Semester I

		L	T	P	C
118ENT01	TECHNICAL ENGLISH	2	0	0	2

COURSE OBJECTIVES

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations, participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialization

UNIT I 9

Listening - Ink talks and gap exercises - **Speaking** – Asking for and giving directions - **Reading** – short technical texts from journals and newspapers - **Writing** - definitions – instructions – checklists – recommendations - **Vocabulary Development** - technical vocabulary -**Language Development** – parts of speech – articles – word formation.

UNIT II 9

Listening - longer technical talks - **Speaking** – process description - **Reading** – longer technical texts – **Writing** – graphical representation - **Vocabulary Development** - vocabulary used in formal letters/emails and reports - **LanguageDevelopment** – tenses - voices - numerical adjectives – question tags.

UNIT III 9

Listening - listening to classroom lectures - **Speaking** – introduction to technical presentations - **Reading** – longer texts both general and technical and practice in speed reading – **Writing** – process description using sequence words and sentences - **Vocabulary Development** - Misspelled words – one-word substitution - **Language Development** - embeddedsentences – singular and plural nouns - compound nouns – editing.

UNIT IV 9

Listening - Listening to documentaries and making notes - **Speaking** – mechanics of presentations - **Reading** – reading comprehension – **Writing** - email etiquettes - job application – cover letter – Résumé preparation - essay writing - **Vocabulary Development** – synonyms and antonyms – paraphrasing - **Language Development** – modals – conditionals.

UNIT V 9

Listening - TED talks - **Speaking** – brainstorming and debate – **Reading** – reading and understanding technical articles– **Writing** – reports - minutes of a meeting - **Vocabulary Development**- verbal analogies - phrasal verbs - **Language Development** - concord - reported speech.

TOTAL:45 PERIODS

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COURSE OUTCOMES

At the end of the course learners will be able to:

CO1 Read technical texts and write area- specific texts effortlessly.

CO2 Listen and comprehend lectures and talks in their area of specialization successfully.

CO3 Speak appropriately and effectively in varied formal and informal contexts.

CO4 Understand the basic grammatical structures and its applications.

CO5 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. Sudharshana. N.P and Saveetha. C. English for Technical Communication, Cambridge University Press: New Delhi, 2016.
3. Uttham Kumar. N. Technical English I (with work book). Sahana Publications, Coimbatore, 2016.

REFERENCE BOOKS

1. Raman, Meenakshi and Sharma, Sangeetha- Technical Communication Principles and Practice. Oxford University Press: New Delhi,2014.
2. Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad,2015.
3. Booth-L. Diana, Project Work, Oxford University Press, Oxford: 2014.
4. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007
5. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges. Cengage Learning, USA: 2007.

Students can be asked to read Tagore and Chetan Bhagat for supplementary reading.

COs	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	2										2	2		
CO2	3	2			2			1				2	2		1
CO3	3	2			2							2	2	2	1
CO4	3	2			2							2		2	1
CO5	3	2						1				2		2	

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118PPT05	PROBLEM SOLVING AND PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures — lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT I ALGORITHMIC PROBLEM SOLVING **9**

Algorithms, building blocksof algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: findminimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA, EXPRESSIONS, STATEMENTS **9**

Python interpreter andinteractive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters andarguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance betweentwo points.

UNIT III CONTROL FLOW, FUNCTIONS **9**

Conditionals: Boolean valuesand operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES **9**

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, merge sort, histogram.

UNIT V FILES, MODULES, PACKAGES **9**

Files and exception: text files, reading and writing files, format operator; command line arguments, date and time, errors and exceptions, handling exceptions, debugging, modules, packages; Illustrative programs: word count, copy file.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1 Develop algorithmic solutions to simple computational problems

CO2 Read, write, execute by hand simple Python programs.

CO3 Structure simple Python programs for solving problems.

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CO4 Decompose a Python program into functions.

CO5 Represent compound data using Python lists, tuples, dictionaries.

TEXT BOOKS

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated forPython3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)
2. Guido van Rossum and Fred L. Drake Jr, —An Introduction to Python – Revised and updated for Python 3.2,Network Theory Ltd., 2011.

REFERENCE BOOKS

1. John V Guttag, —Introduction to Computation and Programming Using Python'', Revised and expandedEdition, MIT Press, 2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, —Introduction to Programming in Python: An Inter-Disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd, —Exploring Python‖, Mc-Graw Hill Education(India) Private Ltd., 2015.
4. Kenneth A. Lambert, —Fundamentals of Python: First Programs‖, CENGAGE Learning, 2012.
5. Charles Dierbach, —Introduction to Computer Science using Python: A Computational Problem-Solving Focus,Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, —Practical Programming: An Introduction to ComputerScience using Python 3‖, Second edition, Pragmatic Programmers, LLC, 2013.

COs	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		3			2					2		2			
CO2			2							2		2			1
CO3			2							2		2		2	
CO4	3	3	2		2					2		2			1
CO5			2							2		2		2	
CO6			2							2		2			

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118PHP07	ENGINEERING PHYSICS LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

- To understand the practical concepts of Interference and diffraction.
- To understand the concept of velocities of sound in different liquids.
- To get better knowledge of modulus of elasticity.
- To understand the concepts of thermal conductivity.
- To understand the concepts of viscosities of liquid

LIST OF EXPERIMENTS

1. (a) Determination of laser parameters – Wavelength.

   (b) Particle size determination using Diode Laser.
2. Determination of thickness of a thin wire-Air wedge method.
3. Determination of velocity of sound and compressibility of liquid- Ultrasonic interferometer.
4. Determination of wavelength of mercury spectrum-Spectrometer grating.
5. Determination of thermal conductivity of a bad conductor-Lee's disc method.
6. Determination of Young's modulus of the material –Non uniform bending.
7. Determination of viscosity of liquid – Poiseuille's method.
8. Spectrometer- Dispersive power of prism.
9. Determination of Young's modulus of the material - Uniform bending.
10. Tensional pendulum- Determination of Rigidity modulus.

COURSE OUTCOMES

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

CO1 Understanding the moduli of elasticity by determining Young's modulus and Rigiditymodulus of a beam and cylinder respectively.

CO2 Understanding the phenomenon of diffraction, dispersion and interference of light using opticalcomponent.

CO3 Acquiring knowledge of viscosity by determining coefficient of viscosity of a liquid.

CO4 Measuringthe parameters of ultrasound propagating through a liquid.

CO5 Understanding the phenomenon of heat transfer through conductors and bad conductors by determining thermal conductivity.

COs	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	2													
CO2	3	2		2											
CO3	3	2		3											
CO4	3	2		3											

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CO5	2	1													

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118PPP08	PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

LIST OF EXPERIMENTS

1. To Implement python scripts using Variables and operators
2. To Demonstrate Operator precedence to evaluate an expression
3. Display grade of a student using elif statement
4. Implement Floyd triangle using for loop
5. Checks the given number is prime or not using while loop
6. Compute the GCD of Numbers using functions
7. Finding factorial of a given number using recursive function.
8. Takes a list of words and returns the length of longest one using strings
9. To perform linear and binary search using strings
10. To implement list as arrays (multiply 2 matrices)
11. To demonstrate use of list & related functions
12. To demonstrate use of tuple, set& related functions
13. To demonstrate use of Dictionary& related functions
14. Finding most frequent words in a text read from a file
15. Programs that take command line arguments (word count)

PLATFORM NEEDED

Python 3 interpreter for Windows/Linux

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1 Write, test, and debug simple Python programs.
CO2 Implement Python programs with conditionals and loops.
CO3 Develop Python programs step-wise by defining functions and calling them.
CO4 Use Python lists, tuples, dictionaries for representing compound data.
CO5 Read and write data from/to files in Python.

COs	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1		3			2					2		2			

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CO2			2							2		2		2	
CO3			2							2		2		2	
CO4	3	3	2		2					2		2			
CO5			2							2		2			

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Semester II

		L	T	P	C
218ENT01	COMMUNICATIVE ENGLISH	2	0	2	3

COURSE OBJECTIVES

- To help learners develop their listening skills which will enable them listen to lectures and comprehendthem by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
-
- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop grammar and vocabulary of a general kind by developing their reading skills

UNIT I 9

Listening - conversation - Speaking – introducing oneself - exchanging personal information - Reading – comprehension. Writing - paragraph - Vocabulary Development - synonyms and antonyms - Language Development – consonants &vowels - phonetic transcription.

UNIT II 9

Listening - telephonic conversation - Speaking – sharing information of a personal kind – greeting taking leave - Reading – short stories – The Gift of the Magi, A Service of Love and The Last Leaf by O. Henry – Writing – developing hints - Vocabulary Development – everyday vocabulary - Language Development – British andAmerican English - infinitive and gerund.

UNIT III 9

Listening – class memory quiz - Speaking – impromptu - Reading – magazines – Writing – agenda proposals - Vocabulary Development - important words used in speaking and writing - Language Development – typesof sentences - information and emphasis.

UNIT IV 9

Listening – interviews of famous persons - Speaking – story narration - Reading – case study – Writing – invitation letter- quotation letter - Vocabulary Development – listening and reading vocabulary - Language Development – cause andeffect – purpose and function.

UNIT V 9

Listening - a scene from a film - Speaking - role play - Reading – jigsaw – Writing – essay writing Vocabulary Development-business vocabulary - Language Development - degrees of comparison real English phrases.

TOTAL:45 PERIODS

COURSE OUTCOMES

At the end of the course learners will be able to:

CO1 Comprehend conversations and talks delivered in English.

CO2 Participate effectively in formal and informal conversations; introduce themselves and their friends and express opinions in English.

CO3 Read short stories, magazines, novels and other printed texts of a general kind.

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CO4 Write short paragraphs, essays, letters and develop hints in English.

CO5 Approach the global market with self-confidence

TEXT BOOKS

1. Board of Editors. Using English A Coursebook for Undergarduate Engineers and Technologists. OrientBlackSwan Limited, Hyderabad: 2015.
2. Richards, C. Jack. Interchange Students' Book-2, New Delhi: CUP, 2015.
3. Uttham Kumar, N. Communicative English (with work book). Sahana Publications, Coimbatore, 2019.

REFERENCE BOOKS

1. Bailey, Stephen. Academic Writing: A Practical Guide for Students. New York: Rutledge, 2011.
2. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English.Cambridge University Press, Cambridge: Reprint 2011.
3. Dutt P. Kiranmai and Rajeevan Geeta. Basic Communication Skills, Foundation Books: 2013.
4. Means, L. Thomas and Elaine Langlois. English & Communication for Colleges. Cengage Learning,USA: 2007.
5. Redston, Chris & Gillies Cunningham. Face2Face (Pre-intermediate Student's Book & Workbook).Cambridge University Press, New Delhi: 2005.

COs	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1		1		2	2								2		
CO2	1		2	2	2					2				2	1
CO3			2	3	2									2	1
CO4		2	1		3								1		
CO5	3									3		2			1

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218GET03	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmentalproblems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision thesurrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.

UNIT I NATURAL RESOURCES 14

Definition, scope and importance of environment – need for public awareness - Forest resources: Use and over- exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture 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. case studies – 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 localarea to document environmental assets – river / forest / grassland / hill / mountain.

UNIT II ECOSYSTEMS AND BIODIVERSITY 8

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

UNIT III ENVIRONMENTAL POLLUTION 10

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marinepollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal wastes – role of

an individual in prevention of pollution – pollution case studies – disastermanagement: floods.

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 – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and humanhealth – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1 Gain knowledge about environment and ecosystem.

CO2 Learn about natural resource, its importance and environmental impacts of human activities on natural resource.

CO3 Gain knowledge about the conservation of biodiversity and its importance.

CO4 Aware about problems of environmental pollution, its impact on human and ecosystem and control measures.

CO5 Learn about increase in population growth and its impact on environment.

TEXT BOOKS

1. Benny Joseph, Environmental Science and Engineering ', Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M. Masters, Introduction to Environmental Engineering and Science ', 2nd edition, PearsonEducation, 2004.
3. Dr. G. Ranganath, Environmental Science and Engineering, Sahana Publishers, 2018 edition.

REFERENCE BOOKS

1. Dharmendra S. Sengar, Environmental law ', Prentice hall of India PVT LTD, New Delhi, 2007.

COs	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2					2	3						2		
CO2	2					2							3		1
CO3	2					2	3						2		
CO4	2				1	2	3						2		1
CO5	2				1	2	3						2		

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215CAT05	CIRCUIT THEORY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To enable the student to learn the major components of a circuit theory.
- To know the correct andefficient ways of handling electrical circuits.

UNIT I BASIC CIRCUITS CONCEPTS AND ANALYSIS 9

Circuit elements, ideal sources (independent and dependent), linear passive element R, L and C; V-I relationshipof circuit elements; sinusoidal voltage and current- RMS value, Average value, form factor, power and power factor; Ohm's Law – Kirchoff's Laws; analysis of series and parallel circuits: Network reduction; voltage and current division, source transformation, star/delta transformation.

UNIT II MULTI DIMENSIONAL CIRCUIT ANALYSIS & NETWEORK THEOREMS 9

Node voltage analysis of multi node circuit with current sources and Mesh-current analysis of multi node circuits with voltage sources for DC and AC circuits. Network Theorems for DC and AC circuits: Thevenin's theorem- Norton's theorem – Superposition theorem – Maximum power transfer theorem – Reciprocity theorem- compensation theorem – substitution theorem- Millman's theorem- Tellegen's theorem.

UNIT III RESONANCE AND COUPLED CIRCUITS 9

Series and parallel resonance – their frequency response – Quality factor and Bandwidth. Magnetically coupledcircuits- Self and mutual inductance –Coefficient of coupling-Dot conversion; Tuned circuits – Single tuned circuits.

UNIT IV TRANSIENT RESPONSE FOR DC CIRCUITS 9

Source free response of RL and RC circuits; forced (step) response of RL and RC circuits; source free response ofRLC series circuit; forced (step) response of RLC series circuit; forced response of RL, RC and RLC series circuitto sinusoidal excitation; time constant and natural frequency of oscillation of circuits. Laplace Transform application to the solution of RL, RC & RLC circuits: Initial and final value theorems and applications.

UNIT V ANALYSING THREE PHASE CIRCUITS 9

Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with starand delta connected loads, balanced & unbalanced – phasor diagram of voltages and currents– power and power factor measurements in three phase circuits.

TOTAL:45 PERIODS

COURSE OUTCOMES

Upon Completion of this course, students will be able to:

CO1 Recognize the different combinations of circuit elements and solving the circuit by applying basic circuital laws irrespective of the type of steady state source given.

CO2 Analyse electrical circuits by applying theorems.

CO3 Understand the concepts of series and parallel resonance.

CO4 Recall the basic concepts of laplace transform and thus analyse the transient behavior of electrical Circuits

CO5 Explain the way of generation of alternating voltage and the response of single phase

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circuits and three phase circuits employing balanced and unbalanced loads.

TEXT BOOKS

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis",TMH publishers, 6th edition, New Delhi, 2002.
2. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", Tata McGrawHill, 2007.
3. Ravish R Singh, "Network Analysis and Synthesis", McGraw Hill, 2013.

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1. Paranjothi SR, "Electric Circuits Analysis," New Age International Ltd., NewDelhi, 1996.
2. Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum'sseries,Tata McGraw- Hill,New Delhi 2001.
3. Chakrabati A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, 1999.
4. Charles K. Alexander, Mathew N.O. Sadik, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, 2003.

COs	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3					1								1	
CO2	3		1		2							1	2		
CO3	3		1		2							1	2		
CO4	3					1						1	2		
CO5	3				2	1						1	2	1	

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218BSE07	PHYSICS OF SEMICONDUCTOR	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

- To study the basic theory of structure of crystalline materials.
- To understand the essential principles of electrical properties of materials.
- To get the better knowledge of Physics of semiconductor materials.
- Become proficient in magnetic and dielectric properties of materials.
- To understand the essential concepts of nanomaterial devices and applications

UNIT I CRYSTALLOGRAPHY 9

Crystal structures- Parameters- Bravais lattice - Calculation of number of atoms per unit cell - Atomic radius - Coordination number - Packing factor for SC, BCC, FCC, HCP and Diamond cubic structure - NaCl, ZnS structures(qualitative). Miller indices- unit cell approach.

UNIT II ELECTRICAL PROPERTIES OF MATERIALS 9

Classical free electron theory-Expression for electrical conductivity-Thermal conductivity, Expression-Wiedemann- Franz law-Success and failures-Quantum free electron theory-Particle in a finite potential well-Tunneling-Particle in athree dimensional box-degenerate States-Fermi-Dirac statistics-Density of energy states-Energy bands in solids.

UNIT III SEMICONDUCTOR PHYSICS 9

Intrinsic Semiconductors-Energy band diagram-direct and indirect band gap semiconductors - Carrier concentration inintrinsic semiconductors-extrinsic semiconductors-Carrier concentration in N-type & P-type semiconductors (qualitative) –Einsein's relation – Hall effect and devices – Zener and avalanche breakdown in p-n junctions – Ohmic contacts – tunnel diode – Schottky diode- MOS capacitor – power transistor.

UNIT IV OPTICAL PROPERTIES OF MATERIALS 9

Classification of optical materials - Absorption emission and scattering of light in metals, insulators and semiconductors(concepts only) – photo current in a P-N diode – solar cell – LED – Organic LED – Laser diodes – Optical data storage techniques.

UNIT V NANOMATERIAL DEVICES 9

Nano materials: Introduction – Synthesis – Plasma arcing – Chemical vapour deposition – Electro deposition – BallMilling – Sol-Gel method – Spin coating method- photo current in a P-N diode – Solar cell – LED- Properties of nanoparticles and their applications.

TOTAL:45 PERIODS

COURSE OUTCOMES

At the end of the course, the students will able to:

CO1 Have the necessary understanding on the functioning of crystalline in solids of materials.

CO2 Gain knowledge on classical and quantum electron theories, and energy band structures.

CO3 Acquire knowledge on basics of semiconductor physics and its applications in various devices.

CO4 Get knowledge on magnetic and dielectric properties of materials and theirapplications.

CO5 Understand the basics of nanodevices and applications.

TEXT/ REFERENCE BOOKS

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1. Donald Askeland, "Materials Science and Engineering", Cengage Learning IndiaPvt Ltd., 2010.
2. Kasap S.O., "Principles of Electronic Materials and Devices" Tata Mc Graw-Hill2007.
3. Pierret R.F, "Semiconductor Device Fundamentals", Pearson 2006
4. W.D.Callister and D.G.Rethwisch, "Materials Science and Engineering", JohnWiley & Sons,Inc., NewJersey (2010).
5. Hanson G.W., "Fundamentals of Nanoelectronics", Pearson Education 2009.

COs	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3													1	
CO2	3	2	1										1		
CO3	3	2	2										2	2	1
CO4	3	2	1										2	2	1
CO5	2	1											2	1	

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218CYP07	ENGINEERING CHEMISTRY LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

- Students will be conversant with the estimation of various compounds using volumetric and instrumental analysis.

LIST OF EXPERIMENTS

1. Estimation of Total hardness by EDTA
2. Determination of percentage of calcium in Lime Stone by EDTA
3. Estimation of chloride in water sample
4. Estimation of alkalinity of Water sample
5. Determination of DO in Water (Winkler's Method)
6. Determination of Rate of Corrosion of the given steel specimen by weight loss method (Without inhibitor)
7. Determination of Rate of Corrosion of the given steel specimen by weight loss method (With inhibitor)
8. Conduct metric titration (Simple acid base)
9. Conduct metric titration (Mixture of weak and strong acids)
10. Conduct metric titration using $BaCl_2$vs Na_2SO_4
11. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$)
12. PH titration (acid & base)
13. Determination of water of crystallization of a crystalline salt -Copper sulphate
14. Preparation of Bio-Diesel by Trans etherification method.

A minimum of TEN experiments shall be offered.

COURSE OUTCOMES

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

CO1 Carry out the volumetric experiments and improve the analytical skills.

CO2 Understand the maintenance and usage of analytical instruments and thereby develop their skills in the field of engineering.

CO3 Understand the principle and handling of electrochemical instruments and Spectrophotometer.

CO4 Apply their knowledge for protection of different metals from corrosion by using different inhibitors.

REFERENCE BOOKS

1. Arthur I. Vogel's, "Quantitative Inorganic Analysis including Elementary Instrumental Analysis",ELBS, Group, 7th Edition, 2000.
2. Dr. K .Sivakumar, "Engineering Chemistry lab manual", S.S publishers, 2016.

