MINUTES OF 7TH MEETING

OF

BOARD OF STUDIES (BOS)

DEPARTMENT OF ELECTRICAL ENGINEERING

UNIVERSITY POLYTECHNIC

JULY 01ST, 2023

Department of Electrical Engineering

Date 01th July 2023

Agenda of the 7TH Meeting of Board of Studies on July 01st, 2023

Department of Electrical Engineering
(University Polytechnic)

The 7th meeting of Board of studies of Electrical Engineering Department is to be held on Saturday, 01st Jul 2023 at 10:00 am in the Principal office, University Polytechnic as per the following agenda: -

Agenda Item –7.1: To confirm the minutes of the 6th BOS Meeting: *The minutes of the meeting of 6th BOS held on 28th **may, 2022** were implementd and enclosed in Annexure A.*

Agenda Item –7.2: Action Taken Report (ATR)

The ATR based on the minutes of the 7th BOS will be presented.

Agenda Item-7.3 Addition of new subject '**Introduction of Electrical Engineering** 'DEE 1001 in the First Year.

Subject	Existing	Proposed	Remark	Annexure
New Subject	-	Addition of Introduction of Electrical Engineering Subject in first Year only.	Addition of New Subject	Annexure B

Agenda Item-7.4: Addition of new subject '**Electrical and Electronics Engineering Material**' DEE 3010 in the third semester in place of '**Basics of Electrical and Electronics Engg**' DEE 3001.

Subject	Existing	Proposed	Remark	Annexure
Subject Replaced	Basics of Electrical and Electronics Engineering DEE3001	Addition of new subject '**Electrical and Electronics Engineering Material**' DEE 3010 in the third semester in place of '**Basics of Electrical and Electronics Engg**' DEE 3001.	Replacement of Existing Subject with new Subject	Annexure C

Minutes of Meeting of 7TH Meeting of Board of Studies on Jul 01, 2023

Members Present:

- **Dr. Mohd. Sarfaraz Alam (Astt Professor)** Universitty Polytechnic,AMU Aligarh
- **Dr. Vikash Sharma (Principal Academic)** University Polytechnic
- Dr. Subhash Chandra (Associate Professor) IET, Electrical Engg Dept. GLA University Mathura
- Mr. Aashish Jaiswal (Astt Professor)
- Ms. Anju Upadhyay (Sr. Lecturer)
- Mr. Jitendra Kumar Singh (Lecturer)
- Mr. Manoj Sharma (Lecturer)
- Mr. Vishal UPPCL (Jr. Engg) GLA Alumni

The Chairman Board of Studies welcomes all the members and started proceedings of the 7th meeting of BOS in accordance with the Agenda note circulated earlier.

Agenda Item –7.1: To confirm the minutes of the 7th BOS Meeting: *The minutes of the meeting of 6th BOS held on 28th* ***may, 2022*** *were implemented and enclosed in Annexure A.*

Agenda Item –7.2: Action Taken Report (ATR)

The ATR based on the minutes of the 6th BOS will be presented.

Agenda Item	Description	Action Taken
1	Confirmation of the minutes of the 6th BoS Meeting	Suggestions incorporated. See Annexure A.

Agenda Item-7.3 Addition of new subject '**Introduction of Electrical Engineering** 'DEE 1001 in the First Year.

Subject	Existing	Proposed	Remark	Annexure
New Subject	-	Addition of Introduction of Electrical Engineering Subject in first Year only.	Experts gave their opinion to add this subject in First Year.	Annexure B

Agenda Item-7.4: Addition of new subject '**Electrical and Electronics Engineering Material**' DEE 3010 in the third semester in place of '**Basics of Electrical and Electronics Engg**' DEE 3001.

Subject	Existing	Proposed	Remark	Annexure
Subject Replaced	Basics of Electrical and Electronics Engineering, DEE3001	Addition of new subject '**Electrical and Electronics Engineering Material**' DEE 3010 in the third semester in place of '**Basics of Electrical and Electronics Engg**' DEE 3001.	Experts gave their opinion to add this subject in Second Year.	Annexure C

Dr. Vikash Sharma
Principal Academic
University Polytechnic

Copy to:
Chairman, Academic Council
Principal (Academic), University Polytechnic, Mathura
Principal (Admin), University Polytechnic, Mathura
Registrar
All the members of BoS

ANNEXURE - A

DEPARTMENT OF ELECTRICAL ENGINEERING

Minutes of Meeting of 6TH Meeting of Board of Studies on

MAY 28th, 2022

Members Present:

- **Dr. Apoorva Saxena (Lecturer)** Govt. Polytechnic, Mankeda Agra
- **Mr. Shakti Singh Soni (Lecturer)** MMIT Government Polytechnic, Aligarh.
- **Mr. Hitesh Upadhyay (Astt Manager), JBM** Group
- **Prof(Dr). Diwakar Bhardwaj (Dean Resource Gen. & Planning, Principal Admin),** University Polytechnic
- **Dr. Vikash Sharma (Principal Academic)** University Polytechnic
- Dr. Sanjay Kr. Maurya (Associate Professor) IET, Electrical Engg Dept. GLA University Mathura
- Mr. Hariom (Prog.Coordinator) Electrical Dept. University Polytechnic
- Ms. Anju Upadhyay (Lecturer)
- Mr. Aashish Jaiswal (Lecturer)
- Mr. Girijapati Sharma (Lecturer)
- Mr. Aman Srivastva (Lecturer)
- Mr. Shiv Kumar Mittal (Lecturer)
- Mr. Jitendra Kumar Singh (Lecturer)
- Mr. Kapil Kumar Sharma (Lecturer)
- Ms. Rohini Sharma (Lecturer)

The Chairman Board of Studies welcomed all the members and started proceedings of the 6th meeting of BOS in accordance with the Agenda note circulated earlier.

Agenda Item – 6.1: To confirm the minutes of the 5th BOS Meeting: *The minutes of the meeting of 5th BOS held on **4th may, 2020** were implemented and enclosed as **Annexure-C***

Agenda Item –6.2: Action Taken Report (ATR)

The ATR based on the minutes of the 5th BOS will be presented.

Agenda Item	Description	Action Taken
1	Confirmation of the minutes of the 5th BoS Meeting	Suggestions incorporated. See Annexure C
2	To Addition of new subject 'Non conventional energy Resources'DEE 3011 in the third semester in place of Signal System Subject DEE 3006.	Suggestions were incorporated and recommended Syllabi were implemented.
3	To recommend the modifications in the syllabus of Basic Electronics DEE 4006, Electrical Machine – I DEE 4101 in fourth Semester.	

4	To recommend the modifications in DEE 5088 Seminar and professional communication and reduced one credit with new code DEE 5188.	
5	To recommend the addition of new Lab Electrical Vehicle, DEE 5089 has to be introduced in the fifth Semester.	
6	To recommend the modifications in the syllabus of Electrical Machine –II DEE 5102 , Electrical Power System and protection DEE 5006 in fifth Semester .	
7	To recommend the modifications in the syllabus of Repairing Lab DEE6084 in Sixth Semester with new code DEE 6184.	

Agenda Item-6.3: Addition of New subject'Non conventional energy Resources'DEE 3011 in place of Signal System DEE 3006 in third is recommended by the expert due to the industrial need.

