MUTHAYAMMAL ENGINEERING COLLEGE

An Autonomous Institution

(Approved by AICTE | Accredited by NBA & NAAC | Affiliated to Anna University)
Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.

Curriculum/Syllabus

Programme Code : EE

Programme Name : B.E.-Electrical and Electronics Engineering

Regulation : 2023

MUTHAYAMMAL ENGINEERING COLLEGE

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Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.

Ph. No.: 04287-220837
Email: info@mec.ac.in

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Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.

DESIGNING YOUR FUTURE
Estd. 2000

Institution Vision & Mission

Institution Vision

- To be a Centre of Excellence in Engineering, Technology and Management on par with International Standards.

Institution Mission

- To prepare the students with high professional skills and ethical values.
- To impart knowledge through best practices.
- To instill a spirit of innovation through Training, Research and Development.
- To undertake continuous assessment and remedial measures.
- To achieve academic excellence through intellectual, emotional and social stimulation.

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Department Vision & Mission

Department Vision

- To produce competent Electrical and Electronics Engineers with advanced skills and knowledge to contribute the society.

Department Mission

- To establish the advance laboratories to enable the students to face the challenges in Electrical and Electronics industries
- To enable collaborative research in contemporary and sustainable technologies in Electrical and Electronics Engineering
- To produce Electrical and Electronics Engineering graduates with quest for excellence, enthusiasm for continuous learning, ethical behavior, integrity and exceptional leadership.

Program Educational Objectives

PEO1 : Graduate should be able to Practice as an Engineer in the Electrical and Electronics industries and become an entrepreneur.

PEO2 : Graduate should be able to pursue higher education and research for professional development.

PEO3 : Graduate should be able to Exhibit the leadership skills and ethical value for society.

Program Specific Outcomes

PSO1 : Apply mathematical and engineering knowledge for designing Electrical and Electronics systems

PSO2 : Derive sustainable solutions for complex Electrical and Electronics Engineering problems

PSO3 : Use modern software tools and techniques related to Electrical and Electronics Engineering industry

Program Outcomes

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

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

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

PO4 : **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

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

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

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

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

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

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

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

PO12 : **Lifelong learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

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B.E. - Electrical and Electronics Engineering
Grouping of Courses

I. Humanities and Social Sciences Courses (HS)

Sl.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week/ Credit			
					L	T	P	C
1.	23HSS01	Technical and Communicative English – I	HS	4	3	0	0	3
2.	23HSS02	Technical and Communicative English – II	HS	4	3	0	0	3
3.	23HSS03	Technical English for Engineers	HS	3	2	0	0	2
4.	23HSS04	Communicative English for Engineers	HS	3	2	0	0	2
5.	23HSS05	Commercial English	HS	3	2	0	0	2
6.	23HSS06	Basics of Japanese Language	HS	3	2	0	0	2
7.	23HSS07	Basics of French	HS	3	2	0	0	2
8.	23HSS08	Heritage of Tamils	HS	2	1	0	0	1
9.	23HSS09	Tamils and Technology	HS	2	1	0	0	1

II. Basic Sciences (BS)

1.	23BSS01	Engineering Physics	BS	4	3	0	0	3
2.	23BSS02	Physics Laboratory	BS	3	0	0	2	2
3.	23BSS03	Bio and Nanomaterial Sciences	BS	4	3	0	0	3
4.	23BSS04	Materials Science	BS	4	3	0	0	3
5.	23BSS05	Applied Physics	BS	4	3	0	0	3
6.	23BSS11	Engineering Chemistry	BS	4	3	0	0	3
7.	23BSS12	Chemistry Laboratory	BS	3	0	0	2	2
8.	23BSS13	Applied Chemistry	BS	4	3	0	0	3
9.	23BSS21	Algebra and Calculus	BS	5	3	1	0	4
10.	23BSS22	Advanced Calculus and Complex Analysis	BS	5	3	1	0	4
11.	23BSS23	Differential Equations and Vector Analysis	BS	5	3	1	0	4
12.	23BSS24	Transforms and Partial Differential Equations	BS	5	3	1	0	4
13.	23BSS25	Discrete Mathematics	BS	5	3	1	0	4
14.	23BSS26	Statistics and Queueing Model	BS	5	3	1	0	4
15.	23BSS27	Statistics and Numerical Methods	BS	5	3	1	0	4
16.	23BSS28	Numerical Methods	BS	5	3	1	0	4
17.	23BSS29	Probability and Random Processes	BS	5	3	1	0	4

III. General Engineering Science (GES)								
1.	23GES01	Programming for Problem Solving Using C	GES	3	3	0	0	3
2.	23GES02	Programming in C Laboratory	GES	3	0	0	2	1
3.	23GES03	Python Programming	GES	3	3	0	0	3
4.	23GES04	Computer Peripherals and Programming Essentials	GES	3	3	0	0	3
5.	23GES05	Python Programming Laboratory	GES	3	0	0	2	1
6.	23GES06	Electrical and Electronics Sciences	GES	3	3	0	0	3
7.	23GES07	CAD Laboratory	GES	4	0	0	4	2
8.	23GES08	Electric Circuits	GES	4	2	2	0	4
9.	23GES09	Engineering Mechanics for Electrical Engineers	GES	3	3	0	0	3
10.	23GES10	Engineering Graphics	GES	3	3	0	0	3
11.	23GES11	Engineering Drawing	GES	3	3	0	0	3
12.	23GES12	Mechanical and Building Sciences	GES	3	3	0	0	3
13.	23GES13	Data Structures using Python	GES	3	3	0	0	3
14.	23GES14	Electronics Product Design	GES	3	3	0	0	3
15.	23GES15	Manufacturing Processes	GES	3	3	0	0	3
16.	23GES16	Fundamentals of Civil Engineering	GES	3	3	0	0	3
17.	23GES17	Bioorganic Chemistry	GES	3	3	0	0	3
18.	23GES18	Basic Electrical and Electronics Engineering	GES	3	3	0	0	3
19.	23GES19	Engineering Mechanics	GES	3	3	0	0	3
20.	23GES20	Basics of Human Anatomy	GES	3	3	0	0	3
21.	23GES21	Engineering Practices Laboratory	GES	3	0	0	4	2
22.	23GES22	Computer Aided Building Drawing Laboratory	GES	3	0	0	4	2
23.	23GES23	Bioorganic Chemistry Laboratory	GES	3	0	0	4	2
24.	23GES24	Electric Circuits Laboratory	GES	2	0	0	2	1
25.	23GES25	Electrical Drives and Controls	GES	3	3	0	0	3
26.	23GES26	Electrical Drives and Controls Laboratory	GES	2	0	0	2	1
27.	23GES27	Electronic Devices and Circuits	GES	3	3	0	0	3
28.	23EES28	Electron Devices and Integrated Circuits Laboratory	GES	2	0	0	2	1
29.	23GES29	Renewable Energy Sources	GES	3	3	0	0	3

IV. Professional Core (PC)								
1.	23EEC01	Electromagnetic Fields	PC	3	2	1	0	3
2.	23EEC02	Measuring and Instrumentation	PC	3	3	0	0	3
3.	23EEC03	Linear Integrated Circuits	PC	3	3	0	0	3
4.	23EEC04	DC Machines and Transformers	PC	4	3	1	0	4
5.	23EEC05	Induction and Synchronous Machines	PC	4	3	1	0	4
6.	23EEC06	Control Systems	PC	4	2	2	0	4

7.	23EEC07	Power Electronics	PC	3	3	0	0	3
8.	23EEC08	Electrical Drives	PC	3	3	0	0	3
9.	23EEC09	Micro-computing-based system design	PC	3	3	0	0	3
10.	23EEC10	Power System Analysis	PC	4	3	1	0	4
11.	23EEC11	Operation and Control of Electrical Power Systems	PC	3	3	0	0	3
12.	23EEC12	Transmission and Distribution	PC	3	3	0	0	3
13.	23EEC13	Protection and switchgear	PC	3	3	0	0	3
14.	23EEC14	Network Analysis and Synthesis	PC	3	2	1	0	3
15.	23EEC16	DC machines and Transformers Laboratory	PC	2	0	0	2	1
16.	23EEC17	AC Machines Laboratory	PC	2	0	0	2	1
17.	23EEC18	Control System Laboratory	PC	2	0	0	2	1
18.	23EEC19	Power Electronics Laboratory	PC	2	0	0	2	1
19.	23EEC20	Power System Simulation Laboratory	PC	2	0	0	2	1
20.	23EEC21	Micro-computing-based system design Laboratory	PC	2	0	0	2	1

V. Professional Elective (PE)								
1.	23EEE01	Power System Stability	PE	3	3	0	0	3
2.	23EEE02	Communication Engineering	PE	3	3	0	0	3
3.	23EEE03	Special Electrical Machines	PE	3	3	0	0	3
4.	23EEE04	Design of Electrical Apparatus	PE	3	2	1	0	3
5.	23EEE05	Flexible AC Transmission Systems	PE	3	3	0	0	3
6.	23EEE06	HVDC Transmission Systems	PE	3	3	0	0	3
7.	23EEE07	Power Plant Engineering	PE	3	3	0	0	3
8.	23EEE08	Total Quality Management	PE	3	3	0	0	3
9.	23EEE09	VLSI Design	PE	3	3	0	0	3
10.	23EEE10	Power Quality	PE	3	3	0	0	3
11.	23EEE11	Emerging Intelligent Techniques	PE	3	3	0	0	3
12.	23EEE12	Electric Energy Utilization and Conservation	PE	3	3	0	0	3
13.	23EEE13	DC micro Grid	PE	3	3	0	0	3
14.	23EEE14	Wind and Solar Energy Systems	PE	3	3	0	0	3
15.	23EEE15	Robotics and Controls	PE	3	3	0	0	3
16.	23EEE16	Fiber Optics	PE	3	3	0	0	3
17.	23EEE17	Human Computer Interaction	PE	3	3	0	0	3
18.	23EEE18	Electric Vehicles	PE	3	3	0	0	3
19.	23EEE19	Electrical Safety and Energy Management	PE	3	3	0	0	3
20.	23EEE20	Smart Grid	PE	3	3	0	0	3
21.	23EEE21	Embedded Systems & IOT	PE	3	3	0	0	3
22.	23EEE22	UPS & SMPS	PE	3	3	0	0	3
23.	23EEE23	Industry 4.0	PE	3	3	0	0	3

24.	23EEE24	Battery Management Systems	PE	3	3	0	0	3
25.	23EEE25	Illumination Engineering	PE	3	3	0	0	3
26.	23EEE26	Artificial Intelligent and Data Science applied to Electrical Engineering	PE	3	3	0	0	3
27.	23EEE27	Cyber Physics and Cyber Security	PE	3	3	0	0	3
28.	23EEE28	Restructured Power System	PE	3	3	0	0	3
29.	23EEE29	Power Semiconductor Devices	PE	3	3	0	0	3
30.	23EEE30	Sensing Techniques and Sensors System	PE	3	3	0	0	3
31.	23EEE31	Testing and Calibration System	PE	3	3	0	0	3
32.	23EEE32	PLC and Automation	PE	3	3	0	0	3
33.	23EEE33	Embedded Systems & IOT Laboratory	PE	2	0	0	2	1
34.	23EEE34	High Voltage Engineering	PC	3	3	0	0	3
35.	23EEC35	Power System Transients	PC	3	3	0	0	3

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VI. Employability Enhancement Courses (EEC)								
1.	23EES01	Project work - I	EEC	6	0	0	6	3
2.	23EES02	Project Work II & Dissertation	EEC	18	0	0	18	9
3.	23EEI01	Internship - I	EEC	2	0	0	2	1
4.	23EEI02	Internship – II	EEC	2	0	0	2	1
5.	23EEI03	Internship – III	EEC	2	0	0	2	1
6.	23EED01	Mini Project	EEC	2	0	0	2	1
7.	23EEK01	Soft skill – I	EEC	2	0	0	2	1
8.	23EEP02	Professional Skill - II	EEC	2	0	0	2	1

VII. Mandatory Courses (MC)								
1.	23EEM01	Constitution Of India and Professional Ethics	EEM	0	0	0	0	0
2.	23EEM02	Disaster Risk Reduction and Management	EEM	0	0	0	0	0

17/6/2023

The Chairman
Board of Studies,
Department of Electrical and Electronics Engineering
Muthayammal Engineering College (Autonomus)
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B.E. - Electrical and Electronics Engineering
Curriculum | UG - R2023
Semester -I

Sl.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week/ Credit			
					L	T	P	C
Theory								
1.	23HSS01	Technical and Communicative English I	HS	3	0	0	3	3
2.	23BSS21	Algebra and Calculus	BS	3	1	0	4	4
3.	23BSS11	Engineering Chemistry	BS	3	0	0	3	3
4.	23GES09	Engineering Mechanics for Electrical Engineers	GES	3	0	0	3	3
5.	23GES10	Engineering Graphics	GES	3	0	0	3	3
6.	23HSS08	Heritage of Tamils	HS	1	0	0	1	1
Practical								
7.	23BSS12	Chemistry Laboratory	BS	0	0	4	4	2
8.	23GES07	CAD Laboratory	GES	0	0	4	4	2
							Total Credit	**21**

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Curriculum | UG - R2023

Semester -II

Sl.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week/ Credit			
					L	T	P	C
Theory								
1.	23HSS02	Technical and Communicative English II	HS	3	0	0	3	3
2.	23BSS22	Advanced Calculus and Complex Analysis	BS	3	1	0	4	4
3.	23BSS01	Engineering Physics	BS	3	0	0	3	3
4.	23GES01	Problem Solving and Programming in C	GES	3	0	0	3	3
5.	23GES08	Electric Circuits	GES	2	2	0	4	4
6.	23HSS09	Tamils and Technology	HS	1	0	0	1	1
Practical								
7.	23BSS02	Physics Laboratory	BS	0	0	4	4	2
8.	23GES02	Programming in C Laboratory	GES	0	0	4	4	1
9.	23GES24	Electric Circuits Laboratory	GES	0	0	2	2	1
							Total Credit	**22**

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Curriculum | UG - R2023
Semester -III

Sl.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week/ Credit			
					L	T	P	C
Theory								
1.	23BSS24	Transforms and Boundary Value Problems	BS	3	1	0	4	4
2.	23GES27	Electronic Devices and Circuits	GES	3	0	0	3	3
3.	23EEC04	DC Machines and Transformers	PC	3	1	0	4	4
4.	23EEC03	Linear Integrated Circuits	PC	3	0	0	3	3
5.	23EEC01	Electromagnetic Fields	PC	2	1	0	3	3
6.	23ECC04	Digital System Design	OE	3	0	0	3	3
Practical								
7.	23GES28	Electronic Devices and Integrated Circuits Laboratory	PC	0	0	2	2	1
8.	23EEC16	DC Machines and Transformers Laboratory	PC	0	0	2	2	1
9.	23EEP02	Professional Skill - II	EEC	0	0	2	2	1
							Total Credit	**23**

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Semester -IV

Sl.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week/ Credit			
					L	T	P	C
Theory								
1.	23BSS26	Numerical Methods	BS	3	1	0	4	4
2.	23EEC05	AC Machines	PC	3	1	0	4	4
3.	23EEC06	Control Systems	PC	2	2	0	4	4
4.	23EEC15	Network Analysis and Synthesis	PC	2	1	0	3	3
5.	23EEC12	Transmission and Distribution	PC	3	0	0	3	3
6.	23EEC02	Measurements and Instrumentation	PC	3	0	0	3	3
Practical								
7.	23EEC17	AC Machines Laboratory	PC	0	0	2	2	1
8.	23EEC18	Control System Laboratory	PC	0	0	2	2	1
9.	23EEI01	Internship - I	EEC					1
							Total Credit	**24**

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Curriculum | UG - R2023
Semester -V

Sl.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week/ Credit			
					L	T	P	C
Theory								
1.	23EEC07	Power Electronics	PC	3	0	0	3	3
2.	23EEC09	Micro-computing-based system design	PC	3	0	0	3	3
3.		Professional Elective - I	PE					3
4.		Professional Elective - II	PE					3
5.		Open Elective	OE					3
6.		NPTEL I	NPTEL					3
Practical								
7.	23EEC19	Power Electronics Laboratory	PC	0	0	2	2	1
8.	23EEC21	Micro-computing-based system design Laboratory	PC	0	0	2	2	1
9.	23EEI02	Internship – II	EEC					1
							Total Credit	**21**

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B.E. - Electrical and Electronics Engineering
Curriculum | UG - R2023

Semester -VI

Sl.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week/ Credit			
					L	T	P	C
Theory								
1.	23GES29	Renewable Energy Sources	GES	3	0	0	3	3
2.	23EEC08	Electrical Drives	PC	3	0	0	3	3
3.	23EEC10	Power System Analysis	PC	3	1	0	4	4
4.	23EEC11	Operation and Control of Electrical Power	PC	3	0	0	3	3
5.		Professional Elective - III	PE					3
6.		NPTEL II	NPTEL					3
Practical								
7.	23EEE33	Embedded Systems & IOT Laboratory	PE	0	0	2	2	1
8.	23EEK01	Soft Skill - I	EEC					1
9.	23EED01	Mini Project	EEC	0	0	2	2	1
							Total Credit	**22**

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B.E. - Electrical and Electronics Engineering
Curriculum | UG - R2023
Semester -VII

Sl.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week/ Credit			
					L	T	P	C
Theory								
1.	23EEC13	Protection and switchgear	PC	3	0	0	3	3
2.	23EEC16	Smart Grid	PC	3	0	0	3	3
3.		Professional Elective – IV	PE					3
4.		Professional Elective – V	PE					3
5.		Professional Elective - VI	PE					3
6.		NPTEL III	NPTEL					3
Practical								
7.	23EES01	Project work - I	EEC	0	0	6	6	3
8.	23EEC20	Power System Simulation Laboratory	PC	0	0	2	2	1
9.	23EEI03	Internship-III	EEC	0	0	2	2	1
							Total Credit	**23**

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B.E. - Electrical and Electronics Engineering
Curriculum | UG - R2023

Semester -VIII

Sl.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week/ Credit			
					L	T	P	C
Theory								
1.	23EEM01	CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS	EEM	0	0	0	0	0
2.	23EEM02	DISASTER RISK REDUCTION AND MANAGEMENT	EEM	0	0	0	0	0
Practical								
3.	23EES02	Project Work II & Dissertation	EEC	0	0	18	18	9
							Total Credit	**9**

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Estd. 2000

B.E. - Electrical and Electronics Engineering
Curriculum | UG - R2023

Summary of Course Component

Sl.No.	Course Area	Semesters								Total Credits	% of Credits
		I	II	III	IV	V	VI	VII	VIII		
1.	HS	4	4							8	4.85
2.	BS	9	9	4	4					26	15.76
3.	GES	8	9	3			3			23	13.94
4.	PC			12	19	8	7	7		53	32.12
5.	PE					6	7	9		22	13.33
6.	OE			3		3				6	3.64
7.	EEC			1	1	1	2	4	9	18	10.91
8.	MC									0	0
9.	NPTEL					3	3	3		9	5.45
										Total	**100.00**

17/6/2023

The Chairman
Board of Studies,
Department of Electrical and Electronics Engineering
Muthayammal Engineering College (Autonomus)
Rasipuram-637 408, Namakkal Dt.

		L	T	P	C
23GES06	**ELECTRICAL AND ELECTRONICS ENGINEERING SCIENCES**	**3**	**0**	**0**	**3**

Course Objective:

- To impart knowledge on laws and theorems of electrical networks
- To understand the concepts of AC circuits
- To understand the constructional features of electric machines
- To impart knowledge on the semiconductor diodes
- To gain knowledge on transistor and opto-electronic devices

Course Outcomes:

23GES06.CO1 Explain the laws and theorems of electrical networks

23GES06.CO2 Outline the parameters of AC circuits

23GES06.CO3 Explain the constructional features of electric machines

23GES06.CO4 Illustrate the characteristics of semiconductor diodes

23GES06.CO5 Explain the Characteristics of transistors and opto-electronic devices

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23GES06.CO1	X	X	X	-	-	X	-	-	-	-	-	X	-	-	-
23GES06.CO2	X	X	X	-	-	X	-	-	-	-	-	X	-	-	-
23GES06.CO3	-	X	X	-	-	X	-	-	-	-	-	X	-	-	-
23GES06.CO4	X	X	X	-	-	X	-	-	-	-	-	X	-	-	-
23GES06.CO5	X	X	X	-	-	X	-	-	-	-	-	X	-	-	-

Unit-I DC Circuits **9**

Basics of electric circuits: Ohms law, Kirchhoff's laws, Resistors in series and parallel, Capacitors in series and parallel, voltage and current division, Mesh analysis, Theorems: Thevenin, Norton, Superposition, Maximum power transfer – Star-delta conversion.

Unit-II AC CIRCUITS **9**

Introduction to AC circuits: waveforms, peak value, average value, RMS value, Form factor, peak factor, power, and power factor- Electromagnetism: Inductor, Faraday's Law, Coefficient of coupling, Inductor in series and parallel - Resonance: Series and parallel resonance - Frequency response – Quality factor and Bandwidth.

Unit-III ELECTRIC MACHINES **9**

Introduction to Transformers – Ideal Transformer – Principle and Operational Features of DC Generator – EMF equation, Construction and Operational Features of DC Motor– Characteristics of DC Motor –Types of DC Machines.

Unit-IV SEMICONDUCTOR DIODES **9**

Semiconductors - Drift and Diffusion Currents-PN Junction Diode: Construction, Operations and Characteristics - Avalanche Breakdown Mechanism - Zener diode- Applications: Rectifiers and Voltage Regulators.

Unit-V TRANSISTORS **9**

Bipolar Junction Transistors: Construction, Operations, Configurations -Characteristics of CE Configurations – MOSFET and CMOS: Constructions and Operations – Opto-electronic devices: Construction and Characteristics of Photodiode, Phototransistors and LED – Integrated Circuits and Its Applications.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	V.N.Mittle and Arvind Mittal	Basic Electrical Engineering	McGraw Hill	2006
2.	Robert L.Boylestad, Louis Nashelsky	Electronic Devices and Circuit Theory	Pearson Education	2012

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	W.H.Hayt, J.E.Kimmerly and S.M.Durbin	Engineering circuit analysis	McGraw Hill Education private limited,	2013
2.	Mahmood Nahvi and Joselph Edminister	Electric Circuits	Schaum's Outline series,	2004.
3.	D P Kothari and I J Nagrath	Basic Electrical and Electronics Engineering	McGraw Hill Education (India) PrivateLimited	2014
4.	Donald A. Neamen	Semiconductor Physics and Devices	Tata McGraw Hill	2017

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23GES07	CAD LABORATORY	L	T	P	C
		0	0	2	1

Course Objective:

- To impart knowledge on laws and theorems of electrical networks
- To understand the concepts of AC circuits
- To understand the constructional features of electric machines
- To impart knowledge on the semiconductor diodes
- To gain knowledge on transistor and opto-electronic devices

Course Outcomes:

23GES06.CO1 Explain the laws and theorems of electrical networks

23GES06.CO2 Outline the parameters of AC circuits

23GES06.CO3 Explain the constructional features of electric machines

23GES06.CO4 Illustrate the characteristics of semiconductor diodes

23GES06.CO5 Explain the Characteristics of transistors and opto-electronic devices

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23GES07.CO1	x	x	x	x	x	-	-	-	-	-	-	x	x	x	x
23GES07.CO2	x	x	x	x	x	-	-	-	-	-	-	x	x	x	x
23GES07.CO3	x	x	x	x	x	-	-	-	-	-	-	x	x	x	x
23GES07.CO4	x	x	x	x	x	-	-	-	-	-	-	x	x	x	x
23GES07.CO5	x	x	x	x	x	-	-	-	-	-	-	x	x	x	x

Sl.No. **List of Experiments**

1. Introduction to AutoCAD Electrical & Interface
2. Interface Components and Commands
3. Workspace Setting & Electrical Components
4. Design and drafting of panel distribution
5. Design and drafting of single line riser diagram
6. Design and drafting of panel schedule table
7. Design and drafting of electrical schematic diagram
8. Design and drafting of electrical one line diagram
9. Design and drafting of a working feeder Configuration
10. Design and drafting of a working feeder with multiple level terminals

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Total Periods: 30

		L	T	P	C
23GES08	**ELECTRIC CIRCUITS**	**2**	**2**	**0**	**4**

Course Objective:

- To develop the ability to apply circuit analysis to DC circuits
- To develop the ability to apply circuit analysis to AC circuits
- To learn the basics of network theorems applied to electric circuits
- To understand transient and steady-state response of RLC circuits and to understand advanced mathematical methods such as Laplace transforms for solving circuit problems.
- To understand the basics of three phase circuits with balanced and unbalanced loads.

Course Outcomes:

23GES08.CO1	Apply the knowledge of basic circuital laws and simplify the DC networks using reduction techniques.
23GES08.CO2	Apply the knowledge of basic circuital laws and simplify the AC networks using reduction techniques.
23GES08.CO3	Analyze the DC and AC Circuit with circuit simplification theorems.
23GES08.CO4	Determine the frequency and transient response parameters for electrical circuits using Laplace transforms.
23GES08.CO5	Understand the basics of three phase circuits with balanced and unbalanced loads.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23GES08.CO1	x	x	-	-	-	-	-	-	-	-	-	x	x	-	-
23GES08.CO2	x	x	-	-	-	-	-	-	-	-	-	x	x	-	-
23GES08.CO3	x	x	-	-	-	-	-	-	-	-	-	x	x	-	-
23GES08.CO4	x	x	x	-		-	-	-	-	-	-	x	x	x	-
23GES08.CO5	x	x	-	-		-	-	-	-	-	-	x	x	-	-

UNIT I DC CIRCUITS **6+6**

Basics of Resistor, Capacitor and Inductor - Ohm's law - Resistors in series and parallel circuits - Voltage division and current division rules - Kirchhoff's laws – Power Balance - Source transformation - Star-Delta conversion – Mesh – super mesh - nodal analysis – super node – Dependent Sources.

UNIT II AC CIRCUITS **6+6**

Introduction to AC circuits - Form Factor - Phase and phase difference - Sinusoidal Voltage and Current - Single phase AC circuits - R, L and C elements - Series RL, RC and RLC circuits - Power - Power factor - Complex Power - Mesh and nodal analysis.

UNIT III NETWORK THEOREMS **6+6**

Superposition theorem – Substitution Theorem - Thevenin's theorem - Norton's theorem - Maximum power transfer theorem - Reciprocity theorem- Tellegen's theorem – Millman's theorem - Concepts of duality and duality theorem.

UNIT IV RESONANCE CIRCUITS AND TRANSIENT RESPONSE **6+6**

Series and parallel resonance - Quality factor and bandwidth - Transient response of R, L, C, RL, RC and RLC Circuits using Laplace transform for AC & DC input.

UNIT V THREE PHASE CIRCUITS **6+6**

Three phase balanced / unbalanced voltage sources - Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced loads - Phasor diagram of voltages and currents - Power and Power factor measurements in three phase circuits – Comparison of 2-Watt meter and conventional power

measurement method.

Total Periods: 60

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	William H. HaytJr, Jack E. Kemmerly and Steven M. Durbin	Engineering Circuits Analysis	McGraw Hill publishers, 9th edition	2020
2.	Charles K. Alexander, Mathew N.O. Sadiku	Fundamentals of Electric Circuits	Second Edition, McGraw Hill	2019

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Chakrabarti A	Circuits Theory (Analysis and synthesis)	Dhanpat Rai& Sons	2020
2.	Joseph A. Edminister, Mahmood Nahvi,	Electric circuits	Schaum's series, McGraw-Hill, First Edition	2019
3.	Richard C. Dorf and James A. Svoboda	Network Analysis	Prentice-Hall of India Pvt Ltd	2015
4.	M E Van Valkenburg	Network Analysis	Prentice-Hall of IndiaPvt Ltd, New Delhi	2015
5.	Sudhakar A and Shyam Mohan SP,	Circuits and Networks Analysis and Synthesis	McGraHill	2015

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23GES18	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		3	0	0	3

Course Objective:

- To impart knowledge on laws and theorems of electrical networks
- To understand the concepts of AC circuits
- To understand the constructional features of electric machines
- To impart knowledge on the semiconductor diodes
- To gain knowledge on transistor and opto-electronic devices

Course Outcomes:

23GES18.CO1 Explain the laws and theorems of electrical networks

23GES18.CO2 Outline the parameters of AC circuits

23GES18.CO3 Explain the constructional features of electric machines

23GES18.CO4 Illustrate the characteristics of semiconductor diodes

23GES18.CO5 Explain the Characteristics of transistors and opto-electronic devices

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23GES18.CO1	x	x	x	-	-	x	-	-	-	-	-	x	-	-	-
23GES18.CO2	x	x	x	-	-	x	-	-	-	-	-	x	-	-	-
23GES18.CO3	-	x	x	-	-	x	-	-	-	-	-	x	-	-	-
23GES18.CO4	x	x	x	-	-	x	-	-	-	-	-	x	-	-	-
23GES18.CO5	x	x	x	-	-	x	-	-	-	-	-	x	-	-	-

UNIT I DC CIRCUITS **9**

Basics of electric circuits: Ohms law, Kirchhoff's laws, Resistors in series and parallel, Capacitors in series and parallel, voltage and current division, Mesh analysis, Theorems: Thevenin, Norton, Superposition, Maximum power transfer – Star-delta conversion.

UNIT II AC CIRCUITS **9**

Introduction to AC circuits: waveforms, peak value, average value, RMS value, Form factor, peak factor, power, and power factor- Electromagnetism: Inductor, Faraday's Law, Coefficient of coupling, Inductor in series and parallel - Resonance: Series and parallel resonance - Frequency response – Quality factor and Bandwidth.

