

LIST OF EXPERIMENTS:

1. Simulation of closed loop control of converter fed DC motor
2. Simulation of closed loop control of chopper fed DC motor.
3. Simulation of VSI fed Three phase induction motor
4. Simulation of Three phase synchronous motor drive
5. Speed control of DC motor using Three phase Rectifier.
6. Speed control of Three phase induction motor using PWM inverter
7. FPGA based drive for induction motor
8. DSP based Speed control of BLDC motor drive.
9. Speed control of SRM Drive in open and closed loop
10. DSP based chopper drive for DC Motor(Programming and Implementation)

TOTAL: 45

REFERENCES / MANUALS / SOFTWARE:

1. Lab Manuals

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: evaluate the performance of DC drives

CO2: examine the performance of AC drives

CO3: carryout the conventional speed control techniques for AC and DC machine

CO4: select modern digital control technique for speed control of various electric motors

CO5: compute the performance of various special electric drives

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1			1				1				1	1
CO2	2	1			1				1				1	1
CO3	2	1			1				1				1	1
CO4	2	1	1		2				1				1	1
CO5	2	1			2				1				1	1

1 – Slight, 2 – Moderate, 3 – Substantial

14EEL72 POWER SYSTEM LABORATORY

0 0 3 1

Pre-requisites: Transmission and Distribution, Power System Analysis and Stability

LIST OF EXPERIMENTS:

Power System Analysis Experiments:

1. Computation of line parameters for single and double circuits.
2. Modeling of medium transmission lines.
3. Formation of bus admittance and impedance matrices.
4. Load flow analysis using Gauss Seidal method.
5. Symmetrical and Unsymmetrical fault analysis.
6. Transient and small signal stability analysis: single-Machine infinite bus system.

Power System Protection Experiments:

7. Characteristics of over current/ overvoltage relay.
8. Bias characteristics of differential relay.
9. Measurement of breakdown voltage of liquid dielectric.
10. Characteristics of negative sequence relay.
11. Study of Buchholz relay, MCB, ELCB.

TOTAL: 45

REFERENCES / MANUALS / SOFTWARE:

1. Lab Manual
2. AUPOWER
3. MIPOWER
4. MATLAB

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: compute the line parameters and evaluate the performance indices

CO2: carryout various power system studies

CO3: evaluate the network matrices

CO4: compute the time current characteristics of analog/digital/numerical relays

CO5: measure the breakdown voltage of liquids

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	2							1	2	
CO2	3	3	1	3	1		2			3		1	1	
CO3	3	2	1	3	1							1	1	
CO4	3	2	1	3					1			1	1	
CO5	3	1	1	3			2		1			1	1	

1 – Slight, 2 – Moderate, 3 – Substantial

14EEP71 DESIGN PROJECT

0 0 6 3

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Choose the proper components as per the requirements of the design/system

CO2: Apply the acquainted skills to develop final model/system

CO3: Estimate, plan and execute the project as a team

CO4: Defend the finding and conclude with oral/written reports.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		2					3	3			2	
CO2	3	2	3	2	3	2	2	2	3	3	3	2	3	3
CO3						2			3	3	3	3		
CO4							2	2	3	3	1	1		

1 – Slight, 2 – Moderate, 3 – Substantial

14GET81 PROFESSIONAL ETHICS AND HUMAN VALUES

(Common to all Engineering and Technology branches)

3 0 0 3

UNIT – I **9**

Understanding: Morals – Values-Ethics– Honesty – Integrity – Work Ethic – Service Learning – Civic Virtue – caring – Sharing – Courage – Valuing Time – Co-operation – Commitment – Empathy –Self-Confidence – Character – Spirituality- Senses of 'Engineering Ethics' - variety of moral issues - types of inquiry.

UNIT – II **9**

Moral dilemmas – moral autonomy – Kohlberg's theory – Gilligan's theory – consensus and controversy – Models of Professional Roles – theories about right action – Self-interest – customs and religion- uses of ethical theories. Meaning of Engineering experimentation - engineers as responsible experimenters.

UNIT – III **9**

Codes of ethics for engineers - a balanced outlook on law - the challenger case study. Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk, Bhobal Gas Tragedy and Chernobyl case studies.

UNIT – IV **9**

Collegiality and loyalty – respect for authority – collective bargaining – confidentiality – conflicts of interest – occupational crime – professional rights – employee rights – discrimination – Intellectual Property Rights (IPR) – Multinational corporations.

UNIT – V **9**

Environmental ethics - Computer ethics – weapons development-engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of Electronics and Telecommunication Engineers(IETE).

TOTAL : 45

TEXT BOOKS:

1. Martin Mike and Schinzinger Roland, "Ethics in Engineering", 4th Edtion, Tata McGraw-Hill, New Delhi, 2014.
2. Govindarajan M., Natarajan S., and Senthil Kumar V.S., "Engineering Ethics", Prentice Hall of India, New Delhi, Reprint 2013.

REFERENCE BOOKS:

1. Fleddermann Charles D., "Engineering Ethics", 4th Edition, Pearson Education/Prentice Hall, New Jersey, 2014.
2. Harris Charles E., Protchard Michael S. and Rabins Michael J., "Engineering Ethics: Concepts and Cases", 4th Edition Wadsworth Thompson Learning, United States, 2008.
3. Seebauer Edmund G. and Barry Robert L., "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2008.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: understand the components of ethics and values

CO2: understand the knowledge interpersonal and organizational issues in ethics

CO3: acquired knowledge on ethical theories and their application

CO4: ability to highlight ethical issues in risky situation

CO5: understand the role of professional bodies

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3		3	2	2		2		2
CO2						3		3	2	3		2		2
CO3						3	2	3	2	1		2		2
CO4						3	3	3	2	3		2		2
CO5						2	2	3	2	2		2		2

1 – Slight, 2 – Moderate, 3 – Substantial

14EEP81 PROJECT WORK

0 0 18 9

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Choose the proper components as per the requirements of the design/system

CO2: Apply the acquainted skills to develop final model/system

CO3: Estimate, plan and execute the project as a team

CO4: Defend the finding and conclude with oral/written reports.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		2					3	3			2	
CO2	3	2	3	2	3	2	2	2	3	3	3	2	3	3
CO3						2			3	3	3	3		
CO4							2	2	3	3	1	1		

1 – Slight, 2 – Moderate, 3 – Substantial

14ECT33 COMMUNICATION ENGINEERING

(Common to EEE, EIE, CSE & IT branches)

3 0 0 3

UNIT – I **9**

Amplitude Modulation: Principles of amplitude modulation – AM envelope - Frequency spectrum and bandwidth - Modulation index and percentage modulation - AM power distribution - AM modulator circuits – Low level AM modulator - AM transmitters – Low level transmitter - AM receivers – Superheterodyne receivers

UNIT – II **9**

Angle Modulation: Angle Modulation – FM and PM waveforms - Phase deviation and modulation index - Frequency deviation - Direct FM and PM demodulators - Frequency spectrum of angle modulated waves - Bandwidth requirement - Narrowband FM and Broadband FM - Average power - FM and PM modulators, Direct FM transmitter - Angle modulation vs. amplitude modulation - Double conversion FM receivers - PLL FM demodulator.

UNIT – III **9**

Digital Modulation: Sampling - Time Division Multiplexing - Digital T-carrier System – Pulse code modulation – Amplitude shift keying - Frequency and phase shift keying – Modulator and demodulator - bit error rate calculation

UNIT – IV **9**

Data Communication: Data communication codes: ASCII - BAR codes - Error Control - Error Detection - Redundancy checking - Error Correction - Hamming – Line coding : AMI – NRZ - RZ - Serial interfaces : RS232 - RS485 - Data communication circuits - Data communication modems - Public Switched Telephone Network(PSTN) – ISDN

UNIT – V **9**

Wireless Technologies: Cellular telephone systems – Cellular concepts – Second generation (2G) Third generation (3G) and (4G) cell phone systems – PANs and Bluetooth - Zigbee and Mesh wireless networks - Infrared wireless networks

TOTAL: 45

TEXT BOOKS:

1. Wayne Tomasi, "Electronic Communications Systems: Fundamentals Through Advanced", 5th Edition, Pearson Education, 2008.

REFERENCE BOOKS:

1. Michael Moher and Simon Haykin, "Communication System", 5th Edition, Wiley India Pvt. Ltd., 2011.
2. Frenzel and Louis E., "Principles of Electronic Communication Systems", 3rd Edition, Tata McGraw Hill Publishing Company, New Delhi, 2008.
3. Anokh Singh, "Principles of Communication Engineering", S. Chand & Co., New Delhi, 2006.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: paraphrase amplitude and angle modulation techniques

CO2: learn the concepts of digital modulation techniques

CO3: summarize the concepts in data communication and network protocol

CO4: identify the cellular telephone systems and concepts

CO5: identify the next generation wireless technologies

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3			1	2	3			2		2			
CO2	3	2		1		2			2		2			
CO3	3			2		2			2		2			
CO4	3				3	3	3		2				1	1
CO5	3				3	3	3		2				1	1

1 – Slight, 2 – Moderate, 3 – Substantial

14EEE01 GENERALIZED MACHINE THEORY

3 1 0 4

Pre-requisites: Electrical Machines I, Electrical Machines II

UNIT – I **9**

Principles of Electromechanical Energy Conversion: Introduction – Energy in Magnetic System – Field Energy and Mechanical Force – Multiple Excited Magnetic Field Systems – Forces/Torques in system with permanent Magnets – Energy Conversion via Electric Field – Dynamic Equations of Electromechanical Systems.

UNIT – II **9**

Generalized Theory: Basic two pole machines – Kron's Primitive Machine - Invariance of Power – Transformations from Three Phase to Two Phase – Transformation from Rotating axes to Stationary axes - Electrical Torque – Restriction of the Generalized Theory of Electrical Machines.

UNIT– III **9**

DC Machines: Separately Excited D.C Generators and Motors – Steady State and Transient Analysis - Interconnection of Machines – Ward-Leonard System of Speed Control - Transfer Function of D.C Series, Shunt, Compound Machines.

UNIT– IV **9**

Poly-phase Synchronous Machines: General Machine Equations-Three Phase Synchronous Machine - Steady state analysis – Transient analysis (qualitative Approach) - Concepts of Synchronous machine Reactances – Concepts of Synchronous Machine Dynamics.

UNIT – V **9**

Induction Machines: Transformations - performance equations – Steady State Analysis – Analysis of Equivalent Circuit - Torque Slip Characteristics – Induction Machine Dynamics.

Lecture: 45,Tutorial: 15, TOTAL: 60

TEXT BOOKS:

1. Bimbhra P.S., "Generalized Theory of Electrical Machines", 5th Edition, Khanna Publishers Ltd., 2012.
2. Krishnan R., "Electric Motor Drives: Modeling, Analysis, and Control", 1st Edition, PHI Learning, 2011.

REFERENCE BOOKS:

1. Bimal K. Bose, "Modern Power Electronics and AC Drives", 1st Edition, PHI Learning, 2011.
2. Paul C. Krause, "Analysis of Electrical Machinery", 2nd Edition, McGraw Hill Book Company, 2011.
3. Kothari D.P., Nagrath I.J., "Electrical Machines", 4th Edition, McGraw Hill Book Company, 5th Reprint 2012.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: apply the basic principles of electromechanical energy conversion

CO2: determine the equivalent circuit parameters and model the electrical machines

CO3: analyze the steady state and transient characteristics of DC machines

CO4: design the mathematical model of polyphase synchronous machines

CO5: analyze the steady state characteristics of induction machines

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	3									1	3
CO2	3	3	2	3									2	3
CO3	3	3	2	3									3	3
CO4	3	3	3	3									3	3
CO5	3	3	2	3									3	3

1 – Slight, 2 – Moderate, 3 – Substantial

14EEE02 POWER GENERATION SYSTEM

3 0 0 3

Pre-requisites: Basics of Electrical and Electronics Engineering

UNIT – I **9**

Introduction: Introduction – Load duration curve – Demand factor – Plant capacity – Plant Use factor. **Thermal Power Plant:** Choice of power station and units - Working of steam power plant - power station design - site selection of coal fired power plant - boiler, steam turbine, water treatment, condensing plant and circulating water system, fuel handling, fuel firing, Ash handling and dust collection.

UNIT – II **9**

Hydro Power Plant: Hydrology, hydrographs, flow duration curve, mass curve, types of dam, principle of working of a hydro electric plant, tidal power plant, power to be developed, types of turbine and their characteristics, characteristics of generators, power station structure and layout. Pumped storage system.