Agenda Item-6.4: To consider changes in existing syllabus of Basic Electronics DEE 4006, Electrical Machine –I DEE 4101 in the Fourth Semester:

Subjects	Change
Basic Electronics (DEE 4006)	Modified with the new code DEE 4106 with addition of topics like breakdown mechanism, brief knowladge of power supplies and Ics as per the industrial requriment
Electrical Machine –I (DEE 4101)	Modified with new code DEE 4201 with addition of V-V connection, scott connection ,3 phase to 2 phase conversion and parallel operation

Agenda Item-6.5: The credit of DEE 5088 Seminar and professional communication has been reduced from 2 to 1 as per the requriment. With New code DEE 5188 is recommend ed.

Agenda Item-6.6: As per the industrial requriment and to provide the practical knowladge to the student to face the changelleges in the field Electrical Vehicle, DEE 5089 lab is introduced in the fifth Semester is recommended.

Agenda Item-6.7: To consider changes in existing syllabus of Electrical Machine –II DEE 5102, Electrical Power System and protection DEE 5006 in the Fifth Semester:

Subjects	Change
Electrical Machine –II (DEE 5102)	Modified with addition of Single phase induction motor in the syllabus as per acadmic and industrial need, DEE 5102 has changed into DEE 5202 in fifth Semester is recommended.

Electrical Power System and protection (DEE 5006)	The modifications in the syllabus of Electrical Power System and protection DEE 5006 in fifth Semester with new code DEE 5106 is recommended.

Agenda Item-6.8: The modifications in the syllabus of Repairing Lab DEE 6084 in Sixth Semester with new code DEE 6184 is recommended by the expert for inhancing the industry based practicals and their application.

Prof. (Dr.) Diwakar Bhardwaj
Principal Admin
University Polytechnic

Dr. Vikash Sharma
Principal Academic
University Polytechnic

Copy to:
Chairman, Academic Council
Principal (Academic), University Polytechnic, Mathura
Principal (Admin), University Polytechnic, Mathura
Registrar
All the members of BoS

ANNEXURE - B

ANNEXURE - C

Course Curriculum

Batch - 2023-26

Three Year Diploma Course

In

Electrical Engineering

UNIVERSITY POLYTECHNIC

C O N T E N T S

44	DEE 4086	PLC & SCADA system Lab	
45	DEE4087	Project-I	
46	DEE4095	Soft skill-II	
47	DEE 5202	Electrical Machines – II	
48	DEE 5004	Power Plant Engineering	
49	DEE 5106	Electrical power system and protection	
50	DEE 5011	Control System	
51	DEE 5012	Electric Traction	
52	DEE 5013	Electric and Hybrid vehicles	
53	DEE 5281	Electrical Machines – II Lab	
54	DEE 5184	Electrical Power System Lab	
55	DEE 5085	Solar Energy Lab	
56	DEE5086	Control system lab	
57	DEE 5087	Project-II	
58	DEE 5188	Seminar And Professional Communication	
59	DEE 5089	Electric vechiles lab	
60	DEE 6101	Utilization of Electrical Energy	
61	DEE 6202	Power Electronics & Drives	
62	DEE 6103	Maintenance and Servicing of Electrical Machines	
63	DEE 6004	Microprocessors	
64	DEE 6181	Power Electronics & Drives Lab	
65	DEE 6383	Microprocessor Lab	
66	DEE 6184	Repairing and Maintenance of Electrical appliances Lab	
67	DEE 6087	Project-III	
68	DEE 6095	Soft skill-III	

GLA UNIVERSITY POLYTECHNIC

COURSE STRUCTURE, CONTACT HOURS and CREDITS

DISCIPLINE: ELECTRICAL ENGINEERING
SEMESTER:I SEM (FULL-TIME)

Sr. No.	Subject Code	Subject Name	Periods Per Week			Cr
			L	T	P/D	
1	**DEE 1001**	**Introduction of Electrical Engineering**	2	0	0	2

L- Lecture Period, **T**-Tutorial Period, **P**- Practical Period, **D**- Drawing Practice Period, **Cr.** Credits,

GLA UNIVERSITY POLYTECHNIC
COURSE STRUCTURE, CONTACT HOURS and CREDITS

DISCIPLINE: ELECTRICAL ENGINEERING
SEMESTER:III SEM (FULL-TIME)

Sr. No.	Subject Code	Subject Name	Periods Per Week			Cr
			L	T	P/D	
1	**DEE 3010**	**Electrical and Electronics Engineering materials**	3	0	0	3
2	DEE 3203	Circuit Theory	3	0	0	3
3	DEE3011	Non Conventional Energy Resources	**3**	**0**	**0**	**3**
4	DEE 3009	Basic Instrumentation And Measurement	3	0	0	3
5	DEE 3181	Electrical Engineering Design and Drawing – I Lab	0	0	2	1
6	DEE 3082	Electrical Measurements and Measuring Instruments Lab	0	0	2	1
7	DEE 3183	Electrical Workshop Practice Lab	0	0	6	3
8	DEE 3285	Electronics – I Lab	0	0	4	2
9	DEE 3087	Simulation Lab	0	0	4	2
10	DEE 3095	Soft Skill- I	0	0	2	1
TOTAL			**12**	**0**	**20**	**22**

L- Lecture Period, **T**-Tutorial Period, **P**- Practical Period, **D**- Drawing Practice Period, **Cr.** Credits,

GLA UNIVERSITY POLYTECHNIC

COURSE STRUCTURE, CONTACT HOURS and CREDITS

DISCIPLINE: ELECTRICAL ENGINEERING.
SEMESTER: IV SEM (FULL-TIME)

Sr. No.	Subject Code	Subject Name	Periods Per Week			Cr
			L	T	P/D	
1	DEE 4201	Electrical Machines-I	**3**	**0**	**0**	**3**
2	DEE 4104	Estimating and Costing in Electrical Engineering	3	0	0	3
3	DEE 4106	Basics Electronics	3	0	0	3
4		ELECTIVE-I	3	0	0	3
5	DEE 4181	Electrical Machines-I Lab	0	0	6	3
6	DEE 4182	Electrical Engineering Design and Drawing – II Lab	0	0	2	1
7	DEE 4083	Instrumentation Lab	0	0	2	1
8	DEE 4285	Electronics – II Lab	0	0	2	1
9	DEE 4086	PLC & SCADA System Lab	0	0	4	2
10	DEE-4087	Project-I	0	0	2	1
11	DEE 4095	Soft skill -II	0	0	2	1
TOTAL			**12**	**0**	**20**	**22**

L- Lecture Period, **T**-Tutorial Period, **P**- Practical Period, **D**- Drawing Practice Period, **Cr.** Credits,

ELECTIVE-I:
1. DEE 4011, PLC& SCADA SYSTEM
2. DEE 4012, AUTOMATION & ROBOTICS ENGINEERING
3. DEE 4013, POWER LINE CARRIER COMMUNICATION

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GLA UNIVERSITY POLYTECHNIC
COURSE STRUCTURE, CONTACT HOURS and CREDITS

DISCIPLINE: ELECTRICAL ENGINEERING
SEMESTER: V SEM (FULL-TIME)