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COs	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	2													
CO2	3	2		2											
CO3	3	2		3											
CO4	2	1													

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218EPP08	ENGINEERING PRACTICE LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

- To get the knowledge on welding techniques and its types.
- To do the fitting operation on a given material. (Specimen)
- To carry out sheet metal operation.
- To know the principle involved in plumbing work.
- To do the carpentry work on a given work piece.

LIST OF EXPERIMENTS

WELDING:

Study of Electric Arc welding and Gas welding tools and equipment's.

Preparation of Arc welding and Gas welding models:

i)Butt joint ii) Lap joint iii) T - joint.

FITTING:

Study of fitting tools and operations.

Preparation of fitting models:

i) V-fitting ii) Square fitting

SHEET METAL WORK:

Study of sheet metal tools and operations

Preparation of sheet metal models:

i) Rectangular Tray ii) Funnel

PLUMBING WORKS:

Study of pipeline joints and house hold fittings.

Preparation of plumbing models:

Basic pipe connections with PVC and GI pipe fittings.

CARPENTRY:

Study of wooden joints and tools used in roofs, doors, windows, furniture.

Preparation of carpentry models:

i) Lap joint ii) Dovetail joint iii) T-Joint

DEMONSTRATION ON: ELECTRICAL ENGINEERING PRACTICE

Study of Electrical components and equipments

Residential house wiring using switches, fuse, indicator, lamp and energy meter.

ELECTRONICS ENGINEERING PRACTICE

Study of Electronic components –Resistor, color coding, capacitors etc

Soldering practice –components soldering in simple electric circuit & testing continuity

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COMPUTERHARDWARE AND SOFTWARE PRACTICE

Study of PC Hardware, Internet & World Wide Web and Productivity tools including Word, Excel, PowerPoint and Publisher.

COURSE OUTCOMES

The students will be able to

CO1 Prepare simple Lap, Butt and T- joints using arc welding equipments.
CO2 Prepare the rectangular trays and funnels by conducting sheet metal operation.
CO3 Prepare the pipe connections and identify the various components used in plumbing.
CO4 Prepare simple wooden joints using wood working tools.
CO5 Demonstrate basic electrical, electronic and computer components based on their physical parameters and dimensions.

TEXT BOOKS:

1. Ranganath. G & Channankaiah, "Engineering Practices Laboratory Manual", S.S. Publishers, 2014.
2. Jeyapoovan.T & Gowri S "Engineering Practice Lab Manual", Vikas publishing house pvt.ltd, 2016.

REFERENCE BOOKS

1. Kannaiah.P & Narayana.K.L, "Manual on Workshop Practice", Scitech Publications, 2015.
2. Ramesh BabuV, "Engineering Practices Laboratory Manual", VRB Publishers Private Limited,Chennai, Revised Edition, 2014.
3. Peter Norton, "Introduction to Computers", 7th Edition, Mc Graw Hill, 2010.
4. Bawa. H.S, "Workshop Practice", Tata McGraw – Hill Publishing Company Limited, 2009.
5. David Anfinson and Ken Quamme, "IT Essentials PC Hardware and Software Companion Guide",CISCO Press, Pearson Education, Third Edition, 2008.

COs	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3		1	2					2				2	3	
CO2	3	2	2	2					2				2		1
CO3	3	2	2	2					2				2	3	
CO4	3	1	2	2					2				2		1
CO5	2		2							2		2		3	

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218EDP09	ELECTRON DEVICES AND CIRCUITS LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

- To provide exposure to the students with hands on experience on various electrical circuit laws andexperiments.

LIST OF EXPERIMENTS

1. Verification of Kirchoff's laws and ohms laws.
2. Verification of Thevenin's and Norton's Theorem.
3. Verification of Superposition Theorem.
4. Verification of Maximum Power Transfer theorem.
5. Verification of Reciprocity theorem
6. Verification of Mesh and Nodal analysis.
7. Transient response of RL and RC circuits for DC input.
8. Frequency response of series and parallel resonance circuit.
9. Characteristics of PN junction diode and Zener diode Characteristics.
10. Common Emitter and Common Base input-output Characteristics
11. FET and SCR Characteristics

COURSE OUTCOMES

Upon Completion of this course, students will be able to:

CO1 Select the suitable range of meters and rheostats for the given circuit and set the appropriate values of circuit elements and energy sources as per the requirement.

CO2 Apply basic circuital laws to confirm the practical values of the current through and voltage across different elements of the circuit with that of the theoretical values.

CO3 Apply theorems to simplify the electric circuits.

CO4 Illustrate the transient response and frequency response of RLC circuits.

CO5 Study the characteristics of Common Electron Devices.

COs	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3														
CO2	3	2			1								3	2	
CO3	2	2											2	3	1
CO4	2	2													
CO5	3	2			1								3	2	

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Semester III

		L	T	P	C
318MAT01	Engineering Mathematics–III	3	1	0	4

COURSE OBJECTIVES

- To learn various methods to solve the partial differential equations.
- To introduce Fourier series analysis which plays a vital role in many applications in engineering.
- To understand the boundary value problems and to obtain the solution using partial differential equations.
- To acquaint the Fourier transform techniques used in wide variety of situations.
- To develop z-transform techniques which analyze the discrete time signals.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9+3

Solutions of first order partial differential equations-Standard types-Singular solutions- Lagrange's Linear equation- Solution of homogeneous and non-homogenous linear equations ofsecond and higher order with constant coefficients.

UNIT II FOURIER SERIES 9+3

Dirichlet's conditions – General Fourier series – Change of scale - Odd and even functions – Half-range Sine and Cosine series – Parseval's identity – Harmonic Analysis.

UNIT III BOUNDARY VALUE PROBLEMS 9+3

Classification of Partial Differential Equations – Method of separation of Variables – Solutions of one dimensional wave equation and One-dimensional heat equations –Applications using Fourier series solutions in Cartesian coordinates - Steady state solution of two-dimensional heat equation.

UNIT IV FOURIER TRANSFORM 9+3

Fourier integral theorem – Fourier transform pair - Sine and Cosine transforms – Properties – Fourier Transform of simple functions – Convolution theorem (statement and applications only) – Parseval's identity (statement and applications only).

UNIT V Z – TRANSFORM 9+3

Z-Transform - Elementary properties and applications – Initial and final value theorems (Statement and applications only) - Inverse Z-Transform – Partial fractions method, Residue theorem method and Convolution theorem (statement and applications only) - Solution of difference equations by applying Z-transforms.

TOTAL:45+15 = 60 PERIODS

COURSE OUTCOMES

At the end of the course learners will be able to:

CO1 Know the methods to solve partial differential equations occurring in various physical and engineering problems.

CO2 Describe an oscillating function which appears in a variety of physical problems by Fourier series which helps them to understand its basic nature deeply.

CO3 Acquire the knowledge to construct partial differential equations with initial and boundary conditions for various physical and engineering real time problems and obtaining solution using Fourier series methods.

CO4 Apply the Fourier transform techniques in engineering field.

CO5 Gain the concept of analysis of linear discrete system using Z-transform approach.

TEXT BOOKS

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publications, 44th edition, 2017.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition Wiley India, 2016.

REFERENCE BOOKS

1. Andrews L.C and Shivamoggi. B.K., "Integral Transforms for Engineers", SPIE Press Book, 1999
2. Wylie C R and Barrett L C, "Advanced Engineering Mathematics", 6th Edition, McGraw-Hill Co., New Delhi, 1995.
3. T.Veerarajan,"Engineering Mathematics-III", Tata McGraw-Hill Publishing company, New Delhi,2015.
4. P.Kandasamy, K.Thilagavathy, K.Gunavathy, " Engineering Mathematics-III", S.Chand Publishers,2015.
5. V.Prameelakaladharan and G.Balaji ,"Engineering Mathematics-III", Amrutha marketing, Chennai,2016.

COs	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	2	2									2	2	2	
CO2	3	3	2									2	2	2	
CO3	3	3	3									2	2	2	
CO4	3	2	2									2	2	2	
CO5	3	2	2									2	2	2	

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318EET02	Electro Magnetic Theory	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To introduce the basic mathematical concepts related to electromagnetic fields.
- To understand the concepts of Electrostatics.
- To understand the concepts of Magneto statics.
- To understand the concept of Electromagnetic Fields,
- To understand the concepts of waves and wave propagation.

UNIT I INTRODUCTION 9

Introduction: Co-ordinate systems and transformation, Cartesian co-ordinates, Circular cylindricalcoordinates, Spherical coordinates and their transformation. Differential length, area and volume indifferent coordinate systems. Numerical problems.

Vector calculus: DEL operator, Gradient of a scalar, Divergence of a vector, Divergence theorem, Curl of a vector, Stokes theorem, Classification of vector fields, Numerical problems.

UNIT II ELECTROSTATIC FIELD 9

Coulomb's law, field intensity, Gauss's law and applications, Electric potential and Potential gradient, Relation between E and V, Electric dipole and flux lines. Energy density in electrostatic field – Capacitance - Boundary conditions: Conductor –dielectric Poisson's and Laplace's equation.Numerical problems.

UNIT III MAGNETO STATIC FIELDS 9

Biot- savart law, Ampere's circuital law, Magnetic flux density, Magneto static and Vector potential, Forces due to magnetic field, Magnetic torque, Magnetic material, Magnetic boundary condition, Inductor and Inductances, Magnetic energy density. Numerical problems.

UNIT IV ELECTROMAGNETIC FIELDS 9

Faraday's law of electromagnetic induction, Transformer and motional Emf, Displacement current, Maxwell's equations, Maxwell's equations in differential and integral form. Relation between field theory and circuit theory Numerical problems.

UNIT V ELECTROMAGNETIC WAVE PROPAGATION 9

Wave equation, Wave propagation in lossy dielectric, Plane waves in loss less dielectric, Plane wave in free space, Plane wave in good conductor, Skin depth, Power, Poynting vector, Reflection and refraction of a plane wave at normal incidence-Polarization. Numerical problems

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1 Learnt mathematical operations of three dimensional vectors related to electromagnetic fields

CO2 Gained the acquaintance in applications of Poisson's and Laplace's equations

CO3 Acquired the knowledge in applications of Biot-Savart's Law and Ampere's Circuital law.

CO4 Gained the indulgent of the Maxwell's equations and its applications.

CO5 Attained the knowledge in principles of propagation of plane waves.

TEXT BOOKS

1. Mathew N.O. Sadiku ,Elements of Electromagnetic, , 4th edition, Oxford university press. 2007

2. William.H. Hayt& J.A. Buck , Engineering Electromagnetic, , 7th Edition, TMH, 2001
3. Joseph A.Edminister, Theory and problems of Electromagnetic, 2nd Edition, TMH, 1993
4. Guru &Hizroglu , Electromagnetic field theory fundamentals, 2nd edition, CambridgeUniversity Press.2000.

REFERENCE BOOKS

1. Krause ,Electromagnetic with application,5th Edition, TMH. 1999.
2. N.N. Rao ,Elements of Engineering Electromagnetic, 6th Edition, Pearson Education 2000.
3. K. A. Gangadhar and P. M. Ramanathan, 'Electromagnetic Field Theory', Khanna Publishers, Delhi 2009.

COs	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO1 2	PSO1	PSO2	PSO3
CO1	3	1											3		1
CO2	3	3											2		
CO3	3	3											2		
CO4	3	2											3		
CO5	3	2			1								3	1	

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318EET03	Network Analysis and Synthesis	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To study about

- Time response of RL,RC and RLC circuits for different sources
- Complex frequency, Pole -Zero concepts and Fourier analysis
- One and Two port network parameters
- Design of various filters
- Synthesis of networks

UNIT I DUALITY AND TOPOLOGY **9**

Concept of duality, Dual network, Graphs of a network, Trees, Chords and branches, Tie set and cut set of a graph, Application to network analysis.

UNIT II S- DOMAIN ANALYSIS AND FOURIER ANALYSIS **9**

Concept of complex frequency - Significance of poles and zeros -Necessary conditions for driving point function – Time domain response from pole-zero configurations - Fourier series representationof different waveforms - Trigonometric and complex forms - Fourier integral and Fourier transforms.

UNIT III SINGLE PORT AND TWO PORT NETWORKS **9**

Driving point impedance and admittance of single port networks - Two port networks: Z, Y, ABCD and h parameters -Inter relationships of two port network parameters - Image parameters - Interconnection of two port networks - T and π representation- Impedance matching.

UNIT IV FILTERS AND ATTENUATORS **9**

Filters: Characteristics of ideal filters - Low pass, High pass and Band pass filters–Constant –k andm – derived filters. Attenuators: T-Type, π-Type, Lattice, Bridged-T and L-Type Attenuator.

UNIT V ELEMENTS OF NETWORK SYNTHESIS **9**

Hurwitz polynomials - PR function - Necessary and sufficient conditions of PR function - Propertiesof driving point impedance - Synthesis of LC,RL and RC networks by Foster I ,II and Cauer I , II methods.

TOTAL:45 PERIODS

COURSE OUTCOMES

At the end of the course, the student will be

CO1 Gained the knowledge of network topology.
CO2 Learnt about apply fourier transforms to analyze electrical networks.
CO3 Learnt network functions and two-port parameters.
CO4 Able to design k and m filters
CO5 Learnt about apply to synthesis techniques

TEXT BOOKS

1. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", TataMcGraw HillPublishers, 4th Edition, 2010.
2. Ravish R Singh, "Network Analysis and Synthesis", Tata McGraw Hill Publishers, 2013.
3. Arumugam .M and Premkumar .N, Electric circuit theory, Khanna Publishers, New Delhi,2006.
4. G.K. Mithal, "Network Anlaysis", Khanna Publishers, New Delhi, 2011.

REFERENCE BOOKS

1. Umesh Sinha, "Network Analysis And Synthesis,"Sathya Prakasan Publishers Limited, NewDelhi, Fifth edition, 1992.

2. Soni M.L and Gupta J.C, "Electrical circuit Analysis", Dhanpat Rai and Sons, Delhi, 1990
3. Edminister, J.A., 'Theory and Problems of Electric Circuits', Schaum's outline series McGraw Hill Book Company, 5th Edition, 2010.

COs	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PSO1	PSO2	PSO3
CO1	3	2											1		
CO2	3	3	1		2				2				2	2	1
CO3	3	2											2	2	
CO4	3	2											2	2	1
CO5	3	1												2	

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318EET04	Linear Integrated Circuits and Applications	L	T	P	C
		3	0	0	3

Prerequisite: Basic knowledge in Electron Devices and Circuits is required

COURSE OBJECTIVES

- To study the IC fabrication procedures.
- 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.
- To study the about Application ICs like regulator Circuits.

UNIT I IC FABRICATION 9

Fundamentals of Integrated Circuits, IC classifications, fundamentals of monolithic IC technology, Basic Planar Processes, Realization of monolithic ICs and packaging. Fabrication of diodes,capacitor, resistor, transistor and FETs.

UNIT II CHARACTERISTICS OF OP AMP 9

OP-AMP -block diagram, Ideal OP-AMP characteristics, virtual ground concept, differential amplifiers, DC characteristics, AC characteristics; frequency response of OP-AMP circuits; summer, differentiator and integrator.

UNIT III APPLICATIONS OF OP AMP 9

Precision rectifier, half wave and full wave rectifiers, clippers, clampers, peak detectors, Instrumentation amplifier, V/I and I/V converters, S/H circuit, comparators, monostable and astable multivibrators, sine and triangular wave generators, first-and second-order active filters, log and antilog amplifier.

UNIT IV SPECIAL ICs 9

555 Timer Functional block diagram and description – Monostable and Astable operation, Applications, 566 Voltage Controlled Oscillator, 565 PLL Functional Block diagram – Principle of operation, Building blocks of PLL, Characteristics, Derivations of expressions for Lock and Capture ranges, Applications of PLL: Frequency synthesis, AM and FM detection, FSK demodulator.

UNIT V APPLICATION ICs 9

IC voltage regulators – 78xx, 79xx, LM317, 723 regulators, switching regulator: SMPS,78S40. LM 380 power amplifier, 8038 function generator IC, isolation amplifiers, opto- coupler – applications.

TOTAL:45 PERIODS

COURSE OUTCOMES

The student will be/have

CO1 Obtained the knowledge of ICs and their applications

CO2 Ability to fabricate and design the circuits using ICs.

CO3 Able to analyze and describe the characteristics of Op amps.

CO4 Learnt about Timers, PLL circuits and regulator Circuits

CO5 Able to analyze different application ICs.

TEXT BOOKS

1. RamakantA.Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, PearsonEducation, 2003/ PHI. (2000)
2. D.RoyChoudhary, Sheil B.Jain, 'Linear Integrated Circuits', II edition, New Age,

2003

REFERENCE BOOKS

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', Pearson Education, 4th edition, 2002 / PHI.
3. David A.Bell, 'Op-amp & Linear ICs', Prentice Hall of India, 2nd edition, 1997.
4. Sedra and Smith, "Microelectronic Circuits", Oxford University Press, Fifth Edition,2004.

COs	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2		2						2				1		
CO2	2		2						2				1		
CO3	2		2						2				2	2	1
CO4	3	2	2						2				2	2	1
CO5			3		2				3				3	1	

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318EET05	Measurements and Instrumentation	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To make the student have a clear knowledge of Functional elements of an instrument, error, calibration etc.
- Emphasis is laid on analog and digital techniques used to measure voltage, current, energy and power etc.
- To have an adequate knowledge of comparison methods of measurement.
- To have elaborate discussion about storage & display devices
- Exposure to various transducers and data acquisition systems.

UNIT I INTRODUCTION **9**

Functions of instruments-Functional elements of an instrument – Performance characteristics of instruments -Static and dynamic characteristics – Errors in measurement – Statistical evaluation of measurement data – Standards and calibration.

UNIT II ELECTRICAL AND ELECTRONICS INSTRUMENTS **9**

PMMC instruments-MI instruments-Digital voltmeters – Single and three phase wattmeter's and Energy meters – Magnetic measurements – Determination of B-H curve and Measurements of iron loss– Instrument transformers – Instruments for measurement of frequency.

UNIT III COMPARISON METHODS OF MEASUREMENTS **9**

Types of D.C potentiometers: Laboratory type, Duo-range, Vernier and Deflection-Types of A.C potentiometers: Polar, co-ordinate Potentiometers-Types of D.C bridges: Wheatstone Bridge-Kelvin Bridge- Types of A.C bridges: Maxwell, Schering and Anderson Bridge-Transformer ratio bridges– Electromagnetic interference.

UNIT IV STORAGE AND DISPLAY DEVICES **9**

Recorders: Analog and Digital recorders: Magnetic tape Recorders-X-Y recorder- Digital plotters – Printers- CRT display-Digital CRO- LED& LCD - Dot matrix display – Data Loggers.

UNIT V TRANSDUCERS AND DATA ACQUISITION SYSTEMS **9**

Requirements of a transducer- Classification of transducers – Selection of transducers – Resistive, inductive &capacitive transducers – Piezoelectric transducers-– Elements of Data Acquisitions system–Types of A/D converters, Types of D/A converters – Smart sensors.

TOTAL:45 PERIODS

COURSE OUTCOMES

Upon Completion of this course, students will be able to:

CO1 Be able to analyze the performance characteristics and calibration of aninstrumentation system

CO2 Understand the operation of various types of Potentiometers and bridges.

CO3 Select and apply analog and digital techniques to measure voltage, current, energy,power etc.

CO4 Elaborate knowledge about storage and display devices.

CO5 Explain about various transducers and data acquisition systems.

TEXT BOOKS

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1. E.O. Doebelin, 'Measurement Systems – Application and Design', Tata McGraw Hill publishingcompany, 2003
2. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2004.

REFERENCE BOOKS

1. A.J. Bouwens, 'Digital Instrumentation', Tata McGraw Hill, 1997
2. D.V.S. Moorthy, 'Transducers and Instrumentation', Prentice Hall of India Pvt Ltd, 2007.
3. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw Hill, II Edition 2004
4. Martin Reissland, 'Electrical Measurements', New Age International (P) Ltd., Delhi, 2001.
5. J. B. Gupta, 'A Course in Electronic and Electrical Measurements', S. K. Kataria & Sons, Delhi,2003.

COs	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PSO1	PSO2	PSO3
CO1	3					1									
CO2	3		1											1	
CO3	3				2	1						1	2		
CO4	3					1						1	2		1
CO5	3				2	1						1	2		

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318EET06	Fundamentals of Data structures in'C'	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Familiarize the basic programming concepts in C.
- Solve real time problems using functions, structure and union.
- Impart the basic concepts of linear data structures.
- Solve problem using nonlinear data structures.
- Identity the various Sorting, Searching and hashing algorithms.