UNIT – III **9**

Nuclear Power Plant: main parts of nuclear power station - principle of nuclear energy - main parts of reactor - types of power reactor - location of nuclear power plant - layout of power station - reactor control - nuclear waste disposal.

UNIT – IV **9**

Renewable Power Plant: Solar power generation – Photo-voltaic and solar thermal generation – solar concentrators, Wind power generation – types of wind mills, wind generators, tidal, biomass, geothermal and magneto-hydro dynamic power generation, micro-hydel power plants, fuel cells and diesel and gas power plants.

UNIT – V **9**

Power Station Economics: Introduction - Cost analysis - Fixed and Operating cost – Terms and definitions related to electrical load – Estimation and prediction of load – Plant design – Operation and economics – Tariff/Energy rates

TOTAL: 45

TEXT BOOKS:

1. Gupta. J.B., "A Course in Power Systems", 11th Edition, S.K.Kataria & Sons., New Delhi, Reprint 2015.
2. Manoj Kumar Gupta, "Power Plant Engineering", 1st Edition, PHI Learning Pvt. Ltd., 2012.

REFERENCE BOOKS:

1. Arora S.C., Domkundwar A.V., Domkundwar S., "Power Plant Engineering", 6th Edition, Dhanpat Rai & Co., 2013.
2. Gupta B.R., "Generation of Electrical Energy", 14th Edition, S.Chand Publications, 2011.
3. Deshpande M.V., "Elements of Electric Power System Design", 3rd Edition, PHI Learning Pvt. Ltd., 2010.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: analyze new energy sources and types of power stations

CO2: classify the thermal, hydro and nuclear power stations

CO3: examine the economic aspects in power generation

CO4: explain the MHD generation

CO5: determine the tariff values and its types

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1					3						1	2
CO2	3	2					2							2
CO3	2	1					3							1
CO4	1						2							1
CO5	3	2		3			2						1	3

1 – Slight, 2 – Moderate, 3 – Substantial

14EEE03 ELECTRONIC INSTRUMENTATION

3 0 0 3

Pre-requisites: Measurements and Instruments

UNIT – I **9**

Analog and Digital Instruments: Voltmeters – Ammeters – True RMS meter – Vector impedance meter – Vector voltmeter – Multimeters –Power meter – Q-meter – Megger – Trivector meter.Digital method for measuring frequency, period, phase difference, pulse width, time interval, and total count – Digital voltmeter: Types – DMM - Block diagram and components of Intelligent Instruments.

UNIT – II **9**

Signal Analyzers and CRO: Function generator - Wave analyzer – Applications – Power analyzer – Spectrum analyzer – Applications – General purpose Oscilloscope (Block Diagram)–Special oscilloscopes: Multi-input oscilloscope, Storage oscilloscopes, Sampling oscilloscope.

UNIT – III **9**

Sensors And Display Devices: Sensors: Introduction – Types of Modern Sensors: Biosensors - Nanosensors - Proximity sensors – Flow sensors. Recorders: Digital recorders – Data loggers. Displays: LED and LCD, Segmental and Dot matrix display.

UNIT – IV **9**

Introduction To Virtual Instrumentation, Data Acquisition: Concept of virtual instruments- Virtual instruments versus traditional instruments – Hardware and Software in Virtual Instrumentation. Data acquisition system – Signal Conditioning – DAQ Hardware and Software - DAQ Hardware Configuration - DAQ Software – Installing the DAQ Card.

UNIT – V **9**

Programming in Labview: Software environment – Block Diagram – Palettes – Data types –Controls and Indicators – Data types –Data flow programming – Editing Debugging and running a VI – FOR Loop – WHILE Loop- Shift Register - Arrays – Array Functions - Strings and File IOs: Strings - String Functions – Editing, Formatting and Parsing Strings – File IOs – High level File IOs.

TOTAL: 45

TEXT BOOKS:

1. Kalsi H.S., "Electronic Instrumentation", 3rd Edition, Tata McGraw-Hill, New Delhi, 2010.
2. Jerome J., "Virtual Instrumentation using Lab VIEW", 1st Edition, Prentice Hall India Pvt. Ltd., New Delhi, 2010.

REFERENCE BOOKS:

1. Sawhney A.K., "Electrical and Electronic Measurements and Instrumentation", 1st Edition, Dhanpat Rai & Co, New Delhi, 2011.
2. Helfrick, Albert D. and Cooper, William D., "Modern Electronic Instrumentation and Measurement Techniques", 2nd Edition, Prentice Hall of India, New Delhi, 2015.
3. Rangan, C.S., Sarma, G.R., Mani, V.S.V., "Instrumentation Devices and Systems", 3rd Edition, Tata McGraw-Hill, New Delhi, 2008.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: understand the analog and digital instruments and their applications

CO2: distinguish different types of signal analyzers and oscilloscopes

CO3: outline the different types of sensors and display devices

CO4: explore the basics of Virtual Instrumentation and data acquisition systems

CO5: perform programs using LabVIEW

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											1	1
CO2	2	1											1	1
CO3	2	1											1	1
CO4	2	2		2	2								1	1
CO5	3	2		3	2					1			2	3

1 – Slight, 2 – Moderate, 3 – Substantial

14ECE08 DIGITAL IMAGE PROCESSING

(Common to ECE, EEE & IT branches)

3 0 0 3

UNIT – I **9**

Digital Image Fundamentals: Elements of digital image processing systems- Elements of visual perception- Brightness- Contrast- Hue- Saturation- Mach band effect -Image sampling- Quantization - Basic relationship between pixels - Color image fundamentals - RGB- HSI models – 2D Image transforms: DFT – DCT – KLT – Haar – Walsh - Hadamard

UNIT – II **9**

Image Enhancement: Basic intensity transformations – Piecewise linear transformation functions - Histogram equalization - Spatial filtering : Smoothing and sharpening Filters – Frequency domain filtering : Smoothing and sharpening filters – Homomorphic filters – Color image enhancement

UNIT – III **9**

Image Restoration: Degradation model – Noise distributions- Median – Geometric mean – Harmonic mean – Contra harmonic mean filters – Order Statistics filters - Inverse and wiener filtering - Constrained least square filtering. **Morphological Image Processing:** Preliminaries – Erosion – Dilation – Duality – Opening – Closing – Hit or Miss Transformation

UNIT – IV **9**

Image Segmentation, Representation & Description: Point, line and edge detection – Basics of intensity thresholding – Region based segmentation : Region growing - Region splitting and merging – Image representation : Chain codes, – Boundary descriptors - Regional descriptors

UNIT – V **9**

Image Compression: Fundamentals: Types of redundancy – Huffmann – Run length coding – Arithmetic coding - Bit-plane coding – Block Transform coding -Wavelet Coding – Lossless and Lossy Predictive coding – JPEG standard

TOTAL: 45

TEXT BOOKS:

1. Gonzalez R.C. and Woods R.E., "Digital Image Processing", 4th Edition, Pearson Education, 2009.

REFERENCE BOOKS:

1. Jain A.K., "Fundamentals of Digital Image Processing", 4th Edition, PHI Learning, 1995.
2. Salomon David, "Data Compression: The Complete Reference", 2nd Edition, Springer, Verlag, New York, 2001.
3. Milan Sonka, Roger Boyle and Vaclav Hlavac, "Image Processing, Analysis, and Machine Vision", 4th Edition, Cengage Learning, 2015.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: analyze the real time images using 2D transforms

CO2: improve the quality of images with various enhancement techniques

CO3: apply the concepts of color image processing

CO4: realize edge detection and segmentation algorithms for images

CO5: perform compression of images

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		3	3								1	1
CO2	3	3	3	3	3	2						2	1	1
CO3	3	3	3	3	3								1	1
CO4	3	3	3		3								1	1
CO5	3	3	3	3	3								1	1

1 – Slight, 2 – Moderate, 3 – Substantial

14EIE03 EMBEDDED CONTROL

(Common to EIE & EEE branches)

3 0 0 3

Pre-requisites: Microprocessors and Microcontrollers

UNIT – I **9**

Introduction to 8 bit Microcontrollers: Architecture of PIC 18 - Pin Description – Memory Organization: Program Memory – Data Memory: Register Organization – Oscillator and Reset Circuits – Addressing Modes – Instruction Set – Simple Programs.

UNIT – II **9**

PIC 18 Timer Programming and Memory Interfacing: Interfacing and Assembly Language Programming of I/O Ports – Timers – Counters – Capture/Compare Mode – PWM – External Hardware Interrupts – Interfacing Memory.

UNIT – III **9**

Interfacing Peripherals with PIC 18 Microcontroller: Interfacing and Assembly Language Programming of ADC – DAC – Temperature Sensor – LCD – Keyboard – Motor Control: DC motor and Stepper motor.

UNIT – IV **9**

Introduction to Embedded Systems: Definition – Classification of Embedded Systems – Characteristics – Quality Attributes – Fundamental issues in Hardware Software Co-Design – Embedded Product Development. Life Cycle: Objectives – Different Phases – Approaches. Trends in the Embedded Industry: Processor Trends – Embedded OS Trends – Open Standards, Frameworks and Alliances – Bottlenecks.

UNIT – V **9**

RTOS Concepts and Case Study: Basics of OS – Types of OS – Tasks – Process – Task scheduling – Task communication – Priority Inversion Problem – Micro C / OS-II. Case Study: Automatic Chocolate Vending Machine – Smart Card Reader – Automated Meter Reading System.

TOTAL: 45

TEXT BOOKS:

1. Mazidi, Muhammad Ali, Mckinlay, Rolin D., and Causey Danny, "PIC Microcontroller and Embedded Systems using Assembly and C for PIC 18", 1st Edition, Pearson Education Asia, 2009.
2. Shibu.K.V, "Introduction to Embedded Systems", 4th Reprint, Tata McGraw Hill Education Pvt. Ltd., 2011.
3. Rajkamal, "Embedded Systems Architecture, Programming and Design", 3rd Edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2014.

REFERENCE BOOKS:

1. Valvano Jonathan W., "Embedded Microcomputer Systems - Real Time Interfacing", 3rd Edition, Cengage Learning, 2011.
2. Labrosse, Jean J., "Micro C / OS –II : The real-time Kernel", Illustrated and Revised Edition, Taylor & Francis, 2002.
3. Microchip: PIC Microcontroller Data manuals.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: understand the basic concepts of PIC Microcontroller
CO2: gain knowledge in the interfacing concepts of PIC Microcontroller
CO3: apply the programming skills to interface peripherals with PIC Microcontroller
CO4: acquire adequate knowledge in objectives, attributes and trends of embedded systems
CO5: perform case studies using RTOS

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EIT63 VLSI SYSTEMS
(Common to EIE & EEE branches)

3 0 0 3

Pre-requisites: Digital Logic Circuits

UNIT – I **9**

MOS Transistor Theory: NMOS enhancement transistor – PMOS enhancement transistor – Threshold voltage – Body effect. MOS transistor switches. Basic D.C. equations – Second order effects: Threshold voltage – Body effect – Sub threshold region – Channel length modulation – Mobility variation – Fowler-Nordheim tunneling – Drain punch through – Hot electron effect. MOS models – Small signal A.C characteristics.

UNIT – II **9**

CMOS Logic and Circuit Design: CMOS Logic: Inverter – Combinational logic – NAND gate – NOR gate – Compound gates – Multiplexers – Memory – Latches and registers. Complementary CMOS inverter - DC characteristics – βn/βp ratio, Noise margin. Switching characteristics: Fall time – Rise time – Delay time. Power dissipation for CMOS logic: Static dissipation – Dynamic dissipation – Short circuit dissipation. Layout design rules and Stick diagram for inverter, NAND and NOR.

UNIT – III **9**

CMOS Fabrication Technology: Silicon semiconductor technology: Wafer processing – Oxidation – Epitaxy, Deposition, Ion implantation and Diffusion. Basic CMOS technology: N-Well CMOS process – P-Well process – Twin tub process – Silicon on Insulator. Latchup: Physical origin of latchup – Latchup triggering – Latchup prevention – Internal latchup prevention techniques – I/O latchup prevention.

UNIT – IV **9**

CMOS Chip Design Options: Types of ASICs: Full custom ASICs – Standard cell based ASICs – Gate array based ASICs: Channeled Gate Array – Channelless Gate Array – Structured Gate Arrays – Programmable Logic Devices. FPGA: Programmable Logic – Programmable Logic structures – Programmable Interconnect – Xilinx Programmable Gate Arrays – Design flow.