Sr. No.	Subject Code	Subject Name	Periods Per Week			Cr
			L	T	P/D	
1	DEE 5202	Electrical Machines –II	**3**	**0**	**0**	**3**
2	DEE 5004	Power Plant Engineering	3	0	0	3
3	DEE 5106	Electrical Power System And Protection	3	0	0	3
4		**ELECTIVE-II**	3	0	0	3
5	DEE 5281	Electrical Machines – II Lab	0	0	4	2
6	DEE 5184	Electrical Power System Lab	0	0	4	2
7	DEE 5085	Solar Energy system Lab	0	0	2	1
8	DEE 5086	Control system lab	0	0	2	1
9	DEE 5087	Project-II	0	0	4	2
10	DEE 5188	Seminar and Professional Communication	0	0	**2**	**1**
11	DEE 5089	Electric Vehicles Lab	0	0	**2**	**1**
TOTAL			12	0	20	22

L- Lecture Period, T-Tutorial Period, P- Practical Period, D- Drawing Practice Period, Cr. - Credits,

ELECTIVE-II:
1.DEE 5101: ELECTRICAL AND ELECTRONICS ENGINEERING MATERIALS
2.DEE 5011: CONTROL SYSTEM
3.DEE 5012: ELECTRIC TRACTION
4.DEE 5013: ELECTRIC AND HYBRID VEHICLES

GLA UNIVERSITY POLYTECHNIC
COURSE STRUCTURE, CONTACT HOURS and CREDITS

DISCIPLINE: ELECTRICAL ENGINEERING.
SEMESTER: VI SEM (FULL-TIME)

Sr. No.	Subject Code	Subject Name	Periods Per Week			Cr
			L	T	P/D	
1	DEE 6101	Utilization of Electrical Energy	3	0	0	3
2	DEE 6202	Power Electronics & Drives	3	0	0	3
3	DEE 6103	Maintenance and Servicing of Electrical Machines	3	0	0	3
4	DEE 6004	Microprocessor	3	0	0	3
5	DEE 6181	Power Electronics & Drives Lab	0	0	4	2
7	DEE 6383	Microprocessor Lab	0	0	4	2
8	DEE 6184	Repairing & Maintenance Of Electrical Appliances Lab	0	0	4	2
9	DEE 6087	Project-III	0	0	6	3
10	DEE 6095	Soft skill -III	0	0	2	1
TOTAL			**12**	**0**	**20**	**22**

L- Lecture Period, T-Tutorial Period, P- Practical Period, D- Drawing Practice Period, Cr.- Credits,

DEE 1001: INTRODUCTION OF ELECTRICAL ENGINEERING

Introduction: Introduction of Electrical Energy is common to first year branches of Diploma Engineering. At the end of the course the student is expected to Know the fundamental of Electrical Engineering and Practical implementation of fundamental theory concepts.

Objective: To provide comprehensive idea about AC and D C circuit analysis, working principles and applications of basic machines in electrical engineering.

Credits: 2 **Semester I** **L-T-P: 2-0-0**

Module No.	Contents	Teaching Hours
Unit - 1	**AC Fundamentals** Basics Electrical Quantities, Concept of alternating quantities, Difference between AC & DC, Concepts of cycle, frequency, time period, amplitude, instantaneous value, average value, r.m.s. value, maximum value, form factor and peak factor and simple problems. **Electrical Power**: Electrical power, Types of power, Power factor, Types of Power Factor, Concept of power factor improvement. **Application of KCL & KVL** Mesh Analysis, Nodal Analysis, Super Position theorem, Star–Delta connections and their conversion. Numerical Problems **Electromagnetism:** Baiscs of Magnetic Quantaties Basic Concept of magnetic circuits, Analogy between electric and magnetic quantities Analogy between electric and magnetic circuit, B-H Curve, Hysteresis and Eddy current losses. Numerical Problems	12
Unit - 2	**Single phase transformer**: Construction, Principle, Types of Transformer, Application Introduction of Auto-Transformer, Simple Numerical **Three Phase Transformer:** Introdcution of Three Phase Transformer **Three phase ac circuit**: Generation and advantages of 3-phase system, star-delta connections, Line and phase voltage/current relationship **Ac Motors**: Basic Principle of single phase and three Induction Motor, and Synchronous Motor its applications **Dc Machine**: Construction of DC Motor, Principle Of DC Generator And Motor, Types of DC Motor Applications **Introduction to Batteries** Basic idea of primary and secondary cells, Construction, Working principle & applications of Lead-Acid battery, Nickel-Cadmium and Silver-Oxide batteries, Charging methods used for lead-acid battery, Care and maintenance of lead-acid battery. Series and parallel connections of batteries General idea of solar cells, Working Principle of Solar cell Introduction to maintenance free batteries.	12

Text Books:

1. Electrical Machines by SK Bhattacharya; Tata McGraw Hill, New Delhi
2. Basic Electrical by VK Mehta; S Chand and Co., New Delhi

Reference Books:

3. Basic Electrical Engineering by Mittal & Mittle
4. A Text Book of Electrical Technology, Vol. I and II by BL Thareja; S Chand and Co., New Delhi
5.

Intended Outcomes: A student who successfully completes the course will have the ability to:

- Students will gain knowledge regarding the various laws and principles associated with electrical systems
- Students will gain knowledge regarding electrical machines and apply them for practical problems.
- Students will gain knowledge regarding various types' semiconductors.
- Students will acquire knowledge in using the concepts in the field of electrical engg. Projects and research.
- Student will gain knowledge on electronic systems.

DEE 3010: ELECTRICAL AND ELECTRONICS ENGINEERING MATERIAL

Introduction: This course is part of an interdisciplinary sequence designed to cover the fundamental concepts of material science. Basic concepts behind the chemistry of organic and inorganic compounds, chemical bonding and structure, electron delocalization, properties of common functional groups and ligands, and structure-property relationships will be covered in this overview course

Objective:

- Conceptually explain the classification schemes that are used to categorize engineering materials.
- Explain the differences in the mechanical behavior of engineering materials based upon bond type, structure, composition, and processing.
- Describe the basic structures and repeat units for common thermoplastics and relate the distribution of molecular weights, degree of polymerization, percent crystallinity, and glass transition temperature to properties in service.
- Describe how and why defects (point, line and interfacial) in materials greatly affect engineering properties and limit their use in service
- Calculate engineering stress, strain and the elastic modulus from data and for basic engineering applications.

Credits: 3 **Semester III** **L-T-P: 3-0-0**

Module No.	Contents	Teaching Hours
Unit – I	**Introduction:** Classification of material into conducting, semi conducting and insulating materials on the basis of their atomic structures and energy bands. **Conducting Materials:** Introduction, Resistance and factors affecting the resistance, Classification of conducting materials such as low resistivity and high resistivity materials & application in the field of electrical engineering, Superconductors and their applications. **Semi-conducting Materials:** Introduction, Semi-conductors and their properties, Different semi-conducting materials (silicon and germanium) used in manufacture of various semiconductor devices (i.e p-type and n-type semiconductors), Materials used for electronic components like resistors, capacitors, diodes, transistors and inductors etc. **Insulating materials**; General Properties: Electrical Properties, Physical Properties, Thermal Properties. Thermal conductivity, Electro-thermal breakdown in solid dielectrics & Chemical Properties.	18