UNIT I C PROGRAMMING BASICS 9

Structure of a C program - compilation and linking processes - Constants, Variables – DataTypes- Expressions using operators in C - Managing Input and Output operations - Decision Making and Branching - Looping statements. Arrays - Initialization - Declaration - One dimensional and Two-dimensional arrays. Strings - String operations - String Arrays.

UNIT II FUNCTIONS, POINTERS, STRUCTURES AND UNIONS 9

Functions - Pass by value - Pass by reference - Recursion - Pointers - Initialization - Pointers arithmetic. Structures and unions - Structure within a structure - Union - Files- Operations on Files-Memory Management.

UNIT III LINEAR DATA STRUCTURES 9

Abstract Data Types - Linked list Implementation of List- polynomial addition- Linked List Implementation of Stack- Balancing Symbols - Postfix Expressions - Infix to Postfix Conversion-Linked list Implementation of Queues- Circular Queue.

UNIT IV NON LINEAR DATA STRUCTURES 9

Preliminaries -Binary Trees -Tree Traversals - Binary Search Tree -Operations on Binary Search Tree - Heaps - Binary Heaps - Operations of Heaps - Graph and its representations -Graph Traversals - Shortest Path Algorithm: Dijkstra's Algorithm- Minimum Spanning Tree:Prim's Algorithm – Kruskal's Algorithm.

UNIT V SEARCHING, SORTING AND HASHING 9

Linear Search - Binary Search -Bubble Sort - Insertion Sort - Quick Sort - Merge Sort - Hash Functions - Separate Chaining -Open Addressing.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1 Summarize the basic concepts of C
CO2 Develop programs for real time application using functions, structures, union
CO3 Gain knowledge on operations of linear data structures
Co4 Develop applications using nonlinear data structures
CO5 Apply appropriate sorting, searching technique for given problem.

TEXT BOOKS

1. Ashok.N.Kamthane,- "Computer Programming" , Pearson Education,Second edition(India), 2012
2. Mark Allen Weiss, "Data Structures And Algorithm Analysis In C", Second Edition, Pearson Education,2002

REFERENCE BOOKS

1. PradipDey and Manas Ghosh, —Programming in C, Second Edition,Oxford University Press, 2011.

2. E.Balagurusamy, - "Computing fundamentals and C Programming", Tata McGraw-Hill Publishing Company Limited, 2008.
3. Ellis Horowitz, SartajSahni, Susan Anderson-Freed, —Fundamentals of Data Structures in C, Second Edition, University Press, 2008

COs	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2													
CO2	2	3	3										3		
CO3	2	3	3										3	2	
CO4	2	3	3										3	2	1
CO5					3								2		2

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318EEP07 **Linear Integrated Circuits Laboratory**

L	T	P	C
0	0	2	1

COURSE OBJECTIVES

- To understand the basics of linear integrated circuits and available ICs
- To understand characteristics of operational amplifier
- To apply operational amplifiers in linear and nonlinear applications
- To acquire the basic knowledge of special function ICs

LIST OF EXPERIMENTS

1. Inverting and Non inverting amplifiers.
2. Design of Integrator using IC 741.
3. Design of Differentiator using IC 741
4. Astable Multivibrator using Op-amp.
5. Half wave Precision rectifier using Op-amp
6. Schmitt Trigger.
7. RC Phase shift oscillator using Op-amp.
8. Wien bridge oscillator using Op-amp.
9. Astable and Monostable multivibrators using 555 Timer.
10. Regulated DC power supply using LM317.
11. Design of Active low-pass and High-pass filters.
12. Study of Voltage Controlled Oscillator (VCO).

TOTAL:45 PERIODS

COURSE OUTCOMES

Upon successful completion of the course, the students will have:

CO1 Learnt about the characteristics of op-amp

CO2 Gained the knowledge to analyze basic applications using op-amps.

CO3 Acquired knowledge to design power supply and multivibrator circuits.

CO4 Obtained knowledge to design and construct waveform generators

CO5 Learnt to design filter circuits using op-amps and learnt about VCO

COs	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3		3										3		
CO2	3	2										1	2	1	
CO3	2	2	2						2					2	1
CO4	3	2	1						2				2		
CO5	3											3	2	1	

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318EEP08	Measurements and Instrumentation Laboratory	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

- To train the students in the measurement of displacement, resistance, inductance and capacitance
- To give exposure to A/D and D/A converters.
- To Calibrate single-phase energy meter
- To measure the three phase power and power factor

LIST OF EXPERIMENTS

1. AC bridges - Measurement of inductance,(Maxwell Bridge , Anderson bridge)
2. AC bridges - Measurement of capacitance(Schering bridge)
3. DC bridges - Wheatstone bridge, Kelvin double bridge.
4. A/D and D/A converters
5. Instrumentation amplifiers
6. Characteristics of LVDT
7. Calibration of single-phase energy meter
8. Calibration of current transformer
9. Measurement of three phase power and power factor
10. Measurement of iron loss
11. Characteristic of pressure transducers
12. Characteristic of LDR

TOTAL:45 PERIODS

COURSE OUTCOMES

Upon successful completion of the course, the students will have:

CO1 Learnt about the working of AC and DC bridges

CO2 Gained the knowledge to analyze A/D and D/A converters.

CO3 Acquired knowledge to calibration of single-phase energy meter andtransformer

CO4 Obtained knowledge to Measurement of three phase power and powerfactor

CO5 Learnt about Characteristic of pressure transducers and LDR

COs	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1															
CO2			3		2				2				2		
CO3			2						2	3	1		2	1	
CO4					1	2			2				3		2
CO5			2		2				2						

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318EEP09	Fundamentals of Data Structures in C Laboratory	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

- Understand and implement basic data structures using C
- Apply linear and non-linear data structures in problem solving
- Learn to implement functions and recursive functions by means of data structures
- Implement searching and sorting algorithms.

LIST OF EXERCISES

1. Basic C Programs – Looping, Decision- Making
2. Programming using Arrays and String functions
3. Programming using Functions and Recursion
4. Programs using Structures and Union
5. Program using Pointers
6. Program using Memory Management Functions
7. Linked list implementation of List ,Stacks and Queues
8. Implementation of Tree Traversals
9. Implementation of Binary Search trees
10. Implementation of Graph Traversals
11. Implementation of Shortest Path Algorithm
12. Implementation of Linear search and binary search
13. Implementation of Insertion sort, Quick sort and Merge Sort

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1 Implement basic and advanced programs in C
CO2 Implement functions and recursive functions in C
CO3 Apply the different Linear Data Structures for Implementing Solutions to PracticalProblems.
CO4 Apply and implement Graph Data Structures for Real Time Applications.
CO5 Implement various Searching, Sorting and hashing Algorithms.

COs	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												2	1	
CO2	3	2	1				1		2			2	2		2
CO3	3	2	1				3		2			3	3	2	1
CO4	2	1							2						
CO5	2												2	1	

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Semester IV

418NMT01	Numerical Methods	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

- To solve equations using direct and iterative methods.
- To introduce interpolation techniques to determine the intermediate values of a function from a given set of values in ordered pairs.
- To study the principle of numerical differentiation and integration using interpolation.
- To learn some of the methods of numerical solutions of ordinary differential equations with initial conditions.
- To determine the solutions of boundary value problems using numerical iterative processes

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9+3

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton-Raphson method- Solution of linear system of equations - Gauss Elimination method - Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel - Eigenvalues of a matrix by Power method.

UNIT II INTERPOLATION AND APPROXIMATION 9+3

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

UNIT III NUMERICAL DIFFERENTATION AND INTEGRATION 9+3

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rules – Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9+3

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-Bashforth predictor-corrector methods for solving first order equations.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9+3

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:45+15 = 60 PERIODS

COURSE OUTCOMES

At the end of the course learners will be able to:

CO1 Apply numerical methods such as direct and iterative methods to solve algebraic or transcendental equations and system of equations.

CO2 Use the concept of interpolation and apply to real life situations.

CO3 Appreciate numerical solutions for differential and integral calculus as a handy tool to solve problems.

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CO4 Implement numerical algorithms to find solutions for intial value problems for ordinary differential equations.

CO5 Demonstrate algorithms using finite differences to obtain solutions to boundary value problems.

TEXT BOOKS

1. Kandasamy.P, Thilagavathy,K. & Gunavathi.K., "Numerical Methods"., S.Chand & Company Ltd., New Delhi, 2014.
2. Grewal, B.S. and Grewal,J.S., " Numerical methods in Engineering and Science", 6th Edition, Khanna Publishers, New Delhi, 2012.

REFERENCE BOOKS

1. Richard L.Burden and J.Dougles Faires, "Numerical Analysis", Ninth Edition, BROOKS/COLE, Visit: www.Cengage.com.,2012, visit www.cengage.com/international.
2. S.S.Sastry, "Introductory Methods of Numerical Analysis", 5th Edition, Prentice Hall of India Private Ltd., New Delhi, 2012.
3. Sankara Rao, K. "Numerical methods for Scientists and Engineers', 2nd Edition Prentice Hall of India Private Ltd., New Delhi, 2005.
4. Ward Cheney and David Kincaid, "Numerical Mathematics and Computing", Brooks/Cole Publishing company, Fourth Edition, 1999.
5. Jain M K, Iyengar S R K and Jain R K, "Numerical methods for Scientific and Engineering Computation", 6th edition, New Age International (P) Ltd, 2012.

COs	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1							2	2	2	
CO2	3	3	2	2	1							2	2	2	
CO3	3	3	3	2	2							2	2	2	
CO4	3	2	1	1	1							2	2	2	
CO5	3	2	2	2	2							2	2	2	

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418EET02	Control Systems	L	T	P	C
		3	0	0	3

Prerequisite: Electric Circuits, Engineering Mathematics-III

COURSE OBJECTIVES

- To make the student to understand the methods of obtaining the open-loop andclosed–loop systems.
- To make them understand the methods of representation of systems and to derivetheir transfer function.
- To make them gain knowledge in the time-domain and frequency domain response of systems
- To make them analyze the stability of the systems
- To make them analyze the system in state space representation.

UNIT I CONTROL SYSTEM MODELING 9

Basic Elements of Control System - Open loop and Closed loop systems – Differential equation - Transfer function, Modeling of Electric systems, Translational and rotationalmechanical systems - Block diagram reduction Techniques - Signal flow graph.

UNIT II TIME RESPONSE ANALYSIS 9

Time response analysis – Test Signals - First Order Systems - Impulse and Step Response analysis of second order systems – Time Domain Specifications-Steady state errors - P, PI, PD and PID Compensation, Analysis using MATLAB.

UNIT III FREQUENCY RESPONSE ANALYSIS 9

Frequency Response- Frequency Domain specifications -Bode Plot, Polar Plot, Nyquist Plot-Constant M and N Circles - Nichol's Chart - Use of Nichol's Chart in Control System Analysis.Lead, Lag, and Lead Lag Compensators, Analysis using MATLAB.

UNIT IV STABILITY ANALYSIS 9

Stability, Routh-Hurwitz Criterion, Root Locus Technique, Construction of Root Locus, Stability, Dominant Poles, Application of Root Locus Diagram - Nyquist Stability Criterion -Relative Stability- Analysis using MATLAB.

UNIT V STATE VARIABLE ANALYSIS 9

State space representation of Continuous Time systems - Transfer function from State Variable Representation - Solutions of the state equations - Concepts of Controllability and Observability.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1 Ability to Understand the basic concepts of open-loop and closed–loop of systems.

CO2 Ability to understand the basic concept of systems and to derive their transferfunction models.

CO3 Analyzing the time-domain and frequency response of systems and steady state error analysis

CO4 Ability to analyze the concept of stability of control systems and designcompensator.

CO5 Ability to analyze the system in state space representation.

TEXT BOOKS

1. Nagrath I J and Gopal M, "Control System Engineering ", New Age InternationalPvt Ltd, Sixth Edition, 2017.
2. Ogata K, "Modern Control Engineering", Prentice-Hall of India Pvt Ltd., NewDelhi,

2010.

REFERENCE BOOKS

1. Norman S. Nise, Control Systems Engineering, 4th Edition, John Wiley, NewDelhi, 2007.
2. Samarajit Ghosh, Control systems, Pearson Education, New Delhi, 2004.
3. Benjamin C. Kuo, Automatic Control systems, Pearson Education, New Delhi,2003.

COs	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO1 2	PSO1	PSO2	PSO3
CO1	3	2											1		
CO2	3	2			2								1	2	
CO3	3	2	1		2								1	2	1
CO4	3	2	1										3	2	1
CO5	2	2			1				3			2	2		

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418EET03	Digital Electronic Circuits	L	T	P	C
		3	0	0	3

Prerequisite: Basic Knowledge in Electron Devices

COURSE OBJECTIVES

- To study various number systems and to simplify the mathematical
- To study the implementation of combinational circuits
- To study the design and analysis of various synchronous sequential circuits.
- To study the design and analysis of various asynchronous sequential circuits.
- To expose the students to various memory devices.

UNIT I BOOLEAN ALGEBRA AND LOGIC GATES 9

Review of number systems; types and conversion, Codes- BCD, Gray, EX-3code, Error detection and correction codes, Code conversion, Logic Gates, Boolean algebra – Basic Postulates and theorems, switching functions, Canonical forms and simplification using K-maps and Quine McCluskey method.

UNIT II COMBINATIONAL CIRCUITS 9

Implementing Combinational Logic - Design of half adder and full adder, half and full- subtractor, magnitude comparators, code converters- Gray, EX-3codes, encoders, decoders,multiplexers and Demultiplexer. Function realization using gates and multiplexers.

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS 9

Basic Concepts, Flip-Flops, Analysis of RS, JK, Master Slaves, T and D Flip-Flop, Registersand their applications, Synchronous and asynchronous counters, Up/Down counters, Ring counter. Analysis of synchronous sequential circuits; design of synchronous sequential circuits – Completely and incompletely specified sequential circuits - state diagrams, state assignment, state reduction.

UNIT IV ASYNCHRONOUS SEQUENCTIAL CIRCUITS 9

Mealy and Moore models, analysis procedure - circuit with latches - design procedure reductionof state and flow tables- race free state assignment- Hazards - Design problems.

UNIT V MEMORY DEVICES, PROGRAMMABLE LOGIC DEVICES 9

Memories: Read only memories, PROMs, EPROMs, EEPROMs, and RAMs: Static RAM,Dynamic RAM, Magnetic memories, CD-ROM, Flash memories. Introduction to Programmable Logic Devices: PLA, PAL, CPLD, EPLD, FPGA.

TOTAL:45 PERIODS

COURSE OUTCOMES

At the end of the course, the student will be

CO1 Gained the knowledge of fundamental concept of various number systems
CO2 Able to Implement simple combinational logic circuits using logic gates.
CO3 Able to design of various synchronous sequential circuits.
CO4 Able to design of various asynchronous sequential circuits.
CO5 Understood about semiconductor memories, PLDs.

TEXT BOOKS

1. M. Morris Mano, 'Digital Design', Pearson Education, 2013.
2. Raj Kamal, ' Digital systems-Principles and Design', Pearson education 2nd edition, 2007
3. Comer "Digital Logic & State Machine Design, Oxford, 2012.
4. James W. Bignel, Digital Electronics, Cengage learning, 5th Edition, 2007.

REFERENCE BOOKS

1. Charles H.Roth, 'Fundamentals Logic Design', Jaico Publishing, IV edition, 2002.

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2. Thomas L.Floyd, 'Digital Fundamentals', 11th edition, Pearson Education, 2015.
3. Mandal, "Digital Electronics Principles & Application, McGraw Hill Edu, 2013.
4. D.P.Kothari, J.S.Dhillon, 'Digital circuits and Design', Pearson Education, 2016.

COs	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PSO1	PSO2	PSO3
CO1	3												2		
CO2	1	3	3										3		2
CO3		3	3										3		1
CO4			1										2		
CO5		2	2		2				3				3	1	

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418EET04	Power Generation Systems	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To learn about the generation of electric power by steam and gas powerstations.
- To understand the generation of electric power by hydro power station.
- To understand the generation of electric power by nuclear and diesel power stations.
- To understand the various types of wind energy conversion systems.
- To study the generation of electric power from solar energy using solarPhotovoltaic systems.

UNIT I STEAM AND GAS POWER PLANT **9**

Generation of electric power from Conventional and non-conventional sources of energy.
Steam Power Station: Schematic arrangement, advantages and disadvantages, choice of site selection, Types of prime movers, Environmental aspects.
Gas Turbine Power Plant: Schematic arrangement, advantages and disadvantages of Gas turbine power plant. Open cycle and Closed cycle gas turbine power plant, Combined cycle power plant.

UNIT II HYDRO POWER STATION **9**

Schematic arrangement, advantages and disadvantages, choice of site constituents of hydro power plant, Hydro turbine. Types of hydro power station- pumped storage plant-Environmental aspects for selecting the sites and locations of hydro power stations.

UNIT III NUCLEAR AND DIESEL POWER STATION **9**

Nuclear power station: Schematic arrangement, advantages and disadvantages, selection of site, types of reactors, Hazards, Environmental aspects for selecting the sites and locations of nuclear power stations.
Diesel power station: Introduction, Schematic arrangement, advantages and disadvantages, Choice and characteristics of diesel engines.

UNIT IV WIND ENERGY **9**

Introduction-Basic principles of wind energy conversion-site selection considerations-basic components of Wind Energy Conversion System-Classification of WECS-Horizontal and vertical axial machines -Advantages and disadvantages of WECS- Grid connection.

UNIT V SOLAR ENERGY **9**

Solar constant-solar radiation measurements-solar radiation Data-Solar energy collectors-Flat-plate collectors and concentrating collector-Solar energy storage-Solar Pond-Solar Electric Power Generation: Solar Photo-Voltaic Systems -Applications of Solar Photovoltaic systems- Solar Pumping-Grid connection. Storage systems-Battery, super capacitor.

TOTAL:45 PERIODS

COURSE OUTCOMES

The student will be/have

CO1 Understanding the layout, construction and working of steam and gas power plants
CO2 Understanding the layout, construction and working of hydro power station and identify the appropriate site for it.
CO3 Understanding the layout, construction and working of Nuclear and Diesel power station.
CO4 Understanding the layout, construction and working of Wind Energy Conversion systemand its applications.
CO5 Analyzing the solar energy system, radiation measurements and applications.

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TEXT BOOKS

1. Renewable Energy Technologies, Solanki, Chetan S. , PHI Learning, New Delhi, 2011
2. Non-Conventional Energy Sources, G.D. Rai , Khanna Publishers, New Delhi, 2011.
3. Solar Energy, S.P.Sukhatme and J.K Nayak, McGraw Hill education, Fourth Edition, 2017.
4. Wind Power Technology, Earnest, Joshua, PHI Learning, New Delhi, 2013.

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1. Electrical Power, Dr. S.L. Uppal, Khanna Publishers, 13th Edition 2009
2. Renewable Energy Sources for Sustainable Development, N.S. Rathore and N. L. Panwar,New India Publishing Agency, New Delhi,2007.
3. Wind Power in Power System, Thomas Ackermann, John Willey &Sons, 2005
4. Electric Power Generation: Transmission and Distribution, S. N. Singh, PHI Learning,2008.
5. A Text book of Power System Engineering, A Chakrabarti, M. L Soni, P. V. Gupta, U. S.Bhatnagar, Dhanpat Rai Publication.2009.

COs	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	2											2		
CO2	3	2											2		
CO3		3	3	2	2				2		2	2	2	3	2
CO4			3	3	3				3		2	2	2	2	1
CO5	3		2		2						2		2		

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418EET05	Electrical Machines-I	L	T	P	C
		3	0	0	3

Prerequisite: Basic knowledge in Electromagnetic Theory is required

COURSE OBJECTIVES

- To introduce the concept of rotating machines and the principle of electromechanical energy conversion in single and multiple excited systems.
- To understand the working principle of generation of D.C. voltages by usingdifferent types of generators.
- To study the working principles of D.C. motors and their load characteristics,starting and methods of speed control. and study their performance
- To study the testing and methods of speed control of D.C. motors.
- To study the working principles of transformers, autotransformer and thedifferent testing methods to estimate their performance.

UNIT I ENERGY CONVERSIONS AND ROTATING MACHINES 9

Principle of energy conversion-Energy in magnetic systems-singly excited system: Electrical input energy, magnetic field energy stored and co-energy - Multiply excited system - Generated EMF - MMF of distributed windings: MMF space wave of single coil– magnetic fieldsin rotating machines- Problems.

