

श्रीचन्द्रशेखरेन्द्रसरस्वतीविश्वमहाविद्यालयः

SRI CHANDRASEKHARENDRA SARASWATHI VISWA MAHAVIDYALAYA

Deemed to be University u/s 3 of UGC Act 1956 | Accredited with "A" grade by NAAC

Enathur, Kanchipuram - 631 561. Tamilnadu, India

www.kanchiuniv.ac.in

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

B.E - EEE (PART TIME)

CURRICULUM - 2024 ONWARDS

FOR CANDIDATES ADMITTED DURING THE YEAR 2024 ONWARDS

(CHOICE BASED CREDIT SYSTEM)



DEPARTMENT VISION AND MISSION

VISION

- To develop effective and efficient Electrical Engineers endowed with conceptual clarity, ethicality and a visionary zeal.

MISSION

- To provide quality teaching empowered with application skills.
- To mould leaders in Electrical Engineering with an all around personality.
- To encourage faulty members and students in research, capable of finding solutions for the problems in the society

PROGRAMME OBJECTIVES

- **PEO: I** To provide students with the knowledge of Basic Sciences in general and Electrical and electronics Engineering in particular so as to acquire the necessary skills for analysis and synthesis of problems in generation, transmission and distribution.
- **PEO 2**: Prepare students to meet the demands of contemporary industrial requirements and successfully engage them in appropriate careers.
- **PEO 3:** Connectivity in learning and professional improvement.
- **PEO 4**: Develop technical leadership qualities with ethicality.
- **PEO 5:** To induce students to design electrical, electronics, computing systems that are innovative and socially acceptable.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOS)

For a graduate study in EE engineering

- to work in research and development organizations
- for employment in electrical power industries
- to acquire job in electronic circuit design and fabrication industries
- to work in IT and ITES industries

PROGRAMME OUTCOMES/GRADUATE ATTRIBUTES

PO1: Engineering Knowledge: Apply the Knowledge of mathematics, science, Engineering fundamentals and an Engineering Specialization to the solution of complex engineering problems.

PO2: **Problem Analysis**: Identify formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural science and engineering sciences.

PO3:Design/ Development Of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal and environmental considerations..

PO4: **Conduct Investigations Of Complex Problems**: Use research based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

PO5: **Modern Tool usage:**Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6:The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7:Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.

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

PO9:Individual and Team Work: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.

PO10:Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large such as being able to comprehend and write effective reports and design documentation make effective presentations and give and receive clear instructions.

PO11:Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work and member and leader in a team to manage projects and in multidisciplinary environments.

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

N.B Graduate attributes have been assigned for all the courses

DEFINITION OF CREDIT

Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credits
2 Hours Practical(Lab)/week	1 credit

B.O.S MEMBERS

SL. NO.	NAME OF THE MEMBER	DESIGNATION	ADDRESS	Feedback	SIGNATURE
1.	Dr.N.Ashokkumar	Chairman	Assistant Professor, Dept. of EEE,SCSVMV & HOD		
2.	Dr.M.Rathinakumar	Representative for Hon'ble VC	Dean(E&T), SCSVMV		
3.	Dr.S.Sentamilselvan	Internal Member	Associate Professor, Dept. of EEE, SCSVMV		
4.	Dr.R.Malathi	Internal Member	Associate Professor, Dept. of EEE,SCSVMV		
5.	Dr.R.Karthikeyan	Internal Member	Assistant Professor, Dept. of EEE,SCSVMV		
6.	Dr.D.Vanitha	Internal Member	Assistant Professor, Dept. of EEE,SCSVMV		
7.	Dr.A.Selvaraj	External Member	Professor & Faculty In charge of COE-EV,Dept of EEE,Rajalakshmi Engineering College		
8.	Dr.R.Sridhar	External Member	Professor and Head,Power Electronics in Renewable Energy Systems,EEE,SRMUniversity,Kattankulathur		
9.	Mr.N.Ganesh	Co-opted Member	Mecwin Tech Pvt Ltd Bangalore,Karnataka		
10.	Mr.I.Saran	Co-opted Member	GET,Menaga Electricals Pvt Ltd No01/177,Bhaathiyar Street,SingaperumalKoil,Kanchipuram		

CURRICULUM FOR PART TIME B.E (EEE) REGULATION

(For candidates admitted during the year 2024 onwards)

SEMESTER –I

Sl.No	Subject Code	Subject Name	Category	L	T	P	C	IA	EA	TM
1.		Mathematics –I (Probability and Statistics)	BSC	3	1	0	4	40	60	100
2.		Electromagnetic Theory [T&P]	PCC	2	0	1	3	40	60	100
3.		Programming OOPS with C++	PCC	2	0	1	2	40	60	100
4.		Analog Electronics	PCC	2	1	0	2	40	60	100
5.		Electric Circuit Theory(T&P)	PCC	2	0	1	2	40	60	100
6.		Circuit Theory Lab	PCC	0	0	2	2	40	60	100
7.		Programming OOPS with C++ Lab	PCC	2	0	1	2	40	60	100
			Total	**13**	**2**	**6**	**17**	**-**	**-**	**700**

SEMESTER –II

Sl.No	Subject Code	Subject Name	Category	L	T	P	C	IA	EA	TM
1.		Mathematics – II(Linear Algebra, Transform	BSC	3	1	0	4	40	60	100
2.		D.C Machines and Transformers(T&P)	PCC	2	0	1	3	40	60	100
3.		Measurement and Instrumentation	PCC	3	0	0	3	40	60	100
4.		Data base Management [T&P]	PCC	2	0	1	3	40	60	100
5.		Digital Electronics	PCC	3	0	0	3	40	60	100
Laboratory										
8.		Analog and Digital Electronics Lab	PCC	0	0	2	2	40	60	100
			Total	**13**	**1**	**4**	**18**	**-**	**-**	**600**

SEMESTER –III

Sl.No	Subject Code	Subject Name	Category	L	T	P	C	IA	EA	TM
1.		Induction and Synchronous Machines(T&P)	PCC	2	0	1	3	40	60	100
2.		Generation, Transmission and Distribution	PCC	3	1	0	4	40	60	100
3.		Control Systems(T&P)	PCC	2	0	1	3	40	60	100
4.		Power Systems - I [Modelling and Components]	PCC	2	1	0	3	40	60	100
5.		Microprocessors and Microcontrollers(T&P)	PCC	2	0	1	3	40	60	100
6.		AC and DC Machines	PCC	0	0	2	2	40	60	100
7.		Control and Instrumentation Lab	PCC	0	0	2	2	40	60	100
			Total	**11**	**2**	**7**	**20**	**-**	**-**	**700**

SEMESTER –IV

Sl.No	Subject Code	Subject Name	Category	L	T	P	C	IA	EA	TM
1.		Professional Elective Course II	PEC	2	1	0	3	40	60	100
2.		Professional Elective Course I	PEC	2	1	0	3	40	60	100
3.		DSP and its Applications(T&P)	MC*	2	0	1	3	40	60	100
4.		Power Electronics	PCC	2	1	0	3	40	60	100
5.		Embedded Systems	PCC	2	0	0	3	40	60	100
Laboratory										
6.		Embedded System Design Lab	PCC	0	0	1	2	40	60	100
7.		DSP and Microcontroller Lab	PCC	0	0	1	2	40	60	100
			Total	**10**	**3**	**4**	**19**	**-**	**-**	**600**

SEMESTER –V

Sl.No	Subject Code	Subject Name	Category	L	T	P	C	IA	EA	TM
1.		Professional Elective Course IIISmart grid	PEC	2	1	0	3	40	60	100
2.		Open Elective Course –I SOLAR PV SYSTEMS Design	OEC	3	0	0	3	40	60	100
3.		Power Plant Engineering.	PCC	2	1	0	3	40	60	100
4.		Electric Drives	PCC	2	1	0	3	40	60	100
7.		POWER SYSTEM II ANALYSIS & CONTROL	PCC	2	1	0	3	40	60	100
		Power Electronics and Drives Lab	PCC	0	0	2	2	40	60	100
		Power System Protection and Testing Lab	PCC	0	0	2	1	40	60	100
			Total	**15**	**3**	**1**	**18**	**-**	**-**	**700**

SEMESTER –VI

Sl.No	Subject Code	Subject Name	Category	L	T	P	C	IA	EA	TM
1.		Open Elective Course –II	OEC	3	0	0	3	40	60	100
2.		Professional Elective Course IV	PEC	2	1	0	3	40	60	100
3.		PLC And SCADA	PEC	2	1	0	3	40	60	100
4.		Electrical Energy Conservation ,Utilisation and Auditing	PCC	2	1	0	3	40	60	100
5.		Power Simulation Lab	PCC	0	0	3	2	40	60	100
6.		Major Project Work [Phase1]	P II	0	0	2	2	40	60	100
			Total	**13**	**3**	**2**	**16**	**-**	**-**	**700**

SEMESTER –VII

Sl.No	Subject Code	Subject Name	Category	L	T	P	C	IA	EA	TM
1.		Professional Elective Course 5 Can be Taken in any Online Mode(NPTEL/MOOCS/ANY ONLINE PLATFORM)	PEC	2	1	0	3	40	60	100
2.		Professional Elective Course 6 Can be Taken in any Online Mode(NPTEL/MOOCS/ANY ONLINE PLATFORM)	PEC	2	1	0	3	40	60	100
3.		Major Project Work - Phase 2	P II	0	0	6	6	40	60	100
			Total	**4**	**2**	**6**	**12**	**-**	**-**	**300**

Total Credits: 120

PROFESSIONAL ELECTIVES [PEC]

1. Computer Architecture.
2. Java Programming and Applications
3. Cloud Computing Fundamentals.
4. Fundamentals of big Data Analysis.
5. Electrical Machine Design
6. Special Electrical Machines
7. Control and Maintenance of Electrical Equipments
8. Embedded Control for Drives Applications
9. Smart grid
10. Design and layout of power apparatus.
11. High voltage Engineering
12. High voltage DC Transmission.
13. Power System Analysis and Control
14. Automotive Electronics
15. Digital Image Processing
16. Virtual Instrumentation
17. Bio Medical Engineering

18. Principles of Communication Engineering
19. Smart Sensors For Engineering Applications
20. Electrical Safety Management
21. Maintenance and Safety Engineering
22. Environmental Safety
23. Industrial Safety, Health And Environment Acts
24. Advanced power Electronics And Drives
25. Electric Vehicles and Hybrid Vehicle.
26. Advanced Power Electronics Lab.
27. Power Quality
28. Electric Vehicle Architecture
29. Electric Vehicle Design, Mechanics and Control
30. Design of Electric Vehicle Charging System
31. Hybrid Electric Vehicle.
32. Embedded C programming
33. Embedded Control for Electric Drives
34. Smart System Automation
35. Embedded System for Automotive Applications
36. VLSI Design Architecture
37. Robotics and Automation

OPEN ELECTIVES [OEC]

1. Solar PV Systems, Design (NSDC)
2. Maintenance of Power Transformer, DG Sets, Industrial Power Distribution(NSDC)
3. Wind Energy, System Design, Control and Maintenance.(NSDC)
4. FPGA Design Lab -System Design (NSDC)
5. Internet of Things (IOT)
6. Fundamentals of Big Data Analysis
7. Bio Information
8. Web development using Python
9. Drone Technology

FIRST SEMESTER

Course Code:	MATHEMATICS III (Probability and Statistics)	L	T	P	Credit	CIA Marks **40**
Course Category: BSC		3	1	0	4	SEE Marks **60**

COURSE OBJECTIVES:

The objective of this course is to familiarize the students with statistical techniques. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems in the discipline.

COURSE OUTCOMES:

Students who successfully complete this course should be able to demonstrate and understanding of:

Cos No.	Course Outcomes	Bloom's level
CO1	Basic probability axioms and rules and the moments of discrete and continuous random variables as well as be familiar with common named discrete and continuous random variables.	Remembering, Understanding Applying
CO2	How to derive the probability function of transformations of random variables and use these techniques to generate data from various distributions.	Remembering, Understanding Remembering, Understanding Applying
CO3	How to calculate and apply measures of location and measures of dispersion in grouped and ungrouped data cases.	Applying
CO4	Test of Hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases.	Analyzing, Evaluating
CO5	How to translate real-world problems into probability models. Also how to collect data, analyze and deduce information from a real time survey without any unwilling bias	Evaluating , create

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	M	M	M	-	M	M	M	M
CO2	S	S	S	S	M	M	M	-	M	M	M	M
CO3	S	S	S	S	M	M	M	-	M	M	M	L
CO4	S	S	S	S	M	M	M	-	M	M	M	L
CO5	S	S	S	S	M	M	M	-	M	M	M	L

SYLLABUS:

MODULEI:

BASIC PROBABILITY:

Probability spaces, conditional probability, Independent random variables, sums of independent random variables, Bayes' Theorem, Discrete and Continuous one dimensional random variables - Expectations, Moments, Variance of a sum, Moment generating function, Tchebyshev's Inequality.

MODULE II

PROBABILITY DISTRIBUTIONS:

Discrete Distributions – Binomial, Poisson and Negative Binomial distributions, Continuous Distributions - Normal, Exponential and Gamma distributions.

MODULE III

BASIC STATISTICS:

Measures of Central tendency: Averages, mean, median, mode, Measures of dispersion – Range, Mean deviation, Quartile deviation and Standard deviation, Moments, skewness and Kurtosis, Correlation and regression – Rank correlation.

MODULE IV

APPLIED STATISTICS:

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

MODULE V

SMALL SAMPLES:

Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

LEARNING RESOURCES:

Text Books:

1. T. Veerarajan, Probability, Statistics and Random Processes, Third edition, Tata McGraw-Hill, New Delhi, 2010.
2. S.P. Gupta, Statistical Methods, 31st edition, Sultan chand and sons, New Delhi, 28thEdition 2002.

References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,10thEdition Dec 2010.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43th Edition 2000.
3. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 9thEdition 2013.
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed.,Wiley, 1968.

5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, LaxmiPublications, Reprint, 9thEdition2015.

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom's Category	Continuous Assessment Tests		Assignment (10)	Terminal Examination (60)
	(15)	(15)		
Remember	7	0	10	20
Understand	8	-		15
Apply	0	8		10
Analysis	0	4		10
Evaluate	0	3		5
Create	0	0		0
Total	**15**	**15**		**60**
	A	**B**	**C**	**D**

A+B+C+D = 100

Course Code:	ELECTROMAGNETIC THEORY [T &P]	L	T	P	Credit	CIA Marks **40**
Course Category: PCC		2	0	1	3	SEE Marks **60**

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

Ability to understand and apply basic science, circuit theory, Electro-magnetic field theory control theory and apply them to electrical engineering problems.

After the successful completion of the course students will be able to

COS NO.	Course Outcomes	Bloom's level
CO1	To differentiate different types of coordinate systems.	Understand
CO2	To use different coordinate systems for solving the problems of electromagnetic field theory.	Apply
CO3	To describe static electric and magnetic fields, their behavior in different media, associated laws, boundary conditions and electromagnetic potentials.	Understand
CO4	To use integral and point form of Maxwell`s equations for solving the problems of electromagnetic field theory.	Apply
CO5	To describe time varying fields, propagation of electromagnetic waves in different media, pointing theorem.	Understand
CO6	To know the sources & effects of electromagnetic fields and to apply the theory of electromagnetic waves in practical problems.	Apply
CO7	To apply concepts of Wave reflection and refraction in practical field.	Apply

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	L	-	-	-	-	-	-		-	-	L
CO2	S	S	M	L	M	-	-	-	L	-	-	M
CO3	S	S	S	M	M	-	-	-	M	-	-	S
CO4	S	S	M	M	M	-	-	-	L	-	-	M
CO5	S	S	M	L	M	-	-	-	-	-	-	M

CO6	S	S	M	S	S	L	M	M	S	-	-	M
CO7	S	S	S	L	M	M	M	L	S	-	-	M

MODULE I

ELECTROSTATICS

The field concept – Sources of electromagnetic fields.-Charges – Columb's Law – electric field intensity – Electric flux – Gauss's law – Potential – Boundary value problems – Laplace and Poissons equations – Electrostatic energy – Dielectrics – Capacitance.

MODULE II

MAGNETOSTATICS

Current density– Magnetic field – Magnetic flux – Biot – Savart's – Ampere's law –Torque – Force – Vector potential – Boundary value problem.

MODULE III

ELECROMAGNETIC FIELDS

Faraday's Law –Lenz's law –Maxwell's equations – Displacement current – Eddy current – Relation between field theory and circuit theory.

MODULE IV

ELECTROMAGNETIC WAVES

Generation–Propagationofwavesindielectrics–ConductorsandTransmissionlines–Pointing vector– Skin effect.

MODULEV

FIELDMODELLINGANDCOMPUTATION

Problem formulation –Boundary conditions – Solutions – Analytical methods – Variables Separable methods – Conformal transformation– Method of images – Numerical methods – Finite difference method–Finite element method –Charge Simulation Method.