Unit – II	**Insulating Materials and their applications:** Plastics: Definition and classification, Thermosetting materials, thermo-plastic materials & their important properties and applications, Natural insulating materials, properties and their applications, Gaseous materials; Air, Hydrogen, Nitrogen, SF6 their properties and applications. **Magnetic Materials:** Introduction - ferromagnetic materials, Curie temperature, magnetostriction effect. **Soft Magnetic Materials:** Alloyed steels with silicon, high silicon, alloy steel for transformers, low silicon alloy steel for electric rotating machines, Cold rolled grain oriented steels for transformer, Non-oriented steels for rotating machine, Nickel-iron alloys, Soft Ferrites, Hard magnetic materials Tungsten steel, chrome steel, hard ferrites and cobalt steel, their applications, Thermocouple, bimetals, lead soldering and fuse material, **Magnetic Properties of Material:** Origin of permanent magnetic dipoles in matters, Classification Diamagnetism, Paramagnetism, Ferromagnetism, Antiferromagnetism and Ferrimagnetism, magnetostriction, properties of magnetic materials, soft and hard magnetic materials, permanent magnetic materials.	18

Text Books:

1.A.J. Dekker," Electrical Engineering Materials" Prentice Hall of India
2.R.K. Rajput," Electrical Engg. Materials," Laxmi Publications
3.C.S. Indulkar & S. Triruvagdan "An Introduction to Electrical Engg. Materials, S. Chand & Co.

References:

1.Solymar, "Electrical Properties of Materials" Oxford University Press.
2.Ian P. Hones," Material Science for Electrical and Electronic Engineering," Oxford University Press.
3.G.P. Chhalotra & B.K. Bhat," Electrical Engineering Materials" Khanna Publishers.

Intended Outcomes:

- Students will be able to describe the basic structure of materials at the molecular, microscopic, and macroscopic scales, and will be able to describe modern methods of characterizing materials at each of these length scales.
- Students will understand diffusion and electrochemical processes in materials.

DEE 3203: CIRCUIT THEORY

Introduction: The course has been designed to introduce fundamental principles of circuit theory commonly used in engineering research and science applications. Techniques and principles of electrical circuit analysis including basic concepts such as voltage, current, resistance, impedance, Ohm's and Kirchoff's law; basic electric circuit analysis

Objective: To develop an understanding of the fundamental laws and elements of electric circuits. To learn the energy properties of electric elements and the techniques to measure voltage and current. To understand waveforms, signals, and transient, and steady-state responses of RLC circuits. To develop the ability to apply circuit analysis to DC and AC circuits. To understand advanced mathematical methods such as Laplace and Fourier transforms along with linear algebra and differential equations techniques for solving circuits problems.

Credits: 3 **Semester III** **L-T-P: 3-0-0**

Module No.	Contents	Teaching Hours
Unit - 1	Active and passive, Linear and non-linear, Unilateral and bilateral, Lumped and distributed circuit, Time varying and time invariant parameter, Voltage and current sources (ideal and practical), Dependent and Independent sources, Source Transformation, KVL & KCL (Based Numerical), Mesh analysis and Nodal analysis, Current & Voltage division rule, Concept of charging and discharging of L & C. Conversion of star to delta & delta to star. **Network theorems:** Superposition Theorem, Thevenin's Theorem, Norton's Theorem, and their application to 2 terminals A.C & D.C Networks. Maximum power transfer theorem for D.C. Circuit. (based Numerical)	18
Unit - 2	**Two port network:** Various two port circuit parameter: Evaluation of Z, Y, h and transmission (ABCD) parameters, **A.C. Circuit**: Basic terminologies, RMS value, Average value, peak factor, form factor, concept of phase and phase difference of alternating voltage and current, Ac through pure resistance Inductance, capacitance, Phasor diagram, power absorbed calculation, Series circuit (RC, RL, RLC), Simple numericals. **Resonance**: Series and Parallel Resonance, Resonance curve, Quality factor for series and parallel ac circuits.	18

Reference Books Text Books

1. A.K. Chakrabarti, ''Circuit Theory'', Dhanpat Rai Publications
2. D Roy & Choudhary, ''Network & System''

Reference Books

1. K Alexander Matthew N O Sadiku, 'Fundamentals of Electric Circuits Charles'Mc Graw Hill
2. Mahmood Nahvi, 'Electric Circuits' Mc Graw Hill

Intended Outcomes: A student who successfully completes the course will have the ability to

- To be able to understand basic electrical properties.
- To be able to analyze electrical circuits.

- To be able to find circuit response using Laplace transform.
- To understand signal superposition and Fourier transform.

DEE 3011 NON CONVENTIONAL ENERGY RESOURCES

Introduction: Energy is the primary and most universal measure of all kinds work by human beings and nature. Everything what happens the world is the expression of flow of energy in one of its forms. Energy is the major input to drive the life cycle and improve it. Energy consumption is closely related to the progress of the mankind. In future, improvement in the living standard of the mankind, industrialization of the developing countries and the global demand for energy will increase with the every growing population. The development of infrastructure plays a significant role to sustain economic growth. The power sector is one of the major significant constituents of infrastructure. In general, India is dependent on conventional sources of energy like thermal, hydro and nuclear.

Objective:The sources of energy which are exhaustible and being produced continuously in nature are called nonconventional energy or renewable sources of energy. Some of these sources include solar energy, wind energy and tidal energy. The conventional energy sources are basically based on fossil fuels which have finite reserves in nature and hence would extinct in future. Since the development and progress of mankind are closely related to energy sources, many countries throughout the world have engaged themselves in searching and developing non-conventional energy sources that would be very essential to sustain the life cycle of human being.

Credits: 3 **Semester III** **L-T-P: 3-0-0**

Module No.	Contents	Teaching Hours
Unit-I	**Introduction:** Various energy sources, importance of non conventional sources of energy, present scenario, future prospects and economic criteria **Solar Energy:** Principle of conversion of solar radiation into heat, photo voltaic cell, electricity generation, application of solar energy like solar water heaters, solar furnaces, solar cookers, solar lighting, solar pumping. **Solar Photovoltaic**: Solar Cell and its function, Solar Technologies, Solar Cell Parameters, Efficiency of Solar Cell, Solar PV Module, Rating of Solar PV Module, PV Module Parameters, Efficiency of PV Module, Measuring Module Parameters. **Bio-energy:** Bio-mass conversion technologies- wet and dry processes. Methods for obtaining energy from biomass. Power generation by using gasifiers	18

Unit -II	**Wind Energy:** Wind energy conversion, windmills, electricity generation from wind- types of wind mills, local control, energy storage **Geo-thermal and Tidal Energy:** Geo-thermal sources, Ocean thermal electric conversion, open and closed cycles, hybrid cycles. Prime movers for geo thermal energy conversion. Steam Generation and electricity generation **Magneto Hydro Dynamic (MHD) Power Generation:** **Chemical Energy Sources:** Design and operating principles of a fuel cell& its different type, conversion efficiency, work output and e.m.f of fuel cells, applications. **Energy Conservation and Management** a) Need for energy conservation with brief description of oil and coal crisis. b) Environmental aspects c)Energy efficiency- its significance d)Energy efficient technology an overview e) Energy conservation in Domestic sector- Lighting, home appliances f) Need for energy efficient devices	18

Text Books:

1. Non- Conventional Energy Resources Paperback – 15 December 2021by D.S. Chauhan

Reference Books:

1. Non Conventional Energy Resources (English, Paperback, Khan B)
2. Non-conventional Energy Sources (English, Paperback, Rai G.D.)