UNIT II DC GENERATORS 9

Constructional details- Principle of operation - EMF equation- Methods of Excitation – Types of DC Generators: Separate, shunt, series and compound - Armature reaction - Commutation - Interpoles- Compensating windings- losses -Applications -Problems.

UNIT III DC MOTORS 9

Principle of operation – Torque equation- Lenz's law-Back EMF- Types of DC Motors: shunt, series and compound - Electrical and Mechanical characteristics of DC shunt series and compound motors - Starters: need for starters, two point, three point and four point. Losses and efficiency - Applications- Problems.

UNIT IV TESTING AND SPEED CONTROL OF DC MACHINES 9

Testing: O.C.C. and load test on separately and self-excited DC Generators - Brake test –Swinburne's test –Hopkinson's test on motor - advantages and disadvantages – Applications - Numerical problems. Speed control: Armature and field control on Shunt motor - Ward- Leonard control system - advantages and disadvantages.

UNIT V TRANSFORMERS 9

Constructional details - Principle of operation - Classification of Transformers-Ideal transformers - EMF equation - Transformation ratio - Equivalent circuit - Voltage regulation - Losses and Efficiency - All day efficiency — Open circuit and short circuit tests - Sumpner's test- Separation of no load losses - Problems. Auto-Transformer - Principle of operation - Applications.

TOTAL:45 PERIODS

COURSE OUTCOMES

Upon Completion of this course, students will be able to:

CO1 Able to understand the basic concepts of rotating machines.

CO2 Learn the working principles and characteristics of DC Generators and motors.

CO3 Analyze the performance characteristics of Rotating Machines.

CO4 Gain the knowledge in testing and speed control on DC machines.

CO5 Learn the working principles, performance of transformer and autotransformer.

TEXT BOOKS

1. Nagrath I. J and Kothari D. P. 'Electric Machines', Tata McGraw Hill Publishing

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Company Ltd, Fifth edition , 2017.
2. P.S. Bimbhra, 'Electrical Machinery', Khanna Publishers, 7th Edition, 2011
3. B.L. Theraja, 'A text book of Electrical Technology', Volume II , S. Chand Limited, 2017 .

REFERENCE BOOKS

1. Fitzgerald.A.E. Charles Kingsely Jr, Stephen D.Umans, 'Electric Machinery', 2017.
2. P. C. Sen., 'Principles of Electrical Machines and Power Electronics', JohnWiley&Sons, 2013
3. K. Murugesh Kumar, 'Electric Machines', Vikas publishing house Pvt Ltd, 2010.
4. Cotton H, "Advanced Electrical Technology", A H Wheeler and CompanyPublications, London, 2011.

COs	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2					2									
CO2	3														
CO3	2												1		
CO4	2				2								1		
CO5	2	2				2									

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PROFESSIONAL ELECTIVE -III

418EEE06	Bio Medical Instrumentation	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To provide an acquaintance of the physiology of the heart, lung, blood circulation and circulation respiration. Methods of different transducers used.
- To introduce the student to the various sensing and measurement devices ofelectrical origin.
- To provide the latest ideas on devices of non-electrical devices.
- To bring out the important and modern methods of imaging techniques.
- To provide latest knowledge of medical assistance / techniques andtherapeutic equipment.

UNIT I BIO-POTENTIAL ELECTRODES AND RECORDERS 9

Introduction- Design of Medical Instruments-Components of the bio-medical instrument system-Bio-potential Micro electrodes- Recording set up and Analysis: ECG, EEG, EMG and ERG-Recorders with high accuracy- recording devices.

UNIT II BIO-MEDICAL INSTRUMENTATION 9

Introduction - Blood cell counter- Radiation Detectors - colorimeter and photometer- Digital thermometer – X-Ray machine - Audio meter - Radiography and fluoroscopy – Image intensifier– Angiography – Applications of X-Ray examination.

UNIT III PHYSIOLOGICAL ASSIST DEVICES 9

Introduction – Pacemaker –Pacemaker batteries – Artificial heart valves - DC Defibrillators Nerves and muscle stimulator -Heart lung machine, Artificial heart valves and kidney machine.

UNIT IV SPECIALISED MEDICAL EQUIPEMENT 9

Introduction – Electromagnetic blood flow meter- Ultrasonic blood flow meters – laser based Doppler blood flow meters – Cardiac output measurements – pulmonary function Analysers-Oxymeters.

UNIT V ADVANCES IN BIO-MEDICAL INSTRUMENTATION 9

Computer in medicine- Laser in medicine – Endoscopes – Thermograph - cryogenic surgery –Basic ideas: CT scanner, MRI and ultra-scanner, Ultrasonic imaging system – Biofeedback Instrumentation.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1 Identify the physiological parameters of various systems of humanbody.
CO2 Recognize the transducers used for the measurement of physiologicalparameters.
CO3 Design the different types of lead systems to record the waveforms.
CO4 Demonstrate the usage of assisting and therapeutic equipment
CO5 Understand the latest imaging equipment

TEXT BOOKS

1. Leslie Cromwell, "Biomedical Instrumentation and measurement", Prentice hall of India, New Delhi, 1997.
2. John G. Webster, "Medical Instrumentation Application and Design", John Wiley andsons, New York, 1998.

REFERENCE BOOKS

1. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, New Delhi,1997.
2. Joseph J.carr and John M. Brown, "Introduction to Biomedical equipment technology",John Wiley and sons, New York, 1997.

COs	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PSO1	PSO2	PSO3
CO1	3	1		2	2								2		
CO2			2	2	2									2	1
CO3			2	3	2									2	1
CO4	3	2	1		3								1		
CO5			2	2	3									2	1

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418EEE07	Neural Networks and Fuzzy Systems	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To conceptualize the working of human brain using ANN.
- To become familiar with neural networks that can learn from available examples and generalizeto form appropriate rules for inference systems.
- To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on humanexperience.
- To provide the mathematical background for carrying out the optimization and familiarizingvarious algorithm for seeking global optimum in self-learning situation.
- To provide the ideas of neuro-fuzzy controller systems.

UNIT I INTRODUCTION TO NEURAL NETWORKS 9

Introduction to Neural Networks, Biological Neural Networks, Comparison between Neural networks and Biological Neural Networks-Fundamental concepts, weights, biases and thresholds-Linear capability-Common activation functions, Learning rules and Learning methods of NN- Supervised Learning algorithms, Un-Supervised Learning algorithms, Single Layer, Multilayer Feed forward network- Recurrent network.

UNIT II NEURAL NETWORKS ARCHITECTURES AND ALGORITHMS 9

Mcculloh Pitts neuron-Hebbnet-Perceptron-Adaline-Hopfield net-Maxnet-Mexican Hat-Hamming net-Kohonen self-organizing map-Adaptive resonance theory-Back propagation neural network.

UNIT III FUZZY SETS AND RELATIONS 9

Crisp set-vagueness – uncertainty and imprecision – fuzzy set-fuzzy operators – properties – crisp versus fuzzy sets-representation of fuzzy sets-Membership functions, fuzzy complements, union, interaction combination of operators, crisp and fuzzy relations – compositions of fuzzy relations

UNIT IV CONCEPTS OF FUZZY LOGIC 9

Fuzzy Systems- Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods –Fuzzy Structure ofFuzzy logic controllers- Comparison of Fuzzy and Neural Systems.

UNIT V APPLICATIONS OF NEURAL NETWORKS AND FUZZY SYSTEMS 9

Cognitron and Neocognitron Architecture-Training Algorithm and application-Fuzzy associative memories-fuzzy and neural function estimators- Fuzzy associative memories system Architecture--Adaptive neuro, Adaptive Fuzzy, Adaptive Neuro-Fuzzy interface systems-Neuro Controller, Fuzzy logicController.

TOTAL:45 PERIODS

COURSE OUTCOMES

At the end of the course, the student will have :

CO1 Ability to understand the difference between biological neuron and neural networks

CO2 Ability to understand the difference between learning and programming and explore practical applications of Neural Networks (NN).

CO3 Ability to appreciate the importance of optimizations and its use incomputer engineering fields and other domains.

CO4 Ability to analyze and appreciate the applications which can use fuzzylogic.

CO5 understood the efficiency of a hybrid system and how NeuralNetwork and fuzzy logic can be hybridized to form a Neuro-fuzzy network and its various applications.

TEXT BOOKS

1. Introduction to Neural Networks using MATLAB 6.0 – S.N.Sivanandam,

S.Sumathi,S.N.Deepa,TMH, 2006.
2. Timothy J.Ross "Fuzzy Logic With Engineering Applications" Wiley, 2011.
3. Laurene Fausett, "Fundamentals of Neural Networks: Architecture, Algorithms andApplications", Pearson Education, 2004.

REFERENCE BOOKS

1. Satish Kumar "Neural Networks A Classroom Approach" Tata McGrawHill,2017.
2. S.Rajasekaran and G.A.Vijayalakshmi Pai "Neural Networks, Fuzzy Logic and GeneticAlgorithms"PHILearning,2003.
3. Zimmermann H.S "Fuzzy Set Theory and its Applications" Kluwer Academic Publishers,2011.

COs	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO1 2	PSO1	PSO2	PSO3
CO1		2	2		2						2		2		
CO2					2						2		2		
CO3			2		2						2			2	
CO4											3				1
CO5		2	2								3			2	

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418EEP07	Electrical Machines-I Laboratory	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

- To study the various characteristics of DC machines and transformer experimentally.

LIST OF EXPERIMENTS

1. Open circuit and load characteristics of a separately excited DC Generator.
2. Open circuit and load characteristics of self-excited DC shunt generator.
3. Load characteristics of DC compound generator with differential and cumulative connection.
4. Load characteristics of DC shunt motor
5. Load characteristics of DC series motor.
6. Load characteristics of DC compound motor
7. Speed control of DC shunt motor.
8. Swinburne's test on DC shunt motor.
9. Hopkinson's test on DC motor – generator set.
10. Load test on single-phase transformer.
11. Open circuit and short circuit tests on single phase transformer
12. Separation of no-load losses in single phase transformer

TOTAL:45 PERIODS

COURSE OUTCOMES

Upon successful completion of the course, the students will have:

CO1 Analyzed the characteristics of DC generators.

CO2 Tested the DC motors.

CO3 Ability to analyze speed and efficiency of DC machines.

CO4 Understood the various tests on transformers.

CO5 Ability to understand the various losses of transformers.

COs	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	2		2											1
CO2	3	2	2	2											
CO3	3	2		2										2	
CO4	3	2	2	1											
CO5	3	2			3				1				2		

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418EEP08	Electrical and Electronics Simulation Laboratory	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

- Gain knowledge on characteristics of Electrical and Electronics simulation

LIST OF EXPERIMENTS

1. Introduction to MATLAB
2. Diode characteristics
3. MOSFET characteristics
4. SCR characteristics
5. Single phase Half wave rectifier with R load
6. Single phase Half wave rectifier with RL load
7. Single phase full wave rectifier with R load
8. Single phase full wave rectifier with RL load
9. IGBT characteristics.
10. Basic operations of matrices using MATLAB
11. Pspice simulation of DC circuits
12. Pspice simulation of AC circuits

TOTAL:45 PERIODS

COURSE OUTCOMES

Upon successful completion of the course, the students will have:

CO1 Analyzed the characteristics of diode.

CO2 Analyzed and verified different Rectifiers.

CO3 Demonstrated the operation of Single phase half wave and full wave rectifiers

CO4 Understood basic operations of Matrices.

CO5 Analyzed the characteristics of DC and AC circuits using Pspice.

COs	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	1	2											1		
CO2	1		2										2		1
CO3	1	2	2										1		
CO4	2	1	2										1		
CO5	2		3		2				1				2	2	1

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418EEP09	Control Systems Laboratory	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

- To impart knowledge on transfer function of various machines, stability analysis, digital simulation of first order and second order systems and stepper motor control.

LIST OF EXERCISES

1. Transfer function of separately excited DC Generator.
2. Transfer function of self-excited DC Generator
3. Transfer function of Armature controlled DC Motor.
4. Transfer function of Field controlled DC Motor.
5. Transfer function of AC Servomotor.
6. DC and AC position control systems.
7. Simulation of first order system using MATLAB.
8. Simulation of second order system using MATLAB.
9. P, PI and PID Controllers (First Order).
10. Design of Lag network.
11. Design of Lead network.
12. Design of Lag-Lead network.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1 Analyze the Transfer function of separately excited DC generators.
CO2 Analyze Transfer function of self-excited DC generators.
CO3 Analyze speed control of DC motor.
CO4 Understand the various position control systems
CO5 Learn about the various controllers and networks.

COs	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO1 2	PSO1	PSO2	PSO3
CO1		2	1												
CO2	2									1					
CO3		2	1							1					
CO4		2													
CO5	3	2	1							1					

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Semester V

		L	T	P	C
518EET01	MICROPROCESSORSAND MICROCONTROLLERS	3	0	0	3

PREREQUISITE : DigitalLogicCircuitsandLinearIntegratedCircuitsandApplications

COURSE OBJECTIVES

- To summarize the architecture and assembly language programming of microprocessors.
- To interpret the architecture and assembly language programming of microcontrollers
- ToDemonstratetheconceptofinterruptsandinterfacingwithvariousperipherals.
- ToIntegratethefeaturesof8051microcontroller anditstimerapplications.
- TogetexposedtofeaturesofPICMicrocontroller.

UNITI 8085 AND8086MICROPROCESSORS 9

Evolution of Microprocessors – Introduction to 8085 – Architecture – Addressing Modes –Timing diagrams –Instruction set – Assembly language programming- Introduction to 8086 – Architecture-Assembly languageProgramming.

UNITII PERIPHERALICs INTERFACING 9

Programmable Peripheral Interface (8255) - keyboard display controller (8279) – ADC – DAC Interface –Programmable Timer Controller (8254) – Programmable interrupt controller (8259) – Serial CommunicationInterface(8251)– DMA Controller(8257).

UNIT III 8051 MICROCONTROLLER 9

8051 Microcontroller- Architecture - Instruction Set –Addressing modes –Interrupts – Assembly LanguageProgramming-Programming8051Timer/Counter-Serial Port Programming– InterruptsProgramming.

UNIT IV 8051 REAL WORLD INTERFACING AND SYSTEM DESIGN 9

8051 Interfacing-ADC,DAC interfacing-External Memory interfacing- Sensors Interfacing-Motor Control-Relay-PWM-DC motor and Stepper Motor-Design of traffic light control and Washing machine Control.

UNIT V INTRODUCTION TO PIC 9

PIC16F8XX Flash microcontrollers: Pin diagram of 16F8XX, Architectural features, I/O Ports, Timers, Interrupts, Memory organizations.

TOTAL:45 PERIODS

COURSE OUTCOMES

Upon successful completion of the course, the students should have the:

CO1 Recognize the basic microprocessor architecture and its concepts.

CO2 Outline the concepts of peripheral interfacing mechanisms.

CO3 Design various assembly language programming using microprocessors and microcontroller.

CO4 Extend the real world interfacing with microcontroller.

CO5 Extrapolate the architecture of PIC microcontroller.

TEXT BOOKS

1. Ramesh S Gaonkar, Microprocessor Architecture, Programming and application with 8085, 6th Edition,PenramInternationalPublishing, New Delhi, 2013.
2. Douglas V.Hall, Microprocessor and Interfacing, Programming and Hardware. Revised second Edition,Indianedition,11thReprint2010, TataMcGraw Hill.
3. MohammedAliMazidiandJaniceGillispieMazidi,The8051MicrocontrollerandEmbedded Systems,PearsonEducationAsia, NewDelhi,2nd Edition 2003.

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4. RajKamal"EmbeddedSystemsArchitectureProgrammingandDesign"2nd Edition,TMH,2008.
5. JohnB.Peatman,DesignwithPICMicrocontrollers,PearsonEducationAsia,6th Edition2002.

REFERENCE BOOKS

1. A.K.RayandK.M.Burchandi,IntelMicroprocessorsArchitectureProgrammingandInterfacing,McGrawHill InternationalEdition,2nd Edition 2000
2. KennethJAyala,The8051Microcontroller,3rd Edition,CengageLearningPublishers(India),2007.

COs	ProgrammeOutcomes												Programme SpecificOutcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	2											2		
CO2	3	2	2		2							2	2		
CO3		3	2	2										3	2
CO4			3	3	3				2		2	2	2	1	
CO5			3	3	3				2		2	2	2	1	

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518EET02	ELECTRICAL MACHINES II	L	T	P	C
		3	0	0	3

PREREQUISITE : Electrical Machines I

COURSE OBJECTIVES

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

UNITI ALTERNATOR **9**

Constructionaldetails–Typesofrotors–EMFequation–Synchronousreactance-Armature reaction – Voltage regulation – EMF, MMF–Synchronizing andcondition of paralleloperation – Synchronizing power – Change of excitation and mechanical input –Blondel's theory –DeterminationofXd and Xqusing sliptest.

UNITII SYNCHRONOUS MOTOR **9**

Principle of operation – Torque equation – Starting methods –Operation on infinitebus bars – V and inverted V curves – Power input and power developed equations – Power/poweranglerelations – Hunting– synchronouscondenser – Applications.

UNIT III THREE PHASE INDUCTION MOTOR **9**

Constructional details – Types of rotors – Principle of operation – Slip – Equivalentcircuit– Torqueequations–Slip-torquecharacteristics–Lossesandefficiency–Loadtest–Noloadand blocked rotor tests – Circle diagram – Separation of no load losses –Crawling and cogging –Inductiongenerator.

UNIT IV STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR **9**

Starters–Typesofstarters–DirectOnLine,Statorresistance,rotorresistance,autotransformerandstar-deltastarters.Speedcontrol:changesofvoltage,frequency,polesandrotorresistance– Cascaded connection-Applications.

UNIT V SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES **9**

Constructionaldetails–Doublerevolvingfieldtheory–Startingmethodsandapplications– Workingprinciplesofshadedpoleinductionmotor,LinearInductionmotors,repulsionmotor,Hysteresismotor,Workingprinciplesofsteppermotor,universalmotor.Applications.

TOTAL:45 PERIODS

COURSE OUTCOMES

Upon successful completion of the course, the students will have the ability to:

CO1 Illustrate the constructional details, principles of operation, performance of Alternators.

CO2 Develop and to calculate torque, starting methods of synchronous motor.

CO3 Demonstrate the constructional details, principles of operation, performance of three phase induction motor.

CO4 Correlate the different starting and speed control methods to three phase induction motors.

CO5 Interpret the knowledge basic concepts and principles of special machines.

TEXT BOOKS

1. D.P. Kothari and I.J. Nagrath, 'Electric Machines', Tata McGraw Hill Publishing CompanyLtd,NewDelhi, 4th Edition, 2010.
2. TherajaBL.,TherajaA K.,"ATextBookofElectricalTechnologyVol.IIAC&DCMachines"S Chand andCompanyLimited,23rd RevisedEdition,2009.
3. J.B. Gupta, 'Theory and Performance of Electrical Machines', S.K.Kataria and Sons,

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14th Edition,2015
4. K.MurugeshKumar,'Induction&SynchronousMachines',VikasPublishingHousePvt.Ltd ,1st Edition, 2000.
5. StephenJ.Chapman,'ElectricMachineryFundamentals'4thEdition,McGrawHillEducationPvt.Ltd, 2010.

REFERENCE BOOKS

1. A.E.Fitzgerald,CharlesKingsley,Stephen.D.Umans,'ElectricMachinery',TataMcGraw Hill Publishing CompanyLtd, 6th Edition, 2015.
2. P.S.Bhimbhra,'ElectricalMachinery',KhannaPublishers,7th Edition,2011.

COs	ProgrammeOutcomes												Programme SpecificOutcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	3	3	2		2							2		
CO2	2					2							2		
CO3	2						2							3	2
CO4	2					3							2	1	
CO5	2					3			2				2	1	

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518EET03	ADVANCED CONTROL THEORY	L	T	P	C
		3	1	0	4

PREREQUISITE :Control Systems

COURSE OBJECTIVES

- Description and stability of non-linear system.
- Conventional techniques of non-linear system.
- Analysis of discrete time systems using conventional techniques.
- Analyze the stability of non-linear systems using different techniques.
- Design of optimal controller.

UNITI **STATE VARIABLE DESIGN** **12**

Introductiontostatevariable-Designbystatefeedback-Outputfeedback-Poleplacementtechnique-Design of state and output feedback controllers – Design of reduced and full order observers-PIfeedback-Dynamicstatefeedback.

UNITII **SAMPLED DATA CONTROL SYSTEM** **12**

IntroductiontoSampledatacontrolsystems-Samplingprocess,signalreconstruction,differenceequation, Z-transform, Z-transfer function – Inverse Z transform, Z- transform analysis of sampled datacontrolsystem,Zand S domain Relationship.