UNIT – V **9**

Verilog HDL: Typical design flow, Basic concepts: Lexical conventions – Data types, Modules and Ports, Gate level modeling, Dataflow modeling: Continuous assignment, Behavioral modeling: Structured procedure – Procedural assignments. Switch level modeling: MOS switches – CMOS switches – Bidirectional switches. Implementation of logic using Verilog HDL: Multiplexer, Comparator, D-Flip-Flop, Half Adder, Full Adder, Ripple Carry Adder, Arithmetic Logic Unit, Multiply and Accumulator Unit.

TOTAL: 45

TEXT BOOKS:

1. Neil H.E.Weste and Kamran Eshraghian, "Principles of CMOS VLSI Design - A systems Perspective", 2nd Edition, Pearson Education, New Delhi, 2002.
2. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", 3rd Edition, Pearson Education, New Delhi, 2006.

REFERENCE BOOKS:

1. Debaprasad Das, "VLSI Design", 1st Edition, Oxford University Press, 2011.
2. Smith M.J.S., "Application Specific Integrated Circuits", 1st Edition, Pearson Education, New Delhi, 2009.
3. Bhaskar J., "Verilog HDL Primer", 3rd Edition, BS Publications, Hyderabad, 2004.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: know the basic characteristics and the second order effects in designing MOSFET

CO2: understand the basic CMOS technology

CO3: carry out MOSFET level design in digital CMOS circuits

CO4: gain knowledge on different types of ASICs and FPGA structure

CO5: apply the programming skills to create digital structures

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3	2											
CO2	2													
CO3	3		3		2								1	1
CO4	2													
CO5	2	3	2		3								2	2

1 – Slight, 2 – Moderate, 3 – Substantial

14EEE04 DESIGN OF ELECTRICAL APPARATUS

3 0 0 3

Pre-requisites: Basics of Electrical and Electronics Engineering, Electrical Machines – I, Electrical Machines - II

UNIT – I **9**

Introduction To Magnetic Circuits: Considerations and limitations in design- Choice of specific electric and magnetic loadings-Concept of electric and magnetic circuits – MMF calculation for various types of electrical machines – real and apparent flux density of rotating machines – direct and indirect cooling methods – cooling of turbo alternators.

UNIT – II **9**

Direct Current Machines: Construction – output equation – main dimensions - choice of specific loadings – choice of number of poles – armature design – design of field poles and field coil – design of Commutator and brushes – losses and efficiency calculations

UNIT – III **9**

Transformers: Construction – output equation of single phase & three phase transformers – optimum design of transformers – design of core, yoke and windings for core and shell type transformers – equivalent circuit parameter calculations – design of tank and cooling tubes of transformers

UNIT – IV **9**

Induction Machines: Construction – output equation – main dimensions – choice of specific loadings – length of air gap - design of stator - design of rotor - calculation of equivalent circuit parameters– losses and efficiency calculations

UNIT-V **9**

Synchronous Machines: Construction – output equation – main dimensions – short circuit ratio – design of stator – design of rotor: cylindrical pole and salient pole machines – design of damper windings – design of field coils - performance calculations from designed data. Computer Aided Design: Introduction to computer aided design - Conventional design procedures - Need for field analysis based design - Design software – Elements of CAD system: Review of synthesis and analysis methods

TOTAL: 45

TEXT BOOKS:

1. Sawhney A.K., "A Course in Electrical Machine Design", 5th Edition, Dhanpat Rai & Co., New Delhi, 2013.
2. Agarwal R.K., "Principles of Electrical Machine Design", 4th Edition, S.K.Kataria & Sons, New Delhi, 2013.

REFERENCE BOOKS:

1. Mittle V.N. and Mittle A., "Design of Electrical Machines", 4th Edition, Standard Publications and Distributors, New Delhi, 2005.
2. Sen S.K., "Principles of Electrical Machine Design with Computer Programs", 2nd Edition, Oxford and IBH Publishing Co. Pvt Ltd., New Delhi, 2006.
3. Brian J. Mcpartland and Mcpartland J.F., "Handbook of Practical Electrical Design", 2nd Edition, Tata Mc Graw Hill Education, 1995.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: understand the basic concepts of magnetic circuits and their MMF calculations

CO2: design the armature and field of DC machines

CO3: analyze the design procedures of static machines

CO4: calculate the design parameters of synchronous and induction machines

CO5: realize the computer aided design procedures of electrical machines

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		2	3		2									
CO2	3	3	3			1					1		2	2
CO3		2	2	1	1								2	2
CO4	3	2	2	1	1								2	2
CO5		1	2		1									

1 – Slight, 2 – Moderate, 3 – Substantial

14EEE05 HIGH VOLTAGE ENGINEERING

3 0 0 3

Pre-requisites: Electromagnetic Theory, Transmission and Distribution

UNIT – I **9**

Overvoltage Phenomenon in Power Systems: Natural causes for over voltages – lightning phenomenon - Over voltages due to switching surges, System faults and other abnormal conditions – Travelling waves on transmission lines(lines terminated with open end, short circuited end, apparatus and cables).

UNIT – II **9**

Electrical Breakdown in Gases, Solids and Liquids: Classical gas laws - Ionization processes – Townsend's Criterion - Paschen's law - Streamer theory - Breakdown in non-uniform fields– Vacuum insulation. Conduction and breakdown in pure and commercial liquids. Intrinsic breakdown in solids - Electromechanical breakdown - Thermal breakdown - Breakdown in composite dielectrics.

UNIT – III **9**

Generation of High Voltages and High Currents: Generation of high DC voltages, alternating voltages, impulse voltages and impulse currents – Tripping and control of Impulse Generators.

UNIT – IV **9**

Measurement of High Voltage and High Currents: Measurement of high DC voltages, high AC voltages and impulse voltages - Measurement of high DC currents, high AC currents and impulse currents - CRO for impulse voltage and current measurement.

UNIT – V **9**

High Voltage Testing of Electrical Power Apparatus: Testing of Insulator, Bushings, Isolators, Cables, Transformers, and Surge Diverters – Partial Discharge measurement – Radio interference measurement -International and Indian Standards.

TOTAL: 45

TEXT BOOKS:

1. Naidu M.S. and Kamaraju V., "High Voltage Engineering", 5th Edition, McGraw-Hill, New York, 2013.
2. Kuffel E, Zaengl, W.S. and Kuffel J., "High Voltage Engineering Fundamentals", 2nd Edition, Butterworth-Heinemann, Burlington, 2005.

REFERENCE BOOKS:

1. Kuffel E. and Abdullah M., "High Voltage Engineering", Pergamon Press, Oxford, 2005.
2. Razevig D.V., "High Voltage Engineering", Khanna Publishers, New Delhi, 2000.
3. Wadhwa C.L., "High voltage Engineering", 3rd Edition, New Age Publishers, New Delhi, 2012.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: discuss the concepts of over voltage and insulation coordination

CO2: distinguish the conduction and electrical breakdown in gases, liquids and solids

CO3: elucidate the various methods of high voltage and impulse voltage generatio

CO4: devise the various measurement techniques of high voltage

CO5: illustrate testing procedure of power apparatus

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		1		1	1						1	
CO2	3	3	1	3		2	1						2	
CO3	2	1		1		1	1						2	
CO4	2	1		1		1	1						1	
CO5	3	1	1	3		1	1						2	

1 – Slight, 2 – Moderate, 3 – Substantial

14EEE06 MODERN CONTROL THEORY

3 1 0 4

Pre-requisites: Control Systems

UNIT – I **9**

Discrete Time Systems: Mathematical Representation of the Sampling Process- signal reconstruction, Z-transform analysis of sampled data control system– Inverse Z transform- Z and S domain Relationship -Pulse transfer function- Modified Z Transforms- Jury Stability criterion.

UNIT – II **9**

State Space Analysis: State space analysis for continuous and discrete systems – Physical variable, Phase variable and Canonical variables forms-Solution of state equation- controllability and observability.

UNIT – III **9**

State Feedback Controller: Design by state feedback –Pole assignment technique – Design of state feedback controllers – Design of reduced and full order observer.

UNIT – IV **9**

Stability Analysis: Stability concepts – Equilibrium points – BIBO and asymptotic stability – Direct and indirect method of Liapunov –Liapunov energy function.

UNIT – V **9**

Non Linear Systems: Types of non-linearity – Typical examples – Equivalent linearization – Phase plane analysis – Limit cycles – Describing functions- Analysis using Describing functions.

Lecture:45, Tutorial:15, TOTAL: 60

TEXT BOOKS:

1. Gopal M., "Digital Control and State Variable Methods", 3rd Edition, Tata McGraw-Hill, New Delhi, 2010.
2. Ogata K., "Modern Control Engineering", 5th Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2010.

REFERENCE BOOKS:

1. Gopal M., "Modern Control Systems Theory", 3rd Edition, New Age International Publishers, New Delhi, 2015.
2. Nagarth I.J. and Gopal M., "Control Systems Engineering", 5th Edition, New Age International Publishers, 2011.
3. Kuo B.C., "Automatic Control Systems", 9th Edition, John Wiley and Sons, New York, 2009.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: analyse the behavior of discrete system

CO2: construct the state space for discrete and continuous systems

CO3: apply pole placement techniques for state space model

CO4: inspect the stability of discrete system

CO5: explore the concept of non-linear system

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1	2									1	2
CO2	3	2		3										3
CO3	2	3		2										2
CO4	3	2	1	3									1	3
CO5	2	1		1										2

1 – Slight, 2 – Moderate, 3 – Substantial

14EIT71 PLC, SCADA and DCS

(Common to EIE & EEE branches)

3 0 0 3

Pre-requisites: Control Systems, Digital Logic Circuits

UNIT – I **9**

Programmable Logic Controllers (PLCs): An overview and PLC hardware components**:** Programmable Logic Controllers - Parts of a PLC - Principles of operation - PLCs versus Computers - PLC size and application – The I/O section – Discrete I/O modules – Analog I/O modules – Special I/O modules – The CPU – Memory design – Memory types – Programming devices – Recording and retrieving data – PLC workstations.

UNIT – II **9**

PLC Programming: Basics of PLC programming: Processor memory organization – Program scan – PLC programming languages – Relay type instructions – Instruction addressing – Internal relay instructions – Programming EXAMINE IF CLOSED and EXAMINE IF OPEN instructions – Entering the ladder diagram – Modes of operation. Programming timers: Mechanical timing relay – Timer instructions – On delay timer instruction – Off delay timer instruction – Retentive timers - Cascading timers. Programming counters: Counter instructions – Up counter – Down counter – Cascading counters – Combining counter and timer functions.

UNIT – III **9**

Advanced PLC Programming and Applications: Program control instructions: Master control reset instruction – Jump instruction and subroutines. Data manipulation instructions: Data manipulation – Data compare instructions. Math instructions. Sequencer and shift register instructions. Process control and Data Acquisition systems: Closed loop container filling process - ON/OFF liquid heating system- PLC control of a PID loop. **SCADA:** Introduction to SCADA – A brief history of SCADA –Real-time systems – Remote control – Communications – Applications: Real time Revisited – Scanning and communications – Automatic control

UNIT – IV **9**

Distributed Control Systems: Evolution of Distributed Control Systems: Emergence of the Distributed Control System architecture. Local control unit architecture: Basic elements of a microprocessor based controller – Functional blocks: An introduction. Local control unit languages: Functional blocks. Local control unit process interfacing issues - Security design issues for the local control unit: Redundant controller designs.

UNIT – V **9**

DCS Operator Interfaces and Applications: Operator interfaces: Introduction – Low level operator interface – High level operator interface: Architectural alternatives, Hardware elements in the operator interface, Operator displays. Engineering interfaces: Engineering interface requirements. DCS applications: Cement plants – Pulp and Paper plants – Water and waste water treatment plants

TOTAL: 45

TEXT BOOKS:

1. Frank D. Petruzella, "Programmable Logic Controllers", 3rd Edition, TataMcGraw Hill, New Delhi, 2010.
2. Michael P.Lukas, "Distributed Control System", Van Nostrand Reinhold Co., Canada 1986.
3. Stuart A. Boyer, "SCADA: Supervisory Control and Data Acquisition", 4th Edition, ISA Press, USA, 2009.

