GOVERNMENT COLLEGE OF ENGINEERING, BARGUR

Regulation – 2017

AUTONOMOUS

Curriculum for Full Time – B.E. -EEE

From the Academic Year 2017-2018 onwards

SEMESTER I

SL. No.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
THEORY							
1.	17ZHS101	Communicative English I	HS	4	0	0	4
2.	17ZBS102	Engineering Mathematics I	BS	3	2	0	4
3.	17ZBS103	Engineering Physics I	BS	3	0	0	3
4.	17ZBS104	Engineering Chemistry	BS	3	0	0	3
5.	17ZES105	Programming in C	ES	3	0	0	3
6.	17ZES106	Engineering Graphics	ES	2	0	4	4
PRACTICALS							
7.	17ZES107	Programming in C Laboratory	ES	0	0	4	2
8.	17ZBS108	Physics Laboratory	BS	0	0	4	2
9.	17ZBS109	Chemistry Laboratory	BS	0	0	4	2
			TOTAL	**18**	**2**	**16**	**27**

SEMESTER II

SL. No.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
THEORY							
1.	17ZHS201	Communicative English II	HS	4	0	0	4
2.	17ZBS202	Engineering Mathematics II	BS	3	2	0	4
3.	17ZBS203	Engineering Physics II	BS	3	0	0	3
4.	17EES204	Basic Civil and Mechanical Engineering	ES	3	0	0	3

5.	17ZBS205	Environmental Science and Engineering	BS	**3**	0	0	3
6.	17EPC206	Electric Circuit Analysis	PC	**3**	2	0	4
PRACTICALS							
7.	17ZES207	Engineering Practices Laboratory	ES	0	0	4	2
8.	17EPC208	Electric Circuits Laboratory	PC	0	0	4	2
			TOTAL	**19**	**4**	**8**	**25**

SEMESTER III

SL. No.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
THEORY							
1.	17ZBS301	Transforms and Partial Differential Equations	BS	3	2	0	4
2.	17EPC302	Power Plant Engineering	PC	3	0	0	3
3.	17EES303	Object Oriented Programming	ES	3	0	0	3
4.	17EPC304	Electromagnetic Theory	PC	2	2	0	3
5.	17EPC305	Analog Electronics	PC	3	0	0	3
6.	17EPC306	Digital Logic Circuits	PC	2	2	0	3
PRACTICALS							
7.	17EES307	Object Oriented Programming Laboratory	ES	0	0	4	2
8.	17EPC308	Analog Electronics Laboratory	PC	0	0	4	2
			TOTAL	**16**	**6**	**8**	**23**

SEMESTER IV

SL. No.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
THEORY							
1.	17EBS401	Numerical methods	BS	3	2	0	4
2.	17EPC402	DC Machines and Transformers	PC	2	2	0	3
3.	17EPC403	Linear Integrated Circuits and Applications	PC	3	0	0	3
4.	17EPC404	Transmissionand Distribution	PC	3	0	0	3
5.	17ZES405	Signals and Systems	ES	3	2	0	4
6.	17EPC406	Measurements and Instrumentation	PC	3	0	0	3
PRACTICALS							
7.	17EPC407	DC Machines and Transformers Laboratory	PC	0	0	4	2
8.	17EPC408	Linear and Digital Integrated Circuits Laboratory	PC	0	0	4	2
			TOTAL	**17**	**6**	**8**	**24**

SEMESTER V

SL. No.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
THEORY							
1.	17EPC501	PowerSystem Analysis	PC	2	2	0	3
2.	17EPC502	Control Systems	PC	2	2	0	3
3.	17EPC503	Synchronous and Asynchronous Machines	PC	2	2	0	3
4.	17EPC504	Professional Ethics	PC	3	0	0	3
5.	17EPC505	Communication Engineering	PC	3	0	0	3
6.		Professional Elective I	PE	3	0	0	3
PRACTICALS							

7.	17EPC507	Synchronous and Asynchronous MachinesLaboratory	PC	0	0	4	2
8.	17EPC508	Control and Instrumentation Laboratory	PC	0	0	4	2
9.	17ZEE509	Communication and Soft Skills-Laboratory Based	EEC	0	0	4	2
			TOTAL	**15**	**6**	**12**	**24**

SEMESTER VI

SL. No.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**L**	**T**	**P**	**C**
THEORY							
1.	17EPC601	Power Electronics	PC	3	0	0	3
2.	17EPC602	Microprocessors, Microcontrollers and Applications	PC	3	0	0	3
3.	17EPC603	Power System Operation and Control	PC	3	0	0	3
4.	17EPC604	Protection and Switchgear	PC	3	0	0	3
5.		Professional Elective II	PE	3	0	0	3
6.		Open Elective	OE	3	0	0	3
PRACTICALS							
7.	17EPC607	Power Electronics Laboratory	PC	0	0	4	2
8.	17EPC608	Microprocessors, Microcontrollers and Applications Laboratory	PC	0	0	4	2
			TOTAL	**18**	**0**	**8**	**22**

SEMESTER VII

SL. No.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
THEORY							
1.	17EPC701	Solid State Drives	PC	3	0	0	3
2.	17EPC702	Electrical Machine Design	PC	2	2	0	3
3.	17EPC703	Special Electrical Machines	PC	3	0	0	3
4.	17EPC704	Energy Utilization, Conservation and Auditing	PC	3	0	0	3
5.		Professional Elective III	PE	3	0	0	3
PRACTICALS							
6.	17EPC706	Power System Laboratory	PC	0	0	4	2
7.	17EEE707	Electrical System Design Laboratory	EEC	0	0	4	2
			TOTAL	**14**	**2**	**8**	**19**

SEMESTER VIII

SL. No.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
THEORY							
1.		Professional Elective IV	PE	3	0	0	3
2.		Professional Elective V	PE	3	0	0	3
PRACTICALS							
3.	17EEE803	Project Work	EEC	0	0	12	6
			TOTAL	**6**	**0**	**12**	**12**

Total no of Credits: 176

LIST OF PROFESSIONAL ELECTIVES

SL. No.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
THEORY							
1.	17EPE001	Applied Soft Computing	PE	3	0	0	3
2.	17EPE002	Principles of Management	PE	3	0	0	3
3.	17EPE003	Biomedical Instrumentation	PE	3	0	0	3
4.	17EPE004	Fundamentals of Nanoscience	PE	3	0	0	3
5.	17EPE005	High Voltage Engineering	PE	3	0	0	3
6.	17EPE006	Optimization Techniques	PE	3	0	0	3
7.	17EPE007	Micro Electro Mechanical Systems	PE	3	0	0	3
8.	17EPE008	Advanced Control System	PE	3	0	0	3
9.	17EPE009	Power Quality	PE	3	0	0	3
10.	17EPE010	System identification and Adaptive Control	PE	3	0	0	3
11.	17EPE011	Microcontroller Based System Design	PE	3	0	0	3
12.	17EPE012	High Voltage Direct Current Transmission	PE	3	0	0	3
13.	17EPE013	Embedded Systems	PE	3	0	0	3
14.	17EPE014	Power Electronics for Renewable Energy Systems	PE	3	0	0	3
15.	17EPE015	Flexible AC Transmission Systems	PE	3	0	0	3
16.	17EPE016	Power System Dynamics	PE	3	0	0	3
17.	17EPE017	Principles of Robotics	PE	3	0	0	3
18.	17EPE018	Total Quality Management	PE	3	0	0	3
19.	17EPE019	Computer Aided Design of	PE	3	0	0	3

		Electrical Apparatus					
20.	17EPE020	VLSI Design	PE	3	0	0	3
21.	17EPE021	Power System Transients	PE	3	0	0	3
22.	17EPE022	Internet of Things	PE	3	0	0	3

LIST OF OPEN ELECTIVES

Students has to take open electives offered from other Departments

Department :Electrical and Electronics Engineering							
SL. No.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**L**	**T**	**P**	**C**
THEORY							
1.	17EOE001	Matlab Programming	OE	3	0	0	3
2.	17EOE002	Renewable Energy Sources	OE	3	0	0	3
3.	17EOE003	Energy Management and Auditing	OE	3	0	0	3
4.	17EOE004	Smart Grid	OE	3	0	0	3
Department :Electronics and Communication Engineering							
5.	17LOE001	Real Time Systems	OE	3	0	0	3
6.	17LOE002	Wireless Sensor Networks	OE	3	0	0	3
7.	17LOE003	Industrial Automation and Robotics	OE	3	0	0	3
8.	17LOE004	Principles of VLSI design	OE	3	0	0	3
9.	17LOE005	Applied Electronics	OE	3	0	0	3
10.	17LOE006	Wireless Networks	OE	3	0	0	3
Department :Computer Science and Engineering							
11.	17SOE001	Programming in C++	OE	3	0	0	3
12.	17SOE002	Java Programming	OE	3	0	0	3
13.	17SOE003	Python Programming	OE	3	0	0	3
14.	17SOE004	Web Designing	OE	3	0	0	3

15.	17SOE005	Android Application Development	OE	3	0	0	3
Department :Mechanical Engineering							
16.	17MOE001	Disaster Management and Mitigation	OE	3	0	0	3
17.	17MOE002	Environmental Management	OE	3	0	0	3
18.	17MOE003	Composite Materials	OE	3	0	0	3
19.	17MOE004	Renewable Energy Sources and Technology	OE	3	0	0	3
20.	17MOE005	Intellectual Property Rights	OE	3	0	0	3
21.	17MOE006	Engineering Economics and Financial Accounting	OE	3	0	0	3
22.	17MOE007	Industrial Safety Acts and Standards	OE	3	0	0	3
23.	17MOE008	Global Warming and Climate Change	OE	3	0	0	3

LIST OF ONE CREDIT COURSES

SL. No.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
THEORY							
1.	17EOC001	Spice Simulation for circuits	OC	0	0	2	1
2.	17EOC002	Yoga and meditation	OC	1	0	0	1
3.	17EOC003	Stress Management	OC	1	0	0	1
4.	17EOC004	PCB design and Fabrication	OC	1	0	0	1
5.	17EOC005	Personality Development	OC	1	0	0	1
6.	17EOC006	Entrepreneurship Development	OC	1	0	0	1
7.	17EOC007	Solar PV System Design	OC	1	0	0	1

CREDIT SUMMARY

Sl. No	Subject Area	Credits per Semester								Credits Total	% of Total Credits	Total no. of Subjects	AICTE Recommended Range of % of Credits	
		I	II	III	IV	V	VI	VII	VIII				MIN	MAX
1	HS	4	4							8	5	2	5	10
2	BS	14	10	4	4					32	18	10	15	20
3	ES	9	5	5	3					22	13	8	15	20
4	PC		6	14	17	19	16	14		86	48	31	30	40
5	PE					3	3	3	6	15	8	5	10	15
6	OE						3			3	2	1	5	10
7	EEC					2		2	6	10	6	3	10	15
	Total	27	25	23	24	24	22	19	12	176	100	60		

SEMESTER I

17ZHS101	COMMUNICATIVE ENGLISH I	L	T	P	C
(Common to MECH, EEE, ECE & CSE)		4	0	0	4

OBJECTIVES:	
•	To develop the active skills as well as the passive skills of the first year Engineering and Technology students.
•	To help learners develop their speaking skills and speak flawlessly in real life situations.
•	To help learners acquire vocabulary by the way of reading skills.
•	To help learners enhance their listening skills which will enable them to listen to lectures and comprehend them by asking questions, seeking clarifications.
•	To help learners improve their writing skills by practicing dialogue writing, and writing short essays.

UNIT I		12

Listening - Short texts- Short formal and informal conversations- listening to TV and Telephonic interviews. **Speaking-** Introducing one self- exchanging personal information. **Reading** -Skimming and Scanning. **Writing** -Letter writing - E-mail writing. **Grammar**- introducing Tenses (Simple Present, Present Continuous, Present Perfect) Articles, **Vocabulary:** Prefix & Suffix and Compounds.

UNIT II		12

Listening- Listening to announcements- listening to news. **Speaking –** Greetings and congratulating and taking leave. **Reading –**Finding key information in a given text. **Writing-** Short narrative descriptions- dialogue writing. **Grammar**- Tenses (Present Perfect Continuous, Simple Past) - WH questions, Yes-No questions,Prepositions **Vocabulary**: Word-formation, Synonym & Antonym.

UNIT III		12

Listening - Listening to dialogue **Speaking –** describing a person, experience, expressing opinions. **Reading-** Reading longer text, reading science articles. **Writing-** Paragraph Writing- informal letter writing. **Grammar**- Tenses (Past continuous, Past Perfect), degrees of comparison, direct-indirect speech**Vocabulary**: One- word substitution.

UNIT IV		12

Listening- Listening to product descriptions. **Speaking**- describing an object- process. **Reading** - Reading comprehension. **Writing**- completing sentences- writing about scientific

objects and inventions. **Grammar**- Tenses (Past Perfect Continuous, Simple Future) **Vocabulary**: Phrasal verbs.		
UNIT V		**12**
Listening- Listening to talks& conversations. **Speaking**- participating in conversations & responding. **Reading**- Reading longer text & close reading.**Writing** –Creative Writing.**Grammar**- Tenses (Future Continuous, Future Perfect, Future Perfect Continuous), conditionals **Vocabulary**- collocations, idioms.		
		TOTAL : 60 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Read articles of a general kind in magazines and newspapers.
•	Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.
•	Comprehend conversations and short talks delivered in English.
•	Write short essays of a general kind and personal letters and emails in English.

TEXT BOOKS:

1.	Board of Editors. Using English A Course book for undergraduate Engineers and Technologists. Orient Black Swan Limited, Hyderabad:2015
2.	A Handbook of English For Professionals , BS Publications, Hyderabad:2008
3.	English for engineering students, Sankar Printers ,Chennai:2001

REFERENCES:

1.	*Richards, C.Jack.Interchange Students' Book-2 New Delhi:CUP,2015.*
2.	*Bailey,Stephen. Academic Writing: A Practical guide for students.New York: Rutledge,2011.*
3.	*Seely, John. The Oxford guide to writing & Speaking. New York.1998.*
4.	*Bhatia M.P ,A Handbook of Applied Grammar ,M.I Publications, AGRA, Sixth Edition*

17ZBS102	ENGINEERING MATHEMATICS I	L	T	P	C
(Common to MECH, EEE, ECE & CSE)		3	2	0	4

OBJECTIVES:

- Matrix Algebra And Techniques And Using Them In Engineering Applications
- The Concept Of Infinite Series And Their Convergence So That They Will Be Familiar With Limitations Of Using Infinite Series Approximations For Solutions Arising In Mathematical Modelling
- Differential And Integral Calculus And Their Applications In Various Engineering Applications

UNIT I	MATRICES	9+6

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of eigenvalues and eigenvectors – Statement and applications of Cayley-Hamilton Theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II	SEQUENCES AND SERIES	9+6

Sequences: Definition and examples – Series: Types and Convergence – Series of positive terms – Tests of convergence: Comparison test, Integral test and D'Alembert's ratio test – Alternating series – Leibnitz's test – Series of positive and negative terms – Absolute and conditional convergence.

UNIT III	APPLICATIONS OF DIFFERENTIAL CALCULUS	9+6

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes - Evolute as envelope of normals.

UNIT IV	FUNCTIONS OF SEVERAL VARIABLES	9+6

Limits and Continuity – Partial derivatives – Total derivative – Differentiation of implicit functions – Jacobian and properties – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT V	MULTIPLE INTEGRALS	9+6

Double integrals in Cartesian and polar coordinates – Change of order of integration – Area enclosed by plane curves – Change of variables in double integrals – Area of a curved surface - Triple integrals – Volume of Solids.

TOTAL : 75(45+30) PERIODS

OUTCOMES: After successful completion of the course students able to

•	Solve problems on matrices and to apply concepts of matrix theory whenever applicable in the field of engineering.
•	Solve problems using convergence tests on sequences and series and to apply them in engineering field appropriately.
•	Write short essays of a general kind and personal letters and emails in English.
TEXT BOOKS:	
1.	Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", Eighth Edition, Laxmi Publications Pvt Ltd., 2011.
2.	Grewal. B.S, "Higher Engineering Mathematics", 41st Edition, Khanna Publications, Delhi, 2011.
REFERENCES:	
1.	*Dass, H.K., and Er. Rajnish Verma, "Higher Engineering Mathematics", S. Chand Private Ltd., 2011*
2.	*Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2012.*
3.	*Peter V. O'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage learning, 2012*
4.	*Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2008.*
5.	*Sivarama Krishna Das P. and Rukmangadachari E., "Engineering Mathematics", Volume I, Second Edition, Pearson Publishing, 2011.*

17ZBS103	ENGINEERING PHYSICS I	L	T	P	C
(Common to MECH, EEE, ECE & CSE)		3	0	0	3

OBJECTIVES:

- To develop knowledge on properties of solids
- To use the principles of lasers,its types and its application
- To make students to understand about fibre optics and its applications.
- To develop knowledge on thermal properties of materials
- To apply principles of quantum physics in engineering field.

UNIT I	PROPERTIES OF MATTER	9

Elasticity – Hooke's law – Stress – Types of Stresses – Strain- Types of Strain - Young's Modulus – Rigidity Modulus – Bulk Modulus –Poisson's ratio – Relationship between three elastic constants and Poisson's ration – Torsional Pendulum – Factors affecting elasticity of materials - Bending moment of a Beam – Depression of cantilever (Theory and Experiment) – Determination of Young's modulus – Uniform and non-uniform bending (Theory and Experiment).

UNIT II	LASERS	9

Introduction to LASER – Interaction of light radiation with materials – Stimulated absorption – Spontaneous emission – Stimulated emission –Einstein's A and B co-efficient derivation – Concept of LASER – Population inversion – Pumping action – Methods for pumping action – Characteristics of LASER - Types of Lasers (Nd-YAG, He-Ne) – Industrial and medical applications of lasers.

UNIT III	FIBRE OPTICS	9

Introduction – Structure of Optical Fibre – Guiding mechanism – Total internal reflection – Critical Angle – Conditions for total internal reflection – Principle and Propagation of light in Optical Fibres – Numerical aperture and acceptance angle – Types of optical fibres (Material, refractive index and mode) – their characteristics and applications – Losses associated in optical fibres.

UNIT IV	THERMAL PHYSICS	9

Introduction to Heat flow – Modes of heat transfer (Conduction, Convection and Radiation) – Thermal conductivity – Expression for thermal conductivity – Newton's law of cooling – Linear heat flow – Heat conduction through a compound media(Series and parallel) – Lee's disk method for determination of thermal conductivity of bad conductors – Application: Heat exchangers, refrigerators.

UNIT V	QUANTUM PHYSICS	9
Concept of Blackbody radiation – Wien's displacement law – Rayleigh-Jean's law - Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh-Jean's law from Planck's law – Matter waves – De-Broglie's Hypothesis – Properties of matter waves - Wave-particle duality – Wave function – Physical Significance – Schrodinger wave equation – Time dependent and time independent – Application of Schrodinger wave equation – Particle in a 1 D box.		
TOTAL : 45 PERIODS		

OUTCOMES:	After successful completion of the course students able to
•	To learn about, three types of elastic modulus and related laws
•	To learn basics of thermal conductivity of different solid materials with relevant Newton's law of cooling
•	Apply the functional knowledge of different types of lasers in their engineering applications
•	To attain the basic knowledge of fiber optics and apply in their engineering & medical applications
•	To apply the fundamental principles of quantum physics in engineering field

TEXT BOOKS:

1.	P. Mani, "Engineering physics", Dhanam Publications, 2017.
2.	G. Senthi kumar, "Engineering physics", VRB Publishers
3.	A.Marikani, "Engineering Physics", PHI Learning Pvt., India 2009.

REFERENCES:

1.	*R. K. Gaur and S.C. Gupta, "Engineering physics", Dhanpat Rai publications, New Delhi 2003.*
2.	*M. N. Avadhanulu and P. G. Kshirsagar, "A text book of engineering physics", S. Chand and Company Ltd, New Delhi, 2005.*
3.	*K. Rajagopal, "Engineering Physics", PHI, New Delhi, 2011.*
4.	*P. K. Palanisamy, "Engineering Physics", SCITECH Publication, 2011*
5.	*M. Arumugam, "Engineering physics", Anuradha publishers*

17ZBS104	ENGINEERING CHEMISTRY	L	T	P	C
(Common to ECE, EEE &CSE)		3	0	0	3

OBJECTIVES:

- To make students conversant with water parameters, boilers, need for water treatment and its merits and demerits.
- Students ought to be aware of fundamental principles behind different electrochemical reactions, corrosion of materials and methods to prevent corrosion.
- To learn the chemistry behind polymers, synthesis, merits, demerits and its applications in various field.
- To acquire basic knowledge in renewable, non renewable and alternate energy resources and the chemical reactions involved in cell, batteries and its applications.
- To learn the working principle of various spectroscopy and its applications.
- To acquire basic knowledge in Nano materials, synthesis, properties and uses.

UNIT I WATER TECHNOLOGY 9

Characteristics – alkalinity and its significance – hardness (problems) - types and estimation by EDTA method – specifications of drinking water (BIS and WHO standards) – potable water treatment – boiler feed water - requirements – disadvantages of using hard water in boilers (Scales & Sludge, Boiler corrosion, Priming & Foaming, Caustic embrittlement) – water treatment – Internal treatment – external treatment – zeolite method - Demineralization process – desalination – reverse osmosis.

UNIT II ELECTROCHEMISTRY AND CORROSION 9

Electrochemistry: Electrochemical cells – reversible and irreversible cells – EMF – measurement of EMF – single electrode potential – Nernst equation (Problems) – reference electrode – standard hydrogen electrode and calomel electrode – ion selective electrode – glass electrode and measurement of pH – electrochemical series and its applications.

Corrosion: Corrosion – Pilling Bedworth rule - dry corrosion and its mechanism - electrochemical corrosion and its mechanism – types (galvanic, pitting, differential aeration) – factors influencing corrosion – corrosion control methods – sacrificial anode method – impressed current method – corrosion inhibitors – protective coatings – paints – constituents – functions – metallic coatings – electroplating (Cu) and electro less plating (Ni).

UNIT III POLYMERS AND COMPOSITES 9

Polymers: Definition – classification – functionality – polymerization – degree of polymerization – types (addition, condensation, copolymerization) – mechanism (free radical)

– plastics – thermoplastics and thermosetting plastics – preparation, properties and uses of individual polymers (PVC, TEFLON, Nylon-6,6, Nylon-6, PET, epoxy resin) – rubber - vulcanization of rubber – applications - Advanced polymeric materials and electronic devices – conducting and semiconducting polymers – liquid crystal properties – dendrimers and their difference from polymers.

Composites: definition – types polymer matrix composites – Fibre Reinforced Polymers – applications – advanced composite materials – physical and chemical properties – applications.

UNIT IV	**ENERGY SOURCES AND STORAGE DEVICES**	**9**

Nuclear energy – fission fusion reactions – light water nuclear reactor for power generation – breeder reactor – solar energy conversion – solar cells – wind energy – batteries: alkaline batteries – lead –acid, Ni-Cd, and Li-ion batteries – fuel cells – principles and applications – advantages and disadvantages.

UNIT V	**ANALYTICAL TECHNIQUES AND NANOMATERIALS**	**9**

Spectroscopy: Electromagnetic spectrum - Fundamentals of spectroscopy – Instrumentation, working principle and applications of UV-Visible spectrophotometer, Atomic Absorbance Spectrophotometer, Flame photometer.

Nanomaterials: Introduction to nanotechnology in electronics - nanomaterials – fullerernes carbon nanotubes– nanowires – Electronics and mechanical properties -synthesis of nanomaterials – topdown and bottomup approach – applications of nanomaterials in electronic devices (Semiconductors, LED & OLED) – electronics and telecommunication – medicines.

	TOTAL : 45 PERIODS

OUTCOMES:	After successful completion of the course students able to

•	Analyze water borne problems faced in boilers, need for water treatment and various methods and techniques for treating hard water.
•	Understand polymerization reactions and its applications in engineering field.
•	Understand the mechanism behindvarious types of electrochemical reactions which in turn helps in understanding the causes for corrosion and prevention methods.
•	Acquire knowledge about energy conversion and chemical reaction taking place in renewable energy resources, batteries and fuel cells.
•	Acquire in-depth knowledge on various nanomaterials and its applications in electronic devices.

TEXT BOOKS:

1.	Vairam S, Kalyani P and Suba Ramesh.,"Engineering Chemistry"., Wiley India PvtLtd.,New Delhi., 2011

2.	Dara S.S,Umare "Engineering Chemistry", S. Chand & Company Ltd., New Delhi , 2010
REFERENCES:	
1.	*Pahari A and Chauhan B., "Engineering Chemistry"., Firewall Media., New Delhi., 2010.*
2.	*Rao, C. N. R.; Govindaraj, A. "Nanotubes and Nanowires" United Kingdom: Royal Society of Chemistry, 2005*
3.	*Advanced Polymeric Materials: From Macro- to Nano-Length Scalesedited by Sabu Thomas, Nandakumar Kalarikkal, Maciej Jaroszewski, Josmine P. Jose; Apple Academic press, Canada, 2016*
4.	*Jain and jain , 16th editin, "Engineering Chemistry" Dhanpat Rqai Publishing Co.*

17ZES105	PROGRAMMING IN C	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Learn the organization of a digital computer
- Be exposed to the number systems.
- Learn to think logically and write pseudo code or draw flow charts for problems.
- Be exposed to the syntax of C.
- Be familiar with programming in C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C

UNIT I	INTRODUCTION	9

Generation and Classification of Computers- Basic Organization of a Computer –Number System – Binary – Decimal – Conversion – Problems. Need for logical analysis and thinking – Algorithm –Pseudo code – Flow Chart.

UNIT II	C PROGRAMMING BASICS	9

Problem formulation – Problem Solving - Introduction to "C" programming –fundamentals – structure of a "C" program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in "C" – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.

UNIT III	ARRAYS AND STRINGS	9

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

UNIT IV	FUNCTIONS AND POINTERS	9

Function – definition of function – Declaration of function – Pass by value – Pass by reference –Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays- Example Problems.

UNIT V	STRUCTURES AND UNIONS	9

Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

TOTAL : 45 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Develop simple applications in C using basic constructs.
•	Design and implement applications using arrays and strings.
•	Develop and implement applications in C using functions and pointers.
•	Develop applications in C using structures.
TEXT BOOKS:	
1.	Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
2.	Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009.
3.	Yashavant P. Kanetkar. "Let Us C", BPB Publications, 2011.
4.	E.Balagurusamy, "Computing fundamentals and C Programming", TMH publishing Company, 2008.
REFERENCES:	
1.	*Byron S Gottfried, "Programming with C", Schaum"s Outlines, Second Edition, Tata McGraw-Hill, 2006.*
2.	*Dromey R.G., "How to Solve it by Computer", Pearson Education, Fourth Reprint, 2007.*
3.	*Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, PearsonEducation, 2006.*

17ZES106	ENGINEERING GRAPHICS	L	T	P	C
(Common to MECH, EEE, ECE & CSE)		2	0	4	4

OBJECTIVES:

- This course aims to introduce the concept of graphic communication, develop the drawing skills for communicating concepts, ideas and designs of engineering products.
- To expose them to existing national standards related to technical drawings.
- To draw the projection of simple solids like prisms, pyramids, cylinder etc.
- To draw the development of surfaces to estimate the sheet metal requirement and to prepare sectional views of solids.
- To develop skills in three-dimensional visualization of engineering components and to draw isometric and perspective views of simple solids.

CONCEPTS AND CONVENTIONS (Not for Examination)

Importance of graphics in engineering applications – use of drafting instruments – BIS conventions and specifications – size, layout and folding of drawing sheets – lettering and dimensioning.

UNIT I	PLANE CURVES AND FREE-HAND SKETCHING	6+9

Basic geometrical constructions, curves used in engineering. Conics – construction ofellipse, parabola and hyperbola by eccentricity method – drawing of tangents and normal to the above curves. Visualization concepts and free hand sketching: visualization principles –representation of three dimensional objects – layout of views- freehand sketching of multiple views from pictorial views of objects.

UNIT II	PROJECTION OF POINTS, LINES AND PLANE SURFACES	6+9

Orthographic projection – principles-principal planes-first angle projection-projection of points.

Projection of straight lines inclined to both the principal planes - determination of true lengths and true inclinations by rotating line method - traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III	PROJECTION OF SOLIDS	6+9

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids, when the axis is inclined to both the principal planes by rotating object method.

UNIT IV	PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES	6+9

Sectioning of prisms, pyramids, cylinders and cones in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true

shape of section. Development of lateral surfaces of simple and sectioned solids – prisms, pyramids cylinders and cones.		
UNIT V	**ISOMETRIC AND PERSPECTIVE PROJECTIONS**	**6+9**
Principles of isometric projection – isometric scale –isometric projections of simple solids and truncated solids - prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - perspective projection of simple solids- prisms, pyramids and cylinders by visual ray method .		
LECTURE: 30 TUTORIAL: 45 TOTAL : 75 PERIODS		
OUTCOMES:	After successful completion of the course students able to	
•	Familiarize with the fundamentals and standards of Engineering graphics	
•	Perform freehand sketching of basic geometrical constructions and multiple views of objects.	
•	Draw orthographic projections of lines and plane surfaces.	
•	Draw projections of solids and development of surfaces.	
•	Visualize and draw isometric and perspective views of simple solids.	
TEXT BOOKS:		
1.	Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2012.	
2.	Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2016.	
3.	Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2014.	
REFERENCES:		
1.	*N S Parthasarathy and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.*	
2.	*Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2013.*	
3.	*Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2013.*	
4.	*Luzzader, Warren.J. and Duff John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production", Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005*	
5.	*Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2009.*	

17ZES107	PROGRAMMING IN C LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:	
•	Be familiar with the use of Office software.
•	Be exposed to presentation and visualization tools.
•	Be exposed to problem solving techniques and flow charts.
•	Be familiar with programming in C.
•	Learn to use Arrays, strings, functions, structures and unions.

LIST OF EXPERIMENTS:

1. Search, generate, and manipulate data using MS office / Open Office.
2. Presentation and Visualization – graphs, charts, 2D, 3D.
3. Problem formulation, Problem Solving and Flowcharts.
4. C Programming using Simple statements and expressions.
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions.
8. Programs with user defined functions – Includes Parameter Passing.
9. Program using Recursive Function and conversion from given program to flow chart.
10. Program using structures and unions.

TOTAL: 60 HOURS

OUTCOMES:	After successful completion of the course students able to
•	Develop C programs for simple applications making use of basic constructs, arrays, strings.
•	Develop C programs involving functions, recursion, pointers and structures.

17ZBS108	PHYSICS LABORATORY	L	T	P	C
(Common to MECH, EEE, ECE & CSE)		0	0	4	2

OBJECTIVES:	
•	To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids

LIST OF EXPERIMENTS : PHYSICS LABORATORY (ANY 5 EXPERIMENTS)	
1.	Determination of rigidity modulus : Torsion Pendulum
2.	Determination of Young's modulus by non-uniform bending method
3.	(a) Determination of wave length and particle size using LASER (b) Determination of acceptance angle in an optical fibre
4.	Determination of thermal conductivity of a bad conductor – Lee's Disc method
5.	Determination of velocity of sound and compressibility of fluid – Ultrasonic interferometer
6.	Determination of wavelength of mercury spectrum – Spectrometer grating
7.	Determination of band gap of a semiconductor

OUTCOMES:	After the course, the student will be able to apply principles of elasticity, optical and thermal properties for engineering applications.

17ZBS109	CHEMISTRY LABORATORY	L	T	P	C
(Common to ECE, EEE, CSE&MECH)		0	0	4	2

OBJECTIVES:

- To make students conversant with hands on water parameter analysis.
- To make the student to acquire practical skills in the corrosion in metals.
- To acquaint the students with the determination of molecular weight of a polymer by Ostwald viscometer.
- To make the student acquire practical skills in analytical instruments.

1. Determination of total hardness of given water sample by EDTA method.
2. Determination of alkalinity in given water sample.
3. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
4. Conductometric titration using mixture of acids and strong base.
5. Determination of strength of in given hydrochloric acid using pH meter.
6. Estimation of sodium present in water using flame photometer.
7. Estimation of Zn present in effluent using Atomic Absorption Spectroscopy(AAS)
8. Corrosion experiment – weight loss method
9. Estimation of iron content of the given solution using potentiometer meter.
10. Estimation of iron content of the given sample using Spectro photometer (thiocyanate method).

OUTCOMES: After successful completion of the course students able to

- Outfitted with hands-on knowledge in the qualitative and quantitative chemical analysis of water quality related parameters, corrosion studies, heavy metal analysis, etc.

REFERENCES:

1. *Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry", LBS Singapore 1994.*
2. *Jeffery G.H., Bassett J., Mendham J.and Denny vogel's R.C, "Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.*
3. *Kolthoff I.M., Sandell E.B. et al. "Quantitative chemical analysis", Mcmillan, Madras 1980.*
4. *Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New York 2001.*

(Note: A minimum of SIX experiments shall be offered)

List of Equipments for a batch of 30 students

1. Flame photometer - 3 Nos
2. Spectrophotometer – 3 Nos
3. Weighing balance - 5 Nos
4. Conductivity meter - 9 Nos
5. Potentiometer - 9 Nos
6. pH meter- 9 Nos
7. Ostwald viscometer - 30 Nos
8. Atomic Absorption Spectrophotometer - 1 no.

Common apparatus: Pipette, Burette, Burette stand, Standard volumetric flask, funnel, Conical flask, porcelain tiles, dropper, reagent bottles, glass rod, beaker, wash bottle, test tube (30 nos each)

SEMESTER II

17ZHS201	COMMUNICATIVE ENGLISH II	L	T	P	C
(Common to MECH, EEE, ECE & CSE)		4	0	0	4

OBJECTIVES:

- To make learners acquire **listening** and **speaking** skills in both formal and informal contexts.
- To help them develop their **reading** skills by familiarizing them with different types of **reading** strategies.
- To equip them with writing skills needed for academic as well as workplace contexts.
- To make them acquire language skills at their own pace by using e-materials and language lab components.
- To help them give a short extempore speech and also make them participate in debates.

UNIT I		12

Listening – Listening to different types of conversation and answering questions. Listening to announcements at railway station, airports, etc. **Speaking** – Comments on topics like weather. Turn taking – Closing a conversation (excuses, general wish, positive comment, thanks); **Reading** – Extensive reading; **Writing** – purpose statements – extended definitions – issue-writing instructions – checklists-recommendations-; **Grammar**- impersonal passive voice, numerical adjectives ; Vocabulary – Homonyms, Homophones.

UNIT II		12

Listening – Listening to situation based dialogues; **Speaking** – Conversation practice in real life situations, asking for directions, giving directions, Discussing various aspects of a film, or a book. Welcome address, Vote of Thanks, special address on special topics. **Reading** –reading a short story or an article from newspaper. **Writing** –writing a review/ summary of a story / article. **Grammar** –Concord, compound words.

UNIT III		12

Listening – Listening to the conversation – Understanding the structure of conversations. **Speaking** – Conversation skills with a sense of stress, intonation, pronunciation and meaning – seeking information – expressing feelings, **Reading** – speed reading – reading passages with time limit - skimming; **Writing** – Minutes of meeting – writing summary after reading articles from journals; **Grammar**- Cause and effect expressions; **Vocabulary** – Words used as nouns and verbs without any change in spelling.

UNIT IV		12
Listening – Viewing model interviews (face-to- face, telephonic and video conferencing); **Speaking** – role play practice in telephone skills – listening and responding, asking questions – note taking – passing on messages, Role play and mock interview for grasping interview skills; **Reading** – Reading the profile of the company concerned – scanning; **Writing** – Applying for a job – cover letter – resume preparation – vision, mission and goals of the candidate; **Grammar**- reported speech **Vocabulary** – Idioms and their meanings.		
UNIT V		**12**
Listening – Viewing a model group discussion ; **Speaking** – Group discussion skills – initiating the discussion – exchanging suggestions and proposals – expressing dissent/ agreement – assertiveness in expressing opinions- mind mapping technique; **Reading** – Note making skills –making notes from books, or any form of written materials – Intensive reading; **Writing** – Types of reports / Project report – report format – recommendations/ suggestions -. **Grammar** – Use of Clauses; Vocabulary – Collocation; fixed and semi-fixed expressions.		
TOTAL : 60 PERIODS		

OUTCOMES:	After successful completion of the course students able to
•	Read technical texts and write areaspecific texts effortlessly.
•	Listen and comprehend lectures and talks in their area of specialization successfully.
•	Speak appropriately and effectively in varied formal and informal contexts.
•	Write reports and winning job applications.