UNIT III **NON-LINEAR SYSTEMS** **12**

Typesofnon-linearity-Typicalexamples-Equivalentlinearization-Phaseplaneanalysis-Limitcycles-Describingfunctions-Analysis usingDescribingfunctions.

UNIT IV **STABILITY ANALYSIS** **12**

Introduction-Equilibriumpoints-BIBOandasymptoticstability-DirectmethodofLiapunov-Applicationtonon-linearproblems-Frequencydomainstabilitycriteria-popov'smethodanditsextensions.

UNIT V **OPTIMAL CONTROL** **12**

Introduction-Decoupling-Time varying optimal control- LQR steady state optimal control-Optimal estimation--Multivariable controldesign.

TOTAL:60 PERIODS

COURSE OUTCOMES

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

CO1 Identify state variables and poles to find the stability of non-linear systems.

CO2 Formulate differential equation, Z-transform, Z transfer function.

CO3 Analyze and functioning of non linear systems.

CO4 Demonstrate the stability analysis of non linear systems.

CO5 Analyze the optimal control theory to non linear systems.

TEXT BOOKS

1. "ModernControlEngineering" byK Ogata,prenticeHall,5th Edition,2010.
2. "DiscreteTimeControlSystems"byKOgata,prenticeHall,2nd Edition,2015.
3. "Digital Control and State Variable Methods" by Madan Gopal, McGraw Hill Education, 3rd Edition,2010.

REFERENCE BOOKS

1. "ModernControl Engineering"byRoyChoudhury,PHILearningPrivateLimited,8th Edition,2015.
2. "AdvancedControlSystemsDesign"byBernardFriedl,PrenticeHall,3rd Edition,2010.

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3. "AdvancedControlSystems"byBNSarkar,,PHILearningPrivateLimited,7th Edition,2015

COs	ProgrammeOutcomes												Programme SpecificOutcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												2		
CO2	3	2											2	1	
CO3	3	2											2	1	1
CO4	3	2											2	1	
CO5	3			1									2		

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518EET04	PROTECTION AND SWITCHGEAR	L	T	P	C
		3	0	0	3

PREREQUISITE :Electrical Machines

COURSE OBJECTIVES

- Nature and causes of faults, earthing, protection schemes, construction and characteristics of relays.
- Apparatus protection and instrument transformer.
- Arc interruption methods, RRRV, Resistance switching and current chopping.
- Function of circuit breakers, Rating and testing of circuit breakers.
- Causes of over voltages, methods of protection against over voltages and insulation coordination.

UNITI PROTECTIVE RELAYS **9**

Needforpowersystemprotectionschemes–natureandcausesoffaults–typesoffaults– Powersystemearthing–Zonesofprotectionandessentialqualitiesofprotection–Protectionscheme– constructionandcharacteristicsofrelays–overcurrentrelays– directional,distanceanddifferentialrelays-underfrequencyrelays –negativesequencerelays– staticrelays–microprocessorbasedrelays.

UNITII APPARATUS PROTECTION **9**

Apparatus protection – generator and transformer protection – protection of bus bars,transmissionlines, CT's, PT's andtheir applicationinprotectiveschemes.

UNIT III THEORY OF CIRCUIT INTERRUPTION **9**

Physics of arc phenomena and arc interruption. Restriking voltage and Recovery voltage, rateof rise of recovery voltage, current chopping, interruption of capacitive current, resistance switching – DCcircuit breaking.

UNIT IV CIRCUIT BREAKERS **9**

Switch gear – fault clearing process – interruption of current – Types of Circuit Breakers – Airblast, oil, SF6 and Vacuum circuit breakers – comparative merits of different circuit breakers – MCBs – Testingofcircuitbreakers– Circuitbreakerratings.

UNIT V PROTECTION AGAINST OVER VOLTAGES **9**

Causesofovervoltages–methodsofprotectionagainstovervoltages– groundwires,Petersoncoil,surgeabsorbers,surgediverters –relayco-ordination– selectionofprotectivesystem–Insulationco-ordination.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1 Recognize the cause of faults, earthing, protection schemes, construction and characteristics of relays.

CO2 Categorize the apparatus protection and instrument transformer.

CO3 Classify the arc interruption methods, estimate RRRV and resistance switching.

CO4 Demonstrate the function of circuit breakers, testing of circuit breakers and estimate the Rating of circuit breakers.

CO5 Identify the causes of over voltages, methods of protection against over voltages and insulation coordination.

TEXT BOOKS

1. Sunil S.Rao, Switchgear and Protection, Khanna publishers, New

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Delhi,13th Edition 4th Reprint,2010.
2. Y.G.Paithankar and S.R.Bhide, 'Fundamentals of power system protection', 2nd Edition, Prentice Hall of India Pvt.Ltd., New Delhi ,2010.
3. Badriram and Vishwakarma DN, "Power System Protection and Switchgear" 2nd Edition Tata McGraw Hill Publishing Company Ltd. New Delhi,2011.

REFERENCE BOOKS

1. B.Rabindranath and N.Chander, 'Power System Protection and /Switchgear', New Age International(P)Ltd., 1st Edition 2011.
2. M.L.Soni,P.V.Gupta,V.S.Bhatnagar,A.Chakrabarti,'A Text Book on Power System Engineering', DhanpatRai&Co., 2nd Edition,2017.
3. Ravindra P.Singh, "Switchgear and Power System Protection" PHI Learning Private Ltd., New Delhi,2014.

COs	Programme Outcomes												Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2					2									
CO2	3														
CO3	2														
CO4	2				2								1		
CO5	2	2				2									

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518EET05	TRANSMISSION AND DISTRIBUTION	L	T	P	C
		3	0	0	3

PREREQUISITE : Nil

COURSE OBJECTIVES

- To study the description and structure of power systems.
- To study the conventional technique transmission line parameters.
- Tostudy the performance of transmission lines.
- Tostudy the different types of cables and insulators.
- Tostudy the mechanical design of transmission line and distribution system.

UNITI INTRODUCTION 9

Structure of electric power systems – Types of transmission systems: AC systems – DC systems-Advantages anddisadvantagesofACandDCSystem-EHVACtransmissionsystems:NecessityforEHVTransmission-MeritsandDemerits of EHV Transmission system-HVDC Transmission: Principle-Types of HVDC System- Merits andDemeritsof HVDCTransmissionsystem-comparisonofHVDCandHVACsystems –Terminalequipmentof-HVDCTransmissionline-FACTS(qualitativetreatmentonly):TCSC,SVC,STATCOM,DVR,UPFC.

UNITII TRANSMISSION LINE PARAMETERS 9

Parameters of single and three phase transmission lines with single and double circuits: Resistance, inductance andcapacitance– stranded and bundled conductors – symmetrical and unsymmetrical spacing – Transposition ofconductors–selfandmutualGMD–SkinandProximityeffect–Inductiveinterferencewithneighboring circuits.

UNIT III PERFORMANCE OF TRANSMISSION LINES 9

Classification of lines: Short line, medium line and long line; equivalent circuits, Attenuation constant, phaseconstant, surge impedance; Transmission Efficiency and Voltage Regulation-Active and Reactive power flow inlines:Power-angledіagram;surgeimpedanceloading,Ferrantieffect–FactorsAffectingcoronaloss–AdvantagesandDisadvantages of Corona-Methodsofreducingcoronaeffect.

UNIT IV CABLES AND INSULATORS 9

Undergroundcables:GeneralConstructionofcable–Typesofcables-AdvantagesofUndergroundcables-Insulationresistance of a cable – Capacitance of a single core and three core cables- Grading of cables– Capacitance and intersheathgrading.

Insulators:Propertiesofinsulators-Typesofinsulatorsforoverheadlines–Voltagedistributionininsulatorstring andgrading–StringEfficiency–Calculatingstringefficiency-Methodsofimprovingstringefficiency.

UNIT V SUBSTATION AND DISTRIBUTION SYSTEMS 9

Calculations of Sag and Tension — Supports at different levels – Factor of Safety-Effect of wind and ice –Requirements of a Tower-Type ofTowers. Distribution system: Requirements of distribution system-Types of DC distribution system – Radial and Ring- mainsystem-Classification of Substations-selection of site and location for a substation- Equipments for substations-Comparison betweenindoor and outdoor substation.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1 Differentiate the higher capacity AC and DC lines.

CO2 Compare the different types of conductors and characteristics.

CO3 Identify the transmission line systems for various ranges.

CO4 Gained the knowledge of the cables, the insulators and study of distribution system.

CO5 Examine the various types of substations.

TEXT BOOKS

1. Wadwa.C.L.,"ElectricPower Systems,NewAgeInternational(P)Ltd,7th Edition, 2017.
2. Mehta.V.K,andRohitMetha,"PrinciplesofPowerSystem",S.Chand,4th Edition,2014.

REFERENCE BOOKS

1. LucesM.Fualkenberry, WalterCoffer,"ElectricalPowerDistributionandTransmission",PearsonEducation,1st Edition, 1996.
2. Despande.M.V,"ElectricalPowerSystemsDesign",TataMcGrawHillPublishingCompany,NewDelhi,26th Reprint,2006.
3. Stevenson.W.L.,"ElementsofPowerSystemAnalysis",McGrawHill,NewDelhi,4th Edition,2014.

COs	ProgrammeOutcomes												Programme SpecificOutcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3														
CO2	3				1								1		
CO3	2	2													
CO4	2	2													
CO5	2	2													

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OPEN ELECTIVE-I

		L	T	P	C
518ECTO3/ 518ECO06	COMMUNICATION THEORY	3	0	0	3

PREREQUISITE :Nil

COURSE OBJECTIVES

- Understand working of various Amplitude modulation and demodulation systems.
- Explain about various Angle modulation and demodulation systems.
- Discuss transmitters and receivers of AM and FM.
- Understand the mathematical representation of noise.
- Understand the effect of noise on the performance of AM and FM receivers.

UNITI AMPLITUDE MODULATION 9

AnalysisofanAMSignalSpectrum–GenerationandDetectionofDSB-FCwaves-SquarelawModulator,Squarelaw detector, Envelope Detector- Generation and Detection of DSB-SC waves-Balanced Modulator, RingModulator, Coherent detection, Costas loop, Generation and Detection of SSB-SC waves– Phase discriminationmethod, coherent detection, Generation and Detection of VSB Signals, Comparison of Amplitude modulationsystems.

UNITII ANGLE MODULATION 9

Phase modulation, Frequency modulation, Analysis of FM Signal Spectrum–Narrowband and wideband FM,TransmissionBandwidthofFMsignals-GenerationofFMsignal–DirectFM,IndirectFM,DemodulationofFMsignals-Balanced slope Detector, Foster-Seeley Discriminator, PLL –Linear and non-linear modelof PLL,FMstereomultiplexing.

UNIT III TRANSMITTERS AND RECEIVERS 9

ClassificationofTransmitters- Blockdiagram ofAMbroadcasting transmitters- Lowlevelandhigh leveltransmitters-FMtransmitters.

ClassificationofReceivers-ReceiverCharacteristics-TunedRadiofrequencyreceiver-Superheterodynereceiver-BlockdiagramofFM receiver-Automaticfrequencycontrol-Automaticgaincontrol.

UNIT IV NOISE THEORY 9

Gaussian Process. Noise – Shot noise, Thermal noise and white noise; Noise temperature; Noise Figure- NoiseBandwidth –mathematical representation of noise-Frequency Domain Representation of Noise, Power SpectralDensity –Effect of a Filter on the Power spectral density of noise- Narrow band representation of noise and itsPSD.

UNIT V NOISE PERFORMANCE AM AND FM RECEIVERS 9

NoiseinAMSystems:CalculationofSignalPowerandNoisePowerinSSB-SC,DSB-SCandDSB-C.FigureofMeritofSquarelawandEnvelopeDetection.NoiseinFMsystem:MathematicalRepresentationof theoperationoftheLimiter,Discriminator,CalculationofSNR-Threshold in FM–Pre-emphasisandDe-emphasis.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1 Understand the modulation and its significance.

CO2 Analyze the different modulation systems.

CO3 Understand the frequency characteristics of noise.

CO4 Calculate and analyze noise performance in various receivers.

CO5 Calculate and analyze noise performance in various receivers.

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TEXT BOOKS

1. HerbertTaub&DonaldLSchilling–PrinciplesofCommunicationSystems(3rdEdition) Tata McGrawHill,2008

2. SimonHaykin,"Communicationsystems",WilleyPublication,NewDelhi,2011.

3. KennedyG,"Electroniccommunicationsystems"TataMcGrawHill,NewDelhi,2009.

REFERENCE BOOKS

1. JohnG.Proakis,MasoudSalehi,FundamentalsofCommunicationSystems,PearsonEducation,2006.
2. B.P.Lathi,ModernDigitalandAnalogCommunicationSystems,ThirdEdition,OxfordPress,2007.
3. P.Ramakrishnarao,"CommunicationSystems",PublishedbyMcGrawHillEducation,2013
4. BruceCarlson-Communication Systems.(IIIEd.),McGrawHill.

COs	ProgrammeOutcomes												ProgrammeSpecific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		1										2		
CO2	3		1									2	2		
CO3	3		3			2	2						2		1
CO4	3	3	1	2									3	2	
CO5	3		1									2			

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518EEP07 **ELECTRICAL MACHINES LABORATORY-II**

L	T	P	C
0	0	2	1

PREREQUISITE :Nil

COURSE OBJECTIVES

- To study the various characteristics of AC machines experimentally.

LIST OF EXPERIMENTS

1. Regulationofthree-phasealternatorbyEMFmethod.
2. Regulationofthree-phasealternatorbyMMFmethod.
3. Loadtestonthree-phase alternator.
4. Regulationofthree-phasesalientpolealternatorbysliptest.
5. VandInvertedVcurvesofThreePhaseSynchronous Motor.
6. Loadtestonthree-phasesquirrel cageinductionmotor.
7. Loadtestonthree-phaseslipringinductionmotor.
8. Determination of Equivalent circuit through No load and blocked rotor tests on three-phaseinduction motor.
9. SeparationofNo-loadlossesofthree-phaseinductionmotor.
10. Loadtestonsingle-phase induction motor.
11. DeterminationofEquivalent circuitofsingle-phaseinductionmotor.
12. StudyofACstarters.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1 Identify the circuit connections of synchronous generators and motors.

CO2 Analyze the motors for specific applications.

CO3 Demonstrate practical experience in starting and testing of three-Phase induction motors.

CO4 Interpret the performance of single phase induction motor.

CO5 Examine the practical experience in speed control of three-Phase induction motors.

COs	ProgrammeOutcomes												Programme SpecificOutcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1		2	2								2		
CO2			2	2	2									2	1
CO3			2	3	2									2	1
CO4	3	2	1		3								1		
CO5			2	2	3									2	1

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518EEP08	MICROPROCESSORS AND MICROCONTROLLERS LABORATORY	L	T	P	C
		0	0	2	1

PREREQUISITE: Digital Logic Circuits and Linear Integrated Circuits and Applications.

COURSE OBJECTIVES

- Develop the code in assembly language programming.
- Interpret the Assembly code using 8085, 8086 processors and 8051 controllers.
- Test the developed code using 8085, 8086 processors and 8051 controllers.
- Demonstrate the interface peripherals with microprocessor and micro controller.
- Apply the interfacing in the real world applications.

LIST OF EXPERIMENTS

1. Programmingfor8/16bit ArithmeticoperationsUsing8085Addition/subtraction/multiplication/division.
2. ProgrammingwithcontrolinstructionsUsing8085Increment/Decrement, Ascending/Descending.
3. ProgrammingwithcontrolinstructionsUsingMaximum/Minimumofnumbers.
4. Codeconversionsusing8085: Hex. /ASCII/ BCDcodeconversions.
5. InterfaceExperiments:-A/DInterfacing.
6. InterfaceExperiments:-D/AInterfacing.
7. Keyboardinterfacing using8279 with 8085.
8. Programmingfor8/16bitArithmeticoperationsUsing 8051Addition/subtraction/multiplication/division.
9. Programming-ArithmeticoperationsUsing8086 Addition/subtraction/multiplication/division.
10. ProgrammingwithcontrolinstructionsUsing8086Increment/Decrement,Ascending/Descendingorder,Maximum/ Minimumof numbers,Rotateinstructions, Hex./ ASCII/BCD codeconversions.
11. InterfacingandProgrammingofTrafficlightcontrollerusing8085.
12. InterfacingandProgramming ofStepperMotorcontrolusing8085.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1 Generate the code for arithmetic operations in assembly language.
CO2 Generalize the developed code using 8085, 8086 processors and 8051 controllers.
CO3 Identify the bugs in the assembly code using 8085, 8086 processors and 8051 controllers.
CO4 Reorganize the Interfacing peripherals with microprocessor and microcontroller.
CO5 Propose the new design for real world applications.

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COs	ProgrammeOutcomes												Programme SpecificOutcomes		
	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	PO 10	PO 11	PO1 2	PSO1	PSO2	PSO3
CO1	3	2											2		
CO2	3	2	2		2							2	2		
CO3		3	2	2									2		
CO4			3	3	3				2		2	2	2	2	1
CO5			3	3	3				2		2	2	2	3	2

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518EEP09	DIGITAL ELECTRONICS LABORATORY	L	T	P	C
		0	0	2	1

PREREQUISITE: Digital Logic Circuits.

COURSE OBJECTIVES

- To design an experiment to produce various logical outputs.
- To study the output of code converters, shift registers, counters.
- To study the output of multiplexers and De-multiplexers.
- To study the output of synchronous sequential circuits.

LIST OF EXPERIMENTS

1. (a)VerificationoftruthtableforlogicgatesAND,OR,EXOR,NOT,NOR,NAND
   (b)VerificationofCharacteristictableforFlip-flopsJKFF,RSFF,TFF
2. DesignandImplementationofHalf/FullAdderandSubtractorusingbasiclogicgates.
3. DesignandImplementationof 4bitbinaryadder/ SubtractorandBCDAdder.
4. DesignandImplementationof16bitevenparitygeneratorandchecker.
5. DesignandImplementationof2bitmagnitudecomparatorusinglogicgates.
6. DesignandImplementationofCodeconvertersusinglogicgates
   (a) BCDto Excess – 3Codeandvice-versa
   (b) BinarytoGraycodesandvice-versa
7. DesignandImplementationof Encoders andDecodersusinglogic gates and studyof IC7445andIC74147.
8. Designandimplementationof BCDto7segment displayusingdecoderIC.
9. DesignandImplementationofMultiplexers and Demultiplexersusinglogic gatesand studyofIC7474150 andIC74154.
10. ConstructionandVerificationof4bit4-bit modulosynchronousCounters.
11. Designand Implementationof3-bit synchronous up-counter,down-counter usingMSIcircuits.
12. ShiftRegisters:Designandimplementationof4-bitshiftregistersinSISO,SIPO,PISO, PIPOmodes usingsuitableICs.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1 Verify the digital logic circuits using digital ICs.
CO2 Apply Boolean functions and to implement those circuits practically.
CO3 Implement the different combinational logic circuits using logic gates.
CO4 Implement the synchronous sequential logic circuits using digital ICs.
CO5 Analyze the design and functioning of synchronous sequential circuits.

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COs	ProgrammeOutcomes												Programme SpecificOutcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2												1		
CO2	2	2											2	1	
CO3	2	2				1							2	1	
CO4	2					1							3	2	1
CO5	2					1									

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Semester VI

		L	T	P	C
618EET01	ELECTRICAL MACHINE DESIGN	3	0	0	3

PREREQUISITE :Electrical Machines-I, Electrical Machines-II

COURSE OBJECTIVES

- To provide sound knowledge about Reluctance and EMF calculations.
- To study the design calculations of armature and field system for D.C machines.
- Todesign core, yoke, windings and cooling systems of transformers.
- Todesign stator and rotor of induction machines.
- Todesign the synchronous machines and Damper winding.

UNITI INTRODUCTION 9

Major considerations in Electrical Machine Design – Limitations in design- Choice of Specific Electrical andMagnetic loadings – Fundamentals of magnetic circuit – Reluctance and MMF calculation for air gap and tooth –real andapparentfluxdensityofrotatingmachines-Standardspecifications.

UNITII DESIGN OF D.C MACHINES 9

Review of Constructional details - Output Equation – Main Dimensions – Selection of number of poles – Designof Armature–Designofcommutatorandbrushes – designoffieldpoleand coils–Designproblems.