REFERENCE BOOKS:

1. John W.Webb, Ronald A.Reis. "Programmable Logic Controllers: Principles and Applications", 5th Edition, PHI Learning Pvt. Ltd., New Delhi, 2013.
2. Popovic D. and Bhatkar V.P., "Distributed Computer Control for Industrial Automation, Marcel Dekkar Inc., New York, 1990.
3. Hughes T., "Programmable Logic Controllers", ISA Press, USA, 1989.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: gain knowledge on the basics of automation system
CO2: analyze theory of operation of PLC and SCADA
CO3: develop programming with PLC, SCADA and DCS
CO4: impart the knowledge of centralized monitoring and distributed control
CO5: apply PLC, SCADA and DCS in industrial process control

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2			1									
CO2		3	3	2							2	2	2	2
CO3	1	3	3	2	2							2	2	2
CO4		2	2	3	3						2			
CO5			2			2					3	1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial

14EEE07 ADVANCED MICROPROCESSOR AND MICRO CONTROLLER

3 0 0 3

Pre-requisites: Microprocessors and Microcontrollers

UNIT – I **9**

80186, 80286, 80386 and 80486 Microprocessors: 80186 Architecture, Enhancements of 80186 – 80286 Architecture – Real and Virtual Addressing Modes – 80386 Architecture – Special Registers – Memory Management – Memory Paging Mechanism – 80486 Architecture – Enhancements – Cache Memory Techniques – Exception Handling – Comparison of Microprocessors (8086 – 80186 –80286 – 80386 – 80486) - Applications and Datasheets

UNIT – II **9**

Pentium Microprocessors: Pentium Microprocessor Architecture – Special Pentium Registers – Pentium Memory Management – New Pentium Instructions – Pentium Pro Microprocessor Architecture – Special features – Pentium II Microprocessor Architecture – Pentium III Microprocessor Architecture – Pentium III Architecture – Pentium IV Architecture – Comparison of Pentium Processors. – Applications & Datasheets

UNIT – III **9**

RISC Processors: The RISC revolution – Characteristics of RISC Architecture – The Berkeley RISC – Register Windows – Windows and parameter passing – Window overflow – RISC architecture and pipelining – Pipeline bubbles – Accessing external memory in RISC systems – Reducing the branch penalties – Branch prediction – Applications & Datasheet

UNIT – IV **9**

ARM Processors: The ARM processors – ARM registers – ARM instructions – The ARM built-in shift mechanism – ARM branch instructions – sequence control – Data movement and memory reference instructions – Applications & Datasheet

UNIT – V **9**

16-Bit Micro Controller: 8096/8097 Architecture-CPU registers –RALU-Internal Program and Data memory Timers-High speed Input and Output –Serial Interface-I/O ports –Interrupts –A/D converter-Watch dog timer –Power down feature –Instruction set- External memory Interfacing –External I/O interfacing – Applications and Datasheet

TOTAL: 45

TEXT BOOKS:

1. Brey B.B., "The Intel Microprocessor 8086/8088 /80186/80188, 80286, 80386, 80486 PENTIUM, PENTIUM Pro, PII, PIII & IV Architecture, Programming & Interfacing", 8th Edition, Pearson Education, 2009.
2. Alan Clements, "The Principles of Computer Hardware", 4th Edition, Oxford University Press, 2006.

REFERENCE BOOKS:

1. Douglas V. Hall, "Microprocessors and Interfacing", Revised II Edition, Tata McGraw Hill, 8th Reprint, 2006.
2. Mohamed Rafiquzzaman, "Microprocessors and Microcomputer Based System Design", II Edition, CRC Press, 2007.
3. John Peatman, "Design with Microcontroller", McGraw Hill Publishing Co. Ltd., New Delhi, 1988.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: classify the generalized architecture of various advanced microprocessors

CO2: distinguish and assess the properties of RISC and ARM processors

CO3: summarise the need for recent Bus standards like PCI Express, VESA etc

CO4: compare various mother boards by its functioning units

CO5: illustrate the working of microcontroller

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		3											1
CO2	3	3	3											
CO3	3		2											
CO4	3		2											
CO5	3		2											1

1 – Slight, 2 – Moderate, 3 – Substantial

14EEE08 ADVANCED POWER ELECTRONICS

3 0 0 3

Pre-requisites: Power Electronics

UNIT – I **9**

Emerging Devices: Power Junction Field Effect Transistors - Field Controlled Thyristors - JFET based devices Vs other power devices - MOS controlled thyristors -. Integrated Gate Commutated Thyristor (IGCT) - Switching and steady state characteristics - Intelligent power modules - Power integrated circuits - New semiconductor materials for power devices - Introduction to silicon carbide devices

UNIT – II **9**

Resonant Converters: Zero voltage and Zero current switching – Classification of resonant converters - Basic resonant circuit concepts - Load resonant converters - Resonant switch converters - Zero voltage switching, clamped voltage topologies -Resonant DC link Inverters and Zero voltage switching - High frequency link integral half cycle converters - Applications in SMPS and lighting.

UNIT– III **9**

Utility Interface: Utility interface - Need for improved utility interface - Improved single phase utility interface - Improved three phase utility interface - Interconnection of renewable energy source and energy storage system to the utility grid –Electromagnetic interference- Generation of current harmonics – Current harmonics and power factor

UNIT – IV **9**

Power Supplies: Introduction – DC power supplies- Switched Mode DC power supplies – Resonant Power Supplies – Bidirectional Power supplies, AC Power Supplies - Switched Mode AC power supplies – Resonant AC Power Supplies – Bidirectional AC power supplies – Multistage Conversions- Power factor conditioning – Magnetic considerations

UNIT – V **9**

Dual Converters: Introduction – Principle of Dual Converter – Practical Dual Converter – Single and Three phase dual converter- Dual Converter without circulating current operation – Dual converter with circulating Current mode operation – Comparison - Microprocessor based firing scheme for a dual converter

TOTAL: 45

TEXT BOOKS:

1. Rashid M.H., "Power Electronics: Circuits Devices and Applications", 4th Edition, Pearson Education, New Delhi, 2013.
2. Ned Mohan, Undeland and Robbins, " Power Electronics: Converters, Applications and Design", 3rd Edition, John Wiley and Sons, Wiley India Ltd., 2007.

REFERENCE BOOKS:

1. Bimal K. Bose, "Modern Power Electronics – Evolution, Technology and Application", Jaico Publishing House, Mumbai, 2006.
2. Jai P. Agrawal, "Power Electronics Systems Theory and Design", 1st Edition, Pearson Education, 2013.
3. Joseph Vithayathil, "Power Electronics - Principles and Applications", 1st Edition, McGraw Hill Education (India) Pvt. Ltd., 2010.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: appraise the emerging power electronic devices

CO2: analyze the various topologies and the working principle of resonant converter

CO3: make use of the utility interface

CO4: analyze AC and DC power supplies

CO5: interpret the working principle of dual converters

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EEE09 PULSE WIDTH MODULATION TECHNIQUES

3 0 0 3

Pre-requisites: Power Electronics

UNIT – I **9**

Overview of PWM Techniques: Concept of PWM - Classification of PWM - Sinusoidal PWM, modified sinusoidal PWM - multiple PWM – Introduction to space vector Modulations - Voltage and harmonic control- Direct modulation.

UNIT – II **9**

Analysis of PWM: - Evaluation of PWM Schemes - Double Fourier Integral Analysis of a Two Level PWM waveform - Naturally Sampled PWM - PWM Analysis by Duty Cycle Variation - Regular Sampled PWM.

UNIT – III **9**

Over and Programmed Modulation Strategies: Region – naturally sampled Over modulation of one phase leg of an inverter – PWM Control gain during Over modulation - Integer versus non integer frequency ratios- Review of PWM variations –Harmonic elimination using PWM –Performance index for optimality –optimum PWM – Minimum loss PWM.

UNIT – IV **9**

Modulation of Single Phase and Three Phase VSI: Single Phase Topology – Three Level Modulation of Single Phase Inverter - Analytic Calculation of Harmonic Losses- Side band Modulation-Switched Pulse Position and Pulse Sequence – Topology of a Three Phase VSI-Three Phase Modulation with Sinusoidal References - Third harmonics reference injection.

UNIT – V **9**

Space Vector Modulation: Space Vector Modulation - types -Phase Leg References for SVM-Naturally Sampled SVM-Analytical Solution for SVM Harmonic Losses for SVM-Placement of the Zero Space Vector-Discontinuous Modulation- SVM for multilevel inverters- discontinuous modulation in multilevel inverters.

TOTAL: 45

TEXT BOOKS:

1. Grahame Holmes D. and Thomas A. Lipo, "Pulse width Modulation for Power Converters : Principles and Practice", First Edition, Wiley-IEEE Press, 2003.
2. Dorin O. Neacsu, "Switching Power Converters: Medium and High Power", 2nd Edition, CRC Press, Taylor & Francis, 2013.

REFERENCE BOOKS:

1. Marian K. Kazimierczuk, "Pulse-width Modulated DC-DC Power Converters", 2nd Edition, John Wiley & Sons Ltd., 2016.
2. Mohammed H. Rashid, "Power Electronics-Circuits, Devices and Applications", 3rd Edition, Eastern Economy Edition, 2011.
3. Keng C. Wu, "Pulse Width Modulated DC-DC Converters", 1st Edition, Springer Science & Business Media, 1997.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: examine the various types of PWM topologies

CO2: evaluate different analysis in PWM

CO3: formulate the modulation strategy with quickly and easily identified without complex analysis

CO4: apply a PWM technique for inverter topologies and harmonic elimination

CO5: develop the space vector modulation technique to provide the analytical solutions

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1		2										2
CO2	3	2		3										2
CO3	3	3	1	3									1	3
CO4	3	2		1									1	3
CO5	3	2		2									1	2

1 – Slight, 2 – Moderate, 3 – Substantial

14EEE10 DESIGN, ESTIMATION AND MAINTENANCE OF ELECTRICAL EQUIPMENT

3 0 0 3

Pre-requisites: Electrical Safety Engineering

UNIT – I **9**

Equipment Specifications as Basis for Design: General Specifications–Ambient conditions, Accessories, IS- Item specifications and catalogues– Oil /Dry type Transformers- HT and LT Switch gears- Circuit Breaker, Isolator, fuse, MCCB, MCB- Motors –duty, mounting, protection, Cooling, Frame size.- Cables–HT/LT, single / Multi core, Power and control cables, ratings, de ratings.

UNIT – II **9**

Introduction to Design and Estimation: Starting documents - Plant Motors and component list- Basic Design for Estimation –voltage, Maximum demand at PCC- SLD, OGA, component list of Plant power circuit- Detailing – Arriving at typical distribution for a medium scale Industry and Large scale Industry. **Electrical Installation Requirements for Industry:** Detailing for Power SLD /Multi line diagrams for PDB-s and MCC-s- Typical detailing of Control circuits for starters of MCCs-DOL / RDOL / Star-delta.

UNIT – III **9**

Rules, Safety and Maintenance of Equipment: Indian electricity rules 2003- Earthing – types, Control of Earth resistance, Step / Touch potential in switchyards- Protection against -lightning, Static electricity- Installation testing – Protections, Insulation- Maintenance– daily, weekly, monthly and yearly schedules for Transformers, Switch gears and Motors – Testing of safety gadgets.

UNIT –IV **9**

Electrical Installation for Residences: Residential plan and appliances required- Total load- Wiring diagram and layout- Main Switch and fuse , MCB and RCCB, Main distribution – 1 / 3 phase loads- Sub distribution- Requirements for Appliances- Estimation- Regulations - Neutral wire, Earthing , voltage drops, wire sizes, sizing of cables, location of switch boards.

UNIT – V **9**

Electrical Equipment for Industry: Major application areas and their Electrical Power Requirements in Cement, Sugar ,Pulp and Paper Industries-Co-generation plants , Iron & Steel Industries- Iron making, Casters and Rolling mills - Textile industries- Typical plant power distribution diagrams and the special considerations

TOTAL: 45

TEXT BOOKS:

1. Kamalesh Das , " Electrical Power Systems For Industrial Plants ", 1st Edition, Jaico Publishing house,Mumbai, 2008
2. Rao, V.S., "Testing, Commissioning, Operation and Maintenance of Electrical Equipments", 6th Edition, Khanna Publishers, New Delhi, 2010.

REFERENCE BOOKS:

1. Surjit Singh., "Electrical Estimating and Costing", 1st Edition, Dhanpat Rai and Co, New Delhi, 2014.
2. Gupta. J.B., "Electrical Installation, Estimating and Costing", 9th Edition, S.K. Kataria & Sons, New Delhi, 2012.
3. S. L. Uppal, "Electrical Wiring and costing Estimation ", 1st Edition, Khanna Publishers, New Delhi, 2008.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: choose the electrical equipment for various applications from it specification

CO2: design the layout to meet installation requirements for Industries

CO3: interpret the various rules and maintenance of equipments

CO4: design the layout to meet installation requirements for residences

CO5: apply their knowledge of electrical installation to various industries

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		3									1	1
CO2	3	3	1	2									1	3
CO3	2	1		1									1	2
CO4	3	3	1	3									1	3
CO5	3	2		3									1	3

1 – Slight, 2 – Moderate, 3 – Substantial

14EEE11 SPECIAL ELECTRICAL MACHINES

3 0 0 3

Pre-requisites: Electrical Machines I, Electrical Machines II

UNIT – I **9**

Permanent Magnet Synchronous Motors: Permanent Magnet Motors – Classifications – PMSM - Principle of operation – EMF and torque equations– Phasor diagram – Locus diagram and torque speed characteristics - Power controllers - Applications: PMSM for Railway vehicles.