UNIT III ELECTRIC MACHINES **9**

Introduction to Transformers – Ideal Transformer – Principle and Operational Features of DC Generator – EMF equation, Construction and Operational Features of DC Motor– Characteristics of DC Motor –Types of DC Machines.

UNIT IV SEMICONDUCTOR DIODES **9**

Semiconductors - Drift and Diffusion Currents-PN Junction Diode: Construction, Operations and Characteristics - Avalanche Breakdown Mechanism - Zener diode- Applications: Rectifiers and Voltage Regulators.

UNIT V TRANSISTORS **9**

Bipolar Junction Transistors: Construction, Operations, Configurations -Characteristics of CE Configurations – MOSFET and CMOS: Constructions and Operations – Opto-electronic devices: Construction and Characteristics of Photodiode, Phototransistors and LED – Integrated Circuits and Its Applications.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	V.N.Mittle and Arvind Mittal	Basic Electrical Engineering	McGraw Hill	2006
2.	Robert L.Boylestad, Louis Nashelsky	Electronic Devices and Circuit Theory	Pearson Education	2012

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	W.H.Hayt, J.E.Kimmerly and S.M.Durbin	Engineering circuit analysis	McGraw Hill Education private limited,	2013
2.	Mahmood Nahvi and JoselphEdminister	Electric Circuits	Schaum's Outline series,	2004.
3.	D P Kothari and I J Nagrath	Basic Electrical and Electronics Engineering	McGraw Hill Education (India) PrivateLimited	2014
4.	Donald A. Neamen	Semiconductor Physics and Devices	Tata McGraw Hill	2017

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23GES24	ELECTRIC CIRCUITS LABORATORY	L	T	P	C
		0	0	2	1

Course Objective:

- To Apply Ohm's law and Kirchoff's law to DC circuits.
- To Apply network theorems technique to solve electrical circuits.
- To Estimate the maximum power in electrical circuits.
- To Determine the RC and RL time constant.
- To Measure the single phase energy.

Course Outcomes:

23GES24.CO1 Apply Ohm's law and Kirchoff's law to DC circuits.

23GES24.CO2 Apply network theorems technique to solve electrical circuits.

23GES24.CO3 Estimate the maximum power in electrical circuits.

23GES24.CO4 Determine the RC and RL time constant.

23GES24.CO5 Measure the single-phase energy.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23GES24.CO1	x	x	x	x	-	-	-	-	x	x	-	x	x	x	-
23GES24.CO2	x	x	x	x	-	-	-	-	x	x	-	x	x	x	-
23GES24.CO3	x	x	x	x	-	-	-	-	x	x	-	x	x	x	-
23GES24.CO4	x	x	x	x	-	-	-	-	x	x	-	x	x	x	-
23GES24.CO5	x	x	x	x	-	-	-	-	x	x	-	x	x	x	-

List of Experiments

Sl.No.

1. Verification of ohm's law
2. Verification of Kirchhoff's voltage and current laws.
3. Verification of Thevenin's theorem
4. Verification of Norton 's theorem
5. Verification of Superposition theorem
6. Verification of Maximum Power Transfer Theorem.
7. a. Study of CRO and measurement of sinusoidal voltage and frequency.
   b. Determination of time constant of series R-C electric circuits.
8. Determination of time constant of series R-L electric circuits.
9. Determination of frequency response of series & parallel RLC circuits.
10. Calibration of single-phase energy meter.

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Total Periods: 30

		L	T	P	C
23GES25	**ELECTRICAL DRIVES AND CONTROL**	**3**	**0**	**0**	**3**

Course Objective:

- To learn the basic concepts of different types of electrical machines and their performance.
- To provide adequate knowledge in the time response of systems and steady state error analysis.
- To study the different methods of starting D.C motors and induction motors
- To study the solid-state speed control of D.C. drives
- To study the solid-state speed control of A.C. drives

Course Outcomes:

23GES25.CO1 Explain the basics of electrical drives

23GES25.CO2 Discuss the basic concepts of different types of electrical machines and their performance

23GES25.CO3 Explain the different methods of starting D.C motors and induction motors

23GES25.CO4 Describe the solid-state speed control of D.C. drives

23GES25.CO5 Explain the solid-state speed control of A.C. drives

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23GES25.CO1	X	X	-	X	-	-	-	-	-	-	-	X	-	-	-
23GES25.CO2	X	X	-	X	-	-	-	-	-	-	-	X	-	-	-
23GES25.CO3	X	X	-	X	-	-	-	-	-	-	-	X	-	-	-
23GES25.CO4	X	X	-	X	-	-	-	-	-	-	-	X	-	-	-
23GES25.CO5	X	X	-	X	-	-	-	-	-	-	-	X	-	-	-

UNIT I INTRODUCTION **9**

Basic Elements of Electric Drives- Types of Electric Drives- Factors Influencing the choice of electrical drives- Heating and cooling curves- Loading Conditions and classes of duty- Selection of power rating for drive motors with regard to thermal overloading and Load variation factors.

UNIT II DRIVE MOTOR CHARACTERISTICS **9**

Dynamics of Motor load system – Multi-quadrant operation – DC Motor (Types, Torque Equation, Characteristics and Applications) - Single phase induction motor (Types and Applications) - Three phase induction motors (Types, Characteristics) - Braking of Electric motors.

UNIT III STARTING METHODS **9**

Necessity of a starters – Types of DC Motor Starters – Types of 3 phase squirrel cage and slip ring Induction Motor Starters.

UNIT IV SOLID STATE DC DRIVES **9**

Speed control of DC series and shunt motors - Armature and field control, Ward-Leonard control system - Using controlled rectifiers and DC choppers - Applications.

UNIT V SOLID STATE AC DRIVES **9**

Speed control of three phase induction motor - Voltage control, voltage / frequency control, slip power recovery scheme - Using inverters and AC voltage regulators - Applications.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Nagrath .I.J. & Kothari .D.P	Electrical Machines	Tata McGraw-Hill	2006
2.	VedamSubrahmaniam	Electric Drives (Concepts and Applications)	Tata McGraw-Hill	2010

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Partab. H.	Art and Science and Utilisation of Electrical Energy	Dhanpat Rai and Sons	2017
2.	Pillai.S.K	A First Course on Electric Drives	Wiley Eastern Limited	2012
3.	Singh. M.D., K.B.Khanchandani	Power Electronics	Tata McGraw-Hill	2006
4.	B.R. Gupta and V. Singhal	Fundamentals of Electric Drives and Control	S.K Kataria and Sons	2013

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		L	T	P	C
23GES26	**ELECTRICAL DRIVES AND CONTROLS LABORATORY**	**0**	**0**	**2**	**1**

Course Objective:

- To clarify the basics of electrical drives.
- To describe drive motor characteristics and different methods of starting D.C motors andInduction Motors.
- To describe speed control of DC drives
- To explain the conventional and solid state speed control of AC drives.
- To describe the different types of special electrical machines and their performance

Course Outcomes:

23GES26.CO1 Test the performance DC machines

23GES26.CO2 Understand the characteristics of DC machines

23GES26.CO3 Compare speed control of DC drives

23GES26.CO4 Test the performance of Induction motor

23GES26.CO5 Estimate the efficiency of the transformers.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23GES26.CO1	x	x	-	x	-	-	-	-	x	x	-	x	-	-	-
23GES26.CO2	x	x	-	x	-	-	-	-	x	x	-	x	-	-	-
23GES26.CO3	x	x	-	x	-	-	-	-	x	x	-	x	-	-	-
23GES26.CO4	x	x	-	x	-	-	-	-	x	x	-	x	-	-	-
23GES26.CO5	x	x	-	x	-	-	-	-	x	x	-	x	-	-	-

Sl.No. **List of Experiments**

1. Load test on DC Shunt & DC Series motor.
2. O.C.C & Load characteristics of DC Shunt and DC Series generator.
3. Speed control of DC shunt motor (Armature, Field control).
4. Load test on single phase transformer.
5. O.C & S.C Test on a single phase transformer.
6. V curves and inverted V curves of synchronous Motor.
7. Load test on three phase squirrel cage Induction motor.
8. Speed control of three phase slip ring Induction Motor.
9. Load test on single phase Induction Motor.
10. Study of DC & AC Starters.

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Total Periods: 30

23GES27	ELECTRONIC DEVICES AND CIRCUITS	L	T	P	C
		3	0	0	3

Course Objective:

- To explain the structure and operation of PN junction devices (diode, Zener diode, LED and Laser diode)
- To analyze the structure and characteristics BJT, FET, MOSFET, UJT, Thyristor and IGBT
- To analyze the performance of various configurations of BJT and MOSFET based amplifier
- To explain the characteristics of MOS based cascade and differential amplifier
- To explain the operation of various feedback amplifiers and oscillators

Course Outcomes:

23GES27.CO1	Explain the structure and operation of PN junction devices (diode, Zener diode, LED and Laser diode)
23GES27.CO2	Analyze the structure and characteristics BJT, FET, MOSFET, UJT, Thyristor and IGBT
23GES27.CO3	Analyze the performance of various configurations of BJT and MOSFET based amplifier
23GES27.CO4	Explain the characteristics of MOS based cascade and differential amplifier
23GES27.CO5	Explain the operation of various feedback amplifiers and oscillators

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23GES27.CO1	x	x	x	x	-	-	-	-	-	-	-	x	x	x	-
23GES27.CO2	x	x	x	x	-	-	-	-	-	-	-	x	x	x	-
23GES27.CO3	x	x	x	x	-	-	-	-	-	-	-	x	x	x	-
23GES27.CO4	x	x	x	x	-	-	-	-	-	-	-	x	x	x	-
23GES27.CO5	x	x	x	x	-	-	-	-	-	-	-	x	x	x	-

UNIT I APPLICATIONS OF SEMICONDUCTOR DEVICES 9

Introduction to semiconductor diode, PN junction diode structure, operation and VI characteristics – Zener diode -. Display devices- LED, LCD, Rectifiers: Half Wave and Full Wave Rectifiers

UNIT II TRANSISTORS 9

UJT, BJT, JFET, MOSFET, IGBT Construction, operation and V-I characteristics – Thyristor construction, operation and V-I characteristics, Two transistor analogy.

UNIT III AMPLIFIERS 9

BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response – MOSFET small signal model– Analysis of CS and Source follower – Gain and frequency response.

UNIT IV MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER 9

BICMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis – Single tuned amplifiers – Gain and frequency response – Neutralization methods, power amplifiers – Types (Qualitative analysis).

UNIT V FEEDBACK AMPLIFIERS AND OSCILLATORS 9

Advantages of negative feedback – voltage / current, series, Shunt feedback –positive feedback – Condition for oscillations, RC phase shift, Wien bridge, Hartley, Colpitts and Crystal oscillators.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jacob. Millman, Christos C.Halkias	Electronic Devices and Circuits	Tata McGraw Hill	2012
2.	Sedra and smith	Microelectronic circuits	Oxford University Press	2017

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	David A.Bell	Electronic Devices and Circuits	Prentice Hall of India Private Limited	2013
2.	Thomas L.Floyd	Electronic devices	Pearson prentice hall	2017
3.	Gupta.J.B	Electron Devices and Circuits	S.K.Kataria & Sons	2012
4.	Mathur.S.P, Kulshreshtha.D.C and Chanda.P.R	Electronic Devices – Applications and Integrated circuits	Umesh Publications	2010

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23EES28	ELECTRONIC DEVICES AND INTEGRATED CIRCUITS LABORATORY	L	T	P	C
		0	0	2	1

Course Objective:

- To test the Characteristics and applications of PN Junction Diode.
- To test the Characteristics of NPN and Junction Field Effect Transistor.
- To design the differential amplifier using FET, Photodiode, Photo Transistor.
- To analyse the applications of operational amplifier.
- To check the waveform generation using op-amp and timer.

Course Outcomes:

23EES28.CO1 Test the Characteristics and applications of PN Junction Diode.

23EES28.CO2 Test the Characteristics of NPN and Junction Field Effect Transistor.

23EES28.CO3 Design the differential amplifier using FET, Photodiode, Photo Transistor.

23EES28.CO4 Analyse the applications of operational amplifier.

23EES28.CO5 Check the waveform generation using op-amp and timer.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EES28.CO1	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
23EES28.CO2	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
23EES28.CO3	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
23EES28.CO4	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
23EES28.CO5	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-

Sl.No. **List of Experiments**

1. Characteristics of PN Junction Diode.
2. Characteristics of Half and Full Wave Rectifier.
3. Characteristics of a NPN Transistor under Common Emitter Configuration.
4. Characteristics of Junction Field Effect Transistor.
5. Differential Amplifiers using FET.
6. Characteristics of Photodiode and Photo Transistor.
7. Design & testing of Inverting & Non – inverting amplifier
8. Design & testing of integrator & Differentiator.
9. Design & testing of active low pass and Band pass filters.
10. Design & testing of A stable and Monostable Using NE555 Timer.

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Total Periods: 30

23GES29	RENEWABLE ENERGY SOURCES	L	T	P	C
		3	0	0	3

Course Objective:

- To Understand the fundamentals of energy scenario.
- To Illustrate the techniques used in utilization and measurement of solar energy
- To Demonstrate the types and performance of wind energy systems
- To Comprehend and identify the bio-mass energy sources and applications.
- To Outline the utilization techniques of tidal; wave, Hydro, geothermal, fuel cell systems and hybrid system energy sources.

Course Outcomes:

23GES29.CO1	Understand the fundamentals of energy scenario.
23GES29.CO2	Illustrate the techniques used in utilization and measurement of solar energy
23GES29.CO3	Demonstrate the types and performance of wind energy systems
23GES29.CO4	Comprehend and identify the bio-mass energy sources and applications.
23GES29.CO5	Outline the utilization techniques of tidal; wave, Hydro, geothermal, fuel cell systems and hybrid system energy sources.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23GES29.CO1	x	x	-	-	-	x	x	-	-	-	-	x	x	-	-
23GES29.CO2	x	x	-	-	-	x	x	-	-	-	-	x	x	-	-
23GES29.CO3	x	x	-	-	-	x	x	-	-	-	-	x	x	-	-
23GES29.CO4	x	x	-	-	-	x	x	-	-	-	-	x	x	-	-
23GES29.CO5	x	x	-	-	-	x	x	-	-	-	-	x	x	-	-

UNIT I INTRODUCTION **9**

World Energy Use – Reserves of Energy Resources – Environmental Aspects of Energy Utilization – Renewable Energy Scenario in Tamilnadu, India and around the World - Potentials - Achievements / Applications – Economics of renewable energy systems

UNIT II SOLAR ENERGY **9**

Solar Radiation – Measurements of Solar Radiation - Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation - Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

UNIT III WIND ENERGY **9**

Wind Data and Energy Estimation – Types of Wind Energy Systems – Performance - Site Selection – Details of Wind Turbine Generator – Safety and Environmental Aspects.

UNIT IV BIO - ENERGY **9**

Biomass direct combustion – Biomass gasifiers – Biogas plants – Digesters – Ethanol production – Bio diesel – Cogeneration - Biomass Applications.

UNIT V OTHER RENEWABLE ENERGY SOURCES **9**

Tidal energy – Wave Energy – Open and Closed OTEC Cycles – Small Hydro-Geothermal Energy Hydrogen and Storage - Fuel Cell Systems – Hybrid Systems.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	G.D. Rai	Non Conventional Energy Sources,	Khanna Publishers, New Delhi,	2011.
2.	Twidell, J.W. & Weir	A., Renewable Energy Sources	EFN Spon Ltd., UK,	2006

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	David M. Mousdale	Introduction to Biofuels,	CRC Press Taylor & Francis Group, USA	2010
2.	Chetan Singh Solanki	Solar Photovoltaic, Fundamentals, Technologies and Applications,	PHI Learning Private Limited, New Delhi	2009
3.	S.P. Sukhatme	Solar Energy	Tata McGraw Hill Publishing Company Ltd., New Delhi,	1997.
4.	Sinduja S	Renewable Energy Sources	Anuradha Publications	2012

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23EEC01	ELECTROMAGNETIC FIELDS	L	T	P	C
		2	1	0	3

Course Objective:

- To discuss the coordinate systems, basic Electrostatic theorems and laws for solving the problems of static electric field problems
- To explain the static electric fields with their behavior in different media, associated laws, boundary conditions and electromagnetic potentials
- To discuss the static magnetic fields with their behavior in different media, associated laws, boundary conditions and electromagnetic potentials
- To solve the problems of electromagnetic field by using the integral and point form of Maxwell`s equation
- To discuss the propagation of electromagnetic waves in different media.

Course Outcomes:

23EEC01.CO1	Discuss the coordinate systems, basic Electrostatic theorems and laws for solving the problems of static electric field problems
23EEC01.CO2	Explain the static electric fields with their behavior in different media, associated laws, boundary conditions and electromagnetic potentials
23EEC01.CO3	Discuss the static magnetic fields with their behavior in different media, associated laws, boundary conditions and electromagnetic potentials
23EEC01.CO4	Solve the problems of electromagnetic field by using the integral and point form of Maxwell`s equations
23EEC01.CO5	Discuss the propagation of electromagnetic waves in different media.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEC01.CO1	x	x	-	-	-	-	-	-	-	-	-	x	x	x	-
23EEC01.CO2	x	x	-	-	-	-	-	-	-	-	-	x	x	-	-
23EEC01.CO3	x	x	-	-	-	-	-	-	-	-	-	x	x	-	-
23EEC01.CO4	x	x	-	-	-	-	-	-	-	-	-	x	x	-	-
23EEC01.CO5	x	x	x	-	-	-	-	-	-	-	-	x	x	x	-

UNIT I INTRODUCTION **6+3**

Sources and effects of electromagnetic fields - Vector fields - Different co-ordinate systems - Gradient, Divergence and Curl operation - Divergence theorem -Stoke's theorem - Coulomb's Law - Electric field intensity - Field due to point and continuous charges – Electric flux density - Gauss's law and application.

UNIT II STATIC ELECTRIC FIELD **6+3**

Electrical potential - Electric field and equipotential plots - Relationship between E and V - Electric field in free space, conductors, dielectric - Dielectric polarization, Electric field in multiple dielectrics - Boundary conditions, Poisson's and Laplace's equations - Capacitance energy density - Dielectric strength.

UNIT III STATIC MAGNETIC FIELD **6+3**

Lorentz Law of force, magnetic field intensity – Biot savart Law - Ampere's Law - Magnetic field due to straight conductors, circular loop, infinite sheet of current - Magnetic flux density in free space, conductor, magnetic materials - Boundary conditions - Scalar and vector potential - Magnetic force – Torque – Inductance – Energy density - Magnetic circuits.

UNIT IV TIME VARYING FIELDS AND MAXWELL'S EQUATIONS **6+3**

Faraday's laws, induced emf - Static and dynamic EMF, Maxwell's equations (differential and integral forms) - Displacement current - Relation between field theory and circuit theory.

UNIT V ELECTROMAGNETIC WAVES **6+3**

Electromagnetic wave generation equations - Uniform plane waves - Phase and group velocity, attenuation - Propagation in good conductors - Waves in free space, lossy and lossless dielectrics, conductors - Skin depth, Poynting theorem and vector

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Gangadhar K A, Ramanathan	Electromagnetic Field Theory	Khanna Publishers	2011
2.	William H. Hayt & Buck	Engineering Electromagnetic	Tata McGraw Hill	2012

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Meenakumari R &Subasri R	Electromagnetic Fields	New Age InternationalLtd Publishers	2010
2.	Mathew N. O.Sadiku	Principles of Electromagnetic	Oxford UniversityPress	2010
3.	Kraus and Fleish	Electro magnetic with Applications	Tata McGraw Hill	2008
4.	AshutoshPramanik	Electromagnetism – Theory and Applications	PHI Learning PrivateLimited	2009

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23EEC02	MEASUREMENTS AND INSTRUMENATION	L	T	P	C
		3	0	0	3

Course Objective:

- To Discuss the classification, application characteristics, error and basics of measuring Instruments
- To Measure the voltage, current, power, energy, frequency and phase by using measuring Instruments
- To Measure the resistance, inductance and capacitance using various bridges
- To Discuss the various types of digital measurements and display devices for measuring Electrical parameters
- To Explain the types, working selection of transducer and data acquisition system.

Course Outcomes:

23EEC02.CO1	Discuss the classification, application characteristics, error and basics of measuring Instruments
23EEC02.CO2	Measure the voltage, current, power, energy, frequency and phase by using measuring Instruments
23EEC02.CO3	Measure the resistance, inductance and capacitance using various bridges
23EEC02.CO4	Discuss the various types of digital measurements and display devices for measuring Electrical parameters
23EEC02.CO5	Explain the types, working selection of transducer and data acquisition system.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEC02.CO1	x	x	x	x	-	-	-	-	-	-	-	x	x	x	-
23EEC02.CO2	x	x	x	x	-	-	-	-	-	-	-	x	x	x	-
23EEC02.CO3	x	x	x	x	-	-	-	-	-	-	-	x	x	x	-
23EEC02.CO4	x	x	x	x	-	-	-	-	-	-	-	x	x	x	-
23EEC02.CO5	x	x	x	x	-	-	-	-	-	-	-	x	x	x	-

UNIT I INTRODUCTION **9**

Instruments: Classification, Applications - Functional elements of an instrument – Static and dynamic characteristics – Errors in measurement – Statistical evaluation of measurement data – Standards and calibration.

UNIT II MEASURING INSTRUMENTS **9**

Classification of instruments: PMMC Instruments, Moving iron instruments, Electrodynamometer type instruments. – Single and three phase wattmeters and energy meters – Magnetic measurements – Determination of B-H curve – Instrument transformers – Instruments for measurement of frequency and phase.

UNIT III BRIDGES **9**

Resistance measurement - Wheatstone bridge, Kelvin Bridge, substitution method - Transformer ratio bridges, self-balancing bridges.Measurement of Earth resistance, insulation resistance – Megger - Measurement of inductance and capacitance – Maxwell's bridge, Anderson Bridge, Desauty's bridge and Schering Bridge.

UNIT IV DIGITAL INSTRUMENTS AND DISPLAY DEVICES **9**

Digital Voltmeter – Types – digital plotters and printers, Magnetic disk and tape – Recorders- CRT display - digital CRO - LED, LCD & dot matrix display – Data Loggers.

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

Classification of transducers – Selection of transducers – Resistive, capacitive & inductive transducers – Piezoelectric, Hall effect, optical and digital transducers – Elements of data acquisition system – A/D, D/A

converters – Smart sensors.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	A.K. Sawhney	A Course in Electrical & Electronic Measurements & Instrumentation	Dhanpat Rai and Co	2004
2.	Gupta JB	A Course in Electronic and Electrical Measurements	S. K. Kataria & Sons	2003

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Doebelin E.O. andManik D.N	Measurement Systems – Applications and Design	Tata McGraw Hill	2007
2.	D.V.S. Moorthy	Transducers and Instrumentation	Prentice Hall of IndiaPvt Ltd	2007
3.	Kalsi H.S	Electronic Instrumentation	Tata McGraw Hill	2004
4.	Alan. S. Morris	Principles of Measurements and Instrumentation	Prentice Hall of IndiaPvt Ltd	2003

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23EEC03	LINEAR INTEGRATED CIRCUITS	L	T	P	C
		3	0	0	3

Course Objective:

- To discuss the characteristics of an OPAMP
- To design the various amplifier circuits and switching circuits using OPAMP
- To develop the various waveform generator circuits using OPAMP
- To create the ADCs, DACs and PLL circuit using OPAMP
- To construct the multi vibrator circuits and voltage regulator using IC 555 timer

Course Outcomes:

23EEC03.CO1 Discuss the characteristics of an OPAMP

23EEC03.CO2 Design the various amplifier circuits and switching circuits using OPAMP

23EEC03.CO3 Develop the various waveform generator circuits using OPAMP

23EEC03.CO4 Create the ADCs, DACs and PLL circuit using OPAMP

23EEC03.CO5 Construct the multi vibrator circuits and voltage regulator using IC 555 timer

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEC03.CO1	x	x	x	x	-	-	-	-	-	-	-	-	x	x	-
23EEC03.CO2	x	x	x	x	-	-	-	-	-	-	-	-	x	x	-
23EEC03.CO3	x	x	x	x	-	-	-	-	-	-	-	-	x	x	-
23EEC03.CO4	x	x	x	x	-	-	-	-	-	-	-	-	x	x	-
23EEC03.CO5	x	x	x	x	-	-	-	-	-	-	-	-	x	x	-

UNIT I CHARACTERISTICS OF OPAMP 9

Block diagram of a typical op-amp – characteristics of ideal and practical op-amp - parameters of opamp - inverting and non-inverting amplifier configurations - frequency response - circuit stability.

UNIT II APPLICATIONS OF OPERATIONAL AMPLIFIER 9

DC and AC amplifiers - summing amplifier – difference amplifier – voltage follower - differentiator – integrator- clamper - clipper– filters

UNIT III WAVEFORM GENERATOR 9

Oscillators, sine wave, square wave, triangular wave, saw tooth wave generation, Schmitt trigger, window detector.

UNIT IV D/A & A/D CONVERTORS AND PHASE LOCKED LOOP 9

Analog-to-digital, digital-to-analog, sample and hold circuits; voltage controlled oscillator, phase locked loop – operating principles, applications of PLL.

UNIT V SPECIAL ICs 9

IC555 Timer, monostable and astable modes of operation; voltage regulators - fixed voltage regulators, adjustable voltage regulators - switching regulators

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Gayakwad R.A	Op-amps & Linear Integrated Circuits	Prentice Hall of India, New Delhi, 4 th Edition	2009
2.	Roy Choudhury and Shail Jain	Linear Integrated Circuits	New Age International Publishers, 4th Edition	2010

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Sergio Franco	Design with Operational Amplifiers and Analog Integrated Circuits	Tata McGraw Hill, 3rd Edition	2002
2.	Sedra Smith,	Microelectronic Circuits	Oxford University Press, 6th Edition	2009
3.	R P Jain	Modern Digital Electronics	Tata McGraw-Hill Education, 3rd Edition,	2003
4.	David A.Bell	Op-amp & Linear ICs	Oxford	2013

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23EEC04	DC MACHINES AND TRANSFORMERS	L	T	P	C
		3	1	0	4

Course Objective:

- To Identify the efficiency of the two winding transformers
- To Compare auto transformers with two winding transformers and illustrate the 3 phase transformers connections
- To Outline the operation and characteristics of DC Machine
- To Demonstrate the starting and speed control of DC Machine
- To Examine the performance of DC Machines and Transformers

Course Outcomes:

23EEC04.CO1	Identify the efficiency of the two winding transformers
23EEC04.CO2	Compare auto transformers with two winding transformers and illustrate the 3 phase transformers connections
23EEC04.CO3	Outline the operation and characteristics of DC Machine
23EEC04.CO4	Demonstrate the starting and speed control of DC Machine
23EEC04.CO5	Examine the performance of DC Machines and Transformers

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEC04.CO1	x	x	x	-	-	-	-	-	-	-	-	x	x	-	-
23EEC04.CO2	x	x	x	-	-	-	-	-	-	-	-	x	x	-	-
23EEC04.CO3	x	x	x	-	-	-	-	-	-	-	-	x	x	-	-
23EEC04.CO4	x	x	x	x	-	-	-	-	-	-	-	x	x	x	-
23EEC04.CO5	x	x	x	x	-	x	x	-	-	-	-	x	x	x	-

UNIT I SINGLE PHASE TRANSFORMER 9+3

Basics of magnetic circuits – flux in DC & AC circuits – Ideal transformer – phasor diagram without & with load – Equivalent circuit of ideal transformer – Rating of a transformer – cascaded and multiple connections of ideal transformer – Practical transformer – core losses – Exact & approximate equivalent circuit of practical transformer – Regulation of transformers.

UNIT II AUTO TRANSFORMERS & THREE PHASE TRANSFORMER 9+3

Auto Transformers - Ideal auto transformer – Types of power transfer in auto transformers– Practical auto transformers – Equivalent circuit of practical auto transformers - Three Phase transformers – Basics of clock conventions Connections – Phase conversion – Scott connection – 3 phase to 6 phase conversion.

UNIT III OPERATION AND CHARACTERISTICS DC MACHINES 9+3

Basics of Motor and Generator - Structure of DC Machines – Stator & Rotor – Armature winding– Electrical and Mechanical Degree – Double layer winding – winding table – lap winding – B-distribution of DC machine – Induced EMF of a DC generator – Torque equation – Effect of load in motor and generator – Types of generators and motors

UNIT IV STARTING AND SPEED CONTROL OF DC MACHINES 9+3

Armature reaction – commutation – Ill effects of armature reaction – Compensating coils – Inter poles – Armature MMF per pole – Compensating winding turns – Power flow diagram of DC motor – Starting of DC motor – 2, 3 & 4 point starters – Speed control of DC motor – Armature voltage control – Field current control – Braking of DC motors.

UNIT V TESTING OF DC MACHINES AND TRANSFORMERS 9+3

Losses and efficiency in DC machines and transformers – Condition for maximum efficiency – Testing of DC machines – Brake test, Swinburne's test - Hopkinson's test – Testing of transformers – Polarity test - Open Circuit and Short Circuit test – Sumpner's test – All day efficiency.