Intended Outcomes:

After completion of course, student will be able to:

- Nonconventional energy also called the renewable source of energy is an indigenous source that is available and has a significant impact on local and regional economic industries.
- There is also a huge scope of research in the nonconventional energy source sectors regarding its future and its utilization in science and other applications.
- The power plants that are based on nonconventional energy do not have much high fuel cost and are hence much more affordable for people and industries.
- Renewable energy has low energy density and is also helpful in reducing pollution and providing a sustainable environment to live in.
- It requires a short gestation period and a low amount to be invested.

DEE 3009: BASIC INSRRUMENTATIONAND MEASUREMENTS

Introduction: This course is aimed at students, professional electrical & electronics engineers, service technicians, energy auditors, operational & maintenance personnel, facility engineers and general audience.

Objective:To introduce students to monitor, analyze and control any physical system. To understand students how different types of meters' work and their construction. To provide a student a knowledge to design and create novel products and solutions for real life problems. To introduce students a knowledge to use modern tools necessary for electrical projects.

Credits: 3 **Semester III** **L-T-P: 3-0-0**

Module No.	Contents	Teaching Hours
Unit – I	**Electrical Measuring Instruments:** Introduction, Classification of instruments, operating forces, moving coil & Moving Iron instruments, Extension of range of Voltmeter and Ammeters. Calibration of voltmeter and ammeter. **Measurement of Power and Energy:** Methods of measuring single phase and 3 phase power, Dynamometer type wattmeter. Single phase energy meter, power factor meter, **Measurement of Resistance:** Measurement of low, medium and high resistances, Megger. **Introduction of AC Bridges:** Balancing of Bridge, Types of AC Bridge	18
Unit – II	Miscellaneous measuring instruments **Cathode ray oscilloscope**: Block diagram of CRO, Lissajus Pattern **Transducers:** Transducer, static characteristics, Transducer-classification **Recorders&DisplayDevices:** Recording system, Types of Recorder Light Emitting Diode, Liquid crystal displays. **Displacement & Pressure Measurement:** LVDT, Hall Effect & Piezoelectric Transducer, Ultrasonic Sensor Strain Gauge, Load Cell **Temperature & Humidity Measurements:** Thermocouple Instrument, Resistance Thermometer, Thermistors, Radiation & Optical Pyrometer, Hydrometer	18

Text books:

1. A course in Electrical Measurement & Measuring instruments by A.K. Sawhney; Dhanpat Rai & Sons Publications, New Delhi.

2. Electrical Measurement & Measuring Instruments by J B Gupta, S K Kataria & Sons, New Delhi
3. Electronic Measurement and Instrumentation by Dr Rajendra Prasad
4. Electrical and Electronics Measurement and Instrumentation by AK Sawhney, Dhanpat Rai and Co., New

Reference Books

1. Electrical Measurements & Measuring instruments by Golding and widdis: Wheeler publishing House, New Delhi
2. Electric Instruments by D. Cooper
3. . Electronic Instrumentation and Measurement Techniques by WD Cooper, AD Helfrick Prentice Hall of India Pvt. Ltd. New Delhi
4. Industrial Instrumentation by Umesh Rathore, SK Kataria and Sons, New Delhi

Intended Outcomes: A student who successfully completes the course will have the ability to:

- To use the techniques and skills for electrical projects.
- Design a system, component or process to meet desired needs in electrical engineering.
- Measurement of R, L, C, Voltage, Current, Power factor, Power, Energy
- Ability to balance Bridges to find unknown values.
- Ability to measure frequency, phase with Oscilloscop
- Ability to use Digital voltmeters

DEE 3181: ELECTRICAL ENGINEERING DESIGN AND DRAWING I – LAB

Introduction: It is graphical representation of physical objects and their relationship.the ability to read drawing is the most important requirement of all technical people inengineering profession

Objective: To get primary concept of Engineering Drawing.To know about equipments in Engineering Drawing.To know various signs, lines and dimensions. To know about sectional view

Credits: 1 **Semester III** **L-T-P: 0-0-2**

LIST OF PRACTICALS

S.No.	Contents	Teaching Hours
I	Symbols and Signs Conventions ,Various Electrical and Electronic Symbols, Electrical Signs Conventions as per BIS Standards.	4
II	Brief description, general specifications and approximate cost of switches, push buttons,	4
III	Simple light and Fan Circuits (min 2 Sheets) 1. Lights, Fan power points controlled by individual switches. 2. One lamp controlled by two switches (staircase circuit) 3. Two lamps controlled by three switches (double staircase circuit)	4
IV	Simple Alarm circuits with and without Relays: 1.One bell controlled by one push button 2. Two ordinary bells (for day and night) used at a distant/ residence 3.Traffic light control system for two-road crossing	4
V	Design and drawing of panels/ distribution board using MCBs, main switch and changeover switch for 1. domestic loads 2.industrial loads	4
VI	Orthographic Projection of Simple Electrical parts (min 5 Sheets) 1. Kit -Kat fuse 2. Pin type and shackle type insulator Design and drawing of panels/ distribution board using MCBs, main switch and changeover for domestic installation.	4

Intended Outcomes: After completion of course, student will be able to:

- Identify and use differing drawing tools/instruments.
- Use the concept of projection for Chemical Engineering Drawings.

DEE 3082: ELECTRICAL MEASUREMENTS AND MEASURING INSTRUMENTS LAB

Introduction:Electrical measurements are the methods, devices and calculations used to measure electrical quantities. Measurement of electrical quantities may be done to measure electrical parameters of a system.

Objective*:* To acquaint with the fundamental concepts of electrical measurements and instrumentation. To understand concepts of different types of transducers. To provide practical, hands-on experience about ho measure displacement, strain, inductance, capacitance using trainer kit

Credits: 1 **Semester III** **L-T-P: 0-0-2**

LIST OF PRACTICALS

Module No.	Contents	Teaching Hours
1.	Use of analog and digital multimeter for measurement of voltage, current (AC/DC) and resistance	24
2.	To calibrate Single phase energy meter by direct loading method.	
3.	To measure the value of earth resistance using earth tester.	
4.	To measure power, power factor in a single-phase circuit, using wattmeter and power factor meter and to verify results with calculations.	
5.	Measurement of power and power factor of a three-phase balanced load by two wattmeter method.	
6.	Measurement of voltage and frequency of a sinusoidal signal using CRO and draw wave shape of signal.	
7.	Measurement of power in a 3 phase circuit using CT, PT and 3-phase wattmeter.	
8.	Use of LCR meter for measuring inductance, capacitance and resistance.	
9.	To record all electrical quantities from the meters installed in the institution premises.	
10.	To measure Energy at different Loads using Single Phase Digital Energy meter.	
11.	To find the parameters by Maxwell Inductance Bridge.	
12.	To find the parameters by Maxwell Capacitance Bridge.	
13.	To find the parameters by Hay's Bridge.	
14.	To find the parameters by Owen's Bridge.	
15.	To find the parameters by Schering Bridge.	

Intended Outcomes: After completion of course, student will be able to:

- At the closing stage of the course, the students will be able to know the fundaments of electrical measurements.They will be able to understand concepts of different types of transducers.