UNIT– II **9**

Permanent Magnet Brushless D.C. Motors: Principle of operation – Types – Comparison between conventional DC and PMBLDC – Electronic commutation – EMF and torque equations – Sensors for Rotor position – Power controllers – Motor characteristics and control - Applications: PMBLDC for Motion control systems.

UNIT– III **9**

Synchronous Reluctance Motors: Constructional features – Synchrel - Types: Axial and Radial motors – Operating principle – Reluctance torque – Phasor diagram - Characteristics - controls of synchrel - Applications: SyRM for Electric ships - Introduction to Vernier motor.

UNIT - IV **9**

Switched Reluctance Motors: Constructional features – Principle of operation – Torque prediction – Inductance profile – Types of Power controllers and converter topologies used – Current control schemes – Torque Speed Characteristics – Hysteresis and PWM – Applications: SRM for Hybrid electric vehicles.

UNIT – V **9**

Stepping Motors: Constructional features – Principle of operation – Variable reluctance motor – Hybrid motor – Single and multi stack configurations – Theory of torque predictions – Linear and non-linear analysis – Characteristics – Drive circuits – Applications: Stepper Motor for Computer printers - Microprocessor based control.

TOTAL: 45

TEXT BOOKS:

1. Miller T.J.E., "Brushless Permanent Magnet and Reluctance Motor Drives", 1st Edition, Clarendon Press, Oxford, 1989.
2. Kenjo T. and Nagamori S., "Permanent Magnet and Brushless DC Motors", 1st Edition, Clarendon Press, London, 1988.

REFERENCE BOOKS:

1. Kenjo T., "Stepping Motors and Their Microprocessor Controls", 1st Edition, Oxford University Press, New Delhi, 2000.
2. Aearnley P.P., "Stepping Motors: A Guide to Motor Theory and Practice", 1st Edition, Peter Perengrinus, London, 1982.
3. Janardanan E.G., "Special Electrical Machines", 1st Edition, PHI Learning Pvt.Ltd., New Delhi, 2014.
4. https://www.academia.edu/9885014/SPECIAL_ELECTRICAL_MACHINES_NPTEL_NOTES
5. https://www.youtube.com/watch?v=TWMai3oirnM

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: explain the construction, operation and performance of permanent magnet synchronous motor

CO2: compare the performance of conventional DC and PMBLDC motors

CO3: distinguish Synchrel , SRM and Stepper motors based on its performance

CO4: choose special drives for specific applications

CO5: determine the importance of special drives for enhanced performance

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2												
CO2	3	2											1	
CO3	3	1											1	
CO4	3	2		1		1	1					2	1	1
CO5	3	2		1		1	1					2	1	1

1 – Slight, 2 – Moderate, 3 – Substantial

14EEE12 POWER SYSTEM OPERATION AND CONTROL

3 0 0 3

Pre- requisites: Power System Analysis and Stability, Control Systems

UNIT – I **9**

Introduction: System load variation: System load characteristics, load curves- daily, weekly and annual, load-duration curve, load factor, diversity factor. Reserve requirements – Overview of system operation: Load forecasting, unit commitment, load dispatching. **System Operation:** System load forecasting – components of system load – classification of base load - forecasting the base load.

UNIT – II **9**

Economic Dispatch: Incremental cost curve, co-ordination equations without loss and with loss, solution by direct method and λ-iteration method. (No derivation of loss coefficients) Base point and participation factors. Economic dispatch controller added to LFC. **Statement of Unit Commitment (UC) problem**: Constraints in UC– UC solution methods: Priority-list methods, forward dynamic programming approach, numerical problems only in priority list method using full-load average production cost.

UNIT – III **9**

Plant Level Control: Real Power – Frequency Control: Fundamentals of speed governing – Transfer function model – Static response – Feedback control – Static and dynamic response of ALFC secondary ALFC loop. **System Control: P-f control:** AGC in isolated power systems – Two area system – modeling of tie line – representation of two area system – static and dynamic response – tie line bias control – Frequency bias tie line control – Basis for selection of bias.

UNIT – IV **9**

Reactive Power – Voltage Control: Excitation systems requirements – Elements of an excitation system – Types of excitation systems – DC, AC, Static and recent developments and future trends – Modeling of exciter, generator – static performance – dynamic performance – AVR root loci. Reactive power and voltage control – Production and absorption of reactive power - Methods of voltage control –Static VAR Systems – Types and applications of SVC.

UNIT – V **9**

Computer Control of Power Systems: Energy control centre: Functions – Monitoring, data acquisition and control. Various operating states – System hardware configuration – SCADA and EMS functions.Security monitoring – Network topology determination, state estimation, security analysis and control.

TOTAL: 45

TEXT BOOKS:

1. Elgerd O.I., "Electrical Energy System Theory: An Introduction", 2nd Edition, Tata McGraw-Hill, New Delhi, 2001.
2. Prabha Kundur, "Power System Stability and Control", 1st Edition, EPRI Series, Tata McGraw-Hill Inc., New York, 2006.

REFERENCE BOOKS:

1. Ramana N.V., "Power System Operation and Control", 1st Edition, Pearson Publications, 2010.
2. Murty P.S.R., "Operation and Control in Power System", 2nd Edition, BS Publications, 2009.
3. Allen J. Wood and Bruce F. Wollenberg, "Power System Operation and Control", 3rd Edition, John Wiley & Sons, 2012.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: understand the overview of operation and control

CO2: apply dynamic approaches for unit commitment and economic dispatch problems

CO3: develop the transfer function model of the speed-governing system

CO4: analyze the static and dynamics performance of AVR loop

CO5: understand the various computer control techniques

Mapping of COs with POs and PSOs

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2	3	2	2											
CO3	2	2	2	2									2	2
CO4	3	3		2									2	2
CO5	1			2	3							2	2	2

1 – Slight, 2 – Moderate, 3 – Substantial

14GEE81 ENTREPRENEURSHIP DEVELOPMENT

(Common to all Engineering and Technology branches except Civil and Chemical Engg.)

3 0 0 3

UNIT – I **9**

Entrepreneurship Concepts: Meaning and concept of entrepreneurship, Role of Entrepreneurship in Economic Development. Factors affecting Entrepreneurship – Creativity, Innovation and Entrepreneurship, Intrapreneurship

UNIT – II **9**

Entrepreneur: Definition, Entrepreneurial Motivation, Characteristics of Entrepreneurs, Distinction between an Entrepreneur and a Manager.

UNIT – III **9**

Business Plan: Objectives of a Business Plan, Business Planning Process, Opportunity Identification and Selection, Contents of a Business Plan, Functional Plans.

UNIT – IV **9**

Entrepreneurial Eco System: Forms of Business Ownership, Sources of Finance, Institutional Support to Entrepreneurs.

UNIT – V **9**

Small Business Management: Definition of Small Scale Industries, Strengths and Weaknesses of Small Business, Growth Strategies in Small Scale Enterprises, Sickness in Small Enterprises – Symptoms, Causes and Consequences.

TOTAL : 45

TEXT BOOK:

1. S.S.Khanka, "Entrepreneurial Development", 4th Edition, S.Chand & Company Ltd., 2012.
2. Madhurima Lall and Shikha Sahai, "Entrepreneurship", 2nd Edition, Excel Books, New Delhi, 2008.

REFERENCE BOOKS:

1. Raj Shankar, "Entrepreneurship, Theory and Practice", Vijay Nicole Imprints Pvt. Ltd., Chennai 2012.
2. Barringer and Ireland, "Entrepreneurship", 3rd Edition, Pearson Education, 2012.
3. Zimmer and Scarborough, "Essentials of Entrepreneurship and Small Business Management", 5th Edition, PHI Learning Pvt. Ltd., 2009.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: understand the concepts of entrepreneurship and its importance

CO2: understand the traits of an entrepreneur and the sources of his motivation

CO3: understand the components of a business plan

CO4: demonstrate knowledge of various sources of finance and institutions supporting entrepreneurship

CO5: understand the nature of small business and causes of industrial sickness

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

14EEE13 SMART GRID

3 0 0 3

Pre-requisites: Transmission and Distribution, Communication Engineering

UNIT – I **9**

Introduction: Traditional electric grid model - Need for implementing smart grid – General considerations for smart grid – Early smart grid initiatives – active distribution networks – Virtual power plant – Other initiatives and demonstrations – Overview of technologies required for smart grid – Case study (Blackout & Brownout)

UNIT – II **9**

Information and Communication Technologies: Introduction – Switching techniques – Communication channels – Layered architecture and protocols – Communication technologies – standards for information exchange – Information security for smart grid.

UNIT – III **9**

Sensing, Measurement & Control: Introduction – Phasor representation of sinusoids – Phasor estimation of nominal frequency signals – Advantages of PMU – Phasor Data Concentrators (PDC) – Communication protocols for PMU's & PDC's. **Smart metering:** An overview of the hardware used – Communications infrastructure – Protocols for smart metering – Demand side integration. Transmission system operation: Introduction – Data sources – Energy management systems.

UNIT – IV **9**

Automation Technologies: Distribution automation equipment – Substation automation equipment – Faults in the distribution system – Voltage regulation – Distribution management system – Data sources and external systems – Modelling and analysis tools – Applications.

UNIT – V **9**

Power Electronics in Smart Grid: Introduction – Renewable energy generation – Fault current limiting – Shunt compensation – Series compensation – FACTS – HVDC – Energy storage – Energy storage technologies.

TOTAL: 45

TEXT BOOKS:

1. Janaka Ekanayake and Nick Jenkins, "Smart Grid: Technology and Applications", 1st Edition, John Wiley & Sons Ltd., 2012.
2. Phadke A.G. and Thorp J.S., "Synchronized Phasor Measurements and their Applications", 1st Edition, Springer, 2008.

REFERENCE BOOKS:

1. Gil Masters, "Renewable and Efficient Electric Power System", 2nd Edition, Wiley-IEEE Press, 2013.
2. Fereidoon P. Sioshansi, "Smart Grid – Integrating renewable, distributed and efficient energy", 1st Edition, Academic Press, 2011.
3. James Momoh, "Smart Grid Fundamentals of Design and Analysis", 1st Edition, Wiley, 2012.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: analyze smart grid technologies, different smart meters and advanced metering infrastructure

CO2: identify the power quality management issues in smart grid

CO3: assess the high performance computing for smart grid applications

CO4: evaluate the automation technologies

CO5: explain phasor measurement unit

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1			1						1		1
CO2	1	1												
CO3	1	2											1	
CO4	1	3	1			1						1	1	1
CO5	1	1	1											1

1 – Slight, 2 – Moderate, 3 – Substantial

14EEE14 POWER QUALITY

3 0 0 3

Pre-requisites : Power Electronics

UNIT – I **9**

Introduction to Power Quality: Definitions – Power quality, Voltage quality – Power quality issues: Short duration voltage variations, Long duration voltage variations, Transients, Waveform distortion, Voltage imbalance, Voltage fluctuation, Power frequency variations – Sources and Effects of power quality problems – IEEE and IEC Standards-Computer Business Equipment Manufacturers Associations (CBEMA) curve – ITC curves.

UNIT – II **9**

Short Interruptions: Introduction – Origin of short interruptions: Voltage magnitude events due to re-closing, Voltage during the interruption – Monitoring of short interruptions, Adjustable speed drives, Electronic equipments – Single phase tripping: Voltage during fault and post fault period, Current during fault period. **Long Interruptions:** Definition – Failure, Outage, Interruption – Origin of interruptions – Causes of long interruptions – Principles of regulating the voltage – Voltage regulating devices.

UNIT – III **9**

Voltage Sag: Introduction – Definition – Magnitude, Duration – Causes of Voltage Sag –Load influence on voltage sags on Adjustable speed drives, Power electronics loads, Sensitive loads - Overview of mitigation methods. **Transients:** Definition and types – Sources and causes of transients – Principles of over voltage protection – Devices for over voltage protection – Capacitor switching transients –Lightning transients – Transients from load switching.