TEXT BOOKS:

1.	Board of editors. Fluency in English A Course book for Engineering and Technology. Orient Blackswan, Hyderabad: 2016.
2.	Communication Skills for Engineers. scitech publication (india) pvt.ltd.chennai.2010
3.	Current english grammar and usage with composition, oxford university press, new delhi,2002.

REFERENCES:

1.	*Comfort, Jeremy, et al. Speaking Effectively : Developing speaking skills for Business English. Cambridge University Press , Cambridge : Reprint 2011.*
2.	*Dutt P. Kiranmai and Rajeevan Geetha . Basic Communication Skills, Foundation Books: 2013.*

3.	*Means,L. Thomas and Elaine Langlois. English & Communication For Colleges. CengageLearning,USA : 2007.*
4.	*Redston, Chris & Gillies Cunningham Face2Face (Pre-intermediate student's Book & Workbook) Cambridge University Press, New Delhi: 2005.*

17ZBS202	ENGINEERING MATHEMATICS II	L	T	P	C
(Common to MECH, EEE, ECE & CSE)		3	2	0	4

OBJECTIVES:

- Vector Calculus And Their Uses In Various Field Theoretic Subjects
- Higher Order And Special Type Of Linear Differential Equations And Methods To Find Solutions
- Laplace Transforms And Properties And Their Applications In Engineering
- Construction Of Analytic Functions And Concepts Of Concepts Of Conformal Mapping, Complex Integration And Series Solutions

UNIT I VECTOR CALCULUS 9+6

curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes'theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

UNIT II ORDINARY DIFFERENTIAL EQUATIONS 9+6

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

UNIT III LAPLACE TRANSFORMS 9+6

Laplace transform – Sufficient condition for existence – Transform of elementary functions – Basic properties – Transforms of derivatives and integrals of functions - Derivatives and integrals of transforms - Transforms of unit step function and impulse functions – Transform of periodic functions. Inverse Laplace transform -Statement of Convolution theorem – Initial and final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

UNIT IV ANALYTIC FUNCTIONS 9+6

Functions of a complex variable – Analytic functions: Necessary conditions – Cauchy-Riemann equations and sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping: $w = z+k$, kz, $1/z$, z^2, e^z and bilinear transformation.

UNIT V COMPLEX INTEGRATION 9+6

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor's and Laurent's series expansions – Singular points – Residues –

Cauchy‘s residue theorem – Evaluation of real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).	
TOTAL : 75(45+30) PERIODS	
OUTCOMES:	After successful completion of the course students able to
•	Solve problems on vector calculus and to apply them in any other field theory related subjects
•	Solve differential equations and will be exposed to their applications in various fields of engineering
•	Solve problems on Laplace transforms and will be able to use Laplace transform in finding solutions of differential and integral equations and other engineering applications.
•	Solve complex integration problems and will be exposed to various applications of analytic functions and conformal mapping in engineering.
TEXT BOOKS:	
1.	Bali N. P and Manish Goyal, “A Text book of Engineering Mathematics”, Eighth Edition, Laxmi Publications Pvt Ltd., 2011.
2.	Grewal. B.S, “Higher Engineering Mathematics”, 41st Edition, Khanna Publications, Delhi, 2011.
REFERENCES:	
1.	*Dass, H.K., and Er. Rajnish Verma, “Higher Engineering Mathematics”, S. Chand Private Ltd., 2011.*
2.	*Glyn James, “Advanced Modern Engineering Mathematics”, 3rd Edition, Pearson Education, 2012*
3.	*Peter V. O‘Neil, “Advanced Engineering Mathematics”, 7th Edition, Cengage learning, 2012.*
4.	*Ramana B.V, “Higher Engineering Mathematics”, Tata McGraw Hill Publishing Company, New Delhi, 2008.*
5.	*Sivarama Krishna Das P. and Rukmangadachari E., “Engineering Mathematics”, Volume II, Second Edition, Pearson Publishing, 2011*

17ZBS203	ENGINEERING PHYSICS II	L	T	P	C
(Common to MECH, EEE, ECE & CSE)		3	0	0	3

OBJECTIVES:	
•	To describe the properties of conducting material.
•	To understand the theory of semi-conducting materials and basic electron devices
•	To get the knowledge about properties of magnetic materials.
•	To understand the polarization process in dielectric materials and their temperature, frequency dependence and the causes of dielectric breakdown.
•	To acquire some exciting prospects of modern engineering materials

UNIT I	ELECTRICAL PROPERTIES OF MATERIALS	9

Conductors – Classification of conducting materials – Ohm's Law – Electrical conductivity – Relation between current density, drift velocity and mobility – Classical free electron theory of metals – Expression for electrical conductivity of a metal – Thermal conductivity – Expression for thermal conductivity of a metal – Wiedemann – Franz law – success and failures of classical free electron theory –Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states.

UNIT II	SEMICONDUCTOR PHYSICS	9

Introduction – Intrinsic semiconductor – Energy band diagram – Direct and indirect semiconductors – Carrier concentration in an intrinsic semiconductors (derivation) – Extrinsic semiconductors – Carier concentration in n-type & p-type semiconductors –Hall effect – Determination of Hall coefficient (Theory) – Application of Hall effect.

UNIT III	MAGNETIC AND SUPER CONDUCTING MATERIALS	9

Magnetization – Magnetic flux – Magnetic flux density – Intensity of Magnetisation – Magnetic field intensity – magnetic permeability – magenetic susceptibility – Magnetic field and induction – Types of magnetic materials – Microscopic classification of magnetic materials – Ferromagnetism : origin and exchange interaction – Domain theory- Hard and soft magnetic materials – Magnetic storage devices – Hard disk.

Superconductivity: Properties – Type I and Type II Superconductors- BCS theory of Superconductivity – Application of Superconductors - SQUID

UNIT IV	DIELECTRIC PROPERTIES OF MATERIALS	9

General properties of Dielectric materials – Electrical susceptibility – Dielectric constant – Electronic, ionic, orientational and space-charge polarization – Frequency and Temperature dependence of Polarisation– Internal field – Claussius – Mosotti relation (derivation) –

Dielectric breakdown – Dielectric loses – Use of dielectric materials (capacitor and transformer) - Ferroelectricity and its applications.		
UNIT V	**MODERN ENGINEERING MATERIALS**	**9**
Metallic glasses – Properties of metallic glasses – Shape memory alloys (SMA) – Preparation, properties and applications of Shape memory alloys (SMA) – Characteristics of Shape memory alloys – Characteristics, properties of Ni-Ti alloy, application, advantages and disadvantages of shape memory alloys (SMA) – Nanomaterials – Different forms of nanomaterials – Preparations –Pulsed Laser Deposition, Chemical Vapour Deposition and Applications.		
	TOTAL : 45 PERIODS	
OUTCOMES:	After successful completion of the course students able to	
•	To explore knowledge about free electron theory and density of states of conducting materials with related laws	
•	Students are able to compare intrinsic and extrinsic semiconductor, density of electrons and holes calculation, Hall effect with applications and basic semiconductor devices	
•	To learnt comparatively about different type of magnetic materials, superconducting materials and apply in their engineering field.	
•	To attain the functional knowledge of different types of dielectric materials, polarization mechanism and their qualitative engineering applications.	
•	To know more about preparation of modern engineering materials and materials suitability for their own engineering field	
TEXT BOOKS:		
1.	P. Mani, “Engineering physics”, Dhanam Publications, 2011.	
2.	G. Senthil kumar, “Engineering physics”, VRB Publishers.	
3.	A.Marikani, “Engineering Physics” PHI Learning Pvt., India 2009.	
4.	Wahen M. A. “Solid state physics: Structure and properties of materials”Narosa publishing house, 2009	
REFERENCES:		
1.	*R. K. Gaur and S. C. Gupta, “Engineering physics”, Dhanpat Rai publications, New Delhi 2003.*	
2.	*M. N. Avadhanulu and P. G. Kshirsagar, “A text book of engineering physics” S. Chand and Company, Ltd, New Delhi 2005.*	
3.	*K. Rajagopal, “Engineering Physics”, PHI, New Delhi, 201.*	

4.	*M. Arumugam, "Engineering physics", Anuradha publishers.*

17EES204	BASIC CIVIL AND MECHANICAL ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart basic knowledge on civil and mechanical engineering among students.
- To familiarise the materials and measurements used in civil engineering.
- To provide the exposure on fundamental elements of civil engineering structures.
- To enable the students to distinguish the components and working principles of power plants and IC Engines.
- To understand the working principle Refrigeration and Air conditioning system.

A – CIVIL ENGINEERING

UNIT I SCOPE OF CIVIL ENGINEERING 4

Overview of Civil Engineering - Civil Engineering contributions to the welfare of Society – Specialized sub disciplines in Civil Engineering – Structural, Construction, Geotechnical, Environmental, Transportation and Water Resources Engineering.

UNIT II SURVEYING AND CIVIL ENGINEERING MATERIALS 9

Surveying: Objects – classification – principles – measurements of distances – angles – levelling –determination of areas– contours - examples.

Civil Engineering Materials: Bricks – stones – sand – cement – concrete – steel - timber – modernmaterials.

UNIT III BUILDING COMPONENTS AND STRUCTURES 9

Foundations: Types of foundations - Bearing capacity and settlement – Requirement of goodfoundations.

Civil Engineering Structures: Brick masonry – stonemasonry – beams – columns – lintels – roofing– flooring – plastering – floor area, carpet area and floor space index - Types of Bridges and Dams – water supply - sources and quality of water - Rain water harvesting - introduction to high way and rail way.

B – MECHANICAL ENGINEERING

UNIT IV SCOPE OF MECHANICAL ENGINEERING 5

Overview of Mechanical Engineering - Mechanical Engineering contributions to the welfare of Society –Specialized sub disciplines in Mechanical Engineering - Production, Automobile, and Energy Engineering - Interdisciplinary concepts in Civil and Mechanical Engineering.

UNIT V	INTERNAL COMBUSTION ENGINES AND POWER PLANTS	9
Classification of Power Plants - Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Working principle of steam, Gas, Diesel, Hydro - electric and Nuclear Power plants –- working principle of Boilers, Turbines, Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps.		
UNIT VI	**REFRIGERATION AND AIRCONDITIONING SYSTEM**	**9**
Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system–Layout of typical domestic refrigerator–Window and Split type room Air conditioner.		
TOTAL : 45 PERIODS		

OUTCOMES:	After successful completion of the course students able to
•	Appreciate the Civil and Mechanical Engineering components.
•	Explain the usage of construction material and proper selection of construction materials.
•	Measure distances and area by surveying.
•	Identify the components used in power plant cycles.
•	Demonstrate working principles of petrol and diesel engines.
•	Elaborate the components of refrigeration and Air conditioning cycle.

TEXT BOOKS:

1.	Shanmugam G and Palanichamy MS, "Basic Civil and Mechanical Engineering", Tata McGraw Hill Publishing Co., NewDelhi, 1996.
2.	Venugopal K. and Prahu Raja V., "Basic Mechanical Engineering", Anuradha Publishers, Kumbakonam, 2000.
3.	Ramamrutham S., "Basic Civil Engineering", Dhanpat Rai Publishing Co.(P) Ltd.1999.

REFERENCES:

1.	*Palanikumar, K. "Basic Mechanical Engineering", ARS Publications, 2010*
2.	*ShanthaKumar SRJ.,"Basic Mechanical Engineering", Hi-tech Publications, Mayiladuthurai, 2000.*

17ZBS205	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIO DIVERSITY — 12

Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards,

Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers-Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds.

Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION & HEALTH RISK — 10

Definition – causes, effects and control measures of: (a) Air pollution: Causes, effects and prevention (b) Water pollution: Causes, effects and prevention (c) Soil pollution: Causes, effects and prevention - (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution – soil waste management: causes, effects and control measures of municipal solid wastes – pollution case studies

Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III	NATURAL RESOURCES	10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization 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 and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Energy Conversion processes – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

Field study of local area to document environmental assets – river / forest / grassland / hill

UNIT IV	SOCIAL ISSUES AND THE ENVIRONMENT	7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air act – Water act – Wildlife protection act – Forest conservation act – The Biomedical Waste (Management and Handling) Rules; 1998 and amendments- scheme of labeling of environmentally friendly products (Ecomark) - central and state pollution control boards- disaster management: floods, earthquake, cyclone and landslides. Public awareness.

UNIT V	HUMAN POPULATION AND THE ENVIRONMENT	6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- -GIS-remote sensing-role of information technology in environment and human health – Case studies.

	TOTAL : 45 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Apply the knowledge of environmental science in identifying, to formulate and to solve the environmental problems.
•	Create awareness about structure and function of various ecosystems and natural resources.
•	Understand the ignorance and incomplete knowledge will lead to misconceptions.

•	Analyse the reason behind serious environmental disasters.
•	Acquire Knowledge about important environmental laws.
•	Acquire in-depth knowledge on population explosion and role of IT in environmental management.
TEXT BOOKS:	
1.	Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
2.	Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.
REFERENCES:	
1.	*R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances andStandards', Vol. I and II, Enviro Media.*
2.	*Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ.,House, Mumbai, 2001.*
3.	*Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi,2007.*
4.	*Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press 2005.*

17EPC206	ELECTRIC CIRCUIT ANALYSIS	L	T	P	C
		3	2	0	4

OBJECTIVES:

- To introduce electric circuits and its analysis
- To impart knowledge on solving circuits using network theorems
- To introduce the phenomenon of resonance in coupled circuits
- To educate on obtaining the transient response of circuits
- To Phasor diagrams and analysis of three phase circuits

UNIT I	BASIC CIRCUITS ANALYSIS	9+6

Ohm'sLaw–Kirchhoff's laws–DC and AC Circuits–Resistors in series and parallel circuits– Mesh current and Node voltage analysis for D.C and A.C.circuits–Phasor Diagram – Power, PowerFactor and Energy.

UNIT II	NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS	9+6

Network reduction: voltage and current division, source transformation– stardelta conversion. Thevenin and Norton Theorem– Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem.

UNIT III	RESONANCE AND COUPLED CIRCUITS	9+6

Series and parallel resonance–their frequency response– Quality factor and Bandwidth–Coupled Circuits- Selfand mutual inductance–Coefficient of coupling– Analysis of coupled circuits-Tuned circuits–Single and double tuned circuits.

UNIT IV	CIRCUIT TRANSIENTS	9+6

Laplace Transformations-Advantages-Laplace transformation of some functions-RL transient-Decay of current in RL Circuits-RC Transient: Decay of Current in RC Circuits-RLC Transient: Over-damped, Critically Damped and Underdamped-AC Transients-RL, RC and RLC Circuits-Natural Frequency and Damping Ratio.

UNIT V	THREE PHASE CIRCUITS	9+6

Comparison between single phase and poly phase systems-Three phase balanced/ unbalanced sources– analysis of three phase 3-wire and 4-wire circuits with star and delta connection-balanced and unbalanced loads-– phasor diagram of voltages and currents–power and powerfactor measurements in three phase circuits.

TOTAL :75(45+30) PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Explain circuit behaviour using ohm's law and Kirchhoff laws, hence solve the circuits using mesh and nodal analysis
•	State various circuit laws and theorems and perform the circuit analysis to prove the theorems.
•	Explain the behaviour of resonance and magnetically coupled circuits.
•	Explain AC circuits using phasor techniques under steady stateand transient conditions for any first order and second ordersystems using R, L, and C Circuits.

TEXT BOOKS:

1.	Arumugam M and Prem Kumar, "Electric Circuit Theory", Khanna Publishers, New Delhi,2006
2.	Sudhakar A and Shyam Mohan SP,"Circuits and Network Analysis and Synthesis",TataMcGraw Hill,2015.
3.	CharlesK.Alexander,Mathew N.O.Sadiku,"Fundamentals of Electric Circuits",Second Edition, McGrawHill, 2013.

REFERENCES:

1.	*Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum'sseries, TataMcGraw-Hill,New Delhi,2014.*
2.	*Paranjothi SR, "Electric Circuits Analysis," New Age International Ltd., New Delhi, 1996.*
3.	*Ashfaq Husain and Harroon Ashfaq, "Fundamentals of Electrical Engineering", Dhanpath Rai & Sons, New Delhi, 2016*
4.	*William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, 6 edition, New Delhi, 2003.*

17ZES207	ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To train the students in safety handling of tools, equipment and machineries, plumbing operation and basic carpentry exercises.
- To impart skill in fabricating simple components using basic machining processes, sheet metal and metal joining process like welding, soldering, etc.
- To expose them in house wiring, basic electrical circuits and Electronic components and equipments.

GROUP A (CIVIL &MECHANICAL)

CIVIL ENGINEERING PRACTICES — 15

A) PLUMBING WORKS:

1. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers and elbows in household fittings.
2. Study of pipe connections requirements for pumps and turbines.
3. Preparation of plumbing line sketches for water supply and sewage works.
4. Hands-on-exercise: Basic pipe connections – Mixed pipe material connection – Pipe connections with differentjoining components.
5. Demonstration of plumbing requirements of high-rise buildings.

B) CARPENTRY USING POWER TOOLS ONLY:

1. Study of the joints in roofs, doors, windows and furniture.
2. Hands-on-exercise: To make basic carpentry joints by sawing, planning and cutting.

MECHANICAL ENGINEERING PRACTICES — 15

A) WELDING:

1. Preparation of arc welding of butt joints, lap joints and tee joints.
2. Gas welding practice

B) BASIC MACHINING:

1. Simple Turning and Facing
2. Drilling Practice

C) SHEET METAL WORK:

1. Forming & Bending:
2. Model making – Trays, funnels, etc.

3. Different type of joints.

D) MACHINE ASSEMBLY PRACTICE:

1. Study of centrifugal pump
2. (b) Study of air conditioner

GROUPB (ELECTRICAL&ELECTRONICS)

ELECTRICAL ENGINEERING PRACTICES	**15**

1. Residential housewiringusingMCB, ELCB, Contactors, switches, fuse,indicator,lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. 4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of electrical equipment.

ELECTRONICS ENGINEERING PRACTICES	**15**

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (Peak-Peak, RMS, Time period, Frequency) using CRO.
2. Study of logic gates AND, OR, EOR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components, Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of Half-wave and Full wave rectifiers.

TOTAL : 60 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Fabricate components by carpentry and pipe connections including plumbing works.
•	Use welding equipment to fabricate permanent joints by welding and also can perform basic machining operations.
•	Fabricate electrical and electronics circuits.

17EPC208	ELECTRIC CIRCUITS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To solve DC and AC electric circuits using mesh analysis, nodal analysis, and network theorems.
- To conduct experiment on DC and AC electric circuits to know the time and frequency response
- To Design and simulate resonance circuits, filter circuits, and three phase circuits
- To fabricate electrical and electronics circuits.

LIST OF EXPERIMENTS

1. Experimental verification of Kirchhoffs voltage and currentl aws
2. Experimental verification of network theorems (Thevenins, Norton, Super position and Maximum PowerTransfer Theorem).
3. Experimental determination of time constant of series R-C circuits.
4. Experimental determination of frequency response of RLC circuits.
5. Design and Simulation of series resonance circuit.
6. Design and Simulation of parallel resonant circuits.
7. Simulation of lowpass and highpass passive filters.
8. Simulation of three phases balanced and unbalanced star, delta networks circuits.
9. Experimental determination of power in threephase circuits by two-wattmeter method.
10. Determination of two port network parameters.
11. Transient analysis of second order under damped system.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. RegulatedPower Supply:0–15VD.C-10 Nos/Distributed Power Source.
2. FunctionGenerator (1MHz) - 10Nos.
3. Oscilloscope (20MHz) - 10Nos.
4. Digital StorageOscilloscope (20MHz) –1 No.
5. Circuit SimulationSoftware(5Users) (Pspice/Matlab/other Equivalentsoftware Package) withPC (5Nos.) andPrinter (1 No.)

6.AC/DC- Voltmeters(10Nos.),Ammeters(10Nos.) andMulti-meters(10Nos.) 7. SinglePhaseWattmeter–3 Nos. 8.Double- element wattmeter - 2 Nos 9. DecadeResistanceBox, DecadeInductanceBox, Decade CapacitanceBoxEach-6Nos. 10. CircuitConnectionBoards- 10Nos. 12.PSpice or its equivalent software - 10 users	
	TOTAL:60 PERIODS
OUTCOMES:	After successful completion of the course students able to
•	Solve DC and AC electric circuits using mesh analysis, nodal analysis, and network theorems.
•	Analyse the time and frequency response of DC and AC electric circuits.
•	Design and simulate resonance circuits, filter circuits, and three phase circuits
•	Fabricate electrical and electronics circuits.

SEMESTER-III

17ZBS301	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C
		3	2	0	4

OBJECTIVES:

- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I	PARTIAL DIFFERENTIAL EQUATIONS	9+6

Formation of partial differential equations – Singular integrals -- Solutions of standard types of first order partial differential equations - Lagrange's linear equation -- Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II	FOURIER SERIES	9+6

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

UNIT III	APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS	9+6

Classification of PDE – Method of separation of variables - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).

UNIT IV	FOURIER TRANSFORMS	9+6

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V	Z - TRANSFORMS AND DIFFERENCE EQUATIONS	9+6

Z- Transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) – Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

	TOTAL : 75(45+30)PERIODS
OUTCOMES:	After successful completion of the course students able to
•	The understanding of the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering
TEXT BOOKS:	
1.	Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 3rd Edition, 2016.
2.	Grewal B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, Delhi, 2017.
3.	Narayanan S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" Vol. II & III, S.Viswanathan Publishers Pvt Ltd., 1998.
REFERNCES:	
1.	*Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", Laxmi Publications Pvt Ltd, 9th Edition 2016.*
2.	*Ramana. B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2018.*
3.	*Glyn James, "Advanced Modern Engineering Mathematics", 4th Edition, Pearson Education, 2016.*
4.	*Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India, 2011.*
5.	*Ray Wylie C and Barrett .L.C, "Advanced Engineering Mathematics", 6th Edition, Tata McGraw Hill Education Pvt Ltd, New Delhi, 2012.*
6.	*Datta K.B., "Mathematical Methods of Science and Engineering", Cengage Learning India Pvt Ltd, Delhi, 2013.*

17EPC302	POWER PLANT ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the construction, operation and characteristics of thermal power plants
- To study the construction, operation and characteristics of diesel, gas turbine and combined cycle power plants
- To study the construction, operation and characteristics of various nuclear reactors power plants
- To study the construction, operation and characteristics of various renewable energy based power plants and energy storage systems.
- To impart knowledge on various economical and environmental issues of various power plants.

UNIT I	COAL BASED THERMAL POWER PLANTS	10

Rankine cycle, Layout of modern coal power plant, Boilers, Turbines, Condensers, Economisers, Super heaters, Reheaters, Subsystems of thermal power plants – Coal and ash handling, ESP Draught system, Feed water treatment, Deaerator. Efficiencies in a steam power plant, Cogeneration systems.

UNIT II	DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS	8

Otto and Diesel Cycle - Analysis & Optimisation. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.

UNIT III	NUCLEAR POWER PLANTS	7

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANada DeuteriumUranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

UNIT IV	POWER FROM RENEWABLE ENERGY	10

Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, SolarPhoto Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.

UNIT V	ENERGY STORAGE, ECONOMICS AND ENVIRONMENTAL ISSUES OF POWER PLANTS	10

Energy Storage: Pumped Hydro, Compressed Air Energy Storage, Flywheel energy storage, Superconducting Magnetic Energy Storage, Super Capacitor Energy Storage, Thermal Energy Storage, Hydrogen Energy Storage - Comparison of site selection criteria, Capital & Operating Cost

of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.	
	TOTAL : 45 PERIODS
OUTCOMES:	After successful completion of the course students able to
•	Explain the construction, operation and characteristics of various conventional power plants such as thermal, diesel, gas and nuclear power plants.
•	Explain the construction, operation and characteristics of various renewable energy based power plants and energy storage systems.
•	Explain various economical and environmental issues of various power plants.
TEXT BOOKS:	
1.	P.K. Nag, Power Plant Engineering, Tata McGraw – Hill Publishing Company Ltd., Third Edition, 2008.
2.	M.M. El-Wakil, Power Plant Technology, Tata McGraw – Hill Publishing Company Ltd., 2010.
3.	Black & Veatch, Springer, Power Plant Engineering, 1996.
REFERNCES:	
1.	*Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, Standard Handbook of Power Plant Engineering, Second Edition, McGraw – Hill, 1998.*
2.	*Godfrey Boyle, Renewable energy, Open University, Oxford University Press in association with the Open University, 2004.*

17EES303	OBJECT ORIENTED PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:	
•	To be familiar with the object oriented programming concepts
•	To understand the basic characteristics of OOPS
•	To understand the concepts of inheritance, polymorphism and overloading
•	To be familiar with the basics of Java
•	To understand concepts of Interfacing , Exception handling in java

UNIT I	OVERVIEW	9
Why Object-Oriented Programming in C++ - Native Types and Statements–Functions and Pointers-Implementing ADTs in the Base Language.		

UNIT II	BASICCHARACTERISTICSOFOOP	9
Data Hiding and MemberFunctions- Object Creation and Destruction- Polymorphism data abstraction: Iteratorsand Containers.		

UNIT III	ADVANCEDPROGRAMMING	9
Templates, GenericProgramming, and STL-Inheritance-Exceptions-OOP Using C++.		

UNIT IV	OVERVIEW OFJAVA	9
Data types, variables and arrays, operators, control statements, classes, objects, methods – Inheritance		

UNIT V	EXCEPTION HANDLING	9
Packages and Interfaces,Exception handling,Multi threaded programming,Strings,Input/output		

	TOTAL : 45 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Gain the basic knowledge on Object Oriented concepts.
•	Ability to develop application susing Object Oriented Programming Concepts.
•	Ability to implement features of object oriented programming to solve real world problems.

TEXT BOOKS:

1.	IraPohl, “Object-OrientedProgrammingUsingC++”,PearsonEducationAsia,2003.

2.	H.M.Deitel,P.J.Deitel,"Java:how to program",Fifth edition,Prentice Hall of India private limited, 2003.
REFERNCES:	
1.	*Herbert Schildt,"The Java2:Complete Reference",Fourth edition,TMH,2002*
2.	*Bjarne Stroustrup,"TheC++ Programming Language",Pearson Education,2004.*
3.	*Stanley B.Lippman and Josee Lajoie,"C++ Primer",Pearson Education,2003*
4.	*K.R.Venugopal, Rajkumar Buyya,T.Ravishankar,"Mastering C++",TMH,2003.*

17EPC304	ELECTRO MAGNETIC THEORY	L	T	P	C
		2	2	0	3

OBJECTIVES:

- To introduce the basic mathematical concepts related to electromagnetic vector fields
- To impart knowledge on the concepts of electrostatics, electrical potential, energy density andtheir applications.
- To impart knowledge on the concepts of magnetostatics, magnetic flux density, scalar and vector potential and its applications.
- To impart knowledge on the concepts of Faraday's law, induced emf and Maxwell's equations
- To impart knowledge on the concepts of Concepts of electromagnetic waves and Pointing vector.

UNIT I	INTRODUCTION	6+6

Sources and effects of electromagnetic fields – Vector fields – Different co-ordinate systems-vectorcalculus – Gradient, Divergence and Curl - Divergence theorem – Stoke's theorem.

UNIT II	ELECTRO STATICS	6+6

Coulomb's Law – Electric field intensity – Field due to point and continuous charges – Gauss's lawand application – Electric potential – Electric field and equipotential plots – Electric field in free space, conductors, dielectric - Dielectric polarization – Dielectric strength - Electric field in multipledielectrics – Boundary conditions, Poisson's and Laplace's equations – Capacitance-Energy density.

UNIT III	MAGNETO STATICS	6+6

Lorentz Law of force, magnetic field intensity – Biot–Savart Law - Ampere's Law – Magnetic fielddue to straight conductors, circular loop, infinite sheet of current – Magnetic flux density (B) – B infree space, conductor, magnetic materials – Magnetization – Magnetic field in multiple media –Boundary conditions – Scalar and vector potential – Magnetic force – Torque – Inductance – Energydensity – Magnetic circuits.

UNIT IV	ELECTRO DYNAMIC FIELDS	6+6

Faraday's laws –induced emf – Transformer and motional EMF – Forces and Energy in

Quasi stationary Electromagnetic Fields - Maxwell's equations (differential and integral forms) – Displacement current – Relation between field theory andcircuit theory.

UNIT V	ELECTRO MAGNETIC WAVES	6+6

Electromagnetic wave equations – Wave parameters; velocity, intrinsic impedance, propagation constant– Waves in free space,lossy and lossless dielectrics , conductors – skin depth, Poynting

vector – Transmissionlines – Line equations– Input impedances – Standing wave ratio and power.	
	TOTAL : 60(30+30) PERIODS
OUTCOMES:	After successful completion of the course students able to
•	Describe the coordinate systems, vector calculus and theorems to electricand magnetic fields.
•	Compare the nature, characteristics, properties andapplications of Electric and Magnetic fields with the help offundamental laws of fields.
•	Explain voltage, and current using electric fields and Develop resistance, capacitance and inductance of a given electrical component.
•	Relate electric and magnetic fields with help of Faraday‘s Lawand Maxwell‘s Equation, and, their applications to electricalmachines.
•	Explain Electromagnetic Wave propagation, Poynting Vectorand Poynting Theorem and Appreciate the significance of electric and magnetic fields inelectrical engineering
TEXT BOOKS:	
1.	Mathew N. O. Sadiku, “Elements of Electromagnetics”, Oxford University press Inc. India Edition, 2014.
2.	Joseph. A. Edminister, “Theory and Problems of Electromagnetics”, 2nd Edition, Schaum Series, Tata McGraw Hill, 1993.
3.	K.A.Gangadhar,P.M.Ramanthan‘ Electromagnetic FieldTheory(includingAntennaes and wave propagation)’, 16thEdition,KhannaPublications,2008.
4.	S.P.Seth, “Elements of Electromagnetic Fields”, Dhanpath Rai & Sons, New Delhi, 2001.
REFERNCES:	
1.	*Ashutosh Pramanik, “Electromagnetism – Theory and Applications”, Prentice-Hall of India Private Limited, New Delhi, 2008.*
2.	*William. H. Hayt, “Engineering Electromagnetics”, Tata McGraw Hill, 2011*
3.	*Kraus and Fleish, “Electromagnetics with Applications”, McGraw Hill International Editions, 5th Edition, 1999.*
4.	*Bhag Singh Guruand Hüseyin R.Hiziroglu “Electromagnetic field Theory Fundamentals”, Cambridge University Press;Second Revised Edition,2009.*

17EPC305	ANALOG ELECTRONICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the PN diode and its applications
- To study the operation and characteristics of BJT AND FETS
- To study the biasing of BJT and BJT based amplifiers
- To impart knowlrdge on feedback amplifiers and oscillators
- To impart knowlrdge on applications of diode circuits and waveform generators

UNIT I	PN DIODE AND ITS APPLICATIONS	9

PN junction diod -VI characteristics – Resistance - temperature effects – Drift and diffusion currents – Rectifiers: HW, FW, Bridge Rectifiers, filters - Zener diode – Characteristics - LED – Regulators (series and shunt) - Introduction to Switched mode power supply (Quantitative treatment only).

UNIT II	BJT AND FETS	9

Bipolar junction transistor – Construction – Input and output characteristics – CE, CB and CCconfigurations – hybrid model – Analytical expressions - JFET – VI characteristics, Pinch off Voltage– small signal model - MOSFET - Characteristics – enhancement and depletion mode.

UNIT III	BIASING AND AMPLIFIERS	9

Need for biasing - Different types of biasing circuits –BJT-FET-Small signal analysis-Classification of amplifiers -CE CB amplifier - frequency response - Class A, B, AB, C and D -RC andtransformer coupled power amplifiers - Class B complementary- symmetry, push-pull power Amplifiers-Darlington connection.

UNIT IV	FEEDBACK AMPLIFIERS AND OSCILLATORS	9

Differential amplifiers: Common Mode and Differential Mode - CMRR – feedback amplifiers - Voltage / current, series / shunt feedback –condition for oscillation - oscillators – LC, RC, crystaloscillators.

UNIT V	PULSE CIRCUITS	9

RC wave shaping circuits – Diode clampers and clippers – Monostable, Astable and Bistable Multivibrators – Schmitt triggers – UJT based saw tooth oscillators.

TOTAL : 45 PERIODS

OUTCOMES: After successful completion of the course students able to

•	Explain the characteristics and applications of electronicdevices such as diode, special diodes, BJTs, and MOSFETs.
•	Compare various biasing methods and circuits for the BJT and MOSFETamplifiers
•	Explain the characteristics and applications of feedback amplifiers, pulse circuits and oscillators.

TEXT BOOKS:

1.	Paynter, "Introductory electronic devices and circuits", PHI, 2006.
2.	David Bell, "Electronic Devices and Circuits", PHI, 2007.
3.	RobertL.Boylestad,"Electronic Device sand Circui",2002.

REFERNCES:

1.	*Theodre F. Boghert, "Electronic Devices & Circuits" Pearson Education, 6th Edition, 2003.*
2.	*Rashid, "Microelectronic circuits", Thomson Publication, 1999.*
3.	*Singh. B.P and Rekha Singh, "Electronic Devices and Integrated Circuits", Pearson Education, 2006.*

17EPC306	DIGITAL LOGIC CIRCUITS	L	T	P	C
		2	2	0	3

OBJECTIVES:

- To study various number systems , simplify the logical expressions using Boolean functions
- To study implementation of combinational circuits
- To design various synchronous and asynchronous circuits.
- To introduce asynchronous sequential circuits and PLCs
- To introduce digital simulation for development of application oriented logic circuits.

UNIT I	NUMBER SYSTEMS AND DIGITAL LOGIC FAMILIES	6+6

Review of number systems, binary codes, error detection and correction codes (Parity and Hamming code) –Digital Logic Families, comparison of RTL, DTL, TTL, ECL and MOS families-operation, characteristics of digital logic family.

UNIT II	COMBINATIONAL CIRCUITS	6+6

Combinational logic-representation of logic functions- SOP and POS forms,K-map representations-minimization using Kmaps- simplification and implementation of combinational logic–multiplexers, demultiplexers,encoders and decoders- codeconverters,adders,and subtractors.

UNIT III	SYNCHRONOUS SEQUENTIAL CIRCUITS	6+6

Sequential logic-SR, JK, D and T flip flops-level triggering and edge triggering -counters- asynchronous and synchronous type-Modulo counters-Shift registers-design of synchronous sequential circuits –Moore and Melay models-Counters, statediagram; state reduction; state assignment

UNIT IV	ASYNCHRONOUS SEQUENTIAL CIRCUITS AND PROGRAMMABLE LOGIC DEVICES	6+6

Asynchronous sequential logic circuits-Transition table, flow table-raceconditions, hazards & errorsin digital circuits; analysis of asynchronous sequential logic circuits- introduction to Programmable Logic Devices:PROM–PLA–PAL.

UNIT V	VHDL	6+6

RTL Design–combinational logic –Sequential circuit–Operators –Introductionto Packages – Subprograms–Testbench. (Simulation / Tutorial Examples: adders, counters, flip-flops, FSM, Multiplexers /Demultiplexers).