Total Periods: 60

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Stephen Chapman	Electric Machinery Fundamentals	Tata McGraw Hill	2020
2.	P. S. Bimbhra	Electrical Machinery	S.Chand & Company Ltd., New Delhi	2019

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Del Toro	Electric Machines and Power System	Tata McGraw Hill	2019
2.	K. Murugesh Kumar	DC Machines and Transformers	Vikas publishing house Pvt Ltd	2002
3.	S.Sarma & K.Pathak	Electric Machines	Cengage Learning India (P) Ltd., Delhi,	2011
4.	Syed A. Nasar	Electric Machines and Power Systems	Volume I, Mcgraw-Hill College; International Edition	1995

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23EEC05	INDUCTION AND SYNCHRONOUS MACHINE	L	T	P	C
		3	1	0	4

Course Objective:

- To Demonstrate the basic principle and analyze the regulation of an alternator
- To Explain the characteristics and operation of synchronous motor
- To Discuss the characteristics and operation of 3 phase Induction Motor
- To Elaborate the starting and speed control of 3 phase Induction Motor
- To Outline the operation of single phase and special Electrical Machines

Course Outcomes:

23EEC05.CO1	Demonstrate the basic principle and analyze the regulation of an alternator
23EEC05.CO2	Explain the characteristics and operation of synchronous motor
23EEC05.CO3	Discuss the characteristics and operation of 3 phase Induction Motor
23EEC05.CO4	Elaborate the starting and speed control of 3 phase Induction Motor
23EEC05.CO5	Outline the operation of single phase and special Electrical Machines

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEC05.CO1	x	x	x	-	-	-	-	-	-	-	-	x	x	-	-
23EEC05.CO2	x	x	x	-	-	-	-	-	-	-	-	x	x	-	-
23EEC05.CO3	x	x	x	-	-	-	-	-	-	-	-	x	x	-	-
23EEC05.CO4	x	x	x	-	-	-	-	-	-	-	-	x	x	-	-
23EEC05.CO5	x	x	x	-	-	-	-	-	-	-	-	x	x	-	-

UNIT I ALTERNATOR **9+3**

Basic principle, construction, types of rotor, pitch factor, distribution factor, emf equation, armature reaction - alternator on load, voltage regulation, synchronous impedance(emf) method, mmf method, ZPF method, synchronization and parallel operation of alternator.

UNIT II SYNCHRONOUS MOTOR **9+3**

Principle of operation – Methods of Starting - Torque equation – Operation on infinite bus bars - V and Inverted V curves – Power developed equations –Current loci for constant power input, constant excitation and constant power developed - -Hunting - damper windings - synchronous condenser – Applications

UNIT III THREE PHASE INDUCTION MOTOR **9+3**

Constructional details – Types – Principle of operation - Slip - Equivalent circuit – Torque developed by an induction motor – Torque-Slip characteristics - Losses and efficiency – Load test - No load and blocked rotor tests – Construction of Circle diagram – Separation of losses – Double cage rotors- Induction generators – Applications.

UNIT IV STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTORS **9+3**

Need for starting – Methods of starting - Direct on Line starter, autotransformer, Star-delta and Rotor resistance starters – Speed control methods– Ward Leonard scheme Voltage control, Frequency control and pole changing – Cascaded connection- V/f control – Slip power recovery scheme- Crawling and Cogging – Braking.

UNIT V SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES **9+3**

Constructional details of single phase induction motor – Double field revolving theory and operation – Equivalent circuit – No load and blocked rotor test – Performance analysis – Capacitor-start capacitor run

Induction motor- Shaded pole induction motor - Linear induction motor – Repulsion motor - Hysteresis motor - AC series motor- Universal Motor.

Total Periods: 60

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	A.E. Fitzgerald, Charles Kingsley, Stephen. D.Umans,	Electric Machinery	Tata Mc Graw Hill publishing Company Ltd	2003
2.	D.P. Kothari and I.J. Nagrath	Electric Machines	Tata Mc Graw Hill publishing Company Ltd	2002

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	M.N.Bandyopadhyay	Electrical Machines Theory and Practice	PHI Learning pvt Ltd.,New Delhi	2009
2.	Charless A. Gross	Electric Machines	CRC Press	2010
3.	K. Murugesh Kumar	Electrical Machines	Vikas Publishing HousePvt. Ltd,	2002
4.	Syed A. Nasar	Electric Machines and Power Systems: Volume I	Mcgraw Hill College International	2003

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		L	T	P	C
23EEC06	**CONTROL SYSTEMS**	**2**	**2**	**0**	**4**

Course Objective:

- To understand the use of transfer function models for analysis physical systems and introduce the control system components.
- To provide adequate knowledge in the time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of systems.
- To introduce stability analysis and design of compensators.
- To develop state space models from transfer functions and appreciate its significance.

Course Outcomes:

23EEC06.CO1 Obtain the transfer function of electrical and mechanical systems

23EEC06.CO2 Determine the time-domain response of first and second order systems

23EEC06.CO3 Examine the stability of open loop system using bode / polar plot

23EEC06.CO4 Analyze the stability of the system by root locus and routh hurwitz criterion.

23EEC06.CO5 Analyze the state variable models and feedback controllers

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEC06.CO1	x	x	x	-	-	-	-	-	-	-	-	x	x	-	-
23EEC06.CO2	x	x	-	-	x	-	-	-	-	-	-	x	x	x	x
23EEC06.CO3	x	x	-	x	-	-	-	-	-	-	-	x	x	x	-
23EEC06.CO4	x	x	x	-	-	-	-	-	-	-	-	x	x	x	-
23EEC06.CO5	x	x	x	x	-	-	-	-	-	-	-	x	x	-	-

UNIT I MATHEMATICAL MODELLING OF CONTROL SYSTEMS 6+6

Introduction to Control system, Classification - Closed Loop Control System with Feedback, Transfer Function (Mathematical Preliminaries – Complex Variables, Laplace Transform) – Transfer function of armature controlled & field controlled DC Motor – Modeling of Mechanical and Electrical Systems- Block diagram reductions techniques – Signal Flow Graph.

UNIT II TRANSIENT AND STEADY STATE RESPONSE ANALYSIS 6+6

Time response - Time domain specifications -Types of test input signals – First Order System, Second Order Systems – Transient response analysis with MATLAB - Effects of Integral and Derivative controller actions – Steady state errors in unity feedback control systems.

UNIT III FREQUENCY RESPONSE ANALYSIS 6+6

Frequency response - Frequency domain specifications - Bode plot - Polar plot - Nyquist plot – The Nyquist stability criterion - Introduction to closed loop Frequency Response. Effect of adding lag and lead compensators - Correlation between frequency domain and time domain specifications.

UNIT IV STABILITY ANALYSIS AND COMPENSATOR DESIGN USING TIME DOMAIN 6+6

Concepts of stability - Characteristic equation - Routh Hurwitz criterion - Root Locus technique – Design Specifications - Lag, lead and lag-lead networks - Cascade compensator design using time domain method - Design using reaction curve and Ziegler-Nichols technique.

UNIT V STATE SPACE ANALYSIS 6+6

Concept of state variables - State models for linear and time invariant systems: Electrical, mechanical

controllability – observability - State transition matrix – State feedback controller design.

Total Periods: 60

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	I J Nagrath & M Gopal	Control Systems Engineering	New Age International Publishers	2021
2.	K. Ogata	Modern Control Engineering	PHI press	2015

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Nise	Control Systems Engineering	John wiley, 6th Edition,	2011
2.	Richard C. Dorf andRobert H. Bishop	Modern Control Systems	Pearson Prentice Hall	2012
3.	Benjamin C. Kuo	Automatic Control systems	PHI press	2010.
4.	S.N.Sivanandam,S.N.Deepa	Control System Engineering using Mat Lab	Vikas Publishing	2012

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23EEC07	POWER ELECTRONICS	L	T	P	C
		3	0	0	3

Course Objective:

- To discuss the operation of semiconductor devices and dynamic characteristics
- To analyze the various controlled rectifiers and its performance characteristics
- To evaluate the various configurations of dc-dc converters and its performance parameters.
- To apply the different modulation techniques to pulse width modulated inverters
- To develop the various configurations of AC voltage controllers and Cycloconverters

Course Outcomes:

23EEC07.CO1 Discuss the operation of semiconductor devices and dynamic characteristics

23EEC07.CO2 Analyze the various controlled rectifiers and its performance characteristics

23EEC07.CO3 Evaluate the various configurations of dc-dc converters and its performance parameters.

23EEC07.CO4 Apply the different modulation techniques to pulse width modulated inverters

23EEC07.CO5 Develop the various configurations of AC voltage controllers and Cycloconverters

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEC07.CO1	x	x	x	x	-	-	-	-	-	-	-	-	x	-	-
23EEC07.CO2	x	x	x	x	-	-	-	-	-	-	-	-	x	-	-
23EEC07.CO3	x	x	x	x	-	-	-	-	-	-	-	-	x	-	-
23EEC07.CO4	x	x	x	x	-	-	-	-	-	-	-	-	x	-	-
23EEC07.CO5	x	x	x	x	-	-	-	-	-	-	-	-	x	-	-

UNIT I POWER SEMICONDUCTOR DEVICES 9

Introduction - V-I and switching characteristics of power semiconductor devices: Power Diode, Thyristor, BJT, MOSFET, IGBT - SCR two transistor analogy - SCR Protection circuits - SCR firing circuits - SCR Commutation techniques.

UNIT II AC - DC CONVERTERS 9

Principle of phase controlled converter - Performance parameters - Single phase half and fully controlled converter with R, RL, RLE load - Freewheeling diode - Three phase half and fully controlled converter with R, RL, RLE load - Effect of source Inductance

UNIT III DC - DC CONVERTERS 9

DC Chopper : Principle of chopper operations - Step up and step down chopper - control strategy - Switched mode regulators - Buck, boost, buck boost regulators - Operation of two quadrant and four quadrant DC choppers with R and RL load – Introduction to Voltage, Current and Load commutated chopper

UNIT IV DC - AC CONVERTERS 9

Principle of operation Single phase voltage source inverters - Three phase voltage source inverters - 1200 and 1800 mode operation - Voltage control of inverter using PWM, Single PWM, Multiple PWM, Sinusoidal PWM and Modified SPWM - Harmonic reduction techniques - Single phase current source inverter

UNIT V AC - AC CONVERTERS 9

AC Voltage controllers: Single phase AC voltage controller with R and RL load – Control Strategy - Cycloconverter - Step up and step down - Principle of operation of single phase to single phase cycloconverter - Principle of operation of single phase to three phase cyclo converter - Matrix converter

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Rashid.M.H	Power Electronics Circuits Devices and Applications	Pearson Education India Publication, New Delhi	2013
2.	Bimbhra.P.S	Power Electronics	Khanna Publishers	2012

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Sen.P.C	Power Electronics	Tata Mc Graw Hill	2004
2.	Singh.M.D and Khanchandani.K.B	Power Electronics	Tata Mc Graw Hill	2006
3.	Umanand L	Power Electronics: Essentialsand Applications	Wiley	2009
4.	Ned Mohan	Power Electronics	John Willey and sons	2007

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23EEC08	ELECTRICAL DRIVES	L	T	P	C
		3	0	0	3

Course Objective:

- To discuss the drive characteristics of AC and DC motors
- To explain the analysis of Converter/Chopper fed dc drive
- To evaluate speed control characteristics of Induction motor drives
- To formulate the speed control characteristics of Synchronous motor drives
- To Design of controllers for Electrical drives

Course Outcomes:

23EEC08.CO1 Discuss the drive characteristics of AC and DC motors

23EEC08.CO2 Explain the analysis of Converter / Chopper fed dc drive

23EEC08.CO3 Evaluate speed control characteristics of Induction motor drives

23EEC08.CO4 Formulate the speed control characteristics of Synchronous motor drives

23EEC08.CO5 Design of controllers for Electrical drives

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23GES08.CO1	x	x	-	-	-	-	-	-	-	-	-	x	x	-	-
23GES08.CO2	x	x	-	-	-	-	-	-	-	-	-	x	x	-	-
23GES08.CO3	x	x	-	x	-	-	-	-	-	-	-	x	x	x	-
23GES08.CO4	x	x	x	x	-	-	-	-	-	-	-	x	x	x	-
23GES08.CO5	x	x	-	-	-	-	-	-	-	-	-	x	x	-	-

UNIT I DRIVECHARACTERISTICS 9

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

UNIT II CONVERTER /CHOPPERFED DC MOTOR DRIVE 9

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

UNIT III INDUCTIONMOTOR DRIVES 9

Stator voltage control–energy efficient drive–v/f control–constant air gap flux–field weakening mode–voltage / current fed inverter– Slip power recovery schemes: Static Kramer drive and static scherbuis drive-closed loop control

UNIT IV SYNCHRONOUSMOTOR DRIVES 9

Self and separate control of synchronous motor: Margin angle control and power factor control – Self-control of CSI and VSI fed synchronous motor- permanent magnet synchronous motor: Sinusoidal PMAC–Trapezoidal PMAC

UNIT V DESIGNOF CONTROLLERSAND APPLICATIONFOR DRIVES 9

Design of controllers; current controller and speed controller - Selection of drives and control schemes forsteelrollingmills, Papermills, LiftsandCranes–Microprocessor/Microcontrollerbasedcontrolofdrives.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dubey G K	Fundamentals of Electrical Drives	Narosa Publishing House	2007
2.	Bimal K Bose	Modern Power Electronics and AC Drives	Pearson Education	2002

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	R.Krishnan	Electric Motor & Drives: Modeling ,Analysis and Control	Prentice Hall of India	2001
2.	John Hind marsh and Alasdain Renfrew	Electrical Machines and Drives System	Elsevier	2012
3.	Shaahin Felizadeh,	Electric Machines and Drives	CRC Press (Taylor and Francis Group)	2013
4.	Pillai SK	A First course on Electrical Drives	Wiley Eastern Limited	2013

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23EEC09	MICRO COMPUTING BASED SYSTEM DESIGN	L	T	P	C
		3	0	0	3

Course Objective:

- To analyze the architecture in 8085 microprocessor.
- To explain the architecture of 8051 microcontroller.
- To develop an ALP of 8085 and 8051 and analyze the PIC Microcontroller.
- To create Programming and Interfacing of 8085 and 8051.
- To design the various applications of 8085 and 8051.

Course Outcomes:

23EEC09.CO1 Analyze the architecture in 8085 microprocessor.

23EEC09.CO2 Explain the architecture of 8051 microcontroller.

23EEC09.CO3 Develop an ALP of 8085 and 8051 and analyze the PIC Microcontroller.

23EEC09.CO4 Create Programming and Interfacing of 8085 and 8051.

23EEC09.CO5 Design the various applications of 8085 and 8051.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEC09.CO1	x	-	x	-	x	-	-	-	-	x	x	x	x	-	-
23EEC09.CO2	x	-	x	-	x	-	-	-	-	x	x	x	x	-	-
23EEC09.CO3	x	x	x	-	x	-	-	-	-	x	x	x	x	-	-
23EEC09.CO4	x	-	x	-	x	-	-	-	-	x	x	x	x	-	-
23EEC09.CO5	x	-	x	-	x	-	-	-	-	x	x	x	x	-	-

UNIT I 8085 Processor **9**

Basics of Microprocessor - Architecture of 8085 - Pin Diagram - Instruction Set - Addressing Modes – Interrupts of 8085 – Memory Organization-Introduction to ARM Processor & ARM Organization.

UNIT II 8051 Controller **9**

Basics of Microcontroller - Architecture of 8051 - I/O Ports of 8051 - Pin Diagram - Instruction Set - Addressing Modes of 8051 - Timing Diagram - Memory Organization.

UNIT III Programming and Advanced Controllers **9**

Basic programming (ALP) of 8085 and 8051 - Loop Structures, counting and Indexing with programming concepts – Subroutine and its programming – PIC microcontroller Concepts - 16C6X Architecture – 16C7X Architecture, Simple operation on PIC.

UNIT IV Programming and Interfacing of 8085 & 8051 **9**

Interfacing: Architecture, configuration and interfacing, with ICs: Programmable Peripheral Interface (PPI) 8255 -programmable interrupt controller (PIC) 8259 - Programmable Interval Timer (PIT) 8254 - DMA Controller 8237 - USART 8251 - keyboard display controller 8279.

UNIT V Applications of Processors and Controllers **9**

Key board and display interface - stepper motor control - Washing Machine Control - LED Control, servo motor Control with 8085 & 8051.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Soumitra Kumar Mandal	Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051	McGraw Hill Education	2013
2.	Furber,S	ARM System on Chip Architecture	Addison Wesley trade Computer Publication	2000

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely	The 8051 Micro Controller and Embedded Systems	PHI Pearson Education, 5th Indian reprint	2003
2.	N.Senthil Kumar, M.Saravanan, S.Jeevananthan	Microprocessors and Microcontrollers	Oxford	2013
3.	R.S. Gaonkar	'Microprocessor Architecture Programming and Application', with 8085	Wiley Eastern Ltd., New Delhi	2013
4.	Rafiquzzaman. M	Microprocessors Theory and applications - Intel and Motorola	Prentice Hall India	2001

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23EEC10	POWER SYSTEM ANALYSIS	L	T	P	C
		3	1	0	4

Course Objective:

- To discuss per unit analysis and computational models of power systems
- To discuss per unit analysis and computational models of power systems
- To evaluate the effect of balanced fault in power system using Z bus computational method
- To estimate the effect of unbalanced fault using computation of symmetrical component
- To discuss the power system during transient condition

Course Outcomes:

23EEC10.CO1	Discuss per unit analysis and computational models of power systems
23EEC10.CO2	Discuss per unit analysis and computational models of power systems
23EEC10.CO3	Evaluate the effect of balanced fault in power system using Z bus computational method
23EEC10.CO4	Estimate the effect of unbalanced fault using computation of symmetrical component
23EEC10.CO5	Discuss the power system during transient condition

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEC10.CO1	x	x	x	x	x	-	x	-	-	x	-	-	x	x	x
23EEC10.CO2	x	x	x	x	x	-	x	-	-	x	-	-	x	x	x
23EEC10.CO3	x	x	x	x	x	-	x	-	-	x	-	-	x	x	x
23EEC10.CO4	x	x	x	x	x	-	x	-	-	x	-	-	x	x	x
23EEC10.CO5	x	x	x	x	x	-	x	-	-	x	-	-	x	x	x

UNIT I INTRODUCTION 9+3

Need for system planning and operational studies – Introduction to restructuring – Single line diagram - Per unit representation – Per unit impedance and reactance diagram – Bus incidence Matrix - Primitive network – Formation of Y – bus by two rule method - Gaussian elimination method - Formation of Y – bus using singular transformation method.

UNIT II POWER FLOW ANALYSIS 9+3

Importance of power flow analysis in planning and operation of power systems – statement of power flow problem – classification of buses – development of power flow model in complex variables form and Polar variable form - Power flow solution using Newton Raphson, Gauss seidel and Fast decoupled method.

UNIT III FAULT ANALYSIS – BALANCED FAULTS 9+3

Importance of short circuit analysis - assumptions in fault analysis – analysis using Thevenin's theorem – Z –bus building algorithm – fault analysis using Z-bus – computations of short circuit capacity, post fault voltage, currents and line flows..

UNIT IV FAULT ANALYSIS – UNBALANCED FAULTS 9+3

Introduction to symmetrical components – sequence impedances – sequence circuits of synchronous machine, transformer and transmission lines - sequence networks analysis of single line to ground, line to line and double line to ground faults using Thevenin's theorem and Z-bus matrix.

UNIT V POWER SYSTEM STABILITY 9+3

Steady state and transient Stability – Introduction to voltage stability – Single Machine Infinite Bus (SMIB) system: Development of swing equation - step by step method - equal area criterion - solution of swing equation by

modified Euler method and Runge - Kutta fourth order method.

Total Periods: 60

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	NagrathI.J. and Kothari D.P	Modern Power System Analysis	Tata McGraw Hill	2011
2.	John J.Grainger and W.D.Stevenson Jr.	Power System Analysis	Tata Mc Graw-Hill	2010

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Hadi Saadat	Power System Analysis	Tata McGraw Hill	2010
2.	P.Venkatesh, B.V.Manikandan, S.Charles Raja, A.Srinivasan	Electrical Power Systems-Analysis, Security and Deregulation	PHI Learning Private Limited	2012
3.	Kundur P	Power System Stability and Control	Tata McGraw Hill	2010
4.	J.DuncanGlover, Mulukutla S.Sarma, Thomas J.Overbye	Power System Analysis & Design	Cengage Learning,	2012

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23EEC11	OPERATION AND CONTROL OF ELECTRICAL POWER SYSTEMS	L	T	P	C
		3	0	0	3

Course Objective:

- To elaborate the operation and control of power system
- To discuss the real power frequency control of power system
- To explain the reactive power voltage control of power system
- To solve the unit commitment and economic dispatch problem
- To develop the computer control of power system

Course Outcomes:

23EEC11.CO1	Elaborate the operation and control of power system
23EEC11.CO2	Discuss the real power frequency control of power system
23EEC11.CO3	Explain the reactive power voltage control of power system
23EEC11.CO4	Solve the unit commitment and economic dispatch problem
23EEC11.CO5	Develop the computer control of power system

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEC11.CO1	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
23EEC11.CO2	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
23EEC11.CO3	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
23EEC11.CO4	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
23EEC11.CO5	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-

UNIT I INTRODUCTION **9**

An overview of power system operation and control - system load variation - load curves and load- duration curve - load factor - diversity factor - Importance of load forecasting and quadratic and exponential curve fitting techniques of forecasting – plant level and system level controls.

UNIT II REAL POWER - FREQUENCY CONTROL **9**

Basics of speed governing mechanism and modeling - speed-load characteristics – load sharing between two synchronous machines in parallel - control area concept - LFC control of a single-area system - static and dynamic analysis of uncontrolled and controlled cases - two-area system – modeling - static analysis of uncontrolled case - state variable model - integration of economic dispatch control with LFC.

UNIT III REACTIVE POWER–VOLTAGE CONTROL **9**

Generation and absorption of reactive power - basics of reactive power control - excitation systems – modeling - static and dynamic analysis - stability compensation - methods of voltage control: tap changing transformer, SVC (TCR + TSC) and STATCOM – secondary voltage control.

UNIT IV UNIT COMMITMENT AND ECONOMIC DISPATCH **9**

Formulation of economic dispatch problem – I/O cost characterization – incremental cost curve – coordination equations without and with loss (No derivation of loss coefficients) - solution by direct method and λ-iteration method - statement of unit commitment problem – priority-list method – forward dynamic programming.

UNIT V COMPUTER CONTROL OF POWER SYSTEMS **9**

Need for computer control of power systems - concept of energy control centre - functions – system monitoring - data acquisition and control - system hardware configuration – SCADA and EMS functions - network topology - state

estimation – WLSE - Contingency Analysis - state transition diagram showing various state transitions and control strategies.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Olle.I.Elgerd	Electric Energy Systems theory -An introduction'	Tata McGraw Hill Education Pvt. Ltd.	2010
2.	Abhijit Chakrabarti	Power System Analysis Operationand Control	PHI learning Pvt. Ltd	2010

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Allen. J. Wood andBruce F.	Power Generation, Operationand Control	John Wiley & Sons	2003
2.	Nagrath I.J. andKothari D.P	Modern Power System Analysis	Tata McGraw-Hill	2011
3.	Kundur P	Power System Stability and Control	Tata McGraw HillEducation Pvt. Ltd	2010
4.	Hadi Saadat	Power System Analysis	Tata McGraw HillEducation Pvt. Ltd	2010

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23EEC12	TRANSMISSION & DISTRIBUTION	L	T	P	C
		3	0	0	3

Course Objective:

- To understand basic structure of power systems and transmission line parameters
- To develop the modelling of various types of transmission line parameters
- To obtain the mechanical design of transmission lines
- To analyse the voltage distribution in insulator strings, cables and methods to improve the same
- To analyze various distribution systems and advances in transmission lines

Course Outcomes:

23EEC12.CO1	Discuss the structure of power systems and evaluate the transmission line parameters
23EEC12.CO2	Develop the modelling and performance of types of transmission lines
23EEC12.CO3	Design the mechanical model of transmission lines under various working condition
23EEC12.CO4	Evaluate the performance and fault detection of cables and insulators
23EEC12.CO5	Design the distribution and the state-of -art in transmission lines

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEC12.CO1	x	x	-	-	-	x	-	-	-	-	-	x	x	-	-
23EEC12.CO2	x	x	x	-	x	-	-	-	-	-	-	-	x	-	x
23EEC12.CO3	x	x	-	-	-	-	-	-	-	-	-	-	x	-	-
23EEC12.CO4	x	x	-	-	x	x	x	-	-	-	-	-	x	-	x
23EEC12.CO5	x	x	x	x	-	-	x	-	-	-	x	x	x	x	-

UNIT I TRANSMISSION LINE PARAMETERS 9

Structure of Power System -Parameters of single and three phase transmission lines with single and double circuits- Resistance, inductance and capacitance of solid, stranded and bundled conductors, Symmetrical and unsymmetrical spacing and transposition –application of self and mutual GMD; skin and proximity effects.

UNIT II MODELLING & PERFORMANCE OF TRANSMISSION LINES 9

Classification of lines - short line, medium line and long line - equivalent circuits, phasor diagram, attenuation constant, phase constant, surge impedance; transmission efficiency and voltage regulation, real and reactive power flow in lines, surge impedance loading, methods of voltage control; Ferranti effect.

UNIT III MECHANICAL DESIGN OF LINES 9

Mechanical design of OH lines –Line Supports –Types of towers – Stress and Sag Calculation–Effects of Wind and Ice loading, interference with neighboring communication circuits - Formation of Corona – Critical Voltages–Effect on Line Performance.

UNIT IV INSULATORS AND CABLES 9

Insulators - Types, voltage distribution in insulator string, improvement of string efficiency, testing of insulators. Underground cables - Types of cables, Capacitance of Single-core cable, Grading of cables, Power factor and heating of cables, Capacitance of 3- core belted cable.

UNIT V DISTRIBUTION SYSTEMS 9

Distribution Systems –General Aspects –Kelvin's Law –AC and DC distributions- Methods of Power factor improvement –Distribution Loss––Trends in Transmission and Distribution: EHVAC, HVDC and FACTS (Qualitative treatment only).

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Soni M L, Gupta P V, Bhatnagar US and Chakrabarthi	A Text Book on Power SystemEngineering	Dhanpat Rai & Co.,New Delhi	2013
2.	B.R.Gupta	Power System Analysis and Design	Chand & Co	2003

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Allen. J. Wood andBruce F.	Power Generation, Operationand Control	John Wiley & Sons	2003
2.	Nagrath I.J. andKothari D.P	Modern Power System Analysis	Tata McGraw-Hill	2011
3.	Kundur P	Power System Stability and Control	Tata McGraw HillEducation Pvt. Ltd	2010
4.	Hadi Saadat	Power System Analysis	Tata McGraw HillEducation Pvt. Ltd	2010

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23EEC13	PROTECTION AND SWITCHGEAR	L	T	P	C
		3	0	0	3

Course Objective:

- To analysis the power system faults, grounding techniques and protection scheme
- To select the protective relay for appropriate protection of power system equipment
- To discuss the transmission line equipment protection methods
- To discuss the characteristics of circuit breaker for protection of power system equipment
- To discuss the working of different types of switch gear equipment's

Course Outcomes:

23EEC13.CO1	Analysis the power system faults, grounding techniques and protection scheme
23EEC13.CO2	Select the protective relay for appropriate protection of power system equipment
23EEC13.CO3	Discuss the transmission line equipment protection methods
23EEC13.CO4	Discuss the characteristics of circuit breaker for protection of power system equipment
23EEC13.CO5	Discuss the working of different types of switch gear equipment's

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEC13.CO1	x	x	x	-	-	x	x	-	-	-	-	x	x	-	-
23EEC13.CO2	x	x	x	-	-	x	x	-	-	-	-	x	x	-	-
23EEC13.CO3	x	x	x	-	-	x	x	-	-	-	-	x	x	-	-
23EEC13.CO4	x	x	x	-	-	x	x	-	-	-	-	x	x	-	-
23EEC13.CO5	x	x	x	-	-	x	x	-	-	-	-	x	x	-	-

UNIT I INTRODUCTION TO PROTECTION SCHEMES 9

Principles and need for protective schemes-Nature and causes of faults, Types of faults - Power system grounding - Zones of protection - Step and Touch potential - Protective scheme.

UNIT II PROTECTIVE RELAY 9

Operating principles of relay - Torque equation – RX diagram for directional, distance, differential, MHO, impedance, negative sequence relay - Static and numerical over current relay.

UNIT III APPARATUS AND LINE PROTECTION 9

Protection of alternator, Merz-Price protection system, protection schemes and operation of transformer, induction motor, bus bar, Primary and Backup protection - transmission line and feeder protection schemes- microprocessor based protective schemes.

UNIT IV CIRCUIT INTERRUPTION AND CIRCUIT BREAKER 9

Arc phenomenon - restriking and recovery voltage – resistance switching , RRRV, current chopping – Introduction to circuit breakers – Types - Air blast, oil, Vacuum, SF6 circuit breakers advantages and disadvantages, applications – HVDC Circuit breakers – MCB, MCCB ELCB – Comparison of circuit breakers -– Selection and testing of circuit breakers.