UNIT– IV **9**

Wiring and Grounding: Definitions-wiring and grounding problems-solutions to wiring and grounding problems. **Waveform Distortion:** Introduction – Definition and terms – Harmonics, Harmonics indices, Inter harmonics, Notching – Voltage Vs Current distortion – Harmonics Vs Transients – Sources and effects of harmonic distortion – System response characteristics.

UNIT – V **9**

Power Quality Monitoring and Solutions: Introduction – Power quality monitoring : Need for power quality monitoring, Evolution of power quality monitoring – Brief introduction to power quality measurement equipments and power conditioning equipments – Mitigation and control techniques – Passive and active Filters for Harmonic Reduction.

TOTAL: 45

TEXT BOOKS:

1. Dugan, Roger C., McGranaghan, Mark F. and Beaty, H. Wayne, "Electrical Power Systems Quality", 3rd Edition, McGraw-Hill, New York, Reprint 2013.
2. Sankaran C., "Power Quality", 1st Edition, CRC Press, Washington D.C., 2002.

REFERENCE BOOKS:

1. Kennedy Barry W., "Power Quality Primer", 1st Edition, McGraw-Hill, New York, 2000.
2. Bollen Math H.J., "Understanding Power Quality Problems: Voltage Sags and Interruptions", 1st Edition, IEEE Press, New York, 2000.
3. Arrillaga J., Watson N.R., and Chen S., "Power System Quality Assessment", 1st Edition, John Wiley & Sons Ltd., England, 2000.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: understand various power quality disturbances and issues

CO2: analyze the effect of short and long interruptions

CO3: analyze the effects of voltage sag and transients

CO4: identify the wiring-grounding problems and measure the harmonic contents

CO5: understand various power quality issues and provide the solutions for the same

Mapping of COs with POs and PSOs

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3				1					1		
CO2	3		2		3								2	2
CO3	2		2		2								2	2
CO4	2	3	2		2		2							
CO5	3	1	3		2		2					1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial

14EEE15 EHV AC TRANSMISSION SYSTEMS

3 0 0 3

Pre-requisites: Transmission and Distribution, Electromagnetic Theory, High Voltage Engineering

UNIT – I **9**

Introduction: Standard transmission voltages – different configurations of EHV and UHV lines – average values of line parameters – power handling capacity and line loss – costs of transmission lines and equipment – mechanical considerations in line performance – Types of EHV towers. **Calculation of Line and Ground Parameters:** Calculation of resistance, inductance and capacitance for multi-conductor lines – calculation of sequence inductances and capacitances – line parameters for different modes of propagation – resistance and inductance of ground return.

UNIT – II **9**

Voltage Gradients of Conductors: Electrostatics- Field of Sphere gap-Charge-potential relations for multi-conductor lines – surface voltage gradient on conductors – gradient factors and their use – distribution of voltage gradient on sub conductors of bundle - voltage gradients on conductors in the presence of ground wires on towers.

UNIT– III **9**

Corona Effects: Power loss and audible noise – I^{2}R loss and corona loss – Corona loss formula – Charge voltage diagram and corona loss – Attenuation of travelling waves due to corona loss – Audible noise generation, Characteristics and formula – Relation between single and three phase audible noise levels – Day-Night equivalent noise level. **Radio Interference:** Corona pulses, its generation and properties – Properties of pulse trains and filter response – Limits for radio Interference fields.

UNIT– IV **9**

Electrostatic and Magnetic Fields of EHV Lines: Electric shock and threshold currents – Capacitance of long objects – Calculation of electrostatic field of AC lines – Meters and Measurements of electrostatic fields – Electrostatic induction in unenergized circuits of DC line – Induced voltages in insulated ground wires – Magnetic field effects on three-phase lines – Effects of power frequency magnetic fields on human health.

UNIT – V **9**

Over voltages in EHV Systems: Origin of Over voltages due to lightning and switching surges and their types – Short Circuit current and circuit breaker – Overvoltages caused by interruption of low inductive current – interruption of capacitive currents – Ferro-Resonance Overvoltages – calculation of switching surges – protection of over voltages – single phase equivalent – Distributed parameter line energized by source – Generalized equation for single and three phase systems – Reduction of switching surges on EHV systems.

TOTAL: 45

TEXT BOOKS:

1. Rakosh Das Begamudre, "Extra High Voltage AC Transmission Engineering", 4th Edition, New Age International Pvt. Ltd., 2011.
2. Kuffel E., Zaengl W.S. and Kuffel J., "High Voltage Engineering Fundamentals", 2nd Edition, Elsevier India Pvt. Ltd., 2005.

REFERENCE BOOKS:

1. "Power Engineer's Handbook, Revised and Enlarged", 6th Edition, TNEB Engineers' Association, October 2002.
2. Naidu M.S. and Kamaraju V., "High Voltage Engineering", 5th Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2013.
3. Rao S., "EHVAC and HVDC Transmission and Distribution Engineering", 3rd Edition, Jain Books, 2014.
4. http://nptel.ac.in/courses/108108033/

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: calculate the various transmission line parameters

CO2: understand the concept of corona and radio interference

CO3: analyze the line and ground parameters of EHV lines

CO4: describe the effects of electrostatic and magnetic fields

CO5: understand the concept of switching surges in EHV lines

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3			2								1	2	2
CO2	3	2										1		
CO3	3	2	2									1	2	1
CO4	3											1		
CO5	3	2	2	2								2		

1 – Slight, 2 – Moderate, 3 – Substantial

14EEE16 STATIC RELAYS

3 0 0 3

Pre-requisites: Power System Protection and Switchgear

UNIT – I **9**

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 comparators. **Amplitude Comparators:** Circulating current type and opposed voltage type- rectifier bridge comparators, Direct and Instantaneous comparators**.**

UNIT – II **9**

Phase Comparators: Coincidence circuit type- block spike phase comparator, techniques to measure the period of coincidence-Integrating type-Rectifier and Vector product type- Phase comparators. **Static Over Current Relays:** Instantaneous over-current relay-Time over-current relays: basic principles –definite time and Inverse definite time over-current relays.

UNIT– III **9**

Static Differential 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 sampling comparator**.**

UNIT– IV **9**

Multi-Input Comparators: Conic section characteristics-Three input amplitude comparator –Hybrid comparator-switched distance schemes –Poly phase 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 and length and source impedance on distance relays.

UNIT – V **9**

Microprocessor Based Protective Relays: (Block diagram and flowchart approach only) - Over current relays – impedance relays - directional relay - reactance relay. Generalized mathematical expressions for distance relays-measurement of resistance and reactance –MHO and offset MHO relays-Realization of MHO characteristics- Realization of offset MHO characteristics -Basic principle of Digital computer relaying.

TOTAL: 45

TEXT BOOKS:

1. Madhava Rao T.S., "Power System protection, static relays with microprocessor applications", 2nd Edition, Tata McGraw-Hill, New Delhi, 2001.
2. Badri Ram and Vishwakarma D.N., "Power System Protection and Switch Gear", 2nd Edition, Tata McGraw-Hill, New Delhi, 2011.

REFERENCE BOOKS:

1. Bhavesh Bhalja, Maheshwari R.P. and Nilesh G. Chothani, "Protection and Switchgear", Oxford University Press, 2011.
2. Wright A. and Christopoulos C., "Electrical Power System Protection", Springer International, 2013.
3. Arun G. Phadke and James S. Thorp, "Computer relaying for power systems", 2nd Edition, Wiley, 2009.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: examine the need of static relays and its advantages

CO2: identify the concepts of different types of comparators

CO3: explain the function of various types of static relays

CO4: inspect the concept of static distance protection

CO5: discuss the concepts of microprocessor based protective relays and digital relaying

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											1	
CO2	2	2											1	1
CO3	3	2	1										3	1
CO4	2	2	1										2	1
CO5	2	2											1	2

1 – Slight, 2 – Moderate, 3 – Substantial

14EEE17 ELECTRICITY DEREGULATION

3 0 0 3

Pre-requisites: Power system analysis and stability, Power system operation and control

UNIT – I **9**

Overview of Key Issues in Electric Utilities-Vertical, Restructured Markets: Introduction to Deregulation: Different entities in Deregulated markets, Benefits from a competitive market, after effects of Deregulation. Restructuring Models: Pool Co Model, Bilateral Contracts Model and Hybrid Model - Independent System Operator (ISO): The Role of ISO - Power Exchange (PX): Market Clearing Price (MCP).

UNIT – II **9**

Electricity Market and Pricing: Market operations: Day-ahead and Hour-Ahead Markets, Elastic and Inelastic Markets - Market Power - Stranded costs - Transmission Pricing: Contract Path Method, The MW-Mile Method - Congestion Pricing: Congestion Pricing Methods, Transmission Rights.

UNIT– III **9**

Electric Utility Markets Position Around World Wide and in India: Industrialized countries: US, British Power Pool, Sweden, Norway, Australia and New Zealand. Developing Countries: South America and India. Power Sector in India: Evolution of integrated, monopoly, state electricity boards (SEBs), Introduction to various institutions in Indian power sector - CEA, planning commission, PFC, Ministry of Power, state and Central Governments, REC, Financial institutions, PTC, Utilities and their roles.

UNIT– IV **9**

OASIS: Open Access Same-Time Information System: Structure of OASIS: Functionality and Architecture of OASIS - Posting of information: Types of information available on OASIS, Information requirement of OASIS, Users of OASIS - Transfer Capability on OASIS: Definitions, Transfer Capability Issues, ATC Calculation, TTC Calculation, TRM Calculation, CBM Calculation -Transmission Services - Methodologies to Calculate ATC.

UNIT – V **9**

Electric Energy Trading: Essence of Electric Energy Trading - Energy Trading Framework: The Qualifying factors - Derivative Instruments of Energy Trading: Forward Contracts, Futures Contracts, Options and Swaps- Energy Trading Hubs - Brokers in Electricity Trading - Green Power Trading.

TOTAL: 45

TEXT BOOKS:

1. Mohammad Shahidehpour and Muwaffaq Almoush, "Restructured Electrical Power Systems Operation, Trading and Volatility", Marcel Dekkar Inc., 2001.
2. Bhattacharaya K., Bollen M.H.J. and Daader J.E., "Operation of Restructured Power Systems", Kluwer Academic Publishers, 2001.

REFERENCE BOOKS:

1. Illic M., Galiana F. and Fink L., "Power Systems Restructuring : Engineering and Economics", Kluwer Academic Publishers, 2000.
2. Loi Lei Lai, "Power System Restructuring and Deregulation : Trading, Performance and Information Technology", John Wiley and Sons Ltd., 2001.
3. Schweppe F.C., Caramanis M.C., Tabors R.D. and Bohn R.E., "Spot Pricing of Electricity", Kluwer Academic Publishers, 2002.
4. http://nptel.ac.in/courses/108101005/

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: classify the different types of restructuring models

CO2: analyze the market operations and pricing methods

CO3: perceive knowledge about worldwide market operations

CO4: analyze the concepts of OASIS and transfer capability issues

CO5: understand the concepts of electric energy trading

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1		1		1	3						1	
CO2	3	3	1	3		3	3					3	1	
CO3	1	1		1		1	3						1	
CO4	3	3	1	3		3	3						1	
CO5	1	2	1	1		1	3					3	1	

1 – Slight, 2 – Moderate, 3 – Substantial

14EEE18 BIO MASS ENERGY SYSTEMS

3 0 0 3

Pre-requisites: Materials Science

UNIT – I **9**

Introduction: Origin of Biomass – Resources - Classification and characteristics - Techniques for biomass assessment - Application of remote sensing in forest assessment - Biomass estimation.

UNIT – II **9**

Thermochemical Conversion: Different processes: Direct combustion – incineration – pyrolysis - gasification and liquefaction - Economics of thermochemical conversion.

UNIT – III **9**

Biological Conversion: Biodegradation and biodegradability of substrate - Biochemistry and process parameters of bio-methanation - Biogas digester types - Digester design and biogas utilization - Chemical kinetics and mathematical modeling of bio-methanation process- Economics of biogas plant - social impacts - Bioconversion of substrates into alcohol: Methanol and ethanol Production.

UNIT – IV **9**

Chemical Conversion: Hydrolysis & hydrogenation - Solvent extraction of hydrocarbons- Solvolysis of wood – Bio-crude and biodiesel - Chemicals from biomass.

UNIT-V **9**

Power Generation: Utilisation of gasifier for electricity generation - Operation of spark ignition and compression ignition engine with wood gas, methanol, ethanol and biogas - Biomass integrated gasification/combined cycles systems. Sustainable cofiring of biomass with coal. Biomass productivity - Energy plantation and power programme.