TOTAL : 60(30+30) PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Explain the different number systems, coding schemes, IC fabrication technique andarithmetic operations on binary numbers.
•	Explain the basic theorems and properties of Boolean algebra, Utilize K- Map for gate level minimization of the given Boolean function and Construct combinational logic circuits for the given requirement anddetermine their performance
•	Construct synchronous and asynchronous sequential logic circuits for the given requirement and determine their performance
•	Explain the programmable logic devices such as PROM, PLA, and PAL, and VHDL Programming.
TEXT BOOKS:	
1.	Raj Kamal,'Digitalsystems-Principlesand Design',PearsonEducation2ndedition, 2007
2.	M.MorrisMano, 'Digital Design with an introduction to the VHDL', Pearson Education, 2013.
3.	FloydandJain, 'Digital Fundamentals',8th edition,PearsonEducation,2003.
4.	Anil K.Maini, "Digital Electronics: Principles, Devices and Applications", Wiley Publications, 2007.
REFERENCES:	
1.	*Mandal "Digital Electronics Principles & Application, McGraw Hill Edu,2013*
2.	*William Keitz, "Digital Electronics- A Practical Approach with VHDL", Pearson, 2013.*
3.	*Comer "Digital Logic & State Machine Design", Oxford, 2012.*
4.	*AnandKumar, "Fundamentals of Digital Circuits",PHI, 2013.*

17EES307	OBJECT ORIENTED PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- Get Introduced to the object oriented programming using C++
- Learn to create simple C++ programs using I/O statements.
- Be familiar with concepts of overloading, Inheritance, templates, virtual functions in C++
- Learn the basic programming techniques in java
- Be familiar with concepts of Interfacing, Threading and Exception handling in Java

LIST OF EXPERIMENTS:

C++:

1.Program using functions

a) Functions with default arguments

b) Implementation of call by value,address,reference

2.Simple classes for understanding objects,member functions&constructors

a)Classes with primitive data members,

b)Classes with arrays as data members

c)Classes with pointers as datamembers

d)Classes with constant data members

e)Classes with static member functions

3.Compile time polymorphism

a)Operator overloading

b)Function overloading

c)Run time polymorphism

d)Inheritance

e)Virtual functions

f)Virtual base classes

g)Templates

4.File handling

a)Sequential access

b)Random access

JAVA:

5.Simple java applications-

a)for understanding references to an instant of aclass

b)Handling strings in JAVA

6.Simple package creation-developing user defined packages in java

7.Interfaces-developing user defined interfaces

8.Threading

a)Creation of threading in java applications

b)Multi-threading

9.Exception handling mechanism in java

a) Handling predefined exceptions.

b) Handling user defined exceptions.

	TOTAL : 60 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Gain the basic knowledge on Object Oriented concepts.
•	Ability to develop applications using Object Oriented Programming Concepts.
•	Ability to implement features of objectoriented programming to solvereal world problems.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

Stand alone desktops with C++complier 30Nos. (or)

Server with C++ compiler supporting 30 terminals or more

17EPC308	ANALOG ELECTRONICS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:	To enable the students to understand the behavior of semiconductor device based on experimentation
•	To understand the behaviour of PN and Zener diode
•	Learn to create simple applications of PN and Zener diode
•	To understand the characteristics of BJT, UJT, JFET and MOSFET in different configurations
•	To impart knowledge on frequency response of various amplifies
•	To impart knowledge on RC phase shift and wein bridge oscillators

LIST OF EXPERIMENTS:

1. Characteristics of PN diode and Zener diode.
2. Diode Clippers and Clampers.
3. Single phase half wave and full wave rectifiers.
4. Characteristics of Voltage Regulators.
5. Characteristics of Transistor under CE, CC and CB configurations.
6. Characteristics of FET.
7. Characteristics of MOSFET.
8. Characteristics of UJT.
9. Frequency response of Common Emitter Amplifier.
10. Frequency response of Common Collector Amplifier.
11. Frequency response of Common Source FET Amplifier.
12. Design of RC Phase Shift and Wien bridge Oscillators.

TOTAL : 60PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Obtain accurately the characteristics of electronic devices (Diodes, BJT, and MOSFET), oscillators and voltage regulators independently.
•	Construct accurately wave shaping circuits for the givenspecifications independently.
•	Obtain accurately the frequency response of various amplifiers with different configurations based on BJT and FET independently.

SEMESTER-IV

17EBS401	NUMERICAL METHODS	L	T	P	C
		3	2	0	4

OBJECTIVSES:

- This course aims at providing the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology

UNIT I	SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS	9+6

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Matrix Inversion by Gauss Jordan method - Eigen values of a matrix by Power method.

UNIT II	INTERPOLATION AND APPROXIMATION	9+6

Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae.

UNIT III	NUMERICAL DIFFERENTIATION AND INTEGRATION	9+6

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

UNIT IV	INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS	9+6

Single Step methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order equations - Multi step methods - Milne's and Adams- Bash forth predictor corrector methods for solving first order equations.

UNIT V	BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS	9+6

Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

	TOTAL : 75(45+30) PERIODS
OUTCOMES:	After successful completion of the course students able to
•	The students will have a clear perception of the power of numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields
TEXT BOOKS:	
1.	Grewal. B.S., and Grewal. J.S., "Numerical methods in Engineering and Science", 9th Edition, Khanna Publishers, New Delhi, 2007.
2.	Gerald. C. F., and Wheatley. P. O., "Applied Numerical Analysis", 7th Edition, Pearson Education, Asia, New Delhi, 2007.
REFERENCES :	
1.	*Chapra. S.C., and Canale.R.P., "Numerical Methods for Engineers", 7th Edition, Tata McGraw Hill, New Delhi, 2016.*
2.	*Brian Bradie. "A friendly introduction to Numerical analysis", Pearson Education, Asia, New Delhi, 2007.*
3.	*Sankara Rao. K., "Numerical methods for Scientists and Engineers", 3rd Edition, Prentice Hall of India Private Ltd., New Delhi, 2007*

17EPC402	DC MACHINES AND TRANSFORMERS	L	T	P	C
		2	2	0	3

OBJECTIVES:

- To study the working principles of electrical machines using the concepts of electromechanical energy conversion principles and derive expressions for generated voltage and torque developed in DCl Machines.
- To study the working principles of DC machines as Generator types, determination of their noload / load characteristics, starting and methods of speed control of motors.
- To estimate the various losses taking place in D.C. Motor and to study the different testing methods to arrive at their performance.
- To familiarize the constructional details, the principle of operation, prediction of performance and three phase transformer connections.
- To study the various methods of testing of DC machines and transformers

UNIT I	BASIC CONCEPTS OF ROTATING MACHINES	6+6

Magnetic Circuits - Principles of electromechanical energy conversion – Single and multiple excited systems – concept of co-energy– Generated voltage – Torque in DC machine.

UNIT II	DC GENERATORS	6+6

Constructional details – emf equation – Methods of excitation – Self and separately excited generators – Characteristics of series, shunt and compound generators – Armature reaction and commutation – Parallel operation of DC shunt and compound generators.

UNIT III	DC MOTORS	6+6

Principle of operation – Back emf and torque equation – Characteristics of series, shunt and compound motors – Starting of DC motors – Types of starters – Speed control of DC series and shunt motors.

UNIT IV	TRANSFORMERS	6+6

Constructional details of core and shell type transformers – Types of windings – Principle of operation – emf equation – Transformation ratio – Transformer on no-load – Parameters referred to HV / LV windings – Equivalent circuit – Transformer on load – Regulation – Parallel operation of single phase transformers – Auto transformer – Three phase transformers – Vector group.

UNIT V	TESTING OF DC MACHINES AND TRANSFORMERS	6+6

Losses and efficiency in DC machines and transformers – Condition for maximum efficiency – Testing of DC machines – Brake test, Swinburne's test, Retardation test and Hopkinson's test – Testing of transformers – Polarity test, load test, open circuit and short circuit tests – All day efficiency.

	TOTAL : 60(30+30)PERIODS
OUTCOMES:	After successful completion of the course students able to
•	Explain the concept of magnetic circuits and electromechanical energy theory.
•	Explain the construction, operation and characteristics of Dc Generators and Motors
•	Explain the construction, operation and characteristics of Transformers
•	Determine the losses and efficiency in dc machines and transformers by conducting various tests.
TEXT BOOKS:	
1.	Fitzgerald A.E. Kingsly C., Umans S.D., '*Electrical Machinery'* 6th edition, McGraw Hill International Edition, New York, 2002.
2.	Kothari D.P. and Nagrath I.J , "*Electric Machines*", Tata McGraw Hill, Fourth Ed., 2011.
3.	P. C. Krause, O. Wasynczuk and S. D. Sudhoff, "Analysis of electric machinery," IEEE Press, 1995.
REFERENCES:	
1.	*D.P.Kothari, 'Electrical Machines.' 3rd edition, TMH, New Delhi 2004.*
2.	*P.C.Sen, "Principles of Electrical Machines and Power Electronics", John-Wiley & Sons, Newyork.*
3.	*Cotton H 'Advanced Electrical Technology', CBS Publishers and Distributors, 1967.*
4.	*P.S.Bimbhra, 'Electrical Machinery', Khanna Publishers,2003.*
5.	*Fitzgerald A.E., Kingsly C. and Kusko.A., "Electric Machinery", Tata McGraw Hill, 2007.*

17EPC403	LINEAR INTEGRATED CIRCUITS AND APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the IC fabrication procedure.
- To study characteristics; realize circuits; design for signal analysis using Op-amp ICs.
- To study the applications of Op-amp.
- To study internal functional blocks and the applications of special ICs like Timers, PLL, circuits, regulator Circuits, ADCs, Opto ICs.

UNIT I	IC FABRICATION	9

IC classification - fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities - Realization of monolithic ICs and packaging - Fabrication of diodes, capacitance, resistance and FETs.

UNIT II	CHARACTERISTICS OF OP-AMP	9

Ideal OP-AMP characteristics, DC characteristics, AC characteristics - offset voltage and current -differential amplifier - frequency response of OP-AMP - Basic applications of OP-AMP – summer, Differentiator and integrator.

UNIT III	APPLICATIONS OF OP-AMP	9

Instrumentation amplifier - first and second order active filters - V/I & I/V converters - comparators, Multivibrators - clippers, clampers, peak detector, S/H circuit, D/A converter - R-2R ladder and weighted resistor types - A/D converter -Dual slope, successive approximation and flash types.

UNIT IV	SPECIAL ICs	9

Timer: Introduction to 555 timers and its functional diagram, Monostable, Astable and Schmitt Trigger applications - Voltage Controlled Oscillator: Operation and Applications using IC 566 - Phase Locked Loops: Introduction, Principles, Block Schematic and Description of IC 565, Applications of PLL: Frequency multiplication and frequency translation.

UNIT V	APPLICATION ICs	9

IC voltage regulators - LM317, 723 regulators, switching regulator, LM2575, LM 380 power Amplifier, ICL 8038 function generator IC, isolation amplifiers, opto coupler, opto electronic ICs, Buffer.

TOTAL : 45 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Explain the different fabrication methods of integrated circuits.
•	Explain the characteristics, frequency response and applications of OP-AMP based circuits
•	Explain the different special ICs and Application ICs and its characteristics.
TEXT BOOKS:	
1.	Ramakant A. Gayakward, "Op-amps and Linear Integrated Circuits", 4th Education, 2003
2.	Roy Choudhary. D, Sheil B.Jani, "Linear Integrated Circuits", 2nd Edition, New Age, 2003
3.	Fiore,"Op-amps&Linear Integrated Circuits Concepts & Applications",Cengage, 2010.
REFERENCES:	
1.	*Jacob Millman, Christos C.Halkias, "Integrated Electronics - Analog and Digital circuits system", Tata McGraw Hill, 2003.*
2.	*Robert F.Coughlin, Fredrick F.Driscoll, "Op-amp and Linear ICs", 4th Edition,Pearson*
3.	*David A.Bell, "Op-amp & Linear ICs", 2nd Edition, Prentice Hall of India, 1997.*
4.	*Floyd,Buchla,"Fundamentals of Analog Circuits",Pearson,2013.*

17EPC404	TRANSMISSION AND DISTRIBUTION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the basic structure of electric power systems, FACTS devices, and Calculate the sag of transmission lines.
- To develop expressions for the computation of transmission line parameters.
- To obtain the equivalent circuits for the transmission lines based on distance and operating voltage for determining voltage regulation and efficiency. Also to improve the voltage profile of the transmission system.
- To analyses the voltage distribution in insulator strings and cables and methods to improve thesame.
- To study the basic structure of substations and distribution systems.

UNIT I POWER SYSTEM TOPOLOGY 9

Structure of electric power system – Generation, Transmission and distribution voltages – HVDC system – structure – Types - Comparison of AC and DC system - EHV AC transmission- need and environmental aspects – FACTS- TCSC – SVC – STATCOM – UPFC (qualitative treatment only) –Mechanical design of transmission line between towers – sag and tension- calculations using approximate equations taking into account the effect of ice and wind.

UNIT II TRANSMISSION LINE PARAMETERS 9

Transmission line Resistance - Inductance and Capacitance calculations for - single and three phase transmission lines with single and double circuits lines - Symmetrical and unsymmetrical spacing -Transposition - Application of self and mutual GMD -Stranded and bundled conductors - Skin and proximity effects.

UNIT III MODELLING AND PERFORMANCE OF TRANSMISSION LINES 9

Classification of lines – Short, medium and long transmission lines – Equivalent circuits Transmission efficiency and voltage regulation – Generalized constants of the transmission line- Surge impedance – Surge impedance loading- Real and reactive power flow in the line- Power angle diagram - Power circle diagrams – Ferranti effect -corona formation and loss.

UNIT IV INSULATORS AND CABLES 9

Insulators – Types – Voltage distribution in string insulator and grading – Improvement of string efficiency – Underground cables – Constructional features of LT and HT cables –

Capacitance single core and three core cables – Dielectric stress and grading – Thermal characteristics.		
UNIT V	**SUBSTATION AND DISTRIBUTION SYSTEM**	**9**
Types of substations- substation equipment – Bus-bar arrangements – Substation bus schemes –Single bus scheme – Double bus with double breaker – Double bus with single breaker – Main and transfer bus – Ring bus – Breaker-and-a-half with two main buses – Double bus-bar with bypass isolators. Neutral grounding- System and equipment grounding - grounded and ungrounded transmission system- Solid, Resistance, reactive, Peterson coil grounding systems –Distribution systems- types -Radial and ring main (qualitative treatment only).		
	TOTAL : 45 PERIODS	

OUTCOMES:	After successful completion of the course students able to
•	Explain the basic structure of electric power systems, FACTS devices, and Calculate the sag of transmission lines.
•	Calculate the line parameters for various type of lines.
•	Explain the characteristics and performance of short, medium and long transmission lines.
•	Explain the construction and performance of insulators and cables
•	Explain the basic structure of substations and distribution systems.

TEXT BOOKS:

1.	Wadhwa C.L., "Electric Power Systems", New Age International (P) Ltd., 2000.
2.	Gupta B.R., "Power System Analysis and Design", S. Chand Company & Ltd, New Delhi, 2003.
3.	D.P.Kothari,I.J.Nagarath,'Power System Engineering',TataMcGraw-Hill Publishing Company limited,New Delhi,Second Edition,2008.

REFERENCES:

1.	*Singh S.N., "Electric Power Generation, Transmission and Distribution", Prentice Hall of India, New Delhi, 2002.*
2.	*Mehta V. K. and Rohit Mehta, "Principles of Power System", S.Chand Company & Ltd, New Delhi, 2006.*
3.	*J.Brian,Hardy and Colin R.Bayliss'Transmission and Distributionin Electrical Engineering', Newnes;Fourth Edition,2012.*
4.	*LucesM.Fualkenberry,Walter Coffer,'Electrical Power Distribution and Transmission',Pearson Education,2007.*
5.	*Wiiliam D. Stevenson Jr, "Elements of Power system Analysis", TataMcGraw-Hill*

	Limited, Publishing NewDelhi.

17ZES405	SIGNALS AND SYSTEMS	L	T	P	C
		3	2	0	4

OBJECTIVES:

- To understand the basic properties of signal & systems and the various methods of classification
- To learn Laplace Transform &Fourier transform and their properties
- To know Z transform & DTFT and their properties
- To characterize LTI systems in Continuous Time domain and various Transform domains
- To characterize LTI systems in Discrete Time domain and various Transform domains

UNIT I	CLASSIFICATION OF SIGNALS AND SYSTEMS	9+6

Continuous time signals (CT signals) - Discrete time signals (DT signals) - Step, Ramp, Pulse, Impulse, Sinusoidal, Exponential, Classification of CT and DT signals - Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals - CT systems and DT systems- Classification of systems – Static & Dynamic, Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non causal, Stable & Unstable.

UNIT II	ANALYSIS OF CONTINUOUS TIME SIGNALS	9+6

Fourier series analysis-spectrum of Continuous Time (CT) signals- Fourier and Laplace Transforms in CT Signal Analysis - Properties.

UNIT III	LINEAR TIME INVARIANT- CONTINUOUS TIME SYSTEMS	9+6

Differential Equation-Block diagram representation-impulse response, convolution integrals-Fourier and Laplace transforms in Analysis of CT systems.

UNIT IV	ANALYSIS OF DISCRETE TIME SIGNALS	9+6

Baseband Sampling - DTFT – Properties of DTFT - Z Transform – Properties of Z Transform.

UNIT V	LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS	9+6

Difference Equations-Block diagram representation-Impulse response - Convolution sum-Discrete Fourier and Z Transform Analysis of Recursive & Non-Recursive systems.

	TOTAL : 75 PERIODS
OUTCOMES:	After successful completion of the course students able to
•	Analyze the properties of signals & systems
•	Apply Laplace transform, Fourier transform, Z transform and DTFT in signal analysis
•	Analyze continuous time LTI systems using Fourier and Laplace Transforms
•	Analyze discrete time LTI systems using Z transform and DTFT
TEXT BOOKS:	
1.	Allan V.Oppenheim, S.Wilsky and S.H.Nawab, "Signals and Systems", Pearson, 2007.
2.	Simon Haykin, Barry Van Veen., "Signals & Systems". John Wiley &Sons (ASIA) Pvt Ltd, 1999.
3.	B. P. Lathi, "Principles of Linear Systems and Signals", Second Edition, Oxford, 2009.
REFERENCES:	
1.	*R.E.Zeimer, W.H.Tranter and R.D.Fannin, "Signals & Systems - Continuous and Discrete", Pearson, 2007.*
2.	*John Alan Stuller, "An Introduction to Signals and Systems", Thomson, 2007.*
3.	*H P HSU, "Signals and Systems", 2nd edition, Mc.Hill.education, 2017.*
4.	*M.J.Roberts, "Signals & Systems Analysis using Transform Methods & MATLAB", Tata McGraw Hill, 2007.*

17EPC406	MEASUREMENTS AND INSTRUMENTATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the basic functional elements of instrumentation
- To introduce the fundamentals of electrical instruments
- To educate on the comparison between various measurement techniques
- To introduce the fundamentals of electronic instruments
- To introduce various transducers and the data acquisition systems

UNIT I INTRODUCTION 9

Types of measurements, instrument classification, Elements of generalized measurement system, input output configuration of measuring instruments, selection of an instruments– Static and dynamic characteristics – Errors in measurement – Statistical evaluation of measurement data – Standards and calibration.

UNIT II ELECTRICAL INSTRUMENTS 9

Principle and working of Moving coil, moving iron and dynamometer type Instruments.– Single and three phase wattmeters-Single and three phase energy meters – Magnetic measurements: Determination of B-H curve and measurements of iron loss – Instrument transformers – Theory and construction of current and potential transformers, transformation ratio and phase angle errors and their minimization - measurement of frequency and phase.

UNIT III POTENTIOMETERS AND BRIDGES 9

D.C potentiometer-Laboratory type, A.C potentiometers-Polar and co-ordinate type, Measurement of low and medium resistance- Kelvin's Double bridge, Wheatstone bridge. Measurement of self-inductance- Maxwell's bridges and Hay's bridge. Measurement of mutual inductance - Anderson's bridge-Low and high voltage Schering bridges- transformer ratio bridges, self-balancing bridges. Sources of error in AC bridges and their minimization. Measurement of high resistance- loss of charge method and Mega ohm bridge method.

UNIT IV ELECTRONIC INSTRUMENTS 9

Digital voltmeters, ammeters, multimeters, DMM with auto ranging and self-diagnostic features-Signal Generators- Distortion meter- Q-meters-Digital R-L-C meters-Spectrum analyzer-Wave analyzer- digital plotters and printers, CRT display, digital CRO, LED and LCD display, Sampling and Digital storage oscilloscope.

UNIT V TRANSDUCERS AND SIGNAL CONDITIONING 9

Transducers – selection criteria ,Resistive Transducers-Potentiometers, strain gauges, Resistance Thermometer, Thermistors, inductive transducers- LVDT, capacitive transducers-based on change in distance between plates– Piezoelectric, thermocouple, Hall effect, optical and digital transducers, ultrasonic transducers – Instrumentation amplifiers, A/D and D/A conversion, S/H and multiplexers-Smart sensors.	
	TOTAL : 45PERIODS
OUTCOMES:	After successful completion of the course students able to
•	Analyse the characteristics of generalized electrical measurements and its errors.
•	Determine various parameters using various type of analog instruments
•	Determine unknown Resistance, inductance and capacitance values using bridge circuits.
•	Explain the measurements of various parameters using various type of digital instruments
•	Analyse the performance of various type of transducers, and signal conversion systems.
TEXT BOOKS:	
1.	A.K.Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2004.
2.	J.B.Gupta, 'ACourse in Electronic and Electrical Measurements', S.K.Kataria & Sons, Delhi, 2003.
3.	Doebelin E.O.and Manik D.N, Measurement Systems Applications and Design, Special Indian Edition, Tata McGraw Hill Education Pvt .Ltd., 2007.
REFERNCES:	
1	*H.S.Kalsi,'Electronic Instrumentation', Tata McGraw Hill, IIEdition 2004*
2	*D.V.S.Moorthy, 'Transducers and Instrumentation', Prentice Hall ofIndiaPvtLtd, 2007.*
3	*A.J.Bouwens, 'Digital Instrumentation', Tata McGraw Hill, 1997.*
4	*Martin Reissland, 'Electrical Measurements', New Age International (P) Ltd., Delhi, 2001.*
5.	*Alan.S.Morris, Principles of Measurements and Instrumentation, 2nd Edition, Prentice Hall of India, 2003.*

17EPC407	DC MACHINES AND TRANSFORMERS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES :

- To expose the students to the operation of various D.C. generators and give them experimental skill.
- To expose the students to the operation of various D.C. motors and give them experimental skill.
- To expose the students to the operation transformers and give them experimental skill to find the efficiency , losses and to draw the equivalent circuit

LIST OF EXPERIMENTS:

1. Study of starters: 2-point, 3-point and 4-point starters.
2. Open circuit and load characteristics of DCshunt generator.
3. Load characteristics of DC compound generator with differential and cumulative connections
4. Load Test on DC series generator.
5. Load test on DCshunt and compound motor.
6. Load test on DC series motor.
7. Swinburne's test and speed control of DC shunt motor.
8. Hopkinson'steston DCmotor –generator set.
9. Loadtest on single-phase transformer and three phase transformers.
10. Open circuit and short circuit tests on single phase transformer.
11. Sumpner's test on single phase transformers.
12. Separation of no-load losses in single phase transformer.
13. Scott connection and 3-phase transformers connections.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

1.	DC Shunt Motor with Loading Arrangement–3Nos
2.	DC Shunt Motor Coupled With Threephase Alternator –1No.
3.	Single Phase Transformer –4Nos
4.	DC Series Motor with Loading Arrangement–1 No.

5.	DC compound Motor with Loading Arrangement–1No.
6.	Three Phase Induction Motor with Loading Arrangement–2Nos
7.	Single Phase Induction Motor with Loading Arrangement–1No.
8.	DC Shunt Motor Coupled With DC Compound Generator –2Nos
9.	DC Shunt Motor Coupled With DC Shunt Motor –1No.
10.	Tachometer -Digital/Analog–8Nos
11.	Single Phase Auto Transformer–2Nos
12.	Three Phase Auto Transformer–1No.
13.	Single Phase Resistive Loading Bank–2Nos
14.	Three Phase Resistive Loading Bank.–2Nos
15.	SPST switch–2Nos
	TOTAL : 60 PERIODS

OUTCOMES: After successful completion of the course students able to

•	Draw the characteristics of Dc Generators and Motors and determine the losses and efficiency.
•	Draw the equivalent circuit and characteristics of transformers and determine the losses and efficiency.

17EPC408	LINEAR AND DIGITAL INTEGRATED CIRCUITS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES :	
•	To provide Experiment test bench to learn logic gates, Boolean functions, adder, subractor and various code convertors
•	To provide Experiment test bench to learn shift registers , counters and Multiplexer/ De-multiplexer
•	To provide Experiment test bench to learn applications of Op-Amp in inverting and non-inverting mode
•	To provide Experiment test bench to learn TIMER IC applications
•	To provide Experiment test bench to learn Analog to Digital Converters and Digital to Analog Converters, VCO and PLL

LISTOFEXPERIMENTS:

1. Basic Digital IC's. (Verification of truth table for AND, OR, XOR, NOT, NOR, NAND, JK FF, RS FF, D FF).
2. Implementation of Boolean Functions, Adder/ Subtractor circuits.
3. Code converters, Parity generator and parity checking, Excess-3, 2'sComplement,Binary to Gray Code using suitable IC's.
4. Encoders and Decoders: Decimal and Implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitable IC's.
5. Counters: Design and implementation of 4-bit modulo counters as synchronous and Asynchronous types using FF IC's and specific counter IC.
6. Shift Registers: Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitable IC's.
7.Multiplexer/ De-multiplexer: 4:1; 8:1 multiplexer and 1:4; 1:8 De-multiplexer
8. Timer IC application: Study of NE/SE 555 timer in Astable, Monostable operation.
9. Application of Op-Amp: inverting and non-inverting amplifier, Adder, Comparator, Differential Amplifier, Integrator and Differentiator.
10. Analog to Digital Converter and Digital to Analog Converter: Verification of A/D conversion using dedicated IC's.
11. VCO and PLL ICs(Voltage to frequency characteristics of NE/ SE 566 IC.
And Frequency multiplication using NE/SE 565 PLL IC).

TOTAL : 60 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Analyse the characteristics of OP-Amp circuits, Special ICS and Application ICs.
•	Explain the performance of digital IC Circuits
•	Able to explain the signal conversion circuits.

SEMESTER-V

17EPC501	POWER SYSTEM ANALYSIS	L	T	P	C
		2	2	0	3

OBJECTIVES :

- To model the power system under steady state operating condition.
- To study numerical methods and matrices
- To apply numerical methods to solve the power flow problem.
- To model and analyze the system under faulted conditions.
- To model and analyze the transient behaviour of power system when it is subjected to a fault.

UNIT I	POWER SYSTEM MODELING	6+6

Basic components of a power system– Per phase and per unit analysis– Modeling of power system components in per unit analysis - Symmetrical Components and sequence networks – Modeling of components in positive, negative and zero sequences. – Impedance and Reactance Diagram.

UNIT II	NETWORK MATRICES	6+6

Primitive Networks – Construction of Ybus using inspection and singular transformation methods. – Direct Building algorithm of Zbus matrix - Sparse Matrix techniques for large scale power systems: Factorization by Bifactorization and Gauss elimination methods; Repeat solution using Left and Right factors and L and U matrices.

UNIT III	POWER FLOW ANALYSIS	6+6

Classification of Buses – Power flow problem formulation in rectangular and polar forms– Solution of Power flow problem: Gauss Seidel method, Newton Raphson method, and Fast decoupled power flow method. Comparison of methods – Statement of Optimal Power Flow

UNIT IV	FAULT ANALYSIS	6+6

Need for fault analysis in power systems – Symmetrical Fault analysis using Zbus – Computation of fault current, short circuit capacity and post fault voltages – Unsymmetrical faults in transmission lines– Sequence network interconnection for various faults – Unsymmetrical fault analysis using symmetrical components.

UNIT V	POWER SYSTEM STABILITY	6+6

Need for stability – Classification of power system stability-angle and voltage stability– Small signal stability analysis of single machine infinite bus system –Solution of swing

equation by modified Euler method and Runge-Kutta fourthorder method – Implicit integration methods - Multimachine Infinite bus system – Introduction to Transient stability.	
	TOTAL : 60 PERIODS
OUTCOMES:	After successful completion of the course students able to
•	Calculate pu quantity for the given components.
•	Compute Y-Bus and Z-Bus.
•	Analyze the various faults in power transmission line.
•	Analyze the stability of single machine and Multimachine infinite bus system.
TEXT BOOKS :	
1.	Nagrath I.J.and Kothari D.P.,'Modern Power System Analysis',TataMcGraw-Hill,Fourth Edition, 2011.
2.	C.L.Wadhwa, 'Electrical Power Systems 'New Academic Science Limited, 2017.
3.	Ashfaq Husain,'Electrical Power System' 5th edition, CBS Publishers, 2017.
4.	P.Venkatesh, B.V.Manikandan, S.CharlesRaja, A.Srinivasan,'Electrical Power Systems Analysis,Security and Deregulation',PHI Learning Private Limited,New Delhi,2012.
REFERNCES:	
1.	*Hadi Saadat, 'Power System Analysis',Tata McGraw Hill Education Pvt.Ltd.,New Delhi,21st reprint, 2010.*
2.	*Kundur P.,'Power System Stability and Control,Tata McGraw Hill Education Pvt.Ltd.,NewDelhi 10th reprint, 2010*
3.	*J.Duncan Glover, Mulukutla S.Sarma,Thomas J.Overbye,'Power System Analysis &Design', Cengage Learning,Fifth Edition,2012.*
4.	*John J.Grainger and W.D.Stevenson Jr., 'Power System Analysis', Tata McGraw-Hill,Sixth reprint, 2010.*

17EPC502	CONTROL SYSTEMS	L	T	P	C
		2	2	0	3

OBJECTIVES :

- To understand the use of transfer function models for analysis physical systems and introduce the control system components.
- To provide adequate knowledge in the time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of systems.
- To introduce stability analysis and design of compensators
- To introduce state variable representation of physical systems and study the effect of state feedback

UNIT I	MATHEMATICAL MODELING OF SYSTEMS	6+6

Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanicaland thermal systems – Transfer function – Synchros – AC and DC servomotors – Block diagramreduction techniques – Signal flow graphs.

UNIT II	TIME RESPONSE	6+6

Test input signals – Time domain specifications – Type and order – I and II order system response – Generalized Error coefficients –Steady state error – PID Controllers –Performance indices – Root locus construction.

UNIT III	FREQUENCY RESPONSE	6+6

Frequency response –Frequency domain specifications – Correlation between time and frequency response – Bodeplot – Polar plot – Determination of closed loop response from open loop response.

UNIT IV	STABILITY AND COMPENSATOR DESIGN	6+6

Concept of Stability – Routh-Hurwitz stability criterion - Nyquist stability criterion –Lag, lead and lag-lead networks – Lag, lead and lag-leadcompensator design using bode plots – Lag, lead and lag-leadcompensator design using Root Locus.

UNIT V	STATE VARIABLE ANALYSIS	6+6

Concept of state variables for linear time invariant Systems – State models from transfer function –State transition matrix - Solution of state equation – Concepts ofcontrollability and observability.

TOTAL : 60 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Determine the transfer function of complex systems using block reduction and signal flow graph techniques and also draw the analogues electrical circuits for non-electrical systems
•	Analyse the time and frequency response of various order systems using mathematical techniques
•	Analyse the stability of closed loop systems
•	Design the compensators to achieve required specifications
•	Analyse the system performance using state variable model technique.
TEXT BOOKS:	
1.	Nagrath J. and Gopal M., "Control Systems Engineering", Tata McGraw-Hill Education Private Limited, Reprint, 2010.
2.	Gopal M., *"*Control Systems, Principles and Design*",* 4th Edition, Tata McGraw Hill, New Delhi, 2012.
3.	S.K.Bhattacharya,"Control SystemEngineering",3rd Edition,Pearson,2013.
REFERNCES:	
1.	*Arthur, G.O.Mutambara, "Design and Analysis of Control; Systems", CRC Press, 2009.*
2.	*Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Pearson Prentice Hall, 2012.*
3.	*Benjamin C. Kuo, "Automatic Control systems", 7th Edition, PHI, 2010.*

17EPC503	SYNCHRONOUS AND ASYNCHRONOUS MACHINES	L	T	P	C
		2	2	0	3

OBJECTIVES :

- To impart knowledge on Construction, principle of operation and performance of three phase induction motor
- To impart knowledge on Starting and speed control of three-phase induction motors.
- To impart knowledge on Construction, principle of operation and performance of single phase induction motors and special machines.
- To impart knowledge on Construction and performance of salient and non – salient type synchronous generators.
- To impart knowledge on Principle of operation and performance of synchronous motor.

UNIT I	THREE PHASE INDUCTION MOTOR	6+6

Constructional details–Types of rotors–-Principle of operation– Slip–cogging and crawling-Equivalent circuit – Torque-Slip characteristics - Condition for maximum torque – Losses and efficiency–Load test-No load and blocked rotor tests-Circle diagram–Separation of losses– Double cage induction motors–Induction generators–Synchronousinductionmotor.

UNIT II	STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR	6+6

Need for starting–Types of starters–DOL, Rotor resistance,Auto transformer andStar-delta starters–Speed control–Voltage control,Frequency control and polechanging –Cascaded connection-V/fcontrol–Slip power recovery scheme-Braking of three phase induction motor:Plugging, dynamic braking and regenerative braking.

UNIT III	SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES	6+6

Constructional details of single phase induction motor–Doublefield revolving theory and operation – Equivalent circuit–No load and blocked rotor test–Performance analysis–Starting methods of single-phase induction motors–Capacitor-startcapacitor run Induction motor-Shaded pole induction motor - Linear induction motor –Repulsion motor- Hysteresis motor-AC series motor- Servo motors- Stepper motors- introduction to magnetic levitation systems.

UNIT IV	SYNCHRONOUS GENERATOR	6+6

Constructional details–Typesofrotors–windingfactors-emfequation–Synchronousreactance–Armaturereaction–Phasor diagramsofnon-salient polesynchronousgenerator connected to

infinite bus-Synchronizing and parallel operation – Synchronizing torque -Change of excitation and mechanicalinput- Voltage regulation–EMF, MMF, ZPF and A.S.A methods–steady state power- angle characteristics–Two reaction theory–sliptest-shortcircuit transients- Capability Curves.		
UNIT V	**SYNCHRONOUS MOTOR**	**6+6**
Principle of operation–Torque equation–Operation on infinite busbars- V and Inverted Vcurves–Power input and power developed equations–Starting methods–Current loci for constant power input, constant excitation and constant power developed-Hunting–natural frequency of oscillations– damper windings- synchronous condenser.		
		TOTAL : 60 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Explain the construction, operation and characteristics of Induction Motors and Special electrical machines.
•	Describe various starters and speed control methods of induction motors.
•	Explain the construction, operation and characteristics of Synchronous machines.
•	Determine the losses and efficiency in ac machines.

TEXT BOOKS:

1.	D.P.KothariandI.J.Nagrath, 'ElectricMachines', Tata McGraw Hill Publishing Company Ltd, 2nd Edition 2002.
2.	P.S.Bhimbhra, 'Electrical Machinery', Khanna Publishers, 2003.
3.	A.E.Fitzgerald, Charles Kingsley, Stephen.D.Umans, 'Electric Machinery', Tata McGraw Hill publishing Company Ltd, 2003.

REFERNCES:

1.	*M.N.Bandyopadhyay, Electrical Machines Theory and Practice, PHI Learning PVT LTD., NewDelhi ,2009.*
2.	*CharlessA.Gross,"Electric /Machines,"CRCPress,2010.*
3.	*Alexander S.Langsdorf, Theory of Alternating –Current Machinery, Tata McGraw Hill Publications, 2001.*

17EPC504	PROFESSIONAL ETHICS	L	T	P	C
		3	0	0	3

OBJECTIVES :	
•	To enable the students to create an awareness on Engineering Ethics
•	To study the engineering associal experimentation
•	To impart knowledge on engineer's responsibility for safety
•	To impart knowledge on engineer's responsibility and rights
•	To study the global issues on business

UNIT I	ENGINEERING ETHICS	9

Senses of 'Engineering Ethics'– Variety of moral issues–Types of inquiry–Moral dilemmas–Moral Autonomy–Kohlberg's theory–Gilligan'stheory–Consensus and Controversy–Professions and Professionalism–Professional Ideals and Virtues–Uses of Ethical Theories.

UNIT II	ENGINEERING ASSOCIAL EXPERIMENTATION	9

Engineering as Experimentation–Engineers as responsible Experimenters–Research Ethics – Codes of Ethics–Industrial Standards- A Balanced Outlook on Law–The Challenger CaseStudy.