LEARNING RESOURCES:

Text Books:

1. JohnDKraus,"Electromagnetics",McGraw-HillBookCo.,NewYork,ThirdEdition,1989.
2. JosephAEdminister,"TheoryandProblemsofElectromagnetics",McGraw-HillbookcompanyNewYork,2nd Edition.
3. WilliamH.Hayt,"EngineeringElectromagnetics",TataMcGraw-HillEdition, NewDelhi,8th Edition July 2017.

References:

1. DavidJGriffith,"IntroductiontoElectrodynamics",PrenticeHallofIndiaPvt.Ltd,NewDelhi, 4th Edition 2015.
2. Richard E. Dubroff, S.V.Marshall, G.G.Skitek, "Electromagnetic Concepts and Applications", FourthEdition,PrenticeHallofIndiaPvt.Ltd.,NewDelhi,1996.
3. Kraus andFleish,"Electromagnetics with Applications",McGraw-HillInternationalEditions5th Edition 2017.

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom's Category	**Continuous Assessment Tests**		**Assignment (10)**	**Terminal Examination (60)**
	(15)	**(15)**		
Remember	7	0	10	20
Understand	8	-		15
Apply	0	8		10
Analysis	0	4		10
Evaluate	0	3		5
Create	0	0		0
Total	**15**	**15**		**60**
	A	**B**	**C**	**D**

A+B+C+D = 100

Course Code:	PROGRAMMING IN C++ WITH OOPS	L	T	P	Credit	CIA Marks **40**
Course Category: ESC		3	0	0	3	SEE Marks **60**

COURSE OBJECTIVES:

- Be exposed to the syntax of C.
- Be familiar with programming in C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C.

COURSE OUTCOMES:

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

- Design C Programs for problems.
- Write and execute C programs for simple applications
- Design problem solutions using Object Oriented techniques

After the successful completion of the course students will be able to

COS NO.	Course Outcomes	Bloom's level
CO1	Write and execute C programs for simple applications.	Remember
Co2	Write and execute Class/Objects programs for simple applications.	Understand
Co3	Develop object-oriented programs for a given application using the concepts of compile-time and run-time polymorphism.	Apply
Co4	Construct object-oriented programs for a given application by demonstrating the inter-relationship between classes using inheritance.	Apply
CO5	Develop object-oriented applications that can handle exceptions and file handling.	Apply

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	S	L	-	-	M	-	M	M
CO2	S	M	S	S	M	M	-	-	M	-	M	M
CO3	S	S	S	M	M	L	-	-	M	-	M	M
CO4	S	M	S	S	M	L	-	-	M	-	-	M
CO5	S	S	S	M	M	M	L	-	M	-	-	M

SYLLABUS:

MODULE - I

OBJECT ORIENTED PROGRAMMING PARADIGM

Introduction – reusability – security – object oriented programming fundamental – abstraction – encapsulation – derivation – object oriented languages.

MODULE- II

CLASSES AND OBJECTS

Introduction to OOPS Concepts-Introduction to C++ - procedural oriented approach to C++ - tokens - expressions - data types – constants and variables – console IO operations - control structures – Array using as an object – static member function - function in C++ – classes and objects – constructors & Destructors.

MODULE- III

POLYMORPHISM AND INHERITANCE

Inheritance – single level – multilevel – multiple – hierarchy inheritance - access control – Functionoverloading– operator overloading –pointers to object - virtual function – pure virtual function –inline function - dynamic binding – abstract classes.

MODULE- IV

TEMPLATE AND STRING MANIPULATION

Class Templates – function Template - Dynamic memory allocation pointers – new and deleteoperators– static members – friend classes – friend functions – manipulation of strings.

MODULE -V

ADVANCED FEATURES

Exception handling – working with files – file stream operations – file modes – read ( ) &write operation - error handling during file operations – command line arguments.

LEARNING RESOURCES:

Text Books:

1. Let Us 'C' - YashawantKanetkar, (Unit 2 to 5), BPB publications, 15thEdition, July 2015.
2. Balagurusami, "Object oriented programming with C++", TATA MCGraw Hill. 7thEdition Sep 2017.
3. K.R.Dittrichetal, "Object Oriented Database System", Springer Verlag, 1991.

References:

1. Byron S Gottfried, " Programming with C", Schaum's Outlines, Second Edition, Tata McGraw-Hill, 4thEdition July 2018.
2. Bertrand Meyer, "Object Software Construction", Prentice Hall,2ndEdition April 1997.
3. Baarkakati.N, "Object Oriented Programming in C++", Prentice Hall of India, 1997

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom's Category	**Continuous Assessment Tests**		**Assignment (10)**	**Terminal Examination (60)**
	(15)	**(15)**		
Remember	7	0	10	20
Understand	8	-		15
Apply	0	8		10
Analysis	0	4		10
Evaluate	0	3		5
Create	0	0		0
Total	**15**	**15**		**60**
	A	**B**	**C**	**D**

A+B+C+D = 100

Course Code:	ANALOG ELECTRONICS	L	T	P	Credit	CIA Marks **40**
Course Category: PCC		3	0	0	3	SEE Marks **60**

COURSE OBJECTIVES:

Understand the functioning of OP-AMP and design OP-AMP based circuits.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

- Understand the characteristics of transistors.
- Design and analyze various rectifier and amplifier circuits. Design sinusoidal and non-sinusoidal oscillators.
- Understand the functioning of OP-AMP and design OP-AMP based circuits.

After the successful completion of the course students will be able to

COS NO.	Course Outcomes	Bloom's level
CO1	Acquire basic knowledge of physical and electrical conducting properties of semiconductors.	Understand
CO2	Develop the Ability to understand the design and working of BJT / FET	Understand
CO3	Able to design amplifier circuits using BJT s And FET's. and observe the amplitude and frequency responses of common amplifier circuits	Apply
CO4	Understand the fundamentals and areas of applications for the Integrated Circuits. Analyze important types of integrated circuits of day-to-day requirements.	Apply
CO5	Understand the differences among theoretical, practical & simulated results in integrated circuits. Choose the appropriate integrated circuit modules to build a given application	Understand

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	L	L	L	L	S	M	-	L	-	M	M
CO2	S	M	M	M	M	L	L	-	L	-	L	L
CO3	S	S	S	S	M	L	L	-	M	-	-	L
CO4	M	S	M	S	M	S	M	-	L	L	-	M
CO5	L	M	L	M	S	M	M	-	L	L	S	M

SYLLABUS:

MODULE I

DIODE CIRCUITS

P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuits.Modeling and Analysis of Diode.

MODULE II

BJT AND AMPLIFIER CIRCUITS

Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier:, biasing circuits,; common-emitter, common-base and common-collector amplifiers Differential amplifier; power amplifier; direct coupled multi-stage amplifier ,Modeling and Analysis of Amplifier circuits.

MODULE III

MOSFET AND AMPLIFIER CIRCUITS

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

MODULE IV

OPERATIONAL AMPLIFIERS AND LINEAR APPLICATIONS

Internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product) Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, Integrator and Differentiator.

MODULE V

NON- LINEAR APPLICATIONS OF OP-AMP

Active filter, P, PI and PID controllers and lead/lag compensator using an op-amp, voltage regulator, oscillators (Wein bridge and phase shift).Astablemultivibrator and Schmitt trigger Analog to Digital Conversion. Zero Crossing Detector, Square-wave and triangular-wave generators.

LEARNING RESOURCES:

Text Books:

1. S. Sedra and K. C. Smith, “Microelectronic Circuits”, New York, Oxford UniversityPress,7th Edition July 2017.
2. J. V. Wait, L. P. Huelsman and G. A. Korn, “Introduction to Operational Amplifier theory and applications”, McGraw Hill U. S., 1992.
3. J. Millman and A. Grabel, “Microelectronics”, McGraw Hill Education, 2nd Edition July 2017.

References:

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom’s Category	**Continuous Assessment Tests**		**Assignment (10)**	**Terminal Examination (60)**
	(15)	**(15)**		
Remember	7	0	10	20
Understand	8	-		15
Apply	0	8		10
Analysis	0	4		10
Evaluate	0	3		5
Create	0	0		0
Total	**15**	**15**		**60**
	A	**B**	**C**	**D**

A+B+C+D = 100

.

Course Code:	ELECTRIC CIRCUIT THEORY	L	T	P	Credit	CIA Marks **40**
Course Category: PCC		2	1	0	3	SEE Marks **60**

COURSE OBJECTIVES:

- To introduce electric circuits and its analysis
- To impart knowledge on solving circuits using network theorems
- To introduce the phenomenon of resonance in coupled circuits.

COURSE OUTCOMES:

- Ability to analyze electric circuits
- Ability to apply circuit theorems
- Ability to analyze AC and DC Circuits

After the successful completion of the course students will be able to

COS NO.	Course Outcomes	Bloom's level
CO1	Concepts, Nodal, Mesh methods	Understand
C02	Sinusoidal Analysis, Resonance, three phase circuits	Apply
C03	Network Theorem and Application	Apply
C04	Circuit Response RLC, DC & AC Excitation	Understand
C05	Two Port Networks, synthesis Networks	Apply

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	M	L	-	-	M	L	-	S
CO2	S	S	S	S	M	-	-	-	M	L	-	M
CO3	S	S	M	M	M	M	-	-	M	L	-	S
CO4	S	M	S	M	M	M	-	-	L	L	-	M
CO5	S	S	S	S	M	L	-	-	L	L	-	S

SYLLABUS:

MODULE I

CIRCUIT CONCEPTS AND MESH & NODAL METHODS:

Lumped circuits – Kirchhoff's Laws – Voltage - Current relationships of R, L and C – Independent sources Dependent sources – Simple resistive circuits – Network reduction – Voltage division – Current division –Source transformation. Formation of matrix equations and analysis of AC and DC circuits using mesh-current and nodal-voltage. Methods – Mutual inductance – Coefficient of coupling – Ideal transformer.

MODULE II

SINUSOIDAL STEADY STATE ANALYSIS:

Phasor – Sinusoidal steady state response – concepts of impedance and admittance- analysis of simple circuits – Power and Power factor – series resonance and parallel resonance – Bandwidth and Q factor Solution of three-phase balanced and unbalanced circuits.

MODULE III

NETWORK THEOREMS AND APPLICATIONS:

Superposition theorem – Reciprocity theorem – Compensation theorem – Substitution theorem – Maximum Power transfer theorem – Thevenin's theorem – Norton's theorem and Millman's theorem with applications.

MODULE IV

TRANSIENT ANALYSIS:

Forced and free response of RL, RC and RLC circuits with D.C. and sinusoidal excitations.

MODULE V

TWO PORT NETWORKS AND SYNTHESIS:

Characterization of two port networks in terms of Z,Y,H and T parameters – networks equivalents – relations between network parameters – Analysis of T, Ladder ,Bridged – T and lattice networks – Characteristics Ideal filter - low pass and high pass filter. Reliability of one port network – Hurwitz polynomials and properties – P. R. functions and properties – synthesis of RL, RC and LC one port networks.

LEARNING RESOURCES:

Text Books:

1. Hyatt W.H. and Kemmerly, “Engineering Circuits Analysis”, McGraw- Hill International 8thEdition 2011.
2. Kuo F.F., “Network Analysis and Synthesis”, Wiley International Edition, 2ndEdition 2006.
3. ParanjothiS.R.,“Electric Circuit Analysis”, New Age International Ltd., Delhi, 2nd Edition. 2008.

References:

1. Edminister J.A., “Theory and Problems of Electric Circuits”, Schaum’s outline series McGraw HillBook Company, 4thEdition 2003.
2. Sudhakar A and Shyam Mohan S.P., “Circuits and Network Analysis and Synthesis”, Tata McGraw- Hill Publishing Ltd., New Delhi5th Edition 2015.
3. Van Valkenburg M.E., “Network Analysis”, Prentice – Hall of India Private Ltd., New Delhi, Third Edition,1974.

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom’s Category	**Continuous Assessment Tests**		**Assignment (10)**	**Terminal Examination (60)**
	(15)	**(15)**		
Remember	7	0	10	20
Understand	8	-		15
Apply	0	8		10
Analysis	0	4		10
Evaluate	0	3		5
Create	0	0		0
Total	**15**	**15**		**60**
	A	**B**	**C**	**D**

A+B+C+D = 100

Course Code:	CIRCUIT THEORY LAB	L	T	P	Credit	CIA Marks **40**
Course Category: PCC		0	0	3	2	SEE Marks **60**

COURSE OBJECTIVES:

To provide practical experience with simulation of electrical circuits and verifying circuit theorems.

COURSE OUTCOMES:

Ability to understand and apply circuit theorems and concepts in engineering applications.

After the successful completion of the course students will be able to

Cos No.	Course Outcomes	Bloom's level
CO1	Verification of theorems	Apply and Understand
CO2	Measurement by two wattmeter method	Understand
CO3	Series and Parallel resonance in RLC Circuits	Understand
CO4	Circuit Transients by Digital simulation	Apply
CO5	Obtain the B-H Curve of a magnetic material	Apply and precision

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	M	L	L	-	M	M	-	S
CO2	S	S	S	S	S	L	L	-	M	M	-	S
CO3	S	S	S	S	M	L	L	-	L	L	-	M
CO4	S	S	S	S	S	M	L	-	M	M	-	M
CO5	S	S	M	M	M	M	L	-	M	M	-	M

SYLLABUS:

LIST OF THE EXPERIMENTS:

1. Verification of Kirchhoff's laws
2. Verification of Superposition theorem.
3. Verification of Thevenin's Theorem.
4. Verification of Norton's Theorem.
5. Verification of Maximum Power Transfer theorem.
6. Three phase power and power factor Measurement by two wattmeter method.
7. Verification of theorems using Digital simulation.
8. Circuit Transients by Digital simulation.

LEARNING RESOURCES:

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom's Category	**Continuous Assessment Tests**		**Terminal Examination**
	TEST - I	**TEST - II**	
Remember	15	15	30
Understand	5	5	10
Apply	-	-	60
Analysis	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total			**100**

Course Code: BEEF183P60	PROGRAMMING OOPS with C++ LAB	L	T	P	Credit	CIA Marks **40**
Course Category: ESC		0	0	3	2	SEE Marks **60**

COURSE OBJECTIVES:

- To get a clear understanding of C++ object-oriented concepts
- To understand object oriented programming through C++

COURSE OUTCOMES:

- Gain the basic knowledge on C++Object Oriented concepts.
- Ability to develop applications using Object Oriented Programming Concepts.
- Ability to implement features of object oriented programming to solve real world problems.

After the successful completion of the course students will be able to

Cos No.	Course Outcomes	Bloom's level
CO1	Write and execute C programs for simple applications.	Remember
Co2	Write and execute Class/Objects programs for simple applications.	Understand
Co3	Develop object-oriented programs for a given application using the concepts of compile-time and run-time polymorphism.	Apply
Co4	Construct object-oriented programs for a given application by demonstrating the inter-relationship between classes using inheritance.	Apply
CO5	Develop object-oriented applications that can handle exceptions and file handling.	Apply

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	S	L	-	-	M	-	M	M
CO2	S	M	S	S	M	M	-	-	M	-	M	M
CO3	S	S	S	M	M	L	-	-	M	-	M	M
CO4	S	M	S	S	M	L	-	-	M	-	-	M
CO5	S	S	S	M	M	M	L	-	M	-	-	M

SYLLABUS:

LIST OF EXPERIMENTS:

1. Develop a C++ program to Add, Subtract Two Vectors

2. Develop a C++ program to perform the quadratic equations ax2+ bx + c =0.

3. Develop a C++ program to perform m x n matrix operations addition subtraction.

4. Create a class Mat A and Mat B to and store the result in Mat C to perform m x n matrixoperations.

5. Develop a C++ program to perform string manipulation.

6. Implementation of arithmetic operations on complex numbers using constructor overloading.

7. Develop a C++ program to compute the employee details using inheritance concept.

8. Write a C++ program to generate Fibonacci series using constructor and copy constructor.

Develop a C++ program to swap the values using template function

SECONDSEMESTER

Course Code:	MATHEMATICS – II (Linear Algebra, Transform Calculus and Numerical Methods)	L	T	P	Credit	CIA Marks **40**
Course Category: BSC		3	1	0	4	SEE Marks **60**

COURSE OBJECTIVES:

This course aims at familiarising the prospective engineers with techniques in Linear Algebra, Transform Calculus and Numerical Methods. To understand the fundamental concepts in the above said topics. To develop the ability to evaluate the problems in transform calculus and its application in varies areas.