UNIT III DESIGN OF TRANSFORMERS 9

ReviewofConstructionaldetails–MainDimensions-KVAoutputequationforsingleandthreephasetransformers-Overalldimensions–designofyoke, coreandwindingforcoreandshell type transformers–Optimumdesigns-DesignofTankandcoolingtubesofTransformers-Designproblems.

UNIT IV DESIGN OF THREE PHASE INDUCTION MOTORS 9

Review of Constructional details - Output equation of Induction motor – Main dimensions – choice of specificloadings–DesignofLengthofairgap–Designofstator-Designofsquirrelcagerotorandwoundrotor–Depthofstatorandrotor core-Design problems.

UNIT V DESIGN OF SYNCHRONOUS MACHINES 9

ReviewofConstructionaldetails-Outputequation–MainDimensions-choiceofspecificloadings–Designofsalientpole machines – Short circuit ratio – shape of pole face – Armature design – Slot dimensions – Estimation of air gaplength–Designofrotor–Designofdamperwinding–Designoffieldwinding–Designofturboalternators-Designproblems.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1 Apply the concept of design considerations for all types of electrical machines.

CO2 Design the armature and field system of DC machines.

CO3 Design single and three phase transformers.

CO4 Design the stator and rotor of induction motor.

CO5 Design and analyze Synchronous machine parameters.

TEXT BOOKS

1. Sawhney, A.K., 'A Course in Electrical Machine Design', Dhanpat Rai & Sons, New Delhi, 6th Edition, 2010.

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2. Sen,S.K.,'PrinciplesofElectricalMachineDesignswithComputerProgrammes',Oxford andIBHPublishingCo. Pvt. Ltd., NewDelhi, 2nd Edition,2011.

3. R.K. Agarwal, 'Principles of Electrical Machine Design', S.K.Kataria and Sons, Delhi, 4th Edition,Reprint 2019.

REFERENCE BOOKS

1. V.N.MittleandA.Mittle,'DesignofElectricalMachines',StandardPublicationsDistributors,Delhi,5thReprintEdition, 2013.

2. Shanmugasundaram,A.,GangadharanG.andPalaniR.,"ElectricalMachineDesignDataBook",New AgeInternational (P) Ltd, 2ndEdition, 2015.

COs	ProgrammeOutcomes												Programme SpecificOutcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	2											3	3	1
CO2	2	3	3										2	3	
CO3	2	3	3										2	3	1
CO4	2	3	3										2	3	
CO5					3								2	3	

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618EET02	POWER ELECTRONICS	L	T	P	C
		3	0	0	3

PREREQUISITE : Electron Devices and circuits

COURSE OBJECTIVES

- To get an overview of different types of power semi-conductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers.
- To study the operation, switching techniques and basic topologies of DC-DC switching regulators.
- To learn the different modulation techniques of pulse width modulated inverters and to understand and the harmonic reduction methods.
- To know the practical application for power electronics converters in conditioning the power supply

UNITI POWER SEMI-CONDUCTOR DEVICES 9

Construction, Principle of operation – Static and dynamic characteristics of Power diodes, SCR, TRIAC,GTO,powerBJT,power MOSFETIGBT and SiC–Types of power diodes– Two Transistor modelof a thyristor – Turn on and Turn off methods of thyristor-series and parallel operation of thyristor-Applications

UNITII PHASE CONTROLLED CONVERTERS 9

AC to DC converters: single phase and three phase half and fully controlled converters with R, RL andRLE loads – Estimation of average and RMS load voltage and current – input power factor – Dualconverters – Effect of source impedance on the performance of converter: single phase and three phaseconverter-Applications.

UNIT III DC TO DC CONVERTER 9

DC to DC converters: Principle of Chopper operation – Time ratio control –step up and step downchoppers– classification of chopper – Buck, Boost, Buck-boost and flyback configurations-Design ofInductors-Applications

UNIT IV INVERTERS 9

DC to AC converters:Inverters–Types:voltage source and currentsource inverters– single phasebridge inverters – three phase bridge inverters :120 and 180 mode of operation-currentsourceinverters:singlephasecapacitorcommutatedCSI–singlephaseAutoSequentialcommutatedCSI–PWMInverter-Harmonicreduction–Applications.

UNIT V CYCLOCONVERTER AND AC VOLTAGE REGULATOR 9

Single phase to single phase cycloconverter- three phase to single phase and three phase to three phasecycloconverter-AC voltage controller: Single phase voltage controller with R,RLLoad-Three phasevoltagecontroller-Applications.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1 Illustrate the principles of operation, performance of power semiconductor devices.

CO2 Develop and Estimation of the function of single phase and three phase controlled converters.

CO3 Demonstrate and operation various commutation of the choppers.

CO4 Correlate the different modes of operation of inverters.

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CO5 Interpret the knowledge basic concepts and principles of operation on cycloconverters and AC voltage regulators.

TEXT BOOKS

1 Rashid, M.H., 'Power Electronics - Circuits Devices and Applications', Prentice Hall of India, 4th Edition, 2017.

2 Singh.M.D and Kanchandani-'Power Electronics'-Tata McGraw-Hill & Hill publication CompanyLtd.,New Delhi,13th Edition, 2008.

3 VedamSubrahmanyam,"PowerElectronics",NewAgeInternational(P)Limited,NewDelhi, 5th Edition, 2012.

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1. JosephVithayathil,"PowerElectronics",McGrawHillseriesinElectricalandComputerEngineering, USA., 2nd Edition,2019.
2. Dubey, G.K., Doradia, S.R., Joshi, A. and Sinha, R.M., 'Thyristorised Power Controllers',NewAgeInternational(P)Ltd, 2nd Edition,2015.
3. Dr.P.S.Bimbhra,"PowerElectronics",khannaPublishers,6th Edition,2018.
4. PhilipTKrein,"ElementsofPowerElectronics", OxfordUniversityPress,Inc.,NewYork,2nd Edition, 2014.

COs	ProgrammeOutcomes												Programme SpecificOutcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3												2		1
CO2	3	2	1											3	
CO3	3	2	2										2		
CO4	3	2	1										2		
CO5	2	1			2								3		

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618EET03	POWER SYSTEM ANALYSIS AND STABILITY	L	T	P	C
		3	1	0	4

PREREQUISITE :Numerical Methods & Transmission and Distribution

COURSE OBJECTIVES

- Per unit analysis, impedance diagram, reactance diagram, construction of Y-bus and Z-bus matrix.
- Importance of power flow analysis, classification of buses and iterative techniques for power flow analysis.
- Symmetrical fault analysis using Thevenin's theorem and Z bus building algorithm.
- Unsymmetrical fault analysis, symmetrical components and sequence networks analysis.
- Stability analysis in power system planning, development of swing equation and equal area criterion.

UNITI INTRODUCTION **12**

Need for system planning and operational studies – basic components of a power system – Singleline diagram –perunitanalysis–per unit impedancediagram–perunitreactancediagram–Generator-transformer–transmissionlineandloadrepresentationfor different power system studies. - Primitive network - construction of Y-bus using inspection andsingulartransformationmethods–constructionofZ-bususingbuildingalgorithm-Introductiontorestructuringofpowersystem.

UNITII POWER FLOW ANALYSIS **12**

Importanceofpowerflowanalysisinplanningandoperationofpowersystems-statementofpowerflow problem - classification of buses - development of power flow model in complex variables form andpolarform-iterativesolutionusingGauss-Seidelmethod-Newton-RaphsonmethodandDecoupledmethod-comparisonsofthreemethods.

UNIT III FAULT ANALYSIS- BALANCED FAULTS **12**

Importance of short circuit analysis - assumptions in fault analysis - analysis using Thevenin'stheorem –Z-bus building algorithm - fault analysis using Z-bus – computations of short circuit capacity,postfaultvoltage andcurrents.

UNIT IV FAULT ANALYSIS – UNBALANCED FAULTS **12**

Introductiontosymmetricalcomponents–sequenceimpedances–sequencecircuitsofsynchronous machine, transformer and transmission lines - sequence networks analysis of single line toground,linetolineanddoublelinetogroundfaultsusingThevenin'stheoremandZ-busmatrix.

UNIT V STABILITY ANALYSIS **12**

Importance of stability analysis in power system planning and operation - classification of powersystem stability - angle and voltage stability – Single Machine Infinite Bus (SMIB) system: Developmentof swing equation - equal area criterion - determination of critical clearing angle and time – solution ofswingequationbymodifiedEuler method andRunge-Kuttafourthordermethod.

TOTAL:60 PERIODS

COURSE OUTCOMES

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

CO1 Illustrate Per unit analysis, impendence diagram and reactance diagram, construct Y bus and Z bus matrix.

CO2 Recognize the importance of power flow analysis, classification of buses and iterative

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techniques for power flow analysis.

CO3 Illustrate symmetrical fault analysis using Thevenin's theorem and Z bus building algorithm.

CO4 Categorize the unsymmetrical fault and estimate symmetrical components.

CO5 Recognize the stability analysis in power system planning, development of swing equation and equal are criterion.

TEXT BOOKS

1. JohnJ.GraingerandStevensonJr.W.D.,'PowerSystemAnalysis',TataMcGrawHill,2017.
2. HadiSaadat,'PowerSystemAnalysis',TataMcGrawHillEducationPvt.Ltd.,NewDelhi,3rdIllustrated Edition, 2010.
3. Nagrath. I.J, Kothari. D.P, "Modern Power system Analysis", Tata McGraw Hill Pub. Co. Ltd., 4thEdition, 2011.

REFERENCE BOOKS

1. KundurP.,'PowerSystemStabilityandControl,TataMcGrawHillEducationPvt.Ltd.,NewDelhi,10threprint2010.
2. "PaiMA,'ComputerTechniquesinPowerSystemAnalysis',TataMcGraw-HiliPublishingCompanyLtd.,New Delhi,2nd Edition, 2007.
3. Wadwa.C.L.,"ElectricPower Systems,NewAgeInternational(P)Ltd,7thEdition, 2017.
4. Gleen W.Stagg, Ahmed H. Ei-Abiad, 'Computer Methods in Power System Analysis', MedtechPublisher,1stEdition,2019.

COs	ProgrammeOutcomes												Programme SpecificOutcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	3		2									3		
CO2	3	2	2	2									2		2
CO3	3	2		2									2	2	
CO4	3	2	2	1									2		
CO5	3	2			3				1				3	2	

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618EET04	HIGH VOLTAGE ENGINEERING	L	T	P	C
		3	0	0	3

PREREQUISITE: Transmission and Distribution & Power Electronics

COURSE OBJECTIVES

- To understand the various types of over voltages in power system.
- Nature of Breakdown mechanism in solid, liquid and gaseous dielectrics.
- Generation of over voltages in laboratories and Measurement of over voltages.
- Discussion on Testing of power apparatus and International and Indian Standards.

UNITI TRANSIENT OVERVOLTAGES IN ELECTRIC POWER SYSTEMS 9

Naturalcausesofovervoltages- Lightningphenomena-Overvoltagesduetoswitchingsurges– Characteristics of switching surges- control of over voltage due to switching- System faults and other abnormalconditions – Travelingwaves ontransmissionlines.

UNITII ELECTRICAL BREAKDOWN IN GASES, SOLIDS AND LIQUIDS 9

Ionization processes – Townsend's Criterion - Paschen's law - Streamer theory - Breakdown in non-uniform fieldsandcoronadischarges–Practicalconsiderationsin using gasesfor insulationpurposes-Vacuuminsulation.Conduction and breakdown in pure and commercial liquids. Intrinsic breakdown in solids- Electromechanicalbreakdown -Thermalbreakdown-Breakdownin compositedielectrics.

UNIT III GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS 9

Generation of high DC voltages, high alternating voltages, impulse voltages and impulse currents – Trippingand controlofimpulse Generators.

UNIT IV MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS 9

Measurementof high DC voltages, high AC voltages and impulse voltages - Measurement of highDC currents, high AC currents and impulse currents - CRO for impulse voltage and current measurement - Digitaltechniquesin highvoltagemeasurement.

UNIT V HIGH VOLTAGE TESTING OF ELECTRICAL POWER APPARATUS 9

TestingofInsulator,Bushings, Isolators,Circuitbreakers,Cables,Transformers,SurgeArresters PartialDischargemeasurement–Radiointerferencemeasurement–InternationalandIndianStandards.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1 Ability to understand in transients over voltages in power system.

CO2 Gain knowledge in the fundamental concept of electric breakdown in liquids, solids and gases.

CO3 Extrapolate the Generation of various types of high voltages and high currents.

CO4 Extrapolate the measurement of various types of high voltages and high currents.

CO5 Outline the Indian and international standards for high voltage testing of power apparatus.

TEXT BOOKS

1. M.S.NaiduandV.Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, 5thEdition,2017.
2. Kuffel, E,Zaengl,W.SandKuffel.J,'HighVoltageEngineering Fundamentals',ReedElsevier India Pvt. Ltd , 2nd Edition,2012.

REFERENCE BOOKS

1. Kuffel, E and Abdullah, M., 'High Voltage Engineering', Pergamon Press, Oxford, 1st IndianEdition,1970.

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COs	ProgrammeOutcomes												Programme SpecificOutcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3												2		
CO2	3	2											2		
CO3	3	2											2	2	1
CO4	3	2											2	2	1
CO5	3			1									2	2	1

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618EET05	RENEWABLE ENERGY SOURCES	L	T	P	C
		3	0	0	3

PREREQUISITE : Power Generation Systems

COURSE OBJECTIVES

- To understand the principle of working and the components of different non-conventional sources of energy and their utilization.
- To get an exposure on the power plants working with non-conventional energy.
- Tostudy and compare the different non-conventional sources of energy and their performance.

UNITI INTRODUCTION **9**

EnergyConservationandEnergyEfficiency–NeedsandAdvantages,DifferenttypesofRenewable Energy Sources - Energy Resources Availability in World –Environmental aspectsof energyutilization– StatisticalReportonRenewableenergyscenarioin India -Applications.

UNITII SOLAR ENERGY **9**

Introduction to solar energy: solar radiation, availability, measurement and estimation – Solarthermal conversion devices and storage – solar cells and photovoltaic conversion – PV systems – MPPT.Applications of PVSystems–solarenergycollectors and storages-Estimation&Design.

UNIT III WIND ENERGY **9**

Introduction – Basic principles of wind energy conversion – wind data and energy estimation – siteselection consideration – basic components of wind energy conversion system –Types of wind turbines -Schemes for electric generations – generator control, energy storage – applications of wind energy – Interconnectedsystems-Estimation&Design.

UNIT IV BIO MASS ENERGY AND OTHER ENERGY SOURCES **9**

Biomass:Introduction,Biomassconversiontechnologies,photosynthesis,classificationofbiogasplants .Biomass direct combustion–BiomassgasifierBiogasplant–Ethanolproduction–Biodiesel.
Cogeneration: Biomass applications. Tidal energy: Basic principles of tidal power, components of tidalpower plants, operation methods of utilization of tidal energy – Wave energy and its energy conversiondevices,OpenandClosedOTECcycle.Geothermalenergyand Fuelcells.

UNIT V GRID INTEGRATION **9**

Introduction to renewable energy grid integration, concept and need of mini/micro grids, and smart grids.Regulationsregardinggridinterconnections ofrenewableenergysystems.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1 Create awareness about the scenario of energy consumption and energy availability in India and world.

CO2 Evaluate the necessity and potential advantages of renewable energy resources like solar thermal and PV system over fossil fuels.

CO3 Examine the process of power generation using bio gas, wind energy and biomass.

CO4 Analyze the functioning of Geo thermal, ocean and small hydro plants and grid integration.

CO5 Create an linking all real time possible ways to generate the power by hybrid mode and optimal.

TEXT BOOKS

1. G.D.Rai,Non-Conventional EnergySources,Khanna Publishers, NewDelhi,6th Edition,2015.
2. S.P.Sukhatme,J.KNayak,SolarEnergy,TataMcGrawHillPublishingCompanyLtd.,NewDelhi,

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4th Edition, 2017

3. ChetanSinghSolanki,SolarPhotovoltaicTechnologyandSystems,PrenticeHall of India,1st Edition,2015.

REFERENCE BOOKS

1. JohnTwidell,TonyWeir,RenewableEnergySources,RoutledgePublisher, 3rd Edition,2019.
2. D. P. Kothari, K. C. Singal, Rakesh Ranjan, Renewable Energy Sources and Emerging Technologies,PrenticeHallof India,2nd Edition, 2016.
3. GodfreyBoyle,"RenewableEnergy:PowerforaSustainableFuture",OxfordUniversityPress,U.K. ,3rd Edition, 2013.

COs	ProgrammeOutcomes												Programme SpecificOutcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	1											2		
CO2	3	2											2		
CO3	2	1											2	2	1
CO4	2	1											2	2	1
CO5	2	2											3	2	1

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618EEE03	HIGH VOLTAGE DIRECT CURRENT TRANSMISSION	L	T	P	C
		3	0	0	3

PREREQUISITE :Transmission and Distribution

COURSE OBJECTIVES

- To study about importance of HVDC transmission.
- To study about Analysis of HVDC converters, Faults and Protections.
- Tostudy about Harmonics and Filters I.
- Tostudy about Reactive power control and power factor improvements of the system.

UNITI BASIC CONCEPTS **9**

Economics & Terminal equipment of HVDC transmission systems: Types of HVDCLinks– Apparatusrequired for HVDC Systems – Comparison of AC & DC Transmission, Application of DC TransmissionSystem – Planning forHVDC transmission &Modern trendsin HVDCTechnology.

UNITII ANALYSIS OF HVDC CONVERTERS **9**

ChoiceofConverterconfiguration–AnalysisofGraetzcircuitwithandwithoutoverlap– characteristicsof6Pulse &12Pulse converters –Cases oftwo 3phaseconverters instar –starmode– theirperformance.

UNIT III CONVERTER & HVDC SYSTEM CONTROL **9**

Principle of DC Link Control – Converters Control Characteristics –Firing angle control –Current andextinctionangle control– Effectofsourceinductanceonthesystem-StartingandstoppingofDClink-PowerControl – Higher level controllers.

UNIT IV REACTIVE POWER CONTROL IN HVDC **9**

Reactive Power Requirements in steady state-Conventional control strategies-Alternate control strategies-sourcesofreactivepower-shunt capacitors-synchronous condensers.

UNIT V POWER FLOW ANALYSIS IN AC/DC SYSTEMS **9**

ModelingofDCLinks-DCNetwork-DCConverter-ControllerEquations-Solution ofDCloadflow– P.U. System for DC quantities-solution of AC-DC Power flow-Simultaneous method Sequential method.Types ofAC filters,Design of Singletuned filters –Designof Highpass filters.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1 Cognitive of basic concepts of HVDC systems.
CO2 Comprehension of power factor improvements of the system
CO3 Emphasis knowledge in the converter control systems.
CO4 Analyze the reactive power control in HVDC.
CO5 Evaluate the concept of Power flow analysis in AC/DC systems.

TOTAL: 45 PERIODS

TEXT BOOKS

1. K.R.Padiyar,HVDCPowerTransmissionSystems,NewAge International publishers,3rdEdition,2017
2. Rao.S,EHVACandHVDCTransmissionEngineering,KhannaPublishers,16thEdition,2014.

REFERENCE BOOKS

1. JosArrillaga,HighVoltageDirectCurrentTransmission,The BritishLibraryPublishers, 2nd Edition,1998.
2. EdwardWilsonKimbark,DirectCurrentTransmission, Volume-1,John Wiley&Sons,1stEdition,1971.
3. ErichUhlmann,PowerTransmissionbyDirectCurrent, SpringerVerlagPublishers,1stEdition,2009.

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COs	ProgrammeOutcomes												Programme SpecificOutcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3												2		
CO2	3		1										2		1
CO3	3				2	1						1	2	2	1
CO4	3					1						1	2	2	1
CO5	3				2	1						1	2	2	1

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618EEE04	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE	L	T	P	C
		3	0	0	3

PREREQUISITE : Nil

COURSE OBJECTIVES

- To study idea of intelligent agents and search methods.
- To study about representing knowledge.
- Tostudy the reasoning and decision making in uncertain world.
- Toconstruct plans and methods for generating knowledge.
- To study the concepts of Data Science and analysis.

UNITI **ARTIFICAIL INTELLIGENCE** **9**

The state of art-Intelligent Agents-Structure-Environment-Definition of AI-AI problems-Altechniques-Artificialintelligenceinpractice-conceptsof AI-Emergenceof artificialintelligence.

UNITII **SEARCH STRATEGIES OF AI** **9**

Heuristic search techniques-depth first search-depth limited search-Uniform cost search-breadthfirstsearch-hill climbingandbest firstsearchtechniques-Comparingsearchtechniques.