UNIT III	ENGINEER'S RESPONSIBILITY FOR SAFETY	9

Safety and Risk– Assessment of Safety and Risk– Risk Benefit Analysis–Reducing Risk–The Government Regulator's Approach to Risk- Chernobyl Case Studies and Bhopal.

UNIT IV	RESPONSIBILITIES AND RIGHTS	9

Collegiality and Loyalty–Respect for Authority–Collective Bargaining–Confidentiality–Conflicts of Interest– Occupational Crime–Professional Rights–Employee Rights– Intellectual Property Rights (IPR) –Discrimination.

UNIT V	GLOBAL ISSUES	9

Multinational Corporations– Business Ethics-Environmental Ethics –Computer Ethics-Rolein Technological Development– Weapons Development– Engineers as Managers–Consulting Engineers–EngineersasExpert Witnesses and Advisors–Honesty–Moral Leadership–Sample Code Conduct.

TOTAL : 45 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Apply the ethical theories in engineering environment.
•	Analyze the risks and improve their responsibility for safety.
•	Uutilize their rights and improve responsibilities.
•	Propose remedies for global issues.

TEXT BOOKS:

1.	Mike Martin and Roland Schinzinger,"Ethics in Engineering",McGraw Hill,NewYork(2005).
2.	Charles E Harris, Michael S Pritchardand Michael J Rabins,"Engineering Ethics– Concepts and Cases",Thompson Learning,(2000).
3.	David Ermannand Michele S Shauf,"Computers,Ethics and Society",Oxford University Press,(2003)
REFERENCES:	
1.	*Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico,1999.*
2.	*John R Boatright, "Ethics and the Conduct of Business", Pearson Education, 2003.*
3.	*Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, 2001.*
4.	*Prof. (Col) PS Bajaj and Dr.Raj Agrawal,"Business Ethics–An Indian Perspective",Biztantra, NewDelhi,2004.*
5.	*David Ermannand Michele S Shauf, "Computers, Ethics and Society",Oxford University Press,2003.*

17EPC505	COMMUNICATION ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To introduce different methods of analog communication and their significance
- To introduce Digital Communication methods for high bit rate transm
- To introduce the concepts of source and line coding techniques for enhancing rating of Transmission of minimizing the errors in transmission.
- To introduce MAC used in communication systems for enhancing the number of users.
- To introduce various media for digital communication

UNIT I	ANALOG COMMUNICATION	9

AM –Frequency spectrum–vector representation–power relations–generation of AM –DSB, DSB/SC,SSB, VSBAM Transmitter & Receiver;FM and PM–frequency spectrum–power relations :NBFM&WBFM ,Generation of FM and DM,Armstrong method & Reactance modulations:FM&PM frequency.

UNIT II	DIGITAL COMMUNICATION	9

Pulse modulations–concepts of sampling and sampling theorems,PAM,PWM,PPM,PTM, quantizationand coding:DCM,DM,slope overload error.ADM,DPCM,OOKsystems –ASK,FSK, PSK,BSK,QPSK,QAM,MSK,GMSK,applicationsofDatacommunication.

UNIT III	SOURCE CODES,LINE CODES&ERROR CONTROL (Qualitativeonly)	9

Primary communication–entropy, properties, BSC, BEC, source coding:Shaum,Fao, Huffman coding:noiseless coding theorem,BW–SNR trade off codes:NRZ,RZ, AMI,HDBP,ABQ, MBnBcodes:Efficiency of transmissions,error control codes and applications:convolutions& block codes.

UNIT IV	MULTIPLE ACCESS TECHNIQUES	9

SS&MA techniques: FDMA, TDMA, CDMA, SDMA application in wire and wireless communication: Advantages.

UNIT V	SATELLITE,OPTICALFIBER –POWERLINE,SCADA	9

Orbits:types of satellites:frequency used link establishment,MA techniques used insatellite communication,earthstation;apertureactuators usedinsatellite–Intelsat and Insat:fibers–types: sources,detectorsused,digitalfilters, optical link:power linecarrier communications:SCADA.

TOTAL:45PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Explain analog and digital communication techniques.
•	Use various codes and error control in communications.
•	Apply various multiple access techniques in communications.
•	Explain advanced communication techniques.
TEXTBOOKS:	
1.	Wayne Tomasi,'Electronic Communications System: Fundamentals through Advanced' Pearson, Fifth edition, 2008.
2.	J.Das"Principles of Digital Communication" New Age International,1986.
REFERENCES:	
1.	*Kennedy and Davis"Electronic Communication Systems" Tata McGraw hill,4th Edition,1993*
2.	*Sklar "Digital Communication Fundamentals and Applications"Pearson Education, 2001.*
3.	*Baryle, Memuschmidt, Digital Communication, Kluwer Publication, 2004.*
4.	*B.P.Lathi "Modern Digital and Analog Communication Systems"Oxford University Press, 1998.*

17EPC507	SYNCHRONOUS AND ASYNCHRONOUS MACHINES LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES :

- To study the various methods of regulation calculation of alternator.
- To study the working principles of Synchronous Motor and to draw V and Inverted V curves
- To estimate the various losses takes place in Induction Motor and to study the load test methods to arrive at their performance.
- To study the various methods of winding configuration of induction motor

LISTOFEXPERIMENTS:

1. Regulation of three phase alternator by EMFand MMF methods.
2. Regulation of three phase alternator by ZPF and ASA methods.
3. Regulation of three phase salient pole alternator by sliptest.
4. Measurements of negative sequence and zero sequence impedance of alternators.
5. V and Inverted V curves of Three Phase Synchronous Motor.
6. Load test on three-phase induction motor.
7. No load and blocked rotor test on three-phase induction motor (Determinationof equivalent circui tparameters).
8. Separation of No-load losses of three-phase induction motor.
9. Load test on single-phase induction motor.
10. No load and blocked rotor test on single-phase induction motor.
11.Study of Induction motor Starters
12. Winding configuration of two pole and three pole connections for motors.

LISTOFEQUIPMENTFORABATCHOF30STUDENTS:

1. Synchronous Induction motor3HP–1 No.
2. DC Shunt Motor Coupled With Three phase Alternator –4nos
3. DC Shunt Motor Coupled With Three phase Slipring Induction motor–1 No.
4. Three Phase Induction Motor with Loading Arrangement–2nos.
5. Single Phase Induction Motor with Loading Arrangement–2nos
6. Tachometer -Digital/Analog–8nos
7. BLDC Motor–1No.
8. Single Phase Auto Transformer –2nos
9. Three Phase Auto Transformer–3nos

10.Single Phase Resistive Loading Bank–2nos 11.Three Phase Resistive Loading Bank–2nos 12. Capacitor Bank–1 No. 13. SPST switch–2nos	
	TOTAL : 60 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Estimate the regulation ofthree phase cylindrical pole Alternator by EMF, MMF, ZPF, ASA methods.
•	Estimate the regulation ofthree phase Salient pole Alternator by slip test.
•	Draw the V- and Inverted V curves of Synchronous motor.
•	Calculate the losses in single phase and three phase induction motors.
•	Obtain the different speeds of motor by pole changing.

17EPC508	CONTROL AND INSTRUMENTATION LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES :

- To provide knowledge on design and analysis of frequency response and stability of various order system using Simulation tool
- To provide knowledge on design and analysis of various compensators
- To study the Characteristics of Synchro-Transmitter- Receiver and Position Control Systems
- To conduct experiment on DC and AC Bridges to find unknown values of circuits elements
- To provide knowledge characteristics of signal conditioning devices.

LISTOFEXPERIMENTS:

CONTROLSYSTEMS:

1. Simulation of First and Second Order Systems
2. P,PI and PID Controllers
3. Stability Analysis
4. Modelling of Systems–Machines,Sensors and Transducers
5. Design of Lag, Lead and Lag-Lead Compensators
6. Position Control Systems
7. Synchro-Transmitter- Receiver and Characteristics

INSTRUMENTATION:

8. Bridge Networks–AC and DC Bridges
9. Dynamic Sensors / Transducers

A.Temperature B.Pressure, C. Displacement, D.Optical, E. Strain F.Flow

10. Signal Conditioning

A. Instrumentation Amplifier

B.Analog–Digital and Digital – Analog Converters (ADCs and DACs), Active Filters

TOTAL : 60 PERIODS

OUTCOMES: After successful completion of the course students able to

•	Analyse the time response, frequency response and stability of various order system using Simulation tool
•	Design the compensators and frequency generators.
•	Analyse the characteristics of various control and instrument elements.
•	Analyse the characteristics of signal conditioning devices.

17ZEE509	COMMUNICATION AND SOFT SKILLS- LABORATORY BASED	L	T	P	C
		0	0	4	2

OBJECTIVES :	
•	To develop their communicative competency in English with specific reference to their speaking and listening.
•	To enhance their ability to communicate effectively in interviews.
•	To strengthen their prospects of success in competitive examinations.
•	To Strengthen a good command over of the language proficiency.
•	To comprehend a different types of accent and use them in their communication

UNITI	LISTENING AND SPEAKING SKILLS	12

Conversational skills (formal and informal) - group discussion – making effective presentations using computers, listening/ watching interviews, conversations, documentaries. Listening to lectures, discussions.

UNITII	READING AND WRITING SKILLS	12

Reading different genres of tests ranging from newspapers to creative writing.Writing job applications - cover letter- resume- e-mails- memos- reports.Writing abstracts- summaries- interpreting visual texts.

UNITIII	ENGLISH FOR NATIONAL AND INTERNATIONAL EXAMINATIONS AND PLACEMENTS	12

International English Language Testing System (IELTS)- Test of English as a Foreign Language (TOEFL)- Civil Service(Language related)- Verbal Ability.

UNITIV	INTERVIEW SKILLS	12

Different types of Interview format- answering questions- offering information- mock interviews- body language(paralinguistic features)- articulation of sounds- intonation.

UNITV	SOFT SKILLS	12

Motivation- emotional intelligence-Multiple intelligences- managing changes- time management- leadership straits- team work- career planning- creative and critical thinking.

	TOTAL:60PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Face interviews, group discussions and other language parameters in the job market
•	Write any competitive examinations which cover language part in it.
•	Take part in any English conversations of any kind in English. Flawlessly without fear and shyness.
•	Write articles for newspapers and magazines or any write-up in English without grammar mistakes.
•	Come out with leadership qualities, team work and career planning and will also possess critical and creative thinking.
TEXTBOOKS:	
1.	Communication Skills for Engineers and Scientists, PHI Learning PVT.LTD, Delhi, 2014.
2.	Communication Skills and Soft Skills An Integrated Approach, Dorling Kindersley (INDIA) PVT.LTD, New Delhi, 2012.
3.	Soft Skills, MJP Publishers, Chennai, 2010.
REFERENCES:	
1.	*Craven, Miles. Listening Extra-A resource book of multi-level skills activities. Cambridge University Press, 2004.*
2.	*Seely, John. The Oxford guide to writing & Speaking. New Delhi: Oxford University Press,20*
3.	*Comfort, Jeremy, et al. Speaking Effectively: Developing speaking skills for Business English. Cambridge University Press, Cambridge: Reprint 2011.*
4.	*Dutt P. Kiranmai and RajeevanGeetha. Basic Communication Skills, Foundation Books:2013*

SEMESTER VI

17EPC601	POWER ELECTRONICS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To get an overview of different types of power semiconductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers
- To study the operation, switching techniques and basics topologies of DC-DC switching regulators.
- To study the operation of AC voltage controller and various configurations.
- To learn the different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.

UNIT I	POWER SEMI-CONDUCTOR DEVICES	9

Basic structure-VI and switching characteristics of SCR, TRIAC, DIAC, Power BJT, Power MOSFET and IGBT –Driver and Snubber circuit-Commutation circuit for SCR.

UNIT II	PHASE-CONTROLLED CONVERTERS	9

2-pulse, 3-pulse and 6-pulse converters – Effect of source inductance – Performance parameters –Power factor control – Dual converters.

UNIT III	DC TO DC CONVERTER	9

Step-down and step-up chopper – Time ratio control and current limit control – Switching mode regulators -Buck, Boost, Buck-Boost and Cuk regulator - Concept of resonant switching.

UNIT IV	AC TO AC CONVERTERS	9

Introduction to phase control and Integral cycle control -Single phase and three AC voltage controllers -– Multistage sequencecontrol - Single and three phase cycloconverters.

UNIT V	INVERTERS	9

Single phase and three phase (both 120º mode and 180º mode) inverters – PWM techniques: Single PWM- Multiple PWM - Sinusoidal PWM, modified sinusoidal PWM — Voltage and harmonic control – Series resonant inverter – Current source inverter- Uninterrupted power supply topologies.

	TOTAL : 45 PERIODS
OUTCOMES:	After successful completion of the course students able to
•	Explain the characteristics of various power semiconductor devices
•	Design and analyse the performance of Phase controlled, AC-AC, and DC-DC converters.
•	Design and analyse the performance of AC-ACconverters
•	Design and analyse the performance of DC-DC converters.
•	Design and analyse the performance of various Inverters.
TEXT BOOKS:	
1.	Rashid M.H., "Power Electronics: Circuits, Devices and Applications", Pearson Education, PHI, New Delhi, 3rd Edition, 2004.
2.	Bimbra P.S., "Power Electronics",Khanna Publishers, 3rd Edition, 2003.
3.	Singh M. D. and Khanchandani K. B., "Power Electronics" Tata McGraw-Hill Publishing Company Limited, New Delhi, 3rdEdition, 2008.
REFERENCES:	
1.	*Ashfaq Ahmed, "Power Electronics for Technology", Pearson Education, Indian reprint, 2003.*
2.	*Philip T. Krein, "Elements of Power Electronics", Oxford University Press, 2004.*
3.	*Ned Mohan, Tore M. Undeland, William P. Robbins, "Power Electronics: Converters, Applications and Design", John Wiley and sons, 3rd Edition, 2003.*
4.	*Bimal K. Bose, "Modern Power Electronics and AC Drives", Pearson Education, 2003.*

17EPC602	MICROPROCESSORS,MICROCONTROLLERS AND APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To study the Architecture of uP8085 & uC 8051
- To study the addressing modes & instruction set of 8085 & 8051.
- To introduce the need & use of Interrupt structure 8085 & 8051.
- To develop skill in simple applications development with programming 8085 & 8051
- To introduce commonly used peripheral / interfacing

UNIT I	INTRODUCTION TO MICROPROCESSORS	9

Hardware Architecture pin outs - Signals – Memory interfacing – I/O ports and data transfer concepts– Timing Diagram – Interrupt structure. Introduction to 8086 processor (Architecture and modes of operation only).

UNIT II	PROGRAMMING OF 8085 PROCESSOR	9

Instruction format and addressing modes – Assembly language format – Data transfer, data manipulation& control instructions – Programming: Loop structure with counting & Indexing – Lookup table - Subroutine instructions - stack.

UNIT III	8051 MICRO CONTROLLER	9

Functional block diagram - Instruction format and addressing modes – Timing Diagram Interrupt structure – Timer –I/O ports – Serial communication.

UNIT IV	PERIPHERAL INTERFACING-8051	9

Study of Architecture and programming of ICs: 8255 PPI, 8259 PIC, 8251 USART, 8279 Key board display controller and 8253 Timer/ Counter -A/D and D/A converter interfacing, interfacing with LCD, digital IOs, keypad and memory.

UNIT V	MICRO CONTROLLER PROGRAMMING AND APPLICATIONS	9

Data Transfer, Manipulation, Control & I/O instructions – Simple programming exercises key board and display interface – Design of PID controller - Closed loop control of servo motor - Stepper motor control - Washing Machine Control.

TOTAL : 45 PERIODS

OUTCOMES: After successful completion of the course students able to

•	Explain the architecture of Microprocessors and its blocks.
•	Write the program for various functions using 8085 processor.
•	Explain the architecture and Program structure of 8051 Microcontrollers.
•	Explain the peripheral interfacing of 8051 Microcontrollers.
•	Apply the 8051 microcontroller into various applications.

TEXT BOOKS:

1.	Senthilkumar N. and Saravanan M. "Microprocessor and Microcontrollers", Oxford University Press, 2011
2.	Krishna Kant "Microprocessor and Microcontrollers" Eastern Company Edition, Prentice – Hall of India, New Delhi, 2007
3.	Ramesh Gaonkar, 'Microprocessor Architecture Programming and Application', CBS Publishers 2011.

REFERENCES:

1.	*Ankaj Gupta "Microcontroller and Embedded System"S.K.Kataria and Sons Publishers 2013*
2.	*Muhammad Ali Mazidi& Janice GilliMazidi, R.D.Kinely"The 8051 Micro Controller and Embedded Systems" (Using Assembly Language and C), PHI Pearson Education, 2011*
3.	*The 8088 & 8086 Microprocessors , Walter A Tribal &Avtar Singh, Pearson, 200*
4.	*Singh B.P., Renu Singh "Advanced Microprocessors and Microcontrollers", New Age International Private Limited, 2009.*

17EPC603	POWER SYSTEM OPERATION AND CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To have an overview of power system operation and control.
- To study the economic operation of power system
- To model power-frequency dynamics and to design power-frequency controller.
- To model reactive power-voltage interaction and the control actions to be implemented for maintaining the voltage profile against varying system load.
- To teach about SCADA and its application for real time operation and control of power systems

UNIT I CHARACTERISTICS OF LOADS — 9

Basics of Power system control and operation – Real and Reactive power of Loads - System load variation – Load characteristics – Load curves and Load Duration curve – load factor and diversity factor - Reserve requirements: Installed reserves, spinning reserves, cold reserves, hot reserves – Overview of system operation: Load forecasting, techniques of forecasting, Importance of load forecasting.

UNIT II POWER SYSTEM OPERATION — 9

Statement of Unit Commitment problem - Constraints - Solution methods: Priority-list methods, forward dynamic programming approach - Formulationofeconomicdispatchproblem with and without losses - Solution bydirect methodandλ-iterationmethod. - Base point and participation factors – Hydrothermal scheduling problem – Short term and long term model and algorithm – Dynamic Programming solution methods for hydrothermal scheduling (Qualitative treatment only).

UNIT III ACTIVE POWER FREQUENCY CONTROL — 9

Basicsofspeedgoverningmechanismandmodeling- speed-loadcharacteristics–Parallel operation of Alternators- LFCcontrolofasingle-area system–Static and Dynamic characteristics – PI controller in LFC– LFC in Two area system - Staticanalysiswith uncontrolledcase- tielinewithfrequency biascontrol- Statemodel– LFC with Economic dispatch controller. Software simulation of LFC (Single Area and Two area system).

UNIT IV REACTIVE POWER VOLTAGE CONTROL — 9

Generation, Absorption and controlofreactivepower– Modeling of excitationsystems – Static and dynamic characteristics-Stability compensation- Secondary voltage control – Tap changing transformers for voltage control – FACTS applications to reactive power control: STATCOM, SVC, TCS and TSC.

UNIT V	SMART POWER CONTROL	9
Need for smart control of power systems-concept of energy controlcentre- functions-system monitoring -dataacquisition and control-system hardware configuration–SCADA and EMS functions-network topology-state estimation–WLSE-Contingency Analysis-statetransition diagram showing various state transitions and control strategies. Recent trends in power system control.		
	TOTAL : 45 PERIODS	

OUTCOMES:	After successful completion of the course students able to
•	Analyse the loads and apply forecasting methods for power system restructuring.
•	Operate the generating units in an efficient way to reduce fuel cost.
•	Design load frequency controller to regulate the frequency and speed.
•	Design the excitation systems with appropriate voltage controllers to regulate voltage and compensate reactive power.
•	Apply smart techniques in power system security.

TEXT BOOKS:

1.	Olle.I.Elgerd,'Electric Energy Systems theory- An introduction',TataMcGrawHill EducationPvt.Ltd.,NewDelhi,34threprint, 2010.
2.	Allen.J.Wood and Bruce F.Wollenberg,'Power Generation,Operation and Control',JohnWiley &Sons,Inc.,2003.
3.	Abhijit Chakrabarti, Sunita Halder,'Power System Analysis Operation and Control',PHI learning Pvt.Ltd.,NewDelhi,Third Edition,2010.
4.	Badri Ram, D. N. Vishwakarma ,'Power System Protection and Switchgear' Tata McGraw-Hill Education, 2001.

REFERENCES:

1.	*Nagrath I.J.and Kothari D.P.,'Modern Power System Analysis',TataMcGraw-Hill,Fourth Edition ,2011.*
2.	*Kundur P.,'Power System Stability and Control,Tata McGraw'Hill Education Pvt.Ltd.,New Delhi ,10threprint, 2010.*
3.	*Hadi Saadat,'Power System Analysis',Tata McGraw Hill Education Pvt.Ltd.,New Delhi,21st reprint, 2010.*
4.	*N.V.Ramana,"Power System Operation and Control," Pearson,2011.*
5.	*C.A.Gross,"PowerSystem Analysis,"Wiley India,2011.*
6.	

	Sunil S Rao,'Switchgear Protection And Power Systems (Theory, Practice & Solved Problems), Khanna Publishers,2008
7.	*M. L. Soni, P. V. Gupta, U. S. Bhatnagar ,'A Course in Electrical Power' Dhanpat Rai, 1987.*

17EPC604	PROTECTION AND SWITCHGEAR	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To educate the causes of abnormal operating conditions (faults, lightning and switching surges) of the apparatus and system.
- To introduce the characteristics and functions of relays and protection schemes.
- To impart knowledge on apparatus protection
- To introduce static and numerical relays
- To impart knowledge on functioning of circuit breakers

UNIT I	PROTECTION SCHEMES	9

Principles and need for protective schemes–nature and causes of faults–types of faults– fault current calculation using symmetrical components–Methods of Neutral grounding–Zones of protection and essential qualities of protection–Protection schemes

UNIT II	ELECTROMAGNETIC RELAYS	9

Operating principles of relays - the Universal relay – Torque equation – R-X diagram – Electromagnetic Relays–Overcurrent,Directional,Distance,Differential,Negative sequenceand Under frequency relays.

UNIT III	APPARATUS PROTECTION	9

Current transformers and Potential transformers and their applications in protection schemes - Protection of transformer, generator, motor, busbars and transmission line.

UNIT IV	STATIC RELAYS AND NUMERICAL PROTECTION	9

Static relays–Phase, Amplitude Comparators–Synthesis of various relays using Static comparators – Block diagram of Numerical relays–Over current protection, transformer differential protection distant protection of transmission lines.

UNIT V	CIRCUIT BREAKERS	9

Physics of arcing phenomenon and arc interruption- DC and AC circuit breaking–

re-striking voltage and recovery voltage-rate of rise of recovery voltage-resistance switching-current chopping- interruption of capacitive current-Types of circuit breakers–air blast, airbreak, oil,SF6 and vacuum circuit breakers–comparison of different circuit breakers– Rating and selection of Circuit breakers

	TOTAL : 45 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Analyze the faults and apply protection schemes for lines.
•	Apply the electromagnetic relays for various protection systems.
•	Design proper protection scheme for generators, transformers, and other power system equipments.
•	Apply the static relays into numerical protection schemes.
•	Analyze the various circuit breakers and apply them into proper protection system.

TEXT BOOKS:	
1.	Sunil S.Rao, 'Switchgear and Protection',Khanna Publishers,NewDelhi,2008.
2.	B.Rabindranath and N.Chander, 'Power System Protection and Switchgear', New Age International
3.	M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakrabarti, 'A Text Book on Power System Engineering', Dhanpat Rai & Co., 1998.

REFERENCES:	
1.	*Badri Ram ,B.H.Vishwakarma,'PowerSystem Protection and Switchgear', New Age International*
2.	*Y.G.Paithankar and S.R.Bhide, 'Fundamentals of power system protection', Second Edition, Prentice Hall of India Pvt.Ltd., New Delhi, 2010.*
3.	*C.L.Wadhwa,'Electrical PowerSystems', 6th Edition,New Age International (P) Ltd.,*

17EPC607	POWER ELECTRONICS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES :	
•	To provide Experiment test bench to learn the characteristics of power semiconductor devices
•	To provide hands on experience with power electronic AC to DC converter and dc to DC converter to determine the control characteristics
•	To provide hands on experience with various power electronic inverters design and testing
•	To study the characteristics of AC voltage controller and SMPS
•	To know the performances of resonant and quasi resonant converter.

LIST OF EXPERIMENTS

1. Characteristics of SCR, TRIAC and DIAC.
2. Characteristics of MOSFET and IGBT.
3. Determination of Control Characteristics of AC to DC fully controlled converter (1-phase and 3-phase).
4. Determination of Control Characteristics of AC to DC half controlled converter (1-phase and 3-phase).
5. Determination of Control Characteristics of Step down and Step up chopper.
6. IGBT based PWM inverter.
7. Series and Parallel inverter.
8. AC Voltage Controller.
9. Switched Mode Power Supply (Fly back, Forward and half Bridge Methods).
10. Performances of Resonant and Quasi Resonant Converter.

TOTAL: 60 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Design conduct experiment on various converter
•	Compare the characteristics of various power semiconductor devices.
•	Demonstrate the operation of phase controlled rectifiers based DC drives.
•	Analyze the basic topologies of DC-DC converters.
•	Employ the different modulation techniques of pulse width modulated inverters.
•	Compute the performance of AC voltage controller.

17EPC608	MICROPROCESSORS, MICROCONTROLLERS AND APPLICATIONS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES :	
•	To provide training on programming of microprocessors and microcontrollers to perform basic binary and mathematical operations like Addition, Subtraction,Multiplication, Division
•	To provide training on programming of microprocessors and microcontrollers using fundamental features and operations
•	To impart knowledge to Develop Assembly Language Program that will provide solutions to real world controlproblems like Speed control, traffic light control.
•	To impart knowledge to Choose appropriate peripheral interfacing devices with 8085& 8051 for specific applications.
•	T o study the Measurement of frequency of the given waveform using microcontroller

1. Programming for 8/16 bit Arithmetic operations using 8085: Addition / Subtraction / Multiplication / Division.

2. Programming with control instructions using 8085: Increment / Decrement, Ascending /Descending order, Maximum / Minimum of numbers, Rotate instructions, Hex / ASCII / BCD codeconversions.

3. Interface Experiments using 8085: A/D Interfacing, D/A Interfacing, Traffic light controller, Simple experiments using 8251, 8253,8255, 8279

4. Interfacing of DC Motor Speed control using 8085

5. Interfacing of Stepper Motor control using 8085

6. Programming for 8/16 bit Arithmetic operations using 8051: Addition / Subtraction / Multiplication / Division.

7. Demonstration of basic instructions with 8051 Microcontroller execution, including: Conditional jumps, looping, calling subroutines.

8. Interface Experiments using 8051: A/D Interfacing, D/A Interfacing.

9. Interfacing of DC Motor Speed control using 8051.

10. Interfacing of Stepper Motor control using 8051.

11. Measurement of frequency of the given waveform using microcontroller.

	TOTAL: 60 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Develop basic binary and mathematical operations like Addition, Subtraction, Multiplication, Division using microprocessor and microcontroller.

•	Describe the fundamental features and operations of contemporary microcontroller and microprocessor.
•	Develop Assembly Language Program that will provide solutions to real world controlproblems like Speed control, traffic light control.
•	Choose appropriate peripheral interfacing devices with 8085& 8051 for specific applications.

17EPC701	SOLID STATE DRIVES	L	T	P	C
		3	0	0	3

OBJECTIVES :	
•	To understand steady state operation and transient dynamics of a motor load system.
•	To study and analyze the operation of the converter/chopper fed dc drive, both qualitatively and quantitatively.
•	To study and understand the operation and performance of AC motor drives.
•	To analyze and design the current and speed controllers for a closed loop solid state DC motors drive.

UNIT I	DRIVE CHARACTERISTICS	9

Electric drive–Equations governing motor load dynamics–steady state stability –multiquadrant Dynamics: acceleration, deceleration, starting & stopping– typical load torque characteristics – Selection of motor

UNIT II	CONVERTER/CHOPPER FED DC MOTOR DRIVE	9

Steady state analysis of the single and three phase converter fed separately excited DC motor drive– continuous and discontinuous conduction–Time ratio and current limit control – 4 quadrant operations of converter / chopper fed drive.

UNIT III	INDUCTION MOTOR DRIVES	9

Stator voltage control-energy efficient drive-v/f control-constant air gap flux – field weakening mod –voltage/ current fed inverter –closed loop control.

UNIT IV	SYNCHRONOUS MOTOR DRIVES	9

V/f control and self- control of synchronous motor: Marginangle control and power factor control– permanent magnet synchronous motor.

UNIT V	DESIGN OF CONTROLLERS FOR DRIVES	9

Transfer function for DCmotor / load and converter – closed loop control with Current and speed feedback – armature voltage control and field weakening mode–Design of controllers; current controller and speed controller-converter selection and characteristics.

	TOTAL : 45 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Design converter/chopper fed dc motor drive

•	Design induction motor drive
•	Design synchronous motor drive
•	Design controllers for drive
TEXT BOOKS:	
1.	GopalK.Dubey,Fundamentals of Electrical Drives,Narosa Publishing House, 1992
2.	Bimal K.Bose.Modern Power Electronics and AC Drives,Pearson Education, 2002
3.	Vedam Subramanyam, "Thyristor Control of Electric Drives", Tata McGraw Hill, 2007
4.	S.K.Pillai, A First course on Electrical Drives, Wiley Eastern Limited, 1993.
REFERENCES:	
1.	*John Hind marshand A lasdain Renfrew,"Electrical Machines and Drives System,"Elsevier 2012*
2.	*Shaahin Felizadeh, "Electric Machines and Drives",CRC Press (Taylor and Francis Group),2013.*
3.	*R.Krishnan, Electric Motor & Drives: Modelling, Analysis and Control, Prentice Hall of India, 2001*

17EPC702	ELECTRICAL MACHINE DESIGN	L	T	P	C
		2	2	0	3

OBJECTIVES:

- To study mmf calculation and thermal rating of various types of electrical machines
- To design armature and field systems for D.C. machines
- To design core, yoke, windings and cooling systems of transformers.
- To design stator and rotor of induction machines.
- To design stator and rotor of synchronous machines and study their thermal behaviour.

UNIT I	INTRODUCTION	6+6

Major considerations in Electrical Machine Design - Electrical Engineering Materials - Space factor – Choice of Specific Electrical and Magnetic loadings – Thermal consideration - Heat Dissipation - Temperature gradient in cores slots and windings - Rating of machines – Standard specifications. Introduction to Computer aided Design in Electrical Machines (Simple Treatment).

UNIT II	DC MACHINES	6+6

Output Equations – Main Dimensions - Magnetic circuit calculations - Carter's Coefficient - Netlength of Iron –Real & Apparent flux densities – Selection of number of poles – Design of Armature – Design of commutator and brushes – Design of field winding.

UNIT III	TRANSFORMERS	6+6

Output Equations – Main Dimensions - KVA output for single and three phase transformers – Window space factor – Design of core and windings - Overall dimensions – No load current– Temperature rise in Transformers – Design of Tank with cooling tubes - Methods of cooling of Transformers.

UNIT IV	INDUCTION MOTORS	6+6

Output equation of Induction motor – Main dimensions – Length of air gap- Rules for selecting rotor slots of squirrel cage machines – Design of rotor bars & slots – Design of end rings – Design ofwound rotor -– Magnetic leakage calculations – Leakage reactance of polyphase machines - Magnetizing current - Short circuit current .

UNIT V	SYNCHRONOUS MACHINES	6+6

Output equations – choice of loadings – Design of salient pole machines – Short circuit ratio – shape of pole face – Armature design – Armature parameters – Estimation of air gap length –

Design of rotor –Design of damper winding – Design of field winding – Design of turbo alternators – Rotor design.	
	TOTAL : 60 PERIODS
OUTCOMES:	After successful completion of the course students able to
•	Formulate Specific Electrical and Magnetic loadings for various electrical DC and AC machines.
•	Devise main dimensions (D, L) of armature and field systems for D.C. machines.
•	Design overall Dimensions of single and three phase transformers core, windings and cooling systems for transformers
•	Design main dimensions of squirrel cage and Slip ring induction machines.
•	Design main dimensions of Synchronous machines.
TEXT BOOKS:	
1.	Sawhney A.K., *"*A Course in Electrical Machine Design*",* Dhanpat Rai & Sons, New Delhi, 2006.
2.	Sen S.K., "Principles of Electrical Machine Designs with Computer Programmes", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2009.
3.	Shanmugasundaram A., Gangadharan G. and Palani R., "Electrical Machine Design Data Book", New Age International Pvt. Ltd., Reprint 2007.
REFERENCES:	
1.	*Say.M.G, "The Performance and Design of Alternating current Machines", Isaac Pitman & sons Limited, 1995.*

17EPC703	SPECIAL ELECTRICAL MACHINES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge on the Construction, principle of operation, control and performance of stepping motors.
- To impart knowledge on the Construction, principle of operation, control and performance of switched reluctance motors.
- To impart knowledge on the Construction, principle of operation, control and performance of permanent magnet brushless D.C. motors.
- To impart knowledge on the Construction, principle of operation and performance of Permanent magnet synchronous motors.
- To impart knowledge on the Construction, principle of operation and performance of Universal, repulsion motors and linear induction motors..

UNIT I	STEPPER MOTORS	9

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

UNIT II	SWITCHED RELUCTANCE MOTORS	9

Constructional features – Principle of operation – Torque prediction – Power controllers – Non-linear analysis –Inductance Profile- Microprocessor based control – Characteristics.

UNIT III	PERMANENT MAGNET BRUSHLESS D.C. MOTORS	9

Principle of operation – Types – Magnetic circuit analysis – EMF and torque equations – Power controllers – Motor characteristics and control.

UNIT IV	PERMANENT MAGNET SYNCHRONOUS MOTORS	9

Principle of operation – EMF and torque equations – Reactance – Phasor diagram– Power controllers - Converter - Volt-ampere requirements – Torque speed characteristics - Microprocessor based control.

UNIT V	COMMUTATOR MOTORS	9

Construction – Principle of operation- Characteristics – Applications – Universal, repulsion motors and linear induction motors.

	TOTAL : 45 PERIODS
OUTCOMES:	After successful completion of the course students able to
•	Use stepper motor for various step angle
•	Control the speed of switched reluctance motor using microprocessor
•	Control the speed of the BLDC motors using power converters
•	Control the speed of PM synchronous motor
•	Identify and characterise commutator motor for applications
TEXT BOOKS:	
1.	K.Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008.
2.	T.Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press London,1984.
3.	E.G.Janardanan, 'Special electrical machines',PHI learning Private Limited, Delhi, 2014.
REFERENCES:	
1.	*T.J.E.Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press, Oxford, 1989.*
2.	*T.Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press London, 1984.*
3.	*P.P.Aearnley, 'Stepping Motors–A Guide to Motor Theory and Practice',Peter Perengrinus London, 1982.*
4.	*T.Kenjoand S.Nagamori, 'Permanent Magnet and Brushless DCMotors', Clarendon Press, London, 1988.*

17EPC704	ENERGY UTILIZATION, CONSERVATION AND AUDITING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge on electric drives and traction systems
- To introduce the energy saving concept by different ways of illumination.
- To understand the different methods of electric heating and electric welding.
- To study various enegy conservation principles
- To study various enegy audit Methodology and its benefits

UNIT I	ELECTRIC DRIVES AND TRACTION	9

Fundamentals of electric drive – choice of an electric motor – application of motors for particular services- traction motors – characteristic features of traction motor-systems of railway electrification- electricbraking- train movement and energy consumption- traction motor control-track equipment and collection gear.

UNIT II	ILLUMINATION	9

Introduction-definition and meaning of terms used in illumination engineering-classification of light sources-incandescent lamps,sodium vapour lamps,mercury vapour lamps, fluorescent lamps–design of illumination systems-indoor lighting schemes- factory lighting halls-outdoor lighting schemes-flood lighting- street lighting- energy saving lamps,LED

UNIT III	HEATING AND WELDING	9

Introduction- advantages of electric heating –modes of heat transfer – methods of electric heating-resistance heating-arc furnaces-induction heating-dielectric heating-electric welding–types-resistance welding-arc welding- power supply for arc welding- radiation welding.

UNIT IV	ENERGY CONSERVATION	9

General energy problem-demand supply gap, Scope for energy conservation and its benefits-Energy conservation Principle –energy saving opportunities in electric motors by Power factor improvement-Energy conservations in air conditioners, compressors,fans,electric furnaces, ovens-lighting techniques – Natural , CFL, LED lighting.