COURSE OUTCOMES:

After the successful completion of the course students will be able to

Cos No.	Course Outcomes	Bloom's level
CO1	Determine consistency of liner system of equations, Rank, eigen values and eigen vectors of the given square matrix also compute power , inverse of the matrix using cayley Hamilton theorem.	Remembering, Applying Understanding, Analysing, Evaluating
CO2	Work numerically on the ordinary differential equations and partial differential equations using different methods through the theory of finite differences	Applying Understanding, Analysing, Evaluating, create
CO3	Apply Laplace transform and its inverse to solve initial value and other related problems.	Applying Understanding, Analysing, Evaluating
CO4	Use Fourier transforms and its inverse in practical applications of electronics engineering.	Applying Understanding, Analysing, Evaluating
CO5	Solving finite difference equation in z-transforms	Applying Understanding, Analysing, Evaluating

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	S	M	M	-	M	M	M	L
CO2	S	S	S	S	S	M	M	-	M	M	M	L
CO3	S	S	S	S	S	M	M	-	M	M	M	L
CO4	S	S	S	S	S	M	M	-	M	M	M	L
CO5	S	S	S	S	S	M	M	-	M	M	M	L

SYLLABUS:

MODULE I

MATRICES

Rank of a matrix, System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Eigen values and eigenvectors; Diagonalization of matrices; Cayley-Hamilton theorem, Orthogonal transformation and quadratic to canonical forms.

MODULE II

NUMERICAL METHODS

Ordinary differential equations: Taylor's series, Euler and modified Euler's methods. Runge-Kutta method of fourth order for solving first order equations.Milne's predicator corrector methods. Partial differential equations: Finite difference solution two dimensional Laplace equation and Poisson equation, Implicit and explicit methods for one dimensional heat equation (Bender-Schmidt and Crank-Nicholson methods), Finite difference explicit method for wave equation.

MODULE III

TRANSFORM CALCULUS- I

Laplace Transforms : Definition, Properties of Laplace transforms: Linearity Property, First shifting property, Change of scale property – Transforms of derivatives - Transforms of integrals Multiplication by tn - Division by t - Evaluation of integrals by Laplace transform - Inverse transforms: Method of partial fractions – Other methods of finding inverse - Convolution theorem (Without proof) Application to differential equations.

MODULE IV

TRANSFORM CALCULUS- II

Fourier integral theorem (without proof) - Fourier Sine and Cosine integrals – Complex form of Fourier integral - Fourier transform – Fourier sine and Cosine transforms – Properties of Fourier Transforms: Linear property, Change of scale property, Shifting property -Parseval's identity for Fourier transforms (without proof) – Application of transforms to boundary value problems: Heat conduction, Vibrations of a string, Transmission lines.

MODULE V

TRANSFORM CALCULUS- III

Standard z-transforms of $1, a^n$ p^n – Linearity property – Damping rule – Shifting rules – Multiplication by n - Initial and final value theorems (without proof) – inverse z –transforms – Convolution theorem (without proof) – Convergence of z-transforms – Two sided z- transform – Evaluation of inverse z-transforms: Power series method, Partial fraction method, inversion integral method.

LEARNING RESOURCES:

Text Books:

1. Grewal B.S, Higher Engineering Mathematics, 41st Edition, Khanna Publishers, New Delhi, 43rdEdition 2011.

References:

1. Alan Jeffrey, Advanced Engineering Mathematics, Academic Press.Jun 2001.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons. Dec 2015.
3. Gerald C.F and Wheatley P.O, Applied Numerical Analysis, Addison-Wesley Publishing Company.7thEdition 2006.

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom's Category	**Continuous Assessment Tests**		**Assignment (10)**	**Terminal Examination (60)**
	(15)	**(15)**		
Remember	7	0	10	20
Understand	8	-		15
Apply	0	8		10
Analysis	0	4		10
Evaluate	0	3		5
Create	0	0		0
Total	**15**	**15**		**60**
	A	**B**	**C**	**D**

A+B+C+D = 100

Course Code:	DC MACHINES AND TRANSFORMERS	L	T	P	Credit	CIA Marks **40**
Course Category: PCC		2	1	0	3	SEE Marks **60**

COURSE OBJECTIVES:

- To understand the generation of D.C. voltages by using different types of generators and Study their performance.
- To study the working principles of D.C. motors and their load characteristics, starting and Methods of speed control.
- To familiarize with the constructional details of different type of transformers, working principle and their performance.

COURSE OUTCOMES:

- The concepts of electromechanical energy conversions in D.C. machines and energy transfer in transformers and also to analyze their performance.

After the successful completion of the course students will be able to

COS NO.	Course Outcomes	Bloom's level
CO1	EMF Equation	Remember
CO2	D.C MACHINE CONSTRUCTION and DC Motor and Generator characteristics, Starting methods of DC motors	Understand
	Transformer and special transformer Construction,	
CO3	Speed control of DC Machines, Faradays Laws	Apply
CO4	Testing of DC Machines, Parallel operation of DC motor and generator,	Analysis
	Parallel operation of transformers,	
CO5	Determination of losses and efficiency of DC Machines	Evaluate
	Determination of losses, efficiency and regulation of Transformers	
CO6	Equivalent circuit of transformer	Create

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	S	M	-	-	-	-	L	L	-	M
CO2	M	L	L	L	M	L	-	-	L	M	-	M
CO3	M	L	S	L	M	L	-	-	L	L	-	S
CO4	S	S	M	S	S	L	-	-	M	L	-	M
CO5	M	S	S	M	L	-	-	-	-	L	-	M

SYLLABUS:

MODULE I

D.C MACHINE CONSTRUCTION

Field System-Armature Core-CommutatorandBrushes-Armaturewinding- E.M.F equation-MethodsofExcitation-ArmatureReaction-Commutation-Load Characteristicsof D.C generators-Series, shunt and compoundmachines-ParalleloperationofD.CGenerators.

MODULEII

D.C MOTORS

Principle-BackEMF-Torque-Loadcharacteristicsofseries,shuntandcompoundmotors-Threepoint,Fourpoint&AutomaticstarterforD.CMotors-SpeedControlofD.CMotors.Losses-EfficiencyofD.Cmotors&Generators – Braketest,Swinburne'stest,Hopkinson'stest,FieldtestforSeriesMachines.

MODULEIII

TRANSFORMERS

Principle – EMFequationandTransformationRatio-Typesoftransformers-Construction-phasordiagramatdifferent load Equivalentcircuit-voltageregulation-lossesandefficiency-Alldayefficiency.

MODULEIV

TRANSFORMERS TESTING & PARALLEL OPERATION

Polarity and ratio test-O.C and S.C test-Load test- Parallel operation -Three phase Transformer connections-Opendelta-Leblancconnection-Threephasetosinglephaseconversion-Tapchanging

MODULEV

SPECIAL TYPE OF TRANSFORMERS

Auto Transformers- current & potential transformers - Earthling-Transformer-Welding Transformer-DistributionTransformer-PowerTransformer-Construction&Operatingprinciple.

LEARNING RESOURCES:

Text Books:

1. Theraja&A.K.Theraja,"ElectricalTechnology",VolII,S.ChandCompanyLtd,NewDelhi,2008.
2. R.KRajput, "ElectricalMachines",4thEdition,Laxmipublications, 2008

References:

1. Dr.MurgeshKumar,"D.CMachinesandTransformer",VikasPublishers,2nd Edition 2013

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom's Category	**Continuous Assessment Tests**		**Assignment (10)**	**Terminal Examination (60)**
	(15)	**(15)**		
Remember	7	0	10	20
Understand	8	-		15
Apply	0	8		10
Analysis	0	4		10
Evaluate	0	3		5
Create	0	0		0
Total	**15**	**15**		**60**
	A	**B**	**C**	**D**

A+B+C+D = 100

Course Code:	MEASUREMENTS AND INSTRUMENTATION	L	T	P	Credit	CIA Marks **40**
Course Category: PCC		3	0	0	3	SEE Marks **60**

COURSE OBJECTIVES:

- Acquire the knowledge on basic measurement concepts.
- Acquire the knowledge on basic electronic measurements.
- Acquire the knowledge on recording devices.

COURSE OUTCOMES:

- Understand Measurement systems, Bridge measurements.
- Know the principles of cathode ray oscilloscopes and other measuring instruments.
- Compare analog and digital techniques, and measurement errors.

After the successful completion of the course students will be able to

COS NO.	Course Outcomes	Bloom's level
CO1	Understand Measurement systems, Bridge measurements.	Remember, Understand & Evaluate
CO2	Know the principles of cathode ray oscilloscopes and other measuring instruments.	Understand
CO3	Compare analog and digital techniques, and measurement errors.	Apply& Analyse

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	S	M	M	L	L	-	L	L	-	M
CO2	M	M	M	M	S	L	-	-	M	L	-	S
CO3	M	S	S	S	S	L	-	-	M	M	-	S

SYLLABUS:

MODULE I

SCIENCE OF MEASUREMENT AND CHARACTERISTICS OF TRANSDUCERS

Functional elements of an instrument - Units and standards - calibration methods – errors in measurement - statistical methods - Static characteristics - accuracy, precision, sensitivity, linearity, Reproducibility, Repeatability and Noise - Dynamic characteristics – impulse, step, ramp and sinusoidal inputs.Classification of transducers – Selection of Transducer – Applications of Transducer -Resistive Transducer: Strain gauges, Resistance Thermometers, Thermistor - Inductive Transducers: LVDT, RVDT- Capacitive Transducers – Piezoelectric Transducer.

MODULEII

POTENTIOMETERS AND ELECTRICAL INSTRUMENTS

DC potentiometer - Loading effect – Application – Basic circuit - standardization – Laboratory type (Crompton's) – AC potentiometer – Drysdale (polar type) type – Gall-Tinsley (coordinate) type – Limitations & applications –Instrument Transformer - C.T and V.T construction, theory, operation, phasor diagram, characteristics, testing, error elimination – Applications – Single and three Phase Wattmeters and Energy meter.

MODULE III

MEASUREMENT OF RESISTANCE AND IMPEDANCE

Low Resistance: Kelvin's double bridge – Ductor Ohmmeter - Medium Resistance: Voltmeter Ammeter method, Substitution method, Wheatstone bridge method – High Resistance: Megger, Direct deflection method, Megohm bridge method - Earth resistance measurement. Introduction to A.C. bridges – Sources and Detectors in A.C. bridges – Measurement of Inductance – Anderson Bridge. - Measurement of Capacitance: Schering's bridge, De-Sauty's bridge - Measurement of frequency using Wien's bridge- LCR meter- Q meter

MODULE IV

CRO AND RECORDING INSTRUMENTS

Oscilloscope: CRO – CRT, Deflection System, Specifications, Controls, Phosphors -Dual Beam / Dual trace oscilloscope - Storage Oscilloscope, Digital Storage Oscilloscope and Sampling Oscilloscope.

Recording Instruments: Method of Recording – Frequency Modulated (FM) recording-Pulse Duration Modulation (PDM) Recording - Strip Chart Recorders, X-Y, UV Recorders, and Plotters.

MODULEV

ANALOG & DIGITAL INSTRUMENTS

Operating Forces – Deflecting Force, Controlling Force, Damping Force - Galvanometer, PMMC & moving iron instruments – Principle of operation, construction and sources of errors and compensation – Dynamo meter – True RMS meter - electronic voltmeter – Digital Voltmeter – Multimeter – vector voltmeter.

LEARNING RESOURCES:

Text Books:

1. Patranabis, 'Sensors and Transducers', Prentice Hall of India, 2nd Edition 2013.

2. Cooper W.D., “Electronic Instrumentation and Measurement Techniques”, Prentice Hall of India, New Delhi, 2003.Joseph J Carr, Elements of Electronic Instrumentation & Measurement, Pearson, 3rd Edition 1995.
3. Kalsi.H.S, “Electronics Instrumentation”, Tata McGraw Hill, New Delhi, 3rdEdition 2017.
4. D.V.S. Moorthy, ‘Transducers and Instrumentation’, Prentice Hall of India Pvt Ltd, 2ndEdition 2018.
5. Sawhney A.K., “A Course in Electrical, Electronic measurement & Instrumentation”, DhanpatRai& sons,18th Edition, Reprint 2015
6. Oliver B.H., and Cage J.M., “Electronics Measurements and Instrumentation”, McGraw Hill, 2017.
7. M.M.S.Anand,”Electronic instruments and instrumentation thcnology,”PHI, 2006.

References:

1. Doeblin E.O. “Measurement System Applications and Design”, McGraw Hill, 6th Edition, July2017.
2. S. Ranganathan, ‘Transducer Engineering’, Allied Publishers Pvt. Ltd., 2003.
3. Stout M.B., “Basic Electrical Measurement”, Prentice Hall of India, 2012.
4. Dalley,J.W., Riley, W.F. and Meconnel, K.G., “ Instrumentation for Engineering Measurement”, John Wiley & Sons, 1999.

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom’s Category	Continuous Assessment Tests		Assignment (10)	Terminal Examination (60)
	(15)	(15)		
Remember	7	0	10	20
Understand	8	-		15
Apply	0	8		10
Analysis	0	4		10
Evaluate	0	3		5
Create	0	0		0
Total	**15**	**15**		**60**
	A	**B**	**C**	**D**

A+B+C+D = 100

Course Code:	DATA BASE MANAGEMENT [T & P]	L	T	P	Credit	CIA Marks **40**
Course Category: PCC		3	0	0	3	SEE Marks **60**

COURSE OBJECTIVES:

- To understand the different database models and language queries to access databases.
- To understand the normalization forms in building an effective database tables
- To protect the data and the database from unauthorized access and manipulation

COURSE OUTCOMES:

- Define, manipulate, and control a relational database management system
- Design SQL based Client-Server applications
- Build a database management system that satisfies relational theory

After the successful completion of the course students will be able to

COS NO.	Course Outcomes	Bloom's level
CO1	Explain the features of database management systems and Relational database.	Understand
CO2	Design conceptual models of a database using ER modeling for real life applications and also construct queries in Relational Algebra.	Understand
CO3	Create and populate a RDBMS for a real life application, with constraints and keys, using SQL.	Apply
CO4	Retrieve any type of information from a data base by formulating complex queries in SQL.	Apply
CO5	Analyze the existing design of a database schema and apply concepts of normalization todesign an optimal database.	Apply
CO6	Build indexing mechanisms for efficient retrieval of information from a database	Apply

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	M	M	M	-	-	S	M	M	S
CO2	S	S	S	S	S	M	-	-	S	M	M	S
CO3	M	M	M	S	S	M	-	-	S	M	M	S
CO4	S	S	M	M	S	M	-	-	S	M	M	M
CO5	M	M	S	M	M	M	-	-	M	M	M	S
CO6	M	M	S	S	M	M	-	-	S	M	L	S

SYLLABUS:

MODULE – I

Databases - Need - Concepts - Architecture - Data independence - Data modeling: Entity relationship model - Weak entity sets - Mapping ER model to Relational model.

MODULE – II

Concepts - Integrity constraints - Relational algebra - Relational calculus - Tuple relational calculus - Domain relational calculus - Overview of QBE.

MODULE – III

SQL Queries - Nested queries - Aggregate operators - Null values - Embedded SQL – Database security - Views - Queries on views.

MODULE – IV

Schema Refinement - Functional dependencies - Normalization - Decomposition - 3NF, BCNF, 4NF - Multi-valued dependencies.

MODULE – V

Object-oriented data model - Object identity and pointers - Object definition and manipulation language - Object-oriented databases - Object relational databases - Recent trends-Mobile databases.

DATA BASE MANAGEMENT LAB

LIST OF PROGRAMS

1. Creation of a database and writing SQL queries to retrieve information from the database.
2. Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.
3. Creation of Views, Synonyms, Sequence, Indexes, Save point.
4. Creating an Employee database to set various constraints

LEARNING RESOURCES:

Text Books:

1. Silberchatz, F. Korth, and S. Sudarshan, "Database System Concepts", 7thillustrated Edition, McGraw Hill 2011.

References:

1. R. Elmasri and S. B. Navathe, "Fundamentals of Database Systems", 7th illustrated Edition, Pearson Education Jun 2017.
2. Raghu Ramakrishnan ,JohannesGehrke "Database Management Systems", 3rd illustrated Edition , WCB, McGraw Hill, July 2014

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom's Category	**Continuous Assessment Tests**		**Assignment (10)**	**Terminal Examination (60)**
	(15)	**(15)**		
Remember	7	0	10	20
Understand	8	-		15
Apply	0	8		10
Analysis	0	4		10
Evaluate	0	3		5
Create	0	0		0
Total	**15**	**15**		**60**
	A	**B**	**C**	**D**

A+B+C+D = 100

Course Code:	DIGITAL ELECTRONICS	L	T	P	Credit	CIA Marks **40**
Course Category: PCC		3	0	0	3	SEE Marks **60**

COURSE OBJECTIVES:

- Study various number systems and to simplify the mathematical expressions using Boolean functions - simple problems.
- Study implementation of combinational circuits.
- Study the design of various synchronous and asynchronous circuits.

COURSE OUTCOMES:

- Understand the basic number system and Boolean algebra.
- Understand the basics of combinational circuits.
- Know about Flip flops and synchronous sequential circuits and their design.