TOTAL: 45

TEXT BOOKS:

1. Sergio Capareda, "Introduction to Biomass Energy Conversions", 1st Edition, CRC Press, 2013.
2. Rai G.D., "Non Conventional Energy Sources", 2nd Edition, Khanna Publishers, 2010.

REFERENCE BOOKS:

1. Pandey A., "Hand Book of Plant Based Biofuel", 1st Edition, CRC Press, Taylor & Francis, 2008.
2. Mukunda H.S., "Understanding Clean Energy and Fuels from Biomass", 1st Edition, Wiley India Pvt. Ltd., New Delhi, 2011.
3. Sobh Nath Singh, "Non Conventional Energy Resources", 1st Edition, Pearson Education, 2014.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: explain the nature and principle of different biomass energy extraction systems

CO2: understand thermo-chemical biomass conversion process

CO3: interpret biological and biochemical conversion methods

CO4: choose the suitable biomass fuels for different bio-energy applications

CO5: categorize various power generation techniques using biomass

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1		2									1	2
CO2	2	1		2									1	2
CO3	2	1		2									1	2
CO4	2	1		2									1	2
CO5	3	3		3									1	3

1 – Slight, 2 – Moderate, 3 – Substantial

14EEE19 ENERGY CONSERVATION AND MANAGEMENT

(Common to EEE & EIE branches)

3 0 0 3

UNIT – I **9**

Introduction: Classification of Energy - Energy Scenario - Energy Needs of Growing Economy - Energy Pricing in India – Energy and Environment - Energy Conservation Act . Energy Audit: Types and Methodology - Energy Audit Instruments - Role of energy managers and auditors - Introduction to Fuels - Properties of fuels - Proximate and Ultimate Analysis

UNIT – II **9**

Thermal Utilities: Steam – Introduction, Properties of steam, Steam distribution systems - Boilers- Types and Classification- Performance Evaluation of Boilers – Boiler Efficiency- Direct and Indirect methods – Energy Conservation opportunities in boilers- Principle of cogeneration – Technical options for cogeneration- Waste heat recovery - Classification and benefits

UNIT – III **9**

Electrical and Lighting System: Introduction to Electric Power Supply Systems - Electricity Billing – Electrical Load Management and Maximum Demand Control- Power factor improvement and its benefit - Factors involved in determination of motor efficiency- Energy efficient motors- Basic Parameters and Terms in Lighting systems, Luminous performance Characteristics of commonly used luminaries and Energy saving opportunities in lighting systems

UNIT – IV **9**

Fans, Blowers and Pumps: Fan Types - Blower Types- Fan Performance evaluation- Fan Laws- Flow control strategies- Pumps- Types – Factors affecting pump performance- System characteristics- Efficient Pumping system operation- Flow Control Strategies- Energy conservation opportunities in pumping systems

UNIT – V **9**

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

TOTAL: 45

TEXT BOOKS:

1. Bureau of Energy Efficiency Exam Materials Volume I and II, III and IV.
2. Umesh Rathore, "Energy Management", 2nd Edition, S.K. Kataria and Sons, 2014.

REFERENCE BOOKS:

1. Hamies, "Energy Auditing and Conservation; Methods, Measurements, Management & Case Study", Hemisphere, Washington, 1980.
2. Smith C.B., "Energy Management Principles", Pergamon Press, New York, 1981.
3. Write Larry C., "Industrial Energy Management and Utilization", Hemisphere Publishers, Washington, 1998.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: interpret the importance of energy, energy conservation and energy audit

CO2: appraise the energy saving opportunities in thermal systems

CO3: predict the energy saving opportunities in motors and lighting systems

CO4: appraise the energy saving opportunities in fan , blowers and pumps

CO5: analyze the different financial management techniques

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1			1		1							1
CO2	2	1				1	2						1	1
CO3	3	2	1	1		1	2						1	1
CO4	2	1				1	2						1	1
CO5	2	3	1	1							2			1

1 – Slight, 2 – Moderate, 3 – Substantial

14EEE20 HVDC AND FACTS

3 0 0 3

Pre-requisites: Transmission and Distribution, Power Electronics

UNIT – I **9**

General Aspects of HVDC Transmission Systems: DC Power transmission technology –Types of HVDC systems – Equipment Required for HVDC Systems – Comparison of AC and DC transmission – Application of DC transmission – Limitations of HVDC Transmission system - Modern trends in HVDC technology – Important HVDC projects – HVDC transmission based on VSC – Types of MTDC system.

UNIT – II **9**

HVDC Converters: HVDC-Voltage Source Converters: Principle and operation – 3-phase 6 pulse converters using SCRs – Power flow in HVDC link Control of HVDC Converter Systems: Principle of control – Necessity of control of HVDC link – Power Reversal in DC link – Starting and stopping of DC link – Firing Angle Control – Constant power control

UNIT – III **9**

Protection Schemes: Nature and Types of faults – Faults on AC side of converter station – Converter Faults – Faults on DC side of the system – Protection against over voltage and over current – Smoothing Reactors – DC breakers: concept of DC circuit interruption.

UNIT – IV **9**

Voltage Controlled Facts Devices: Reactive power control in electrical power transmission lines -Uncompensated transmission line – shunt compensation-series compensation – Basic principle of operation of Saturated reactor(SR) - Thyristor Controlled Reactor(TCR) -Thyristor switched Capacitor(TSC) - Basic concepts of Static Var Compensator (SVC) – Thyristor Controlled Series capacitor (TCSC)

UNIT – V **9**

Recent Trends in Facts Controllers: Emerging FACTS controllers - Unified power flow controller (UPFC) – Static Synchronous Compensator (STATCOM) – Static Synchronous Series Compensator (SSSC) – Unified Power Quality Conditioner (UPQC) – Interline Power Flow Controller (IPFC) - Performance and Comparison of different FACTS controllers.

TOTAL: 45

TEXT BOOKS:

1. Kamakshaiah S., Kamaraju, "HVDC Transmission", 1st Edition, Tata McGraw-Hill, 2011.
2. Padiyar K.R., "FACTS Controllers in Power Transmission and Distribution", 1st Edition, New Age International Pvt. Ltd. Publishers, New Delhi, 2007, Reprint 2013.

REFERENCE BOOKS:

1. Kimbark E.W., "Direct Current Transmission", Vol. I, Wiley Interscience, New York, 1971.
2. Kundur P., "Power System Stability and Control", 1st Edition, McGraw-Hill, 2006.
3. Narain G. Hingorani, "Understanding FACTS-Concepts and Technology of Flexible AC Transmission Systems", Standard Publishers Distributors, Delhi, 2011.
4. nptel.ac.in/courses/108104013/

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: identify the different HVDC transmission systems

CO2: examine HVDC converter and inverter stations

CO3: list out the various faults in stations

CO4: explain about various FACTS controllers in transmission systems

CO5: determine the operation of advanced FACTS controllers

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		3										
CO2	2	1												
CO3	2	1												
CO4	2	2												
CO5	2	2											2	1

1 – Slight, 2 – Moderate, 3 – Substantial

14EEO01 ELECTRIC POWER UTILISATION AND ENERGY AUDITING

3 1 0 4

UNIT - I **9**

Tariffs, Illumination, Heating and Welding: Tariffs: Types of tariffs - simple problems in tariffs, Definitions in Illumination: lighting calculations -design of illumination systems (for residential and industrial workshop) – types of lamps - energy efficiency lamps. Methods of heating - requirement of heating material-design of heating element-furnaces - Welding transformer: construction and characteristics - Types of Welding.

UNIT - II **9**

Electric Traction: Introduction – requirements of an ideal traction system – supply systems –speed time curves for train movement - calculation of average and crest speed of various services - mechanics of train movement – tractive effort – specific energy consumption - calculation of specific energy consumption on a level track.

UNIT - III **9**

Traction Motors and Control: Characteristics of traction motors - series motor for traction services - control of traction motors – multiple units - braking methods – current collection systems - recent trends in electric traction– Details of locomotives used in India.

UNIT -IV **9**

Electrolytic Process and Storage of Electricity: Electrolysis – simple problems involving faraday's laws of electrolysis - Electroplating – Nickel iron batteries – Lead acid Batteries – components and materials - capacity rating of batteries – battery chargers – Method of charging and maintenance.

UNIT - V **9**

Energy Conservation: Need for electrical energy conservation - methods – energy efficient equipment – energy management – energy auditing - Features of Energy Conservation act 2001- Economics of power factor improvement – design for improvement of power factor using power capacitors – DSM techniques - potential energy conservation opportunities in motor and transformers - compressors and fans.

Lecture: 45, Tutorial: 15, TOTAL: 60

TEXT BOOKS:

1. Taylor E. Openshaw, "Utilization of Electrical Energy", Universities Press, Hyderabad, 2012.
2. Gupta J.B., "Utilization of Electric Power and Electric Traction", S.K. Kataria & Sons, New Delhi, 2012.

REFERENCE BOOKS:

1. Chakrabarti A., Soni M.L., Gupta P.V. and Bhatnagar U.S., "A Textbook on Power System Engineering", Dhanpat Rai & Co., New Delhi, 2010.
2. Amlan Chakrabarti, "Energy Engineering and Management", PHI, New Delhi, 2011.
3. Rajput R.K., " Utilization of Electrical Power", Laxmi Publications, New Delhi, 2006.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: understand the application of electrical energy for heating, lighting, traction and electrolysis

CO2: apply energy management schemes in electrical systems

CO3: perform economic analysis and load management

CO4: formulate electric traction systems and their performance

CO5: discuss about electrical energy conservation, energy auditing and power quality

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1										1
CO2	3	1	1	1										2
CO3	3	3	2	2										1
CO4	3	2	1	1										2
CO5	3	2	1			1	2					2	1	2

1 – Slight, 2 – Moderate, 3 – Substantial

14EEO02 SOLAR AND WIND ENERGY

3 0 0 3

Pre-requisites: Materials Science, Electrical Machines I & II

UNIT – I **9**

Photovoltaic Energy Conversion And Applications: Solar energy scenario in India - Solar radiation and measurement - Solar cells and their characteristics - domestic solar cell - Concentrated PV and its types - Influence of insolation and temperature - PV arrays Electrical storage with batteries - Switching devices for solar energy conversion - Stand alone inverters - Charge controllers.

UNIT – II **9**

Power Electronics Interface for PV Systems: DC Power conditioning Converters - Maximum Power point tracking algorithms - AC Power conditioners - Line commutated inverters - Synchronized operation with grid supply – grid related issues.

UNIT – III **9**

Wind Energy Systems: Wind energy scenario in India - Basic Principle of wind Energy conversion - Nature of Wind - Components of Wind Energy Conversion System (WECS) - Performance of Induction Generators for WECS - Classification of WECS - Self Excited Induction Generator (SEIG) for isolated Power Generators - Lightning protection For Wind turbine – Commercial wind turbine specification in India.

UNIT –IV **9**

Grid Connected WECS: Grid connector's concepts - Wind farm and its accessories - Grid related problems - Generator control - Performance improvements - Different schemes - AC voltage controllers - Harmonics and PF improvement.

UNIT – V **9**

Stand Alone Power Supply Systems: Wind / Solar PV integrated systems - Selection of power conversion ratio - Optimization of system components - Storage - Reliability evolution – Introduction to micro grid- Concept and definition of microgrid, microgrid drivers and benefits, review of sources of microgrids, typical structure and configuration of a microgrid.

TOTAL: 45

TEXT BOOKS:

1. Rai G.D., "Non-conventional Energy Sources", 1st Edition, Khanna Publishers, New Delhi, 2010.
2. Mukund R. Patel, "Wind and Solar Power Systems: Design Analysis and Operation", 2nd Edition, CRC Press, 2005.

REFERENCE BOOKS:

1. Roger A. Messenger, Jerry Ventre, "Photovoltaic System Engineering", 2nd Edition, CRC Press, 2010.
2. Khan B.H., "Non Conventional Energy Resources", 2nd Edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2009.
3. Sobh Nath Singh, "Non Conventional Energy Resources", 1st Edition, Pearson Education, 2014.
4. http://nptel.ac.in/courses/108105058/

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: explain the Photovoltaic energy conversion

CO2: select suitable switches and power conditioning unit for energy conversion system

CO3: classify the wind energy conversion scheme

CO4: identify grid related problems in wind farm

CO5: elaborate the wind/solar PV systems integration

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2					1							
CO2	3	2	1										1	3
CO3	2	1					1							
CO4	3	1	1										1	2
CO5	2	1	1				1							

1 – Slight, 2 – Moderate, 3 – Substantial

14EEO03 COMPUTER AIDED SIMULATION AND DESIGN OF ELECTRICAL MACHINES

3 0 0 3

UNIT – I **9**

Introduction: Considerations and limitations in design; choice of specific electric and magnetic loadings. Concept of magnetic circuit – MMF calculation for various types of electrical machines – real and apparent flux density of rotating machines – leakage reactance calculation for transformers, induction and synchronous machine.