UNIT V	ENERGY AUDITING	9

Energy audit and its benefits- Energy flow diagram- Preliminary, Detailed energy audit-Methodology of –Pre audit, audit and post audit- Energy audit report- Electrical Measuring Instruments: Power Analyser- Combustion analyser,fuel efficiency monitor, thermometer-contact, infrared, pitot tube and manometer, water flowmeter, leak detector, tachometer and luxmeter-IE

rules and regulations for energy audit Electricity act.	
	TOTAL : 45 PERIODS
OUTCOMES:	After successful completion of the course students able to
•	Design traction system
•	Design indoor and outdoor lightening system
•	Design different heating and welding Machines.
•	Apply Energy conservation methods in various loads.
•	Perform energy audit and prepare the report.
TEXTBOOKS:	
1.	N.V.Suryanarayana,"Utilisation of Electric Power",Wiley Eastern Limited,New Age International Limited,1993.
2.	J.B.Gupta,"Utilisation Electric power and Electric Traction",S.K.Kataria andSons,2000.
3.	Paul O Callaghan,' Energy management' Mcgraw Hill, New Delhi.
REFERENCES:	
1.	*R.K.Rajput, Utilisation of Electric Power, Laxmi publications Private Limited., 2007.*
2.	*H.Partab, Art and Science of Utilisation of Electrical Energy", Dhanpat Rai and Co., New Delhi,2004.*
3.	*C.L.Wadhwa, "Generation, Distribution and Utilisation of Electrical Energy", New Age InternationalPvt.Ltd.,2003.*
4.	*S.Sivanagaraju, M.Balasubba Reddy, D.Srilatha,' Generation and Utilization of Electrical Energy', Pearson Education, 2010.*
5.	*'Fundamentals of electrical system', Bureau of Energy Efficiency.*
6.	*www.bee-india.com*

17EPC706	POWER SYSTEM LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To provide better understanding to design and analyse transmission lines
- To provide better understanding to analyse load flow problems using Gauss Seidel method, Newton Raphson method and Fast decoupled power flow method.
- To provide better knowledge to stimulate transients in power systems, power system faults and to carry out stability analysis
- To study Economic Load Dispatch, Unit commitment and Load frequency control of Single area and two area system
- To study the Performance parameters of Circuit Breakers (ACB&VCB).

LISTOF EXPERIMENTS:

1. Modelling and Analysis of Transmission lines.
2.Formation of Network matrices
3. Load flow analysis using Gauss Seidel method, Newton Raphson method and Fast decoupled power flow method.
4. Simulation of power system faults.
5. Stability analysis of SMIB system.
6. Simulation of Transients in power system.
7. Economic Load Dispatch.
8.Unit commitment
9. Load frequency control of Single area and two area system.
10. Simulation of Excitation system.
11. Performance parameters of Circuit Breakers (ACB&VCB).

TOTAL:60 PERIODS

OUTCOMES: After successful completion of the course students able to

- Apply simulation tool to solve power system problems.
- Evaluate the Performance of Circuit Breakers.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1.Personal computers (Pentium-IV,80GB, 512 MBRAM) –25nos

2. Printer laser-1No.

3. Dotmatrix- 1No.

4. Server (Pentium IV, 80GB,1GB RAM) (HighSpeedProcessor) –1No.

5.Software: anypower system simulation software- 5 licenses

6.Any relevant Compliers:25users
7. Air circuit Breaker set up.
8. Vacuum Circuit Breaker Set up.

17EEE707	ELECTRICAL SYSTEM DESIGN LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:	
•	To provide better understanding to design, analyse and fabricate constant voltage power supply
•	To provide better understanding to design, analyse and fabricate variable power supply
•	To provide better understanding to design, analyse and fabricate Driver Circuit to drive an Electromagnetic relay using Microprocessor with required Protection.
•	To provide better understanding to design, analyse and fabricate domestic UPS

LIST OF EXPERIMENTS: (Any Three of the following must be developed like a commercial product)

1. Design, Analysis and Fabrication of 5V Constant Voltage Power supply
2. Design, Analysis and Fabrication of 0-12 V, 1A Variable Power Supply
3. Design, Analysis and Fabrication of Driver Circuit to drive an Electromagnetic relay using Microprocessor with required Protection.
4. Design, Analysis and Fabrication of an isolation circuit using opto coupler which is required for Microcontroller interfacing
5. Design, Analysis and Fabrication of Domestic UPS.

	TOTAL :60 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Design 5V, 12V power supply and UPS.
•	Design the driver circuits.
•	Design the isolation Circuits.

17EEE803	PROJECTWORK	L	T	P	C
		0	0	12	6

OBJECTIVES:	
•	To develop the ability to solve a specific problem right from its identification and literature review til lth esuccessful solution of the same.To train the students in preparing project reports and to face reviews and vivavoce examination.

	TOTAL :180 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	On Completion of the project work students will be in a position to takeup any challenging practical problems and find solution by formulating proper methodology.

LIST OF PROFESSIONAL ELECTIVES

17EPE001	APPLIED SOFT COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To expose the students to the concepts of feed forward neural networks.
- To provide adequate knowledge about feedback neural networks
- To provide adequate knowledge about fuzzy and neuro-fuuzy systems
- To provide comprehensive knowledge of fuzzy logic control to real time systems.
- To provide adequate knowledge of genetic algorithms and its application to economic dispatch and unit commitment problems.

UNIT I	ARCHITECTURES–ANN	9

Introduction–Biological neuron–Artificialneuron–Neuronmodel –Supervisedandunsupervised learning-Singlelayer–Multi layer feed forward network–Learning algorithm-Back propagation network.

UNIT II	NEURAL NETWORKS FOR CONTROL	9

Feedback networks–Discrete time Hopfield networks– Transient response of continuous time system–Applications of artificial neural network-Process identification–Neuro controller for inverted pendulum.

UNIT III	FUZZY SYSTEMS	9

Classical sets– Fuzzysets –Fuzzy relations– Fuzzification – Defuzzification – Fuzzy rules – Membership function–Knowledge base–Decision-making logic–Introduction to neurofuzzy system- Adaptive fuzzy system.

UNIT IV	APPLICATION OF FUZZYLOGIC SYSTEMS	9

Fuzzy logic control: Home heating system-liquid level control-aircraft landing-inverted pendulum–fuzzy PID control, Fuzzy based motor control.

UNIT V	GENETIC ALGORITHMS	9

Introduction-Gradient Search–Non-gradient search–Genetic Algorithms:binary and real representation schemes,selection methods,crossover and mutation operators for binary and real coding-constraint handling methods–applications to economic dispatch and unit commitment problems

	TOTAL : 45 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Design an algorithm for Artificial Neural Network Controller
•	Design a Genetic algorithm
•	Design an algorithm for Fuzzy Logic Controller
•	Apply Fuzzy Logic Controller for specific applications
•	Apply Genetic algorithm for specific applications
TEXT BOOKS:	
1.	Laurance Fausett, Engle woodcliffs, N.J.,'Fundamentals of Neural Networks',Pearson Education,1992
2.	S.N.Sivanandam and S.N.Deepa, Principles of Soft computing, Wiley India Edition, 2nd Edition, 2013.
3.	TimothyJ.Ross,'Fuzzy Logic with Engineering Applications',Tata McGraw Hill,1997.
REFERENCES:	
1.	*Simon Haykin, 'Neural Networks',Pearson Education,2003.*
2.	*John Yen&RezaLangari,'FuzzyLogic–Intelligence Control&Information', Pearson*
3.	*M.Genand R, Cheng, Genetic algorithms and Optimization, Wiley Series in Engineering Design and Automation, 2000.*
4.	*Hagan, Demuth, Beale, "Neural Network Design", Cengage Learning, 2012.*
5.	*N.P.Padhy, "Artificial Intelligence and Intelligent Systems",Oxford,2013*
6.	*William S.Levine, "Control System Advanced Methods," The Control Handbook CRC Press,2011.*

17EPE002	PRINCIPLES OF MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:	
•	To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization.
•	To enable the students to study planning process and planning types.
•	To enable the students to study the organization structure.
•	To enable the students to study the leadership and process of communication.
•	To enable the students to study the System and process of controlling.

UNIT I	INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS	9

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

UNIT II	PLANNING	9

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques– Decision making steps and process.

UNIT III	ORGANISING	9

Natureandpurpose–Formalandinformalorganization–organizationchart–organizationstructure–types – Line andstaffauthority– departmentalization–delegationofauthority –centralizationand decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection,TrainingandDevelopment,PerformanceManagement,Careerplanningandmanagement

UNIT IV	DIRECTING	9

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

UNIT V	CONTROLLING	9

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management

– control and performance – direct and preventive control – reporting.	
	TOTAL : 45 PERIODS
OUTCOMES:	After successful completion of the course students able to
•	Know how to become manager and differentiate with entrepreneur.
•	Ability to become a good planner and successively executing the scheme.
•	Motivate the individuals (workers) to finish the task.
•	Control the process as leader.
TEXT BOOKS:	
1.	Stephen P. Robbins & Mary Coulter, "Management", Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009.
2.	JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", Pearson Education, 6th Edition,2004
REFERENCES:	
1.	*Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management" Pearson Education, 7th Edition, 2011.*
2.	*Robert Kreitner & Mamata Mohapatra, "Management", Biztantra, 2008*.
3.	*Harold Koontz & Heinz Weihrich "Essentials of Management" Tata McGraw Hill,1998*
4.	*Tripathy PC & Reddy PN, "Principles of Management", Tata Mcgraw Hill, 1999.*

17EPE003	BIO MEDICAL INSTRUMENTATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Introduce Fundamentals of Biomedical Engineering
- To Introduce various bio potential electrodes used in Biomedical Engineering
- To study the heart system and its measurements
- To study the measurement of electrical activity in neuromuscular system and brain
- To have a basic knowledge in life assisting and therapeutic devices

UNIT I	FUNDAMENTALS OF BIOMEDICAL ENGINEERING	9

Brief description of musculoskeletal, endocrine, gastrointestinal, nervous, circulatory and respiratory systems; the nature of bioelectricity, action events of nerve; the origin of bio potentials. Basic components of a biomedical system-Kidney and blood flow - Biomechanics of bone - Biomechanics of soft tissues - Basic mechanics of spinal column and limbs.

UNIT II	BIO POTENTIAL ELECTRODES	9

Signal acquisition; electrodes for biophysical sensing; electrode-electrolyte interface; skin preparation, electrode-skin interface and motion artifact; surface electrodes; microelectrodes; Internal electrodes; electrode arrays; electrodes for electric stimulation of tissues; electrode polarization, electrical interference problems in biopotential measurement; electrical safety.

UNIT III	THE HEART SYSTEM AND ITS MEASUREMENTS	9

The heart; electro conduction system of the heart; the ECG waveform; the standard lead system; the ECG preamplifier; ECG machines; Cardiac monitors; Transient protection; common-mode and other interference-reduction circuits, Measurement of blood pressure, spirometer – Photo Plethysmography, Body Plethysmography, finger-tip oxymeter, measurement of blood pCO2, pO2

UNIT IV	MEASUREMENT OF ELECTRICAL ACTIVITY IN NEUROMUSCULAR SYSTEM AND BRAIN	9

Neuron potential; muscle potential; electromyography (EMG); electroencephalography (EEG); EEG electrodes and the 10-20 system; EEG amplitude and frequency bands; the EEG system – simplified block diagram; preamplifiers and EEG system specifications; EEG diagnostic uses and sleep patterns; visual and auditory evoked potential recordings; EEG system artifacts.

UNIT V	IMAGING, LIFE ASSISTING, THERAPEUTIC AND ROBOTIC DEVICES	9

Computer tomography – MRI – Ultrasonography – Endoscopy ,Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio

meters – Dialysers – Lithotripsy - ICCU patient monitoring system - Nano Robots - Robotic surgery – Advanced 3D surgical techniques- Orthopedic prostheses fixation.	
	TOTAL : 45 PERIODS
OUTCOMES:	After successful completion of the course students able to
•	Know electrical signal production and its conduction in human body.
•	Select proper electrode for signal pick up from human body
•	Trace cardiac waveform and characterise its condition
•	Trace brain waveform and characterise its condition
•	Know the different life saving, therapeutic and imaging bio medical systems its importance to patients
TEXT BOOKS:	
1.	Leslie Cromwell, Biomedical Instrumentation and Measurement, Prentice hall of India, New Delhi,2007.
2.	Joseph J.carr and John M. Brown, Introduction to Biomedical Equipment Technology, John Wiley and sons, New York, 4th Edition, 2012.
3.	Khandpur R.S, Handbook of Biomedical Instrumentation, , Tata McGraw-Hill, New Delhi, 2nd Edition, 2003
REFERENCES:	
1.	*John G. Webster, Medical Instrumentation Application and Design, John Wiley and sons, New York, 1998*
2.	*Duane Knudson, Fundamentals of Biomechanics, Springer, 2nd Edition, 2007.*
3.	*Ed. Joseph D. Bronzino, The Biomedical Engineering Hand Book, Third Edition, Boca Raton, CRC Press LLC, 2006.*
4.	*M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.*

17EPE004	FUNDAMENTALS OF NANOSCIENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn about basis of nanomaterial science
- To learn about nanomaterial preparation methods
- To learn about basis of nanomaterial science, preparation method and types
- To learn about nanomaterial characterization techniques
- To study various application fields of nano materials

UNITI	INTRODUCTION	9

Nanoscale Science and Technology-Implications for Physics, Chemistry, Biology and Engineering-Classifications of nano structured materials-nano particles-quantum dots,nano wires-ultra-thin films-multi-layered materials.Length Scales in volved and effecton properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties.Introduction to properties and motivation for study (qualitativeonly).

UNITII	GENERAL METHODS OF PREPARATION	9

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy,Atomic Layer Epitaxy,MOMBE.

UNITIII	NANO MATERIALS	9

Nano forms of Carbon-Buckminster fullerene-graphene and carbon nano tube,Single wall carbon Nanotubes(SWCNT)and Multiwall carbon nanotubes(MWCNT)-methods of synthesis(arc-growth, laser ablation,CVD routes,Plasma CVD),structure-property Relationships applications-Nanometal oxides-ZnO, TiO2,MgO,ZrO2, NiO, nano alumina, CaO,AgTiO2,Ferrites, Nano clays- functionalization and applications-Quantum wires,Quantum dots-preparation,properties and applications.

UNITIV	CHARACTERIZATION TECHNIQUES	9

X-ray diffraction technique, Scanning Electron Microscopy- environmental techniques,Transmission Electron Microscopy including high-resolution imaging ,Surface Analysis techniques -AFM,SPM, STM,SNOM,ESCA,SIMS-Nano indentation.

UNITV	APPLICATIONS	9

NanoInfoTech:Information storage- nano computer,molecular switch,super chip,nanocrystal, Nanobiotechlogy:nano probes in medical diagnostics and biotechnology,Nano medicines, Targetted drug delivery,Bioimaging-Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical

Systems(NEMS)-Nano sensors, nano crystalline silver for bacterial inhibition,Nano particles for sunbarrier products- In Photostat,printing,solar cell,battery.	
	TOTAL:45PERIODS
OUTCOMES:	After successful completion of the course students able to
•	Familiarize about the science of nano material
•	Demonstrate the preparation of nano material
•	Develop knowledge in characteristic nano material
•	Apply Nano Science into the applications
TEXTBOOKS:	
1.	A.S.Edelstein and, R.C.Cammearata,eds.,"Nano materials: Synthesis,Properties and Applications",Institute of Physics Publishing,Bristol andPhiladelphia, 1996
2.	NJohn Dinardo,"Nano scale Charecterisation of surfaces &Interfaces",2nd edition, Weinheim Cambridge,Wiley-VCH,2000.
REFERENCES:	
1.	*G Timp,"Nano technology",AIP press/Springer,1999*
2.	*Akhlesh Lakhtakia,"The Hand Bookof NanoTechnology,Nanometer Structure, Theory,Modeling and Simulations".Prentice-Hall of India(P) Ltd,NewDelhi,2007.*

17EPE005	HIGH VOLTAGE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the various types of over voltages in power system and protection methods.
- Generation of over voltages in laboratories.
- Measurement of over voltages.
- Nature of Breakdown mechanism in solid, liquid and gaseous dielectrics.
- Testing of power apparatus and insulation coordination.

UNIT I	OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS	9

Causes of overvoltages and its effects on power system–Lightning,switching surges and temporary overvoltages,Corona and its effects–Reflectionand Refractionof Travelling waves- Protection against overvoltages

UNIT II	DIELECTRIC BREAKDOWN	9

Gaseous breakdown in uniform and non-uniform fields–Corona discharges–Vacuum breakdown–Conduction and breakdown in pure and commercial liquids,Maintenance of oil Quality – Breakdown mechanisms in solid and composite dielectrics.

UNIT III	GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS	9

Generationof High DC: Voltage doubler, Voltage multiplier circuits and Van de Graff generator, Generationof High AC: Cascade Transformer and Resonant transformer, Circuits for impulse voltagesand currents generation- Tripping and control of impulse generator.

UNIT IV	MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS	9

High Resistance with series ammeter–Dividers,Resistance,Capacitance and Mixed dividers- Peak Voltmeter,Generating Voltmeters-Capacitance Voltage Transformers,Electrostatic Voltmeters–Sphere Gaps- High current shunts- Digital techniques in high voltage measurement.

UNIT V	HIGH VOLTAGE TESTING & INSULATION COORDINATION	9

High voltage testing of electrical power apparatus as per International and Indianstandards–Power frequency,impulse voltage and DC testing of Insulators, circuit breakers, bushing,isolators and transformers- Insulation Coordination.

TOTAL : 45 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Explain the causes and effects of over voltages and transients
•	Know the electrical breakdown on various medium
•	Design the generation circuit of overvoltage, impulse voltage and Current.
•	Measure the overvoltage and current using various components.
•	Test the electrical apparatus against overvoltages and impulse current.
TEXT BOOKS:	
1.	M.S.Naidu andV.Kamaraju,'High Voltage Engineering',Tata McGraw Hill,Fifth Edition, 2013.
2.	E.Kuffel and W.S.Zaengl, J.Kuffel,'High voltage Engineering fundamentals ',Newnes Second Edition Elsevier ,New Delhi,2005.
3.	Subir Ray,'An Introduction to High Voltage Engineering'PHI Learning Private Limited, New Delhi, Second Edition, 2013.
REFERENCES:	
1.	*L.L.Alston,'High Voltage Technology',Oxford UniversityPress,First Indian Edition, 2011.*
2.	*C.L.Wadhwa,'High voltage Engineering',NewAge International Publishers,Third Edition,2010*

17EPE006	OPTIMIZATION TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the basic concepts of linear programming
- To educate on the advancements in Linear programming techniqu
- To introduce non-linear programming techniques
- To introduce the interior point methods of solving problems
- To introduce the dynamic programming method

UNITI	LINEAR PROGRAMMING	9

Introduction - formulation of linear programming model-Graphical solution–solving LPP using simplex algorithm – Revised Simplex Method.

UNITII	ADVANCES IN LPP	9

Dualittheory-Dual simplex method-Sensitivity analysis–-Transportation problems–Assignment problems-Traveling salesman problem –Data Envelopment Analysis.

UNITIII	NON LINEAR PROGRAMMING	9

Classification of Non Linear programming– Lagrange multiplier method –Karush –KuhnTucker conditions–Reduced gradient algorithms–Quadratic programming method –Penaltyand Barrier method.

UNITIV	INTERIOR POINT METHODS	9

Karmarkar's algorithm–Projection Scaling method–Dual affine algorithm–Primal affine algorithm Barrier algorithm.

UNITV	DYNAMIC PROGRAMMING	9

Formulation of Multi stage decision problem–Characteristics–Concept of sub-optimization and the principle of optimality–Formulation of Dynamic programming–Backward and Forward recursion–Computational procedure–Conversion of final value problem into Initialvalue problem.

TOTAL:45PERIODS

OUTCOMES: After successful completion of the course students able to

- Explain the methods of Linear Programming Problem
- Explain the methods of Non Linear Programming Problem
- Know the Interior Point Methods

•	Explain the methods of Dynamic Programming
TEXTBOOKS:	
1.	Hillier and Lieberman“Introduction to Operations Research”,TMH, 2000.
2.	R.Panneerselvam,“Operations Research”,PHI,2006
3.	HamdyATaha,“Operations Research –An Introduction”,Prentice Hall India,2003.
4.	SS RAO : ‘Optimization: Theory and Applications’ Wiley Eastern, 1979.
REFERENCES:	
1.	*Philips,Ravindran and Solberg,“Operations Research”,JohnWiley,2002.*
2.	*Ronald L.Rardin, “Optimization in Operation Research” Pearson Education Pvt. Ltd.New Delhi, 2005.*

17EPE007	MICRO ELECTRO MECHANICAL SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- To educate on the rudiments of Micro fabrication technique
- To introduce various sensors and actuators
- To introduce different materials used for MEMS
- To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

UNIT I	INTRODUCTION:	9

Intrinsic Characteristics of MEMS–Energy Domains and Transducers-Sensorsand Actuators – Introduction to Micro fabrication-Silicon based MEMS processes–New Materials–Review of Electrical and Mechanical concepts in MEMS–Semi conductor devices–Stress and strain analysis– Flexural beam bending- Torsional deflection.

UNIT II	SENSORS AND ACTUATORS I	9

Electrostatic sensors–Parallel plate capacitors–Applications–Interdigitated Finger capacitor–Combdrive devices–Micro Grippers–Micro Motors- Thermal Sensing and Actuation–Thermal expansion–Thermal couples–Thermal resistors–Thermal Bimorph- Applications–Magnetic Actuators–Micromagnetic components–Case studies of MEMS in magnetic actuators-Actuation using Shape Memory Alloys

UNIT III	SENSORS AND ACTUATORS II	9

Piezoresistive sensors–Piezoresistive sensor materials- Stress analysis of mechanical elements–Applications to Inertia, Pressure,Tactile and Flow sensors–Piezoelectric sensors and actuators–piezoelectric effects–piezoelectric materials– Applications toInertia,Acoustic,TactileandFlow sensors.

UNIT IV	MICROMACHINING	9

Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process.

UNIT V	POLYMERAND OPTICALMEMS	9

Polymersin MEMS–Polimide-SU-8-Liquid Crystal Polymer (LCP) –PDMS–PMMA–Parylene– Fluoro carbon- Application to Acceleration, Pressure, Flow and Tactile sensors-

Optical MEMS– Lenses and Mirrors–Actuators for Active Optical MEMS.	
	TOTAL : 45 PERIODS
OUTCOMES:	After successful completion of the course students able to
•	Fabricate MEMS devices.
•	Design sensors and actuators for MEMS.
•	Do micromachining process.
•	Apply recent MEMS into physical applications.
TEXT BOOKS:	
1.	Chang Liu,'Foundations of MEMS',PearsonEducationInc., 2012.
2.	Stephen DSenturia, 'Microsystem Design',Springer Publication,2000.
3.	Tai RanHsu,"MEMS&MicrosystemsDesignandManufacture"TataMcGrawHill, NewDelhi,2002.
REFERENCES:	
1.	*Nadim Maluf,"An Introduction to Micro Electro Mechanical System Design",Artech House,2000.*
2.	*Mohamed Gad-el-Hak, editor, " The MEMS Handbook",CRC press BacoRaton, 2001.*
3.	*Julian w.Gardner, VijayK.Varadan, OsamaO.Awadelkarim,Micro Sensors MEMS.*
4.	*JamesJ.Allen,Micro Electro Mechanical System Design,CRC Press Publisher, 2005.*
5.	*Thomas M.Adams and Richard A.Layton,"Introduction MEMS,Fabrication and Application,"*

17EPE008	ADVANCED CONTROL SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide knowledge on design in state variable form
- To provide knowledge in phase plane analysis
- To give basic knowledge in describing function analysis
- To study the design of optimal controller
- To study the design of optimal estimator including Kalman Filter

UNIT I	STATE VARIABLE CONTROLLER DESIGN	9

Introduction to state Model- effect of state Feedback- Necessary and Sufficient Condition for ArbitraryPole-placement- pole placement Design- design of state Observers- separation principle- servodesign: -State Feedback with integral control.

UNIT II	PHASE PLANE ANALYSIS	9

Features of linear and non-linear systems - Common physical non-linearities – Methods oflinearization Concept of phase portraits – Singular points – Limit cycles – Construction of phaseportraits – Phase plane analysis of linear and non-linear systems – Isocline method.

UNIT III	DESCRIBING FUNCTION ANALYSIS	9

Basic concepts, derivation of describing functions for common non-linearities – Describingfunction analysis of non-linear systems – limit cycles – Stability of oscillations.

UNIT IV	OPTIMAL CONTROL	9

Introduction –Continuous Time Linear State Regulator – Discrete Time Linear State Regulator – Solution of Ricatti'sequation.

UNIT V	OPTIMAL ESTIMATION	9

Optimal estimation – Kalman- Bucy Filter-Solution by duality principle-Discrete systems-KalmanFilter.

TOTAL : 45 PERIODS

OUTCOMES:

After successful completion of the course students able to

- Design in state variable form.
- Understand the phase plane analysis.
- Understand the describing function analysis.
- Design of optimal controller.

•	Design of optimal estimator including Kalman Filter.
TEXT BOOKS:	
1.	M.Gopal, "Digital Control & State Variable Methods", Tata McGraw Hill, 4th EDITION, 2012
2.	I.J. Nagrath and M.Gopal, "Control Systems Engineering", New Age International Publishers, 5thEdition, 2010.
3.	Richard C. Dorf, "Modern control systems",8th Edition, Addison Wesley, 2012.
REFERNCES:	
1.	*K.Ogatta, "Discrete time control system", PHI, 2010.*
2.	*B.C.Kuo," Digital Control Systems", SRL Publication, 1997.*
3.	*M. Gopal, "Control Systems Principles and Design", TATA Mcgraw hill, 3 Edition, 2010*
4.	*M.Gopal," Modern control system theory", New Age International Publishers, 2002*

17EPE009	POWER QUALITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the power quality problem
- To educate on production of voltages sags, over voltages and harmonics and methods of control.
- To study overvoltage problems
- To study the sources and effect of harmonics in power system
- To impart knowledge on various methods of power quality monitoring.

UNITI	INTRODUCTIONTOPOWER QUALITY	9

Termsand definitions: Overloading-undervoltage-overvoltage.Concepts of transients-short duration variations such as interruption-long duration variation such as sustained interruption. Sags and swells-voltagesag-voltageswell-voltage imbalance-voltage fluctuation - power frequency variations.International standards of power quality. Computer Business Equipment Manufacturers Associations (CBEMA) curve.

UNITII	VOLTAGE SAGS AND INTERRUPTIONS	9

Sources of sags and interruptions- estimating voltage sag performance.Thevenin'sequivalentsource –analysis and calculation of various faulted condition.Voltage sag due to induction motor starting. Estimation of the sagseverity- mitigation of voltage sags, active series compensators. Static transfer switchesandfasttransfer switches.

UNITIII	OVERVOLTAGES	9

Sources of over voltages - Capacitor switching – lightning - ferro resonance. Mitigation of voltage swells - surge arresters - low pass filters - power conditioners. Lightning protection – shielding - line

Arresters - protection of transformers and cables. An introduction to computer analysis tools for transients, PSCAD and EMTP.

UNITIV	HARMONICS	9

Harmonicsources from commercial and industrial loads, locating harmonic sources.Power system response characteristics- HarmonicsVs transients.Effect of harmonics- harmonic distortion- voltage and current distortion - harmonic indices - inter harmonics – resonance. Harmonic distortion evaluation-devices for controlling harmonic distortion-passive and active filters.

UNITV	POWER QUALITYMONITORING	9

Monitoring considerations - monitoring and diagnostic techniques for various power quality problems - modelling of power quality (harmonics and voltage sag) problems by mathematical simulation tools - power line disturbance analyzer – quality measurement equipment - harmonic / spectrum analyzer - flicker meters -Applications of expert systems for power quality monitoring.	
	TOTAL:45PERIODS
OUTCOMES:	After successful completion of the course students able to
•	Classify the power quality issues.
•	Explain IEEE and IEC standards of power quality.
•	Analyze and mitigate the voltage sag, over voltages and interruptions.
•	Analyze the harmonic distortion and design the components to reduce harmonics.
•	Explain power quality monitoring devices.
TEXTBOOKS:	
1.	Roger.C.Dugan, Mark.F.Mc Granagham,Surya Santoso,H.Wayne Beaty,'Electrical Power Systems Quality' McGrawHill,2003.
2.	Edward.F.Fucksand M.A.S.Masoum,"Power Quality in Power System and Electrical Machines," Elsevier Academic Press, 2013.
3.	J.Arrillaga , N.R.Watson, S.Chen,'Power System Quality Assessment',Wiley, 2011.
REFERENCES:	
1.	*G.T.Heydt,'Electric Power Quality', 2nd Edition. (West Lafayette,IN,Starsina Circle Publications,1994).*
2.	*M.H.JBollen,'Understanding Power Quality Problems:Voltage Sags and Interruptions',(New York:IEEEPress, 1999).(For Chapters1,2,3and5)*
3.	*G.J.Wakileh,"Power Systems Harmonics–Fundamentals, Analysis and Filter Design,"Springer 2007.*
4.	*E.Aehaand M.Madrigal, "Power System Harmonics, Computer Modelling and Analysis,"Wiley India,2012.*
5.	*R.S.Vedam, M.S.Sarma,"Power Quality–VAR Compensation in Power Systems," CRC Press 2013.*
6.	*C.Sankaran,'Power Quality',CRC press,Taylor&Francis group,2002.*

17EPE010	SYSTEM IDENTIFICATION AND ADAPTIVE CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce Non parametric methods
- To impart knowledge on parameter estimation metho
- To impart knowledge on Recursive identification methods
- To impart knowledge on Adaptive control schemes
- To introduce stability, Robustness and Applications of adaptive control method

UNIT I	NON PARAMETRIC METHODS	9

Non parametric methods:Transient analysis–frequency analysis–Correlation analysis–Spectral analysis

UNIT II	PARAMETER ESTIMATION METHODS	9

Least square estimation–bestlinear unbiased estimation under linear constraints–updating the parameter estimates for linear regression models–prediction error methods: description of prediction methods– optimal prediction – relation between prediction error methods and other identification methods–theoretical analysis- Instrumental variable methods:Description of instrumental variable methods–Inputsignal design for identification.

UNIT III	RECURSIVE IDENTIFICATION METHODS	9

The recursive least square method –there cursive instrumental variable methods- there cursive prediction error methods–Maximum likelihood.Identification of systems operating in closed loop: Identifiability considerations–direct identification–indirect identification.

UNIT IV	ADAPTIVE CONTROL SCHEMES	9

Introduction –Types of adaptive control–Gain scheduling controller–Model reference adaptive control schemes–Selftuning controller–MRAC and STC: Approaches–The Gradient approach– Lyapunov functions– Passivity theory– pole placement method–Minimum variance control – Predictive control.

UNIT V	ISSUES IN ADAPTIVE CONTROL AND APPLICATIONS	9

Stability– Convergence–Robustness–Applications of adaptive control.

TOTAL:45PERIODS

OUTCOMES: After successful completion of the course students able to

•	Apply non parametric methods to control problems
•	Apply parameter estimation methods to control problems
•	Apply recursive identification methods to control problems
•	Apply adaptive control schemes to control problems
TEXTBOOKS:	
1.	Soder Storm TandPeter Stoica, " System Identification", Prentice Hall International, 1989.
2.	Astrom,K.J.andWittenmark,B.,"Adaptive Control",Pearson Education,2nd Edition,2001
3.	Sastry,S. and Bodson,M.," Adaptive Control–Stability,Convergence and Robustness",Prentice Hall inc.,New Jersey,1989.
REFERENCES:	
1.	*LjungL,System Identification:Theoryfor theuser,Prentice Hall,Engle wood Cliffs, 1987.*
2.	*Bela.G.Liptak.,"Process Control and Optimization".,Instrument Engineers' Handbook.,volume 2,CRC press and ISA, 2005.*
3.	*WilliamS.Levine,"Control Systems Advanced Methods,the Control Handbook,CRC Press, 2011.*

17EPE011	MICROCONTROLLER BASED SYSTEM DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the architecture of PIC microcontroller
- To educate on use of interrupts and timers To educate on the peripheral devices for data communication and transfer
- To introduce the functional blocks of ARM processor
- To educate on the architecture of ARM processors
- To educate on design applications of ARM processors

UNITI	INTRODUCTION TO PIC MICROCONTROLLER	9

Introduction to PIC Micro controller–PIC16C6x and PIC16C7xArchitecture–PIC16cxx–-Pipelining- Program Memory considerations–Register File Structure-Instruction Set-Addressing modes – Simple Operations.

UNITII	INTERRUPTS AND PERIPHERALS INTERFACING	9

PIC microcontroller Interrupts- External Interrupts-Interrupt Programming–Loop time subroutine-Timers-Timer Programming–Frontpanel I/O-Soft Keys–State machines and key switches–Display of Constant and Variable strings- I^2C Bus for Peripherals Chip Access–Bus operation-Bus subroutines–Serial EEPROM—Analog to Digital Converter–UART-Baud rate selection–Data handling circuit–Initialization- LCD and keyboard Interfacing-ADC,DAC, and Sensor Interfacing.

UNITIII	INTRODUCTION TO ARM PROCESSOR	9

ARM Architecture–ARM programmer's model–ARM Development tools-MemoryHierarchy–ARM Assembly Language Programming–Simple Examples–Architectural Support for Operating systems.

UNITIV	ARM ORGANIZATION	9

3-Stage Pipeline ARM Organization– 5-Stage Pipeline ARM Organization–ARM Instruction Execution-ARM Implementation–ARM InstructionSet–ARM co processor interface–Architectural support for High Level Languages–Embedded ARM Applications.

UNITV	DESIGN APPLICATIONS	9

Generation of Gate signals for converters and Inverters – Motor Controls – Controlling of DC/ AC appliances –Temperature Control Applications- Monitoring: Overvoltage, Under voltage and

Overcurrent- Measurement of frequency – Stand-alone Data Acquisition System applications.	
	TOTAL:45PERIODS
OUTCOMES:	After successful completion of the course students able to
•	Explain the architecture and programming of PIC microcontrollers.
•	Interface various peripherals to PIC microcontrollers.
•	Explain architecture, Programming and organization of ARM processor.
•	Apply ARM processor to Various applications
TEXTBOOKS:	
1.	Peatman,J.B.,"Design with PIC MicroControllers"Pearson Education,3rdEdition,2004.
2.	Furber,S.,"ARM System on Chip Architecture"AddisonWesley trade Computer Publication
REFERENCES:	
1.	*Rajkamal,".Microcontrollers-Architecture, Programming, Interfacing & System Design",2ed ,Pearson,2012.*
2.	*Mazidi, M.A., "PIC Microcontroller" RollinMckinlay, Dannycausey Printice Hall ofIndia, 2007.*

17EPE012	HIGH VOLTAGE DIRECT CURRENT TRANSMISSION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concept, planning of DC power transmission and comparison with AC Power transmission.
- To analyze HVDC converters.
- To study about the HVDC system control.
- To analyze harmonics and design of filters.
- To model and analysis the DC system under study state.

UNIT I	INTRODUCTION	9

DC Power transmission technology–Comparison of AC and DC transmission–Application of DC transmission–Description of DC transmission system– Planning for HVDC transmission–Modern trends in HVDC technology–DC breakers–Operating problems–HVDC transmission based on VSC–Types and applications of MTDC systems.

UNIT II	ANALYSIS OF HVDC CONVERTERS	9

Line commutated converter-Analysis of Graetz circuit with and without overlap-Pulse number – Choice of converter configuration–Converter bridge characteristics –Analysis of a 12 pulse converters– Analysis of VSC topologies and firing schemes.

UNIT III	CONVERTER AND HVDC SYSTEM CONTROL	9

Principles of DC link control–Converter control characteristics–System control hierarchy–Firing angle control–Current and extinction angle control–Starting and stopping of DC link–Power control– Higher level controllers–Control of VSC based HVDC link.

UNIT IV	REACTIVE POWER AND HARMONICS CONTROL	9

Reactive power requirements in steady state–Sources of reactive power–SVC and STATCOM – Generation of harmonics–Design of AC and DC filters–Active filters.