After the successful completion of the course students will be able to

COS NO.	Course Outcomes	Bloom's level
CO1	Explain the different number systems and coding schemes and arithmetic operations on binary numbers	Understand
CO2	Explain the basic theorems and properties of Boolean algebra	Understand
CO3	Construct combinational logic circuits for the given requirement and determine their performance	Understand
CO4	Utilize K- Map for gate level minimization of the given Boolean function	apply
CO5	Know about Flip flops and synchronous sequential circuits and their design.	Apply

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	S	L	-	-	-	M	M	-	M
CO2	S	S	S	M	L	-	-	-	-	-	-	S
CO3	S	S	S	S	M	L	-	-	M	M	M	S
CO4	M	M	S	S	L	-	-	-	-	M	-	M
CO5	M	M	S	M	M	L	-	-	-	M	-	S

SYLLABUS:

MODULEI

NUMBER SYSTEMS AND CODES

Review of Number systems: Binary, Octal and Hexadecimal. Representations of numbers and their conversions.Binaryarithmetic's.Conversionalgorithms.Weighted binary codes and Non-weighted binary codes.Error detecting and error correcting codes.Alphanumeric codes.

MODULE II

BOOLEAN ALGEBRA AND LOGIC FUNCTIONS

Boolean Algebra: Introduction to Boolean algebra - The AND, OR and NOT operations. Laws of Boolean algebra.Minimization of Boolean expression.Boolean expressions and logic diagrams.Universal building blocks.Negative logic.

Logic Simplifications: Truth tables and maps. Sum-of-products and product-of-sums. Simplification of logic functions using Karanaugh map Minimization and Quine-McCluskey method of minimization.

MODULEIII

COMBINATIONAL CIRCUITS

Arithmetic circuits: Half Adder, Full Adder, Half Subtractor and Full Subtractor, Number complements. Multiplexer - Demultiplexer, Decoder and Encoder code converters – BCD to Excess3, Gray, Seven Segment Display Conversions – Parity Generator and Checkers.

MODULEIV

SEQUENTIAL CIRCUITS

Synchronous sequential circuits: Basic latch circuits - Flip-flops, truth table and excitation table. Shift Registers. Synchronous counter design using JK, T, D flip flops, Up-down counter, General BCD counter and Ring counters. **Asynchronous Sequential Circuits** – State Reduction, Multiple Inputs.

MODULE V

LOGIC FAMILIES AND PROGRAMMABLE LOGIC DEVICES

Logic Families: BJT as a switch- Logic Specifications – RTL, DTL, IIL, TTL open Collector O/P, Totem pole O/P, Tristate O/P, Schottky TTL gate, ECL, MOS, CMOS Logic – Comparison of Logic Families. VHDL Implementation

Programmable Logic Devices: PAL, PLA, PROM.

LEARNING RESOURCES:

Text Books:

1. W.H. Gothmann: Digital Electronics - An Introduction, Theory and Practice, Prentice Hall of India. Second edition, 1992.
2. M.Morris Mano – Digital Logic & Computer Design – PHI, 2nd Edition, 1999.

References:

1. A. Anand Kumar: Switching Theory and Logic Design – PHI,3rdEdition July 2016.
2. Heiser Man: Handbook of Digital IC applications, Prentice Hall.2008.
3. D.J. Comer: Digital Logic and State Machine Design, HOLT-SAUN-DERS, 3rd Edition, 1995.
4. T.L. Floyd: Digital Fundamentals, Prentice Hall of India.11thEdition July 2014.

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom's Category	Continuous Assessment Tests		Assignment (10)	Terminal Examination (60)
	(15)	(15)		
Remember	7	0	10	20
Understand	8	-		15
Apply	0	8		10
Analysis	0	4		10
Evaluate	0	3		5
Create	0	0		0
Total	**15**	**15**		**60**
	A	**B**	**C**	**D**

A+B+C+D = 100

Course Code:	ANALOG AND DIGITAL ELECTRONICS LAB	L	T	P	Credit	CIA Marks **40**
Course Category: PCC		0	0	3	2	SEE Marks **60**

COURSE OBJECTIVES:

- To expose the students to digital circuits
- To understand the basics of combinational logic circuits
- To understand characteristics of sequential logic circuits.

COURSE OUTCOMES:

Ability to understand and analyse digital electronic circuits.

After the successful completion of the course students will be able to

COS NO.	Course Outcomes	Bloom's level
CO1	Demonstrate minimization of the given Boolean function using K-Map and realize it using logic gates	Apply & precision
CO2	Construct combinational logic circuit for the given application and analyse its performance using PSIM software	Analysis & precision
CO3	Construct synchronous / asynchronous sequential logic circuits for the given application and analyse its performance using PSIM software	Analysis & precision

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	M	M	L	L	-	M	M	M	S
CO2	S	S	S	S	M	M	L	L	S	S	M	S
CO3	S	S	S	S	M	M	-	-	S	S	M	S

SYLLABUS:

LISTOFTHE EXPERIMENTS:

1. VI Characteristics of Semi conductor diode/ Zener diode
2. Input and output characteristics of a BJT in CE configuration
3. Characteristics of JFET/MOSFET

4. Clipper and Clamper
5. Frequency response of CE amplifier
6. Operational Amplifiers (IC741) – Characteristics and Applications
7. Differential Amplifier
8. Instrumentation amplifier using OP-AMP ICs
9. RC-Phase Shift Oscillator using OP-AMP IC.
10. Astablemultivibrator and Schmitt trigger using OP-AMPIC.
11. Implementation of Boolean Functions, Adder and Subtractor circuits.
12. Implementation of Code converters
13. Implementation of Encoders and Decoders.
14. Implementation of Multiplexer and de multiplexer
15. Implementation of Counter circuits

LEARNING RESOURCES:

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom's Category	Continuous Assessment Tests		Terminal Examination
	TEST - I	TEST - II	
Remember	15	15	30
Understand	5	5	10
Apply	-	-	60
Analysis	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total			**100**

THIRD SEMESTER

Course Code:	INDUCTION AND SYNCHRONOUS MACHINES (T & P)	L	T	P	Credit	CIA Marks **40**
Course Category: PCC		2	1	0	3	SEE Marks **60**

COURSE OBJECTIVES:

- To know the Construction and performance of salient and non – salient type synchronous generators.
- To provide deep understanding of Principle of operation and performance of synchronous motor.
- To impart knowledge on Construction, principle of operation and performance of induction machines.

COURSE OUTCOMES:

By studying the subject the students will understand the concepts of synchronous and asynchronous machines and also analyze their performance.

After the successful completion of the course students will be able to

COS NO.	Course Outcomes	Bloom's level
CO1	Types of alternators, induction motors.	Remember
	Applications of alternators, induction motors and fractional horsepower motors.	
CO2	Construction and working of synchronous, Induction and special types of machines.	Understand
	Armature reaction and synchronizing methods.	
	Double Field revolving Theory.	
CO3	Determination Voltage Regulation of Alternator by EMF, MMF, ZPF and ASA methods.	Apply
CO4	Performance analysis of three phase and single phase induction motors.	Analysis
	Phasor diagrams, v –curve and inverted v curves of synchronous machines.	
CO5	Estimation of torque and power output.	Evaluate
CO6	Equivalent circuits of alternator, three and single phase induction machines.	Create

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	L	L	M	M	L	M	M	L	M
CO2	M	M	M	L	L	M	L	L	L	L	M	M
CO3	S	S	S	S	M	M	L	L	S	S	L	M
CO4	S	S	S	S	M	M	L	L	S	S	L	M
CO5	M	M	S	S	M	M	-	-	S	S	L	M

SYLLABUS:

MODULE I

ALTERNATORS

Construction- types - circuit model - synchronous reactance - voltage regulation - EMF, MMF, Potier and ASA methods - armature reaction – synchronizing - parallel operation.

MODULE II

SYNCHRONOUS MOTORS

Principle -Starting-Speed-torque curves -phasor diagrams - V & inverted V curves- phase modifiers - Hunting in synchronous machines and its prevention – applications.

MODULE III

THREE PHASE INDUCTION MACHINES

Construction - types - principle of operation - equivalent circuit - torque and power output - testing - circle diagram - cogging and crawling - starting and speed control double cage rotor – induction generator.

MODULE IV

SINGLE PHASE INDUCTION MACHINE

Single phase induction motor - double revolving field theory - equivalent circuit - performance analysis - load characteristics - starting methods

MODULE V

FRACTIONAL HORSE POWER MOTORS

Shaded - pole induction motor - variable reluctance motor - stepper motor - AC series motor - repulsion motor - linear motor - permanent magnet DC and AC motors.

LEARNING RESOURCES:

Text Books:

1. B.L.Theraja&A.K.Theraja, "Electrical Technology",Vol-II, S.Chand Company Ltd, New Delhi,23rd Edition 2007.

References:

1. Fitzgerald, A.E.Charles Kingsley Jr.StephenD.Umans, "Electric Machinery", McGraw-Hill Book Company, 5th Edition 2005.
2. Syed A.Nassar, "Electric Machines and Power System", Vol - I, McGraw -Hill Inc., NewYork,
3. Dr.Murgesh Kumar, "Induction and synchronous machines", vikas publications, New Delhi. 1st Edition 2004.

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom's Category	**Continuous Assessment Tests**		**Assignment (10)**	**Terminal Examination (60)**
	(15)	**(15)**		
Remember	7	0	10	20
Understand	8	-		15
Apply	0	8		10
Analysis	0	4		10
Evaluate	0	3		5
Create	0	0		0
Total	**15**	**15**		**60**
	A	**B**	**C**	**D**

A+B+C+D = 100

Course Code:	GENERATION TRANSMISSION AND DISTRIBUTION	L	T	P	Credit	CIA Marks **40**
Course Category: PCC		3	0	0	3	SEE Marks **60**

COURSE OBJECTIVES:

- To develop expressions for the computation of transmission line parameters.
- To obtain the equivalent circuits for the transmission lines based on distance and operating
- Voltage for determining voltage regulation and efficiency. Also to improve the voltage profile of the transmission system.

COURSE OUTCOMES:

Ability to understand and analyze power system generation, transmission line parameter calculation, performance of transmission line, types of cables and insulators, HVDC transmission.

After the successful completion of the course students will be able to

COS NO.	Course Outcomes	Bloom's level
CO1	Calculate the transmission network parameters for various configurations	Apply
CO2	Calculate the performance characteristics of the given transmission line using nominal-T,π, rigorous methods and power circle diagram	Apply
CO3	Explain the effect of corona and sag on overhead transmission lines	Understand
CO4	Calculate the sag of a overhead line for various conditions	Apply
CO5	Explain the various types of insulators, cables and their construction	Understand
CO6	Calculate string efficiency of the suspension type insulators	Apply
CO7	Compute the insulation resistance, capacitance and grading of cables	Apply
CO8	Calculate the voltage at a point on the given type of distribution system	Apply

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	M	-	-	-	-	-	M	-	M
CO2	S	S	S	M	L	-	-	-	-	M	-	M

CO3	M	M	S	S	M	S	M	M	M	M	M	S
CO4	M	M	S	M	L	M	M	M	S	S	L	M
CO5	M	M	M	S	M	S	S	M	S	M	M	M
CO6	M	S	S	M	L	L	L	-	M	M	-	M
CO7	M	M	S	M	S	M	S	S	S	S	S	S
CO8	M	S	S	M	L	M	-	-	M	M	M	S

SYLLABUS:

MODULEI

GENERATIONANDDISTRIBUTIONSYSTEMS

Hydel, thermal, nuclear, tidal, Biogas,Biomassplants –structureofelectric powersystem-One line diagram - Generation, Transmission and Distribution systems- Comparison of distribution systems- Radial and ring systems-twowireDC,ACsinglephaseandthreephasesystemsCurrentandvoltage calculationdistributionwithconcentratedanddistributedloads-Kelvin'sforthe designoffeedersand itslimitations.

MODULE II

LINE PARAMETERS AND CORONA

Resistance and capacitance of single phase and three phase line - Stranded bundled conductor configuration - Symmetrical and unsymmetrical spacing- Transposition of line conductor - Double circuit lines - Application of self and GMD - Skin and proximity effects - Earth effect on capacitance – Interference - Corona characteristics – Effect on performance of lines.

MODULEIII

PERFORMANCE OF OVER HEAD LINE

Equivalent circuits for short, medium (PI and T circuits) and long lines- Efficiency and Regular - Tuned power lines - Attenuation and surge impedance loading - Power circle diagrams for receiving and sending ends- Transmission capacity - Steady state power limit - Voltage control of lines- Shunt and series compensation.

Module IV

UNDERGROUND CABLES AND INSULATOR

Underground cables - types Construction- Capacitance of cables - Insulation resistance - Dielectric stresses and grading - Capacitance and intersheath grading - Dielectric loss - Thermal characteristics - Capacitance of three core cables - Fault location - Short circuit and open circuit in – Insulators - Types and comparison- Voltage distribution in string insulators - String efficiency - Methods of improving efficiency.

MODULE V

MECHANICAL DESIGN AND HVDC TRANSMISSION

Stress and sag calculations- Effect of wind and ice- Supports at different levels - Stringing chart condition erection – Dampers - HVDC transmission: Comparison of AC and DC systems - Economics distance for DC - Terminal equipment for DC systems.

LEARNING RESOURCES:

Text Books:

1. C.L.Wadhwa,Electricalpowersystems,WilleyEasternLimited,NewDelhi,5th Edition 2011.

References:

1. W.L.Stevenson,ElementsofpowersystemsanalysisMcGrawhill.S.L.Uppal,Electricalpower,khanna publishers,NewDelhi,4th Edition 1982.
2. Soni, BhatnagarandGupta, A course in electrical power DhanpatRaj&Sons,New Delhi,9th Edition 1985.

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom's Category	**Continuous Assessment Tests**		**Assignment (10)**	**Terminal Examination (60)**
	(15)	**(15)**		
Remember	7	0	10	20
Understand	8	-		15
Apply	0	8		10
Analysis	0	4		10
Evaluate	0	3		5
Create	0	0		0
Total	**15**	**15**		**60**
	A	**B**	**C**	**D**

A+B+C+D = 100

Course Code:	CONTROL SYSTEMS (T&P)	L	T	P	Credit	CIA Marks **40**
Course Category: PCC		3	0	0	3	SEE Marks **60**

COURSE OBJECTIVES:

- Analyze representation of systems and to derive transfer function models.
- Provide adequate knowledge in the time response of systems and steady state error analysis.
- Give basic knowledge in obtaining the open loop and closed-loop frequency responses of systems.

COURSE OUTCOMES:

- Describe various input/output models of dynamic system.
- Be familiar with frequency domain descriptions and dynamic analysis.
- Understand the concept of stability and effect of feedback control on sensitivity.

After the successful completion of the course students will be able to

COS NO.	Course Outcomes	Bloom's level
CO1	Basics of systems, Modelling of various kind of systems, detection of transfer function from the pictorial representation	Understand& Evaluate (Design)
CO2	Analyse the performance of the systems with time base	Apply& Analyse
CO3	Analyse the performance of the systems with frequency base	Apply& Analyse
CO4	Stability analysis and compensation technics	Analyse
CO5	State space condition of the systems	Apply& Analyse

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	M	M	L	L	M	M	L	M
CO2	S	S	S	S	M	M	M	L	S	S	M	M
CO3	S	S	S	S	M	S	M	L	S	M	M	M
CO4	S	S	S	S	S	S	M	L	S	M	M	S
CO5	S	S	S	S	S	M	M	L	S	M	M	S

SYLLABUS:

MODULE I

SYSTEM AND THEIR REPRESENTATION

Basic elements of control systems- open and close loop systems – Differential equation - Transfer function – Modelling of Electrical systems, translational and rotational mechanical systems – Block diagram reduction techniques – Signal flow graphs.

MODULE II

TIME RESPONSE

Time response – Time domain specifications – types of input – I and II order system response – Error coefficients – Generalized error series – Steady state error –Effect of P,PI,PD and PID modes of feedback control ,Analysis using MATLAB.

MODULE III

FREQUENCY RESPONSE

Frequency response – Bode plot – Polar plot – Nyquist plot – Frequency domain specifications from plots – Constant M and N circles – Nichol's chart– Analysis using MATLAB.

MODULE IV

STABILITY AND COMPENSATOR DESIGN

Characteristic equation – BIBO stability - Routh Hurwitz criterion - Root locus technique Construction of Root locus - Nyquist stability criterion – Effect of Lag, Lead and lag-lead compensation on frequency response, Analysis using MATLAB.

MODULE V

STATE VARIABLE ANALYSIS

Concept of state variables – State models for linear and time invariant systems – solution of state and output equation in controllable canonical form – concept of controllability and observability – Effect of state feedback

.

LEARNING RESOURCES:

Text Books:

1. M.Gopal,"Control system – Principle and Design," Tata McGraw Hill, 6th edition, 2012.
2. K.Ogata,"Modern control Engineering, "fifth edition, PHI, 2012.

References:

1. Benjamin C.Kuo, "Automatic control systems," PHI, 9thEdition 2014.
2. Nagrath I.J and Gopal M, "Control Systems Engineering", New Age Publishers, 6th Edition, 2018.