UNIT V SWITCHGEAR 9

Switchgear - essential features - Substations – Types – Equipment - Layout of a typical substation- CTs and PTs of protection.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Sunil S. Rao	Protection and Switch Gear	Khanna Publishers 4th edition, New Delhi	2392
2.	Badri Ram andD.N. Vishwakarma	Power System Protection andSwitch Gear	McGraw Hill 2nd edition	2007

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Badri Ram & Viswakarma D N	Power system Protection andswitchgear	Tata Mcgraw Hill	2013
2.	Wadhwa C L	Electrical Power Systems	New age International	2010
3.	Metha V K and RohitMetha	Principles of power system	S. Chand company	2011
4.	Blackburn J. Lewis	Protective Relaying: Principlesand Applications	CRC Press, New York	2006

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23EEC14	NETWORK ANALYSIS AND SYNTHESIS	L	T	P	C
		2	1	0	3

Course Objective:

- To apply dot convolution concepts to coupled coils.
- To analyze the two port network ideas.
- To apply the two port ideas into electrical network.
- To analyze the basic concepts of graph theory
- To apply the concepts of graph theory to electrical network

Course Outcomes:

23EEC14.CO1	Apply dot convolution concepts to coupled coils.
23EEC14.CO2	Analyze the two port network ideas.
23EEC14.CO3	Apply the two port ideas into electrical network.
23EEC14.CO4	Analyze the basic concepts of graph theory
23EEC14.CO5	Apply the concepts of graph theory to electrical network

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEC14.CO1	x	x	x	x	-	-	-	-	-	-	-	x	x	x	-
23EEC14.CO2	x	x	x	-	-	-	-	-	-	-	-	x	x	x	-
23EEC14.CO3	x	x	x	x	-	-	-	-	-	-	-	x	x	x	-
23EEC14.CO4	x	x	x	-	-	-	-	-	-	-	-	x	x	x	-
23EEC14.CO5	x	x	x	x	-	-	-	-	-	-	-	x	x	x	-

UNIT I COUPLED COILS 6+3

Review basic Magnetic circuits – basic terminologies – self and mutual inductance – coefficient of mutual coupling – Dot convolution in mutually coupled coils – mutually coupled coils in series and parallel – energy stored in mutually coupled coils – steady state response with sinusoidal excitation when coils are mutually coupled.

UNIT II TWO PORT NETWORKS 6+3

Basics of two port network – Z parameter, Y Parameter - Relation between Z parameter and Y parameter – H parameter – ABCD parameter – Theory of reciprocity and symmetry for Z, Y, H and ABCD parameter.

UNIT III INTERCONNECTION OF NETWORKS 6+3

Series connections of two port network – parallel connections of two port network – cascade connection of two port network – represent an ideal transformer as a two-port network – Gyrator – matrix of Gyrator – representation of ideal transformer using Gyrator.

UNIT IV GRAPH THEORY 6+3

Graph theory applied to network analysis – nodes – branches – elements – incidence matrix (A) – KCL and NODE equations using incidence matrix – Tie set matrix (B) – KCL and NODE equations using tie set matrix – Cut set matrix (Q) - KCL and NODE equations using cut set matrix.

UNIT V APPLICATIONS OF GRAPH THEORY TO NETWORKS 6+3

Mesh Analysis using with Graph theory – Nodal Voltage Analysis using with Graph theory – Cut set analysis with Graph theory – solving electrical network with incidence, tie set and cut set matrix.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	A. Sudhakar, Shyammohan S Palli	Circuits and NETWORKS Analysis and Synthesis	Tata McGraw Hill	2010
2.	William H Hayt ,Jack E Kemmerly, Steven M Durbin	A Course in Electronic Engineering Circuit Analysis	Tata McGraw Hill	2013.

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Ghosh, A KChakraborty	Network Analysis and Synthesis	Tata McGraw Hill	2006.
2.	S. P. Eugene Xavier	Electric Circuit Analysis	New Age InternationalLtd	2008
3.	Ravish R. Singh	Electrical Networks	Tata McGraw Hill	2009
4.	M.E.Van Valkenburg	Network Analysis PHI Learning	Tata McGraw Hill	2014

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23EEC16	DC MACHINES AND TRANSFORMERS LABORATORY	L	T	P	C
		0	0	2	1

Course Objective:

- To Infer the characteristics of DC generators.
- To Infer the characteristics of DC Motors
- To Determine the efficiency of the DC Machines
- To Determine the efficiency of the Transformers
- To Predetermine the efficiency of the DC Machines and Transformer

Course Outcomes:

23EEC16.CO1	Infer the characteristics of DC generators.
23EEC16.CO2	Infer the characteristics of DC Motors
23EEC16.CO3	Determine the efficiency of the DC Machines
23EEC16.CO4	Determine the efficiency of the Transformers
23EEC16.CO5	Predetermine the efficiency of the DC Machines and Transformer

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEC16.CO1	x	x	x	x	-	-	-	-	x	x	-	x	x	x	-
23EEC16.CO2	x	x	x	x	-	-	-	-	x	x	-	x	x	x	-
23EEC16.CO3	x	x	x	x	-	-	-	-	x	x	-	x	x	x	-
23EEC16.CO4	x	x	x	x	-	-	-	-	x	x	-	x	x	x	-
23EEC16.CO5	x	x	x	x	-	-	-	-	x	x	-	x	x	x	-

Sl.No.	List of Experiments
1.	Open circuit and load characteristics of DC shunt generator.
2.	Load characteristics of DC compound generator with differential and cumulative connections.
3.	Load test on DC shunt and compound motor.
4.	Load test on DC series motor.
5.	Swinburne's test.
6.	Speed control of DC shunt motor.
7.	Load test on single-phase transformer and three phase transformers.
8.	Open circuit and short circuit tests on single phase transformer
9.	Polarity Test and Sumpner's test on single phase transformers
10.	Separation of no-load losses in single phase transformer.

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Total Periods: 30

23EEC17	AC MACHINES LABORATORY	L	T	P	C
		0	0	2	1

Course Objective:

- To determine the regulation of an alternator by EMF, MMF, ZPF and Slip test Methods
- To measure the negative sequence and zero sequence impedance of alternators
- To compare the characteristics of Synchronous Motor
- To test the performance of single-phase Induction Motor
- To test the performance of three phase Induction Motor

Course Outcomes:

23EEC17.CO1	Determine the regulation of an alternator by EMF, MMF, ZPF and Slip test Methods
23EEC17.CO2	Measure the negative sequence and zero sequence impedance of alternators
23EEC17.CO3	Compare the characteristics of Synchronous Motor
23EEC17.CO4	Test the performance of single-phase Induction Motor
23EEC17.CO5	Test the performance of three phase Induction Motor

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEC17.CO1	x	x	x	x	-	-	-	-	x	x	-	x	x	x	-
23EEC17.CO2	x	x	x	x	-	-	-	-	x	x	-	x	x	x	-
23EEC17.CO3	x	x	x	x	-	-	-	-	x	x	-	x	x	x	-
23EEC17.CO4	x	x	x	x	-	-	-	-	x	x	-	x	x	x	-
23EEC17.CO5	x	x	x	x	-	-	-	-	x	x	-	x	x	x	-

Sl.No. **List of Experiments**

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1. Regulation of three phase alternator by EMF and MMF methods.
2. Regulation of three phase alternator by ZPF methods and slip test.
3. Measurements of negative sequence alternators
4. Measurements of zero sequence impedance of alternators
5. V and Inverted V curves of Three Phase Synchronous Motor.
6. Load test on three-phase induction motor.
7. No load and blocked rotor test on three-phase induction motor (Determination of equivalent circuit parameters).
8. Separation of No-load losses of three-phase induction motor.
9. Load test on single-phase induction motor.
10. No load and blocked rotor test on single-phase induction motor.

Total Periods: 30

23EEC18	CONTROL SYSTEMS LABORATORY	L	T	P	C
		0	0	2	1

Course Objective:

- To learn, design and characterizing of circuit behavior with OPAMP ICs.
- To learn, design and characterizing of circuit behavior with analog ICs like 555 timer VCO and regulators.
- To determine the characteristics of synchro pair and closed loop PID controller
- To determine the transfer function of Servomotor and motor position control
- To examine the lag, lead compensators and stability of linear system using MATLAB

Course Outcomes:

23EEC18.CO1	Design the OP-AMP circuit for different applications
23EEC18.CO2	Design multi-vibrator using NE / SE 555 timer and voltage regulator using LM317&LM723
23EEC18.CO3	Determine the characteristics of synchro pair and closed loop PID controller
23EEC18.CO4	Determine the transfer function of Servomotor and motor position control
23EEC18.CO5	Examine the lag, lead compensators and stability of linear system using MATLAB

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEC17.CO1	x	x	x	x	-	-	-	-	x	x	-	x	x	x	-
23EEC17.CO2	x	x	x	x	-	-	-	-	x	x	-	x	x	x	-
23EEC17.CO3	x	x	x	x	-	-	-	-	x	x	-	x	x	x	-
23EEC17.CO4	x	x	x	x	-	-	-	-	x	x	-	x	x	x	-
23EEC17.CO5	x	x	x	x	-	-	-	-	x	x	-	x	x	x	-

Sl.No. **List of Experiments**

1. Regulation of three phase alternator by EMF and MMF methods.
2. Regulation of three phase alternator by ZPF methods and slip test.
3. Measurements of negative sequence alternators
4. Measurements of zero sequence impedance of alternators
5. V and Inverted V curves of Three Phase Synchronous Motor.
6. Load test on three-phase induction motor.
7. No load and blocked rotor test on three-phase induction motor (Determination of equivalent circuit parameters).
8. Separation of No-load losses of three-phase induction motor.
9. Load test on single-phase induction motor.
10. No load and blocked rotor test on single-phase induction motor.

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Total Periods: 30

23EEC19	POWER ELECTRONICS LABORATORY	L	T	P	C
		0	0	2	1

Course Objective:

- To design the various firing circuits for triggering the semiconductor devices
- To evaluate the characteristics of power semiconductor devices
- To develop the skills to simulate ac-dc converters circuits using simulation software
- To evaluate the performance of choppers and inverters experimentally
- To construct the power converter circuits for ac-ac converters experimentally

Course Outcomes:

23EEC19.CO1	Design various firing circuits for triggering the semiconductor devices
23EEC19.CO2	Evaluate the characteristics of power semiconductor devices
23EEC19.CO3	Develop skills to simulate ac-dc converters circuits using simulation software
23EEC19.CO4	Evaluate the performance of choppers and inverters experimentally
23EEC19.CO5	Construct power converter circuits for ac-ac converters experimentally

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEC19.CO1	x	x	x	x	x	-	-	-	-	-	-	x	x	x	-
23EEC19.CO2	x	x	x	x	x	-	-	-	-	-	-	x	x	x	-
23EEC19.CO3	x	x	x	x	x	-	-	-	-	-	-	x	x	x	-
23EEC19.CO4	x	x	x	x	x	-	-	-	-	-	-	x	x	x	-
23EEC19.CO5	x	x	x	x	x	-	-	-	-	-	-	x	x	x	-

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Sl.No. **List of Experiments**

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1. Generation of gate pulse using R, RC and UJT.
2. Characteristics of SCR
3. Characteristics of MOSFET and IGBT
4. Experimental verification and simulation of single-phase half-controlled converters
5. Experimental verification and simulation of single phase fully controlled converters
6. Experimental verification and simulation of three phase half-controlled Converters
7. Experimental verification and simulation of three phase fully controlled Converters
8. Four quadrant operation of dc motor using chopper.
9. Single phase and three phase IGBT based PWM inverters.
10. A. Experimental verification of single-phase AC voltage controller.
    B. Experimental verification of single phase cycloconverter

Total Periods: 30

23EEC20	POWER SYSTEM SIMULATION LABORATORY	L	T	P	C
		0	0	2	1

Course Objective:

- To model the Transmission Lines
- To perform the power evacuation studies for future generation and transmission system planning
- To analysis the short circuit and stability studies on power system
- To operate of power system with respect to voltage and frequency
- To optimal the scheduling of generator

Course Outcomes:

23EEC20.CO1	Modeling of Transmission Lines
23EEC20.CO2	Performance on power evacuation studies for future generation and transmission system planning
23EEC20.CO3	Analysis of short circuit and stability studies on power system
23EEC20.CO4	Operation of power system with respect to voltage and frequency
23EEC20.CO5	Optimal scheduling of generator

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEC20.CO1	x	x	x	x	x	-	x	-	-	x	-	-	x	x	x
23EEC20.CO2	x	x	x	x	x	-	x	-	-	x	-	-	x	x	x
23EEC20.CO3	x	x	x	x	x	-	x	-	-	x	-	-	x	x	x
23EEC20.CO4	x	x	x	x	x	-	x	-	-	x	-	-	x	x	x
23EEC20.CO5	x	x	x	x	x	-	x	-	-	x	-	-	x	x	x

Sl.No.	List of Experiments
1.	Modeling and computation of transmission lines
2.	Formation of bus admittance matrices
3.	Formation of bus impedance matrices
4.	Load flow analysis using Gauss-Seidel method
5.	Load flow analysis using Newton-Raphson methods
6.	Symmetrical short circuit fault analysis
7.	Unsymmetrical short circuit fault analysis
8.	Transient stability analysis of Single-Machine Infinite Bus system
9.	Transient stability analysis of Multi machine power systems
10.	C. Load – frequency dynamics of Single- Area and Two-Area power systemsEconomic dispatch in power systems

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Total Periods: 30

23EEC21	Micro computing Based System Design Laboratory	L	T	P	C
		0	0	2	1

Course Objective:

- To Verify the addition and subtraction in 8085 Microprocessor
- To Verify multiplication and division in 8085 Microprocessor
- To Desing a program to verify Ascending and Descending order in 8085 Microprocessor.
- To Desing a program for code conversion.
- To Verify the addition, subtraction, multiplication and division in 8085 Microprocessor

Course Outcomes:

23EEC21.CO1	Verify the addition and subtraction in 8085 Microprocessor
23EEC21.CO2	Verify multiplication and division in 8085 Microprocessor
23EEC21.CO3	Desing a program to verify Ascending and Descending order in 8085 Microprocessor.
23EEC21.CO4	Desing a program for code conversion.
23EEC21.CO5	Verify the addition, subtraction, multiplication and division in 8085 Microprocessor

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEC21.CO1	x	x	x	-	x	-	-	-	x	x	x	x	x	-	x
23EEC21.CO2	x	x	x	-	x	-	-	-	x	x	x	x	x	-	x
23EEC21.CO3	x	x	x	x	x	-	-	-	x	x	x	x	x	x	x
23EEC21.CO4	x	x	x	-	x	-	-	-	x	x	x	x	x	-	x
23EEC21.CO5	x	x	x	x	x	-	-	-	x	x	x	x	x	x	x

Sl.No.	List of Experiments
1.	Programming With 8085 – 8bit and 16bit Addition and Subtraction.
2.	Calculate the sum of series of numbers
3.	Programming With 8085- 8bit and 16bit Multiplication and Division.
4.	Programming With 8085-Ascending and Descending Order.
5.	Programming With 8085- Maximum and Minimum Number in A Group of Data.
6.	Code Conversion ASCII/Binary/BCD.
7.	Interfacing A/D with 8085 Microprocessor.
8.	8-Bit Addition and Subtraction Using 8051.
9.	8-Bit Multiplication Using 8051.
10.	D. 8-Bit Division Using 8051.

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Total Periods: 30

23EEE01	POWER SYSTEM STABILITY	L	T	P	C
		3	0	0	3

Course Objective:

- To understand the basic modeling and stability considerations of power system
- To investigate transient stability issues of single and multiple synchronous machines in power systems
- To appraise and analyze the small signal stability and the effects of excitation systems on small signal stability
- To evaluate the various aspects of voltage stability in power systems
- To interpret and devise different schemes for improving transient stability and voltage stability.

Course Outcomes:

23EEE01.CO1	Understand the basic modeling and stability considerations of power system
23EEE01.CO2	Investigate transient stability issues of single and multiple synchronous machines in power systems
23EEE01.CO3	Appraise and analyze the small signal stability and the effects of excitation systems on small signal stability
23EEE01.CO4	Evaluate the various aspects of voltage stability in power systems
23EEE01.CO5	Schemes for improving transient stability and voltage stability.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEE01.CO1	X	-	-	-	-	-	-	-	-	X	-	X	X	-	X
23EEE01.CO2	X	X	-	-	-	X	-	-	-	X	-	-	X	X	X
23EEE01.CO3	X	X	-	-	-	X	-	-	-	X	-	-	X	X	X
23EEE01.CO4	X	-	X	-	X	-	-	-	-	X	-	-	X	-	X
23EEE01.CO5	X	-	-	-	-	-	-	-	-	X	-	-	X	-	X

UNIT I POWER SYSTEM STABILITY INTRODUCTION 9

Power system stability considerations – definitions-classification of stability - rotor angle and voltage stability - synchronous machine – Modeling - load modeling concepts - modeling of excitation systems - modeling of prime movers.

UNIT II TRANSIENT STABILITY 9

Transient stability - swing equation-equal area criterion - solution of swing equation- Numerical methods - Euler method-Runge - Kutte method - critical clearing time and angle - effect of excitation system and governors- Multimachine stability – extended equal area criterion - transient energy function approach.

UNIT III SMALL SIGNAL STABILITY 9

Small signal stability – state space representation – Eigen values - modal matrices - small signal stability of single machine infinite bus system – effect of field circuit dynamics - effect of excitation system-smallsignal stability of multi machine system.

UNIT IV VOLTAGE STABILITY 9

Voltage stability – generation aspects - transmission system aspects – load aspects – PV curve – QV curve – PQ curve – analysis with static loads – load ability limit - sensitivity analysis - continuation power flow analysis - instability mechanisms – examples.

UNIT V METHODS OF IMPROVING STABILITY 9

Methods of improving stability – transient stability enhancement – high speed fault clearing – steam turbine fast valving - high speed excitation systems - small signal stability enhancement - power systemstabilizers –

voltage stability enhancement – reactive power control.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Kundur, P	Power System Stability and Control	McGraw-Hill International Editions,	2012
2.	Van Cutsem, T.and Vournas, C	Voltage Stability of Electric Power Systems	Kluwer Academic Publishers	2014.

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Abhijit Chakrabarti, D.P. Kothari, A.K. Mukhopadhyay and Abhinandan De	An Introduction to ReactivePower Control and VoltageStability in Power Transmission Systems	PHI Learning PrivateLtd	2010.
2.	R.Ramanujam,	Power System Dynamics: Analysis and Simulation	PHI Learning PrivateLtd.,	2009.
3.	Ravish R. Singh	Electrical Networks	Tata McGraw Hill	2009
4.	M.E.Van Valkenburg	Network Analysis PHI Learning	Tata McGraw Hill	2014

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23EEE02	COMMUNICATION ENGINEERING	L	T	P	C
		2	1	0	3

Course Objective:

- To identify different methods of analog communication and their significance.
- To comprehend digital communication methods for high bit rate transmission.
- To apply the concepts of source and line coding techniques for error minimization in transmissionline
- To clarify various MA Techniques for enhancing the number of users.
- To recognize the various media for digital communication.

Course Outcomes:

23EEE02.CO1	Identify different methods of analog communication and their significance.
23EEE02.CO2	Comprehend digital communication methods for high bit rate transmission.
23EEE02.CO3	Apply the concepts of source and line coding techniques for error minimization in transmission line
23EEE02.CO4	Clarify various MA Techniques for enhancing the number of users.
23EEE02.CO5	Recognize the various media for digital communication.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEE02.CO1	x	x	x	x	x	-	-	-	-	x	-	x	x	x	-
23EEE02.CO2	x	x	x	x	x	-	-	-	-	x	-	x	x	x	-
23EEE02.CO3	x	x	x	x	x	-	-	-	-	x	-	x	x	x	-
23EEE02.CO4	x	x	x	x	x	-	-	-	-	x	-	x	x	-	-
23EEE02.CO5	x	x	x	x	x	-	-	-	-	x	-	x	x	x	-

UNIT I ANALOG COMMUNICATION **9**

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

UNIT II DIGITAL COMMUNICATION **9**

Pulse modulations – concepts of sampling and sampling theorems, PAM, PWM, PPM, PTM, quantization and coding : DCM, DM, slope overload error. ADM, DPCM, OOK systems – ASK, FSK, PSK, BSK, QPSK, QAM, MSK, GMSK, applications of Data communication.

UNIT III SOURCE CODES, LINE CODES & ERROR CONTROL **9**

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

UNIT IV MULTIPLE ACCESS TECHNIQUES **9**

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

UNIT V SATELLITE, OPTICAL FIBER – POWERLINE, SCADA **9**

Orbits : types of satellites : frequency used link establishment, MA techniques used in satellite communication, earth station; aperture actuators used in satellite – Intelsat and Insat: fibers – types:sources, detectors used, digital filters, optical link: power line carrier communications: SCADA.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Taub & Schiling	Principles of Communication Systems	Tata McGraw Hill	2007
2.	John G Proakis	Communication Systems Engineering	Pearson Education	2015

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Sklar	Digital Communication Fundamentals and Applications	Pearson Education	2001
2.	Bary le, Memuschmidt	Digital Communication	Kluwer Publication	2004
3.	Miller	Modern Electronic Communication	Prentice Hall of India	2003
4.	S.Salivahanan	Communication Theory	Tata McGraw Hill	2010

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23EEE03	SPECIAL ELECTRICAL MACHINES	L	T	P	C
		3	0	0	3

Course Objective:

- To analyze the operation and characteristics of synchronous reluctance motor
- To explain the operation and characteristics of stepper motors
- To elaborate the operation and characteristics of switched reluctance motors
- To discuss the operation and characteristics of permanent magnet brushless D.C. motors
- To know the importance of operation and characteristics of permanent magnet Synchronous motors.

Course Outcomes:

23EEE03.CO1	Analyze the operation and characteristics of synchronous reluctance motor
23EEE03.CO2	Explain the operation and characteristics of stepper motors
23EEE03.CO3	Elaborate the operation and characteristics of switched reluctance motors
23EEE03.CO4	Discuss the operation and characteristics of permanent magnet brushless D.C. motors
23EEE03.CO5	Know the importance of operation and characteristics of permanent magnet Synchronous motors.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEE03.CO1	x	x	x	x	x	x	x	-	-	-	x	x	x	x	x
23EEE03.CO2	x	x	x	x	x	x	x	-	-	-	x	x	x	x	x
23EEE03.CO3	x	x	x	x	x	x	x	-	-	-	x	x	x	x	x
23EEE03.CO4	x	x	x	x	x	x	x	-	-	-	x	x	x	x	x
23EEE03.CO5	x	x	x	x	x	x	x	-	-	-	x	x	x	x	x

UNIT I SYNCHRONOUS RELUCTANCE MOTORS 9

Constructional features – Types – Axial and Radial motors – Operating principle – Steady state phasor diagram – Circle diagram – Characteristics – Applications -Practical Applications

UNIT II STEPPER MOTORS 9

Constructional features – Principle of operation – Classification of stepping motors – Variable reluctance motors – PM Stepping motor – Hybrid motors – Single and multi-stack configurations – Modes of excitation – Theory of torque predictions – Characteristics – Drive circuits – Microprocessor based control
– Applications-Case Studies

UNIT III SWITCHED RELUCTANCE MOTORS 9

Principle of operation – Types – EMF and torque equations – Magnetic circuit analysis – Static and dynamic torque production – Energy conversion loop – Power controllers – Motor characteristics and control – Applications-Case Studies

UNIT IV PERMANENT MAGNET BRUSHLESS D.C. MOTORS 9

Comparison of conventional and brushless DC motors – Electronic and mechanical commutation – PMDC motors – Constructional features – Principle of operation - EMF and torque equations – Magnetic circuit analysis - Power controllers - Microprocessor based control – Applications-Practical applications

UNIT V PERMANENT MAGNET SYNCHRONOUS MOTORS 9

Constructional features - Principle of operation – Classifications of PMSM - EMF and torque equations - Phasor diagram - Power controllers – Torque speed Characteristics - Microprocessor based control – Application-Practical

Applications.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	T.J.E. Miller	Brushless Permanent Magnet and Reluctance Motor Drives	Clarendon Press, Oxford	2001
2.	T.Kenjo	Stepping Motors and Their Microprocessor Controls	Clarendon Press London	1984

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	R.Krishnan	Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application	CRC Press, New York	2001
2.	C L Wadwa	Electrical Power Systems	New Age International Publishers	2017
3.	K.Vengatratnam	Special Electrical Machines	Universities Press (India) Private Limted	2008
4.	E.G. Janardanan	Special Electrical Machines	PHI learning Private Limited, Delhi	2014

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23EEE04	DESIGN OF ELECTRICAL APPARATUS	L	T	P	C
		2	1	0	3

Course Objective:

- To analyze the various thermal rating of electrical machines.
- To design the D.C Machines.
- To develop the Transformer.
- To formulate the Induction Machines.
- To Design the Synchronous machine.

Course Outcomes:

23EEE04.CO1	Analyze the various thermal rating of electrical machines.
23EEE04.CO2	Design the D.C Machines.
23EEE04.CO3	Develop the Transformer.
23EEE04.CO4	Formulate the Induction Machines.
23EEE04.CO5	Design the Synchronous machine.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEE04.CO1	x	x	x	x	-	x	-	-	-	x	-	x	x	x	-
23EEE04.CO2	x	x	x	x	-	x	-	-	-	x	-	x	x	x	-
23EEE04.CO3	x	x	x	x	-	x	-	-	-	x	-	x	x	x	-
23EEE04.CO4	x	x	x	x	-	x	-	-	-	x	-	x	x	x	-
23EEE04.CO5	x	x	x	x	-	x	-	-	-	x	-	x	x	x	-

UNIT I INTRODUCTION **9**

Major considerations in Electrical Machine Design - Electrical Engineering Materials - Choice of Specific Electrical and Magnetic loadings - Thermal considerations - Insulating Materials - Rating of machines - Standard specifications.

UNIT II D.C MACHINES **9**

Output Equations - Main Dimensions - Choice of Specific Electric and Magnetic Loading – selection of number of poles (Derivation and simple problem) - Problem on Armature Design – Derivation oncommutators and brushes design.

UNIT III TRANSFORMERS **9**

Main Dimensions - kVA output equation on single and three phase transformers - Window space factor - Design of core and winding - Overall dimensions - Temperature rise in Transformers - tank design -Methods of cooling of Transformers

UNIT IV INDUCTION MOTORS **9**

Output equation of Induction motor – Main dimensions– Length of air gap- Rules for selecting rotor slots of squirrel cage machines – Design of rotor bars & slots – Design of end rings – Design of wound rotor - Magnetizing current - Short circuit current – Operating characteristics- Losses and Efficiency.

UNIT V SYNCHRONOUS MACHINES **9**

Output equations - choice of Electrical and Magnetic Loading - Design of salient pole machines - Shortcircuit ratio - Armature design - Estimation of air gap length - Design of rotor - Design of damper winding.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Sawhney, A.K	A Course in Electrical MachineDesign	Dhanpat Rai & Sons	2010
2.	Sen, S.K	Principles of Electrical MachineDesigns with Computer Programmes	Oxford and IBH Publishing Co. Pvt. Ltd	2009

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	A.Shanmuga sundaram	Electrical Machine Design Data Book	New Age IntenationalPvt. Ltd	2007
2.	Nagsarkar T K	Basics of Electrical Engineering	Oxford press	2005
3.	H .M.Rai	Principles of Electrical Machine Design	Sathya prakashan	20007
4.	V.K.Mehta	Principle of Electrical Machines	S. Chand Limited	2002

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23EEE05	FLEXIBLE AC TRANSMISSION SYSTEMS	L	T	P	C
		3	0	0	3

Course Objective:

- To analyze the various types of FACTS controllers.
- To design the shunt compensation devices used for power factor improvement.
- To develop the series compensation devices based on their operating characteristics.
- To create Static Synchronous Compensator and static synchronous series compensator.
- To analyze the co-ordination of FACTS controllers.

Course Outcomes:

23EEE05.CO1	Analyze the various types of FACTS controllers.
23EEE05.CO2	Design the shunt compensation devices used for power factor improvement.
23EEE05.CO3	Develop the series compensation devices based on their operating characteristics.
23EEE05.CO4	Create Static Synchronous Compensator and static synchronous series compensator.
23EEE05.CO5	Analyze the co-ordination of FACTS controllers.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEE05.CO1	x	x	x	-	-	-	-	-	-	-	-	x	x	-	-
23EEE05.CO2	x	x	x	-	-	-	-	-	-	-	-	x	x	-	-
23EEE05.CO3	x	x	x	-	-	-	-	-	-	-	-	x	x	-	-
23EEE05.CO4	x	x	x	-	-	-	-	-	-	-	-	x	x	-	-
23EEE05.CO5	x	x	x	-	-	-	-	-	-	-	-	x	x	-	-

UNIT I INTRODUCTION **9**

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

UNIT II STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS **9**

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

UNIT III THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) ANDAPPLICATIONS **9**

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

UNIT IV VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS **9**

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

UNIT V CO-ORDINATION OF FACTS CONTROLLERS **9**

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

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	R.Mohan MathurRajiv K.Varma	Thyristor – Based Facts Controllers for Electrical Transmission Systems	IEEE press and JohnWiley & Sons	2002
2.	Narain G.Hingorani	Understanding FACTS - Conceptsand Technology of Flexible AC Transmission Systems	Standard Publishers Distributors	2011

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	K.R.Padiyar	FACTS Controllers in Power Transmission and Distribution	New Age International(P) Limited	2008
2.	A.T.John	Flexible A.C. Transmission Systems	Institution of Electrical and Electronic Engineers	2005
3.	V.K.Sood	HVDC and FACTS controllers – Applications of StaticConverters in Power System	Kluwer Academic Publishers	2004
4.	Xiao – Ping Zang	Christian Rehtanz and Bikash Pal, "Flexible AC Transmission System: Modelling and Control	Springer	2012

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23EEE06	HIGH VOLTAGE DIRECT CURRENT TRANSMISSION SYSTEMS	L	T	P	C
		3	0	0	3

Course Objective:

- To Understand the concept, planning of DC power transmission and comparison with AC Power transmission.
- To Analysis of Line Commutated Converters and Voltage Source Converters in HVDC Transmission System
- To Derive and analyze the HVDC link control techniques for managing power flow, reactive power control and voltage regulation in LCC and VSC based HVDC system
- To Analyze the harmonics and the design of filters in HVDC LCC and VSC systems.
- To Demonstrate the power flow analysis in HVDC system under steady state.