UNIT V	POWER FLOWANALYSIS IN AC/DC SYSTEMS	9

Per unit system for DC quantities–DC system model–Inclusion of constraints–Power flow analysis Case study.

	TOTAL:45PERIODS
OUTCOMES:	After successful completion of the course students able to
•	Understand the concepts of DC transmission Technology
•	Apply and Analysis of HVDC Converters
•	Explain about HVDC system control
•	Explain about Reactive Power control
•	Explain about Harmonics control
TEXTBOOKS:	
1.	Padiyar,K.R.,"HVDC power transmission system",New Age International (P) Ltd.,NewDelhi, Second Edition,2010.
2.	Edward Wilson Kimbark,"Direct Current Transmission",Vol.I,Wiley interscience,NewYork, London,Sydney,1971.
3.	Arrillaga,J.,"High Voltage Direct Current Transmission",Peter Pregrinus,London,1983.
REFERENCES:	
1.	*KundurP ., "Power System Stability and Control", McGraw-Hill, 1993.*
2.	*Colin Adamson and Hingorani NG,"High Voltage Direct Current Power Transmission",Garraway Limited,London,1960*
3.	*RakoshDas Begamudre, "Extra High Voltage AC Transmission Engineering" , New Age International (P)Ltd.,NewDelhi,1990.*

17EPE013	EMBEDDED SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To studt the characteristics of Embedded systems and its architectures.
- To study the types of embedded architectures and its variants.
- To Understand the CPU bus and its protocols.
- To study the operation of real time operating systems.
- To understand the operation of control systems applications of electrical engineering and design the same.

UNIT I	INTRODUCTION	9

Characteristics of Embedding Computing Applications-Concept of Real time Systems,- Challenges in Embedded System Design- Design Process- Requirements, Specifications, Architecture Design- Designing of Components and System Integration.

UNIT II	EMBEDDED SYSTEM ARCHITECTURE	9

Instruction Set Architecture-CISC architecture [8051] and RISC instruction set architecture [ARM processors], DSP Processors, Harvard Architecture-PIC. Co- processors and Hardware Accelerators, Processor Performance Enhancement- Pipelining, Super-scalar Execution, CPU Power Consumption, Memory System Architecture-, Caches, Virtual Memory, Memory management unit and address Translation.

UNIT III	DESIGNING EMBEDDED COMPUTING PLATFORM	9

Designing with Processors-System Architecture, Hardware Design, and Implementation-Development Environment, Debugging Techniques, Manufacturing and Testing. Design Using CPU Bus: Bus Protocols, Bus Organization, I/O Device Interfacing, Interfacing Protocols-GPIB, FIREWIRE, USB, Watchdog Timers.

UNIT IV	OPERATING SYSTEMS	9

Kernel Features: Real-time Kernels, Polled Loops System, Co-routines, Interrupt- driven System, Multi-rate System, Processes and Threads, Context Switching, Cooperative Multi-tasking, Pre-emptive Multi-tasking. Scheduling-Rate-Monotonic Scheduling, Earliest-Deadline First Scheduling, Task Assignment, Fault-Tolerant Scheduling. Inter-process Communication-Real-time Memory Management: Stack Management, Dynamic Allocation-Evaluating and Optimizing Operating System Performance-Response.

UNIT V	- EMBEDDED CONTROL APPLICATIONS	9
Open-loop and Closed Loop Control Systems-Application Examples-Washing Machine, Automotive Systems, Auto-focusing digital camera, Air-conditioner, Elevator Control System, ATM System.		
	TOTAL : 45 PERIODS	

OUTCOMES:	After successful completion of the course students able to
•	Understand the characteristics of Embedded systems and its architectures.
•	Understand the types of embedded architectures and its variants.
•	Understand and use the CPU bus and its protocols.
•	Understand the operation of real time operating systems.
•	Explain the operation of control systems applications of electrical engineering and design the same.

TEXT BOOKS:

1.	Stewart, James W, Miao, Kai X, "8051 Microcontroller: Hardware, Software and Interfacing", 2nd Edition, Prentice Hall.
2.	Arnold S. Berger – Embedded System Design CMP books, USA 2002
3.	David E. Simon, "An Embedded Software Primer", Pearson Education, 1999.
4.	A.S.Tenenbaum,"Modern Operating System" Pearson Education International, Third Edition,2006.

REFERENCES:

1.	*Wayne wolf, "Computers as components", Morgan Kaufmann publishers, 2nd Edition, 2008.*
2.	*Ayala. K.J. "The 8051 Microcontroller", Penram International, 1991.*
3.	*Dr. Prasad, "Embedded Real Time System", Wiley Dreamtech, 2004.*
4.	*Jean J.Labrosse, "Embedded system building blocks", CMP books, 2nd Edition, 1999.*
5.	*Arnold berger, "Embedded system design", CMP books, 1st Edition, 2001.*
6.	*Narayan and gong, "Specifications and design of embedded systems", Pearson education, 2nd Edition, 1999*
7.	*Raj Kamal, "Embedded Systems", TMH,first edition, 2004.*

17EPE014	POWER ELECTRONICS FOR RENEWABLE ENERGYSYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study importance of renewable energy systems in distributed generation
- To analyse and comprehend the various operating modes of solar energy systems and develop maximum power point tracking algorithm
- To analyse and comprehend the various operating modes of wind electrical generators and develop maximum power point tracking algorithm
- To impart knowledge on fuel cell systems
- To Provide knowledge about various hybrid renewable energy systems

UNIT I	INTRODUCTION:	9

Importance of renewable energy, renewable energy systems in distributed power system, Need for Distributed generation, current scenario in Distributed Generation, Planning of DGs.

UNIT II	PHOTOVOLTAIC SYSTEMS AND ITS GRID INTEGRATION	9

Basics of Photovoltaic, Maximum Power Point Tracking (MPPT) techniques, Sizing of stand-Alone PV systems, Inverters for grid-connected PV system: Line commutated, self-commutated with high frequency transformer, central-plant inverter, multiple string inverter, module integrated inverter.

UNIT III	WIND POWER SYSTEMS	9

Basics of wind power, Fixed speed and variable speed wind turbines, storm strategies, MPPT techniques Induction generators, synchronous generators, half scale, full scale and PMSG for wind energy systems, Stand-alone systems, and grid connected wind power systems.

UNIT IV	FUEL CELL SYSTEMS	9

Introduction to fuel cell systems, types of fuel cell systems, Power Electronic Interface of fuel cell systems, Fuel cell/Battery Hybrid systems.

UNIT V	HYBRID RENEWABLE ENERGY SYSTEMS	9

Need for Hybrid Systems- Range and type of Hybrid systems, wind-diesel system, wind-PV system, micro hydro-PV system, biomass-PV-diesel system, PV-Fuel cell hybrid system.

TOTAL : 45 PERIODS

OUTCOMES: After successful completion of the course students able to

- Apply Distributed generation in existing power systems.
- Design PV cell integrated solar power system
- Design controllers for wind power systems.
- Apply fuel cells in renewable energy integrated power systems.
- Design the converter system for hybrid renewable energy sources.

TEXT BOOKS:

1. Volker Quaschning, James & James, “Understanding Renewable Energy Systems”, Earth scan, 2005.

2.	M.GodoySimoes, Felix A. Farret, "Renewable Energy Systems – Design and Analysis with Induction Generators", CRC press, 2nd edition 2007
3.	Siegfried Heir, "Grid Integration of Wind Energy Systems", John Willey & Sons; 2nd Edition, 2006.
REFERENCES:	
1.	*Mohammed H. Rashid, "Power Electronics Handbook", Elsevier, 2011.*
2.	*.Nick Jenkins, Ron Allan, Peter Crossley, David Kirchen and GoranStrbac, "Embedded Generation" IET Power and Energy series, London-2000.*
3.	*M. P. Kazmierkowski, R. Krishnan, J.D. Irwin, "Control in Power Electronics: Selected Problems", Academic Press; 2002.*
4.	*James Larminie and Andrew Dicks, "Fuel Cell Systems Explained", John Wiley & Sons; 2nd edition, 2003.*

17EPE015	FLEXIBLE AC TRANSMISSION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the reactive power control techniques
- To educate on static VAR compensators and their applications
- To provide knowledge on Thyristor controlled series capacitors
- To educate on STATCOM devices
- To provide knowledge on FACTS controllers

UNIT I	INTRODUCTION	9

Reactive power control in electrical power transmission lines-Uncompensated transmission line- series compensation–Basic concepts of Static Var Compensator (SVC)–Thyristor Controlled Series capacitor (TCSC)–Unified power flow controller (UPFC).

UNIT II	STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS	9

Voltage control by SVC–Advantages of slope in dynamic characteristics–Influence of SVC on system voltage–Design of SVC voltage regulator–Modelling of SVC for power flow and fast transient stability–Applications:Enhancement of transient stability–Steady state power transfer – Enhancement of power system damping.

UNIT III	THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) AND APPLICATIONS	9

Operation of the TCSC–Different modes of operation–Modelling of TCSC–Variable reactance model–Modelling for Power Flow and stability studies.Applications: Improvement of the system stability limit–Enhancement of system damping.

UNIT IV	VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS	9

Static Synchronous Compensator (STATCOM)–Principle of operation–V-I Characteristics. Applications: Steady state power transfer-enhancement of transient stability- prevention of voltage instability. SSSC-operation of SSSC and the control of power flow–modelling of SSSC in load flow and transient stability studies.

UNIT V	CO-ORDINATION OF FACTS CONTROLLERS	9

Controller interactions–SVC –SVC interaction–Co-ordination of multiple controllers using linear control techniques–Control coordination using genetic algorithms.

	TOTAL : 45 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Design static VAR compensator
•	Design TCSC and various Facts controllers
•	Explain Voltage Source Converter
•	Explain coordination of multiple controllers
TEXT BOOKS:	
1.	R.MohanMathur, RajivK.Varma, "Thyristor –Based Facts Controllers for Electrical Transmission Systems", IEEE press and John Wiley&Sons, Inc,2002.
2.	Narain G.Hingorani, "Understanding FACTS-Concepts and Technology of Flexible AC Transmission Systems", Standard Publishers Distributors, Delhi 2011.
3.	K.R.Padiyar," FACTS Controllers in Power Transmission and Distribution", New Age International (P) Limited, Publishers, NewDelhi, 2008.
REFERENCES:	
1.	*A.T.John,"Flexible A.C. Transmission Systems",Institution of Electrical and Electronic Engineers(IEEE),1999.*
2.	*V.K.Sood, HVDC and FACTS controllers Applications of Static Converters in Power System, APRIL 2004, Kluwer AcademicPublishers,2004.*
3.	*Xiao Ping Zang, Christian Rehtanz and BikashPal, "Flexible AC Transmission System: Modelling and Control"Springer, 2012*

17EPE016	POWER SYSTEM DYNAMICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the basics of dynamics and stability problems
- To educate on modeling of synchronous machines
- To educate on the excitation system and speed-governing controllers.
- To study small signal stability of a single-machine infinite bus system with excitation system and power system stabilizer.
- To educate on the transient stability simulation of multi machine power system.

UNIT I INTRODUCTION 9

Concept and importance of stability in power system operation and design- distinction between transient and dynamic stability-complexity of stability problem in large system-Need for reduced models- stability of interconnected systems.

UNIT II MACHINE MODELING 9

Park'stransformation- flux linkageequations,currentspace model-per unit conversion-normalizing theequations- equivalent circuit- flux linkage state space model- Simplified models(oneaxis andconstant flux linkage)- steadystate equations andphasordiagrams.

UNIT III MACHINE CONTROLLERS 9

Exciter and voltage regulators- function of excitation systems, types of excitation systems-typical excitation system configuration-block diagram and state space representation of IEEE type1 excitation system-saturation function- stabilizing circuit-Function of speed governing systems-block diagram and state space representation of IEEE mechanical hydraulic governor and electrical hydraulic governors for hydro turbines and steam turbines.

UNIT IV TRANSIENT STABILITY 9

State equation for multi machine simulation withoneaxismodel-transient stability simulation of multi machinepower system with one axis machine model including excitation system and speed governing system using R-K method of fourth order (Gill's technique)- power system stabilizer.

UNIT V DYNAMIC STABILITY 9

System response to small disturbances- Linear model of the unregulated synchronous machine and its modes of oscillation-regulated synchronous machine- distribution of power impact-linearization of the load equation for the one machine problem – Simplified linear model-effect

of excitation on dynamic stability- approximate system representation- supplementary stabilizing signals- dynamic performance measure- small signal performance measures.	
	TOTAL : 45 PERIODS
OUTCOMES:	After successful completion of the course students able to
•	Analyse various types of stability
•	Design synchronous machines based on flux in power system.
•	Design excitation systems and speed regulation systems
•	Analyse transient stability and design power system stabilizer.
•	Analyse the dynamic stability.
TEXT BOOKS:	
1.	Kundur.P, "PowerSystem Stability andControl", McGraw Hill Inc., USA,1994
2.	Anderson.P.M and Fouad.A.A, "Power System Control and Stability" GalgotiaPublications, New Delhi, 2003
3.	R.Ramanujam, "Power System Dynamics – Analysis and Simulation", PHI, 2009.
REFERENCES:	
1	*Pai. M.A and Sauer.W, "Power System Dynamics and Stability", Pearson Education Asia, India, 2002.*
2.	*JamesA.Momoh, Mohamed.E.EI-Hawary. "Electric Systems, Dynamics and Stability with Artificial Intelligence applications", Marcel Dekker, USA First Edition, 2000.*
3.	*C.A.Gross,"Power System Analysis,"WileyIndia,2011.*
4.	*B.M.Weedy, B.J.Lory, N.Jenkins, J.B.Ekanayake and G.Strbac," Electric Power Systems",Wiley India,2013.*
5.	*K.Umarao,"Computer Techniques and Models in Power System," I.K.International, 2007.*

17EPE017	PRINCIPLES OF ROBOTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the basics concepts and drives system of robot
- To impart knowledge on end effectors and robor controls
- To educate on various coordinates transformations and sensors
- To study robot cell design and robot applications
- To introduce application oriented Micro/ Nano robotics systems

UNIT I	BASIC CONCEPTS	9

Brief history-Types of Robot–Technology-Robot classifications and specifications-Applications- Robot anatomy-Manipulation and Control-Robot Drive systems Hydraulic, Pneumatic and Electric system- Programming languages.

UNIT II	END EFFECTORS AND ROBOT CONTROLS	9

Mechanical grippers-Slider crank mechanism, Screw type, Rotary actuators, cam type-Magnetic grippers-Vacuum grippers-Air operated grippers-Gripper force analysis-Gripper design-Simple problems-Robot controls-Point to point control, Continuous path control, Intelligent robot-Control system for robot joint-Control actions-Feedback devices-Encoder, Resolver, LVDT-Motion Interpolations-Adaptive control.

UNIT III	ROBOT TRANSFORMATIONS AND SENSORS	9

Robot kinematics-Types- 2D, 3D Transformation-Scaling, Rotation, Translation- Homogeneous coordinates, multiple transformation-Simple problems. Sensors in robot – Touch sensors-Tactile sensor – Proximity and range sensors – Robotic vision sensor-Force sensor-Light sensors, Pressure sensors.

UNIT IV	ROBOT CELL DESIGN AND APPLICATIONS	9

Robot work cell design and control-Sequence control, Operator interface, Safety monitoring devices in Robot-Mobile robot working principle, actuation using MATLAB, NXT Software Introductions-Robot applications Material handling, Machine loading and unloading, assembly, Inspection, Welding, Spray painting and undersea robot.

UNIT V	MICRO/NANO ROBOTICS SYSTEM	9

Micro/Nanorobotics system overview-Scaling effect-Top down and bottom up approach-Actuators of Micro/Nano robotics system-Nanorobot communication techniques-Fabrication of micro/nano grippers-Wall climbing micro robot working principles-Biomimetic robot-Swarm robot-Nanorobot in targeted drug delivery system.

	TOTAL : 45 PERIODS
OUTCOMES:	After successful completion of the course students able to
•	An ability to develop an understanding automated systems and their design.
•	An ability to develop skills in sensor integration about the design aspects in the area of robotics.
•	An ability to apply skills in robot dynamics.
•	An ability to apply skills in robot programming.
TEXT BOOKS:	
1.	S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education., 2009.
2.	Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, Technology programming and Applications, McGraw Hill, 2012
3.	Richard D. Klafter, Thomas .A, Chri Elewski, Michael Negin, Robotics Engineering an Integrated Approach, Phi Learning., 2009.
REFERENCES:	
1.	*Francis N. Nagy, Andras Siegler, Engineering foundation of Robotics, Prentice Hall Inc., 1987.*
2.	*P.A. Janaki Raman, Robotics and Image Processing an Introduction, Tata McGraw Hill Publishing company Ltd., 1995.*
3.	*Carl D. Crane and Joseph Duffy, Kinematic Analysis of Robot manipulators, Cambridge University press, 2008.*
4.	*Fu. K. S., Gonzalez. R. C. & Lee C.S.G., "Robotics control, sensing, vision and intelligence", McGraw Hill Book co, 1987.*
5.	*Craig. J. J. "Introduction to Robotics mechanics and control", Addison- Wesley, 1999.*
6.	*Ray Asfahl. C., "Robots and Manufacturing Automation", John Wiley & Sons Inc.,1985.*
7.	*Bharat Bhushan., "Springer Handbook of Nanotechnology", Springer, 2004.*
8.	*Julian W. Gardner., "Micro sensor MEMS and Smart Devices", John Wiley & Sons, 2001*

17EPE018	TOTAL QUALITY MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:	
•	To introduce quality definitions, quality statements and barriers to TQM
•	To facilitate the understanding of Quality Management principles and process.
•	To impart knowledge on Total Quality Management tools
•	To impart knowledge on Total Quality Management techniques
•	To educate on various quality systems and its benefits

UNIT I	INTRODUCTION	9

Introduction-Need for quality- Evolution of quality-Definitions of quality-Dimensions of product and service quality- Basic concepts of TQM-TQM Framework-Contributions of Deming,Juran and Crosby-BarrierstoTQM –Quality statements- Customer focus-Customer orientation,Customer satisfaction,Customer complaints,Customer retention- Costs of quality.

UNIT II	TQM PRINCIPLES	9

Leadership-Strategic quality planning,Quality Councils-Employee involvement-Motivation, Empowerment,Team and Teamwork, Qualitycircles Recognition and Reward,Performance appraisal-Continuous process improvement-PDCA cycle,5S,Kaizen-Supplier partnership-Partnering, Supplier selection,Supplier Rating.

UNIT III	TQM TOOLS AND TECHNIQUES I	9

The seven traditional tools of quality-New management tools- Sixsigma: Concepts, Methodology, applications to manufacturing, service sector including IT-Bench marking-Reason to benchmark, Benchmarking process- FMEA-Stages, Types.

UNIT IV	TQM TOOLS AND TECHNIQUES II	9

Control Charts- Process Capability-Concepts of Six Sigma-Quality Function Development (QFD)- Taguchi quality lossfunction - TPM- Concepts,improvement needs-Performance measures.

UNIT V	QUALITY SYSTEMS	9

Need for ISO 9000-ISO9001-2008 Quality System-Elements, Documentation, Quality Auditing- QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors.

	TOTAL:45PERIODS
OUTCOMES:	After successful completion of the course students able to
•	Explain about TQM Principles
•	Apply the tools of quality management to manufacturingandservicesprocesses
•	Apply the techniques of quality management to manufacturing and services processes
•	Understand the concepts of Quality Systems
TEXTBOOKS:	
1.	Dale H.Besterfiled, etat.,"Total quality Management", Pearson Education Asia,Third Edition, Indian Reprint,2006.
REFERENCES:	
1.	*James R.Evans and William M.Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.*
2.	*Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt.Ltd.,2006.*
3.	*Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.*

17EPE019	COMPUTER AIDED DESIGN OF ELECTRICAL APPARATUS	L	T	P	T
		3	0	0	3

OBJECTIVES:

- To introduce the importance of computer aided design method.
- To provide basic electromagnetic field equations and the problem formulation for CAD applications.
- To get familiarized with Finite Element Method as applicable for Electrical Engineering.
- To introduce the organization of a typical CAD package.
- To introduce Finite Element Method for the design of different Electrical apparatus.

UNIT I	INTRODUCTION	9

Conventional design procedures–Limitations–Need for field analysis based design–Review of Basic principles of energy conversion– Development of Torque/Force.

UNIT II	MATHEMATICAL FORMULATION OF FIELD PROBLEMS	9

Electromagnetic Field Equations – Magnetic Vector/Scalar potential – Electrical vector /Scalar potential–Stored energy in Electric and Magnetic fields–Capacitance-Inductance-Laplace and Poisson's Equations–Energy functional.

UNIT III	PHILOSOPHY OF FEM	9

Mathematical models–Differential/Integral equations–Finite Difference method–Finite element method–Energy minimization –Variational method-2D field problems–Discretisation–Shape functions–Stiffness matrix–Solution techniques.

UNIT IV	CAD PACKAGES	9

Elements of a CAD System–Pre-processing–Modelling–Meshing–Material properties-Boundary Conditions–Setting up solution–Post processing.

UNIT V	DESIGN APPLICATIONS	9

Voltage Stress in Insulators–Capacitance calculation- Design of Solenoid Actuator –Inductance and force calculation–Torque calculation in Switched Reluctance Motor.

TOTAL :45 PERIODS

OUTCOMES: After successful completion of the course students able to

- Formulate mathematical problem.
- Analyse using finite element method.

•	Understand the CAD packages.
•	Design Electrical machine design using CAD packages.
TEXT BOOKS:	
1.	S.JSalon, 'Finite Element Analysis of Electrical Machines', Springer, Yes DEE publishers, Indian reprint, 2007
2.	Nicola Bianchi, 'Electrical Machine Analysis using Finite Elements', CRC Taylor & Francis, 2005.
REFERENCES:	
1.	*Joao Pedro, A.Bastos and Nelson Sadowski, 'Electromagnetic Modeling by Finite Element Methods', Marcell Dekker Inc., 2003.*
2.	*M Ramamoorthy, " Computer Aided, Analysis and Design of Electrical equipment"*
3.	*P.P.Silvester and Ferrari, 'Finite Elements for Electrical Engineers', Cambridge University Press, 1983.*
4.	*D.A.Lowther and P.PSilvester, 'Computer Aided Design in Magnetics', Springer Verlag, NewYork, 1986.*
5.	*S.R.H.Hoole, 'Computer Aided Analysis and Design of Electromagnetic Devices', Elsevier, NewYork, 1989.*
6.	*George, Omura, "Mastering AutoCAD", BPB Publications, New Delhi, 1988.*
7.	*User Manuals of MAGNET, MAXWELL & ANSYS Softwares.*

17EPE020	VLSI DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study modes of operation of MOS Transistor and fabrication of CMOS
- To get familiarized with MOS circuit design rules ,design process and switching characteristics
- To impart knowledge on CMOS circuit and logic circuit design
- To study design of Programmable Logic Devices
- To Provide knowledge for circuit designing using VHDL

UNIT I	MOS TRANSISTOR THEORY	9

Basic MOS Transistor- MOSFET Threshold Voltage-Enhancement and Depletion mode operation-Saturation and linear mode operation-CMOS Fabrication: P well, N Well andTwin Tub process – Sub micron technology.

UNIT II	MOS CIRCUIT DESIGN PROCESS	9

MOS Layers- Stick Diagrams- Design rules and layout –Sheet resistance –Area capacitanceof layers –NMOS Inverter –CMOS inverter -Switching characteristics. Rise time. Fall time–Latch-up problem in CMOS Circuits.

UNIT III	CMOS CIRCUIT AND LOGIC DESIGN	9

Pass Transistor and Transmission gates- NMOS and CMOS Logic gates- CMOSCombinational Logic Design-Clocked Sequential Logic Circuits.

UNIT IV	PROGRAMMABLE LOGIC DEVICES	9

Read Only Memory (ROM)- PLA, PAL- Complex Programmable Logic Devices (CPLD)-Field Programmable Logic Devices(FPGA)- Xilinx 4000 Series FPGA:CLB,I/O Blocks –FPGA Design Flow.

UNIT V	CIRCUIT DESIGN USING VHDL	9

EDA Tools – VHDL Code structures – Data types – concurrent code – sequential code –signals and variables – simple design examples.

	TOTAL :45 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Understand the Concept of MOS circuit design
•	Understand the Concept of CMOS circuit design
•	Design Programmable Logic Devices
•	Design the Circuits using VHDL
•	Apply VHDL for various Electrical applications
TEXT BOOKS:	
1.	Douglas a. Pucknell and K.Eshragian, "Basic VLSI Design" 3rd Edition. Printice Hall India Pvt Ltd, 2000
2.	Volnei A Pedroni,"Circuit design with VHDL",Printice Hall India Pvt Ltd, 2005
3.	N.Weste, K.Eshraghian, "Principles of CMOS VLSI Design", Second Edition, Addision Wesley 1993.
REFERENCES:	
1.	*Charles H Roth,"Digital System Design Using VHDL", PWS Publishing company*
2.	*R.JacobBaker,HarryW.LI.,DavidE.Boyee,"CMOSCircuitDesign,LayoutandSimulation", PrenticeHall ofIndia2005*
3.	*A.Pucknell, Kamran Eshraghian, "BASIC VLSI Design", Third Edition, Prentice Hall of India, 2007.*
4.	*Zylinc 4000 series data sheets.*

17EPE021	POWER SYSTEM TRANSIENTS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the importance, casues and effectys of transients
- To study the generation of switching transients and their control using circuit – theoretical concept.
- To study the mechanism of lighting strokes and the production of lighting surges.
- To study the propagation, reflection and refraction of travelling waves.
- To study the impact of voltage transients caused by faults, circuit breaker action, load rejection on integrated power system.

UNIT I	INTRODUCTION	9

Review and importance of the study of transients-causes for transients. RL circuit transient with sine wave excitation-double frequency transients-basic transforms of the RLC circuit transients. Different types of power system transients- effect of transients on power systems–role of the study of transients in system planning.

UNIT II	SWITCHING TRANSIENTS	9

Over voltages due to switching transients - resistance switching and the equivalent circuit for interrupting the resistor current - load switching and equivalent circuit - waveforms for transient voltage across the load and the switch - normal and abnormal switching transients. Current suppression - current chopping - effective equivalent circuit. Capacitance switching - effect of source regulation - capacitance switching with a restrike, with multiple restrikes. Illustration for multiple restriking transients - ferro resonance.

UNIT III	LIGHTNING TRANSIENTS	9

Review of the theories in the formation of clouds and charge formation-rate of charging of thunder clouds–mechanism of lightning discharges and characteristics of lightning strokes–model for lightning stroke- factors contributing to good line design- protection using ground wires-tower footing resistance- Interaction between lightning and power system.

UNIT IV	TRAVELING WAVES ON TRANSMISSION LINES	9

Computation of transients-transient response of systems with series and shunt lumped parameters and distributed lines. Traveling wave concept- step response- Bewely's lattice diagram-standing waves and natural frequencies- reflection and refraction of travelling waves.		
UNIT V	**TRANSIENTS IN INTEGRATED POWER SYSTEM**	**9**
The short line and kilometric fault- distribution of voltages in a power system-Line dropping and load rejection- voltage transients on closing and reclosinglines- over voltage induced by faults-switching surges on integrated system Qualitative application of EMTP for transient computation.		
	TOTAL:45PERIODS	
OUTCOMES:	After successful completion of the course students able to	
•	Explain the causes and analyse the switching transients	
•	Explain the lightning transients and protection methods.	
•	Explain the effect of travelling waves on transmission lines.	
•	Explain the effect of transient in integrated power system.	
TEXTBOOKS:		
1.	AllanGreenwood,'Electrical TransientsinPower Systems',WileyInter Science,NewYork,2nd Edition, 1991.	
2.	Pritindra Chowdhari,"ElectromagnetictransientsinPowerSystem",JohnWileyandSonsInc., SecondEdition,2009	
3.	C.S.Indulkar,D.P.Kothari,K.Ramalingam,'Power System Transients–Astatisticalapproach', PHILearningPrivateLimited,SecondEdition, 2010	
4.	R.D. Begamudre, "Extra High Voltage AC Transmission Engineering", NewAge International.	
REFERENCES:		
1.	*M.S.NaiduandV.Kamaraju,'High Voltage Engineering', Tata McGraw Hill,Fifth Edition,2013.*	
2.	*R.D.Begamudre,'Extra High Voltage AC Transmission Engineering',WileyEasternLimited, 1986.*	
3.	*Y.Hase,Handbook of Power System Engineering,"Wiley India,2012.*	
4.	*J.L.Kirtley, "Electric Power Principles, Sources, Conversion, Distribution and use," Wiley, 2012.*	

17EPE022	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the concepts of Internet of Things
- To study the basic protocols in wireless sensor network
- To impart knowledge on the IoT design challenges
- To impart knowledge on the IoT applications in different domain and to analyze their performance
- To study the IoT applications on embedded platform

UNIT I	INTRODUCTION	09

Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs, Machine to Machine, Difference between IoT and M2M, Software define Network

UNIT II	NETWORK AND COMMUNCIATION ASPECTS	09

Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination

UNIT III	IOT CHALLENGES	09

Design challenges, Development challenges, Security challenges, Other challenges

UNIT IV	IOT APPLICATIONS	09

Home automation, Industry applications, Surveillance applications, Other IoT applications

UNIT V	IOT IMPLEMENTATION	09

Introduction to Python, Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python-Cloud Data.

TOTAL :45 PERIODS

OUTCOMES: After successful completion of the course students able to

- Understand the concepts of Internet of Things

•	Analyze basic protocols in wireless sensor network
•	Explain the IoT challenges and Design its applications in different domain and be able to analyze their performance
•	Implement basic IoT applications on embedded platform
TEXT BOOKS:	
1.	Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach"
2.	Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"
REFERENCES:	
1.	*Adrian McEwen and Hakim Cassimally "Designing the Internet of Things"*
2.	*Gaston C. Hillar, "Internet of Things with Python"*

LIST OF OPEN ELECTIVES OFFERED BY EEE DEPARTMENT

17EOE001	MATLAB PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:	
•	To study basics of MATLAB programming
•	To introduce MATLAB Functions and File processing
•	To impart knowledge on MATLAB programming techniques
•	To enable the students to plot the functions using MATLAB
•	To develop skill in simple engineering applications development with MATLAB

UNIT I	INTRODUCTION	9

Basics of MATLAB programming–Variables and Arrays – initializing variables in MATLAB – Multidimensional Arrays – Sub arrays – Special Values–Displaying Output Data – Data Files – Scalar and Array Operations – Hierarchy of Operations

UNIT II	FUNCTIONS & FILES	9

Built-in MATLAB Functions – Elementary Mathematical Functions – User Defined Functions – Binary I/O Functions – Advanced Function Programming – Introduction to MATLAB File Processing –, File Opening and Closing, Working with Data Files.

UNIT III	PROGRAMMING TECHNIQUES	9

Program Design and Development–Relational Operators and Logical Variables–Logical Operators and Functions–Conditional Statements–Loops–The Switch Structure–Debugging MAT LAB Program.

UNIT IV	PLOTTING OF FUNCTIONS	9

XY plotting functions– Subplots and Overlay plots–Plots With Error Bars– Special Plot types– Polar Plot– Interactive plotting– Putting Multiple Plots on the Same Page– Function Discovery– Regression– 3-D plots–Mesh and Surface Plots – Examples of MATLAB Applications– Problems-GUI.

UNIT V	ENGINEERING APPLICATIONS	9

Numerical Differentiation in single variable,: Higher derivatives, multiple variables, Newton-Cotes integration formulae, MATLAB functions for integration, Linear algebra in MATLAB, Gauss Elimination, LU decomposition and partial pivoting, Iterative methods: Gauss Siedel, Special Matrices: Tri- diagonal matrix algorithm- Engineering Applications-Optimization.	
	TOTAL :45 PERIODS
OUTCOMES:	After successful completion of the course students able to
•	Articulate importance of MATLAB software's in research by simulation work
•	Understand the Basics of MATLAB programming tools, functions and files that are essential in solving engineering problems
•	In-depth knowledge of providing programming techniques and plotting of functions.
•	Understand the loops and Debugging of MAT LAB Programs
•	Understand the writing of programs & simulation in MATLAB for engineering problems.
TEXT BOOKS:	
1.	Amos Gilat , MATLAB An Introduction With Applications By, Wiley Publication.6th edition, 2016
2.	Rudra Pratap , "MATLAB 7" , Oxford University Press,2006
3	R.K. Bansal, A.K. Goel , "MATLAB and Its Applications In Engineering" Dorling kindeslay pvt. Lt, india, 2009.
REFERENCES:	
1.	*Stephen j. Chapman.,"MATLAB programming for engineers ", Fifth Education,United States of America, 2015.*
2.	*Otto S.R, Denier J.P.,"An introduction to p r o g r a m m i n g and numerical methods in MATLAB ", Springer –verlag London limited.2005.*

17EOE002	RENEWABLE ENERGY SOURCES	L	T	P	C
		3	0	0	3

OBJECTIVES:	
•	To introduce Different types of Renewable Energy Sources
•	To educate the students on principle of solar energy
•	To educate the students on wind energy conversion systems
•	To educate the students on biomass energy and cogeneration systems
•	To impart knowledge on tidal energy and geothermal energy

UNIT I	INTRODUCTION	9

Energy Conservation and Energy Efficiency – Needs and Advantages, Different types of Renewable Energy Sources - Energy Resources Availability in World –Environmental aspects of energy utilization – Energy Conservation Act 2003 - Statistical Report on Renewable energy scenario in India - Applications.

UNIT II	SOLAR ENERGY	9

Solar Flat plate and concentrating collectors – Solar heating and cooling techniques –Solar desalination – Solar Pond – Solar cooker – Solar Drying – Solar pumping – Solar thermal power plant – Solar photo voltaic conversion – Solar cells – PV applications.

UNIT III	WIND ENERGY	9

Wind energy estimation in World and in India – Types of wind energy systems –Performance of Wind energy System– Details of wind turbine generator – Safety and Environmental Aspects.

UNIT IV	BIOMASS ENERGY	9

Biomass direct combustion – Biomass gasifier – Biomass: Types – Advantages &Drawbacks - Biogas plant – Ethanol production – Bio diesel – Cogeneration: steam turbine cogeneration systems, gas turbine cogeneration systems, reciprocating IC engine cogeneration systems, combined cycle cogeneration systems – Applications of Cogeneration in utility sector – Biomass applications.

UNIT V	OTHER RENEWABLE ENERGY SOURCES	9

Tidal energy – Wave energy – Open and closed OTEC Cycles – Small hydro –Geothermal energy – Fuel cell systems - Stirling Engines.

	TOTAL :45 PERIODS
OUTCOMES:	After successful completion of the course students able to
•	To know importance of renewable energy source
•	Understand about Solar Energy.
•	Understand about Wind Energy.
•	Understand about BioMass Energy.
•	Understand about all renewable Energy Sources.
REFERENCES:	
1.	*G.D. Rai, Non-Conventional Energy Sources, Khanna Publishers, New Delhi, 1999.*
2.	*S.P. Sukhatme, Solar Energy, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.*
3.	*G.N. Tiwari, Solar Energy – Fundamentals Design, Modelling and applications, Narosa Publishing House, New Delhi, 2002.*

17EOE003	ENERGY MANAGEMENT AND AUDITING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the forms of energy, energy auditing types and roles of energy managers
- To impart knowledge on energy costing and importance of power factor in energy cost
- to study metering for energy management & power quality analyses
- To educate the students on different lighting systems
- To study energy economics techniques

UNIT I	INTRODUCTION	9

Types & Forms of Energy - Primary / Secondary Energy Sources –EC Act 2003 – Energy Auditing: Types, Classifications, Deliverables, Barriers – Benchmarking - Roles & Responsibility of Energy Managers.

UNIT II	ENERGY COSTING, MONITORING &TARGETING	9

Data & Information Analysis – Cost / Energy Share Diagram – Data Graphing – Electricity Billing : Components & Costs – kVA – Need & Control – Determination of kVA demand & Consumption –Time of Day Tariff – Power Factor Basics – Penalty Concept for PF – PF Correction – Wheeling and Banking - Demand Side Management – comparison on unit cost of power cost from various sources – steam cost from different sources.