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom's Category	**Continuous Assessment Tests**		**Assignment (10)**	**Terminal Examination (60)**
	(15)	**(15)**		
Remember	7	0	10	20
Understand	8	-		15
Apply	0	8		10
Analysis	0	4		10
Evaluate	0	3		5
Create	0	0		0
Total	**15**	**15**		**60**
	A	**B**	**C**	**D**

A+B+C+D = 100

Course Code:	POWER SYSTEMS – I [MODELLING AND COMPONENTS]	L	T	P	Credit	CIA Marks **40**
Course Category: PCC		3	0	0	3	SEE Marks **60**

COURSE OBJECTIVES:

- Understand the concepts of power systems.
- Understand the various power system components.
- Evaluate fault currents for different types of faults.
- Understand the generation of over-voltages and insulation coordination.
- Understand basic protection schemes.

COURSE OUTCOMES:

- Study of relays & Study of protection scheme, solid state relays.
- To understand instrument transformer and accuracy.
- To understand the method of circuit breaking various arc theories Acing phenomena capacitive and inductive breaking.

After the successful completion of the course students will be able to

COS NO.	Course Outcomes	Bloom's level
CO1	Explain the Structure of a power system	Understand
CO2	Analysis of simple three-phase circuits. Power Transfer in AC circuits and Reactive Power.	Analysis
CO3	Calculation of Surge Impedance Loading.	Apply
CO4	Comparison of Series and Shunt Compensation of transmission lines.	Remember
CO5	Per-unit System and per-unit calculations.	Apply
CO6	Explain Lightning and Switching Surges.	Understand
CO7	Method of Symmetrical Components.	Understand
CO8	Types of Circuit Breakers.	Understand

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	M	M	M	M	M	L	M	M	M	L
CO2	S	S	S	S	M	M	L	L	S	S	L	M
CO3	S	S	S	S	M	M	L	L	M	S	L	L
CO4	S	S	S	S	S	M	M	L	S	S	M	M
CO5	S	S	S	S	M	M	M	L	S	S	M	M
CO6	M	S	S	M	M	S	S	L	S	S	M	M
CO7	M	M	S	S	M	-	-	-	M	M	-	M
CO8	S	S	S	S	M	S	S	S	S	M	S	S

SYLLABUS:

MODULE I

BASIC CONCEPTS

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

MODULE II

POWER SYSTEM COMPONENTS

Overhead Transmission Lines and Cables: Types of Travelling-wave Equations. **Sinusoidal Steady staterepresentation of Lines:** Short, medium and long lines. Power Transfer, Voltage profile and Reactive Power.**Characteristics of transmission lines**. Surge Impedance Loading. Series and Shunt Compensation of transmission lines.

Transformers: Vector Representation and Phase-shifts. Three-winding transformers, auto-transformers, Neutral Grounding transformers. Tap-Changing in transformers.

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

MODULE III

OVER-VOLTAGES AND INSULATION REQUIREMENTS

Generation of Over-voltages: Lightning and Switching Surges. Protection against Over-voltages, Insulation Coordination.Propagation of Surges, lighting arresters, surge arresters. Voltages produced by traveling surges. BewleyDiagrams,Ground wire, protector tube.

MODULE IV

FAULT ANALYSIS AND PROTECTION SYSTEMS

Method of Symmetrical Components (positive, negative and zero sequences). Balanced and Unbalanced Faults.Representation of generators, lines and transformers in sequence networks.Computation of Fault Currents.Neutral Grounding.

Switchgear: Types of Circuit Breakers. Attributes of Protection schemes, Back-up Protection. Protection schemes(Over-current, directional, distance protection, differential protection) and their application.Earthing switches,

MODULE V

NUMERICAL PROTECTION

Introduction, Block Diagram of a Numerical Relay, Numerical over current Protection, Numerical Transformer Differential protection, Numerical distance protection of Transmission line, Software and Hardware.

LEARNING RESOURCES:

Text Books:

1. Ravindranath.B and Chander.N, “Power System Protection and Switchgear”, New Age International 2nd Edition 2018.
2. Chakrabarti .A, Soni .M.L, Gupta .P.V, “A text book on power system Engineering”,Dhanpatrai& Co. pvt.Ltd., 2013.
3. Y.G.Paithankar and S.R.Bhinde, “Fundamentals of power system protection”, PHI, New Delhi, 2010.

References:

1. Wadhwa C.L., “Electrical Power Systems”, New Age International Pvt. Ltd., Publishers, 2010 6th Edition.
2. Patra S.P., Basu S.K. and Chowduri S., “Power systems Protection”, Oxford and IBH Publishing Co, 1983.
3. Sunil.S.Rao, “Switchgear Protection and power systems”, Khanna Publishers, New Delhi, 13rd Edition, 2008.

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom's Category	Continuous Assessment Tests		Assignment (10)	Terminal Examination (60)
	(15)	(15)		
Remember	7	0	10	20
Understand	8	-		15
Apply	0	8		10
Analysis	0	4		10
Evaluate	0	3		5
Create	0	0		0
Total	**15**	**15**		**60**
	A	**B**	**C**	**D**

A+B+C+D = 100

Course Code:	MICROPROCESSOR AND MICROCONTROLLERS (T&P)	L	T	P	Credit	CIA Marks **40**
Course Category: PCC		3	0	0	3	SEE Marks **60**

COURSE OBJECTIVES:

- To learn the concepts of microprocessor, microcontroller and its applications.
- To design microprocessor & microcontroller along with interfacing devices
- To understand the impact of microcontroller in engineering applications.

COURSE OUTCOMES:

- Demonstrate potential knowledge in internal hardware details of microprocessor & microcontroller
- Design suitable interfaces for real time applications
- Exhibit programming skills, choose suitable hardware and program the devices to solve engineering problems.

After the successful completion of the course students will be able to

COS NO.	Course Outcomes	Bloom's level
CO1	Demonstrate potential knowledge in internal hardware details of microprocessor & microcontroller.	Understand
CO2	Assembly language programs for data manipulating and accessing on-chip hardware units.	Apply
CO3	Design suitable interfaces for real time applications.	Apply
CO4	Exhibit programming skills, choose suitable hardware and program the devices to solve engineering problems.	Evaluate

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	M	S	M	L	-	M	M	L	M
CO2	S	S	S	S	S	S	L	L	S	S	M	S
CO3	S	S	S	S	S	S	L	L	S	S	M	S
CO4	S	S	S	S	S	M	L	L	S	S	M	S

SYLLABUS:

MODULE I

INTEL 8086 MICROPROCESSOR

Microprocessor Evolution and Types- Architecture of 8086- Pin configuration-Instruction Set- Addressing Modes – Interrupts-Simple Programs.

MODULE II

INTEL 8051 MICROCONTROLLER

8051 Architecture-pin configuration – flags and PSW-CPU registers-Internal RAM & ROM-Special Function Registers-I/O Ports & Circuits.

MODULE III

INTEL 8051 PROGRAMMING

Instruction Set- Data Transfer Instruction-Arithmetic and Logical Instruction- Jump Loop and Call Instruction-Simple Programs.

MODULE IV

PERIPHERAL INTERFACING

Parallel I/O (8255) Programmable Interval Timer (8253/8254)-Keyboard/Display Controller 8279) - Serial I/O (8251) using 8086 Microprocessor. A/D and D/A Interfacing -Temperature Sensor Interfacing - Stepper Motor Interfacing using 8051 Microcontroller.

MODULE V

ADVANCED MICROPROCESSOR AND MICROCONTROLLER

Architecture of AVR , PIC and ARM Microcontrollers - JTAG Concepts and Boundary Scan Architecture - Core 2 duo Processor - i7 Core Processor(Qualitative Study).

LEARNING RESOURCES:

Text Books:

1. Amar K.Ganguly,"AnuvaGanguly,Microprocessor and Microcontroller 8085,8086 and 8051",Narosa Publication HousePvt. Ltd,2012.
2. Kenneth J.Ayala, "The 8051 microcontroller Architecture, Programming and applications" ,Third edition,Cengage Learning India pvt ltd,2009.
3. D.Karunasagar,"The 8051 microcontroller" ,CengageNarosa Publication HousePvt. Ltd, 1st Edition 2011.

References:

1. Douglas V.Hall, " Microprocessors and Interfacing : Programming and Hardware", Tata McGraw Hill ,3rd Edition July 2017.
2. A.K.Ray& K.M Bhurchandi, "Advanced Microprocessor and Peripherals – Architecture, Programming and Interfacing", Tata McGrawHill , 2006.
3. Mohamed Ali Mazidi,JaniceGillispieMazidi," The 8051 microcontroller and embedded systems using Assembly and C",second edition, Pearson education /Prentice hall of India, 2007.
4. A.K.Ray,K.M.Bhurchandi "Advanced Microprocessor and Pheripherals",Tata McGraw Hill ,3rd Edition 2012.

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom's Category	**Continuous Assessment Tests**		**Assignment (10)**	**Terminal Examination (60)**
	(15)	**(15)**		
Remember	7	0	10	20
Understand	8	-		15
Apply	0	8		10
Analysis	0	4		10
Evaluate	0	3		5
Create	0	0		0
Total	**15**	**15**		**60**
	A	**B**	**C**	**D**

A+B+C+D = 100

Course Code:	AC and DC Machines	L	T	P	Credit	CIA Marks **40**
Course Category: PCC		3	0	0	3	SEE Marks **60**

Course Outcome:

CO: 1. Students understand the operation and characteristics of DC generator

CO: 2. Students understand the operation and characteristics of DC motor

CO: 3.students able to estimate the performance of AC and DC machine by direct and indirect method

CO: 4.students able to gain the knowledge how to control the speed of induction motor

CO: 5. Students understand the procedure for connecting one alternator with another alternator

ELECTRICAL MACHINES LAB

LIST OF EXPERIMENT

1. Load test on D.C shunt Generator

2. Load test on D.C Series Generator

3. Load test on D.C Shunt Motor

4. Load test on D.C Series Motor

6. Load test on Compound Generator

7. Predetermination of Efficiency of D.C Shunt Generator by Swinburne's test

8. O.C & S.C Test on Single phase Transformer

9. Predetermination of Regulation of Alternator by EMF /MMF methods.

10. Parallel operation of Alternators.

11. Determination of “V” & inverted “V” Curves.

12. Speed control of Induction Motors.

13. No load and Blocked Rotor test on Single Phase Induction Motor.

14. Load test on Single Phase Induction Motor.

Course Code:	Control and instrumentation Lab	L	T	P	Credit	CIA Marks **40**
Course Category: PCC		3	0	0	3	SEE Marks **60**

1. Transfer function of separately Excited DC generator.
2. Transfer function of field controlled of DC Motor.
3. Transfer function of Armature controlled of DC Motor.
4. DC Position control of Servo System.
5. AC Position control of Servo System.
6. Calibration of Wattmeter.
7. Calibration of Energy meter – Conventional and Electric type
8. Measurement of Resistance using Whetstone's bridge.
9. Measurement of displacement Using LVDT.
10. Measurement of temperature by thermocouples.
11. Usage of CT and PT for the measurement of High current and high voltage.
12. Simulation using Lab View Software and MATLAB

Fourth semester

Course Code:	DIGITAL SIGNAL PROCESSING AND ITS APPLICATIONS	L	T	P	Credit	CIA Marks **40**
Course Category: PCC		3	0	0	3	SEE Marks **60**

COURSE OBJECTIVES:

- To introduce discrete Fourier transforms.
- To teach the design of infinite and finite impulse response filters for filtering undesired signals.
- To study the architecture of TMS320F24XX processor and about communication interface.

COURSE OUTCOMES:

- Perform frequency transforms for the signals.
- Design IIR and FIR filters.
- Apply TMS320F24XX processor for power electronic applications.

After the successful completion of the course students will be able to

COS NO.	Course Outcomes	Bloom's level
CO1	Characteristics of different digital systems	understand
CO2	Compute Discrete Fourier Transform for the given signals.	remember
CO3	Design the Digital Infinite Impulse Response Filters (IIR) from given Specifications	apply
CO4	To describe about TMS320F24XX processor	understand
CO5	Use of TMS320F24XX processor for power electronic applications.	apply

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	M	M	M	-	-	M	M	L	L
CO2	S	S	S	S	M	M	-	-	M	S	L	M
CO3	S	S	M	M	M	M	-	-	S	S	M	S
CO4	M	M	M	M	M	M	-	-	S	S	M	M
CO5	M	M	S	S	M	S	-	-	S	S	M	S

SYLLABUS:

MODULE I

INTRODUCTION

Classification of systems: Continuous, discrete, linear, causal, stable, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect. Digital signal representation.

MODULE II

DISCRETE TIME SYSTEM ANALYSIS

Z-transform and its properties, inverse z-transforms; Fourier transform of discrete sequence – Discrete Fourier series.Computation of DFT using FFT algorithm - DIT & DIF - FFT using radix 2 - Butterfly structure.

MODULE III

DESIGN OF DIGITAL FILTERS

FIR & IIR filter realization - Direct I, Direct II Parallel & cascade forms- IIR design: Analog filter design - Butterworth and Chebyshev approximations; digital design using impulse invariant and bilinear transformation.

MODULE IV

DIGITAL SIGNAL PROCESSORS

Introduction - Architecture ofTMS320F24XX–Event Manager-General purpose Timer-SerialCommunication interface-Serial Peripheral Interface - CAN- Features – pipeline- Instruction set.

MODULE V

DSP APPLICATIONS TO MOTOR CONTROL

PWM generation using LF24XX – Procedure; DSP control of BUCK-BOOST converter- Block diagram; DSP Control of BLDC Motor - Block diagram; SVPWM generation using LF24XX – Procedure.

LEARNING RESOURCES:

Text Books:

1. Sanjit.K.Mitra, " Digital Signal Processing – A computer Based Approach", Tata McGraw – Hill Edition, Edition 4,2013.
2. Hamid A. Toliyat Steven Campbell ,"Dsp-Based Electromechanical Motion Control",CRC Press ,1st Edition 2019.

References:

1. John G. Proakis ,Dimitris K Manolakis , " Digital Signal Processing", Pearson Prentice Hall Publishing Ltd, 1st Edition 2009.
2. Lonnie C. Lumen, "Fundamentals of Digital Signal Processing', John WHily and sons, 1987.
3. R.G.Lyons, "Understanding Digital Signal Processing", Addison Wesley, 3rd Edition 1997.
4. TMS320C2xx User's Guide, Texas Instruments, 1999

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom's Category	**Continuous Assessment Tests**		**Assignment (10)**	**Terminal Examination (60)**
	(15)	**(15)**		
Remember	7	0	10	20
Understand	8	-		15
Apply	0	8		10
Analysis	0	4		10
Evaluate	0	3		5
Create	0	0		0
Total	**15**	**15**		**60**
	A	**B**	**C**	**D**

A+B+C+D = 100

Course Code:	POWER ELECTRONICS	L	T	P	Credit	CIA Marks **40**
Course Category: PCC		3	0	0	3	SEE Marks **60**

COURSE OBJECTIVES:

- To get an overview of different types of power semiconductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifier.
- To study the operation, switching techniques and basic topologies of DC-DC switching regulators.

COURSE OUTCOMES:

Ability to understand &analyze various power converter circuits**.**

After the successful completion of the course students will be able to

COS NO.	Course Outcomes	Bloom's level
CO1	Understand the Basic structure, working and switching characteristics of Power semiconductor devices	Knowledge
CO2	Various protection circuit for power semiconductor devices.	Analyse
CO3	Principle and working of AC-DC controlled converters	Understand
CO4	AC-DC Converters with different types of load	Analyse
CO5	Working of Different types of DC Choppers	Understand
CO6	Voltage Control strategies for DC Choppers	Apply
CO7	Working of different types of DC-AC Converters	Understand
CO8	Calculating voltage in 120 degree and 180 degree modes operation	Apply
CO9	Operation of AC-AC Converters and control techniques	Understand
CO10	Calculate voltage and frequency for AC-AC Converters	Evaluate

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	S	L	L	L	M	M	-	M
CO2	M	S	M	S	S	M	M	L	M	M	L	M
CO3	S	S	M	M	S	M	M	L	M	M	-	M
CO4	S	S	S	S	S	M	M	-	S	S	-	M
CO5	S	M	M	M	S	M	M	-	S	S	-	M
CO6	S	S	S	S	S	M	L	L	S	S	L	M
CO7	M	M	M	M	S	M	M	M	S	S	L	M
CO8	M	M	S	S	S	M	M	L	S	S	L	M
CO9	M	M	M	M	S	M	L	L	S	S	L	M
CO10	S	S	S	S	S	L	L	L	S	S	L	M

SYLLABUS:

MODULE I

POWER SEMICONDUCTOR DEVICES

Basic structure and switching characteristics of Power Diode, Power Transistor, Power MOSFET, IGBT and GTO.SCR-Basic Operation- VI characteristics-Turn-on, Turn-off methods-Switching characteristics - Combination of SCRs - Snubber circuits - Ratings and Protection circuits.