Course Outcomes:

23EEE06.CO1	Understand the concept, planning of DC power transmission and comparison with AC Power transmission.
23EEE06.CO2	Analysis of Line Commutated Converters and Voltage Source Converters in HVDC Transmission System
23EEE06.CO3	Derive and analyze the HVDC link control techniques for managing power flow, reactive power control and voltage regulation in LCC and VSC based HVDC system
23EEE06.CO4	Analyze the harmonics and the design of filters in HVDC LCC and VSC systems.
23EEE06.CO5	Demonstrate the power flow analysis in HVDC system under steady state.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEE06.CO1	x	x	x	x	-	x	x	-	-	-	-	x	x		-
23EEE06.CO2	x	x	x	x	-	x	x	-	-	-	-	x	x	-	-
23EEE06.CO3	x	x	x	x	-	-	-	-	-	-	-	x	x	-	-
23EEE06.CO4	x	x	x	x	-	-	-	-	-	-	-	x	x	-	-
23EEE06.CO5	x	x	x	x	-	-	-	-	-	-	-	x	x	-	-

UNIT I INTRODUCTION **9**

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

UNIT II ANALYSIS OF HVDC CONVERTERS **9**

Line commutated converter - Analysis of Graetz circuit with and without overlap - Pulse number – Choice of converter configuration–Converter bridge characteristics–Analysis of a12pulse converters–Analysis of VSC topologies and firing schemes.

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

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

UNIT IV REACTIVE POWER AND HARMONICS CONTROL **9**

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

UNIT V POWER FLOWANALYSIS IN AC/DC SYSTEMS **9**

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

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Padiyar, K. R	HVDC power transmission system	New Age International (P) Ltd.,New Delhi,	2010
2.	Kundur P	Power System Stability and Control	Tata McGraw Hill	2011

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Edward Wilson Kimbark	Direct Current Transmission	Vol.I,Wiley interscience, New York, London,Sydney	2000
2.	Rakosh Das Begamudre	Extra High Voltage AC Transmission Engineering	New Age International (P)Ltd., NewDelhi	2008
3.	Colin Adamson and Hingoranin	High Voltage Direct Current Power Transmission	Garraway Limited, London,	2011
4.	S.Kamakshaiah, V.Kamaraju,	HVDC Transmission	Tata McGraw Hill Education Private Limited	2011

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23EEE07	POWER PLANT ENGINEERING	L	T	P	C
		3	0	0	3

Course Objective:

- To analyze about the steam power plant and its various components.
- To elaborate the working of diesel, gas turbine and combined cycle power plants.
- To measure the various nuclear reactors and safety measures.
- To design the various techniques involved in harvesting power from renewable energy.
- To develop tariff structure and sharing of loads to different types of power plants economically.

Course Outcomes:

23EEE07.CO1 Analyze about the steam power plant and its various components. 23EEE07.CO2

23EEE07.CO4 Design the various techniques involved in harvesting power from renewableenergy.

23EEE07.CO5 Develop tariff structure and sharing of loads to different types of power plantseconomically.

23EEE07.CO1 Analyze about the steam power plant and its various components. 23EEE07.CO2

23EEE07.CO4 Design the various techniques involved in harvesting power from renewableenergy.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEE07.CO1	x	-	x	-	-	-	-	-	-	x	-	x	-	-	-
23EEE07.CO2	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
23EEE07.CO3	x	-	x	-	-	-	-	-	-	x	-	x	-	-	-
23EEE07.CO4	x	-	x	-	-	x	x	-	-	x	-	x	x	-	-
23EEE07.CO5	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-

UNIT I COAL BASED THERMAL POWER PLANTS 9

Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Steam & Heat rate, Subsystems of thermal power plants – Fuel and ash handling, Draught system, Cooling towers, Feed watertreatment. Binary Cycles and Cogeneration systems.

UNIT II DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS 9

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

UNIT III NUCLEAR POWER PLANTS 9

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

UNIT IV POWER FROM RENEWABLE ENERGY 9

Hydro Electric Power Plants – Classification, Typical Layout. Principle, Construction and working ofWind, Tidal, Solar Photo Voltaic (SPV), Solar Thermal, Biogas and Geo Thermal.

UNIT V ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWERPLANTS 9

Power tariff types, Load distribution parameters, load curve, load duration curve, Capital & Operating Cost of different power plants. Comparison of site selection criteria, relative merits & demerits of power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Nag	Power Plant Engineering	Tata Mc Graw Hill	2008
2.	Rajput	Book of Power Plant Engineering	Lakshmi publication	2008

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	M.M. El-Wakil	Power Plant Technology	Tata McGraw – Hill Publishing Company Ltd	2010
2.	Black & Veatch,Springer	Power Plant Engineering	Prentice Hall of India PvtLtd	2005
3.	Thomas C. Elliott, Kao Chen and Robert C. Swanekamp	Standard Handbook of Power Plant Engineering	Second Edition, McGraw – Hill	2012
4.	Godfrey Boyle	Renewable energy	Oxford University Press	2004

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23EEE08	TOTAL QUALITY MANAGEMENT	L	T	P	C
		2	1	0	3

Course Objective:

- To acquire the knowledge about Coal based thermal power plants.
- To diesel, Gas Turbine and Combined Cycle Power Plants.
- To acquire the knowledge about nuclear power plants.
- To acquire the knowledge about power from renewable energy.
- To analyze and solve energy and economic related issues in power sectors.

Course Outcomes:

23EEE08.CO1	Discuss the various dimensions of product process and service quality
23EEE08.CO2	Improve the quality of organization by using total quality process
23EEE08.CO3	Elaborate the controlled manufacturing process by using SPC
23EEE08.CO4	Improve the existing process of organization using TQM tools
23EEE08.CO5	Develop the organization in international level and market need by using ISO

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEE08.CO1	x	-	x	-	-	x	x	x	-	x	x	-	-	-	-
23EEE08.CO2	x	-	x	-	-	x	x	x	-	x	x	-	-	-	-
23EEE08.CO3	x	-	x	-	-	x	x	x	-	x	x	-	-	-	-
23EEE08.CO4	x	-	x	-	-	x	x	x	-	x	x	-	-	-	-
23EEE08.CO5	x	-	x	-	-	x	x	x	-	x	x	-	-	-	-

UNIT I INTRODUCTION **9**

Definition of Quality – Dimensions of Quality – Quality Planning – Quality costs – Analysis Techniques for Quality Costs – Basic concepts of Total Quality Management – Historical Review – Quality Statements – Strategic Planning, Deming Philosophy – Crosby philosophy – Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen – Obstacles to TQM Implementation.

UNIT II TQM PRINCIPLES **9**

Principles of TQM, Leadership – Concepts – Role of Senior Management – Quality Council, Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits– Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

UNIT III STATISTICAL PROCESS CONTROL (SPC) **9**

The seven tools of quality – Statistical Fundamentals – Measures of central Tendency and Dispersion,Population and Sample, Normal Curve, Control Charts for variables X bar and R chart and attributes P, nP, C, and u charts, Industrial Examples, Process capability, Concept of six sigma – New seven Management tools.

UNIT IV TQM TOOLS **9**

Benchmarking – Reasons to Benchmark – Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, and Benefits – Taguchi Quality Loss Function – Total Productive Maintenance (TPM) – Concept, Improvement Needs, and FMEA – Stages of FMEA- Case studies.

UNIT V QUALITY SYSTEMS **9**

Need for ISO 9000 and Other Quality Systems – ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, ISO 9000:2005 (definitions), ISO 9001:2008 (requirements) and ISO 9004:2009 (continuous improvement), TS 16949, ISO 14000, AS9100 – Concept, Requirements and Benefits- Case studies.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dale H. Besterfiled	Total Quality Management	Pearson Education Inc,New Delhi	2003
2.	James R. Evans and William M.Lidsay,	The Management and Control ofQuality	South-Western	2002

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	N. Gupta and B.Valarmathi,	Total Quality Management	Tata McGraw-Hill Publishing Company Pvt Ltd., New Delhi	2009
2.	Dr S. Kumar	Total Quality Management,	Laxmi Publications Ltd., New Delhi	2006
3.	P. N. Muherjee	Total Quality Management	Prentice Hall of India,New Delhi	2006
4.	James R. Evans andWilliam M. Lindsay	The Management andControl of Quality	8thEdition, First Learning	2012

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23EEE09	VLSI DESIGN	L	T	P	C
		3	0	0	3

Course Objective:

- To Understand different MOS Transistors.
- To Explain the basic concepts of CMOS circuits and the CMOS processtechnology.
- To Explain the techniques of chip design using programmable devices.
- To Model the digital system using Hardware Description Language.
- To Explain the basic FPGA circuits.

Course Outcomes:

23EEE09.CO1 Understand different MOS Transistors.

23EEE09.CO2 Explain the basic concepts of CMOS circuits and the CMOS processtechnology.

23EEE09.CO3 Explain the techniques of chip design using programmable devices.

23EEE09.CO4 Model the digital system using Hardware Description Language.

23EEE09.CO5 Explain the basic FPGA circuits.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEE09.CO1	x	x	-	-	-	-	-	-	-	-	-	x	x	-	-
23EEE09.CO2	x	x	-	-	-	-	-	-	-	-	-	x	x	-	-
23EEE09.CO3	x	x	-	x	-	-	-	-	-	-	-	x	x	x	-
23EEE09.CO4	x	x	x	x	-	-	-	-	-	-	-	x	x	x	-
23EEE09.CO5	x	x	-	-	-	-	-	-	-	-	-	x	x	-	-

UNIT I MOS TRANSISTOR PRINCIPLE 9

NMOS and PMOS transistors, Process parameters for MOS and CMOS, Electrical properties of CMOS Circuits and device modeling, Scaling principles and fundamental limits, CMOS inverter Scaling, propagation delays, Stick diagram, Layout diagrams.

UNIT II COMBINATIONAL LOGIC CIRCUITS 9

Examples of Combinational Logic Design, Elmore's constant, Pass transistor Logic, Transmission gates, static and dynamic CMOS design, Power dissipation – Low power design principles

UNIT III SEQUENTIAL LOGIC CIRCUITS 9

Static and Dynamic Latches and Registers, Timing issues, pipelines, clock strategies, Memory Architecture and memory control circuits, Low power memory circuits, Synchronous and Asynchronous design

UNIT IV DESIGNING ARITHMETIC BUILDING BLOCKS 9

Data path circuits, Architectures for ripple carry adders, carry look ahead adders, High speed adders, Accumulators, Multipliers, dividers, Barrel shifters, and speed and area tradeoff

UNIT V IMPLEMENTATION STRATEGIES 9

Full custom and Semi-custom design, Standard cell design and cell libraries, FPGA building blockArchitectures, FPGA interconnect routing procedures

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jan Rabaey, Anantha Chandrakasan, B.Nikolic	Digital Integrated Circuits: A Design Perspective	Second Edition, Prentice Hall of India	2003
2.	M.J. Smith	Application Specific IntegratedCircuits	Addison Wesley	2001

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	R.Jacob Baker, Harry W.LI., David E.Boyee	CMOS Circuit Design,Layout and Simulation	Prentice Hall of India	2005
2.	A.Pucknell, KamranEshraghian	Basic VLSI Design	Third Edition, PrenticeHall of India	2013
3.	Charles H.Roth,	Fundamentals of LogicDesign	Jaico Publishing House	2006
4.	Weste N H	Principles of CMOS VLSI Design	Pearson Education, India,	2003

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23EEE10	POWER QUALITY	L	T	P	C
		3	0	0	3

Course Objective:

- To analyze the various types of power quality problem.
- To discuss the voltage sag and Interruption power quality problem
- To explain the over voltage power quality issue.
- To illustrate the harmonics in power quality issue.
- To know the importance of power quality monitoring devices.

Course Outcomes:

23EEE10.CO1 Analyze the various types of power quality problem.

23EEE10.CO2 Discuss the voltage sag and Interruption power quality problem.

23EEE10.CO3 Explain the over voltage power quality issue.

23EEE10.CO4 Illustrate the harmonics in power quality issue.

23EEE10.CO5 Know the importance of power quality monitoring devices

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEE10.CO1	X	X	-	X	-	-	-	-	-	-	-	-	X	-	-
23EEE10.CO2	X	X	-	X	-	-	-	-	-	-	-	-	X	-	-
23EEE10.CO3	X	X	-	X	-	-	-	-	-	-	-	-	X	X	-
23EEE10.CO4	X	X	-	X	-	-	-	-	-	-	-	-	X	X	-
23EEE10.CO5	X	X	-	X	-	-	-	-	-	-	-	-	X	-	-

UNIT I INTRODUCTION TO POWER QUALITY **9**

Terms and definitions: Overloading - under voltage - over voltage. Concepts of transients – short Durationvariations such as interruption - long duration variation such as sustained interruption. Sags and swells - voltage sag - voltage swell - voltage imbalance - voltage fluctuation - power frequency Variations. International standards of power quality. Computer Business Equipment Manufacturers Associations (CBEMA) curve.

UNIT II VOLTAGE SAGS AND INTERRUPTIONS **9**

.Sources of sags and interruptions - estimating voltage sag performance. Thevenin's equivalent source- analysis and calculation of various faulted condition. Voltages sag due to induction motor starting. Estimation of the sag severity - mitigation of voltage sags, active series compensators. Static transfer switches and fast transfer switches.

UNIT III OVERVOLTAGES **9**

Sources of over voltages - Capacitor switching – lightning - Ferro resonance. Mitigation of voltage swells - surge arresters - low pass filters - power conditioners. Lightning protection – shielding – line arresters - protection of transformers and cables. An introduction to computer analysis tools for transients, PSCAD and EMTP

UNIT IV HARMONICS **9**

.Harmonic sources from commercial and industrial loads, locating harmonic sources. Power system Response characteristics - Harmonics Vs transients. Effect of harmonics - harmonic distortion – voltage andcurrent distortion - harmonic indices - inter harmonics – resonance. Harmonic distortion evaluation - devices for controlling harmonic distortion - passive and active filters. IEEE and IEC standards.

UNIT V POWER QUALITY MONITORING **9**

Monitoring considerations - monitoring and diagnostic techniques for various power quality problems - modeling of power quality (harmonics and voltage sag) problems by mathematical simulation tools - power line disturbance

analyzer – quality measurement equipment - harmonic / spectrum analyzer - flicker meters - disturbance analyzer. Applications of expert systems for power quality monitoring.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Roger. C. Dugan	Electrical Power Systems Quality	McGraw Hill	2003
2.	Eswald.F.Fudis and Masoum	Power Quality in Power System and Electrical Machines	Elsevier Academic Press	2013

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	E.Aeha and M.Madrigal	Power System Harmonics, Computer Modeling and Analysis	Wiley	2012
2.	G.T. Heydt	Electric Power Quality	Circle Publications	2016
3.	M.H.J Bollen	Understanding Power Quality Problems: Voltage Sags and Interruptions	New York: IEEE Press	2012
4.	G.J.Wakileh	Power Systems Harmonics – Fundamentals, Analysis and Filter Design	Springer	2007

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23EEE11	EMERGING INTELLIGENT TECHNIQUES	L	T	P	C
		3	0	0	3

Course Objective:

- To understand basic concept of intelligent controller.
- To study various types of artificial neural network
- To introduce the concept of genetic algorithm
- To study measures to improve the fuzzy logic system
- To study GA application to optimization problem.

Course Outcomes:

23EEE11.CO1 understand basic concept of intelligent controller.

23EEE11.CO2 study various types of artificial neural network

23EEE11.CO3 introduce the concept of genetic algorithm

23EEE11.CO4 study measures to improve the fuzzy logic system

23EEE11.CO5 study GA application to optimization the problem.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEE11.CO1	x	x	x	x	x	-	x	x	-	-	-	x	x	x	x
23EEE11.CO2	x	-	-	x	x	-	x	x	-	-	-	-	x	x	x
23EEE11.CO3	x	-	-	x	x	-	x	-	-	-	-	-	x	x	x
23EEE11.CO4	x	-	x	x	x	-	x	-	-	-	-	-	x	x	-
23EEE11.CO5	x	x	-	x	x	-	x	-	-	-	-	-	x	x	-

UNIT I INTRODUCTION **9**

Approaches to intelligent control. Architecture for intelligent control. Symbolic reasoning system, rule- based systems, the AI approach. Knowledge representation. Expert systems.

UNIT II ARTIFICIAL NEURAL NETWORKS **9**

Concept of Artificial Neural Networks and its basic mathematical model, McCulloch-Pitts neuron model, simple perceptron, Adaline and Madaline, Feed-forward Multilayer Perceptron. Learning and Training the neural network. Data Processing: Scaling, Fourier transformation, principal-component analysis and wavelet transformations. Hopfield network, Self-organizing network and Recurrent network. Neural Network based controller

UNIT III GENETIC ALGORITHM **9**

Basic concept of Genetic algorithm and detail algorithmic steps, adjustment of free parameters. Solution of typical control problems using genetic algorithm. Concept on some other search techniques like tabu -search and ant-colony search techniques for solving optimization problems.

UNIT IV FUZZY LOGIC SYSTEM **9**

Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modeling and control. Fuzzification, inferencing and defuzzification. Fuzzy knowledge and rule bases. Fuzzy modeling and control schemes for nonlinear systems. Selforganizing fuzzy logic control. Fuzzy logic control for nonlinear time-delay system.).

UNIT V APPLICATIONS **9**

GA application to power system optimization problem, Case studies: Identification and control of linear and nonlinear dynamic systems using Matlab-Neural Network toolbox. Stability analysis of Neural- Network interconnection systems. Implementation of fuzzy logic controller using Matlab fuzzy-logic

toolbox. Stability analysis of fuzzy control systems.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Padhy.N.P	Artificial Intelligence and Intelligent System	Oxford University Press	2005
2.	Kosko,B.	Neural Networks And FuzzySystems	Hall of India Pvt. Ltd	2002

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jacek.M.Zurada	Introduction to ArtificialNeural Systems	Jaico Publishing House	2004
2.	klir G.J. & folger T.A	Fuzzy sets, uncertainty and Information	Prentice-Hall of IndiaPvt.Ltd	2007
3.	Zimmerman H.J	Fuzzy set theory-and its Applications	Kluwer Academic Publishers	2004
4.	Driankov, Hellendroon	Introduction to Fuzzy Control	Narosa Publishers	2004

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23EEE12	ELECTRICAL ENERGY GENERATION, UTILIZATION AND CONSERVATION	L	T	P	C
		3	0	0	3

Course Objective:

- To interpret the concepts behind renewable energy resources.
- To obtain the energy saving concept by different ways of illumination.
- To illustrate the different methods of electric heating and electric welding.
- To understand the concept of solar radiation and solar energy collectors
- To enhance the concepts of Wind Energy and its utilization

Course Outcomes:

23EEE12.CO1	Interpret the concepts behind renewable energy resources
23EEE12.CO2	Obtain the energy saving concept by different ways of illumination.
23EEE12.CO3	Illustrate the different methods of electric heating and electric welding.
23EEE12.CO4	Understand the concept of solar radiation and solar energy collectors
23EEE12.CO5	Enhance the concepts of Wind Energy and its utilization

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEE12.CO1	x	x	-	-	-	-	-	-	-	x	-	x	x	-	-
23EEE12.CO2	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
23EEE12.CO3	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
23EEE12.CO4	-	x	x	x	-	-	-	-	-	x	-	x	-	x	-
23EEE12.CO5	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-

UNIT I ELECTRIC DRIVES AND TRACTION **9**

Fundamentals of electric drive - Choice of an electric motor - Traction motors - Characteristic features of traction motor - Systems of railway electrification -Electric braking - train movement and energy consumption - Traction motor control - track equipment and collection gear, Recent trends in electric traction.

UNIT II ILLUMINATION **9**

Importance of lighting – Properties of good lighting scheme – Laws of illumination- Classification of light sources - Incandescent lamps, Sodium vapor lamps, Mercury vapors lamps, Fluorescent lamps – Design of illumination systems - Indoor lighting schemes - Factory lighting halls - Outdoor lighting schemes - Flood lighting - Street lighting - Energy saving lamps, LED.

UNIT III HEATING AND WELDING **9**

Introduction - Advantages of electric heating – Modes of heat transfer - Methods of electric heating - Resistance heating - Arc furnaces - Induction heating - Dielectric heating -Electric welding – types - Resistance welding - Arc welding - Power supply for arc welding - Radiation welding.

UNIT IV ENERGY CONSERVATION **9**

Energy efficient motors and Soft starters - Automatic power factor Controllers - Variable speed drivers - Electronic ballasts - LED Lighting.

UNIT V ENERGY AUDITING AND MANAGEMENT **9**

Need of Energy Audit and Management. Definition, Objective and Principles of Energy Management - Energy Management Skills and Strategy - Economics of implementation of energy optimization projects & its constraints - barriers and limitations –Types of Energy Audit- Report-writing - preparations and presentations of energy audit reports.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	N.V. Suryanarayana	Utilisation of Electric Power	Wiley Eastern Limited, New Age International Limited	2011
2.	J.B.Gupta	Utilisation Electric power and Electric Traction	S.K.Kataria and Sons	2010

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	R.K.Rajput,	Utilisation of Electric Power	Laxmi publications Private Limited	2010
2.	H.Partab	Art and Science of Utilisation of Electrical Energy	Dhanpat Rai and Co., New Delhi	2012
3.	C.L.Wadhwa,	Generation and Utilization of Electrical Energy	New Age International Pvt.Ltd	2010
4.	S. Sivanagaraju, M. Balasubba Reddy	Generation and Utilization of Electrical Energy	Pearson Education	2010

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23EEE13	DC MICROGRID	L	T	P	C
		3	0	0	3

Course Objective:

- To recognize the basic concept of smart grid
- To learn about smart grid technologies
- To comprehend the micro grids.
- To realize the different control schemes.
- To analysis the Protection issues for Micro grids.

Course Outcomes:

23EEE13.CO1	Recognize the basic concept of smart grid
23EEE13.CO2	learn about smart grid technologies
23EEE13.CO3	Comprehend the micro grids.
23EEE13.CO4	Realize the different control schemes.
23EEE13.CO5	Analysis the Protection issues for Micro grids.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEE13.CO1	x	x	-	x	x	-	x	-	-	-	-	x	x	x	x
23EEE13.CO2	x	-	-	x	x	-	x	-	-	-	-	x	x	x	-
23EEE13.CO3	x	-	-	x	x	-	x	-	-	-	-	x	x	-	x
23EEE13.CO4	x	-	-	x	x	-	x	-	-	-	-	x	x	-	-
23EEE13.CO5	x	-	-	x	x	-	x	-	-	-	-	x	x	x	x

UNIT I INTRODUCTION TO SMARTGRID **9**

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, Concept of Resilient & Self-Healing Grid, Present development & International policies in Smart Grid.

UNIT II SMARTGRID TECHNOLOGIES **9**

Drivers, Smart energy resources, Smart substations, Feeder Automation - Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/VAR control, Fault Detection, Isolation and service restoration, Outage management.

UNIT III MICROGRIDS **9**

Concept and definition of micro grid, micro grid drivers and benefits, review of sources of micro grids, typical structure and configuration of a micro grid, AC and DC micro grids, Power Electronics interfacesin DC and AC micro grids, communication infrastructure, modes of operation and control of micro grid: grid connected and islanded mode, Active and reactive power control, protection issues, anti-islanding schemes: passive, active and communication based techniques.

UNIT IV CONTROL OF MICROGRIDS **9**

Introduction to Central Controller (CC) and Micro source Controllers (MCs) - Control functions for micro source controller, Active and reactive power control, Voltage control, Storage requirement for fast load tracking, Load sharing through power-frequency control.

UNIT V PROTECTION ISSUES FOR MICROGRIDS **9**

Introduction, Islanding, Different islanding scenarios, Major protection issues of stand-alone Micro grid -Impact of DG integration on electricity market, environment, distribution system, communication

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Janaka Ekanayake	Smart Grid: Technology and Applications	Yokoyama Jo& Sons, New Jersey	2012
2.	S. Chowdhury, S.P. Chowdhuryand P. Crossley	Micro grids and Active Distribution Networks	IET	2009

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Xiao	Security and Privacy in Smart Grids	CRC Press	2012
2.	Yang Xiao	Communication and Networking in Smart Grids	Taylor and Francis	2012
3.	James Momoh	SMART GRID: Fundamentals of Design and Analysis,	John Wiley and Sons	2012
4.	Tony Flick, Justin Morehouse	Securing the Smart Grid: Next Generation Power Grid Security	Academic Press Boston	2011

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23EEE14	WIND AND SOLAR ENERGY SYSTEMS	L	T	P	C
		3	0	0	3

Course Objective:

- To analyze the physics of wind power and energy.
- To explain principle of operation of wind generators.
- To exhibit the operation of solar power resources.
- To evaluate the network integration issues.
- To explain the solar thermal power generation.

Course Outcomes:

23EEE14.CO1	Analyze the physics of wind power and energy.
23EEE14.CO2	Explain principle of operation of wind generators.
23EEE14.CO3	Exhibit the operation of solar power resources.
23EEE14.CO4	Evaluate the network integration issues.
23EEE14.CO5	Explain the solar thermal power generation.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEE14.CO1	x	x	-	-	-	-	-	-	-	-	-	x	x	-	-
23EEE14.CO2	x	x	x	x	-	-	-	-	-	-	-	x	x	x	-
23EEE14.CO3	x	x	x	x	-	-	-	-	-	-	-	x	x	x	-
23EEE14.CO4	-	x	x	x	-	-	-	-	-	-	-	x	-	x	-
23EEE14.CO5	x	x	x	x	-	-	-	-	-	-	-	x	x	x	-

UNIT I PHYSICS OF WIND POWER 9

History of wind power-Indian and Global statistics-Wind physics-Betz limit ratio-Stall and pitch control-Wind speed statistics-Probability distributions and Wind power-Cumulative distribution functions.

UNIT II WIND GENERATOR TOPOLOGIES 9

Review of modern wind turbine technologies-Fixed and Variable speed wind turbine-Induction Generators-Doubly-Fed Induction Generators and their characteristics-Permanent Magnet Synchronous Generators-Power electronics converters-Generator configurations-Converter Control.

UNIT III THE SOLAR RESOURCE 9

Introduction-Solar radiation spectra-Solar geometry-Earth Sun angles-Observer Sun angles-Solar day length-Estimation of solar energy availability. Technologies-Amorphous, mono-crystalline and polycrystalline. V-I characteristics of a PV cell-PV module-array-Power Electronic Converters for Solar Systems-Maximum Power point Tracking (MPPT) algorithms-Converter Control.

UNIT IV NETWORK INTEGRATION ISSUES 9

Overview of grid code technical requirements-Fault ride-through for wind farms - Real and reactive powerregulation-Voltage and frequency operating limits-Solar PV and wind farm behavior during grid disturbances-Power quality issues-Power system interconnection experiences in the world-Hybrid and isolated operations of solar PV and wind systems.

UNIT V SOLAR THERMAL POWER GENERATION 9

Technologies-Parabolic trough-Central receivers-Parabolic dish-Fresnel-Solar pond-Elementary analysis.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	T. Ackermann	Wind Power in Power Systems	John Wiley and Sons Ltd	2005
2.	G. M. Masters	Renewable and Efficient ElectricPower Systems	John Wiley and SonsLtd	2004

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	S. P. Sukhumi	Solar Energy: Principles of Thermal Collection and Storage	McGraw Hill	2001
2.	H. Siegfried and R.Waddington	Grid integration of wind energy conversion systems	John Wiley and SonsLtd	2006
3.	G. N. Tiwari and M. K. Ghosal	Renewable Energy Applications	Narosa Publications	2006
4.	J. A. Duffie and W. A. Beckman,	Solar Engineering of ThermalProcesses"	John Wiley & Sons	2008

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23EEE15	ROBOTICS AND CONTROLS	L	T	P	C
		3	0	0	3

Course Objective:

- To introduce the functional elements of Robotics
- To learn the basics of network theorems applied to electric circuits
- To introduce the manipulator differential motion and control.
- To educate on various path planning techniques
- To introduce the dynamics and control of manipulators

Course Outcomes:

23EEE15.CO1	Introduce the functional elements of Robotics
23EEE15.CO2	Impart knowledge on the direct and inverse kinematics
23EEE15.CO3	Introduce the manipulator differential motion and control
23EEE15.CO4	Educate on various path planning techniques
23EEE15.CO5	Introduce the dynamics and control of manipulators

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEE15.CO1	x	x	x	x	x	x	x	x	-	-	x	x	x	x	x
23EEE15.CO2	x	x	x	x	x	x	x	x	-	-	x	x	x	x	x
23EEE15.CO3	x	x	x	x	x	x	x	x	-	-	x	x	x	x	x
23EEE15.CO4	x	x	x	x	x	x	x	x	-	-	x	x	x	x	x
23EEE15.CO5	x	x	x	x	x	x	x	x	-	-	x	x	x	x	x

UNIT I BASIC CONCEPTS 9

Brief History Brief history-Types of Robot–Technology-Robot classifications ands pecifications-Design andcontrol issues Various manipulators–Sensors- work cell- Programming languages.

UNIT II DIRECTAND INVERSE KINEMATICS 9

Mathematical representation of Robots - Position and orientation - Homogeneous transformation - Various joints-Representation using the Denavit Hartenberg parameters - Degrees of freedom - Direct kinematics - Inverse kinematics-PUMA560 & SCARA robots- Solvability - Solution methods - Closed form solution.

UNIT III MANIPULATOR DIFFERENTIALMOTION ANDSTATICS 9

Linear and angular velocities-Manipulator Jacobian-Prismatic and rotary joints–Inverse -Wrist and arm singularity - Static analysis - Force and moment Balance

UNIT IV PATH PLANNING 9

Definition-Joint space technique-Use of p-degree polynomial-Cubic polynomial-Cartesian space technique - Parametric descriptions - Straight line and circular paths - Position and orientation planning.