DEE 3183: ELECTRICAL WORKSHOP PRACTICE LAB

Introduction: Use of tools used by electricians, **wiring** regulations, **types of** cables and electric accessories including switches, plugs, circuit breakers, fuses etc., symbols for **electrical wiring** schematics e.g. switches, lamps, sockets etc., drawing and **practice** in simple house wring and testing methods, **wiring** schemes of two-way

Objective: To understand how different objects can be made from the given raw material by using different mechanical tools. To introduce students to the basic concepts of manufacturing via shaping, forming, machining. To develop a knowledge of appropriate parameters to be used for various machining operations. To develop a knowledge of workshop practice and basic use of machine tools and workshop equipment.

Credits: 3 **Semester III** **L-T-P: 0-0-6**

LIST OF PRACTICALS

Module No.	Contents	Teaching Hours
1.	Identification of tool and equipment, Study of electrical safety measures as mentioned in the Electricity Rules and shock treatment including first aid.	48
2.	Wire jointing	
2.1	Straight married joint	
2.2	Technology-joint	
2.3	Western union joint	
2.4	Britannia joint	
2.5	Twist sleeve joint	
2.6	Bolted type joint	
3.	Filling and crimping of thimbles (using hydraulic and hand crimping tool)	
4.	Wiring of main distribution board with four outgoing circuits for light and power loads including main switch and fuses (only internal connection)	
5.	Construction of an extension board with two 5A sockets, one 15A socket controlled by theirrespective switches, a fuse and indicator	
6.	Wiring of a switch board containing at least two switches, one fan regulator and one 5/15A socket controlled by their respective switches using piano type switches and matchingsocket	
7.	Wiring of a series test lamp board and to use it for finding out simple faults	
8.	Fault finding and repair of a tube light circuit	
9.	Wiring and testing of alarm and indicating circuits using relay, push buttons and bells (simple single phase circuits)	
10.	Assembly of distribution board/ panel using MCB, main switch, changeover switch andELCB etc.	
11.	Testing of domestic wiring installation using meggar	
12.	Power cable jointing using epoxy based Jointing-I and Demonstration of laying of underground cables at worksite	

13.	Soldering and de-soldering practice (soldering and de-soldering of electronic components on PCB) in Electronic Lab-I	
14.	Use of data book to know the parameters of a given transistor	
15.	Battery charger - Repair and maintenance	
16.	Power supplies: Working Principles of different types of power supplies viz. CVTs, UPS, Stabilizers, SMPS,IC voltage regulator (78 XX,79XX)	

Intended Outcomes: After completion of course, student will be able to:

- Acquire skills in basic engineering practice.
- Identify the hand tools and instruments.
- Gain measuring skills.
- Obtain practical skills in the trades.

DEE 3285: ELECTRONICS-I LAB

Introduction: Electronics labis designed to be a full year introductory course for students who wish to further understand how their world is shaped by electricity and the **electronic** devices that surround them. The course blends **electronic** concepts and theory with practical hands on activities.

Objective: To acquaint with the fundamental concepts of Digital Electronics and Digital Instruments.To make them understand concepts of different types of analog and digital circuits.

Credits: 2 **Semester III** **L-T-P: 0-0-4**

LIST OF PRACTICALS

S. No.	Contents	Teaching Hours
1.	Verification of truth table for AND, OR, NOT, NAND, EX-OR, NOR gate.	48
2.	Verify De Morgan's Theorem	
3.	To realize different Boolean expressions with logic gates.	
4.	Verification of NAND and NOR gate as universal gates.	
5.	To study 1's complement, 2's complement method.	
6.	Study of CRO and function & observe the sine wave, square wave, triangular waves & ramp waveform on the CRO and to measure the amplitude & frequency of the waveform.	
7.	Identification and testing of electronic components such as resistor, inductor, capacitor, diode, transistor and different types of switches used in Electronic circuits.	
8.	Measurement of resistances using multimeter and their comparison with color code values.	
9.	Plotting input and output characteristics of a transistor in CB configuration.	
10.	Plotting input and output characteristics of a transistor in CE configuration.	
11.	To Study transistor as a switch. To draw the DC load line for	
12.	given circuit. Measurement of operating point in case of (i)fixed biased circuit (ii)Potential divider biasing circuit and to observe the effect of temperature variation on the operating point.	
13.	To measure the voltage, gain and band width by plotting frequency response curve of a single stage amplifier using CE configuration at different loads.	
14.	To study the effect of coupling capacitor on lower cut off frequency and upper cut off frequency by plotting frequency response curve of a two stage RC coupled amplifier	
15.	To plot V-I characteristics of a FET	

Product based projects:

1. Implementation of logic gates using discrete components (AND, OR, NAND, NOR, INVERTER)
2. Regulated 5volt supply.
3. Touchy switch using BC 547.
4. Activated LED using Photo resistor.
5. Single stage audio amplifier using Transistor.

Intended Outcomes*:* After completion of course, student will be able to:

- Able to understand basic concepts of digital electronics, sequential and combinational circuits.
- Able to implement the concepts of digital electronics in electronic measuring instruments.

DEE 3087: SIMULATION LAB

Introduction:A simulation is an approximate limitation of the operation of a process or system. the act of simulating first requires a model to be developed. This model is a well-defined description of the simulated subject, and represents its key characteristics, such as its behaviour, functions and abstract or physical properties. The model represents the system itself, whereas the simulation represents its operation over time.

Objective: To impart the fundamental knowledge on using various analytical tools like ANSYS, FLUENT, etc., for Engineering Simulation. To know various fields of engineering where these tools can be effectively used to improve the output of a product. To impart knowledge on how these tools are ued in Industries by solving some real time problems using these tools.

Credits: 2 **Semester: III** **L-T-P: 0-0-4**

S.No.	Contents	Teaching Hours
	LIST OF EXPERIMENTS WITH MATLAB:	48
1.	Basic Operations on Matrices.	
2.	To Study of different window, sub-window and work in Environment of MATLAB.	
3.	Single Phase Half controlled converter using R and RL load using MATLAB/SIMULINK.	
4.	Single Phase fully controlled converter using R and RL load using MATLAB/SIMULINK.	
5.	Write a program to multiply two vector quantity of electrical circuit.	
6.	Verification of Network Theorems. i) Superposition Theorem. ii) Thevenin's Theorem iii) Maximum Power Transfer Theorem.	
7.	Write a program to plot the three sine waves in a single figure window.	
8.	Write a program to develop user defined three phase voltage source.	
9.	Modeling and simulation of Sine wave, Step, and Pulse Generator signals by combining them into bus by using Bus Creator Block.	
10.	Design the model to perform basic arithmetic operation addition, subtraction using MATLAB.	
11.	Design the model to perform MUX and D-MUX of three sine wave sources.	
	LIST OF EXPERIMENTS WITH PSPICE:	
1.	Verification of Half–Wave and Full-Wave Rectifier	

2.	Frequency Response of CE Amplifier	
3.	Frequency Response of CS Amplifier	
4.	Frequency Response of CC Amplifier	
5.	Design of Wein-Bridge Oscillator	
6.	Verification of Clippers & Clampers	
7.	Design and Verification of Voltage Regulator	

Intended Outcomes: After completion of course, student will be able to:

- The student will be able to appreciate the utility of the tools like ANSYS or FLUENT in solving real time problems and day to day problems.
- Use of these tools for any engineering and real time applications.
- Acquire knowledge on utilizing these tools for a better project in their curriculum as well as they will be prepared to handle industry problems with confidence when it matters to use these tools in their employment.