UNIT III	METERING FOR ENERGY MANAGEMENT & POWER QUALITY ANALYSES	9

Instruments Used in Energy systems: Load and power factor measuring equipment, Wattmeter, Flue gas analysis, Temperature and thermal loss measurements, Air quality analysis-Relationships between parameters-Units of measure-Typical cost factors- Utility meters – Timing of meter disc for kilowatt measurement - Demand meters - Paralleling of current transformers - Instrument transformer burdens-Multitasking solid-state meters - Metering location vs. requirements – Net metering - Metering techniques and practical examples.

UNIT IV	LIGHTING SYSTEMS & COGENERATION	9

Concept of lighting systems - The task and the working space - Light sources - Ballasts -Luminaries - Lighting controls - Optimizing lighting energy - Power factor and effect of harmonics on power quality - Cost analysis techniques - Lighting and energy standards Cogeneration: Forms of cogeneration - feasibility of cogeneration- Electrical interconnection.

UNIT V	ECONOMICS	9
Energy Economics – Depreciation - Financial Analysis Techniques – Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, Life Cycle Costing – ESCO concept – CUSUM Technique – ESCO Concept – ESCO Contracts.		
		TOTAL : 45 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Analyse the energy data of industries.
•	Can carry out energy accounting and balancing.
•	Can suggest methodologies for energy saving.
•	Design Lighting systems
•	Explain the concepts of Energy Economics

TEXT BOOKS:

1.	Energy Manager Training Manual (4Volumes) available at www.Energymanager training.com, a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India. 2004.
2.	Amit K. Tyagi, Handbook on Energy Audits and Management, TERI, 2003.
3.	Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, Guide to Energy Management, Fifth Edition, The Fairmont Press, Inc., 2006.

REFERENCES:

1.	*L.C. Witte, P.S. Schmidt, D.R. Brown, "Industrial Energy Management and Utilisation" Hemisphere Publ, Washington, 1988.*
2.	*Callaghn, P.W. "Design and Management for Energy Conservation", Pergamon Press, Oxford,1981*
3.	*Eastop T.D & Croft D.R, Energy Efficiency for Engineers and Technologists, Logman Scientific & Technical, ISBN-0-582-03184, 1990.*
4.	*WC Turner: Energy Management Handbook, Seventh Edition, (Fairmont Press Inc., 2007)*

17EOE004	SMART GRID	L	T	P	T
		3	0	0	3

OBJECTIVES:

- To introduce the architecture of smart grid
- To study the smart grid communications and its measurement techniques
- To educate the students on load flow analysis in smart grid
- To impart knowledge on voltage stability in smart grid
- To introduce grid integration for renewable energy souces

UNIT I	SMART GRID ARCHITECTURE	9

Introduction – Comparison of Power grid with Smart grid – power system enhancement – communication and standards - General View of the Smart Grid Market Drivers - Stakeholder Roles and Function - Measures - Representative Architecture - Functions of Smart Grid Components- Wholesale energy market in smart grid-smart vehicles in smart grid.

UNIT II	SMART GRID COMMUNICATIONS AND ITS MEASUREMENT TECHNIQUES	9

Communication and Measurement - Monitoring, Phasor Measurement Unit (PMU), Smart Meters, Wide area monitoring systems (WAMS)- Advanced metering infrastructure- GIS and Google Mapping Tools.

UNIT III	LOAD FLOW ANALYSIS IN SMART GRID	9

Introduction to Load Flow Studies - Challenges to Load Flow in Smart Grid and Weaknesses of the Present Load Flow Methods - Load Flow State of the Art: Classical, Extended Formulations, and Algorithms –Load flow for smart grid design-Contingencies studies for smart grid.

UNIT IV	SMART GRID STABILITY	9

Voltage Stability Analysis Tools-Voltage Stability Assessment Techniques-Voltage Stability Indexing-Application and Implementation Plan of Voltage Stability in smart grid-Angle stability assessment in smart grid-Approach of smart grid to State Estimation-Energy management in smart grid.

UNIT V	GRID INTEGRATION WITH RENEWABLE ENERGY	9

Renewable Energy Resources-Sustainable Energy Options for the Smart Grid-Penetration and Variability Issues Associated with Sustainable Energy Technology-Demand Response Issues-Electric Vehicles and Plug-in Hybrids-PHEV Technology-Environmental Implications-Storage Technologies-Grid integration issues of renewable energy sources.	
	TOTAL :45 PERIODS
OUTCOMES:	After successful completion of the course students able to
•	Explain the concepts and design of Smart grid
•	Explain the various communication and measurement technologies in smart grid
•	Perform load flow in smart grid.
•	Analyze the stability of smart grid.
•	Integrate the renewable energy resources and storages with smart grid
TEXT BOOKS:	
1.	Stuart Borlase "Smart Grid: Infrastructure, Technology and Solutions", CRC Press 2012.
2.	Janaka E kanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technologyand Applications",Wiley2012.
REFERENCES:	
1.	*VehbiC.Güngör,Dilan Sahin,Taskin Kocak,SalihErgüt,Concettina Buccella,CarloCecati, and Gerhard P. Hancke, "Smart Grid Technologies: Communication Technologies and Standards"IEEE Transactions On Industrial Informatics, Vol.7,No.4, November2011.*
2.	*Xi Fang,Satyajayant Misra, Guoliang Xue,and Dejun Yang"Smart Grid –The New and Improved PowerGrid: ASurvey",IEEE Transaction on Smart Grids,vol.14,2012.*

OPEN ELECTIVES OFFERED BY DEPARTMENT OF ECE

17LOE001	REAL TIME SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To expose the students to the fundamentals of Real Time systems
- To teach the fundamentals of Scheduling and features of programming Languages
- To study the data management system for real time
- To introduce the fundamentals of real time communication
- To teach the different algorithms and techniques used for real time systems

UNIT I	INTRODUCTION	9

Introduction – Issues in Real Time Computing – Structure of a Real Time System – Task classes – Task Assignment and Scheduling – Task assignment – Mode changes and Fault Tolerant Scheduling.

UNIT II	PROGRAMMING LANGUAGES AND TOOLS	9

Programming Languages and Tools – Desired language characteristics – Data typing – Control structures – Multitasking – Low level programming – Task Scheduling – Timing Specifications – Programming Environments – Run – time support.

UNIT III	REAL TIME DATABASES	9

Real time Databases – Basic Definition, Real time Vs General Purpose Databases, Main Memory Databases, Transaction priorities, Transaction Aborts, Concurrency control issues, Disk Scheduling Algorithms, Maintaining Serialization Consistency – Databases for Hard Real Time Systems.

UNIT IV	FAULT TOLERANCE AND RELIABILTY	9

Real – Time Communication – Fault Tolerance Techniques – Fault Types – Fault Detection. Fault Error containment Redundancy – Data Diversity – Reversal Checks – Integrated Failure handling.

UNIT V	EVALUATION TECHNIQUES	9

Reliability Evaluation Techniques – Obtaining parameter values, Reliability models for Hardware Redundancy – Software error models. Clock Synchronization – Clock, A Nonfault – Tolerant Synchronization Algorithm – Impact of faults – Fault Tolerant Synchronization in

Hardware – Fault Tolerant Synchronization in software.	
	TOTAL : 45 PERIODS
OUTCOMES :	After successful completion of the course students able to
•	Understand the basics of the real time systems.
•	Analyse the programming languages and tools.
•	Remember the real time database.
•	Evaluate real time communication between devices
•	Evaluate different fault tolerant techniques.
TEXT BOOKS:	
1.	C.M. Krishna, Kang G. Shin, "Real – Time Systems", McGraw – Hill International Editions, 1997.
2.	Rajib Mall, "Real-time systems: theory and practice", Pearson Education, 2007
3.	Peter D.Lawrence, "Real Time Micro Computer System Design – An Introduction", McGraw Hill, 1988.
REFERENCES:	
1.	*Stuart Bennett, "Real Time Computer Control – An Introduction", Prentice Hall of India, 1998.*
2.	*S.T. Allworth and R.N.Zobel, "Introduction to real time software design", Macmillan, 2nd Edition, 1987.*
3.	*R.J.A Buhur, D.L Bailey, "An Introduction to Real – Time Systems", Prentice – Hall International, 1999.*
4.	*Philip.A.Laplante, "Real Time System Design and Analysis", Prentice Hall of India, 3rd Edition, April 2004*

17LOE002	WIRELESS SENSOR NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:	
•	Understand the overview of sensor networks.
•	Learn the different types of sensor networks architecture.
•	Be familiar with networking sensors
•	Be exposing to the infrastructure establishment in sensor networks.
•	Learn the platforms and tools of wireless sensor networks.

UNIT I	OVERVIEW OF WIRELESS SENSOR NETWORKS	9

Challenges for Wireless Sensor Networks, Enabling Technologies For Wireless Sensor Networks.

UNIT II	ARCHITECTURES	9

Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes , Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

UNIT III	NETWORKING SENSORS	9

Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks- S-MAC , The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing.

UNIT IV	INFRASTRUCTUREESTABLISHMENT	9

Topology Control , Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

UNIT V	SENSOR NETWORK PLATFORMS AND TOOLS	9

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.

	TOTAL:45PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Understand the concepts of wireless sensor networks
•	Analyze the architecture of sensor networks
•	Understand the protocols for wireless sensor networks with respect to some

	protocol design issues
•	Analyse the infrastructure establishment in Sensor networks.
•	Anayse the sensor network platforms and tools.
TEXT BOOKS:	
1.	Holger Karl & Andreas Willig, " Protocols And Architectures for Wireless Sensor Networks" , John Wiley, 2005.
2.	Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.
REFERENCES:	
1.	*Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks- Technology, Protocols, And Applications", John Wiley, 2007.*
2.	*Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003*

17LOE003	INDUSTRIAL AUTOMATION AND ROBOTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know the evolution of robotics
- To study the dynamics and kinematics
- To learn the various actuators
- To learn the various sensors
- To understand the automation

UNIT I	INTRODUCTION TO ROBOTICS AND AUTOMATION	9

Robotics**:** History of Robotics, Applications of Robotics, Current Research in Robotics, General Structure of Robotic Mechanical Systems, Classification of Robots based on coordinate system, Classification of Robotics, Overview of robot subsystems, Components of Robot system- Manipulator, Controller, Power conversion unit etc, Specifications of robot. Commercially available Software Packages for Robot Simulation

UNIT II	KINEMATICS AND DYNAMICS	12

Kinematics**:** Homogeneous co-ordinate vector operations, Workspace , Forward Kinematics - forward solutions- Link coordinate frames, D-H matrix, Inverse Kinematics - Existence and Uniqueness of Solutions, Analytical Approaches - Reduction of Inverse Kinematics to Sub-problems, **Dynamics**: Newton's equation, Euler equations, Dynamic Modeling of Robotic Manipulators - Two DOF Planar Robot with Two Revolute Joints, Generalized Coordinates and Speeds, Velocities, Partial Velocities, Accelerations, Generalized Inertia Forces, Generalized Active Forces, Equations of Motion, Special Issues in Kane's Method

UNIT III	MECHANISMS ACTUATORS AND SENSORS	9

Some Popular **Mechanisms** - Four-bar Mechanism, Slider-crank Mechanism, Rack and Pinion, Cams and Cranks, Gear and Gear Trains, System Features, Kinematics and Kinetics, Serial Robots, Parallel Robots, Mechanical Structure, Joint Mechanisms.

Actuators: Electromagnetic Actuators, Fluid Power Actuators. Different types of grippers - Compressed Air, Vacuum, Hydraulic Fluid Power, Electrical Power & other methods of gripping. DC Motors, Stepper Motors, Servo Motor, Controlling of these motors.

UNIT IV	SENSORS	7

Sensors: Encoders - Rotary and Linear Incremental Encoders, Tachometer, Quadrature Encoders, Absolute Encoders. Analog Displacement Sensors, Force and Tactile Sensors, Ultrasonic Transponder, Accelerometers, Gyroscopes , proximity sensors, Infrared Sensors,

touch slip sensor, laser range finder, Vision-based Sensors, Color-tracking Sensors, Sensor Mounting Arrangement, Reading the Pulses in a Computer, Design of the Circuitry		
UNIT V	**AUTOMATION**	**8**
Structure of Automatic Industrial Systems, Relationship between the Robot Intelligence and the Product, Productivity of a Manufacturing Process, Kinematics and Control of Automatic Machines, Feedback Sensors, Transporting Devices, Feeding and Orientation Devices, Automatic Assembling, Inspection Systems, Welding _ Automation.		
	TOTAL:45PERIODS	

OUTCOMES:	After successful completion of the course students able to
•	Understand the basic concepts of working of robot
•	Analyze the function of sensors in the robot
•	Apply program to use a robot for a typical application
•	Analyze Robots in different applications

TEXT BOOKS:

1.	Bruno Siciliano, Oussama Khatib (Eds.), _"Springer Handbook of Robotics"_, 2008,.
2.	Jorge Angeles, _"Fundamentals of Robotic Mechanical Systems Theory, Methods, and Algorithms"_ Second Edition, 2003, Springer-Verlag New York, Inc.,
3.	Edwin Wise, _"Robotics Demystified_", 2005, The McGraw-Hill Companies,

REFERENCES:

1.	*Thomas R. Kurfess, _"Robotics And Automation Handbook"_, CRC Press, 2004,*
2.	*_Robotics: "Appin Knowledge Solutions (Firm)"_, Infinity Science Press , 2007,*
3.	*J. Norberto Pires, Altino Loureiro and Gunnar Bölmsjo, _"Welding Robots - Technology, System Issues and Applications"_, Springer-Verlag 2006,*
4.	*J.G Proakis, "Digital Communication", 4th Edition, Tata Mc Graw Hill Company, 2001.*

17LOE004	PRINCIPLES OF VLSI DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:	
•	Understand the fabrication process of CMOS
•	To understand the electrical properties of circuits
•	To Study the design of combinational and sequential circuit
•	To learn the testing of CMOS
•	Analyse the verilog HDL

UNIT I	CMOS TECHNOLOGY	9

A brief History-MOS transistor, Ideal I-V characteristics, C-V characteristics, Non ideal IV effects, DC transfer characteristics - CMOS technologies, Layout design Rules, CMOS process enhancements, Technology related CAD issues, Manufacturing issues

UNIT II	CIRCUIT CHARACTERIZATION AND SIMULATION	9

Delay estimation, Logical effort and Transistor sizing, Power dissipation, Interconnect, Design margin, Reliability, Scaling- SPICE tutorial, Device models, Device characterization, Circuit characterization, Interconnect simulation

UNIT III	COMBINATIONAL AND SEQUENTIAL CIRCUIT DESIGN	9

Circuit families –Low power logic design – comparison of circuit families – Sequencing static circuits, circuit design of latches and flip flops, Static sequencing element methodology- sequencing dynamic circuits – synchronizers

UNIT IV	CMOS TESTING	9

Need for testing- Testers, Text fixtures and test programs- Logic verification- Silicon debug principles- Manufacturing test – Design for testability – Boundary scan

UNIT V	SPECIFICATION USING VERILOG HDL	9

Basic concepts- identifiers- gate primitives, gate delays, operators, timing controls, procedural assignments conditional statements, Data flow and RTL, structural gate level switch level modeling, Behavioral and RTL modeling, Structural gate level description of decoder, equality detector, comparator, priority encoder, half adder, full adder, Ripple carry adder, D latch and D flip flop.

	TOTAL : 45 PERIODS

OUTCOMES:	After successful completion of the course students able to

•	Understand the basics of CMOS circuits.
•	Understand the CMOS process technology.
•	Understand the concepts of designing VLSI subsystems.
•	Analyze the techniques of chip design using programmable devices.
•	Remember digital system using hardware description language.
TEXT BOOKS:	
1.	Weste and Harris: "CMOS VLSI DESIGN", (Third edition) Pearson Education, 2005
2.	J.Bhasker: "Verilog HDL primer", BS publication,2001
REFERENCES:	
1.	*Uyemura J.P: "Introduction to VLSI circuits and systems", Wiley 2002.*
2.	*D.A Pucknell & K.Eshraghian ,"Basic VLSI Design", Third edition, PHI, 2003*
3.	*M.J.S.Smith: "Application specific integrated circuits", Pearson Education, 1997*
4.	*Ciletti "Advanced Digital Design with the Verilog HDL", Prentice Hall of India, 2003*

17LOE005	APPLIED ELECTRONICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Describe the basic principles of electronics
- Identify the electronic components and their various applications on board
- Trace and analyze the electronic circuits
- Analyse the telecommunication systems
- To study the concepts of PIC microcontroller

UNIT I	ANALOG CIRCUITS	9

Overview on semiconductors, diodes, transistor switches, capacitors, fields and inductors – BJT amplifiers, JFET amplifiers, MOSFET amplifiers.

UNIT II	APPLICATION OF ANALOG CIRCUITS	9

Operational amplifiers, application of op-amps, active filters, 555 timer and oscillators – power amplifiers – power supplies.

UNIT III	DIGITAL CIRCUITS	9

Overview on logical circuits, logical operations, combinational and sequential circuits – display devices – converter circuits.

UNIT IV	ELECTRONIC COMMUNICATION SYSTEMS	9

Audio and video systems – noise – telecommunications – cable transmission, optical transmission – electronic control systems – process control systems.

UNIT V	MICROPROCESSORS AND MICROCONTROLLER	9

Input and output - microprocessors and programming - sensors and interfacing - The PIC microcontroller - circuit simulation – circuit construction.

TOTAL : 45 PERIODS

OUTCOMES : After successful completion of the course students able to

- Acquires knowledge for building, testing and modifying simple circuits to complex circuits.
- Acquires the basic knowledge of electronics.
- Gains knowledge about the microprocessor and microcontroller.

•	Understand the communication systems
TEXT BOOKS:	
1.	Owen Bishop, “Electronics – Circuits and Systems”, 3 rd Edition, Newnes, 2010.
2.	Michael Tooley B A, “Electronic Circuits: Fundamentals and Applications”, 3 rd Edition, Newnes, 2006.
REFERENCES:	
1.	*John B.Peatman ,” Design with PIC Microcontrollers”, Prentice Hall, 1998.*

17LOE006	WIRELESS NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Learn the design of the wireless networks
- Understand the concepts of wireless networks layer
- To study the wireless protocols with TCP enhancement
- Analyse the wireless wide area network
- Understand the concepts of wireless networks and next generation networks

UNIT I	WIRELESS LAN	9

Introduction-WLAN technologies: Infrared, UHF narrowband, spread spectrum -IEEE802.11: System architecture, protocol architecture, physical layer, MAC layer, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, Radio Layer, Baseband layer, Link manager Protocol, security - IEEE802.16-WIMAX: Physical layer, MAC, Spectrum allocation for WIMAX

UNIT II	MOBILE NETWORK LAYER	9

Introduction - Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6-Network layer in the internet- Mobile IP session initiation protocol - mobile ad-hoc network: Routing, Destination Sequence distance vector, Dynamic source routing.

UNIT III	MOBILE TRANSPORT LAYER	9

TCP enhancements for wireless protocols - Traditional TCP: Congestion control, fast retransmit/fast recovery, Implications of mobility - Classical TCP improvements: Indirect TCP, Snooping TCP, Mobile TCP, Time out freezing, Selective retransmission.

UNIT IV	WIRELESS WIDE AREA NETWORK	9

Overview of UTMS Terrestrial Radio access network-UMTS Core network Architecture: 3G-MSC, 3G-SGSN, 3G-GGSN, SMS-GMSC/SMS-IWMSC, Firewall, DNS/DHCP-High speed Downlink packet access (HSDPA)- LTE network architecture and protocol.

UNIT V	4G NETWORKS	9

Introduction – 4G vision – 4G features and challenges - Applications of 4G – 4G Technologies: Multicarrier Modulation, Smart antenna techniques, OFDM-MIMO systems.

TOTAL : 45 PERIODS

OUTCOMES : After successful completion of the course students able to

- Acquires knowledge about the latest 3G/4G and WiMAX networks and its

	architecture.
•	Understand the wireless network environment for any application using latest wireless protocols and standards.
•	Apply different types of applications for smart phones and mobile devices with latest network strategies.
•	Remember the concepts of networks layers and its applications.
TEXT BOOKS:	
1.	Jochen Schiller, ”Mobile Communications”, Second Edition, Pearson Education 2012.(Unit I,II,III)
2.	Vijay Garg , “Wireless Communications and networking”, First Edition, Elsevier 2007.(Unit IV,V)
REFERENCES:	
1.	*Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, “3G Evolution HSPA and LTE for Mobile Broadband”, Second Edition, Academic Press, 2008.*
2.	*Anurag Kumar, D.Manjunath, Joy kuri, “Wireless Networking”, First Edition, Elsevier 2011.*
3.	*Simon Haykin , Michael Moher, David Koilpillai, “Modern Wireless Communications”, First Edition, Pearson Education 2013*

17SOE001	PROGRAMMING IN C++	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To get introduced to bacis of C++ programming
- To be familiar with OOPS concepts
- To understand the concept of Inheritance and its types
- To understand the concept of Polymorphism
- To be familiar with templates and file handling concepts

UNIT I	BASIC C++ PROGRAMMING	9

C++ Programming features –Data types, Variables and Arrays – Operators - Pointers – References – Functions - String Handling.

UNIT II	OOPS CONCEPTS	9

Data Abstraction - Encapsulation - Class - Object – Constructors - Destructors - Static Members – Constant Members – Member Functions - Friend Functions- Role of this pointer – Storage Classes – Copy Constructor.

UNIT III	INHERITANCE	9

Inheritance –Types of Inheritance –public, protected and private inheritance – Method Overriding – Abstract and Concrete Class – Virtual Class - Virtual Functions - Dynamic Memory Allocation - Nested Classes.

UNIT IV	POLYMORPHISM	9

Polymorphism – Compile Time and Run Time Polymorphisms – Function Overloading – Operators Overloading – Dynamic Binding – Exception Handling.

UNIT V	ADVANCED OOPS FEATURES	9

Standard Libraries - Generic Programming - Templates – Class Template - Function Template – Iterators – Function Adaptors – Allocators - File Handling concepts.

TOTAL : 45 PERIODS

OUTCOMES: After successful completion of the course students able to

- Have the knowledge about the concepts of object oriented programming language.

•	Know the various concepts related to inheritance and polymorphism.
•	Describe about the concepts of templates and error handling.

TEXT BOOKS:

1.	Bjarne Stroustrup, "The C++ Programming Language", 3rd edition, Pearson Education, 2007.
2.	K R Venugopal, Rajkumar Buyya, "Mastering C++", 2nd Edition, McGraw Hill Education, 2013.

REFERENCES:

1.	*Ira Pohl, "Object Oriented Programming using C++", 2nd edition, Pearson Education, 1997.*
2.	*Herbert Schildt, "C++: The Complete Reference", 4th Edition, McGraw Hill Education, 2003.*

OPEN ELECTIVES OFFERED BY DEPARTMENT OF CSE

17SOE002	JAVA PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:	
•	To get introduced to fundamentals of java programming
•	To be familiar with concepts of classes and objects in java
•	To understand how information hiding and reusability is implemented in java
•	To understand the concept of exception, concurrency and streams
•	To be familiar with graphical programming using applets

UNIT I	FUNDAMENTALS OF JAVA	7

Java Buzzwords- Overview of Java- Data types, Variables and Arrays - Simple types- Scoping rules Automatic Type Conversion- Type Casting and Arrays- Operators - Operators Precedence & Associativity – Expression- Control Statements- Comparison of C++ and Java- Entry point for Java Programs.

UNIT II	CLASSES AND OBJECTS	11

Introducing Classes - Class fundamentals- Declaring objects- Assigning object reference variable- Methods & Method Signatures- Method retuning Values- Method with parameters – Constructors- Default Constructor Parameterized constructor- this keyword- Garbage Collector- finalize() method- Overloading methods and constructors- Using object as parameters- returning object in methods – recursion- Access control- static and final keyword- Nested and Inner classes- Command Line argument- String and String Buffer class.

UNIT III	INFORMATION HIDING AND REUSABILITY	9

Inheritance - basics- Using super- Method Overriding- Constructor call- Dynamic method dispatch Abstract class- Using final with inheritance - Packages - Default Package- Path & Class Path Environment Variables- Package level access- Importing Packages – Interface - Multiple Inheritance in Java- Extending interface- Wrapper class.

UNIT IV	EXCEPTION, CONCURRENCY NAD STREAMS	9

Exception Handling mechanism - I/O Basics - Byte stream & Character Stream- Getting user input- Reading console input & Writing console output- Reading and Writing files- Threading –

Thread class & Runnable Interface- Inter Thread Communication- Synchronized keyword- Deadlock.		
UNIT V	**GRAPHICAL PROGRAMMING**	**9**
Applet Basics – methods – creation - designing and examples - Event handling- event classes - Event listener interfaces - AWT classes - working with frames - AWT controls-layout manager - user interface components –Swings – JDBC Connectivity – Introduction to JavaFX.		
	TOTAL : 45 PERIODS	

OUTCOMES:	After successful completion of the course students able to
•	Differentiate between Java and other OOPs languages.
•	Develop programs using classes and objects.
•	Implement multi threading.
•	Design a page using applet.

TEXT BOOKS:

1.	Patric Naughton & Herbert Schildt, "The Complete Reference Java 2", Tata Mcgraw Hill, New Delhi, 2001, 4th Edition.
2.	Bruce Eckel, "Thinking in Java", Pearson Eduction Asia, 2000, 2nd Edition.

REFERENCES:

1.	*Deitel & Deitel, "Java How to Program", Prentice Hall, 2002, 5th Edition.*
2.	*Ken Arnold & James Gosling, "The Java Programming Language", 2000, AWL.*
3.	*Peter Haggar, "Practical Java: Programming Language Guide", Addison Wesley Pub Co 2000, 1st Edition.*

17SOE003	PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Understand the basic of Python Programming
- To Learn about string in Python
- To be introduced to Classes in python
- To Understand basic concepts on files.
- To get hands on XML and serialization

UNIT I	INTRODUCTION TO PYTHON	9

Function Declaration - Import - Objects - Indenting as Requirement - Exceptions - Unbound Variables - Case Sensitive - Scripts - Native Data Types - Booleans - Numbers - Lists - Tuples - Sets - Dictionaries - Comprehensions - List Comprehensions - Dictionary Comprehensions - Set Comprehensions.

UNIT II	STRING	9

Strings - Unicode - Formatting - String Methods - Bytes - Encoding - Regular Expressions - Verbose - Case Studies.

UNIT III	CLASSES	9

Closures - List of Functions - List of Patterns - File of Patterns - Generators - Defining Classes - Instantiating Classes - Instance Variables - Iterators – Itertools - Assert - Generator Expressions.

UNIT IV	FILES	9

Reading and Writing Text Files - Binary Files - Stream Objects - Standard Input, Output and Error.

UNIT V	XML AND SERIALIZATION	9

XML - Atom Feed - Parsing HTML - Searching for Nodes - html - Generation - Serializing Objects - Pickle Files - Versions - Debugging - Serializing to JSON.

TOTAL : 45 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Understand the concepts of object oriented programming.
•	Use generators and iterators.
•	Develop test cases and handle refactoring.
•	Use objects to program over the web.
TEXT BOOKS:	
1.	Mark Pilgrim, "Dive into Python 3", Apress, 2009.
2.	John V. Guttag, "Introduction to Computation and Programming using Python",Prentice Hall of India, 2014.
REFERENCES:	
1.	*Mark Lutz, "Learning Python: Powerful Object-Oriented Programming", Fifth Edition, O'Reilly, Shroff Publishers and Distributors, 2013.*
2.	*Allen Downey, Jeffrey Elkner, Chris Meyers, "How to Think Like a Computer Scientist - Learning with Python", Green Tea Press, 2002.*

17SOE004	WEB DESIGNING	L	T	P	C
		3	0	0	3

OBJECTIVES:	
•	To Learn about basics of websites and get introduced to HTML 5, CSS 3, WEB 2.0
•	To understand client side programming using java script
•	To Learn about java servlets and DB connectivity
•	To Learn web development using PHP and XML
•	To Get Introduced to AJAX and web services

UNIT I	WEBSITES BASICS, HTML 5, CSS 3, WEB 2.0	9

Web 2.0: Basics-RIA Rich Internet Applications - Collaborations tools - **Understanding websites and web servers:** Understanding Internet – Difference between websites and web server- Internet technologies Overview –Understanding the difference between internet and intranet

HTML and CSS: HTML 5.0 , XHTML, CSS 3.

UNIT II	CLIENT SIDE PROGRAMMING	9

Java Script: An introduction to JavaScript–JavaScript DOM Model-Date and Objects,-Regular Expressions- Exception Handling-Validation-Built-in objects-Event Handling- DHTML with JavaScript

VB Script: VB Script programming – Forms – Scripting Object.

UNIT III	SERVLETS AND JSP	9

Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies-Installing and Configuring Apache Tomcat Web Server.**Database Connectivity:** JDBC perspectives, JDBC program example.

JSP: Understanding Java Server Pages-JSP Standard Tag Library(JSTL)-Creating HTML forms by embedding JSP code.

UNIT IV	PHP AND XML	9

An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions-Connecting to Database – Using Cookies-Regular Expressions

XML: Basic XML- Document Type Definition- XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM).

UNIT V	INTRODUCTION TO AJAX AND WEB SERVICES	9

AJAX: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods

Web Services: Introduction- Java web services Basics – Creating, Publishing, Testing and Describing a Web services (WSDL)-Consuming a web service, Database Driven web service from an application –SOAP – Introduction to modern tools / framework – AngloJS – Jquery.

TOTAL : 45 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Create a basic website using HTML and Cascading Style Sheets.
•	Design and implement dynamic web page with validation using JavaScript objects and VB Script objects and by applying different event handling mechanisms.
•	Design rich client presentation using AJAX.
•	Design and implement simple web page in PHP, and to present data in XML format.
•	Design and implement server side programs using Servlets and JSP.

TEXT BOOKS:

1.	Deitel and Deitel, Nieto, "Internet and World Wide Web - How to Program", Prentice Hall, 5th Edition, 2011.
2.	Herbert Schildt, "Java-The Complete Reference", Eighth Edition, Mc Graw Hill Professional, 2011.

REFERENCES:

1.	*Stephen Wynkoop,John Burke "Running a Perfect Website", QUE, 2nd Edition,1999.*
2.	*Chris Bates, "Web Programming – Building Intranet Applications", 3rd Edition, Wiley Publications, 2009.*
3.	*Jeffrey C, Jackson, "Web Technologies- A Computer Science Perspective", Pearson Education, 2011.*
4.	*Paul Dietel, Harvey Deitel, "Java How to Program", 8th Edition Prentice Hall of India.*
5.	*Gopalan N.P., Akilandeswari J., "Web Technology", Prentice Hall of India, 2011.*
6.	*Mahesh P. Matha, "Core Java A Comprehensive Study", Prentice Hall of India, 2011.*
7.	*Uttam K.Roy, "Web Technologies", Oxford University Press, 2011.*

17SOE005	ANDROID APPLICATION DEVELOPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:	
•	Understand how to work with various mobile application development frameworks.
•	Learn how UI for mobile application development is done for Android
•	Know the tools used in android application development
•	Learn the basic and important design concepts and issues of development of mobile applications.
•	Understand the process of android application development

UNIT I	INTRODUCTION	9

Mobile Applications – Characteristics and Benefits – Frameworks and Tools – Introduction to Java – Classes and Objects – Inheritance – Packages and Interfaces – Strings – I/O – Event handling.

UNIT II	USER INTERFACE	9

Generic UI Development – Multimodal and Multichannel UI – Designing the right UI– Introduction to XML –XML basics – Attributes – DTD - XML schema – Screen Elements and Layouts.

UNIT III	TOOLS	9

Google Android Platform – Android Application Architecture – Android Studio – Android Widgets and Menus – Event handling – Packaging and Deployment - Apple iPhone Platform.

UNIT IV	APPLICATION DESIGN	9

Memory Management – Design patterns for limited memory – Work flow for Application Development – Techniques for composing Applications – Intents and Services – Fragments – Graphics – Animation.

UNIT V	APPLICATION DEVELOPMENT	9

Storing and Retrieving data – Communication via the Web – Notification and Alarms – Telephony – Location based services – Apps with Firebase Real Time Database – Project on respective Discipline.

	TOTAL : 45 PERIODS

OUTCOMES:	After successful completion of the course students able to

•	Design and implement the user interfaces for mobile applications.
•	Design the mobile applications that are aware of the resource constraints of mobile devices.
•	Develop advanced mobile applications that access the databases and the web.
•	Develop useful mobile applications in the current scenario using Google Android Studio.

TEXT BOOKS:

1.	Jeff Friesen, "Learn Java for Android Development: Java 8 and Android", 5th Edition Paperback – 2014.
2.	Share Conder, Lauren Darcey, "Android Wireless Application Development" Pearson 3 rd Edition.

REFERENCES:

1.	*Zigurd Mednieks, Laird Dornin, G, Blake Meike and Masumi Nakamura, "Programming Android", O"Reilly, 2011.*
2.	*Jeff Mcherter, Scott Gowell, "Professional mobile Application Development", paperback,2012, Wiley India Private Limited.*
3.	*Reto Meier, Wrox Wiley, "Professional Android 2 Application Development", 2010.*
4.	*Alasdair Allan, "iPhone Programming", O"Reilly, 2010.*
5.	*Wei-Meng Lee, "Beginning iPhone SDK Programming with Objective-C", Wrox Wiley, 2010.*
6.	*Stefan Poslad, "Ubiquitous Computing: Smart Devices, Environments and interactions", Wiley, 2009.*
7.	*Bear Cachil, "iOS in Practise", Paperback, 2012.*
8.	*Markus Jakobsson, "Mobile Authentication: Problems and Solutions", (SpringerBriefs in Computer Science), Paperback, 2012.*
9.	*Paula Beer, Carl Simmons, "Android App Development for Young Adults & The Rest of US", Paperback, 2015.*
10.	*Luc Bros., "Oracle Mobile Application Framework Developer Guide: Build Multiplatform Enterprise Mobile Apps", Paperback, 2014.*
11.	*Herbert Schildt, "Java: The Complete Reference", Ninth Edition –The McGraw-Hill, 2014.*
12.	*Heather Williamson, "XML: The Complete Reference", The McGraw-Hill, 2001.*
13.	*Tim Duckett, Apress, "Pro iOS Table VIews: for iPhone, iPad and IPod Touch", Paperback,2012.*

OPEN ELECTIVES OFFERED BY DEPARTMENT OF MECHANICAL ENGINEERING

17MOE001	DISASTER MANAGEMENT AND MITIGATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To make the students understand basic concepts of disaster and hazards if India
- To study the various natural disasters
- To study the various manmade disasters
- To understand the disaster management principles.
- To study the modern techniques used in disaster mitigation and management.

UNIT I	INTRODUCTION TO DISASTER	9

Meaning, Nature, Importance of Hazard, Risk, Vulnerability and Disaster-Dimensions & Scope of Disaster Management - India's Key Hazards –Vulnerabilities - National disaster management framework - Disaster Management Cycle.

UNIT II	NATURAL DISASTER	9

Natural Disasters- Meaning and nature of natural disaster; their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion.

UNIT III	ANTHROPOGENIC DISASTER	9

Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation and industrial waste water pollution.

UNIT IV	APPROACHES IN DISASTER MANAGEMENT	9

Pre-disaster stage (preparedness) - Preparing hazard zonation maps, Predictability/ forecasting & warning - Preparing disaster preparedness plan -Land use zoning - Preparedness through Information, education. Emergency Stage - Rescue training for search & operation - Immediate relief – Assessment surveys. Post Disaster stage – Rehabilitation - Social Aspect - Economic Aspectand Environmental Aspect.

UNIT V	DISASTER MITIGATION	9

Meteorological observatory - Seismological observatory - Hydrology Laboratory and Industrial Safety inspectorate. Technology in Disaster Management -Emergency Management Systems (EMS) in the Disaster Management Cycle -Remote Sensing and Geographic Information Systems (GIS) in Disaster Management.