UNIT V DYNAMICS AND CONTROL 9

Lagrangian mechanics-2DOF Manipulator-Lagrange Euler formulation-Dynamic model -Manipulator control problem-Linear control schemes-PID control scheme-Force control of robotic manipulator.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	R.K.Mittal andI.J.Nagrath	Robotics and Control	Tata McGraw Hill,NewDelhi,4th Reprint	2005
2.	JohnJ.Craig	Introduction to Robotics Mechanics and Control,	Third edition,Pearson Education,	2009

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Ashitava Ghoshal	Robotics-FundamentalConcepts and Analysis'	Oxford University Press,Sixth impression	2010
2.	K.K.AppuKuttan	Robotics,	IK International	2007
3.	EdwinWise,	Applied Robotics	Cengage Learning	2003
4.	R.D.Klafter,T.A.Chimielewskiand M.Negin,	Robotic Engineering– An Integrated Approach,	Prentice Hall of India PvtLtd, NewDelhi	2003

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23EEE16	FIBER OPTICS	L	T	P	C
		3	0	0	3

Course Objective:

- To analyze optical fibers and their properties
- To explain the industrial application of optical fibers
- To exhibit the laser fundamentals
- To evaluate the industrial application o f lasers
- To explain the hologram and medical application

Course Outcomes:

23EEE16.CO1	Analyze optical fibers and their properties
23EEE16.CO2	Explain the industrial application of optical fibers
23EEE16.CO3	Exhibit the laser fundamentals
23EEE16.CO4	Evaluate the industrial application of lasers
23EEE16.CO5	Explain the hologram and medical application

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEE16.CO1	x	x	-	-	-	-	-	-	-	-	-	x	x	x	x
23EEE16.CO2	x	x	x	-	-	-	-	-	-	-	-	x	x	x	x
23EEE16.CO3	x	x	x	-	x	-	-	-	-	-	-	x	x	x	x
23EEE16.CO4	x	x	x	-	x	-	-	-	-	-	-	x	x	x	x
23EEE16.CO5	x	x	x	-	-	-	-	-	-	-	-	x	-	x	x

UNIT I OPTICAL FIBERSAND THEIRPROPERTIES **9**

Principles of light propagation through a fiber – Different types of fibers and their properties transmission characteristics of optical fiber–Absorption losses–Scattering losses–Dispersion–Optical fiber measurement–Optical sources–Optical detectors–LED-LD-PIN and APD.

UNIT II INDUSTRIALAPPLICATIONOFOPTICALFIBERS 9

Fiber optic sensors – Fiber optic instrumentation system – Different types of modulators – Detectors –Application in instrumentation – Interferometric method of measurement of length – Moiré fringes –Measurement of pressure, temperature, current, voltage, liquid level and strain – Fiber optic gyroscope –Polarization maintaining fibers.

UNIT III LASER FUNDAMENTALS 9

FundamentalcharacteristicsofLasers–Threelevelandfourlevellasers–Propertiesof laser–Laser modes–Resonatorconfiguration–Q-switchingandmodelocking–Cavitydumping–Typesoflasers
-Gas lasers- Solid lasers- Liquid lasers semiconductor lasers.

UNIT IV INDUSTRIALAPPLICATIONOFLASERS 9

Laser for measurement of distance, length velocity, acceleration, current, voltage and atmospheric effect –Material processing–Laser heating, welding melting and trimming of materials–Removal and Vaporization

UNITV HOLOGRAMANDMEDICAL APPLICATION 9

Holography–Basic principle; methods; holographic interferometer rand applications-Holography for non-destructive testing–Holographic components–Medical applications of lasers; laser and tissue interaction -
Laser instruments for surgery, removal of tumors of vocal cords, brain surgery, plastic surgery, gynecology and oncology.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	John and Harry	Industrial lasers and their applications	Mc Graw Hill	2002
2.	SeniorJ.M	Optical Fiber Communication Principles and Practice	Prentice Hall	2001

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	JohnF Read	Industrial applications of lasers	Academic Press	2002
2.	Monte Ross	Laser applications	McGraw Hill	2005
3.	Keiser G	Optical Fiber Communication	McGraw Hill,	2003
4.	JaspritSingh	Semiconductor opto electronics	McGraw Hill	2012

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23EEE17	HUMAN COMPUTER INTERACTION	L	T	P	C
		3	0	0	3

Course Objective:

- To design effective dialog for HCI.
- To design effective HCI for individuals and persons with disabilities.
- To explain the HCI implications for designing multimedia/ ecommerce-learning Web sites.
- To assess the importance of mobile applications.
- To develop meaningful user interface.

Course Outcomes:

23EEE17.CO1 Design effective dialog for HCI.

23EEE17.CO2 Design effective HCI for individuals and persons with disabilities.

23EEE17.CO3 Explain the HCI implications for designing multimedia/ ecommerce-learning Websites.

23EEE17.CO4 Assess the importance of mobile applications.

23EEE17.CO5 Develop meaningful user interface.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEE17.CO1	_	x	-	-	-	-	-	-	-	-	-	x	_	-	-
23EEE17.CO2	x	x	x	-	-	-	-	-	-	-	-	x	x	x	-
23EEE17.CO3	x	x	x	-	-	-	-	-	-	-	-	x	x	x	x
23EEE17.CO4	_	x	x	-		-	-	-	-	-	-	x	_	x	-
23EEE17.CO5	x	x	-	-		-	-	-	-	-	-	x	x	x	x

UNIT I FOUNDATIONS OF HCI **9**

The Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices –Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms.

UNIT II DESIGN & SOFTWARE PROCESS **9**

. Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design

UNIT III MODELS AND THEORIES **9**

. Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW.

UNIT IV MOBILE HCI **9**

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

UNIT V WEB INTERFACE DESIGN **9**

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Helen Sharp, JennyPreece and Yvonne Rogers	Interaction Design: Beyond Human-Computer Interaction	John Wiley & Sons	2002
2.	Helen Sharp, JennyPreece and Yvonne Rogers	Interaction Design: Beyond Human-Computer Interaction	John Wiley & Sons	2002

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Abbas Moallem	Human-ComputerInteraction and Cybersecurity Handbook	CRC Press	2023
2.	Kent Norman, JurekKirakowski	The Wiley Handbook of Human ComputerInteraction Set	John Wiley & Sons	2017
3.	Bill Scott and TheresaNeil	Designing Web Interfaces	O'Reilly	2009
4.	Alan Cooper, RobertReimann and David Cronin	About Face: The Essentialsof Interaction Design	John Wiley & Sons	2007

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23EEE18	ELECTRIC VEHICALS	L	T	P	C
		3	0	0	3

Course Objective:

- To Explain the basics of electric and hybrid electric vehicles, their architecture, technologies and fundamentals.
- To Analyze the power electronics-based control strategies for electric and hybrid vehicles
- To Apply controls of different motors for drive system efficiency.
- To Understand various Energy storage devices including the Hybridization.
- To Explain the various applications of electric and hybrid vehicles

Course Outcomes:

23EEE18.CO1	Explain the basics of electric and hybrid electric vehicles, their architecture, technologies and fundamentals.
23EEE18.CO2	Analyze the power electronics-based control strategies for electric and hybrid vehicles
23EEE18.CO3	Apply controls of different motors for drive system efficiency.
23EEE18.CO4	Understand various Energy storage devices including the Hybridization.
23EEE18.CO5	Explain the various applications of electric and hybrid vehicles

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEE18.CO1	x	x	x	-	-	-	x	-	-	-	-	x	x	-	-
23EEE18.CO2	x	x	x	-	-	-	x	-	-	-	-	x	x	-	-
23EEE18.CO3	x	x	x	-	-	-	x	-	-	-	-	x	x	-	-
23EEE18.CO4	x	x	x	-	-	-	x	-	-	-	-	x	x	-	-
23EEE18.CO5	x	x	x	-	-	-	x	-	-	-	-	x	x	-	-

UNIT I ELECTRIC AND HYBRID ELECTRIC VEHICLES 9

Environmental impact and history of modern transportation, history of transportation electrification, Electric Vehicles(EVs)-Introduction, configurations and traction motor characteristics-Hybrid-Electric Vehicles(HEVs)-Concept and architectures-Series HEV-Configuration, operation, Advantages and disadvantages; HEVs-Interdisciplinary nature, challenges and key technologies.

UNITII POWER ELECTRONICS IN HEVS 9

Introduction, principle of power electronics, rectifiers used in HEVs, Buck converter used in HEVs. Non-isolated bidirectional DC-DC Converter–Operating principle, torque and power capability, current ripple and regenerative braking-Isolated bidirectional DC- DC converter - principle, steady state operations, output voltage and output power-Battery chargers-forward, fly back and bridge converters.

UNITIII ELECTRIC PROPULSION SYSTEMS 9

Introduction, Typical functional block diagram and classification of electric motor drive, DC motor drives-Control methods, class A and B choppers, two and four quadrant chopper control. Induction Motor drives -Operating principle, steady - state performance, v/f control and power electronic control. PM BLDC Motor drives-Construction, advantages and disadvantages, performance analysis and control. Switched Reluctance Motor drives-SRM basic magnetic structure, torque production, converter topologies.

UNITIV ENERGY STORAGE TECHNOLOGIES 9

Battery –basic theory and characterization, battery technologies, Types–lead acid batteries, nickel-based batteries and lithium-based batteries. Ultra-capacitors-Features, Basic Principles, Performance, Battery Modeling based on electric

equivalent circuit, Modeling of ultra-capacitors, Battery charging control and Flywheel Energy Storage System.

UNIT V APPLICATIONS OF HYBRID ELECTRIC VEHICLES 9

Introduction, Hydraulic Hybrid Vehicles (HHV) - Principle and operation of regenerative braking. Hybrid off road vehicular system, electric or hybrid ships and locomotives. Military applications-Electromagnetic launchers and hybrid-powered ships.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Mehrdad Ehsani, Yimin Gaoand Ali Emadi	Modern Electric, Hybrid Electric and Fuel Cell Vehicles	CRC Press	2015
2.	Chris Mi, M.Abul Masrur, David Wenzhong Gao	Hybrid Electric Vehicles Principles and Applications with Practical Perspectives	Wiley	2018

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Iqbal Husain	Electric and Hybrid Vehicles Design Fundamentals	CRC Press	2010
2.	Jack Erjavec	Hybrid, Electric & Fuel-Cell Vehicles	Delmar Cengage learning	2013
3.	Tom Dention	Electric Hybrid Vehicles	Institute of the Motor Industry	2016
4.	Iqbal Husain	Electric and Hybrid Vehicles Design Fundamentals	CRC Press	2010

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23EEE19	ELECTRICAL SAFETY AND ENERGY MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objective:

- To provide knowledge on basics of electrical fire and statutory requirements for electrical safety.
- To understand the causes of accidents due to electrical hazards
- To know the various protection systems in Industries from electrical hazards
- To know the importance of earthing
- To distinguish the various hazardous zones and applicable fire proof electrical device

Course Outcomes:

23EEE19.CO1	This course would make familiar of basic concepts in electrical circuit and hazards involved in it.
23EEE19.CO2	Course would be helpful to understand the electrical hazards in Industries.
23EEE19.CO3	Elaborate the characteristics and components of wind power system and its components
23EEE19.CO4	Students would be able to understand the operation of various protection systems from electrical hazards
23EEE19.CO5	Recognize different hazardous zones in Industries

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEE19.CO1	x	x	x	x	x	x	x	x	-	-	-	x	x	x	x
23EEE19.CO2	x	x	x	x	x	x	x	-	-	-	-	x	x	x	x
23EEE19.CO3	x	x	x	x	x	x	x	x	-	-	-	x	x	x	x
23EEE19.CO4	x	x	x	x	x	x	x	-	x	-	-	x	x	x	x
23EEE19.CO5	x	x	x	x	x	x	x	x	-	-	-	x	x	x	x

UNIT I CONCEPTS AND STATUTORY REQUIREMENTS 9

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

UNIT II ELECTRICAL HAZARDS 9

Primary and secondary hazards-shocks, burns, scalds, falls-human safety in the use of electricity. Energy leakage-clearances and insulation-classes of insulation-voltage classifications-excess energycurrent surges-Safety in handling of war equipments-over current and short circuit current-heating effects of current-electromagnetic forces-corona effect-static electricity –definition, sources, hazardous conditions, control, electrical causes of fire and explosion-ionization, spark and arc ignition energy-national electrical safety code ANSI. Lightning, hazards, lightning arrestor, installation – earthing, specifications, earth resistance, earth pit maintenance.

UNIT III PROTECTION SYSTEMS 9

Fuse, circuit breakers and overload relays – protection against over voltage and under voltage – safe limits of amperage – voltage –safe distance from lines-capacity and protection of conductor-joints-and connections, overload and short circuit protection-no load protection-earth fault protection. FRLS insulation-insulation and continuity test-system grounding-equipment grounding-earth leakage circuit breaker (ELCB)-cable wires-maintenance of ground-ground fault circuit interrupter-use of low voltage-electrical guards-Personal protective equipment – safety in handling hand held electrical appliances tools and medical equipments.

UNIT IV SELECTION, INSTALLATION, OPERATION AND MAINTENANCE 9

Role of environment in selection-safety aspects in application - protection and interlock-self diagnostic features and fail safe concepts-lock out and work permit system-discharge rod and earthing devices safety in the use of portable tools-cabling and cable joints-preventive maintenance

UNIT V HAZARDOUS ZONES 9

Classification of hazardous zones-intrinsically safe and explosion proof electrical apparatus-increase safe equipment-their selection for different zones-temperature classification-grouping of gases-use of barriers and isolators-equipment certifying agencies

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Fordham Cooper, W	Electrical Safety Engineering	Butterworth and Company, London,	1986
2.	N.S.C., Chicago	"Accident prevention manual for industrial operations	EFN Spon Ltd	1982

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	N.S.C., Chicago	Accident prevention manual for industrial operations	EFN Spon Ltd	1982
2.	Handbook of TNEB, Chennai,	Power Engineers	Power Engineers	1989
3.	Martin Glov Electrostatic Hazards in powder handling	Research Studies Pvt. Ltd., England	Research Studies Pvt. Ltd., England	1988
4.	Fordham Cooper, W	Electrical Safety Engineering	Butterworth and Company, London,	1986

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23EEE20	SMART GRID	L	T	P	C
		3	0	0	3

Course Objective:

- To Understand the fundamental element of the smart grid and power grid..
- To Assess the role of automation and digitization in the Transmission and Distribution
- To Apply advanced knowledge of electrical power system operations and control to analyse the challenges and opportunities due to increased penetration of renewable energy sources.
- To Understand and conceptualize the design of smart grid by selecting appropriate communication technologies, implementing smart meter and FACTS
- To Describe the principles and requirements of the next generation future power network (or smart grid), using the latest trends in IoT for power systems.

Course Outcomes:

23EEE20.CO1	Understand the fundamental element of the smart grid and power grid.
23EEE20.CO2	Assess the role of automation and digitization in the Transmission and Distribution
23EEE20.CO3	Apply advanced knowledge of electrical power system operations and control to analyse the challenges and opportunities due to increased penetration of renewable energy sources.
23EEE20.CO4	Understand and conceptualize the design of smart grid by selecting appropriate communication technologies, implementing smart meter and FACTS
23EEE20.CO5	Describe the principles and requirements of the next generation future power network (or smart grid), using the latest trends in IoT for power systems.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEE20.CO1	x	x	x	x	-	x	x	-	-	-	-	x	x		-
23EEE20.CO2	x	x	x	x	-	x	x	-	-	-	-	x	x	-	-
23EEE20.CO3	x	x	x	x	-	-	-	-	-	-	-	x	x	-	-
23EEE20.CO4	x	x	x	x	-	-	-	-	-	-	-	x	x	-	-
23EEE20.CO5	x	x	x	x	-	-	-	-	-	-	-	x	x	-	-

UNIT I INTRODUCTION TOSMARTGRID **9**

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, Concept of Resilient &Self-Healing Grid, Present development & International policies in Smart Grid.

UNIT II SMARTGRID TECHNOLOGIES **9**

Drivers, Smart energy resources, Smart substations, Feeder Automation - Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/VAR control, Fault Detection, Isolation and service restoration, Outage management.

UNIT III MICRO GRIDS 9

Concept and definition of micro grid, micro grid drivers and benefits, review of sources of micro grids, typical structure and configuration of a micro grid, AC and DC micro grids, Power Electronics interfaces in DC and AC micro grids, communication infrastructure, modes of operation and control of micro grid: grid connected and islanded mode, Active and reactive power control, protection issues, anti-islanding schemes: passive, active and communication based techniques.

UNIT IV CONTROL OF MICROGRIDS 9

Introduction to Central Controller (CC) and Micro source Controllers (MCs) - Control functions for micro source controller, Active and reactive power control, Voltage control, Storage requirement for fast load tracking, Load sharing

through power-frequency control.

UNIT V PROTECTION ISSUES FOR MICROGRIDS 9

Introduction, Islanding, Different islanding scenarios, Major protection issues of stand-alone Micro grid-Impact of DG integration on electricity market, environment, distribution system, communication Standards and protocols.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Janaka Ekanayake	Smart Grid: Technology and Applications	Yokoyama Jo & Sons, New Jersey	2012
2.	S.Chowdhury, S.P. Chowdhury and P.Crossley	Micro grids and Active Distribution Networks	IET	2009

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Xiao	Security and Privacy in Smart Grids	CRC Press	2012
2.	Yang Xiao	Communication and Networking in Smart Grids	Taylor and Francis	2012
3.	James Momoh	SMARTGRID: Fundamentals of Design and Analysis,	JohnWiley and Sons	2012
4.	Tony Flick, Justin Morehouse	Securing the Smart Grid: Next Generation Power Grid Security	Academic Press Boston	2011

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23EEE21	EMBEDDED SYSTEMS AND IOT	L	T	P	C
		3	0	0	3

Course Objective:

- To understand Smart Objects and IoT Architectures
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To apply basics concepts of Arduino IDE to interface basic components
- To apply basics concepts of Arduino IDE to develop home automation applications

Course Outcomes:

23EEE21.CO1	Explain the concept of IoT.
23EEE21.CO2	Analyze various protocols for IoT.
23EEE21.CO3	Design a PoC of an IoT system using Rasperry Pi/Arduino
23EEE21.CO4	Apply basics concepts of Arduino IDE to interface basic components
23EEE21.CO5	Apply basics concepts of Arduino IDE to develop home automation applications

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEE21.CO1	x	x	x	x	x	-	-	-	-	x	-	x	x	x	-
23EEE21.CO2	x	x	x	x	x	-	-	-	-	x	-	x	x	x	-
23EEE21.CO3	x	x	x	x	x	-	-	-	-	x	-	x	x	x	-
23EEE21.CO4	x	x	x	x	x	-	-	-	-	x	-	x	x	x	-
23EEE21.CO5	x	x	x	x	x	-	-	-	-	x	-	x	x	x	-

UNIT I **FUNDAMENTALS OF IoT** **9**

Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack -– Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

UNIT II **IoT PROTOCOLS** **9**

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

UNIT III **DESIGN AND DEVELOPMENT** **9**

Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

UNIT IV **INTERFACING BASIC COMPONENTS WITH ARUINO BOARD** **9**

Arduino with tricolor LED and Push button – Arduino with LCD – Display counter using Arduino – Seven Segment Display – Pulse width modulation – Analog to digital conversion – wireless connectivity to Arduino.

UNIT V **HOME AUTOMATION USING IOT** **9**

Assembly programming through Arduino – Digital Logic Design with Arduino – AVR – GCC programming through Arduino – Interfacing LCD through AVR-GCC Programming – Mixing Assembly and C programming – Home Automation with Arduino IoT.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry	IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press	Willey	2017
2.	S.Chowdhury, S.P. Chowdhury and P.Crossley	Micro grids and Active Distribution Networks	IET	2009

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Arshdeep Bahga, Vijay Madisetti,	Internet of Things	A hands-on approach	2015
2.	Olivier Hersent, David Boswarthick, Omar Elloumi	The Internet of Things	Key applications and Protocols	2012 (for Unit 2)
3.	Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle	From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence"	Elsevier	2014
4.	Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds)	Architecting the Internet of Things	Springer	2011

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23EEE22	UPS AND SMPS	L	T	P	C
		3	0	0	3

Course Objective:

- Modern power electronic converters and its applications in electric power utility.
- Resonant converters and UPS
- Knowledge on modern power electronic converters and its applications in electric power utility.
- To apply basics concepts of Arduino IDE to interface basic components
- To apply basics concepts of Arduino IDE to develop home automation applications

Course Outcomes:

23EEE22.CO1	Apply the knowledge of basic circuital laws and simplify the DC networks using reduction techniques.
23EEE22.CO2	Apply the knowledge of basic circuital laws and simplify the AC networks using reduction techniques.
23EEE22.CO3	Analyze the DC and AC Circuit with circuit simplification theorems.
23EEE22.CO4	Determine the frequency and transient response parameters for electrical circuits using Laplace transforms.
23EEE22.CO5	Understand the basics of three phase circuits with balanced and unbalanced loads.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEE22.CO1	x	x	x	x	-	-	x	-	-	-	x	x	x	x	-
23EEE22.CO2	x	x	x	x	-	-	x	-	-	-	x	x	x	x	-
23EEE22.CO3	x	x	x	x	-	-	x	-	-	-	x	x	x	x	-
23EEE22.CO4	x	x	x	x	-	x	x	-	-	-	x	x	x	x	-
23EEE22.CO5	x	x	x	x	-	x	x	-	-	x	x	x	x	x	-

UNIT I DC-DC CONVERTERS 9

Principles of step down and step up converters – Analysis and state space modeling of Buck, Boost, Buck- Boost and Cuk converters.

UNIT II SWITCHED MODE POWER CONVERTERS 9

Analysis and state space modeling of fly back, Forward, Push pull, Luo, Half bridge and full bridge converters- control circuits and PWM techniques

UNIT III RESONANT CONVERTERS 9

Introduction- classification- basic concepts- Resonant switch- Load Resonant converters- ZVS , Clamped voltage topologies- DC link inverters with Zero Voltage Switching- Series and parallel Resonant inverters- Voltage control.

UNIT IV DC-AC CONVERTERS 9

Single phase and three phase inverters, control using various (sine PWM, SVPWM and PSPWM) techniques, various harmonic elimination techniques- Multilevel inverters- Concepts - Types: Diode clamped- Flying capacitor- Cascaded types- Applications.

UNIT V POWER CONDITIONERS, UPS & FILTERS 9

Introduction- Power line disturbances- Power conditioners –UPS: offline UPS, Online UPS, Applications – Filters: Voltage filters, Series-parallel resonant filters, filter without series capacitors, filter for PWM VSI, current filter, DC filters – Design of inductor and transformer for PE applications – Selection of capacitors.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Simon Ang, Alejandro Oliva	"Power-Switching Converters	Third Edition, CRC Press	2010
2.	M.H. Rashid	Power Electronics handbook	Elsevier Publication	2001

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Philip T Krein	Elements of Power Electronics	Oxford University Press	2013
2.	Ned Mohan, Tore.M.Undeland, William.P.Robbins	Power Electronics converters, Applications and design	Third Edition-John Wiley and Sons	2006
3.	M.H. Rashid	Power Electronics circuits, devices and applications	third edition Prentice Hall of India New Delhi	2007.
4.	Erickson, Robert W	Fundamentals of Power Electronics	Springer, second edition	2010

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23EEE23	INDUSTRY 4.0	L	T	P	C
		3	0	0	3

Course Objective:

- To impart basic idea in Industry 4.0.
- To discuss Cyber Physical Systems (CPS) architecture and Emerging applications in CPS in different fields
- To Learn the design and analysis of Industry 4.0 systems for Energy and smart vehicular applications.
- To explain the Design challenges of smart grid and Industry 4.0.
- To apply basics concepts of Arduino IDE to develop home automation applications

Course Outcomes:

23EEE23.CO1	Develop more Understand the basic concepts of Industry 4.0 and the other related fields.
23EEE23.CO2	Study about Understand cyber physical system and the emerging applications.
23EEE23.CO3	Acquire knowledge Analyze the different energy storage systems
23EEE23.CO4	Knowledge Analyze a smart grid system.
23EEE23.CO5	Develop more understanding on Implement the industry 4.0 to solve engineering problems.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEE23.CO1	x	-	x	x	x	-	x	x	x	x	x	x	x	x	x
23EEE23.CO2	x	-	x	x	-	x	x	x	x	x	x	x	x	x	x
23EEE23.CO3	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
23EEE23.CO4	x	x	x	x	x	-	x	-	-	-	x	x	x	x	x
23EEE23.CO5	x	x	x	x	x	x	x	x	x	x	-	x	x	x	x

UNIT I INTRODUCTION TO INDUSTRY 4.0 **9**

Introduction, Historical Context, General framework, Application areas, Dissemination of Industry 4.0 and the disciplines that contribute to its development, Artificial intelligence, The Internet of Things and Industrial Internet of Things, Additive manufacturing, Robotization and automation, Current situation of Industry 4.0. Introduction to Industry 4.0 to Industry 5.0 Advances

UNIT II INDUSTRY 4.0 AND CYBER PHYSICAL SYSTEM 9

Introduction to Cyber Physical Systems (CPS), Architecture of CPS- Components, Data science and technology for CPS, Emerging applications in CPS in different fields. Case study: Application of CPS in health care domain.

UNIT III SMART ENERGY SOURCES 9

Energy Storage for Mitigating the Variability of Renewable Electricity Sources-Types of electric energy storage, Potential of Sodium-Sulfur Battery Energy Storage to Enable Integration of Wind-Case study. Electric Vehicles as Energy Storage: V2G Capacity Estimation.

UNIT IV SMART GRID 9

Smart grid definition and development Smart Grid, Understanding the Smart Grid, Smart grid solutions, Design challenges of smart grid and Industry 4.0.

UNIT V SMART APPLICATIONS 9

Understanding Smart Appliances -Smart Operation-Smart Monitoring-Smart Energy Savings-Smart Maintenance, Case study-Smart Cars, Self-Driving Cars, Introducing Google‘s Self-Driving Car, Intellectual Property Rights.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jean-Claude André	Industry 4.0	Wiley- ISTE	2019
2.	Diego Galar Pascual	Handbook of Industry 4.0 and SMART Systems	Taylor and Francis	2020

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Miller M	The internet of things: How smart TVs, smart cars, smart homes, and smart cities are changing the world	Pearson Education	2015
2.	Pengwei Du and Ning Lu	Energy storage for smart grids: planning and operation for renewable and variable energy resources VERs	Academic Press	2018
3.	Hossam A. Gabbar	Smart Energy Grid Engineering	Academic Press	2017
4.	Erickson, Robert W	Fundamentals of Power Electronics	Springer, second edition	2010

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23EEE24	BATTERY MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

Course Objective:

- To impart fundamental knowledge on electrochemical energy storage systems considering the operation and design of various battery technologies
- To discuss Battery performance evaluation
- To provide Recent development of electrode materials in lithium ion batteries
- To enable the students to understand the requirement of batteries for automotive application combined with environment policy considerations.
- To discuss the design principles of battery BMS

Course Outcomes:

23EEE24.CO1	Recognize the basic physical concepts of thermodynamics and kinetics involved in electrochemical reactions
23EEE24.CO2	Develop the appropriate battery system with respect to application
23EEE24.CO3	Analyze the characterization methods of batteries and interpret concepts describing battery performance
23EEE24.CO4	Analyze the recent developments of battery systems
23EEE24CO5	Evaluate the requirements of battery systems for automotive applications and understand the modelling of battery systems

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEE24.CO1	x	x	x	-	x	-	-	-	-	-	-	x	x	-	-
23EEE24.CO2	x	x	x	-	x	-	-	-	-	-	-	x	x	x	-
23EEE24.CO3	x	x	x	x	x	-	-	-	-	-	-	x	x	x	-
23EEE24.CO4	x	x	x	x	x	-	-	-	-	-	-	x	x	-	-
23EEE24.CO5	x	x	x	-	x	-	-	-	-	-	-	x	x	x	-

UNIT I Introduction to Electrochemical energy storage **9**

Introduction to battery technologies Electromotive force- Reversible cells- Relation between electrical energy and energy content of a cell-Free energy changes and electromotive force in cell- Current challenges in Energy storage Technologies.

UNIT II Major Battery Chemistries Development and testing **9**

Battery performance evaluation- Primary battery - Service time- Voltage data- Service life – ohmic load curve- Effect of operating temperature on service life. Secondary batteries- Discharge curves Terminal voltages- Plateau voltage –Lead acid Batteries – Construction and application.

UNIT III Recent Technologies **9**

Recent development of electrode materials in lithium ion batteries- Recent development of solid electrolytes and their application to solid state batteries-Polymer solid electrolytes for lithium ion conduction– Thin Film solid state Batteries: Fundamentals, Constriction and application – Super Capacitors: Fundamental, Construction and application.

UNIT IV Batteries for Automotives – Future prospects **9**

Degrees of vehicle electrification – Battery size vs. application -USABC and DOE targets for vehicular energy storage systems – Analysis and Simulation of batteries - Equivalent circuit and life modeling – Environmental concerns in battery production – recycling of batteries.