DEE 4201: ELECTRICAL MACHINES – I

Introduction: In electrical engineering, electric machine is a general term for machines using electromagnetic forces, such as electric motors, electric generators, and others. They are electromechanical energy converters: an electric motor converts electricity to mechanical power while an electric generator converts mechanical power to electricity. The moving parts in a machine can be rotating (rotating machines) or linear (linear machines). Besides motors and generators, a third category often included is transformers,

Objective: To prepare the students to have a basic knowledge of transformers. To prepare the students to have a basic knowledge of induction motors. To prepare the students to have a basic knowledge of alternators.

Credits: 3 **Semester IV** **L-T-P: 3-0-0**

Module No.	Contents	Teaching Hours
Unit – I	**Transformers (single phase)** Introduction, Construction features of a transformer & parts of transformer, Working principle, EMF equation of transformer, Phasor diagram and equivalent circuit of a transformer, Open circuit test & short circuit test, Voltage regulation of a transformer, Losses & Efficiency- Condition for maximum efficiency and All day efficiency. Autotransformer-Construction, saving of copper, Working and application, Testing of transformer- Routine Test, Sumpner's Test, Rating plate in Transformers, **Three phase transformer**- Construction, Types of 3-phase transformer i.e. delta-delta, delta-star, star-delta, star-star., V-V connection, scott Conection, 3-phase to 2-phase conversion, , Parallel operation, Application of 3-phase transformer, Power and Distribution transformer.	18
Unit – II	**Introduction to Electrical Machines** Definition of motor and generator, Concept of torque, Basic Electromagnetic laws, EMF induced in coil Rotating in Magnetic field, Common features of Rotating electrical machine. **DC Machines** Constructional features, Function of the Commutator for motoring and generation action, Types of armature winding, Principle of Generating and Motoring action and relationship between terminal voltage and induced EMF,Armature reaction, commutation, Types of DC machine on the basis of excitation, Torque equation, Voltage Bildup Process, Factors determining the speed of a DC motor, Speed control of DC motor, Performance and characteristics of different types of dc machine, Starting of DC machine, Need of starter, Types of starter- Three point starter and Four point starter, Determination of losses & efficiency, Swinburne test, Hopkinson test, Maintenance of dc machine, Application of DC machine.	18

Text Books:

1. Electrical Machines by SK Bhattacharya, Tata Mc Graw Hill
2. Electrical Machinery by P.S. Bhimbra
3. Electrical Machines by Ashfaq Hussain

Reference Books:

1. Electrical Machines by Nagrath and Kothari, Tata Mc Graw Hill
2. Electrical Machines by Smarajit Ghosh-Pearson Publishers, Delhi.

Intended Outcomes: After completion of course, student will be able to:

- Acquire knowledge about the fundamental principles and classification of electromagnetic machines.
- Acquire knowledge about the constructional details and principle of operation of dc machines.
- Acquire knowledge about the working of dc machines as generators and motors.
- Acquire knowledge about testing and applications of dc machines.

DEE 4104: ESTIMATING AND COSTING IN ELECTRICAL ENGINEERING

Introduction:The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competencies: Plan, use and control resources optimally and economically. Estimate production/operation cost for budgeting and analysis

Objective: This course is designed to develop the ability in the students to evaluate materials, consumables and process costs in the monetary units. Hence, it will help to increase the productivity of the organization and conservation of valuable resources. This course will also help in developing the skills required in the process of decision making and to plan, use, monitor and control resources optimally and economically. This will also be helpful in budgeting.

Credits: 3 **Semester IV** **L-T-P: 3-0-0**

Module No.	Contents	Teaching Hours
Unit – I	**Introduction** Purpose of estimating and costing, Performa for making estimates, preparation of materials schedule, costing, price list, preparation of tender document (with 2-3 exercises), net price list, market survey, overhead charges, labor charges, electrical point method and fixed percentage method, contingency, profit, purchase system, enquiries, comparative statements, orders for supply, payment of bills. Tenders – its constituents, finalization, specimen tender. **Types of wiring** Cleat, batten, casing capping and conduit wiring, comparison of different wiring systems, selection and design of wiring schemes for particular situation (domestic and Industrial). Selection of wires and cables, wiring accessories and use of protective devices i.e. MCB, ELCB etc. Use of wire-gauge and tables (to be prepared/arranged)	18
Unit – II	**Estimating of Domestic Internal Wiring Circuits** Service line connections estimate for domestic up to 10 KW and Industrial loads up to 20 KW (over-head and underground connections) from pole to energy meter. **Estimating the material required for** Transmission and distribution lines (overhead and underground) planning and designing of lines with different fixtures, earthling etc. based on unit cost calculations **Substation:** Types of substations, substation schemes and components, estimate of 11/0.4 KV pole mounted substation up to 200 KVA rating, methods of earthing of substations, Key Diagram of 66 KV/11KV and 11 KV/0.4 KV Substation. Single line diagram, layout sketching of outdoor, indoor 11kV sub-station or 33kV substation	18

Text Books:

1.Electrical Installation, Estimating and Costing by JB Gupta, SK Kataria and Sons, New Delhi

2. Estimating and Costing by SK Bhattacharya, Tata McGraw Hill, New Delhi

Reference Books:

1. Estimating and Costing by Surjeet Singh, Dhanpat Rai & Co., New Delhi
2. Estimating and Costing by Qurashi
3. Estimating and Costing by SL Uppal, Khanna Publishers, New Delhi
4. Electrical Estimating and Costing by N Alagappan and B Ekambaram, TMH, New Delhi

Intended Outcomes:

- The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning objectives in cognitive, psychomotor and affective domain to demonstrate following course outcomes.
- Calculate material cost of given component/product.
- Identify and estimate elements of cost in various processes.
- . Perform break even analysis to calculate break even quantity.
- Investigate the problem of cost and suggest their solution using cost reduction techniques.
- . Interpret given model of balance sheet and profit loss account
- . Prepare simple engineering contracts.

DEE 4106: BASICS ELECTRONICS

Introduction:Electronics I is designed to be a full year introductory course for students who wish to further understand how their world is shaped by electricity and the electronicdevices that surround them. The course blends electronic concepts and theory with practical hands on activities.

Objective: To understand operation of semiconductor devices. To understand DC analysis and AC models of semiconductor devices. To apply concepts for the design of Regulators and Amplifiers to verify the theoretical concepts through laboratory and simulation experiments. To implement mini projects based on concept of electronics circuit concepts

Credits: 3 **Semester IV** **L-T-P: 3-0-0**

Module No.		Teaching Hours
Unit – I	**Semiconductor Diodes:** PN Junction, Terminology related to PN Junction, Forward & Reverse Characteristics, Breakdown mechanism, Rectifier & types of rectifier **Bi-polar Transistors:** Transistor - NPN and PNP Transistor, Transistor configurations (CB, CE, CC) and input - output characteristics. α, β, and γ factors, Comparison of CB, CE, and CC configurations. **Field Effect Transistor (FET):** Construction, operation and characteristics of FET and its application. Construction, operation and characteristics of MOSFET. **Power supplies :** Working Principle of power supplies using Regulating IC.	18
Unit – II	**ICs:** IC741(as Adder, Subtractor, Integrator, Diffrentiator), 555timer (Block Diagram, Pin Discription) **Feedback:(** Positive and Negative feedback, Effect of feedback on amplifier Gain) **Power Amplifier** Difference between voltage and power amplifier. Basic classification of power amplifier class A, B and C, Principle of the working of Push-pull amplifier. **Oscillators:** Defination, Difference between an oscillator and an amplifier, Types of Oscillator (RC, LC and crystal). **Number system and Boolean algebra**: Binary, Octal, Decimal, Hexadecimal number system, 1's and 2's complement, Binary arithmetic, Logic gates - AND, OR, NOT, NAND, NOR, EXOR, EX-NOR. Universal gates- NAND &; NOR gates, Basic law of Boolean algebra, De Morgan's theorems.	18