UNIT III **MACHINE LEARNING** **9**

Introduction- data preprocessing-supervised learning-supervised learning classification-unsupervisedlearning–learningobjectives– featuresofmachinelearning

UNIT IV **INTRODUCTION TO DATA SCIENCE** **9**

Introduction to Big Data Platform – Challenges of Conventional Systems – Intelligent data analysis – Nature of Data – Analytic Processes and Tools – Analysis Vs Reporting – Modern Data Analytic Tools –StatisticalConcepts: SamplingDistributions –Re-Sampling–Statistical Inference–PredictionError.

UNIT V **EVOLUTION OF DATA ANALYTICS** **9**

Importanceofdataanalytics-dataanalyticsoverviewandprocessflow-dataanalyticslifecycle-typesof dataanalytics-descriptiveanalytics-dataanalyticsbenefits-decisionmaking-case studies.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1 Familiar with the idea of intelligent agents and search methods.

CO2 Do reasoning and decision making in uncertain world.

CO3 Illustrate language processing and learning.

CO4 Illustrate the concepts of Data Science.

CO5 Analyze the concepts of Data Science.

TEXT BOOKS

1. ElaineRich,Kevinknight,ShivashankarBNair,"ArtificialIntelligence",TMH,3rdEdition,2018.
2. DanWPatterson,"IntroductiontoArtificialIntelligenceandExpertSystems",PearsonEducation Limited, 1stEdition,2016.
3. MichaelBerthold,DavidJ.Hand,"IntelligentDataAnalysis",Springer,2ndRevisedEdition,2010.

REFERENCE BOOKS

1. Stuart Russell and Peter Norvig, "Artificial Intelligence-A Modern Approach", PearsonEducationLimited,3rd Edition,2017.
2. EugeneCharniak,DrewMcDermott, "Introduction to Artificial Intelligence", PearsonEducationLimited,1stEdition,2013.
3. BillFranks,"TamingtheBigDataTidalWave:FindingOpportunitiesinHugeDataStreamswithAdvancedAnalytics", WileyIndiaPvtLimited, 1stEdition,2014.

COs	ProgrammeOutcomes												Programme SpecificOutcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3		1	1					2				2		
CO2	3	2	2	1					2				2		
CO3	3	2	2	1					2				3	2	2
CO4	3	1	2	1					2				3	2	2
CO5	2		2							2		2	3	2	2

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618EEP07	POWER ELECTRONICS LABORATORY	L	T	P	C
		0	0	2	1

PREREQUISITE :Electrical and Electronics Circuit Simulation Lab

COURSE OBJECTIVES

- To study the characteristics and applications of power switching devices through experimentally.

LIST OF EXPERIMENTS

1. VIandSwitchingcharacteristicsof SCRandTRIAC.
2. VIandSwitchingcharacteristicsofMOSFETandIGBT.
3. Single phaseandThreephasehalf controlledRectifiers.
4. SinglephaseandThreephasefullycontrolledRectifiers
5. Step upandstep downchopper.
6. SinglephaseIGBTinverter.
7. Threephase IGBTinverter.
8. Resonantdc-to-dcconverter
9. BuckBoost /flybackVoltage andcurrent commutatedchopper.
10. SinglephaseACvoltagecontrollers.
11. Single-phasecycloconverter.
12. Seriesandparallelinverter.
13. SimulationofSinglephaseandThreephasehalfandfullycontrolledRectifiersusingPSPICE orMATLAB.
14. SimulationofSinglephaseandThreephaseInvertersusingPSPICEorMATLAB.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1 Interpret to describe about modern power semiconductors and their control.

CO2 Examine and experimentally quantify steady state and transient characteristics of power converters.

CO3 Demonstrate and build complete converters, choppers and inverters.

CO4 Identify the variable output voltage using AC voltage controller.

CO5 Analyze the variable output voltage using Single-phase cycloconverter.

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COs	ProgrammeOutcomes												Programme SpecificOutcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	3		3					2	1			3		
CO2	3	3		3					2	1			3		1
CO3	3	3		3	2				2	1			3	2	1
CO4	3	2											2	2	
CO5	3	2											3	2	

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618EEP08	ELECTRONIC SYSTEM DESIGN LABORATORY	L	T	P	C
		0	0	2	1

PREREQUISITE: Electrical and Electronics Circuit Simulation Lab.

COURSE OBJECTIVES

- To make the students to learn the design procedures and fabrication techniques of small electrical & electronics circuits..

LIST OF EXPERIMENTS

1. DesignandFabricationof 5V ConstantVoltage Powersupply
2. DesignandFabricationof 0-12 V,1AVariable PowerSupply
3. DesignandFabricationofDriverCircuittodriveanElectromagneticrelayusingMicroprocessorwithrequiredProtection.
4. Design and Fabrication of an isolation circuit using opto coupler which is requiredforMicrocontrollerinterfacing
5. DesignandFabricationofDomesticUPS
6. Soundoperatedtimercircuit
7. MotionDetectorUsingNE555Timer
8. Smart CellphoneGuard
9. Opticalsmokealarm
10. AutomaticAnchorLight
11. DesignofDrivercircuitforMOSFETandIGBT.
12. Designof UJTandRCtriggeringcircuit forSCR.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1 Design power supply units.
CO2 Design driver circuit for different ICs.
CO3 Design and fabricate opto-coupler and timer IC based circuits.
CO4 Design domestic Kits for different applications.
CO5 Analyze the performance of domestic kits.

COs	ProgrammeOutcomes												Programme SpecificOutcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	3	3	2	1								2	3	
CO2	3	3	3	2	1								2	3	
CO3	3	3	2										3	3	
CO4	1	2	3									2	2	3	2

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CO5	1	2	3								2	3	2	

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618EEP09	EMPLOYABILTIY SKILLS LABORATORY	L	T	P	C
		0	0	2	1

PREREQUISITE: Nil.

COURSE OBJECTIVES

- To equip students of engineering and technology with effective speaking and listening skills in English.
- To help them enrich their soft skills and interpersonal skills, which will make the transition from college to workplace smoother and help them excel in their career.
- To enhance the performance of the students in the recruitment processes, self enhancement and launching start ups.

UNIT I LISTENING **7**

ListeningAudiosandansweringMCQs-Watchingvideoclipsonfamousspeeches,motivationalvideos,documentariesandansweringMCQs-ListeningComprehension andTEDtalks.

UNIT II SPEAKING **10**

Prepared talk - Extempore - story knitting - Picture Talk - Brainstorming- Debate - Group Discussion - ElevatorSpeech-MockHRInterviews-StoryNarration-Miming -ShortSkits.

UNIT III READING **12**

ReadingComprehension-VerbalAnalogy-Classification-AlphabetTest-LogicalSequenceofWords-Statement& Conclusions - Statement & Courses of Action - Situation Reaction Test - Theme Detection - Deriving ConclusionsfromPassages.

UNIT IV WRITING **7**

Business Letters -EmailWriting-EssayWriting-ParagraphWriting-Paraphrasing.

UNIT V CAREER SKILLS **9**

Vocabulary Test (GRE, TOEFL, TOEIC & CAT Exam words) - Confused Pair of words - Contronyms - One WordSubstitution -Sequencingof Sentences– Sentencecorrection.

TOTAL: 45 PERIODS

LAB REQUIREMENTS

1. Teacher console and system for students.
2. English Language Lab Software
3. Career Lab Software

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1 Comprehend the various strategies of listening and its significance.

CO2 Articulate their views clearly and concisely with self-confidence and persuasiveness.

CO3 Understand the prevailing practices of testing in the recruitment process by the corporate and the institutional selection processes.

CO4 Communicate the corporate and social requirements in an impressive written mode.

CO5 Enhance their verbal skills in the screening tests competently both for recruitment and pursuing higher studies as well.

TEXT BOOKS

1. AgarwalR.S.,AModernApproach to Verbaland Non-verbalReasoning,Chand&Co.,
2. AshrafRizviM.EffectiveTechnicalCommunication.TATAMcGrawHill,NewDelhi:2007.

REFERENCE BOOKS:

1. Lingua:EssaysforTOEFL/IELTS,DreamtechPress,NewDelhi,2016.
2. Lily Mangalam, Global EnglishComprehension, AlliedPublishers Pvt. Ltd., New Delhi,2014.
3. Sharon Weiner GreenandIraK.Wolf,Barron's GRE, Glagotia Publications Pvt.Ltd.,18th Edition, New Delhi,2011.
4. Mohamed Elias, R. Gupta's IELTS/TOEFL Essays, Ramesh Publishing House, 6th Edition,New Delhi,2016

COs	ProgrammeOutcomes												Programme SpecificOutcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	1											2		1
CO2	3	3											2		1
CO3	3	3											3		2
CO4	3	2											2		2
CO5	3	2			1								2		3

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Course Code	Course Title	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
715EET02	POWER SYSTEM OPERATION AND CONTROL	3	2	0	4	50	50	100

Prerequisite: Transmission and Distribution &Power System Analysis and Stability

Objectives:

1. To get an overview of system operation and control.
2. To understand & model power-frequency dynamics and to design power-frequency controller.
3. To understand & model reactive power-voltage interaction and different methods of control for maintaining voltage profile against varying system load.

UNIT – I INTRODUCTION **12**

System load variation: System load characteristics, load curves ,tariff - Reserve requirements: Installed reserves, spinning reserves, cold reserves, hot reserves. Overview of system operation: Load forecasting, unit commitment, load dispatching. Overview of system control: Governor control, LFC, EDC, AVR, system voltage control, security control.

UNIT – II SYSTEM OPERATION

System load forecasting – components of system load – classification of base load - forecasting the base load – forecasting procedure Economic dispatch – Incremental cost curve, co-ordination equations without loss and with loss, solution by direct method and λ-iteration method. (No derivation of loss coefficients.) Base point and participation factors. Economic dispatch controller added to LFC.

UNIT – III SYSTEM CONTROL – REAL POWER – FREQUENCY CONTROL **12**

MW – frequency interaction – load-frequency mechanism – load frequency control – Q- IVI control – interaction between P – f and Q - IVI channels – Basic control loops Fundamentals of speed governing – Transfer function model – speed governing system – Turbo generator - Static response – Feedback control – static and dynamic response of ALFC – secondary ALFC loop AGC in isolated power systems - AGC in interconnected power systems – Two area system – modeling of tie line – representation of two area system – static and dynamic response – tie line bias control - Frequency bias tie line control.

UNIT – IV SYSTEM CONTROL – REACTIVE POWER – VOLTAGE CONTROL **12**

Reactive power and voltage control - Production and absorption of reactive power - Methods of voltage control - Shunt reactors, Shunt capacitors, Series capacitors, synchronous condensers - Static VAR Systems - Types of SVC - Application of Static VAR compensators Excitation systems requirements - Elements of an excitation system - Types of excitation systems - DC, AC, Static and recent developments and future trends – Modeling of exciter, generator – static performance – dynamic performance.

UNIT – V COMPUTER CONTROL OF POWER SYSTEMS **12**

Energy control center: Functions – Monitoring, data acquisition and control. System hardware configuration – SCADA and EMS functions: Network topology determination, state estimation, security analysis and control. Various operating states: Normal, alert, emergency, in-extremis and restorative.

Lecture : 45, Tutorial : 15, TOTAL : 60

Course Outcomes:

CO1 Gained knowledge about Outline of planning and control of power system.

CO2 Develop the mathematical model of single area and two area load frequency control for static and dynamic analysis.

CO3 Determine the economic dispatch of the generating units with loss and without loss case.

CO4 Got Used to SCADA and EMS for monitor and controlling the power system.

	Programme Outcomes												Programme Specific Outcomes		
	a	b	c	d	e	f	g	h	i	j	k	l	PSO1	PSO2	PSO3
CO1	3	2											2		
CO2	2	2				2							2	2	1
CO3	2	2	2				2		2		2		1	2	
CO4		1											3	1	

TEXT BOOK

1 O.I.Elgerd - Electrical Energy System Theory : An introduction - Tata McGraw Hill Publication, 2003 second Edition.

2 PrabhaKundur - Power System stability and control - EPRI Series - McGraw Hill Inc., 2004

REFERENCE BOOKS

1 PSR Moorthy - Power System Operation & Control, Tata McGraw Hill publication,1992

2 Dr S Mukhopadhyaya - Modern power system control and operation, Roorkee Publishing House, Roorkee, 1983Edition

3 HadiSaadat, Power system analysis, WCB, McGraw Hill International Edition, 2002

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Course Code	Course Title	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
715EET03	ELECTRIC DRIVES AND CONTROL	3	0	0	3	50	50	100

Prerequisite: Electrical Machines and Power Electronics

Objectives:

1. To understand the stable steady-state operation and transient dynamics of a motor-load system and analyze the operation of the converter / chopper fed dc drive and to solve simple problems.
2. To study and understand the operation of both classical and modern induction motor drives and synchronous motor drive
3. To learn the basics of permanent magnet synchronous motor drives and to analyze digital control for a drive and various applications.

UNIT – I CHARACTERISTICS OF ELECTRIC DRIVES 9

Electric drives: introduction, types, advantage, choice. Speed - Torque characteristics of various types of drive motors- dynamics of electric drives. Selection of power rating for drive motors with regard to thermal overloading and load variation factors – Classes of duty and selection of motor-load equalization – Starting, braking, and reversing operations.

UNIT - II DC DRIVES 9

Speed control of DC motors - Ward - Leonard scheme - drawbacks - Thyristor converter fed dc drives: - Single, two and four quadrant operations - Chopper fed DC drives : - Time ratio control and current limit control - Single, two and four quadrant operations - Effect of ripples on the motor performance.

UNIT – III THREE PHASE INDUCTION MOTOR DRIVES 9

Speed control of three phase Induction Motors - Stator control: Stator voltage and frequency control - AC chopper, Inverter and cycloconverter fed Induction Motor drives, rotor control - Rotor resistance control and slip power recovery schemes - Static control of rotor resistance using DC chopper - Static Kramer and Scherbius drives – Introduction to Vector Controlled Induction Motor Drives

UNIT - IV THREE PHASE SYNCHRONOUS MOTOR DRIVES 9

Speed control of three phase Synchronous Motors - True synchronous and self-controlled modes of operation - Inverter fed Synchronous Motors – Commutator-less DC motors - cycloconverter fed Synchronous Motor - Effect of harmonics on the performance of AC motors

UNIT – V DIGITAL CONTROL AND DRIVE APPLICATIONS 9

Digital techniques in speed control - Advantages and limitations – Microprocessor/ Microcontroller based separately excited dc motor drive and field oriented control of a CSI fed induction motor and PLC based control of drives - Selection of drives and control schemes for Steel rolling mills, Paper mills, Lifts and Cranes.

Lecture : 45, TOTAL : 45

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Course Outcomes:

CO1 Understood the steady-state operation and transient dynamics of a motor-load system.
CO2 Learnt about steady state behavior of converter fed DC drive.
CO3 Gained knowledge in speed control of AC motor drives.
CO4 Gained knowledge regarding relevant drive system for a given application with given specifications.

	Programme Outcomes												Programme Specific Outcomes		
	a	b	c	d	e	f	g	h	i	j	k	l	PSO1	PSO2	PSO3
CO1	3	2										3	3		
CO2	2	2		2			1		2		2		2	2	2
CO3	2	2		2				2					1	2	
CO4	1						1			2			3		

TEXT BOOKS

1 VedamSubramanyam, "Electric Drives: Concepts and Applications", Tata McGraw hill Pvt. Ltd, New Delhi, 2011.
2 Dubey G.K., "Fundamentals of Electrical Drives", Narosa Publishing House, New Delhi, 2017.

REFERENCE BOOKS

1 Bose, B.K., "Power Electronics and Variable frequency Drives – Technology and Applications", IEEE, Press, Inc. New York, 1997.
2 Bose, B.K., "Modern Power Electronics and AC Drives", Pearson Education (Singapore) Pvt.. Ltd, New Delhi, 2003
3 Ion Boldea and S. A. Nasar", Electric Drives", CRC Press LLC, New York, 2005.
4 Krishnan R, "Electric Motor Drives: Modeling, Analysis and Control, Prentice Hall of India, Pvt. Ltd, New Delhi, 2002.

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		L	T	P	C	CA	EA	Total
715EET04	RENEWABLE ENERGY SOURCES	3	0	0	3	50	50	100

Prerequisite: Power Generation Systems
Objectives:

1. To understand the principle of working and the components of different non-conventional sources of energy and their utilization.
2. To get an exposure on the power plants working with non-conventional energy.
3. To study the comparison of different non-conventional sources of energy and their performance

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 – - Statistical Report on Renewable energy scenario in India - Applications.

UNIT - II SOLAR ENERGY 9

Introduction to solar energy: solar radiation, availability, measurement and estimation – Solar thermal conversion devices and storage – solar cells and photovoltaic conversion – PV systems – MPPT. Applications of PV Systems – solar energy collectors and storages-Estimate & Design

UNIT - III WIND ENERGY 9

Introduction – Basic principles of wind energy conversion – wind data and energy estimation – site selection consideration – basic components of wind energy conversion system –Types of wind machines -Schemes for electric generations – generator control, energy storage – applications of wind energy – Inter connected systems- Estimate & Design

UNIT - IV BIOMASS ENERGY AND OTHER ENERGY SOURCES 9

Biomass: Introduction, Biomass conversion technologies, photosynthesis, classification of biogas plants. Biomass direct combustion – Biomass gasifier Biogas plant – Ethanol production – Bio diesel. Cogeneration: , Biomass applications. Tidal energy : Basic principles of tidal power, component of tidal power plants, operation methods of utilization of tidal energy – Wave energy and its energy conversion devices ,Open and Closed OTEC cycle. Geothermal energy and Fuel cells.

UNIT -V GRID INTEGRATION 9

Introduction to renewable energy grid integration, concept and need of mini/micro grids, and smart grids. Regulations regarding grid interconnections of renewable energy systems.

Lecture: 45, TOTAL: 45

Course Outcomes:

CO1 Create awareness about the scenario of energy consumption and energy availability in India and world.

CO2 Understand the necessity and potential advantages of renewable energy resources like solar thermal and PV system over fossil fuels.

CO3 Understand the process of power generation using bio gas, wind energy and biomass.

CO4 Analyze the functioning of Geo thermal, ocean and small hydro plants and grid integration.

	Programme Outcomes												Programme Specific Outcomes		
	a	b	c	d	e	f	g	h	i	j	k	l	PSO1	PSO2	PSO3
CO1	3					2						1	2	2	
CO2	3	3						2				3	3	3	
CO3	3	2			3					1		3	3	2	2
CO4	2	1						2						3	

TEXT BOOKS

1. G.D. Rai, Non-Conventional Energy Sources, Khanna Publishers, New Delhi, 2011.

2. S.P. Sukhatme, Solar Energy, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2008.

REFERENCE BOOKS

1. Twidell, J.W. & Weir, A., "Renewable Energy Sources", EFN Spon Ltd., UK, 2006.
2. Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future", Oxford University Press,U.K., 2012.

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Course code	Course Title	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
715EEE06	Power Quality Management	3	0	0	3	50	50	100

Objectives:

1. To understand the various power quality issues.
2. To understand the concept of power and power factor in single phase and three phase systems supplying non linear loads
3. To understand the conventional compensation techniques used for power factor correction and load voltage regulation.
4. To understand the active compensation techniques used for power factor correction.
5. To understand the active compensation techniques used for load voltage regulation.

UNIT – I INTRODUCTION 9

Definitions – Power quality, Voltage quality – Power quality issues : Short duration voltage variations, Long duration voltage variations, Transients, Waveform distortion, Voltage imbalance, Voltage fluctuation, Power frequency variations, low power factor – Sources and Effects of power quality problems – Power quality terms – Power quality and Electro Magnetic Compatibility (EMC) Standards.

UNIT – II SHORT INTERRUPTIONS & LONG INTERRUPTIONS 9

Introduction – Origin of short interruptions : Voltage magnitude events due to re-closing, Voltage during the interruption – Monitoring of short interruptions –Influence on induction motors, Synchronous motors, Adjustable speed drives, Electronic equipments – Single phase tripping : Voltage during fault and post fault period, Current during fault period – Prediction of short Interruptions. Definition – Failure, Outage, Interruption – Origin of interruptions – Causes of long interruptions – Principles of regulating the voltage – Voltage regulating devices, Applications : Utility side, End-User side –Reliability evaluation – Cost of interruptions.