UNIT V Design of battery BM **9**

Design principles of battery BMS, Effect of distance, load, and force on battery life and BMS, energy balancing with multi-battery system.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	T.Minami	Solid state ionics for batteries	Springer Publication	2009
2.	Sandeep Dhameja	Electric Vehicle Battery Systems	Newnes publication	2001

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Bard, Allen J	Electrochemical Methods: Fundamentals and Applications	Wiley– VCH	2000
2.	Masataka Wakihara	Lithium ion Batteries Fundamental and Performance	Wiley– VCH	1999
3.	Robert A.Huggins	Advanced Batteries – Materials science aspects	Springer	2009
4.	Erickson, Robert W	Fundamentals of Power Electronics	Springer, second edition	2010

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23EEE25	ILLUMINATION ENGINEERING	L	T	P	C
		3	0	0	3

Course Objective:

- To provide an introduction to the fundamentals of illumination engineering and architectural lighting design.
- To Identify the criteria for the selection of lamps and lighting systems for an indoor or outdoor space
- To Perform calculations on photometric performance of light sources and luminaries for lighting design
- To Evaluate different types of lighting designs and applications
- To Knowledge about Outdoor Lighting

Course Outcomes:

23EEE25.CO1	Provide an introduction to the fundamentals of illumination engineering and architectural lighting design.
23EEE25.CO2	Identify the criteria for the selection of lamps and lighting systems for an indoor or outdoor space
23EEE25.CO3	Perform calculations on photometric performance of light sources and luminaries for lighting design
23EEE25.CO4	Evaluate different types of lighting designs and applications
23EEE25.CO5	Knowledge about Outdoor Lighting

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEE25.CO1	x	x	x	-	-	-	-	-	-	-	-	x	-	-	-
23EEE25.CO2	x	x	-	-	-	-	-	-	-	-	-	x	x	-	-
23EEE25.CO3	x	x	-	x	-	-	-	-	-	-	-	x	x	x	-
23EEE25.CO4	x	x	x	x	-	-	-	-	-	-	-	x	x	x	-
23EEE25.CO5	x	x	-	-	-	-	-	-	-	-	-	x	x	-	-

UNIT I INTRODUCTION OF LIGHT **9**

. Types of illumination, Day lighting, Supplementary artificial lighting and total lighting, Quality of good lighting, Factors affecting the lighting-shadow, glare, reflection, Colour rendering and stroboscopic effect, Methods of artificial lighting, Lighting systems-direct, indirect, semi direct, semi indirect, Lighting scheme, General and localised.

UNIT II MEASUREMENT OF LIGHT **9**

Definition of luminous flux, Luminous intensity, Lumen, Candle power, Illumination, M.H.C.P, M.S.C.P, M.H.S.C.P, Lamp efficiency, Brightness or luminance, Laws of illumination, Inverse square law and Lambert's Cosine law, Illumination at horizontal and vertical plane from point source, Concept of polar curve, Calculation of luminance and illumination in case of linear source, round source and flat source

UNIT III DESIGN OF INTERIOR LIGHTING **9**

Definitions of maintenance factor, Uniformity ratio, Direct ratio, Coefficients of utilisation and factors affecting it, Illumination required for various work planes, Space to mounting height ratio, Types of fixtures and relative terms used for interior illumination such as DLOR and ULOR, Selection of lamp and luminance, Selection of utilisation factor, reflection factor and maintenance factor

UNIT IV DESIGN OF OUTDOOR LIGHTING **9**

Types of street and their level of illumination required, Terms related to street and street lighting, Types of fixtures used and their suitable application, Various arrangements in street lighting, Requirements of good street lighting, Selection of lamp and luminaire, Calculation of their wattage, Number and arrangement.

UNIT V DESIGN OF OUTDOOR LIGHTING **9**

Flood Lighting: Terms related to flood lighting, Types of fixtures and their suitable applications, Selection of lamp and projector, Calculation of their wattage and number and their arrangement, Calculation of space to mounting height ratio, Recommended method for aiming of lamp

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Cayless	Lamps and Lighting	Routledge,	1996
2.	Sandeep Dhameja	Electric Vehicle Battery Systems	Newnes publication	2001

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Bard, Allen J	Electrochemical Methods: Fundamentals and Applications	Wiley– VCH	2000
2.	D.C. Pritchard	Lighting	Routledge	2016
3.	Jack L. Lindsey	Applied Illumination Engineering	PHI	1991
4.	John Matthews	Introduction to the Design and Analysis of Building Electrical Systems	Springer	1993

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		L	T	P	C
23EEE26	**ELECTRIC CIRCUIT ARTIFICIAL INTELLIGENT AND DATA SCIENCE APPLIED TO ELECTRICAL ENGIENEERING S**	**3**	**0**	**0**	**3**

Course Objective:

- To Explain intelligent agent frameworks
- To Apply problem solving techniques
- To Apply game playing and CSP techniques
- To Perform logical reasoning
- To Perform probabilistic reasoning under uncertainty

Course Outcomes:

23EEE26.CO1	Develop intelligent agent frameworks
23EEE26.CO2	Apply problem solving techniques
23EEE26.CO3	Apply game playing and CSP techniques
23EEE26.CO4	Implement logical reasoning
23EEE26.CO5	Analyse probabilistic reasoning under uncertainty

Course Outcomes	**Program Outcomes**												**Program Specific Outcomes**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
23EEE26.CO1	X	X	-	-	X	-	-	-	-	-	-	X	X	-	X
23EEE26.CO2	X	X	-	-	X	-	-	-	-	-	-	X	X	-	X
23EEE26.CO3	X	X	-	-	X	-	-	-	-	-	-	X	X	-	X
23EEE26.CO4	X	X	X	X	X	-	-	-	-	-	-	X	X	X	X
23EEE26.CO5	X	X	X	-	X	-	-	-	-	-	-	X	X	X	X

UNIT I INTELLIGENT AGENTS **9**

Introduction to AI – Agents and Environments – concept of rationality – nature of environments – structure of agents. Problem solving agents – search algorithms – uninformed search strategies.

UNIT II PROBLEM SOLVING **9**

. Heuristic search strategies – heuristic functions. Local search and optimization problems – local search in continuous space – search with non-deterministic actions – search in partially observable environments – online search agents and unknown environments.

UNIT III GAME PLAYING AND CSP **9**

Game theory – optimal decisions in games – alpha-beta search – monte-carlo tree search – stochastic games – partially observable games. Constraint satisfaction problems – constraint propagation – backtracking search for CSP – local search for CSP – structure of CSP.

UNIT IV LOGICAL REASONING **9**

Knowledge-based agents – propositional logic – propositional theorem proving – propositional model checking – agents based on propositional logic. First-order logic – syntax and semantics – knowledge representation and engineering – inferences in first-order logic – forward chaining – backward chaining – resolution.

UNIT V REASONING **9**

Acting under uncertainty – Bayesian inference – naïve Bayes models. Probabilistic reasoning – Bayesian networks – exact inference in BN – approximate inference in BN – causal networks.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Stuart Russell and Peter Norvig,	Artificial Intelligence – A Modern Approach",	Fourth Edition, Pearson Education	2023
2.	Deepak Khemani,	"Artificial Intelligence"	Tata McGraw Hill Education	2013.

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dan W. Patterson, "	Introduction to AI and ES"	Pearson Education,	2007
2.	Kevin Night, Elaine Rich Nair	"Artificial Intelligence"	McGraw Hill, 2008	2008
3.	Patrick H. Winston,	"Artificial Intelligence"	Third Edition, Pearson Education	2006
4.	John Matthews	Introduction to the Design and Analysis of Building Electrical Systems	Springer	1993

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		L	T	P	C
23EEE27	**CYBERPHYSICS AND CYBERSECURITY**	**3**	**0**	**0**	**3**

Course Objective:

- To Learn Cybercrime and Cyber Law Using Physics in Electrical Engineering
- To Understand the cyber-attacks and tools for mitigating them.
- To Understand information gathering using Cyber Physics
- To Learn how to detect a cyber-attack in Electrical Systems
- To Learn how to prevent a cyber-attack in Electrical Systems

Course Outcomes:

23EEE27.CO1	Learn Cybercrime and Cyber Law Using Physics in Electrical Engineering
23EEE27.CO2	Understand the cyber-attacks and tools for mitigating them.
23EEE27.CO3	Understand information gathering using Cyber Physics
23EEE27.CO4	Learn how to detect a cyber-attack in Electrical Systems
23EEE27.CO5	Learn how to prevent a cyber-attack in Electrical Systems

Course Outcomes	**Program Outcomes**												**Program Specific Outcomes**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
23EEE27.CO1	X	X	X	X	X	X	-	X	-	X	X	X	X	-	X
23EEE27.CO2	X	X	X	X	X	X	-	X	-	X	X	X	X	-	X
23EEE27.CO3	X	X	X	X	X	X	-	X	-	X	X	X	X	-	X
23EEE27.CO4	X	X	X	X	X	X	-	X	-	X	X	X	X	-	X
23EEE27.CO5	X	X	X	X	X	X	-	X	-	X	X	X	X	-	X

UNIT I INTRODUCTION **9**

Cyber Security – History of Internet – Impact of Internet – CIA Triad; Reason for Cyber Crime – Need for Cyber Security – History of Cyber Crime; Cybercriminals – Classification of Cybercrimes – A Global Perspective on Cyber Crimes; Cyber Laws – The Indian IT Act – Cybercrime and
Punishment.

UNIT II ATTACKS AND COUNTERMEASURES **9**

OSWAP; Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks – Security Breach – Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineering Attack – Wireless Network Attack – Web Application Attack – Attack Tools – Countermeasures

UNIT III RECONNAISSANCE **9**

Harvester – Whois – Netcraft – Host – Extracting Information from DNS – Extracting Information from E-mail Servers – Social Engineering Reconnaissance; Scanning – Port Scanning – Network
Scanning and Vulnerability Scanning – Scanning Methodology – Ping Sweer Techniques – Nmap Command Switches – SYN – Stealth – XMAS – NULL – IDLE – FIN Scans – Banner Grabbing and OS Finger printing Techniques.

UNIT IV INTRUSION DETECTION **9**

Host -Based Intrusion Detection – Network -Based Intrusion Detection – Distributed or Hybrid Intrusion Detection – Intrusion Detection Exchange Format – Honeypots – Example System Snort

UNIT V INTRUSION PREVENTION **9**

Firewalls and Intrusion Prevention Systems: Need for Firewalls – Firewall Characteristics and Access Policy – Types of Firewalls – Firewall Basing – Firewall Location and Configurations – Intrusion Prevention Systems – Example Unified

Threat Management Products.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Anand Shinde	Introduction to Cyber Security Guide to the World of Cyber Security	Notion Press	2021
2.	Nina Godbole Sunit Belapure	Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives	Wiley Publishers	2011

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	David Kim, Michael G. Solomon	Fundamentals of Information Systems Security", Jones &	Bartlett Learning Publishers	2013
2.	Patrick Engebretson	The Basics of Hacking and Penetration Testing, Ethical Hacking and Penetration Testing Made easy",	Elsevier	2011
3.	Kimberly Graves	"CEH Official Certified Ethical hacker Review Guide	Wiley Publishers	2007
4.	William Stallings, Lawrie Brown	Computer Security Principles and Practice	Third Edition, Pearson Education	2015

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		L	T	P	C
23EEE28	**RESTRUCTURED POWER SYSTEM**	**3**	**0**	**0**	**3**

Course Objective:

- To Understand the restructuring process of power industry and its different mechanisms throughout the world
- To Distinguish the fundamental economic principles that governs the behavior of consumers and suppliers in a restructured power market.
- To Classify various market models, levels of competition exist among these models and features of electricity as a commodity.
- To Examine the diverse ancillary services and their markets in both domestic and international contexts.
- To Acquire knowledge related to transmission congestion management methods, pricing mechanism and indices to calculate market power under deregulated environment

Course Outcomes:

23EEE28.CO1	Understand the restructuring process of power industry and its different mechanisms throughout the world
23EEE28.CO2	Distinguish the fundamental economic principles that govern the behavior of consumers and suppliers in a restructured power market.
23EEE28.CO3	Classify various market models, levels of competition exist among these models and features of electricity as a commodity.
23EEE28.CO4	Examine the diverse ancillary services and their markets in both domestic and international contexts.
23EEE28.CO5	Acquire knowledge related to transmission congestion management methods, pricing mechanism and indices to calculate market power under deregulated environment

Course Outcomes	**Program Outcomes**												**Program Specific Outcomes**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
23EEE28.CO1	x	x	-	-	-	x	x	x	-	-	-	x	x		-
23EEE28.CO2	x	x	x	x	-	x	x	x	-	-	-	x	x	-	-
23EEE28.CO3	x	x	x	x	-	x	x	x	-	-	-	x	x	-	-
23EEE28.CO4	x	x	-	-	-	x	x	x	-	-	-	x	x	-	-
23EEE28.CO5	x	x	x	x	-	x	x	x	-	-	-	x	x	-	-

UNIT I INTRODUCTION TO RESTRUCTURING OF POWER INDUSTRY: 9

Introduction, reasons for restructuring/deregulation, understanding the restructuring process and frame work, issues involved in deregulation, reasons and objectives of deregulation of various power systems across the world.

UNIT II FUNDAMENTALS OF ECONOMICS AND MARKET MODELS 9

Introduction, consumer behavior, supplier behavior, market equilibrium, short run and long-run costs, various costs of production, perfectly competitive market, philosophy of market models, market models based on contractual arrangements, comparison of various market models, electricity vis-a-vis other commodities, market architecture, trading of electric energy.

UNIT III TRANSMISSION CONGESTION MANAGEMENT AND LOCATIONAL MARGINAL PRICES 9

Classification of congestion management methods, calculation of ATC, nonmarket methods, nodal pricing, inter-zonal and intra-zonal congestion management, price area congestion management, capacity alleviation method; fundamentals of Location Marginal Pricing (LMP), LMP formulation and implementation, LMP using DCOPF

UNIT IV ANCILLARY SERVICE MANAGEMENT 9

Introduction, types of ancillary services, classification, load-generation balancing related services, voltage control and reactive power support services, black start capability services, mechanism for ancillary services, co-optimization of energy and reserve services, international comparison.

UNIT V PRICING OF TRANSMISSION NETWORK USAGE AND LOSS ALLOCATION 9

Introduction, principles of transmission pricing, classification of transmission pricing method, rolled in transmission pricing, marginal transmission pricing, composite pricing paradigms, comparison between different paradigms, debated issues in transmission pricing; introduction to loss allocation methods, classification of loss allocation methods, comparison between various methods.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Sally Hunt	Making competition work in electricity	John Willey and Sons Inc	2002
2.	Steven Stoft	Power system economics: designing markets for electricity	John Wiley & Sons	2002

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	S. A. Khaparde,A. R. Abhyankar,	"Restructured Power Systems	Alpha Science, U.K.,	2011.
2.	PRAYAS Energy Group, Second Edition, ,	"Know Your Power, A citizens Primer on the Electricity Sector",	PRAYAS Energy Group, Pune	2006.
3.	S. R. Paranjothi, 1st Edition,	"Modern Power Systems – The Economics of Restructuring",	New Age International Pvt. Ltd.	2017.
4.	Lo Lei Lai, Indian Edition,	"Power System Restructuring and Deregulation: Trading, Performance and Information Technology",	Wiley India Ltd.,	2001.

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		L	T	P	C
23EEE29	**POWER SEMICONDUCTOR DEVICES**	**3**	**0**	**0**	**3**

Course Objective:

- To understand the concepts related with power switches and its requirements.
- To know about the developments and characteristics of Silicon Carbide (SiC) and Galium Nitride (GaN) devices.
- To understand the working, steady state and switching characteristics of current controlled and voltage-controlled silicon devices.
- To study the working of driving circuits, protection circuits for power devices.
- To understand the thermal characteristics of power devices and the ability to design heat sink for the power devices.

Course Outcomes:

23EEE29.CO1	Identification of suitable device for the application.
23EEE29.CO2	Know the advantages of Silicon Carbide devices and Galium Nitride devices.
23EEE29.CO3	Understand the principles and characteristics of Silicon devices, Silicon Carbide devices and Galium Nitride devices.
23EEE29.CO4	Design proper driving circuits and protection circuits.
23EEE29.CO5	Construct a proper thermal protective device for power semiconductor devices.

Course Outcomes	**Program Outcomes**												**Program Specific Outcomes**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
23EEE29.CO1	X	X	X	X	-	-	X	-	-	-	X	X	X	X	-
23EEE29.CO2	X	X	X	X	-	-	X	-	-	-	X	X	X	X	-
23EEE29.CO3	X	X	X	X	-	-	X	-	-	-	X	X	X	X	-
23EEE29.CO4	X	X	X	X	-	X	X	-	-	-	X	X	X	X	-
23EEE29.CO5	X	X	X	X	-	X	X	-	-	X	X	X	X	X	-

UNIT I INTRODUCTION **9**

Power switching devices overview – Attributes of an ideal switch, application requirements, circuit symbols; Power handling capability – (SOA); Power diodes - Types, forward and reverse characteristics, switching characteristics – rating. Features and Brief History of Silicon Carbide- Promise and Demonstration of SiC Power Devices- Physical Properties of Silicon Carbide devices - Unipolar and Bipolar Diodes- GaN Technology Overview.

UNIT II CURRENT CONTROLLED DEVICES **9**

BJT's – Construction, static characteristics, switching characteristics; Negative temperature coefficient and second breakdown; - Thyristors – Construction, working, static and transient characteristics, types, series and parallel operation; comparison of BJT and Thyristor – steady state and dynamic models of BJT &Thyristor- Basics of GTO, SiC based Bipolar devices- Applications- Building a GaN Transistor -GaN Transistor Electrical Characteristics

UNIT III VOLTAGE CONTROLLED DEVICES **9**

Power MOSFETs and IGBTs – Principle of voltage controlled devices, construction, types, static and switching characteristics, steady state and dynamic models of MOSFET and IGBTs - and IGCT. New semiconductor materials for devices – Intelligent power modules- study of modules like APTGT100TL170G, MSCSM70TAM05TPAG. Integrated gate commutated thyristor (IGCT) - SiCbased unipolar devices-application

UNIT IV DEVICE SELECTION, DRIVING and PROTECTING CIRCUITS **9**

Device selection strategy – On-state and switching losses – EMI due to switching. Necessity of isolation, pulse transformer, optocoupler – Gate drive integrated circuit: Study of Driver IC – IRS2310/2313. SCR, MOSFET, IGBTs and base driving for power BJT. - Over voltage, over current and gate protections; Design of snubber

UNIT V THERMAL PROTECTION 9

Heat transfer – conduction, convection and radiation; Cooling – liquid cooling, vapour – phase cooling; Guidance for hear sink selection – Thermal resistance and impedance -Electrical analogy of thermal components, heat sink types and design – Mounting types- switching loss calculation for power device

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Rashid M.H.	Power Electronics Circuits, Devices and Applications	Pearson, 4th Edition, 10th Impression	2023
2.	Ned Mohan, T.M.Undeland and W.P.Robbins	Power Electronics: converters, Application and design	3rd edition Wiley	2007

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Tsunenobu Kimoto and James A. Cooper	Fundamentals of Silicon Carbide Technology: Growth, Characterization, Devices, and Applications	First Edition, John Wiley & Sons Singapore Pte Ltd	2014
2.	Alex Lidow, Johan Strydom, Michael de Rooij, David Reusch, GaN	Transistors for efficient power conversion	Second Edition, Wiley	2015
3.	Biswanath Paul	Power Electronics	Universities Press	2019
4.	Tsunenobu Kimoto and James A. Cooper	Fundamentals of Silicon Carbide Technology: Growth, Characterization, Devices, and Applications	First Edition, John Wiley & Sons Singapore Pte Ltd	2014

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		L	T	P	C
23EEE30	**SENSING TECHNIQUES AND SENSORS SYSTEM**	3	0	0	3

Course Objective:

- To introduce students to the principle of various Transducers, their construction, applications and principles of operation, standards and units of measurements.
- To provide students with opportunities to develop basic skills in the understanding the operation of analog electronic based technology.
- To identify and expose the students to analog to digital and digital to analog conversion and conditioning of analog signals
- To disseminate the design knowledge in analyzing the specific requirements for applications sensors
- To introduce students to the principle of various Transducers, their construction, applications and principles of operation, standards and units of measurements.

Course Outcomes:

23EEE30.CO1	Apply scientific principles for sensing various physical quantities.
23EEE30.CO2	Understand the operational details of analog devices for measurements and signal processing.
23EEE30.CO3	Apply various techniques in converting analog to digital and digital to analog and signal processing.
23EEE30.CO4	Disseminate the design knowledge in analyzing the specific requirements for applications in sensors
23EEE30.CO5	Disseminate the design knowledge in measurement of various physical quantities

Course Outcomes	**Program Outcomes**												**Program Specific Outcomes**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
23EEE30.CO1	x	x	-	-	-	-	-	-	-	-	-	x	x	-	-
23EEE30.CO2	x	x	-	-	-	-	-	-	-	-	-	x	x	-	-
23EEE30.CO3	x	x	-	x	-	-	-	-	-	-	-	x	x	x	-
23EEE30.CO4	x	x	x	x	-	-	-	-	-	-	-	x	x	x	-
23EEE30.CO5	x	x	-	-	-	-	-	-	-	-	-	x	x	-	-

UNIT I INTRODUCTION TO ELECTRONICS MEASUREMENT AND INSTRUMENTATION 9

Transducers and sensors- Accuracy and precisions, types of errors, statistical analysis, probability of errors, limiting errors, sensitivity, linearity, hysteresis, resolution, reproducibility, transfer function.

UNIT II ANALOG SIGNAL CONDITIONING 9

Signal conditioning, Loading effects, Bridges for measurement techniques, Attenuators and Amplifiers, Passive filters, Op-amp based signal conditioning circuits, Inverting and Non-Inverting Amplifiers, Linearization, Differential amplifiers and Instrumentation amplifiers.

UNIT III DIGITAL SIGNAL CONDITIONING 9

Digital measuring techniques, Sample and Hold Circuits, Comparator, Buffers, D/A Conversion and A/D Conversion, Single channel and multichannel Data Acquisition System (DAS).

UNIT IV TEMPERATURE SENSORS 9

Digital measuring techniques, Sample and Hold Circuits, Comparator, Buffers, D/A Conversion and A/D Conversion, Single channel and multichannel Data Acquisition System (DAS).

UNIT V PRESSURE, FORCE, DISPLACEMENT AND WEIGHT MEASUREMENT 9

Capacitive and inductive transducers, Displacement Sensor (LVDT), Strain Sensors – strain gauges, its principle, applications, types of strain gauges, Load cells, Piezo-electric sensors, Motion sensors. RF sensing:Basic principle of EM fields, Antenna, RFID, Near Field and Far Field Sensing, Radar and Navigation, EMI & EMC sensing

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Curtis D. Johnson	Process Control Instrumentation Technology	Pearson, 4th Edition, 10th Impression	2000
2.	Shawhney A. K.	A Course In Electrical and Electronics Measurements and Instrumentation	DhanpatRai& Sons, 11th Ed.	2003

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Bell David A	Electronic Instrumentation and Measurements	PHI / Pearson Education.	2003
2.	Mathew Sadiku	Elements of Electromagnetics	Pearson, 4th Edition, 10th Impression	2000
3.	Biswanath Paul	Power Electronics	Universities Press	2019
4.	Tsunenobu Kimoto and James A. Cooper	Fundamentals of Silicon Carbide Technology: Growth, Characterization, Devices, and Applications	First Edition, John Wiley & Sons Singapore Pte Ltd	2014

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		L	T	P	C
23EEE31	**TESTING AND CALIBRATION SYSTEM**	**3**	**0**	**0**	**3**

Course Objective:

- To provide knowledge about material testing
- Understand about Various mechanical testing
- To provide knowledge about Non destructive testing
- To provide knowledge about material characterization testing
- To provide knowledge about other testing

Course Outcomes:

23EEE31.CO1	Knowledge about material testing
23EEE31.CO2	Understand about Various mechanical testing
23EEE31.CO3	Knowledge about Non destructive testing
23EEE31.CO4	Knowledge about material characterization testing
23EEE31.CO5	Knowledge about other testing

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEE31.CO1	-	x	x	x	x	x	-	-	-	x	-	x	-	x	x
23EEE31.CO2	x	x	x	x	x	x	-	-	-	x	-	x	x	x	x
23EEE31.CO3	x	x	x	x	x	x	-	-	-	x	-	x	x	x	x
23EEE31.CO4	x	x	x	x	x	x	-	-	-	x	-	x	x	x	x
23EEE31.CO5	x	x	x	x	x	x	-	-	-	x	-	x	x	x	x

UNIT I INTRODUCTION TO MATERIALS TESTING **9**

Overview of materials, Classification of material testing, Purpose of testing, Selection of material, Development of testing, Testing organizations and its committee, Testing standards, Result Analysis, Advantages of testing.

UNIT II MECHANICAL TESTING **9**

Introduction to mechanical testing, Hardness test (Vickers, Brinell, Rockwell), Tensile test, Impact test (Izod, Charpy) - Principles, Techniques, Methods, Advantages and Limitations, Applications. Bend test, Shear test, Creep and Fatigue test - Principles, Techniques, Methods, Advantages and Limitations, Applications.

UNIT III NON DESTRUCTIVE TESTING **9**

Visual inspection, Liquid penetrant test, Magnetic particle test, Thermography test – Principles, Techniques, Advantages and Limitations, Applications. Radiographic test, Eddy current test, Ultrasonic test, Acoustic emission- Principles, Techniques, Methods, Advantages and Limitations, Applications.

UNIT IV MATERIAL CHARACTERIZATION TESTING **9**

Macroscopic and Microscopic observations, Optical and Electron microscopy (SEM and TEM) - Principles, Types, Advantages and Limitations, Applications. Diffraction techniques, Spectroscopic Techniques, Electrical and Magnetic Techniques- Principles, Types, Advantages and Limitations, Applications.

UNIT V OTHER TESTING **9**

Thermal Testing: Differential scanning calorimetry, Differential thermal analysis. Thermo-mechanical and Dynamic mechanical analysis: Principles, Advantages, Applications. Chemical Testing: X-Ray Fluorescence, Elemental Analysis by Inductively Coupled Plasma-Optical Emission Spectroscopy and Plasma-Mass Spectrometry.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Baldev Raj, T.Jayakumar, M.Thavasimuthu	"Practical Non Destructive Testing "	Narosa Publishing House	2009.
2.	Cullity, B. D.	Elements of X-ray diffraction",	3rd Edition, Addison-Wesley Company Inc., New York	2000.

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Bell David A	Electronic Instrumentation and Measurements	PHI / Pearson Education.	2003
2.	Metals Handbook:,	Mechanical testing, (Volume 8) ASM Handbook Committee, 9th Edition	American Society for Metals	1978.
3.	ASM Metals Handbook,	"Non-Destructive Evaluation and Quality Control",	American Society of Metals, Metals Park, Ohio, USA	1982
4.	Brandon D.G.,	"Modern Techniques in Metallography",	Von Nostrand Inc. NJ, USA,	1986.

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		L	T	P	C
23EEE32	**PLC AND AUTOMATION**	**3**	**0**	**0**	**3**

Course Objective:

- To discuss the Architecture and networking of PLCs
- To develop PLC and HMI systems programming
- To explain the architecture and operation of SCADA and DCS
- To design rectifier circuit of voltage and current control loop
- To create Automation system for different applications

Course Outcomes:

23EEE32.CO1	Discuss the Architecture and networking of PLCs
23EEE32.CO2	Develop PLC and HMI systems programming
23EEE32.CO3	Explain the architecture and operation of SCADA and DCS
23EEE32.CO4	Design rectifier circuit of voltage and current control loop
23EEE32.CO5	Create Automation system for different applications

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEE32.CO1	X	X	X	X	X	X	X	-	-	-	-	X	X	X	X
23EEE32.CO2	X	X	X	X	X	X	X	-	-	-	-	X	X	X	X
23EEE32.CO3	X	X	X	X	X	X	X	-	-	-	-	X	X	X	X
23EEE32.CO4	X	X	X	X	X	X	X	-	-	-	-	X	X	X	X
23EEE32.CO5	X	X	X	X	X	X	X	-	-	-	-	X	X	X	X

UNIT I PROGRAMMABLE LOGIC CONTROLLERS 9

Programmable Logic Controllers Basics of PLC - Architecture of PLC - Advantages - Types of PLC - Introduction to PLC Networking- Networking standards - Protocols - Field bus - Process bus and Ethernet IEEE Standard. Process bus and Ethernet IEEE Standard.

UNIT II PROGRAMMING OF PLC & HMI SYSTEMS PROGRAMMING OF PLC 9

Types of Programming - Simple process control programs using Relay Ladder Logic and Boolean logic methods - PLC arithmetic functions - Introduction to advanced programming methods. HMI systems: Necessity and Role in Industrial Automation, Text display - operator panels - Touch panels - Panel PCs - Integrated displays (PLC & HMI).

UNIT III DISTRIBUTED CONTROL SYSTEMS (DCS) 9

Difference between SCADA system and DCS – architecture – local control unit – programming language –communication facilities – operator interface – engineering interfaces.

UNIT IV APPLICATIONS OF PLC & DCS 9

Switched Mode Rectifier - Operation of Single/Three Phase Bridges in Rectifier Mode - Control Principles - Control of the DC Side Voltage - Voltage Control Loop - The inner Current Control Loop. Inner current control loop.

UNIT V AUTOMATION 9

Factory Automation: Flexible Manufacturing Systems concept – Automatic feeding lines, ASRS, transfer lines, automatic inspection– Computer Integrated Manufacture – CNC, intelligent automation, Industrial networking, bus standards, HMI Systems, DCS and SCADA, Wireless controls

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	John.W.Webb &Ronald A. Reis	Programmable logic controllers:Principles and Applications	Prentice Hall of India	2003
2.	W. Bolton	Programmable Logic Controllers	Elsevier India PrivateLimited, New Delhi	2008

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Michael P. Lukas	Distributed Control systems	Van Nostrand ReinfoldCompany	2002
2.	Gary Dunning	Introduction to Programmable Logic Controllers	Thomson Press	2005
3.	Groover	Programmable Logic Controllers	Van Nostrand ReinfoldCompany	2008
4.	Mikell P	Automation Production systems and Computer Integrated Manufacturing	Prentice Hall of India	2007

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23EEE33	EMBEDDED SYSTEMS AND IOT LABORATORY	L	T	P	C
		0	0	2	1

Course Objective:

- To Understand the basics of Arduino with simple examples
- To Understand interfacing of LCD and Seven Segment display with Arduino
- To Apply PWM and analog to digital conversion using Arduino
- To Understand the basics of wireless connectivity of Arduino
- To Apply basics of Arduino basics with Tincker CAD online tool.