UNIT– II **9**

Design of DC Machines: Construction details - output equation – main dimensions – choice of number of poles –armature design – design of air gap - design of field poles and field coil – design of commutator and brushes

UNIT– III **9**

Design of Transformers: Construction details - output rating of single phase and three phase transformers –optimum design of transformers – design of core and windings for core and shell type transformers –design of tanks and cooling tubes of transformer

UNIT– IV **9**

Design of Induction Machine: Construction details - output equation – main dimensions - length of air gap – design of stator – design of squirrel cage and slip ring rotor – performance calculation from designed data.

UNIT – V **9**

Design of Mechanical Parts and Computer Aided Simulation: Design of shaft, bearing and frame– modes of heat dissipation-cooling system for rotating electrical machines-introduction to computer aided design – pre-processing – post-processing – optimization – flowchart.

TOTAL: 45

TEXT BOOKS:

1. Sawhney A.K., "A Course in Electrical Machine Design", Dhanpat Rai and Sons, New Delhi, 2003.
2. Sen S.K., "Principles of Electrical Machine Design with Computer Programmes", Oxford and IBH Publishing Co., New Delhi, 2006.

REFERENCE BOOKS:

1. Hendershot Jr J.R. and Miller T.J.E., "Design of Brushless Permanent Magnet Motors", Magna Physics Pub., 1994.
2. Agarwal R.K., "Principles of Electrical Machine Design", S.K. Kataria and Sons, Delhi, 2002.
3. Mittle V.N. and Mittle A., "Design of Electrical Machines", Standard Publications Distributors, Delhi, 2002.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: explore the design concept of various electrical machines

CO2: calculate the necessary electrical and magnetic circuit parameters

CO3: design armature and field system for AC/DC machines

CO4: design core, yoke, windings and cooling systems for transformers

CO5: model and analyze various electrical machines using computer aided simulation

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3										1		
CO2	3	3	2									1	1	
CO3	3	3	3		2							1	2	2
CO4	3	3	3									1	2	2
CO5	3	3	3		2		1					1	2	2

1 – Slight, 2 – Moderate, 3 – Substantial

14EEO04 ENERGY STORAGE SYSTEMS

3 0 0 3

UNIT – I **9**

Energy Storage System: Introduction - Need of energy storage - Battery - Components of Cells and Batteries – Classification - Operation of a Cell - Theoretical Cell Voltage, Capacity, and Energy - Electrochemical Principles and Reactions: Cell Polarization - Electrical Double-Layer Capacity and Ionic Adsorption - Mass Transport to the Electrode Surface.

UNIT - II **9**

Battery Design and Selection: Battery parameters and specification - Designing to Eliminate Potential Safety Problems- Battery Safeguards when Using Discrete Batteries – Safety issues- Battery Construction- Factors Affecting Battery Performance- Major Considerations in Selecting a Battery - Parameters that Influence the Cell Reaction.

UNIT- III **9**

Secondary Batteries: Introduction - Performance, charging and discharging- storage density, energy density, classical batteries -Lead Acid, Nickel-Cadmium, Zinc Manganese dioxide and modern batteries -Zinc-Air, Nickel Hydride, Lithium Battery-Principle and working - Ongoing Barriers to Storage Deployment for the Grid.

UNIT -IV **9**

Ultracapacitors and Flywheels: Ultracapacitors: Features- Basic Principles of Ultracapacitors - Performance of Ultracapacitors – Mathematical model - Ultrahigh-Speed Flywheels - Operation Principles of Flywheels – Basic structure - Power Capacity of Flywheel Systems - Flywheel Technologies - Hybridization of Energy Storage systems.

UNIT - V **9**

Fuel Cells: Introduction - direct energy conversion -maximum intrinsic efficiency of an electrochemical converter, physical interpretation, carnot efficiency factor in electrochemical energy converters - types of fuel cells -hydrogen oxygen cells, hydrogen air cell, alkaline fuel cell, and phosphoric fuel cell.

TOTAL: 45

TEXT BOOKS:

1. David Linden, Thomas B. Reddy,"Handbook of Batteries", 3rd Edition, McGraw-Hill, 2002.
2. MehrdadEhsani, YiminGao, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicle", 2nd Edition, CRC Publisher, 2010.

REFERENCE BOOKS:

1. Tetsuya Osaka, MadhavDatta, "Energy Storage Systems in Electronics", 1st Edition, Gordon and Breach Science Publishers, 2000.
2. R. M. Dell, D.A.J. Rand, "Understanding Batteries", 1st Edition, RSC Publications, 2001.
3. James Larminie, Andrew Dick, "Fuel Cell System Explained", 2nd Edition, J. Wiley, 2003.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: conceptualize the principles of energy storage systems

CO2: understand the performance of primary batteries and their design aspects

CO3: interpret the concepts of secondary batteries

CO4: comprehend the fundamental concepts of ultracapacitors and flywheels

CO5: perceive the importance of fuel cell system in replacing fossil fuel based energy generation

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1		2			1						1	
CO2	2	1		2									1	
CO3	3	3		3									2	2
CO4	2	1		2									2	
CO5	2	1		2			3						1	

1 – Slight, 2 – Moderate, 3 – Substantial

14EEO05 INDUSTRIAL AUTOMATION AND CONTROL

3 0 0 3

UNIT – I **9**

Introduction: Starting documents-Motors and component list for Process and Motion Control Industries-Architecture of the basic three level Integrated Industrial Automation Systems-Field level for sensors actuators and smart devices, Control level for process and motion control functions, Distributed control system-Supervisory level for Data logging and Acquisition systems–DAS and SCADA for Management functions-Integrated automation through bus structure at the different levels

UNIT – II **9**

Field Level Equipment-Sensors and Actuators : Field level equipment-Sensors and measurement systems for Temperature, Pressure , Force ,Displacement and speed measurement-Flow measurement techniques-Measurement of level, humidity, pH etc-Introduction to Actuators – solenoids, on/off valves-Proportional Flow Control Valves-Hydraulic Actuator Systems - Principles, Components and Symbols-Pumps , fans and Motors-Pneumatic Control Systems - System Components-Integrated Control Systems using Smart sensors, Hart communication protocol.

UNIT – III **9**

Motion Controls in Industrial Automation: Variable Speed Electric Drives-Introduction, Energy Saving with Adjustable Speed drives-Controlled Rectifiers and DC Motor Drives-DC-DC Converters Fed DC motors, Active front-end fed DC motors-AC Motors -Induction Motor Drives- Introduction, Characteristics, Adjustable Speed Drives-Synchronous Motor Drives- Motor Principles, Adjustable Speed Drives-Closed loop Control system for speed, torque, position control using Industrial drives-Digital drives - architecture and typical control diagram-Engineering bus and control bus for typical motion controls.

UNIT – IV **9**

PLC and HMI Controls: Introduction to PLC-s, PLC-s and Relay controls-PLC processor modules -input/output modules – Parallel /Local and Serial / Remote I/O modules-power supplies for I/O modules-Selection of PLC based on I/O counts and Scan times, PLC programming Languages- Ladder logic, functional block diagram-On/ Off logic functions, timer / counter , Register functions - control instructions- PID controls, Arithmetic and other Math instructions-sequencer Instructions- HMI controls for data acquisition (SCADA) -developer and runtime packages – available tools-definition of tags-display of real time parameters in graphical form; generation of various reports –logging of alarms ,trend curves , historical reports.

UNIT – V **9**

Special Controls: Signal Conditioning and Processing-Estimation of errors and calibration- Introduction to Process Control-P--I--D Control-Controller Tuning- Implementation of PID Controllers-Special Control Structures-Feed forward and Ratio Control-Special Control Structures - Predictive Control, Control of Systems with Inverse Response-Special Control Structures-Cascade Control, Overriding Control, Selective Control, Split Range Control-Networking of Sensors, Actuators and Controllers using the Field bus Communication Protocol-Introduction to Production Control Systems.

TOTAL: 45

TEXT BOOKS:

1. Webb, John W. and Reis Ronald A., "Programmable Logic Controllers". Prentice Hall Publications, New Delhi, 2006.
2. Lukas, Michael P., " Distributed Control Systems", Van Nostrand Reinfold Company, 2002.

REFERENCE BOOKS:

1 NPTEL web book on Industrial Automation and controls by Mr. S.Mukhopadhyay and Mr.S.Sen of IIT, Kharagpur.

2 The Control Techniques Drives and Controls Handbook, by Bill Drury, IET Power and Energy Series 57, 2nd Edition 2009.

3 Deshpande P.B and Ash R.H, "Elements of computer process control with advanced control applications", tenth edition, Research Triangle Park, N.C.: Instrument Society of America; Englewood Cliffs, N.J.: Prentice-Hall, 1983.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: identify the role and purpose of integrated industrial automation system

CO2: understand the concept of 3- level integrated industrial automation system

CO3: realize the field, process, control and supervisory levels

CO4: choose appropriate equipment for the three level of the architecture and appropriate SCADA package for typical industries

CO5: derive benefits from such a system in terms of improved productivity and quality of the products

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	2								1		
CO2	2	2	2									1		
CO3	2	3	2									1		
CO4	2	2	2									1	3	3
CO5			2				3					1	3	2

1 – Slight, 2 – Moderate, 3 – Substantial

14EEO06 NEURAL NETWORKS AND FUZZY LOGIC SYSTEMS

3 0 0 3

UNIT – I **9**

Artificial Neural Networks: Introduction to soft Computing and Artificial Neural Networks- Fundamental concepts, weights, biases and thresholds- Artificial models- Common activation functions- Learning rules and Learning methods of ANN- Single Layer, Multilayer Feed forward network-Recurrent network.

UNIT – II **9**

Neural Networks Architectures and Algorithms: Mcculloh Pitts neuron- Perceptron- Hebbnet – Adaline- Hopfield net - Maxnet - Kohonen self - Organizing map - Adaptive resonance theory-Back propagation neural net.

UNIT – III **9**

Fuzzy Theory: Classical sets – Fuzzy sets – simple operations on fuzzy sets-Fuzzy relations – Fuzzification – Defuzzification – Fuzzy rules. Membership function – Knowledge base – Set theoretic operations – Fuzzy Rules and Fuzzy Reasoning.

UNIT – IV **9**

Neuro Fuzzy Control: Cognitron and Neocognitron Architecture-Training Algorithm and application-Fuzzy associative memories-fuzzy and neural function estimators-Comparison of Fuzzy and Neural systems-Adaptive neuro, Adaptive Fuzzy, Adaptive Neuro-Fuzzy interface systems.

UNIT – V **9**

Neural Network Applications: Process identification, Reactor flow control, MPPT, Speed control of DC and AC Machines, Pattern recognition and XOR Problem. **Fuzzy Logic Applications:** Home heating system - Printer character recognition, Inverse kinematic problem - Case studies: Identification and control of linear and nonlinear dynamic systems.

TOTAL: 45

TEXT BOOKS:

1. Fausset, Laurence, "Fundamentals of Neural Networks", Pearson India, 1994.
2. Ross, Timothy J., "Fuzzy Logic with Engineering Applications", 3rd Edition, Wiley India Pvt. Ltd., New Delhi, 2011.

REFERENCE BOOKS:

1. Zurada J.M., "Introduction to Artificial Neural Systems", Jaico Publishing House, Delhi, 2002.
2. Simon O. Haykin, "Neural Networks and Learning Machines", 3rd Edition, Pearson Publication, 2009.
3. LiMin Fu, "Neural Networks in Computer Intelligence", Tata Mcgraw Hill, Har/Dsk Edition, 1994.
4. http://nptel.ac.in/courses/117105084/
5. https://www.youtube.com/playlist?list=PL53BE265CE4A6C056

Course Outcomes:

COURSE OUTCOMES

On completion of the course the students will be able to

- CO1: interpret the concept of Biological and Artificial Neural Network
- CO2: analyze various supervised and unsupervised learning networks
- CO3: examine the concept of fuzzy sets, membership functions, rules and reasoning
- CO4: apply Neural Network , fuzzy logic and reasoning to handle uncertainty of engineering problems
- CO5: develop a suitable soft computing technique on real time systems

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2									1	
CO2	2	3	2	2									1	
CO3	3	2	2	3										1
CO4	3	3	2	3										3
CO5	2	3	2	3									1	2

1 – Slight, 2 – Moderate, 3 – Substantial