MODULE II

AC-DC CONVERTERS

Principles of Phase control - Natural commutation - Operation of 1Φ H.W controlled converters with R, RL, RL+FWD, RLE Loads - 1Φ F.W controlled converters with R, RL load, RL+FWD for bridge type converters. Operation of 3Φ H.W. controlled converters & F.W. controlled converters with R, RL - Effect of Source inductance on 1Φ and 3Φ F.W controlled converters - Operation of Dual converters.

MODULE III

DC-DC CONVERTERS

Voltage, Current and Load commutation - Principles of chopper - Control strategies - T.R.C, C.L.C - Step-up, Step-down, Step-up-down choppers - Classification and operation of Choppers (A,B,C,D,and E). Introduction to Resonant converters – Effect of EMI on converters.

MODULE IV

DC-AC CONVERTERS

Classification of Inverters - Basic Series Inverter - Basic Parallel Inverter - VSI Operation - single phase half Bridge and Full Bridge - three phase 180o & 120o conduction modes. CSI – Operation of single phase CSI with ideal switches – voltage control techniques in single phase inverters.

MODULE V

AC-AC CONVERTERS

Types of control (phase & Integrated cycle control), Operation of single phase voltage regulator with R, RL Loads.Operation of three phase AC voltage controls (with Anti parallel SCR configuration) with R load operation.Cyclo converters: single phase - step up & step down cyclo converters, three phase cyclo converter with R, RL loads.

LEARNING RESOURCES:

Text Books:

1. M. H. Rashid, Power Electronics: Circuits, Devices and Applications, Prentice Hall of India 3rd Edition, 2014.
2. Theory of Power Electronics, “K.L.Rao, C.H.SaiBabu - S.Chand& Company Ltd.”, New Delhi.5th Edition 2010.

References:

1. M. D. Singh & K. B. Kanchandhani, “Power Electronics”, Tata McGraw – Hill Publishing Company, 2nd Edition, 2014.
2. N.Mohan, T.M.Undeland, W.P.Robbins, “Power Electronics, Converters and Applications & Design”,3rd Edition John Wiley & sons. 2007.
3. Dr P S Bimbhra “Power Electronics“, Khanna Publishers, New Delhi, Edition 2012.

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom's Category	Continuous Assessment Tests		Assignment (10)	Terminal Examination (60)
	(15)	(15)		
Remember	7	0	10	20
Understand	8	-		15
Apply	0	8		10
Analysis	0	4		10
Evaluate	0	3		5
Create	0	0		0
Total	**15**	**15**		**60**
	A	**B**	**C**	**D**

A+B+C+D = 100

Course Code:	EMBEDDED SYSTEM	L	T	P	Credit	CIA Marks **40**
Course Category: PCC		3	0	0	3	SEE Marks **60**

COURSE OBJECTIVES:

- To study the architecture of LPC 2148 ARM processor.
- To learn the design aspects of LPC 2148's i/o and memory interfacing circuits.
- To study about communication and bus interfacing.

COURSE OUTCOMES:

- Design and implement programs on LPC 2148 Arm processor.
- Design various scheduling algorithms.
- Work with Task and Time management functions.

After the successful completion of the course students will be able to

COS NO.	Course Outcomes	Bloom's level
CO1	A. Understand basic concept of embedded systems. B. Analyze the applications in various processors and domains of embedded system.	Knowledge, Understand Apply
CO2	To describe about ARM architecture	Understand
CO3	To understand the building blocks of ARM LPC 214X and its peripherals	Remember
CO4	To describe about the Real time Operating Systems	Understand
CO5	To understand the micro c/os Real time operating system and its functions	Understand

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	M	M	M	M	L	L	S	S	L	M
CO2	S	M	M	M	M	M	L	L	S	S	L	M
CO3	S	S	S	S	S	M	L	L	S	S	L	M
CO4	S	S	M	S	S	M	M	L	S	S	M	M
CO5	S	S	M	S	S	M	M	L	S	S	M	M

SYLLABUS:

MODULE I

ARM INTRODUCTION

Introduction - The ARM Architecture Overview - Instruction set Summary - Processor operating states- Memory formats - Memory Interface - Bus interface signals -Addressing signals Addressing timing - Data Timed Signals - Debug interface - Debug systems - Debug interface signals - ARM7TDMI Core and system state - About Embedded ICE-RT Logic – Instruction Set.

MODULE II

LPC2148 ARM CPU

Introduction: - Architectural Overview - Memory Mapping -Block Diagram System control block functions: PLL - Power Control - Reset - VPB Divider - Wakeup Timer - Memory Acceleration Module - Timer0 and Timer1- PWM - RTC - On Chip ADC - On Chip DAC- Interrupts- Vector Interrupt Controller.

MODULE III

LPC 2148 – PERIPHERALS

General Purpose Input/Output Ports (GPIO) - Universal Asynchronous Receiver/Trasmitter

(UART) - I2C Interface – Multimaster and Multislave communication - SPI Interface - SSP Controller – USB 2.0 Device Controller.

MODULE IV

OPERATING SYSTEM OVERVIEW

Introduction OS – Function of OS – Defining an RTOS – Differences in Embedded Operating Systems – Introduction to Kernel – Resources – Shared Resources - Defining a Task – Task States - Multitasking - Scheduling and Scheduling Algorithms - Context Switching – Clock Tick – Timing of Task.

MODULE V

MC/OS – II

Introduction–II Task Management Functions – Creating a Task - Time Management Functions – OS Delay Functions - Implementation of Scheduling and rescheduling.

LEARNING RESOURCES:

Text Books:

1. Embedded Systems Architecture - Tammy Noergaard, Newnes 2005.
2. ARM System Developer‟s Guide – Andrew N.Sloss.
3. ARM Architecture Reference Manual - David Seal.
4. ARM System-on-Chip Architecture (2nd Edition) by Steve Furbe.

References:

1. Micro C/OS – II The Real Time Kernel Jean J. Labrosse.
2. Real Time Concepts for Embedded Systems – by Qing Li and Caroline Yao, 2003
3. Embedded / Real Time Systems : Concepts , Design & Programming by Dr. K.V.K.K PRASAD.
4. LPC 2148 User Manual.

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom's Category	**Continuous Assessment Tests**		**Assignment (10)**	**Terminal Examination (60)**
	(15)	**(15)**		
Remember	7	0	10	20
Understand	8	-		15
Apply	0	8		10
Analysis	0	4		10
Evaluate	0	3		5
Create	0	0		0
Total	**15**	**15**		**60**
	A	**B**	**C**	**D**

A+B+C+D = 100

Course Code:	EMDEDDED SYSTEM DESIGN LAB	L	T	P	Credit	CIA Marks **40**
Course Category: PCC		0	0	3	2	SEE Marks **60**

COURSE OBJECTIVES:

- Learn the working of ARM processor.
- Understand the Building Blocks of Embedded Systems.
- Learn the concept of memory map and memory interface.

COURSE OUTCOMES:

- Write programs in ARM for a specific Application
- Interface memory and Write programs related to memory operations
- Interface A/D and D/A convertors with ARM system

After the successful completion of the course students will be able to

COS NO.	Course Outcomes	Bloom's level
CO1	Analyze the architecture of a ARM processor	Understand
CO2	Write and execute program to generate PWM waveforms	Apply
CO3	Write and execute program to interface ADC and DAC with ARM Processor	Apply
CO4	Write and execute program to interface stepper motor , temperature sensor and others with ARM Processor	Apply
CO5	Design an embedded system for a specific application	Create

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	**Program Outcomes**											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	M	M	L	L	L	S	M	L	M
CO2	S	S	S	M	S	M	M	-	S	S	M	M
CO3	S	M	M	S	S	M	M	-	S	M	M	S
CO4	S	S	M	M	S	S	L	-	S	S	M	M
CO5	S	S	S	S	S	M	L	L	S	S	M	M

SYLLABUS:

LIST OF EXPERIMENTS:

1. Study of ARM evaluation system
2. Interfacing ADC and DAC.
3. Interfacing LED and PWM.
4. Interfacing real time clock and serial port.
5. Interfacing keyboard and LCD.
6. Interfacing EPROM and interrupt.
7. Mailbox. 76
8. Interrupt performance characteristics of ARM and FPGA.
9. Flashing of LEDS.
10. Interfacing stepper motor and temperature sensor.
11. Implementing zigbee protocol with ARM.

LEARNING RESOURCES:

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom's Category	**Continuous Assessment Tests**		**Terminal Examination**
	TEST - I	**TEST - II**	
Remember	15	15	30
Understand	5	5	10
Apply	-	-	60
Analysis	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total			**100**

Course Code:	DSP AND MICRO CONTROLLER LAB	L	T	P	Credit	CIA Marks **40**
Course Category: PCC		0	0	3	2	SEE Marks **60**

COURSE OBJECTIVES:

To provide training on programming of Microcontroller and DSP to understand the interface requirements.

COURSE OUTCOMES:

To understand and apply computing platform and software for engineering problems.

After the successful completion of the course students will be able to

COS NO.	Course Outcomes	Bloom's level
CO1	Write 8051 assembly language programs and embedded 'C' programs for microcontroller to implement arithmetic operations and code conversions.	Apply
CO2	Develop 8051 based embedded 'C' programs for ADC and DAC interfacing, 7 segment LCD/LED display, stepper motor interface, Relay interface	Apply

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	S	M	L	L	S	S	M	M
CO2	S	S	S	S	S	S	L	M	S	S	S	S

SYLLABUS:

LIST OF THE EXPERIMENTS:

Using Assembly/Embedded 'C' Program with 8051 microcontroller

1. Addition, Subtraction, Multiplication, Division
2. Interfacing of 7 segment LED/LCD display
3. Interfacing of ADC/DAC conversion
4. Interfacing of Stepper Motor
5. Relay Interface
6. Keyboard Interface
7. I2C based serial EEPROM/ RTC using I2C

Using Code Composer Studio with TMS320F2418 DSP

1. Study of special instruction in C2418 and its programming.
2. Waveform generation using C2418 and 12 bit DAC.
3. Generation of fixed pulse width modulation using full compare unit/ Generation of pulse width modulation with specified switching frequency.
4. Reading the analog voltage through on chip ADC module.
5. Generation of Sine pulse width modulation with constant output frequency.
6. Interfacing of limit switches and its programming/Interfacing of LCD display.

MODEL BASED DESIGN AND VERIFICATION USING SIMULINK AND REALIZATION WITH 2418.

1. Model based design to access Input port using Simulink and realized with c2418 kit.
2. Model based design to access pulse width modulator for generate fixed PWM using Simulink and realized with c2418 kit.

LEARNING RESOURCES:

Text Books:

1.John G. Proakis ,Dimitris K Manolakis , " Digital Signal Processing", Pearson Prentice Hall Publishing Ltd, 2007.

2.Kenneth J.Ayala, "The 8051 microcontroller Architecture, Programming and applications" ,Third edition,Cengage Learning India pvt ltd,2009.

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom's Category	**Continuous Assessment Tests**		**Terminal Examination**
	TEST - I	**TEST - II**	
Remember	15	15	30
Understand	5	5	10
Apply	-	-	60
Analysis	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total			**100**

ELECTIVE SUBJECTS

PROFESSIONAL ELECTIVE COURSE – I

(Information Technology)

A. Computer Architecture.

B. Java Programming and Applications [T & P]

C. Cloud Computing Fundamentals.

D. Fundamentals of big Data Analysis.

Course Code:	COMPUTER ARCHITECTURE	L	T	P	Credit	CIA Marks **40**
Course Category: PEC		3	0	0	3	SEE Marks **60**

COURSE OBJECTIVES:

- To have a thorough understanding of the basic structure and operation of a digital computer.
- To discuss in detail the Arithmetic and Logical operations, fixed and floating point operations including the algorithms & implementation.
- To study in detail the different types of controls and the concept of pipelining.
- To study in detail the different types of Bus, Memory systems and I/O systems.
- To study in detail the different types of parallel processor model and its architectures.

COURSE OUTCOMES:

- An ability to design the arithmetic and logical unit.
- An ability to implement different types of control and the concept of pipelining.
- An ability to select appropriate computer systems for given application domains.
- Understand what hardware and software problems will require solutions for future generations.
- Organize a modern computer system and be able to relate it to real examples.
- An ability to understand the various parallel processor model and architecture.

After the successful completion of the course students will be able to

COS NO.	Course Outcomes	Bloom's level
CO1	Understand the theory and architecture of central processing unit. Exemplify in a better way the I/O and memory organization.	Understand
CO2	Analyze some of the design issues in terms of speed, technology, cost, performance.	Understand
CO3	Design a simple CPU with applying the theory concepts.	Understand
CO4	Use appropriate tools to design verify and test the CPU architecture	Understand
CO5	Learn the concepts of parallel processing, pipelining and inter processor communication.	Apply
CO6	Define different number systems, binary addition and subtraction, 2's complement representation and operations with this representation.	Understand
CO7	Understand the architecture and functionality of central processing unit	Understand

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	M	S	M	L	L	S	S	L	M
CO2	S	S	S	S	S	M	L	L	S	S	L	L
CO3	S	S	M	M	S	M	L	L	S	S	M	L
CO4	S	S	M	M	S	L	L	L	S	M	M	M
CO5	S	S	M	M	M	L	L	-	S	M	M	L
CO6	S	S	M	M	M	L	L	-	M	M	-	M
CO7	S	M	M	M	M	L	L	-	M	M	-	L

SYLLABUS:

Module - I

BASIC STRUCTURE OF COMPUTER & INSTRUCTIONS

Functional components and operations of general computer system, Interconnection of components, Computer Evolution and Performance, Representation of Instructions- Machine instructions, Operands, Addressing modes, Instruction cycles, Instruction formats, Instruction sets, Instruction set architectures - CISC and RISC architectures.

Module - II

BASIC PROCESSING UNITS

Number Systems and conversions, Integer Arithmetic operations, Fixed and Floating point representation and operations, Organization of a processor - Single and Multiple bus organization, Processing units elements, Control unit, Data path in a CPU, Organization and operations of a control unit, Hardwired and Micro programmed control unit.

Module - III

MEMORY SYSTEM

Classification of memory - Internal Organization of a memory chip, Cache memories– Virtual memory – Secondary Storage devices Associative memories and Memory management requirements

Module - IV

I/O ORGANIZATION

Accessing I/O devices – Programmed Input/output –Interrupts – Direct Memory Access – Buses – Interface circuits – Standard I/O Interfaces (PCI, SCSI, USB).

Module – V

PIPELINING

Basic concepts – Single-Cycle versus Pipelined Performance- Pipeline Hazards- Data hazards- forwarding vs. stalling, Control hazards–Pipeline Data path and control – Branch prediction- Performance considerations.

LEARNING RESOURCES:

Text Books:

1. V. Carl, G. Zvonko and S. G. Zaky, “Computer organization”, McGraw Hill, 6th edition 2017.

2. J. L. Hennessy and D. A. Patterson, “Computer Architecture - A Quantitative Approach”, Morgan Kauffman, 5th2011.
3. Kai Hwang, “Advanced Computer Architecture, Parallelism, Scalability, Programmability”, McGraw Hill, 2003.

References:

1. W. Stallings, “Computer organization”, PHI, 8th 2010.
2. P. Barry and P. Crowley, “Modern Embedded Computing”, Morgan Kaufmann, 2012.
3. N. Mathivanan, “Microprocessors, PC Hardware and Interfacing”, Prentice Hall, 2004.
4. Y. C. Lieu and G. A. Gibson, “Microcomputer Systems: The 8086/8088 Family”, Prentice Hall India, 1986.
5. J. Uffenbeck, “The 8086/8088 Design, Programming, Interfacing”, Prentice Hall, 1987.
6. B. Govindarajalu, “IBM PC and Clones”, Tata McGraw Hill, 2 nd edition1991.
7. B. Brey and C. R. Sarma, “The Intel microprocessors”, Pearson Education, 2005.
8. P. Able, “8086 Assembly Language Programming”, Prentice Hall India.
9. Kai Hwang , Faye A. Briggs, “Computer Architecture and Parallel Processing”, McGraw-Hill series, 1985

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom’s Category	**Continuous Assessment Tests**		**Assignment (10)**	**Terminal Examination (60)**
	(15)	**(15)**		
Remember	7	0	10	20
Understand	8	-		15
Apply	0	8		10
Analysis	0	4		10
Evaluate	0	3		5
Create	0	0		0
Total	**15**	**15**		**60**
	A	**B**	**C**	**D**

A+B+C+D = 100

Course Code:	Java Programming and Applications [T & P]	L	T	P	Credit	CIA Marks **40**
Course Category: PEC		3	0	0	3	SEE Marks **60**

COURSE OBJECTIVES:

- To understand the concept of OOP as well as the purpose and usage principles of inheritance, polymorphism, encapsulation and method overloading.
- To identify classes, objects, members of a class and the relationships among them needed for a specific problem.
- To create Java application programs using sound OOP practices (e.g., interfaces and APIs) and proper program structuring (e.g., by using access control identifies, automatic documentation through comments, error exception handling)

COURSE OUTCOMES:

- Design, implement, test, debug, and document programs that use basic data types and computation, simple I/O, conditional and iterative structures, and functions.
- Describe and use the mechanics of parameter passing.
- Discuss and use primitive data types and User defined data types.