Course Outcomes:

23EEE33.CO1	Understand the basics of Arduino with simple examples
23EEE33.CO2	Understand interfacing of LCD and Seven Segment display with Arduino
23EEE33.CO3	Apply PWM and analog to digital conversion using Arduino
23EEE33.CO4	Understand the basics of wireless connectivity of Arduino
23EEE33.CO5	Apply basics of Arduino basics with Tincker CAD online tool.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEE33.CO1	x	x	x	x	-	-	x	-	x	x	-	x	x	x	-
23EEE33.CO2	x	x	x	x	-	-	x	-	x	x	-	x	x	x	-
23EEE33.CO3	x	x	x	x	-	-	x	-	x	x	-	x	x	x	-
23EEE33.CO4	x	x	x	x	-	-	x	-	x	x	-	x	x	x	-
23EEE33.CO5	x	x	x	x	-	-	x	-	x	x	-	x	x	x	-

Sl.No.	List of Experiments
1.	Basics of Arduino installation and basics board installation.
2.	Blink, Tricolor and push button operation with Arduino.
3.	Interface LCD with Arduino
4.	Display counter with Arduino and seven segment display
5.	Pulse width modulation with Arduino
6.	Analog to digital conversion with Arduino
7.	Wireless connectivity with Arduino
8.	Basics Tincker CAD online tool
9.	Interfacing LCD with Arduino in Tincker CAD
10.	Interfacing gas sensor with Arduino in Tincker CAD

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Total Periods: 30

		L	T	P	C
23EEE34	**HIGH VOLTAGE ENGINEERING**	**3**	**0**	**0**	**3**

Course Objective:

- To discuss the over voltages in power systems and over voltage protection methods
- To compare the dielectric break down strength of gas liquid and solids insulation systems
- To discuss the generation of high voltages, impulse voltages and impulse currents
- To measure the high voltages and currents by lying dynamic response analysis
- To test the high voltage electrical power apparatus and insulation

Course Outcomes:

23EEE34.CO1	Discuss the over voltages in power systems and over voltage protection methods
23EEE34.CO2	Compare the dielectric break down strength of gas liquid and solids insulation systems
23EEE34.CO3	Discuss the generation of high voltages, impulse voltages and impulse currents
23EEE34.CO4	Measure the high voltages and currents by lying dynamic response analysis
23EEE34.CO5	Test the high voltage electrical power apparatus and insulation

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEE34.CO1	x	x	-	-	-	-	x	-	-	-	x	x	x	x	-
23EEE34.CO2	x	x	-	-	-	x	-	-	-	-	x	x	x	x	-
23EEE34.CO3	x	x	x	x	-	-	-	-	-	-	x	x	x	x	-
23EEE34.CO4	x	x	-	x	-	-	-	-	-	-	-	x	x	x	x
23EEE34.CO5	x	-	x	-	-	-	x	-	-	-	x	x	x	x	-

UNIT I OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS 9

Causes of over voltages and its effects on power system – Lightning, switching surges and temporary over voltages, Corona and its effects – Bewley's lattice diagram- Protection against over voltages.

UNIT II DIELECTRIC BREAKDOWN 9

Properties of Dielectric materials – Gaseous breakdown in uniform and non-uniform fields – Corona discharges – Vacuum breakdown – Conduction and breakdown in pure and commercial liquids, Maintenance of oil Quality – Breakdown mechanisms in solid and composite dielectrics- Applications of insulating materials in electrical equipment's.

UNIT III GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS 9

Generation of High DC voltage: Rectifier's, voltage multipliers -Vandigraf generator: Generation of high impulse voltage - Single and multistage Marx circuits – Generation of high AC voltages: Cascaded transformers, resonant transformer and tesla coil- Generation of switching surges – Generation of impulse currents – Triggering and control of impulse generators.

UNIT IV MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS 9

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

UNIT V HIGH VOLTAGE TESTING & INSULATION COORDINATION 9

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

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	S.Naidu and V.Kamaraju	High Voltage Engineering	Tata McGraw Hill	2013
2.	E. Kuffel and W.S. Zaengl,J.Kuffel	High voltage Engineering fundamentals	Newnes Second Edition Elsevier	2005

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Subir Ray	An Introduction to High Voltage Engineering	PHI Learning PrivateLimited	2013
2.	L.L. Alston	High Voltage Technology	Oxford University	2011
3.	C.L. Wadhwa	High voltage Engineering	New Age International Publishers	2010
4.	Küchler, Andreas	High voltage Engineering-Fundamentals-Technology-Applications	Springer	2015

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23EEE35	POWER SYSTEMS TRANSIENTS	L	T	P	C
		3	0	0	3

Course Objective:

- To discuss the basic concepts of transients and effects of transients
- To elaborate the generation of switching transients and control circuits
- To design the mechanism of lighting strokes and productions
- To analyze the computation of transients in distributed lines
- To explain the impact of voltage transients and circuit breaker

Course Outcomes:

23EEE35.CO1	Discuss the basic concepts of transients and effects of transients.
23EEE35.CO2	Elaborate the generation of switching transients and control circuits.
23EEE35.CO3	Design the mechanism of lighting strokes and productions.
23EEE35.CO4	Analyze the computation of transients in distributed lines.
23EEE35.CO4	Explain the impact of voltage transients and circuit breaker.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEE35.CO1	x	x	x	x	-	-	-	-	-	x	-	x	x	x	x
23EEE35.CO2	x	x	x	x	-	-	-	-	-	x	-	x	x	x	x
23EEE35.CO3	x	x	x	x	-	-	-	-	-	x	-	x	x	x	x
23EEE35.CO4	x	x	x	x	-	-	-	-	-	x	-	x	x	x	x
23EEE35.CO4	x	x	x	x	-	-	-	-	-	x	-	x	x	x	x

UNIT I INTRODUCTION AND SURVEY **9**

Review and importance of the study of transients - causes for transients. RL circuit transient with sine wave excitation - double frequency transients - basic transforms of the RLC circuit transients - Source of transients - Various types of power systems transients - Effect of transients on power systems, importance of study of transients in planning.

UNIT II SWITCHING TRANSIENTS **9**

Introduction, circuit closing transients: RL circuit with sine wave drive, double frequency transients, observations in RLC circuit and basic transforms of the RLC circuit - Resistance switching - Load switching - Normal and abnormal switching transients - Current suppression, current chopping and effective equivalent circuit - Capacitance switching, effect of source regulation, capacitance switching with a restrike, with multiple restrikes, illustration for multiple restriking transients, Ferro resonance.

UNIT III LIGHTNING TRANSIENTS **9**

Causes of over voltage - lightning phenomenon, charge formation in the clouds - Rate of charging of thunder clouds, mechanisms of lighting strokes - Mathematical model for lightning, characteristics of lightning strokes; factors contributing to good line design, protection afforded by ground wires - Tower footing resistance- Interaction between lightning and power system.

UNIT IV TRAVELLING WAVES ON TRANSMISSION LINE COMPUTATION OF TRANSIENTS **9**

Computation of transients: Transient response of systems with series and shunt lumped parameters and distributed lines - Travelling wave concept: step response, reflection and refraction of travelling waves - Bewely's lattice diagram - Attenuation and distortion of travelling waves.

UNIT V TRANSIENTS IN INTEGRATED POWER SYSTEM 9

The short line and kilometric fault - distribution of voltage in a power system: Line dropping and load rejection - Voltage transients on closing and reclosing lines - Over voltage induced by faults - Switching surges on integrated system - Computation of transient: Transient network analyzer, EMTP.

Total Periods: 45

Text Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Pritindra Chowdhari	Electromagnetic transients in Power System	John Wiley and Sons Inc Second Edition,	2009
2.	R.D.Begamudre	Extra High Voltage AC Transmission Engineering	Wiley Eastern Limited	2011

Reference Books:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	M.S.Naidu andV.Kamaraju	High Voltage Engineering	Tata McGraw Hill, 4thedition	2009
2.	Y.Hase	Handbook of Power System Engineering	Wiley India	2012
3.	J.L.Kirtley	Electric Power Principles, Sources, Conversion, Distribution and use	Wiley India	2012
4.	Allan Greenwood	Electrical Transients in Power Systems	Wiley Inter science	2010

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		L	T	P	C
23EES01	**PROJECT WORK – PHASE - I**	**0**	**0**	**6**	**3**

Course Objective:

- Choose an appropriate research problem
- Compile the relevant literature and frame hypotheses for the stated research problem
- Plan a research design and conduct an engineering project through software or hardware
- Contribute as an individual or in a team in development of technical projects
- Ddemonstrate, prepare reports, communicate by adhering to ethical responsibilities.

Course Outcomes:

23EES01.CO1	Choose an appropriate topic for study and will be able to clearly formulate & state a research problem
23EES01.CO2	Compile the relevant literature and frame research design for the stated research problem
23EES01.CO3	Conduct an engineering project through software implementation
23EES01.CO4	Contribute as an individual or in a team in development of technical projects
23EES01.CO5	Ddemonstrate, prepare reports, communicate by adhering to ethical responsibilities.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EES01.CO1	x	x	x	-	-	-	x	-	-	-	-	x	x	-	-
23EES01.CO2	x	x	x	x	x	-	x	x	x	x	x	x	x	x	x
23EES01.CO3	x	x	x	x	x	x	x	x	x	-	x	x	x	x	x
23EES01.CO4	x	x	x	x	x	x	x	x	x	x	x	-	x	x	x
23EES01.CO5	-	-	-	x	x	x	-	-	x	x	x	x	-	x	x

GUIDELINE FOR REVIEW AND EVALUATION:

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

Total Periods: 90

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		L	T	P	C
23EES02	**PROJECT WORK II & Dissertations**	**0**	**0**	**18**	**9**

Course Objective:

- Formulate a real-world problem, identify the requirement and develop the design solutions.
- Express the technical ideas, strategies and methodologies.
- Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project
- Test and validate through conformance of the developed prototype and analysis the cost effectiveness
- Demonstrate, prepare reports, communicate and work in a team as a member/leader by adhering to ethical responsibilities.

Course Outcomes:

23EES02.CO1	Ability to identify and formulate research problem
23EES02.CO2	Ability to identify, formulate, design, interpreter, analyze and provide solutions to complex engineering and societal issues by applying knowledge gained on basics of science and Engineering
23EES02.CO3	Ability to understand, formulate and propose new learning algorithms to solve engineering and societal problems of moderate complexity through multidisciplinary projects understanding commitment towards sustainable development.
23EES02.CO4	Test and validate through conformance of the developed prototype by hardware implementation and analysis thecost effectiveness
23EES02.CO5	Ability to demonstrate, prepare reports, communicate and work in a team as a member/leader by adhering to ethical responsibilities

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EES02.CO1	x	x	x	-	-	-	x	-	-	-	-	x	x	-	-
23EES02.CO2	x	x	x	x	x	-	x	x	x	x	x	x	x	x	x
23EES02.CO3	x	x	x	x	x	x	x	x	x	-	x	x	x	x	x
23EES02.CO4	x	x	x	x	x	x	x	x	x	x	x	-	x	x	x
23EES02.CO5	-	-	-	x	x	x	-	-	x	x	x	x	-	x	x

GUIDELINE FOR REVIEW AND EVALUATION:

The student should continue the phase I work on the selected topic as per the formulated methodology under the same supervisor. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the Head of the department. The students will be evaluated based on the report submitted and the viva-voce examination by a panel of examiners including one external examiner.

Total Periods: 270

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		L	T	P	C
23EED01	**MINI PROJECT**	**0**	**0**	**2**	**1**

Course Objective:

- find a specific problem in the real time applications
- find the solution of the problem by literature review
- Select the new techniques to find the right solution of the problem
- Contribute as an individual or in a team in development of technical projects
- Understand the guidelines to Prepare report for oral demonstrations

Course Outcomes:

23EEDO1.CO1	find a specific problem in the real time applications
23EEDO1.CO2	solve the problem by literature review
23EEDO1.CO3	select the new techniques to find the right solution of the problem
23EEDO1.CO4	contribute as an individual or in a team in development of technical projects
23EEDO1.CO5	understand the guidelines to Prepare report for oral demonstrations

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EED01.CO1	x	x	x	-	-	-	x	-	-	-	-	x	x	-	-
23EED01.CO2	x	x	x	x	x	-	x	x	x	x	x	x	x	x	x
23EED01.CO3	x	x	x	x	x	x	x	x	x	-	x	x	x	x	x
23EED01.CO4	x	x	x	x	x	x	x	x	x	x	x	-	x	x	x
23EED01.CO5	-	-	-	x	x	x	-	-	x	x	x	x	-	x	x

GUIDELINE FOR REVIEW AND EVALUATION:

The students may be grouped into 2 to 4 and work under a project supervisor. The device/system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible, with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

Total Periods: 30

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23EEI01	INTERNSHIP - I	L	T	P	C
		0	0	2	1

Course Objective:

- To understand the guidelines to prepare report for oral demonstrations
- To gain practical experience within industry in which the internship is done.
- To apply the technical knowledge acquired from the internship
- To contribute as an individual or in a team in development of technical projects
- To acquire the knowledge of administration, marketing, finance and economics

Course Outcomes:

23EEI01.CO1	Understand the guidelines to prepare technical report for oral demonstrations
23EEI01.CO2	Gain practical experience within industry in which the internship is done.
23EEI01.CO3	Apply the technical knowledge acquired from the internship
23EEI01.CO4	Contribute as an individual or in a team in development of technical projects
23EEI01.CO5	Acquire the knowledge of administration, marketing, finance and economics

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEI01.CO1	x	x	-	-	x	x	-	-	-	x	-	x	x	-	x
23EEI01.CO2	x	x	-	-	x	x	-	-	-	-	-	x	x	-	x
23EEI01.CO3	x	x	x	x	x	x	-	-	-	-	-	x	x	x	x
23EEI01.CO4	x	x	x	x	x	x	x	-	x	-	-	x	x	x	x
23EEI01.CO5	x	x	-	-	x	x	-	-		-	x	x	x	-	x

GUIDELINE FOR REVIEW AND EVALUATION:

1. It is mandatory for every student to undergo this course.
2. Every student is expected to spend a minimum of 30-days in an Industry/ Company/ Organization, during the Winter vacation.
3. The type of industry must be NOT below the Medium Scale category in his / her domain of the degree programme.
4. The student must submit the "Training Completion Certificate" issued by the industry / company / Organization as well as a technical report not exceeding 15 pages, within the stipulated time to be eligible for making a presentation before the committee constituted by the department.
5. The committee will then assess the student based on the report submitted and the presentation made.
6. Marks will be awarded out of maximum 100.
7. Appropriate grades will be assigned as per the regulations.
8. Only if a student gets a minimum of pass grade, appropriate credit will be transferred towards the degree requirements, as per the regulations.
9. It is solely the responsibility of the individual student to fulfil the above conditions to earn the credits.
10. The attendance for this course, for the purpose of awarding attendance grade, will be considered 100%, if the credits are transferred, after satisfying the above (1) to (8) norms; else if the credits are not transferred or transferable, the attendance will be considered as ZERO.
11. The committee must recommend redoing the course, if it collectively concludes, based on the assessment made from the report and presentations submitted by the student, that either the level of training received or the skill and / or knowledge gained is NOT satisfactory.

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Total Periods: 30

23EEI02	INTERNSHIP - II	L	T	P	C
		0	0	2	1

Course Objective:

- To understand the guidelines to prepare report for oral demonstrations
- To gain practical experience within industry in which the internship is done.
- To apply the technical knowledge acquired from the internship
- To contribute as an individual or in a team in development of technical projects
- To acquire the knowledge of administration, marketing, finance and economics

Course Outcomes:

23EEI02.CO1	Understand the guidelines to prepare technical report for oral demonstrations
23EEI02.CO2	Gain practical experience within industry in which the internship is done.
23EEI02.CO3	Apply the technical knowledge acquired from the internship
23EEI02.CO4	Contribute as an individual or in a team in development of technical projects
23EEI02.CO5	Acquire the knowledge of administration, marketing, finance and economics

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEI02.CO1	x	x	-	-	x	x	-	-	-	x	-	x	x	-	x
23EEI02.CO2	x	x	-	-	x	x	-	-	-	-	-	x	x	-	x
23EEI02.CO3	x	x	x	x	x	x	-	-	-	-	-	x	x	x	x
23EEI02.CO4	x	x	x	x	x	x	x	-	x	-	-	x	x	x	x
23EEI02.CO5	x	x	-	-	x	x	-	-		-	x	x	x	-	x

GUIDELINE FOR REVIEW AND EVALUATION:

1. It is mandatory for every student to undergo this course.
2. Every student is expected to spend a minimum of 30-days in an Industry/ Company/ Organization, during the Winter vacation.
3. The type of industry must be NOT below the Medium Scale category in his / her domain of the degree programme.
4. The student must submit the "Training Completion Certificate" issued by the industry / company / Organization as well as a technical report not exceeding 15 pages, within the stipulated time to be eligible for making a presentation before the committee constituted by the department.
5. The committee will then assess the student based on the report submitted and the presentation made.
6. Marks will be awarded out of maximum 100.
7. Appropriate grades will be assigned as per the regulations.
8. Only if a student gets a minimum of pass grade, appropriate credit will be transferred towards the degree requirements, as per the regulations.
9. It is solely the responsibility of the individual student to fulfil the above conditions to earn the credits.
10. The attendance for this course, for the purpose of awarding attendance grade, will be considered 100%, if the credits are transferred, after satisfying the above (1) to (8) norms; else if the credits are not transferred or transferable, the attendance will be considered as ZERO.
11. The committee must recommend redoing the course, if it collectively concludes, based on the assessment made from the report and presentations submitted by the student, that either the level of training received or the skill and / or knowledge gained is NOT satisfactory.

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Total Periods: 30

23EEI03	INTERNSHIP - III	L	T	P	C
		0	0	2	1

Course Objective:

- To understand the guidelines to prepare report for oral demonstrations
- To gain practical experience within industry in which the internship is done.
- To apply the technical knowledge acquired from the internship
- To contribute as an individual or in a team in development of technical projects
- To acquire the knowledge of administration, marketing, finance and economics

Course Outcomes:

23EEI03.CO1	Understand the guidelines to prepare technical report for oral demonstrations
23EEI03.CO2	Gain practical experience within industry in which the internship is done.
23EEI03.CO3	Apply the technical knowledge acquired from the internship
23EEI03.CO4	Contribute as an individual or in a team in development of technical projects
23EEI03.CO5	Acquire the knowledge of administration, marketing, finance and economics

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEI03.CO1	x	x	-	-	x	x	-	-	-	x	-	x	x	-	x
23EEI03.CO2	x	x	-	-	x	x	-	-	-	-	-	x	x	-	x
23EEI03.CO3	x	x	x	x	x	x	-	-	-	-	-	x	x	x	x
23EEI03.CO4	x	x	x	x	x	x	x	-	x	-	-	x	x	x	x
23EEI03.CO5	x	x	-	-	x	x	-	-		-	x	x	x	-	x

GUIDELINE FOR REVIEW AND EVALUATION:

1. It is mandatory for every student to undergo this course.
2. Every student is expected to spend a minimum of 30-days in an Industry/ Company/ Organization, during the Winter vacation.
3. The type of industry must be NOT below the Medium Scale category in his / her domain of the degree programme.
4. The student must submit the "Training Completion Certificate" issued by the industry / company / Organization as well as a technical report not exceeding 15 pages, within the stipulated time to be eligible for making a presentation before the committee constituted by the department.
5. The committee will then assess the student based on the report submitted and the presentation made.
6. Marks will be awarded out of maximum 100.
7. Appropriate grades will be assigned as per the regulations.
8. Only if a student gets a minimum of pass grade, appropriate credit will be transferred towards the degree requirements, as per the regulations.
9. It is solely the responsibility of the individual student to fulfil the above conditions to earn the credits.
10. The attendance for this course, for the purpose of awarding attendance grade, will be considered 100%, if the credits are transferred, after satisfying the above (1) to (8) norms; else if the credits are not transferred or transferable, the attendance will be considered as ZERO.
11. The committee must recommend redoing the course, if it collectively concludes, based on the assessment made from the report and presentations submitted by the student, that either the level of training received or the skill and / or knowledge gained is NOT satisfactory.

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Total Periods: 30

23EEP02	PROFESSIONAL SKILLS - II	L	T	P	C
		0	0	2	1

Course Objective:

- To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize, interlink, and utilizing many more critical features offered
- To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations.
- To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize, interlink, and utilizing many more critical features offered

Course Outcomes:

23EEP02.CO1	Use MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements
23EEP02.CO2	Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding
23EEP02.CO3	Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEP02.CO1	-	-	-	-	x	x	-	-	-	x	x	x	-	-	-
23EEP02.CO2	-	-	-	-	x	x	-	-	-	x	x	x	-	-	-
23EEP02.CO3	-	-	-	-	x	x	-	-	-	x	x	x	-	-	-

MS WORD:

Create and format a document
Working with tables
Working with Bullets and Lists
Working with styles, shapes, smart art, charts
Inserting objects, charts and importing objects from other office tools
Creating and Using document templates
Inserting equations, symbols and special characters
Working with Table of contents and References, citations
Insert and review comments
Create bookmarks, hyperlinks, endnotes footnote
Viewing document in different modes
Working with document protection and security
Inspect document for accessibility

Total Periods: 10

MS EXCEL:

Create worksheets, insert and format data
Work with different types of data: text, currency, date, numeric etc.
Split, validate, consolidate, Convert data
Sort and filter data
Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.,)
Work with Lookup and reference formulae
Create and Work with different types of charts
Use pivot tables to summarize and analyse data
Perform data analysis using own formulae and functions
Combine data from multiple worksheets using own formulae and built-in functions to generate results
Export data and sheets to other file formats
Working with macros
Protecting data and Securing the workbook

Total Periods: 10

MS POWERPOINT:

Select slide templates, layout and themes
Formatting slide content and using bullets and numbering
Insert and format images, smart art, tables, charts
Using Slide master, notes and handout master
Working with animation and transitions
Organize and Group slides
Import or create and use media objects: audio, video, animation
Perform slideshow recording and Record narration and create presentable videos

Total Periods: 10

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		L	T	P	C
23EEM01	**CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS**	**0**	**0**	**0**	**0**

Course Objective:

- To create an awareness on Engineering Ethics and Human Values.
- To instill Moral and Social Values and Loyalty.
- To Create awareness among engineers about their social responsibilities
- To Appreciate the Ethical issues
- To Know the Human rights and concept of women empowerment

Course Outcomes:

23EEM01.CO1	Practice the moral values that ought to guide the Engineering profession.
23EEM01.CO2	Discover of the set of justified moral principles of obligation, ideals that ought to be endorsed by the engineers and apply them to concrete situations
23EEM01.CO3	Know the definitions of risk and safety also discover different factors that affect the perception of risk
23EEM01.CO4	Appreciate the Ethical issues and know the code of ethics adopted in various professional bodies and industries
23EEM01.CO5	Justify the need for protection of human rights and to know about concept of women

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
23EEM01.CO1	x	x	-	-	-	-	-	-	-	-	-	x	x	-	-
23EEM01.CO2	x	x	-	-	-	-	-	-	-	-	-	x	x	-	-
23EEM01.CO3	x	x	-	x	-	-	-	-	-	-	-	x	x	x	-
23EEM01.CO4	x	x	x	x	-	-	-	-	-	-	-	x	x	x	-
23EEM01.CO5	x	x	-	-	-	-	-	-	-	-	-	x	x	-	-

UNIT I HUMAN VALUES

Professional Ethics-Objectives of study of professional ethics-Human values- Definition of Morals and Ethics-Difference between Morality and Ethics-Values-Definition-Types of valuesDefinition of Integrity- Concept of Work Ethic- Service Learning- Definition Virtues-DefinitionCivic Virtue-Duties and Rights - Respect for Others – Attitude and values, opinions-changing attitude-beliefs-Reliability-Living Peacefully-Means to be adopted for leavingpeacefully-CaringSharing-Honesty-ValuingTime-Co-operation-Commitment-Empathy-Self-ConfidenceSpirituality.

UNIT II ENGINEERING ETHICS

Engineering ethics-Definition-Approach-Senses of Engineering Ethics-variety of moral issues–Inquiry-Types-Moral dilemmas-Steps to solve dilemma-Moral autonomy –Definition-consensus & controversy –Profession-Definition–Ethical theories-Theories about right action Personality–Self control- Self-interest –Self respect.

UNIT III SAFETY, RESPONSIBILITIES OF ENGINEERS

Safety and risk-definition- - assessment of safety and risk - risk benefit analysis and reducing risk –Personal risk-Public risk-Reducing risk-Voluntary Risk-Collegiality and loyalty– Authority Types- collective bargaining -occupational crime – Responsibilityofengineers–Types – Socialresponsibility-Professional responsibility-confidentiality-conflicts of interest-liability.

UNIT IV ETHICAL ISSUES IN ENGINEERING PRACTICE

Ethical issues–Industrial standards-Environmental ethics –Plastic waste disposal-E-Waste Disposal-Semi conductor waste Disposal-Industrial waste disposal-Human centred environmental ethics- computer ethics –Types of issues-

Computer as the Instrument and Object of Unethical Acts -Engineers as managers-Codes of ethics-Sample code of Ethics like -Institution of Engineers(India)-Institute of Electrical & Electronics engineers- Institute of Electronics & Telecommunication Engineers - Indian Institute of Materials Management.

UNIT V HUMAN RIGHTS

Human Rights-Definition-constitutional provisions-right to life and liberty-Human Rights of Women-Discrimination against women- steps that are to be taken to eliminate discrimination against women in Education, employment, health care, Economic and social life, Women in rural areas- Status of Women in India - Constitutional Safeguards - Dowry Prohibition act 1961- Domestic violence act 2005- Sexual harassment at work place bill 2006-Human Rights of Children- Who is a child- list the Rights of the Child- Right to education--Protection of Children from Sexual Offences Act(POCSO)-2012- National Human Rights Commission- Constitution Powers and function of the Commission-Employee rights- Provisions made-Contractual-Non contractual employee rights-Whistle blowing-definition-Aspects-Intellectual Property Rights (IPR)–Meaning-Need for protection- Briefly description of concept of patents, Copy right, Trade mark.

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		L	T	P	C
23EEM02	**DISASTER RISK REDUCTION AND MANAGEMENT**	**0**	**0**	**0**	**0**

Course Objective:

- To impart knowledge on concepts related to disaster, disaster risk reduction, disaster management.
- To acquaint with the skills for planning and organizing disaster response.

Course Outcomes:

23EEM02.CO1	To impart knowledge on the concepts of Disaster, Vulnerability and Disaster Risk reduction (DRR)
23EEM02.CO2	To enhance understanding on Hazards, Vulnerability and Disaster Risk Assessment prevention and risk reduction
23EEM02.CO3	To develop disaster response skills by adopting relevant tools and technology
23EEM02.CO4	Enhance awareness of institutional processes for Disaster response in the country and
23EEM02.CO5	Develop rudimentary ability to respond to their surroundings with potential Disaster response in areas where they live, with due sensitivity

Course Outcomes	**Program Outcomes**												**Program Specific Outcomes**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
23EEM01.CO1	x	x	-	-	-	-	-	-	-	-	-	x	x	-	-
23EEM01.CO2	x	x	-	-	-	-	-	-	-	-	-	x	x	-	-
23EEM01.CO3	x	x	-	x	-	-	-	-	-	-	-	x	x	x	-
23EEM01.CO4	x	x	x	x	-	-	-	-	-	-	-	x	x	x	-
23EEM01.CO5	x	x	-	-	-	-	-	-	-	-	-	x	x	-	-

UNIT I HAZRADS, VULNERABILITY AND DISASTER RISKS

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Types of Disasters: Natural, Human induced, Climate change induced –Earthquake, Landslide, Flood, Drought, Fire etc – Technological disasters- Structural collapse, Industrial accidents, oil spills -Causes, Impacts including social, Economic, political, environmental, health, psychosocial, etc.- Disaster vulnerability profile of India and Tamil Nadu - Global trends in disasters: urban disasters, pandemics, Complex emergencies, - -, Inter relations between Disasters and Sustainable development Goals

UNIT II DISASTER RISK REDUCTION (DRR)

Sendai Framework for Disaster Risk Reduction, Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community Based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions / Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Early Warning System – Advisories from Appropriate Agencies.- Relevance of indigenous Knowledge, appropriate technology and Local resources.

UNIT III DISASTER MANAGEMENT

Components of Disaster Management – Preparedness of rescue and relief, mitigation, rehabilitation and reconstruction- Disaster Risk Management and post disaster management – Compensation and Insurance- Disaster Management Act (2005) and Policy - Other related policies, plans, programmers and legislation - Institutional Processes and Framework at State and Central Level- (NDMA –SDMA-DDMA-NRDF- Civic Volunteers)

UNIT IV TOOLS AND TECHNOLOGY FOR DISASTER MANAGEMENT

Early warning systems -Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment. - Elements of Climate Resilient Development –Standard operation Procedure for disaster response – Financial planning for disaster Management

UNIT V DISASTER MANAGEMENT: CASE STUDIES

Discussion on selected case studies to analyse the potential impacts and actions in the contest of disasters-Landslide Hazard Zonation: Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.- Field work-Mock drill.

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