UNIT - III VOLTAGE SAG AND TRANSIENTS 9

Introduction – Definition – Magnitude, Duration – Causes of Voltage Sag – Three Phase Unbalance – Phase angle jumps – Load influence on voltage sags on Adjustable speed drives, Power electronics loads, Sensitive loads - Stochastic assessment of voltage sags - Overview of mitigation methods. Definition – Power system transient model – Principles of over voltage protection - Types and causes of transients – Devices for over voltage protection - Capacitor switching transients –Lightning transients – Transients from load switching.

UNIT - IV WAVEFORM DISTORTION, WIRING AND GROUNDING 9

Introduction – Definition and terms – Harmonics, Harmonics indices, Inter harmonics, Notching – Voltage Vs Current distortion – Harmonics Vs Transients – Sources and effects of harmonic distortion – System response characteristics – Principles of controlling harmonics – Standards and limitation - Definitions and terms – Reasons for grounding –National Electrical Code (NEC) grounding requirements – Utility Power system grounding –End-User power system grounding – Wiring and grounding problems.

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UNIT - V POWER QUALITY SOLUTIONS 9

Introduction – Power quality monitoring : Need for power quality monitoring, Evolution of power quality monitoring, Deregulation effect on power quality monitoring – Power factor improvement – Brief introduction to power quality measurement equipments and power conditioning equipments – Planning, Conducting and Analyzing power quality survey – Mitigation and control techniques - Active Filters for Harmonic Reduction

Lecture: 45, TOTAL: 45

Course Outcomes:

CO1 To study various methods of power quality monitoring and the production of voltages sags.
CO2 To Study the interruptions types and its influence in various components.
CO3 To Study the Effects of harmonics on various equipment's.
CO4 Understand power quality monitoring and classification techniques.

	Programme Outcomes												Programme Specific Outcomes		
	a	b	c	d	e	f	g	h	i	j	k	l	PSO1	PSO2	PSO3
CO1	3	1									2		2	3	
CO2	3	2					3						3	3	
CO3	3	2			1							2	2	3	2
CO4	3								2				1		

Text Book

1 Roger C.Dugan, Mark F. McGranaghan andH.WayneBeaty, "Electrical Power Systems Quality", McGraw-Hill, New York, 2nd Edition, 2002.
2 Barry W.Kennedy, "Power Quality Primer", McGraw-Hill, New York, 2000.

REFERENCE BOOKS :

1 Sankaran.C, "Power Quality", CRC Press, Washington, D.C., 2002

2 Math H.J.Bollen, "Understanding Power Quality Problems: Voltage Sags and Interruptions", IEEE Press, New York, 2000.
3 Arrillaga.J, Watson.N.R and Chen.S, "Power System Quality Assessment", John Wiley & Sons Ltd., England, 2000
4 Short.T.A., "Distribution Reliability and Power Quality", CRC Press Taylor and Francis Group, 2006.

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Course Code	Course Title	Hours/week			Credits	Maximum Marks		
715EEE10	SPECIAL ELECTRICAL MACHINES	L	T	P	C	CA	EA	TOTAL
		3	0	0	3	50	50	100

Prerequisite: Electrical Machines – I & II

Objectives:

To impart knowledge on

- Construction, principle of operation and performance of permanent magnet synchronous motors.
- Construction, principle of operation and performance of permanent magnet brushless D.C. motors and synchronous reluctance motors
- Construction, principle of operation and performance of switched reluctance motors and stepping motors.

UNIT – I PERMANENT MAGNET SYNCHRONOUS MOTORS **09**

Permanent Magnet Motors – Classifications – PMSM - Principle of operation – EMF and Torque equations – Reactance – Power controllers - Converter - Volt- ampere requirements – circle diagram and torque / speed characteristics - Microprocessor based control- Slotless motors.

UNIT - II PERMANENT MAGNET BRUSHLESS D.C. MOTORS **09**

Necessity for brushless DC. Principle of operation – Types. Three phase unipolar and bipolar driven motors. Rotor position detection. Elimination of dead points– EMF and Torque equations – Power controllers – torque /speed characteristics and control.

UNIT - III SYNCHRONOUS RELUCTANCE MOTORS **09**

Constructional features – Types –rotor design. Operating principle – Reluctance – Phasor diagram - torque /speed characteristics. Vernier motor- constructional features, working principle and characteristics- design of vernier motor- Applications.

UNIT - IV SWITCHED RELUCTANCE MOTORS **09**

Constructional features – Principle of operation – poles, phases and winding- static torque production – Analysis - converter circuits. Control: current regulation, commutation.
Torque / speed characteristics-Microprocessor based control-Applications.

UNIT - V STEPPING MOTORS **09**

Constructional features – Principle of operation – Variable reluctance motor – Hybrid motor – Single and multi stack configurations – Theory of torque production – Linear and non-linear analysis – static and dynamic characteristics – Drive circuits – Microprocessor based control- Applications..

Lecture: 45, TOTAL: 45 HRS

Course Outcomes:

CO1 Classify and explain the working of PMSM.

CO2 Apply control techniques to permanent magnet brushless DC motors.

CO3 Analyze the performance of switched reluctance motor andsynchronous reluctance motor.

CO4 Categorize the stepping motors and analyze their performance.

	Programme Outcomes												Programme Specific Outcomes		
	a	b	c	d	e	f	g	h	i	j	k	l	PSO1	PSO2	PSO3
CO1	3												2	3	
CO2	3	1		2			2		2			2	2	2	
CO3	3	3	3			2	2				1		3	2	1
CO4	3	2											2	1	

TEXT BOOKS:

1. T.J.E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press, Oxford, 1989.

2. T. Kenjo and S. Nagamori, 'Permanent Magnet and Brushless DC Motors', Clarendon Press, London, 1988.

REFERENCE BOOKS:

1. P.P. Aearnley,Stepping Motors – A Guide to Motor Theory and Practice', Peter Perengrinus, London, 1982.

2. T. Kenjo,'Stepping Motors and Their Microprocessor Controls', Clarendon Press London, 1984.

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Course Code	Course Title	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
715EEP07	MINI PROJECT	0	0	4	2	50	50	100

Objectives:

To enable the students to do a project involving some design and fabrication work.

Every project work shall have a Guide who is a member of the faculty. Four periods per week shall be allotted in the time table for this important activity and this time shall be utilized by the students to receive directions from the Guide, on library reading, laboratory work, computer analysis, or field work as assigned by the Guide and also to present in periodical seminars or viva to review the progress made in the mini project.

Each student shall finally produce a comprehensive report covering background information, literature – survey, problem statement, project work details, estimation of cost and conclusions. This final report shall be in typewritten form as specified in the guidelines.

The continuous assessment and semester evaluation is to be carried out as specified in the guidelines to be issued from time to time.

Course Outcomes:

CO1 Identification of real time problems
CO2 Awareness of design methodologies & its implementation.
CO3 Implementing advanced simulation software techniques.
CO4 Able to produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion.

	Programme Outcomses												Programme Specific Outcomes		
	a	b	c	d	e	f	g	h	i	j	k	l	PSO1	PSO2	PSO3
CO1	3	1						2					3		3
CO2	2	3	2		3					2		2	2	3	2
CO3	2	2		2	3			2					2	3	
CO4	3									2			3		2

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Course Code	Course Title	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
715EEP08	POWER SYSTEM SIMULATION LABORATORY	0	0	4	2	50	50	100

Prerequisite: Power System Operation and Control

Objectives:

1. To be familiar with the simulation power system analysis.

LIST OF EXPERIMENTS

1	Computation of parameters and modelling of transmission lines.
2	Formation of Bus admittance and impedance matrices
3	Load flow analysis by Gauss-siedel method
4	Power flow analysis by Newton Raphson method
5	Fault analysis
6	Transient stability analysis of single machine infinite bus system
7	Transient stability analysis of multi machine infinite bus system
8	Load frequency dynamics of single area power system
9	Load frequency dynamics of two area power system
10	Economic dispatch in power system

Practical= 60 Total = 60

Course Outcomes:

CO1 Acquire experience in the usage of standard packages for the following analysis / simulation / control functions.
CO2 Ability to develop computer programs to perform load flow analysis on the power system.
CO3 Compute and model the transmission lines and analyze the generation control on power system using simulation tools.
CO4 Solve the transient stability problem in single machine infinite bus system.

	Programme Outcomes												Programme Specific Outcomes		
	a	b	c	d	e	f	g	h	i	j	k	l	PSO1	PSO2	PSO3
CO1	3	2										2	3	3	
CO2	3	2		2			3		2		2		2	2	1
CO3	3		2		2							1	1	3	
CO4	2									1			3		

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Course Code	Course Title	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
715EEP09	ELECTRIC DRIVES LABORATORY	0	0	4	2	50	50	100

Prerequisite: Nil

Objectives:

1. To be familiar with the simulation of DC & AC drives,
2. To get the speed control and closed loop control of different machines using DSP processor.

LIST OF EXPERIMENTS

Simulation of

1	Closed loop control of converter fed DC motor
2	Closed loop control of chopper fed DC motor
3	Single phase full controlled bridge rectifier fed separately excited DC motor
4	Single phase semi controlled bridge rectifier fed separately excited DC motor
5	Three phase rectifier fed DC motor.
6	VSI fed 3ϕ induction motor
7	Closed Loop PWM Inverter Fed IM Drive
8	Closed Loop Control Of PMSM By V/F/ Method
9	Speed control of BLDC motor
10	Switched reluctance motor drive
11	Stepper motor drive
12	3ϕ synchronous motor drive

Practical= 60 Total = 60

Course Outcomes:

CO1 Demonstrate the software tools used for simulation of drives.
CO2 Design and apply the speed control for converter/chopper fed DC motor.
CO3 Design and apply the speed control for stepper motor.
CO4 Demonstrate the software tools used for simulation of drives.

	Programme Outcomes												Programme Specific Outcomes		
	a	b	c	d	e	f	g	h	i	j	k	l	PSO1	PSO2	PSO3
CO1	3	1							2				3	1	
CO2	3	2	2				2		2				2	2	
CO3	2	3			2			2	3			3	2	3	3
CO4	3												3		

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Course Code	Course Title	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	TOTAL
815EET015	**Electric Power Utilization and Energy Auditing**	**3**	**0**	**0**	**3**	**50**	**50**	**100**

Prerequisite: : power system

Objectives:

To impart knowledge on

- Principle and design of illumination systems and methods of heating and welding.
- Electric traction systems and their performance.
- Electrolytic process and storage of electricity.
- Electrical energy conservation, energy auditing and power quality

UNIT – I ILLUMINATION **09**

Nature-of radiation –definition – laws of photometry – polar curves – lighting calculations-design of illumination systems (for residential, industrial, commercial and street lightings) - types of lamps-energy efficiency lamps – comparison with CFL and LED.

UNIT - II ELECTRIC HEATING AND WELDING **09**

Advantages of electric heating – Types of Heating - Resistance heating – Temperaturecontrol, Induction heating – induction furnace - Dielectric heating - Choice of voltage and frequencies for Dielectric heating –Welding - Equipment's for Welding - Resistance welding- Arc welding - Laser welding – Ultrasonic Welding-Introduction to TIG, MIG Welding

UNIT - III ELECTRIC TRACTION **09**

Introduction – requirements of an ideal traction system – supply systems – mechanics of train movement – tractive effort – Specific energy consumption – traction motors and control – multiple units – braking methods - current collection systems-recent trends in electric traction-Introduction to EMU and metro railways.

UNIT - IV ELECTROLYTIC PROCESS AND STORAGE OF ELECTRICITY **09**

Electrolysis – Polarization factor – Preparation of work for electroplating – tanks and other equipment – Method of charging and maintenance – Nickel iron, Nickel-cadmium and lithium ion batteries – components and materials – capacity rating of batteries – battery chargers: charging and discharging..

UNIT - V ENERGY CONSERVATION **09**

Economics of generation – definitions – load curves – number and size of units – cost of electrical energy – tariff – need for electrical energy conservation-methods – energy efficient equipment – energy management – energy auditing – case study. Economics of power factor improvement – design for improvement of power factor using power capacitors – power quality – effect on conservation.

Lecture: 45, TOTAL: 45 HRS

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Course Outcomes:

CO1 Impart knowledge on Generation of electrical power by conventional,non–conventional methods.
CO2 Understand the principle and design of illumination systems and methodsof heating and welding.
CO3 Attain the knowledge about Electric traction systems and theirperformance.
CO4 Determine the needs of energy conservation and implement conservation techniques.

	Programme Outcomes												Programme Specific Outcomes		
	a	b	c	d	e	f	g	h	i	j	k	l	PSO1	PSO2	PSO3
CO1	3	1		2								1	3	3	
CO2	3	3				3		2		2		2		2	
CO3	3	2	3						1				2		1
CO4	3				2							3	1	2	

TEXT BOOKS:

1,S.L. Uppal, "Electrical Power", Khanna Publishers, 1988

2.E. Openshaw Taylor, "Utilization of Electrical Energy in SI Units" Orient Longman Private Limited, 2003.

REFERENCE BOOKS:

1.M.L. Soni, P.V. Gupta, V.S. Bhatnagar, A. Chakrabarti, 'A Text Book on Power System Engineering', DhanpatRai& Co., 1998.

2.Utilization of Electrical Energy by JB Gupta, Kataria Publications, Ludhiana. Albert Thumann, William J. Younger, "Hand Book of Energy Audits", The Fairmont Press, Inc., 2003.

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CourseCode	CourseTitle	Hours/week			Credits	Maximum Marks		
815EEE04	Distributed Generation and Micro Grid	L	T	P	C	CA	EA	TOTAL
		3	0	0	3	50	50	100

Prerequisite: Renewable energy sources

Objectives:

1. To illustrate the concept of distributed generation
2. To analyze the impact of grid integration.
3. To study concept of Microgrid and its configuration.
4. To analyze control and protection of microgrid.

UNIT–I INTRODUCTION **09**

Concept of distributed generations, topologies, selection of sources, regulatory standards/ framework, Standards for interconnecting Distributed resources to electric power systems: IEEE 1547. DG installation classes, security issues in DG implementations. Energy storage elements:

UNIT-II DISTRIBUTED GENERATIONS **09**

Concept of distributed generations, topologies, selection of sources, regulatory standards/framework, Standards for interconnecting Distributed resources to electric power systems: IEEE1547. DG installation classes, security issues in DG implementations. Energy storage elements:Batteries,ultra-capacitors, flywheels. Captivepower plants

UNIT-III IMPACT OF GRID INTEGRATION **09**

Requirements for grid interconnection, limits on operational parameters,: voltage, frequency, THD, response to grid abnormal operating conditions, islanding issues. Impact of grid integration with non conventional energy sources on existing power system: reliability, stability and power quality issues.

UNIT-IV BASICS OF A MICROGRID **09**

Concept and definition of micro grid, microgrid drivers and benefits, review of sources of microgrids, typical structure and configuration of a microgrid, AC and DC microgrids, Power Electronics interfaces in DC and AC microgrids.

UNIT-V CONTROL AND OPERATION OF MICROGRID **09**

Modes of operation and control of microgrid: grid connected and islanded mode, Active and reactive power control, protection issues, anti-islanding schemes: passive, active and communication based techniques, microgrid communication infrastructure, Power quality issues in microgrids, regulatory standards, Microgrid economics, Introduction to smart microgrids.

Lecture:45,TOTAL: 45HRS

CourseOutcomes:

CO1 Attaining knowledge on the various schemes of conventional and nonconventional power generation.

CO2 Learning about energy sources of distributed generation.

CO3 Learning about the fundamental concept of Microgrid and the requirements for grid interconnection.

CO4 Understanding protection issues and control schemes

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	Programme Outcomes												Programme Specific Outcomes		
	a	b	c	d	e	f	g	h	i	j	k	l	PSO1	PSO2	PSO3
CO1	3	2						2			2		1	2	
CO2	2	1	3				2					2		3	2
CO3	2	2			3			3			3		2	3	
CO4	3								3				3		

TEXTBOOKS:

1 John Twidell and Tony Weir, "Renewable Energy Resources" Tyalor and Francis Publications, Second edition 2006

2 DorinNeacsu, "Power Switching Converters: Medium and High Power", CRC Press, Taylor & Francis, 2006

3 S. Chowdhury, S.P. Chowdhury and P. Crossley Microgrids and Active Distribution Networks,2009.

REFERENCEBOOKS:

1 Chetan Singh Solanki, "Solar Photo Voltaics", PHI learning Pvt. Ltd., New Delhi,2009

2 J.F. Manwell, J.G. McGowan "Wind Energy Explained, theory design and applications", Wiley publication 2010.

3 D. D. Hall and R. P. Grover, "Biomass Regenerable Energy", John Wiley, New York,1987.

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Course Code	Course Title	Hours/week		Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
815EEE05	HVDC Transmission Systems	3	0	0	3	50	50	100

Prerequisite: Transmission and Distribution.

Objectives:

1. To study about importance of HVDC transmission,
2. To study about Analysis of HVDC converters, Faults and protections,
3. To study about Harmonics and Filters. I
4. To study about Reactive power control and Power factor improvements of the system

UNIT – I BASIC CONCEPTS **9**

Economics and Terminal equipment of HVDC transmission systems: Types of HVDC Links – Apparatus required for HVDC Systems – Comparison of AC &DC Transmission, Application of DC Transmission System – Planning & Modern trends in D.C. Transmission-Introduction to multi terminal HVDC system.

UNIT – II ANALYSIS OF HVDC CONVERTERS **9**

Choice of Converter configuration – analysis of Graetz – characteristics of 6 Pulse & 12 Pulse converters – Cases of two 3 phase converters in star –star mode – their performance.

UNIT – III CONVERTER & HVDC SYSTEM CONTROL **9**

Principle of DC Link Control – Converters Control Characteristics – Firing angle control – Current and extinction angle control – Effect of source inductance on the system; Starting and stopping of DC link; Power Control.

UNIT-IV REACTIVE POWER CONTROL IN HVDC **9**

Reactive Power Requirements in steady state-Conventional control strategies-Alternate control strategies-sources of reactive power-AC Filters – shunt capacitors-synchronous condensers.

UNIT –V POWER FLOW ANALYSIS IN DC SYSTEMS **9**

Modeling of DC Links-DC Network-DC Converter-Controller Equations-Solution of DC load flow – P.U. System for d.c. quantities-solution of DC Power flow-Simultaneous method-Sequential method.

Lecture: 45, TOTAL: 45

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Course outcomes:

CO1: To understand basic concepts of HVDC systems

CO2: To understandPower factor improvements of the system

CO3: Emphasis knowledge in the converter control systems

CO4: Power flow analysis in DC Systems

	Programme Outcomes												Programme Specific Outcomes		
	a	b	c	d	e	f	g	h	i	j	k	l	PSO1	PSO2	PSO3
CO1	3	2	3						2			3	3	2	
CO2	3	3	2		2				2		3		3	2	
CO3	2	3	2					2		1			3	3	1
CO4	1												2	3	

TEXT BOOKS:

1.K.R.Padiyar, HVDC Power Transmission Systems, London: New Academic Science, New
Age International (UK), Third edition, 2017

2.S. Rao ,Ehv-Ac,Hvdc Transmission & Distribution, Khanna Publishers , Third Edition, 2009

REFERENCE BOOKS:

1. J.Arrillaga, High Voltage Direct Current Transmission , The Institution of Electrical Engineers- London, 1998.
2. E.W.Kimbark, Direct Current Transmission, John Wiley & Sons.1999
3. E.Uhlmann, Power Transmission by Direct Current, Springer,2011

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Course Code	Course Title	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
815EEP04	PROJECT WORK	0	0	14	7	50	50	100

Objectives:

To enable the students to do a project involving some design and fabrication work.

Every project work shall have a Guide who is a member of the faculty. Fourteen periods per week shall be allotted in the time table for this important activity and this time shall be utilized by the students to receive directions from the Guide, on library reading, laboratory work, computer analysis, or field work as assigned by the Guide and also to present in periodical seminars or viva to review the progress made in the project.

Each student shall finally produce a comprehensive report covering background information, literature – survey, problem statement, project work details, estimation of cost and conclusions. This final report shall be in typewritten form as specified in the guidelines.

The continuous assessment and semester evaluation is to be carried out as specified in the guidelines to be issued from time to time.

Course Outcomes:

CO1 Identification of real time problems.
CO2 Awareness of design methodologies and its implementation.
CO3 Implementing advanced simulation software techniques.
CO4 Able to produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion.

	Programme Outcomes												Programme Specific Outcomes		
	a	b	c	d	e	f	g	h	i	j	k	l	PSO1	PSO2	PSO3
CO1	3	1					3			3		1	3	2	
CO2		2	2			3						2	3	2	1
CO3	3				2			2		2			3	2	
CO4	3	2													

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