After the successful completion of the course students will be able to

COS NO.	Course Outcomes	Bloom's level
CO1	Design, implement, test, debug, and document programs that use basic data types and computation, simple I/O, conditional and iterative structures, and function.	Apply
CO2	Describe and use the mechanics of Interfaces and Packages.	Apply
CO3	Discuss and use of Multithread Programming.	Apply
CO4	Implement applet exception handling.	Apply
CO5	Develop network and window application using awt and swings.	Apply

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	S	S	M	S	S	M	M	S	M	M	S
CO2	S	M	S	M	S	S	S	M	S	L	M	S
CO3	S	S	M	S	S	M	M	M	S	M	M	S
CO4	M	M	S	M	M	M	S	S	S	M	M	S
CO5	S	S	S	M	S	S	M	S	S	M	M	S

SYLLABUS:

MODULE I

Introduction to Java: Fundamentals of OOPS-Java Evolution, Java Vs C++-JVM-Java Tokens-Constants, Data Types & Variables, Operators and Expressions-String Handling: String Basics, String Operations, Character Extraction, String Buffer, Arrays, Classes, objects and Methods, Final, Static- Exception Handling. : Types of Errors, Exceptions, Exception Handling Mechanisms, Advantages, Throwing User defined Exceptions-Exploring java.io: Buffered Input Stream& Buffered Output Stream-Modifiers-Inheritance.

MODULE II

Interfaces: Defining Interfaces, Extending Interfaces, Implementing Interfaces, Accessing Interfaces-Packages: Creating and Accessing Packages, Mechanisms of Using Packages, Hiding Classes, Import command.

MODULE III

Multithread Programming: Fundamental Concepts, Thread Creations, Thread Life Cycle, Thread Priorities and Thread Scheduling, Thread Synchronization, Inter Thread Communication- Managing I/O Files: Concepts of I/O Streams, Stream classes, character Streams, Byte Streams, File Streams, random Access Files, and Serializations-Exploring java.net: Inet Address, Server Socket, socket, Datagram Packet, Datagram Socket, and Multicast Socket.

MODULE IV

Exploring java.Util: collections, Enumerations, iterations, String Tokenizer, Bitset, Date, Calendar, Gregorian Calendar, Time Zone, Currency-Applet Programming: Applet Fundamentals-Java Application Vs Java Applets, Applet life Cycle, Building the Applet code, Running the Applet-Passing Parameters to Applet, Applet tag, Java Applet Package.

MODULE V

Exploring javax.swing: J Component, containers, panes, Layout Managers, Basic Components, Advanced Components-Handling Events: Listener, Interfaces and Adapter classed for various components-JDBC principles:

Exploring java.sql-connection, Driver Manager, Statement, Resultset, Callable statement, prepared Statement, Result set Metadata & Database Meta Data.

LEARNING RESOURCES:

Text Books:

1. Herbert Schildt, “Java The Complete Reference” , 8th Edition, Tata McGraw Hill,9th edition 2017.
2. James Jaworski, “Java Unleashed”, 4th revised edition, SAMS Techmedia Publications, Digitized-2010.

References:

1. Kogent Solution Inc ,Java 6 Programming Black Book, New Ed, Dreamtech Press, 2007
2. Campione, Walrath and Huml, “The Java Tutorial”, Addison Wesley,3rd edition 2001.
3. Elliotte Rusty Harold ,Java Network Programming, Second Edition, O'Reilly Media, Inc.", 4th edition 2013, (for Java.net package in Unit -III)
4. Java Database Programming Bible, John O’ Donahue, illustrated Edition, Wiley, 2002 (for Unit -V)

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom’s Category	**Continuous Assessment Tests**		**Assignment (10)**	**Terminal Examination (60)**
	(15)	**(15)**		
Remember	7	0	10	20
Understand	8	-		15
Apply	0	8		10
Analysis	0	4		10
Evaluate	0	3		5
Create	0	0		0
Total	**15**	**15**		**60**
	A	**B**	**C**	**D**

A+B+C+D = 100

Course Code:	JAVA PROGRAMMING LAB	L	T	P	Credit	CIA Marks **40**
Course Category: PEC		3	0	0	3	SEE Marks **60**

COURSE OBJECTIVES:

- To introduce the students to some concepts of advanced programming and practice on reusing components.
- To focuses on Graphical User Interface (GUI), multithreading, networking, and database manipulation.
- To develop applet programs and swing concepts.

COURSE OUTCOMES:

- Develop applications in Java.
- Use java libraries.
- Create packages and develop interfaces.

After the successful completion of the course students will be able to

Cos No.	Course Outcomes	Bloom's level
CO1	Understanding reference to an instance of a Class(object), methods	Understanding
CO2	Developing User defined packages in java	Apply
CO3	File operations in java	Apply

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	S	S	S	M	S	M	M	S
CO2	S	S	S	M	M	S	S	M	S	M	M	S
CO3	M	S	M	S	S	M	S	M	S	M	M	S

SYLLABUS:

LIST OF PROGRAMS

1. Simple Java Applications

a. For understanding reference to an instance of a Class(object), methods

b. Handling Arrays, Control statements and operators.

c. Handling Strings in java.

2. Package Creation

a. Developing User defined packages in java

3. Interface

a. Developing user-defined interfaces and implementation.

b. Use of predefined Interfaces.

4. Inheritance

a. Handling inheritance in java

5. Threading

a. Creation of thread in java applications.

b. Multithreading

6. Exception Handling Mechanisms

a. Handling pre-defined exceptions

b. Handling user-defined exceptions

7. File operations in java

8. Applets

a. Handling simple applet programs.

b. Creation of color Palette.

9. Swings

a. Handling Layouts in java

b. Handling Events in javax.swing

c. Handling swing controls.

10. Database connectivity

a. Handling backend connectivity for data retrieval

LEARNING RESOURCES:

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom's Category	**Continuous Assessment Tests**		**Terminal Examination**
	TEST - I	**TEST - II**	
Remember	15	15	30
Understand	5	5	10
Apply	-	-	60
Analysis	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total			**100**

Course Code:	CLOUD COMPUTING FUNDAMENTALS	L	T	P	Credit	CIA Marks **40**
Course Category: PEC		3	0	0	3	SEE Marks **60**

COURSE OBJECTIVES:

- To understand the concepts of virtualization and virtual machines
- To gain expertise in server, network and storage virtualization.
- To understand and deploy practical virtualization solutions and enterprise solutions

COURSE OUTCOMES:

- Employ the concepts of storage virtualization, network virtualization and its management
- Apply the concept of virtualization in the cloud computing
- Identify the architecture, infrastructure and delivery models of cloud computing

After the successful completion of the course students will be able to

COS NO.	Course Outcomes	Bloom's level
CO1	Define Cloud Computing and memorize the different Cloud service and deployment models.	Understand
CO2	Describe importance of virtualization along with their technologies.	Apply
CO3	Use and Examine different cloud computing services.	Apply
CO4	Analyze the components of open stack & Google Cloud platform and understand Mobile Cloud Computing.	Apply
CO5	Design & develop backup strategies for cloud data based on features.	Understand
CO6	Illustrate the capabilities of Cloud Security.	Apply

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	S	S	M	M	S	M	M	S
CO2	S	S	S	S	S	S	M	M	S	M	M	S
CO3	S	S	S	S	S	S	M	M	S	M	M	S

SYLLABUS:

MODULE I

VIRTUALIZATION

Basics of Virtual Machines - Process Virtual Machines – System Virtual Machines –Emulation – Interpretation – Binary Translation - Taxonomy of Virtual Machines. Virtualization –Management Virtualization –– Hardware Maximization – Architectures – Virtualization Management – Storage Virtualization – Network Virtualization

MODULE II

VIRTUALIZATION INFRASTRUCTURE

Comprehensive Analysis – Resource Pool – Testing Environment –Server Virtualization – Virtual Workloads – Provision Virtual Machines – Desktop Virtualization – Application Virtualization - Implementation levels of virtualization – virtualization structure – virtualization of CPU, Memory and I/O devices – virtual clusters and Resource Management – Virtualization for data center automation.

MODULE III

CLOUD PLATFORM ARCHITECTURE

Cloud deployment models: public, private, hybrid, community – Categories of cloud computing: everything as a service: infrastructure, platform, software .A generic cloud architecture design-layered cloud-architectural development-virtualization support and disaster recovery-architectural design challengers-public cloud platform-GAE, AWS-intercloud resource management

MODULE IV

PROGRAMMING MODEL

Introduction to Hadoop Framework - MapReduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job –Developing Map Reduce Applications - Design of Hadoop file system –Setting up Hadoop Cluster - Cloud Software Environments -Eucalyptus, Open Nebula, Open Stack, Nimbus

MODULE V

CLOUD SECURITY

Cloud Infrastructure security: network, host and application level – aspects of data security, provider data and its security, Identity and access management architecture, IAM practices in the cloud, SaaS, PaaS, IaaS availability in the cloud - Key privacy issues in the cloud –Cloud Security and Trust Management

LEARNING RESOURCES:

Text Books:

1. Danielle Ruest, Nelson Ruest, —Virtualization: A Beginner‟s Guide‖, McGraw-Hill Osborne Media, 1st edition 2009.
2. Jim Smith, Ravi Nair , "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 1st edition 2005

3. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.

References:

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 1st edition2013.
2. Tim Mather, SubraKumaraswamy, and ShahedLatif ,"Cloud Security and Privacy", O'Reilly Media, Inc.,2009.
3. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, 2009.
4. Tom White, "Hadoop: The Definitive Guide", Yahoo Press, 2012.

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom's Category	**Continuous Assessment Tests**		**Assignment (10)**	**Terminal Examination (60)**
	(15)	**(15)**		
Remember	7	0	10	20
Understand	8	-		15
Apply	0	8		10
Analysis	0	4		10
Evaluate	0	3		5
Create	0	0		0
Total	**15**	**15**		**60**
	A	**B**	**C**	**D**

A+B+C+D = 100

Course Code:	Fundamentals of Big Data Analysis	L	T	P	Credit	CIA Marks **40**
Course Category: PEC		3	0	0	3	SEE Marks **60**

COURSE OBJECTIVES:

- To study in detail aboutprinciple of big data architecture and its technology foundations
- To study Compare and contrast the nature of data in distributed file systems.

COURSE OUTCOMES:

- To understand the concept ofbig data perspective and its real world requirement.
- Determine the results of big data analysis using certain analytical techniques or tools.

After the successful completion of the course students will be able to

COS NO.	Course Outcomes	Bloom's level
CO1	Explain the big data perspective and its real world requirement.	Understand
CO2	Illustrate the working principle of big data architecture and its technology foundations.	Understand
CO3	Compare and contrast the nature of data in distributed file systems.	Understand
CO4	Utilize the hadoop platform to work on huge data.	Apply
CO5	Make use of certain analytical techniques on big data.	Apply
CO6	Determine the results of big data analysis using certain analytical techniques or tools.	Evaluate

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	M	S	S	M	M	S	M	M	S
CO2	S	S	S	M	S	S	S	M	S	M	M	S
CO3	S	S	S	M	S	S	S	M	S	M	M	S
CO4	S	S	S	M	S	S	M	S	S	M	M	S
CO5	S	S	S	M	S	S	S	M	S	M	M	S
CO6	S	S	S	M	S	S	M	M	S	M	M	S

SYLLABUS:

MODULE I

INTRODUCTION TO BIG DATA

Evolution of Big data – Best Practices for Big data Analytics – Big data characteristics – Validating – The Promotion of the Value of Big Data – Big Data Use Cases- Characteristics of Big Data Applications – Perception and Quantification of Value -Understanding Big Data Storage – A General Overview of High-Performance Architecture – HDFS – MapReduce and YARN – Map Reduce Programming Model

MODULE II

CLUSTERING AND CLASSIFICATION

Advanced Analytical Theory and Methods: Overview of Clustering – K-means – Use Cases – Overview of the Method – Determining the Number of Clusters – Diagnostics – Reasons to Choose and Cautions .- Classification: Decision Trees – Overview of a Decision Tree – The General Algorithm – Decision Tree Algorithms – Evaluating a Decision Tree – Decision Trees in R – Naïve Bayes – Bayes‘ Theorem – Naïve Bayes Classifier.

MODULE III

ASSOCIATION AND RECOMMENDATION SYSTEM

Advanced Analytical Theory and Methods: Association Rules – Overview – Apriori Algorithm – Evaluation of Candidate Rules – Applications of Association Rules – Finding Association& finding similarity – Recommendation System: Collaborative Recommendation- Content Based Recommendation – Knowledge Based Recommendation- Hybrid Recommendation Approaches.

MODULE IV

STREAM MEMORY

Introduction to Streams Concepts – Stream Data Model and Architecture – Stream Computing, Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating moments – Counting oneness in a Window – Decaying Window – Real time Analytics Platform(RTAP) applications – Case Studies – Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics

MODULE V

NOSQL DATA MANAGEMENT FOR BIG DATA AND VISUALIZATION

NOSQL Databases : Schema-less Models‖: Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores – Tabular Stores – Object Data Stores – Graph Databases Hive – ShardingHbase – Analyzing big data with twitter – Big data for E-Commerce Big data for blogs – Review of Basic Data Analytic Methods using R.

LEARNING RESOURCES:

TEXT BOOKS:

1. Bill Franks, —Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics‖, Wiley and SAS Business Series, 2012.

2. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.
3. Michael Berthold, David J. Hand, —Intelligent Data Analysis‖, Springer, Second Edition, 2007.

REFERENCES:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
3. Richard Cotton, "Learning R – A Step-by-step Function Guide to Data Analysis, , O'Reilly Media, 2013

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom's Category	**Continuous Assessment Tests**		**Assignment (10)**	**Terminal Examination (60)**
	(15)	**(15)**		
Remember	7	0	10	20
Understand	8	-		15
Apply	0	8		10
Analysis	0	4		10
Evaluate	0	3		5
Create	0	0		0
Total	**15**	**15**		**60**
	A	**B**	**C**	**D**

A+B+C+D = 100

PROFESSIONAL ELECTIVE COURSE – II

(Machines & Drives)

A. Electrical Machine Design [T & P]

B. Special Electrical Machines

C. Control and Maintenance of Electrical Equipments

D. Electrical Energy Conservation and Auditing

E. Electrical Safety and Management

Course Code:	Electrical Machine Design [T & P]	L	T	P	Credit	CIA Marks **40**
Course Category: PEC		3	0	0	3	SEE Marks **60**

COURSE OBJECTIVES:

- To study MMF calculation and thermal rating of various types of electrical machines.
- To design armature and field systems for D.C. machines.
- To design core, yoke, windings and cooling systems of transformers.

COURSE OUTCOMES:

Ability to model and analyze electrical apparatus and their application to power system.

After the successful completion of the course students will be able to

COS NO.	Course Outcomes	Bloom's level
CO1	Calculation of MMF for air gap and teeth sections.	Apply/ Analysis
CO2	Explain heating and cooling characteristics of rotating machines.	Understand/ Remember
CO3	Derive the output equations of DC and AC Machines.	Apply/ Understand
CO4	Design of main dimensions of DC & AC machines and transformers.	Apply
CO5	Explain the concept of computer aided design.	Understand/ Remember
CO6	Concept of analysis and synthesis methods.	Understand

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	S	M	M	M	S	M	M	S
CO2	S	S	S	S	S	M	M	M	S	S	S	S
CO3	S	S	S	S	S	M	M	M	S	S	M	S
CO4	S	S	S	S	S	S	M	M	S	M	M	S
CO5	S	S	S	S	S	S	M	M	S	S	M	S
CO6	S	S	S	S	S	M	M	M	S	S	M	S

SYLLABUS:

MODULE I

MAGNETIC CIRCUIT CALCULATIONS

Magnetization characteristics - loss curves - estimation of total mmf - mmf for airgap - mmf for teeth - significance of Carter's coefficient - real and apparent flux densities - leakage flux - Leakage reactance in transformer - leakage reactance in rotating machines - Heating and cooling characteristics.

MODULE II

DESIGN OF DC MACHINES

Standard specifications - output equation - output coefficient - choice of specific magnetic and electric loadings - choice of number of poles - length of airgap - design of armature slot - dimensions of pole - design of field windings - design of commutator and brushes - design of interpole and its winding.

MODULE III

DESIGN OF TRANSFORMERS

Design of transformers - standard specification - EMF per turn - output equation - window space factor - specific loadings - dimensions of core and yoke - design of winding - cooling tubes - estimation of no load current of transformer - change of parameters with change of frequency.