TOTAL : 45 PERIODS	
OUTCOMES:	After successful completion of the course students able to
•	Explain the basic concepts of disaster and hazards.
•	Understand the various natural disasters.
•	Analyzethe various manmade disasters.
•	Explore the disaster management principles.
•	Compare the modern techniques used in disaster mitigation andmanagement.
TEXT BOOKS:	
1.	Sharma.S.R, **"Disaster management",** A P H Publishers, 2011.
2.	Gupta.H.K, **"Disaster Management",** University Press, India, 2003.
3.	D. B. N. Moorthy, **"Disaster Management: Text and Case studies",**Deep and Deep Publications, 2007.
REFERENCES:	
1.	*VenuGopal Rao. K, "**Geoinformatics for Disaster Management",** ManglamPublishers and Distributors, 2010.*
2.	*Singh. R. B, **"Natural Hazards and Disaster Management: Vulnerability andMitigation",** Rawat Publications, 2006.*
3.	*Gupta. M. C, **"Manuals on Natural Disaster management in India",** NationalCentre for Disaster Management, IIPA, New Delhi, 2001.*
4.	*Rajan Kumar Sahoo, Tilotama Senapati, **"Management and Mitigation of Natural Disasters"**, Regal Publication, 2013.*
5.	*Palanivel K., Saravanavel J., Gunasekaran S., **"Disaster Management"**, Allied Publishers Pvt. Ltd., 2015*

17MOE002	ENVIRONMENTAL MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the importance of nature and study about the water, air and soil pollution Control as well as solid waste management.
- To understand the importance of nature and study about the water pollution and control.
- To understand the importance of nature and study about the air pollution.
- To understand the importance of nature and study about the soil pollution control as well as solid waste management.
- ISO 14001 and skills for environmental performance in terms of legal compliance, pollution prevention and continual improvement

UNIT I	NATURE AND SCOPE OF ENVIRONMENTAL PROBLEMS	9

Environment and sustainable development – Natural and human environmental disturbances – Global warming –acid rain – ozone depletion – effects and control - climate change conventions – Kyoto protocol – India‘s efforts for Environmental protection – Public policy and role of NGO‘s

UNIT II	WATER POLLUTION AND CONTROL	9

Fresh water and its pollution – Natural processes – sources and pollutants – pollution due to industrial, agricultural and municipal wastes – effects on streams - limitations of disposal by dilution – BOD consideration in streams – Oxygen Sag Curve – Strategies for sustainable water management: Water management – Marine environment and its management – Water acts.

UNIT III	AIR AND NOISE POLLUTION	9

Pollutant emissions - sources and sink – effects of air pollution on human health, vegetation and climate– Global effects – prevention and control of air pollution – Control of particulates – Air pollution survey sand sampling – Air quality monitoring - Air Act – Management of air pollution – Sound level – Effect of noise on people – Environmental noise control- noise pollution rules 2000.

UNIT IV	SOLID WASTE MANAGEMENT AND SOIL POLLUTION	9

Sources – Characteristics – Quantities – Collection methods – Processing and disposal techniques – Onsite Handling, storage and processing – sanitary landfill – Incineration and pyrolysis – Composting – aerobic and anaerobic of compositing – Recycling and reuse of solid wastes – Hazardous wastes – Definition – Sources & types only – Integrated system for waste management – The Basel convention Land use and degradation – Management problems – strategies for sustainable land management – soil pollution –wetland conservation.

UNIT V	ENVIRONMENTAL MANAGEMENT SYSTEM	9
Terminology – installation and common motives of EMS – Environmental standards – ISO 14000 (Series) – basicprinciples – Environmental Audit – Environmental Impact assessment - Trade rules and environmental protection– Practices For Waste Minimisation And Cleaner Production.		
		TOTAL : 45 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Explainthe concept of sustainable development, climate change and roles of NGO's.
•	Understand the sources and management of Water pollution.
•	Discuss the causes of Air and Noise pollution and various management techniques.
•	Analyse solid waste and environmental protection legislations.
•	Explore the various Environmental Standards.

TEXT BOOKS:

1.	N.K.Uberoi, **"Environmental Management",** Excel Books, New Delhi(2006).
2.	Mallick A., **"Environmental Science and Management",** 1st Edition, Viva Books, 2014.
3.	PrakashTalwar, **"Environmental Management",**Isha Books,2006.

REFERENCES:

1.	*S. Vigneahwaran,M.Sundaravadivel and D.S.Chaudhary,**"EnvironmentalManagement"**, SCITECH Publications(India) Pvt.Ltd, Chennai & Hyderabad (2004).*
2.	*Mackenzie Davis, David Cornwell., "Introduction to Environmental Engineering", 4th Edition, McGraw-Hill Companies Incorporated, 2008.*
3.	*Mary K. Theodore, Louis Theodore, "**Introduction to Environmental Management**",1st Edition, CRC Press, 2009.*
4.	*P.S. BhushanaRao., **"Environment Management**", Deep & Deep Publishers, 2007.*
5.	*T.V. Ramachandra,Vijay Kulkarni, **"Environmental Management",** TERI Press New Delhi, 2009.*

17MOE003	COMPOSITE MATERIALS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To enable the students understand the properties and design of composite materials
- To familiarize the manufacturing methods for polymer matrix composites
- To familiarize the students with the manufacturing methods for metal matrix Composites
- To familiarize the students with the manufacturing methods for ceramic matrix Composites
- To understand practical requirements associated with joining and manufacturing

UNIT I	INTRODUCTION TO REINFORCEMENT AND MATRIX INTERFACE	12

Reinforcement – Fibres – Glass fibre, Aramid fibre, Carbon fibre, boron fibre – Fabrication – Properties – Applications – Comparison of fibres – Particulate and whisker reinforcements. Matrix materials – Properties.Wettability – Effect of surface roughness – Interfacial bonding – Methods for measuring bond strength.

UNIT II	POLYMER MATRIX COMPOSITES	8

Types – Processing – Thermal matrix composites – Hand layup and spray technique, filament winding, Pultrution, resin transfer moulding, autoclave moulding – Thermoplastic matrix composites – Injection moulding, film stacking – Diaphragm forming – Thermoplastic tape laying. Glass fibre/polymer interface. Mechanical properties – Fracture. Applications.

UNIT III	METAL MATRIX COMPOSITES	8

Types. Important metallic matrices. Processing – Solid state, liquid state, deposition, insitu. Sic fibre / Titanium interface. Mechanical properties. Applications.

UNIT IV	CERAMIC MATRIX COMPOSITES	8

Ceramic matrix materials – Processing – Hot pressing, liquid infiltration technique, Lanxide process, insitu chemical reaction techniques – CVD, CVI, sol-gel process. Interface in CMCs. Mechanical properties – Thermal shock resistance – Applications.

UNIT V	GEOMETRICAL ASPECTS, FATIGUE AND CREEP IN COMPOSITE MATERIALS	9

Unidirectional laminas – Volume fraction and weight fraction – Woven roving, in-plane random fibres – Fibre length and fibre orientation distribution – Voids – Fibre orientation during flow. Fatigue – S-N curves – Fatigue behaviours of CMCs – Fatigue of particle and whisker reinforced composites – Hybrid composites – Thermal fatigue – Creep.	
TOTAL : 45 PERIODS	
OUTCOMES:	After successful completion of the course students able to
•	Analyse the fiber reinforced Laminate for optimum design.
•	Explore the concepts of Polymer Matrix Composites.
•	Discuss different Metal Matrix Composites properties and manufacturing process.
•	Understand the different Ceramic Matrix Compositesproperties.
•	Apply Fatigue and creep theory to study and analyse the Mechanical behaviour of Composites.
TEXT BOOKS:	
1.	Krishnan K Chawla, "**Composite Materials Science and Engineering**", Springer, 2001.
2.	Mathews F L and Rawlings R D, **"Composite Materials: Engineering and Science",** CRC Press and Woodhead Publishing Limited, 2002.
3.	Derek Hull, "**An introduction to Composite Materials**", Cambridge Univ. Press, 1988.
REFERENCES:	
1.	***"Handbook of Composites"*** *– American Society of Metals, 1990*
2.	*Gibson, R.F., "**Principles of Composite Material Mechanics",** Second Edition, McGraw-Hill, CRC press in progress, 1994.*
3.	*Autar K. Kaw, **"Mechanics of Composite Materials",** Second Edition, CRC Press,2006*
4.	*Halpin, J.C**., "Primer on Composite Materials, Analysis",** Technomic Publishing Co., 1984.*
5.	*Mallick, P.K. and Newman, S., **"Composite Materials Technology: Processes and Properties"**, Hansen Publisher, Munish, 1990.*

17MOE004	RENEWABLE ENERGY SOURCES AND TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To educate the students scientifically the new developments in renewable energy studies.
- To educate the concepts of various aspects of Solar energy and utilization
- To enable the students understand wind energy
- To understand the various aspects of Biomass energy and utilization
- To emphasize the significance of Green Energy Technologies.

UNIT I	INTRODUCTION	9

World energy status, Current energy scenario in India, Environmental aspects ofenergy utilization, Environment - Economy - Energy and Sustainable Development,Energy planning.Reserves of Energy resources, Renewable energy resources - potentials -achievements – applications. Technical and social implications, issuesin grid integration of power from renewable energy sources, Comparison between different Renewable energy sources.

UNIT II	SOLAR ENERGY	9

Basic concepts, Solar radiation , Measurement, Solar thermal systems ,Flat plate and concentrating collectors, Solar passive space, Solar heating andcooling techniques, Solar desalination, Solar dryers, Solar furnaces, Solar pumping, Solar greenhouse, Solar thermal electricpower plant, Photo-voltaics, p-n junctions. Solar cells, PV systems, Standalone, Grid connected solar power satellite, Calculation of energy through photovoltaic power generation,Hybrid systems, Solar Engines: Stirling, Brayton engines.

UNIT III	WIND ENERGY	9

Energy available from wind, General formula, Lift and drag. Basis of Wind energy conversion, Effect of density, Frequency variances, Angle of attack, Wind speed, Windmill rotors, Horizontal axis and Vertical axis rotors, Determination of torque coefficient, Induction type generators, Working principle of wind power plant and Site selection.

UNIT V	BIOMASS ENERGY	9

Biomass – usable forms- composition- fuel properties – applications, Biomassresources, Biomass conversion technologies - direction combustion - pyrolysis –gasification -anaerobic digestion, Bio-ethanol and Biodiesel Production -Economics - Recent developments.Energy farming, Biogas technology – Domestic biogas plants, Community and institutional biogas plants – design consideration –applications.

UNIT V	OTHER RENEWABLE ENERGY SOURCES	9
Tidal energy – Wave energy – Open and closed OTEC Cycles – small hydro –Geothermal energy – Social and environmental aspects.Fuel cell technology -types, principle of operation – applications.Hydrogen energy production – Storage– transportation – utilization.		
TOTAL : 45 PERIODS		
OUTCOMES:	After successful completion of the course students able to	
•	Emphasis the current energy status and role of renewable energy sources.	
•	Explain the concepts of various aspects of Solar energy and utilization.	
•	Explore the various aspects of Wind energy and utilization.	
•	Familiarize with various aspects of Biomass energy and utilization.	
•	Understand various other renewable energy sources.	
TEXT BOOKS:		
1.	Ashok Desai V, **"Non-Conventional Energy**", Wiley Eastern Ltd, 1990	
2.	Mittal K.M, **"Non-Conventional Energy Systems"**, Wheeler Publishing Co. Ltd, 1997.	
3.	Ramesh R, Kurnar K.U, **"Renewable Energy Technologies"**, Narosa Publishing House, New Delhi, 1997.	
REFERENCES:		
1.	*Freris, L.L, **"Wind Energy Conversion systems",** Prentice Hall, UK, 1990*	
2.	*Veziroglu.T.N, **"Alternative Energy Sources"**, Vol 5 and 6, McGraw-Hill, 1978.*	
3.	*S.P. Sukhatme, **"Solar Energy"**, Tata McGraw Hill, New Delhi, 1997.*	
4.	*Kothari P, K C Singal and Rakesh Ranjan, "**Renewable Energy Sources and Emerging Technologies"**, PHI Pvt. Ltd.,New Delhi, 2008.*	
5.	*G.D. Rai, **"Non Conventional Energy Sources",** Khanna Publishers, New Delhi, 1999.*	

17MOE005	INTELLECTUAL PROPERTY RIGHTS	L	T	P	C
		3	0	0	3

OBJECTIVES:	
•	To enable the students have an overall law of Property
•	To understand details about of the impacts of IP on industry
•	To understand the protecting cumulative innovations
•	To understand Litigation and Enforcement
•	To teach students about details current government policy about IPR

UNIT I	INTRODUCTION	9

Background and Concepts - Brief History of - Institutions - Investing in Knowledge-Market Failures in Knowledge - IP, Public Sponsorship & Prize - IP Law Basics Meansof IP Protection - Patents - Copyrights - Trade Secrets - Others - IP andAntitrustProperty.

UNIT II	THE IMPACTS OF IP ON THE PLANT/SEED INDUSTRY	9

The logic of IP - Patenting vs. Company Secrets - Plant Patent Timeline EmpiricalEvidence in Plants: A Puzzle - Optimal Design of IP - Scarce Ideas vs.Non-scarce ideas - Policy Levers in IP Design - Breadth - Length - Required InventiveSteps - Optimal Size of Reward and Structure - Entry Cost Regime HorizontalCompetitionRegime- Economic Effects of Exemptions.

UNIT III	PROTECTING CUMULATIVE INNOVATIONS	9

Three Types of Cumulativeness - Basic v. Applied Research - Research Tool QualityLadders - Policy Levers and Prospecting - Open Source.

UNIT IV	LITIGATION AND ENFORCEMENT	9

Litigation and Enforcement - Remedies for Infringement - How they matter Enforcementof IP by Technical Means - Limited Sharing of Copyrighted Works TechnologyTransfer, Diffusion, and Adoption - Networks and Network Effects Conceptsand Issues - Direct vs. Indirect Network Effects - Physical Networks BusinessStrategies- System Competition vs. Standard Competition

UNIT V	INNOVATION TODAY	9

A Private-Public Partnership - University Innovation - Government Grant Process MixedPrivate-Public Incentives - Innovation in the Global Economy – WhoPatents and Where - Trade Policy and Treaties - Paris Convention, BerneConvention, TRIPS - PCT and WIPO - National Treatment and Efficient Protection -Harmonization - Externalities and International Cooperation

TOTAL : 45 PERIODS

OUTCOMES:	After successful completion of the course students able to

•	Explain the basics of intellectual property.
•	Discuss the impacts of IP on Plants/Seed industry
•	Explore protecting methods of innovations.
•	Understand the concept of litigation and enforcement.
•	Learn Various treaties and acts on Innovation.
TEXT BOOKS:	
1.	Christopher May, Susan K. Sell, **"Intellectual Property Rights",** Lynne Rienner Publishers. 2005
2.	N. K. Acharya,**"Text Book on Intellectual Property Rights"** Asia Law House, 2010.
3.	R Radhakrishnan and S. Balasubramanian, **"Intellectual Property Rights: Text and Cases"**, First Edition, Excel books New Delhi, 2008
REFERENCES:	
1.	*Subbaram, N. R. "**Handbook Of Indian Patent Law And Practice**", S. Viswanathan Printers And Publishers Pvt. Ltd., 1998.*
2.	*N.S. Gopalakrishnan & T.G. Agitha, **"Principles Of Intellectual Property**". 2nd Edition, Eastern Book Company, 2014.*
3.	*Tanya Frances Aplin, Jennifer Davis, **"Intellectual Property Law: Text, Cases and Materials",** 3rd Edition, Oxford University Press, 2017.*
4.	*Neeraj Pandey, Khushdeep Dharni, **"Intellectual Property Rights",** PHI Learning, 2014.*
5.	*Rachna Singh Puri, Arvind Viswanathan**, "Practical Approach to Intellectual Property Rights",** I. K. International Publishing House Pvt. Ltd. Delhi 2009.*

17MOE006	ENGINEERING ECONOMICS AND FINANCIAL ACCOUNTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To make the students understand the basic concepts of managerial economics.
- To make the students understand the basics of demand, supply and related concepts.
- To make the students understand various production and cost concepts
- To make the students understand and apply the basic concepts of pricing.
- To make the students understand and apply the basic concepts of capital budgeting.

UNIT I	INTRODUCTION	9

Managerial Economics - Relationship with other disciplines - Firms: Types, objectives and goals - Managerial decisions - Decision analysis.

UNIT II	DEMAND & SUPPLY ANALYSIS	9

Demand - Types of demand - Determinants of demand - Demand function – Demand elasticity –Demand forecasting - Supply – Determinants of supply - Supply function - Supply elasticity.

UNIT III	PRODUCTION AND COST ANALYSIS	9

Production function - Returns to scale - Production optimization - Least cost input - Isoquants – Managerial uses of production function.

Cost Concepts- Cost function - Determinants of cost - Short run and Long run cost curves Cost Output Decision - Estimation of Cost.

UNIT IV	PRICING	9

Determinants of Price - Pricing under different objectives and different market structures - Price discrimination - Pricing methods in practice.

UNIT V	CAPITAL BUDGETING	9

Investments - Risks and return evaluation of investment decision - Average rate of return - Payback Period - Net Present Value - Internal rate of return.

TOTAL : 45 PERIODS

OUTCOMES: After successful completion of the course students able to

- Explain the basics of managerial economics and decisions.

•	Analyse the concepts of demand and supply.
•	Discuss various functions of production and cost analysis concepts.
•	Understand various pricing techniques.
•	Explore the concept of capital budgeting.
TEXT BOOKS:	
1.	R. Kesavan, C.Elanchezhian, T. Sunder selvin, **"Engineering Economics And Financial Accounting"**, laxmi publications (p) Ltd. First edition, 2005.
2.	M. Kasi Reddy, S. Saraswathy, **"Managerial Economics and Financial Accounting", Prentice Hall of India Private Limited,2007.**
3.	McGuigan, Moyer and Harris, **'Managerial Economics**; Applications, Strategy and Tactics', Thomson South Western, 10th Edition, 2005.
REFERENCES:	
1.	*Salvatore Dominick, '**Managerial Economics in a global economy**'. Thomson South Western, 4th Edition, 2001.*
2.	*Prasanna Chandra. '**Fundamentals of Financial Management**', Tata Mcgraw Hill Publishing Ltd., 4th edition, 2005.*
3.	*N. Samuelson. Paul A and Nordhaus W.D**., 'Economics'**, Tata Mcgraw Hill Publishing Company Limited, New Delhi, 2004.*
4.	*Paresh Shah, '**Basic Financial Accounting for Management**', Oxford University Press, N ew Delhi, 2007.*
5.	*R. Panneerselvam, "**Engineering Economics**", PHI Learning PVT. Ltd. Delhi. 2013.*

17MOE007	INDUSTRIAL SAFETY ACTS AND STANDARDS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To make the students to understand basic concepts of factories act.
- To understand basic concepts of Environment act.
- To study the various hazardous chemical rules
- To study the various Indian Boiler ,industry and Electricity act
- To study the various international acts and standards

UNIT I	FACTORIES ACT – 1948	9

Statutory authorities – inspecting staff, health, safety, provisions relating to hazardous processes, welfare, working hours, employment of young persons – special provisions – penalties and procedures-Tamilnadu Factories Rules 1950 under Safety and health chapters of Factories Act 1948

UNIT II	ENVIRONMENT ACT – 1986	9

General powers of the central government, prevention, control and abatement of environmental pollution-Biomedical waste (Management and handling Rules, 1989-The noise pollution (Regulation and control) Rules, 2000-The Batteries (Management and Handling Rules) 2001- No Objection certificate from statutory authorities like pollution control board. Air Act 1981 and Water Act 1974: Central and state boards for the prevention and control of air pollution-powers and functions of boards – prevention and control of air pollution and water pollution – fund – accounts and audit, penalties and procedures.

UNIT III	MANUFACTURE, STORAGE AND IMPORT OF HAZARDOUS CHEMICAL RULES 1989	9

Definitions – duties of authorities – responsibilities of occupier – notification of major accidents – information to be furnished – preparation of offsite and onsite plans – list of hazardous and toxic chemicals – safety reports – safety data sheets

UNIT IV	OTHER ACTS AND RULES	9

Indian Boiler Act 1923, static and mobile pressure vessel rules (SMPV), motor vehicle rules, mines act 1952, workman compensation act, rules – electricity act and rules – hazardous wastes (management and handling) rules, 1989, with amendments in 2000- the building and other construction workers act 1996., Petroleum rules, Gas cylinder rules-Explosives Act 1983-Pesticides Act

UNIT V	INTERNATIONAL ACTS AND STANDARDS	9

Occupational Safety and Health act of USA (The Williames - Steiger Act of 1970) – Health and safety work act (HASAWA 1974, UK) – OSHAS 18000 – ISO 14000 – American National Standards Institute (ANSI)	
TOTAL : 45 PERIODS	
OUTCOMES:	After successful completion of the course students able to
•	List out important legislations related to health, Safety and Environment.
•	Creating requirements mentioned in factories act for the prevention of accidents.
•	Analyze the health and welfare provisions given in factories act.
•	Evaluate the statutory requirements for an Industry on registration and license
•	Learn the various international acts and standards.
TEXT BOOKS:	
1.	**The Factories Act 1948**, Madras Book Agency, Chennai, 2000
2.	**The Environment Act (Protection) 1986,** Commercial Law Publishers, Delhi, 1986.
3.	L. M. Deshmukh,**Industrial Safety Management**, Tata McGraw Hill, NewDelhi, 2005.
REFERENCES:	
1.	***The manufacture, storage and import of hazardous chemical rules 1989****, Madras Book Agency,*
2.	***The Indian boilers act 1923,*** *Commercial Law Publishers (India) Pvt.Ltd., Allahabad*
3.	*S. N. Dhyani,* ***International Labour Organisation and India: In Pursuit of Social Justice****, National, 1977.*
4.	***The Mines Act 1952,*** *Commercial Law Publishers (India) Pvt.Ltd., Allahabad.*
5.	***Water (Prevention and control of pollution) act 1974****,* ***Air (Prevention and control of pollution) act 1981****, Commercial Law Publishers (India) Pvt.Ltd., New Delhi.*

17MOE008	GLOBAL WARMING AND CLIMATE CHANGE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To make the students to understand basic concepts of disaster and hazards if India.
- To study the various natural disasters.
- To study the various manmade disasters.
- To understand the disaster management principles.
- To study the modern techniques used in disaster mitigation and management.

UNIT I	EARTH'S CLIMATE SYSTEM	9

Role of ozone in environment-ozone layer-ozone depleting gases - Green House Effect, Radiative Effects of Greenhouse Gases - The Hydrological Cycle - Green House Gases and Global Warming – Carbon Cycle.

UNIT II	ATMOSPHERE AND ITS COMPONENTS	9

Importance of Atmosphere-Physical Chemical Characteristics of Atmosphere - Vertical structure of the atmosphere-Composition - Atmospheric stability-Temperature profile of the atmosphere - Lapse rates –Temperature inversion-effects of inversion on pollution dispersion.

UNIT III	IMPACTS OF CLIMATE CHANGE	9

Causes of Climate change : Change of Temperature in the environment - Melting of ice Pole-sea level rise-Impacts of Climate Change on various sectors –Agriculture, Forestry and Ecosystem – Water Resources – Human Health –Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions– Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes.

UNIT IV	OBSERVED CHANGES AND ITS CAUSES	9

Climate change and Carbon credits- Initiatives in India - Kyoto Protocol-Intergovernmental Panel on Climate change- Climate Sensitivity and Feedbacks –The Montreal Protocol – UNFCCC – IPCC –Evidences of Changes in Climate and Environment – on a Global Scale and in India .

UNIT V	CLIMATE CHANGE AND MITIGATION MEASURES	9

Clean Development Mechanism –Carbon Trading - examples of future Clean Technology Biodiesel – Natural Compost – Eco - Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar

Energy – Wind – Hydroelectric Power – Mitigation Efforts in India - Adaptation funding- Key Mitigation Technologies – Energy Supply – Transport – Buildings – Industry – Agriculture – Forestry - Carbon sequestration – Carbon capture and storage (CCS)- Waste MSW & Bio waste, Biomedical, Industrial waste – International and Regional cooperation.	
TOTAL : 45 PERIODS	
OUTCOMES:	After successful completion of the course students able to
•	Analysethe earth's climate system.
•	Explainthe various layers and composition of earth atmosphere.
•	Discuss the impacts of Climate Change on various sectors.
•	Explore various observed climate changes and its causes.
•	Understand the concept of mitigation measures against global warming.
TEXT BOOKS:	
1.	Dash Sushil Kumar,**"*Climate Change – An Indian Perspective*"**, Cambridge University Press (India Pvt. Ltd), 2007.
2.	J. Houghton, **"Global Warming The Complete Briefing"**,Cambridge Univ. press,2015.
3.	Jerry Silver, **"Global Warming and Climate Change Demystified",**McGraw-Hill,2008.
REFERENCES:	
1.	*Watson, Robert T., Marufu C. Zinyowera, and Richard H. Moss.* ***"Impacts, adaptations and mitigation of climate change: scientific-technical analyses****. 1996.*
2.	*J.M. Wallace and P.V. Hobbs,****"Atmospheric Science"****, Elsevier / AcademicPress 2006.*
3.	*Jan C. van Dam, Impacts of* ***"Climate Change and Climate Variability on Hydrological Regimes",*** *Cambridge University Press, 2003.*
4.	*T. M. Letcher* ***"Climate Change:Observed impacts on planet Earth",****Elsevier, 2015*
5.	*Farmer, G. Thomas, Cook, John,****"Climate Change Science: A Modern Synthesis",****Springer Netherlands, 2013.*

LIST OF ONE CREDIT COURSES

17EOC001	SPICE SIMULATION FOR CIRCUITS	L	T	P	C
		0	0	2	1

OBJECTIVES:	
•	To enable the students to stimulate the behavior of semiconductor devices using SPICE simulation software.
•	To enable the students to stimulate the behavior of Analog electronic circuits using SPICE simulation software.
•	To enable the students to stimulate the behavior of Digital electronic circuits using SPICE simulation software.

1. Simulation of rectifier circuits and clipper/clamper circuit.
2. Simulation of any one transistor biasing circuit.
3. Simulation of CE single/double stage amplifier circuit.
4. Simulation of any one power amplifier circuit.
5. Simulation of any one JFET/MOSFET amplifier circuit.
6. Simulation of any one negative feedback circuit.
7. Simulation of encoder/multiplexer circuit.
8. Simulation of decoder/de multiplexer circuit.
9. Simulation of any one flip-flop circuit using gates.
10. Simulation of any one register/counter circuit.

TOTAL :30 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Design the electronics circuits using software tools like NGspice/LTSpice/Multisim.
•	Simulate various analog and digital circuits using NGspice/LTSpice/Multisim

17EOC002	YOGA AND MEDITATION	L	T	P	C
		1	0	0	1

OBJECTIVES:

- To study the origin of yoga, meaning of yoga and types of yoga
- to provide knowledge on yogic practices and modern concept of yoga
- To Provide knowledge on different types of asanas and know the difference between asanas and yogas

UNIT I	INTRODUCTION	5

Origin of Yoga & its brief development-Meaning of Yoga & its importance-Yoga as a Science of Art (Yoga Philosophy)-Meaning of meditation and its types and principles-Classification of Yoga/Types of Yoga: Hatha Yoga , Raja Yoga, Laya Yoga, Bhakti Yoga, Gyan Yoga, Karma Yoga, Asthang Yoga.

UNIT II	YOGIC PRACTICES AND MODERN CONCEPT OF YOGA	5

Principles of Yogic Practices: Meaning of Asana, its types and principles- Meaning of Pranayama, its types and principles- Meaning of Kriya its types and principles- Naturopathy, Hydrotherapy-Electrotherapy, Messotherapy-Acupressure, acupuncture- Meaning and importance of prayer- Psychology of mantras- Different mudras during prayers.

UNIT III	ASANAS	5

Classification of Asanas and its Mechanism- Cultural Asana (standing, sitting, supinline, praline position & topsy-turvy)- Meditative Asana and Relaxative Asana. Effect of Asanas on various Systems-Difference between Asana and Exercise-Difference between Pranayama and deep breathing-Yogic Diet.

TOTAL:15 PERIODS

OUTCOMES: After successful completion of the course students able to

- Do different Yogas and Asanas.
- Maintain body physically and mentally.

TEXT BOOKS:

1. B.K.S Iyengar ,"Light on Yoga" Publisher: Schocken Books, New York,1996
2. Leslie Kaminoff and Amy Mathews, "Yoga Anatomy" 2nd edition,Kindle,2012
3. Lorin Roche ,"For Beginners Medidation made easy"Harper Collins,2012.

17EOC003	STRESS MANAGEMENT	L	T	P	C
		1	0	0	1

OBJECTIVES:	
•	To understand the nature of stress, sources of stress and body's reactions to stress
•	To study the strategies of stress management and prevention and prevention of stress
•	To study the strategies of synthesis

UNIT I	UNDERSTANDING THE NATURE OF STRESS	5

The Meaning of Stress-The Body's Reactions to Stress-Sources of Stress Across the Lifespan-Adaptive and Maladaptive Behavior-Individual and Cultural Differences.

UNIT II	STRATEGIES OF STRESS MANAGEMENT AND PREVENTION	5

Challenging Stressful Thinking-Problem Solving and Time Management-Psychological and Spiritual Relaxation Methods-Physical Methods of Stress Reduction- Preparing for the Future: College and Occupational Stress- Care of the Self: Nutrition and Other Lifestyle Issues- Stress and Conflict in Relationships.

UNIT III	STRATEGIES OF SYNTHESIS AND PREVENTION	5

Resilience and Stress-Optimal Functioning-Making Changes Last.

TOTAL:15 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Understand the nature of stress
•	Comprehend the psychological and physiological effects of stress.
•	Assess individual risk factors as related to stress.

TEXT BOOKS:

1.	Kottler, J. A. & Chen, D. D. (2011). " Stress management and prevention: Applications to daily life", London and New York
2.	Gina Lake, "From Stress to Stillness: Tools for inner Peace" Kindle, 2012.
3.	Rita Emmett. "Manage your Time to reduce your stress : a handbook for the overworked, overscheduled and overwhelmed"

17EOC004	PCB DESIGN AND FABRICATION	L	T	P	C
		1	0	0	1

OBJECTIVES:	
•	To study the design of schematic electronic circuits using software
•	To impart knowledge on simulation of electronic circuits
•	To impart knowledge on PCB Layout design

UNIT I	DESIGN OF SCHEMATIC ELECTRONIC CIRCUITS USING SOFTWARE	5

PCB layout design software- Wire, bus, junction, probe, voltage source, current source, and ground etc. used in circuit simulation software- Create new project and schematic file- Search, add and create new electronic part. Edit, Connect or wire the circuit.

UNIT II	SIMULATION OF ELECTRONIC CIRCUITS	5

Test RC, LC or RLC based electronic circuit- Test diode, transistor or MOSFET based electronicCircuit- Test analog/digital IC based electronic circuit- Transient analysis of RC, LC,or RLC based electronic circuit-Bias point analysis or characteristic curve of diode, transistor or MOSFET based electronic circuit- Frequency response (AC Analysis) of RC, diode, andtransistor etc. based electronic circuit.

UNIT III	PCB LAYOUT DESIGN	5

Net list file, back annotation,bill of material, foot print,PTH, track width, mil, etc- Transfer circuit to PCB layout- Search, add and create footprint- Place, route and generate PCB Layout- Drawing and printing layout on board, photo etching process, masking process- PCB manufacturing techniques.

TOTAL:15 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	State the features of different circuit simulation tools.
•	Define the general terms used in circuit simulation.
•	Simulate electronic Circuits.
•	Fabricate a PCB.

TEXT BOOKS:

1.	Bossart ,"Printed Circuit Boards: Design and Technology" TMH, New Delhi 2008 Edition.
2.	Multisim user manual by National Instruments. **www.ni.com**
3.	Orcade online manual by Cadence .**www.cadence.com**

17EOC005	PERSONALITY DEVELOPMENT	L	T	P	C
		1	0	0	1

OBJECTIVES:	
•	To study the self analysis and importance of self confidence
•	To study the importance of attitude and motivations
•	To study the goal settings and time management

UNIT I	SELF ANALYSIS AND CREATIVITY	5

SWOT Analysis, Who am I, Attributes, Importance of Self Confidence, Self Esteem- Out of box thinking, Lateral Thinking.

UNIT II	ATTITUDE AND MOTIVATION	5

Factors influencing Attitude, Challenges and lessons from Attitude, Etiquette-Factors of motivation, Self-talk, Intrinsic & Extrinsic Motivators.

UNIT III	GOAL SETTING	5

Wish List, SMART Goals, Blue print for success, Short Term, Long Term, Life Time Goals.

Time Management

Value of time, Diagnosing Time Management, Weekly Planner To do list, Prioritizing work.

TOTAL:15 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Develop inter personal skills and be an effective goal oriented team player.
•	Develop communication and problem solving skills.
•	Re-engineer attitude and understand its influence on behavior

TEXT BOOKS:

1.	Covey Sean, "*Seven Habits of Highly Effective Teens"*, New York, Fireside Publishers, 1998.
2.	Carnegie Dale, "*How to win Friends and Influence People"*, New York: Simon & Schuster, 1998.
3.	*Thomas A Harris, "I am ok, You are ok" , New York-Harper and Row, 1972.*
4.	*Daniel Coleman, "Emotional Intelligence", Bantam Book, 2006.*

17EOC006	ENTERPRENEURSHIP DEVELOPMENT	L	T	P	C
		1	0	0	1

OBJECTIVES:	
•	To study the types and importance of enterpreneurship
• ·	To impart knowledge on business and challenges to be faced in market
•	To study the Financing and accounting related to business.

UNIT I	ENTREPRENEURSHIP	5

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

UNIT II	BUSINESS	5

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

UNIT III	FINANCING AND ACCOUNTING	5

Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, and Taxation – Income Tax, Excise Duty – Sales Tax.

TOTAL:15 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Know the importance of Entrepreneurship.
•	Start a business and successfully run it.
•	Know Financing and accounting related to business.

TEXT BOOKS:

1.	Khanka S.S., "Entrepreneurial Development" S.Chand & Co. Ltd.,Ram Nagar, New Delhi, 2013.
2.	Donald F Kuratko, " Entreprenuership – Theory, Process and Practice", Cengage Learning 9th edition, 2014.
3.	Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill, 2013.

4.	Rajeev Roy, “Entrepreneurship” 2nd Edition, Oxford University Press, 2011.

17EOC007	SOLAR PV SYSTEM DESIGN	L	T	P	C
		1	0	0	1

OBJECTIVES:	
•	To study the design of PV systems and its components
• ·	To impart knowledge on site selection for PV systems and to study different mounting methods
•	To study the Design Grid Connected and Off grid connected PV system.

UNIT I	PV SYSTEMS AND ELECTRICAL COMPONENTS	5

Basic components for electrical and PV systems- components required for different types of PV systems- grid connected and off grid differences- economics of each- grid-connected PV system- basics of a micro inverter vs string inverter system- PV module- series/parallel circuits- temperature and irradiance fluctuations- MPPT.

UNIT II	SITE ANALYSIS AND MOUNTING SOLUTIONS	5

Site analysis, planning, and implementation- instruments and tools required for solar site analysis- Azimuth-Magnetic declination-Tilt angle-Shading, debris, other losses- Roof type (material and condition)-Roof structure- solar resource data- different mounting methods.

UNIT III	GRID-CONNECTED PV SYSTEMS AND OFF GRID PV SYSTEMS	5

Grid Connected System: system sizing- energy efficiency- losses- derating factors, solar insolation, temperature co-efficient parameters - types of grid-dependent inverters-Off Grid System:Different system designs and configurations- sizing calculations for PV array and battery bank sizes- installation methods for PV arrays, battery banks, and additional Equipment- maintenance.

TOTAL :15 PERIODS

OUTCOMES:	After successful completion of the course students able to
•	Design PV system and its components.
• ·	Select proper site for PV installation.
•	Design Grid Connected and Off grid connected PV system.

TEXT BOOKS:

1.	C.H.Solangi ,"Solar Photovoltaic Technology and Systems: A Manual for Technicians, Trainers and Engineers".PHI,2016.

2.	Michael Boxwell ,”Solar Electricity Handbook”.Greenstream,2015.
3.	”Photovoltaics: Design and Installation Manual” New Society Publisher, 2004.