MODULE IV

DESIGN OF SYNCHRONOUS MACHINES

Standard specifications - output equation - choice of specific loadings - design of salient pole machines - short circuit ratio - length of air gap - armature design - design of rotor - design of damper winding -design of turbo alternator design of three phase induction motor - output equation - choice of specific loadings - main dimensions - design of stator windings and core - length of air gap - design of cage rotor - design of wound rotor.

MODULE V

COMPUTER AIDED DESIGN

Introduction of computer aided design - advantages - methods of approach- Analysis method - synthesis method – optimization - general procedure - variables and constraints - optimal design of power transformer - optimal design of induction motor - optimal design of synchronous machine.

(Only for Demo) Design of DC Machines, Single phase &Three phase Transformer, Single phase & Three phase induction motor, Synchronous Machines using MAGNET Software.

LEARNING RESOURCES:

Text Books:

1. A course in Electrical Machine Design A.K.Sawhney, Dhanpatrai& co, 2016.
2. Principles of Electrical Machine Design, R.K.Agarwal, S.K.Kataria& sons, 1997.
3. Computer Aided Design of Electrical Equipment, M.Ramamoorthy, Associated East West Press, 2008.

References:

1. The Performance and Design of DC Machines, Clayton & Hancock, oxford and IBH Publishing co, 2004.
2. The Performance and Design of AC Machines, M.G.Say, ELBS, 3rd edition2002.
3. Electrical Machine Design Data Book, A.Shanmugasundram,G.Gangadhar&R.palani, wileyEstern Ltd., NewDelhi, 1979.

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom's Category	**Continuous Assessment Tests**		**Assignment (10)**	**Terminal Examination (60)**
	(15)	**(15)**		
Remember	7	0	10	20
Understand	8	-		15
Apply	0	8		10
Analysis	0	4		10
Evaluate	0	3		5
Create	0	0		0
Total	**15**	**15**		**60**
	A	**B**	**C**	**D**

A+B+C+D = 100

Course Code:	SPECIAL ELECTRICAL MACHINES	L	T	P	Credit	CIA Marks **40**
Course Category: PEC		3	0	0	3	SEE Marks **60**

COURSE OBJECTIVES:

- To impart knowledge on Construction, principle of operation and performance of synchronous reluctance motors.
- To impart knowledge on the Construction, principle of operation, control and performance of stepping motors.
- To impart knowledge on the Construction, principle of operation, control and performance of switched reluctance motors.

COURSE OUTCOMES:

Ability to model and analyze electrical apparatus (machines) and their application to power system

After the successful completion of the course students will be able to

COS NO.	Course Outcomes	Bloom's level
CO1	Illustrate the basic construction and operating principle of synchronous reluctance motor, SRM, Stepper motor, PMSM, PMBLDC motor and linear induction motor	Understand
CO2	Explain the motor characteristics, power input and torque developed for Synchronous Reluctance Motor, SRM, Stepper motor.PMSM and PMBLDC Motor	Understand
CO3	Develop the drive systems and control schemes for stepper motors. SRM, PMSM and PMBLDC motor	Apply
CO4	Select the suitable special purpose motor for the specific application	Apply
CO5	Explain the Microprocessor /DSP based control of stepper motors, SRMPMSM and PMBLDC motor	Understand
CO6	Analyse the performance of a drive system using Matlab-Simulink	Analyse

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PSO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	S	S	S	S	S	M	M	S
CO2	S	S	S	M	S	S	S	M	S	M	S	S
CO3	M	M	M	S	S	S	S	S	S	S	S	S
CO4	S	M	S	S	M	M	M	S	M	S	S	S
CO5	S	S	S	M	S	S	S	M	M	M	M	S
CO6	M	S	S	S	S	S	S	S	S	S	S	S

SYLLABUS:

MODULE I

SYNCHRONOUS RELUCTANCE MOTORS

Constructional features – types – axial and radial air gap motors – operating principle – reluctance – phasor diagram - characteristics – Vernier motor.

MODULE II

STEPPING MOTORS

Constructional features – principle of operation – variable reluctance motor – Hybrid motor – single and Multi stack configurations – theory of torque predictions – linear and non-linear analysis – characteristics – drive circuits.

MODULE III

SWITCHED RELUCTANCE MOTORS

Constructional features – principle of operation – torque prediction – power controllers –Nonlinear analysis – Microprocessor based control - characteristics – computer control.

MODULE IV

PERMANENT MAGNET BRUSHLESS D.C. MOTORS

Principle of operation – types – magnetic circuit analysis – EMF and Torque equations – Power Controllers – Motor characteristics and control.

MODULE V

PERMANENT MAGNET SYNCHRONOUS MOTORS

Principle of operation – EMF and torque equations – reactance – phasor diagram – power controllers - converter - volt-ampere requirements – torque speed characteristics - microprocessor based control.

LEARNING RESOURCES:

Text Books:

1. Miller, T.J.E., “Brushless Permanent Magnet and Reluctance Motor Drives”, Clarendon Press, Oxford, 1989.
2. Aearnley,P.P., “Stepping Motors - A Guide to Motor Theory and Practice”, Peter Perengrinus, London, 4th edition 2002.

References:

1. Kenjo T., “Stepping Motors and their microprocessor Controls”, Claredon Press London, 1995.
2. Kenjo T and Nagamori S., “Permanent Magnet and Brushless DC Motors”, Clarendon Press, London, 1988.

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom’s Category	**Continuous Assessment Tests**		**Assignment (10)**	**Terminal Examination (60)**
	(15)	**(15)**		
Remember	7	0	10	20
Understand	8	-		15
Apply	0	8		10
Analysis	0	4		10
Evaluate	0	3		5
Create	0	0		0
Total	**15**	**15**		**60**
	A	**B**	**C**	**D**

A+B+C+D = 100

Course Code:	CONTROL AND MAINTENANCE OF ELECTRICAL EQUIPMENTS	L	T	P	Credit	CIA Marks **40**
Course Category: PEC		3	0	0	3	SEE Marks **60**

COURSE OBJECTIVES:

- To enable the students to understand the basic operation of Electrical Equipments.
- To enable the students to understand the principle of control and maintenanceof Electrical Equipments.

COURSE OUTCOMES:

Ability to understand the basic things about the control as well as maintenance of electrical equipments.

After the successful completion of the course students will be able to

COS NO.	Course Outcomes	Bloom's level
CO1	Symbols for various components, Control diagram- Two wire control circuit, Three wire control circuit	Remember
	Primary cell – storage batteries	
	Requirements of electric drive, Solid state devices used in electric drive	
CO2	Fuses and combination fuse switch units, Miniature circuit breaker, Contactors-Solenoid type, Clapper type, Over-load relays-Thermal over-load relay, Ratchet type over load relay, Magnetic over load relay, Dash pot type oil filled relay, Timing relays, Phase failure relay, Push buttons, Selector switches, Limit switches – types, Temperature controller (Thermostat), Float switches, Mechanical brakes for motors, Control transformer	Understand
CO3	Forward/reversing of 3 phase motors-With push button inter-locking, withAuxillary contact inter-locking, Sequence starting of motors, Starting multispeed squirrel cage motor, Dynamic braking of squirrel cage induction motor, Plugging of squirrel cage induction motor, Over-load protection of motors, Single phase protection, Over-temperature protection, Voltage stabilizer for 3 phase and single phase motors	Apply
	Requirements of electric drive, Solid state devices used in electric drive – DC Motor Drives – AC Motor Drives	
	care – service and maintenance of motors	
CO4	Preventive and predictive maintenance of electric machines	Analysis
	selection of batteries- troubleshooting of batteries	
	Maintenance management of rotating machines	
	Mechanical Maintenance	
CO5	Digital UPS testing systems	Evaluate

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	M	S	S	S	S	S	S	S	S
CO3	S	S	M	S	S	M	S	S	M	S	M	S
CO4	M	M	S	S	S	S	M	M	S	M	M	M
CO5	S	S	S	M	S	S	S	S	S	S	S	S

SYLLABUS:

MODULE I

Control Components

Fuses and combination fuse switch units, Miniature circuit breaker, Contactors-Solenoid type, Clapper type, Over-load relays-Thermal over-load relay, Ratchet type over load relay, Magnetic over load relay, Dash pot type oil filled relay, Timing relays, Phase failure relay, Push buttons, Selector switches, Limit switches – types, Temperature controller (Thermostat), Float switches, Mechanical brakes for motors, Control transformer, Symbols for various components, Control diagram- Two wire control circuit, Three wire control circuit.

MODULE II

A.C. Control Circuits

Forward/reversing of 3 phase motors-With push button inter-locking, withAuxillary contact inter-locking, Sequence starting of motors, Starting multispeed squirrel cage motor, Dynamic braking of squirrel cage induction motor, Plugging of squirrel cage induction motor, Over-load protection of motors, Single phase protection, Over-temperature protection, Voltage stabilizer for 3 phase and single phase motors.

MODULE III

Control of Electric Drives

Requirements of electric drive, Solid state devices used in electric drive – DC Motor Drives – AC Motor Drives.

MODULE IV

Maintenance of Rotating Machines

Mechanical – site testing and checking – care – service and maintenance of motors - Maintenance management of rotating machines, Preventive and predictive maintenance of electric machines.

MODULE V

Maintenance of Batteries

Primary cell – storage batteries; charging and maintenance – fuel cells, fuels and fuel cell power plants - acid water - selection of batteries- troubleshooting of batteries – Digital UPS testing systems.

LEARNING RESOURCES:

Text Books:

1. Electric Contacts- Theory and Application by RagnarHalm; Springer Publication 1967
2. Industrial Electronics & Control by S.K. Bhattacharya & S. Chatterji; New AgeInternational Publications(P) Ltd., New Delhi, 2017
3. Testing, Commissioning, Operation and Maintenance of Electrical Equipment by S Rao,Khanna Technical Publication, New Delhi.6th edition1991

References:

1. Preventive Maintenance of Electrical Apparatus by SK Sharotri, Katson Publishing House, Ludhiana.2nd edition1980
2. Installation and Maintenance of Electrical Equipment by Praveen Kumar, North Publication, Jalandhar.

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom's Category	**Continuous Assessment Tests**		**Assignment (10)**	**Terminal Examination (60)**
	(15)	**(15)**		
Remember	7	0	10	20
Understand	8	-		15
Apply	0	8		10
Analysis	0	4		10
Evaluate	0	3		5
Create	0	0		0
Total	**15**	**15**		**60**
	A	**B**	**C**	**D**

A+B+C+D = 100

Course Code:	ELECTRICAL ENERGY CONSERVATION AND AUDITING	L	T	P	Credit	CIA Marks **40**
Course Category: PEC		3	0	0	3	SEE Marks **60**

COURSE OBJECTIVES:

- Understand the methods of improving energy efficiency in different electrical systems.
- Understand the concepts of different energy efficient devices.

COURSE OUTCOMES:

- Understand the current energy scenario and importance of energy conservation.
- Understand the concepts of energy management.

After the successful completion of the course students will be able to

COS NO.	Course Outcomes	Bloom's level
CO1	To have knowledge in the concepts of Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply.	Knowledge
CO2	To analyze the importance of Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents .	Analyze
CO3	To understand and apply the concepts of energy management (audit) approach understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments.	Understand & Apply
CO4	To evaluate the concepts of .Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses. Electric motors: Types, losses in induction motors, motor efficiency.	Evaluate
CO5	To evaluate the concepts of Compressed Air System: Types of air compressors, compressor efficiency, efficient compressor operation, Compressed air system components, capacity assessment, leakage test, factors the performance and savings opportunities in HVAC, Fans and blowers: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Pumps and Pumping System: Types, performance evaluation.	Evaluate
CO6	To analyze the concepts of Maximum demand controllers, automatic power factor controllers, energy efficient motors, soft starters with energy saver, variable speed drives, energy efficient transformers etc.	Analyze

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	S	S	S	S	S	S	S	S
CO2	S	M	S	S	S	S	S	S	S	S	M	M
CO3	M	S	M	M	M	S	S	S	S	S	S	S
CO4	S	S	S	S	M	M	M	M	M	M	S	S
CO5	S	M	S	S	S	S	S	S	S	S	M	S
CO6	M	S	M	M	S	S	S	S	S	S	S	S

SYLLABUS:

MODULE I

ENERGY SCENARIO

Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features.

MODULE II

BASICS OF ENERGY AND ITS VARIOUS FORMS

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

MODULE III

ENERGY MANAGEMENT & AUDIT

Definition, energy audit, need, types of energy audit. Energy management (audit) approach understanding energy costs, bench marking, energy audit instruments. Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams.

MODULE IV

ENERGY EFFICIENCY IN ELECTRICAL SYSTEMS

Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses. Electric motors: Types, losses in induction motors.

MODULE V

ENERGY EFFICIENCY IN INDUSTRIAL SYSTEMS

Compressed Air System: Types of air compressors, compressor efficiency, efficient compressor operation, Compressed air system components, capacity assessment, leakage test, factors affecting the performance and savings opportunities in HVAC, Fans and blowers: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Pumps and Pumping System: Types, Cooling Tower: Types and performance evaluation,

LEARNING RESOURCES:

Text Books:

1. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects (available online)
2. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-3, Electrical Utilities (available online)
3. S. C. Tripathy, “Utilization of Electrical Energy and Conservation”, McGraw Hill, 1991.
4. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org) 2015.

References:

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

Bloom’s Category	**Continuous Assessment Tests**		**Assignment (10)**	**Terminal Examination (60)**
	(15)	**(15)**		
Remember	7	0	10	20
Understand	8	-		15
Apply	0	8		10
Analysis	0	4		10
Evaluate	0	3		5
Create	0	0		0
Total	**15**	**15**		**60**
	A	**B**	**C**	**D**

A+B+C+D = 100

Course Code:	ELECTRICAL SAFETY AND MANAGEMENT	L	T	P	Credit	CIA Marks **40**
Course Category: PEC		3	0	0	3	SEE Marks **60**

COURSE OBJECTIVES:

- Explain the importance of electrical safety measurements tools available.
- Different types of grounding methods for electrical equipment.
- Necessary core to handle electrical protection systems.

COURSE OUTCOMES:

- It gives a very comprehensive idea about safety measures to be undertaken by the person before attains any electrical failure.

After the successful completion of the course students will be able to

COS NO.	Course Outcomes	Bloom's level
CO1	To understand different types of protection systems ,electrical hazards and safety equipments	Understand
CO2	To analyse the importance of grounding of electrical equipment- hot sticks, insulated tools, barriers and signs, safety tags, locking devices- voltage measuring instruments- proximity and contact testers.	Analyze
CO3	To understand the six step safety methods- pre job briefings- hot -work decision tree-safe switching of power system lockout-tag out- safety equipment.	Understand
CO4	To evaluate Electrical safety programme structure, development- company safety team- safety policy- programme implementation- employee electrical safety teams- safety meetings- safety audit- accident prevention- first aid- rescue techniques-accident investigation.	Evaluate
CO5	To apply Safety related case for electrical maintenance-reliability centered maintenance (RCM) - eight step maintenance programme- frequency of maintenance-maintenance requirement for specific equipment.	Apply

Mapping of Course Outcome to Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S	S	S

SYLLABUS:

Module I

Primary and secondary hazards- arc, blast, shocks-causes and effects-safety equipment- flash and thermal protection, head and eye protection-rubber insulating equipment.

Module II

General requirements for grounding and bonding- definitions- grounding of electrical equipment- hot sticks, insulated tools, barriers and signs, safety tags, locking devices- voltage measuring instruments- proximity and contact testers- safety electrical one line diagram- electrician’s safety kit.

Module III

The six step safety methods- pre job briefings- hot -work decision tree-safe switching of power system lockout-tag out- safety equipment , procedure for low, medium and high voltage systems- the one minute safety audit .

Module IV

Electrical safety programme structure, development- company safety team- safety policy- programme implementation- employee electrical safety teams- safety meetings- safety audit- accident prevention- first aid- rescue techniques- accident investigation.

Module V

Safety related case for electrical maintenance- reliability centered maintenance (RCM) - eight step maintenance programme- frequency of maintenance- maintenance requirement for specific equipment and location- regulatory bodies-

LEARNING RESOURCES:

Text Books:

1. Dennis Neitzel, Al Winfield,'Electrical Safety Handbook', McGraw-Hill Education , 4th Edition,2012.

References:

1. John Cadick, 'Electrical Safety Handbook', McGraw-Hill School Education Group,July 2019.
2. Maxwell Adams.J, "Electrical safety- a guide to the causes and prevention of electric hazards",The Institution of Electric Engineers, 1994.
3. Ray A. Jones, Jane G. Jones, 'Electrical safety in the workplace', Jones & Bartlett Learning, 2000.

Online resources:

1. www.nptl.co.in
2. www.electrical4u.com

ASSESSMENT PATTERN:

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Evaluate	0	3		5
Create	0	0		0
Total	**15**	**15**		**60**
	A	**B**	**C**	**D**

A+B+C+D = 100