Text Books:

1.A text book of Basic Electronics and Linear Circuits by NN Bhargava and others, TMH, New Delhi
2. Electronics Principles by SK Sahdev, Dhanpat Rai and Co., New Delhi

3.Basic Electronics and Linear Circuit by NN Bhargava, Kulshreshta and SC Gupta, Tata McGraw Hill Education Pvt Ltd, New Delhi.
4.Electronic Principles by SK Sahdev, Dhanpat Rai & Co., New Delhi

Reference Books:

1. Electronics Principles by Albert Paul Malina, Tata McGraw Hill, New Delhi
2. Operational Amplifiers and Linear Circuits by Rama Kant and A. Gaykwad, Prentice Hall of India, New Delhi
3. Electronic Devices Circuits by Rama Reddy, Narosa Publishing House Pvt. Ltd., New Delhi
4. Electronic Devices and Circuits by Millman and Halkias, McGraw Hill, New Delhi
5. Electronic Devices and Circuits-I, Eagle Prakashan, Jalandhar

Intended Outcomes: A student who successfully completes the course will have the ability to:

- Understand electronic systems with a continuously variable signal
- Understand proportional relationship between a signal and a voltage or current that represents the signal.
- To learn function of basic component's use in linear circuits.
- Understand component symbol, working principle, classification and specification.
- To learn different theorems for simplification of basic linear electronics circuits.

DEE 4011 PLC & SCADA SYSTEM

Introduction:A PLC, Technical Definition of PLC, what are its advantages, characteristics functions of A PLC, Chronological Evolution of PLC, Types of PLC, Unitary PLC, Modular PLC, Small PLC, Medium PLC, Large PLC, Block Diagram of PLC: Input/output (I/O) section, Processor Section, Power supply, Memory central Processing Unit: Processor Software / Executive Software, Multi asking, Languages, Ladder Language.

Objective: Students will be able to

- Gain the Knowledge of various skills necessary for Industrial applications of Programmable logic controller(PLC)
- Understand the basic programming concepts and various logical Instructions used in Programmable logic controller (PLC)
- Solve the problems related to I/O module, Data Acquisition System and Communication Networks using Standard Devices.
- Design and analysis of general structure of an automated process for real time applications using Programmable logic controller (PLC) and SCADA

Credits: 3 **Semester IV** **L-T-P: 3-0-0**

Module No.	Contents	Teaching Hours
Unit – I	**Programmable Logic Controller (PLC) Basics**: Introduction, Parts of PLC, Principles of operation, PLC size and applications, PLC Advantages and Disadvantages, PLC Manufacturers, PLC hardware components, I/O section, Analog I/O modules, Digital I/O modules, CPU- Processor memory module, Programming devices, Devices which can be connected to I/O modules, Relay, Contactor, SPST, Push Buttons, NO/NC Concept. **Programming of Programmable Logic Controller:** General PLC Programming Procedures, Contacts and Coils, Program SCAN, Programming Language **Programming of Programmable Logic Controller continue:** Ladder Programming, Relay Instructions, Instruction Addressing, Concept of Latching, Branch Instructions, Contact and Coil I/O Programming Examples, Relation of Digital Gate Logic to Contact/Coil Logic.	18
Unit – II	**Programmable Logic Controller Functions:** Timer Instructions: ON DELAY Timer and OFF DELAY timer, Counter Instructions: UP/DOWN Counters, Timer and Counter Applications, Program Control Instructions: Master Control Reset, Jump and Subroutine, Math Instructions- ADD, SUB. Data Handling: Data Move, Data Compare, Data Selection, Electro-pneumatic Sequential Circuits and Applications.	18

	SCADA: Definition of SCADA, Applicable Processes, Elements of SCADA System, A Limited Two-Way System. Real Time Systems: Communication Access and Master-Slave determining scan interval. Introduction to Remote Control, Communications-A/D Conversion, Long Distance Communication, Communication System components in brief- Protocol, Modems, Synchronous/Asynchronous telephone cable/radio, Half Duplex, Full Duplex System, Brief introduction to RTU and MTU, Applications-Automatic Control, Advisory Applications.	

Text Books:

[1] Frank D. Petruzella "Programmable Logic Controllers", McGraw-Hill Book Company.
[2] John w. Webb and Ronald A. Reis, "Programmable Logic Controllers", PHI

Reference Books:

[1] Stuart A. Boyer "Supervisors Control and Data Acquisition", ISA
[2] William I. Fletcher "An Engineering Approach to Digital Design", PHI.
[3] Simpson, Colin "Programmable Logic Controllers", Englewood Cliffs NJ PHI.

Intended Outcomes:

- have the knowledge of Joints, Links, Sensors, Control units, Actuators. and elements of Automation CO2: describe motions and control system of Robots.

DEE 4012 AUTOMATION AND ROBOTICS ENGINEERING

Introduction:Introduction to mechanics and control of robotic manipulators. Topics include spatial transformations, kinematics, dynamics, trajectory generation, actuators and control, and relations to product design and flexible automation.

Objective: Students will be able to
1. To develop the student's knowledge in various robot structures and their workspace2. To develop student's skills in performing spatial transformations associated with rigid body motions.
3. To develop student's skills in perform kinematics analysis of robot systems.
4. To provide the student with knowledge of the singularity issues associated with the operation of robotic systems. 5. To provide the student with some knowledge and analysis skills associated with trajectory planning.
6. To provide the student with some knowledge and skills associated with robot control.

Credits: 3 **Semester IV** **L-T-P: 3-0-0**

Module No.	Contents	Teaching Hours
Unit – I	**Introduction:** Definition, Classification of Robots, geometric classification and control classification. **Robot Elements:** Drive system, control system, sensors, end effectors, gripper actuators and gripper design. **Applications:** Application of robot in welding, machine tools, material handling, and assembly operations parts sorting and parts inspection. **Robot Coordinate Systems and Manipulator Kinematics**: Robot co-ordinate system representation, transformation, homogenous transform and its inverse, relating the robot to its world. Manipulators Kinematics, parameters of links and joints, kinematic chains, dynamics of kinematic chains, trajectory planning and control, advanced techniques of kinematics and dynamics of mechanical systems, parallel actuated and closed loop manipulators.	18
Unit – II	**Robot Control:** Fundamental principles, classification, position, path velocity and force control systems, computed torque control, adaptive control, Servo system for robot control, and introduction to robot vision. **Robot Programming**: Level of robot programming, language based programming, task level programming, robot programming synthesis, robot programming for welding, machine tools, material handling, assembly operations, collision free motion planning.	18

Text/Reference Books:

1.Coifet Chirroza, "An Introduction to Robot Technology" Kogan Page.

2.Y. Koren “Robotics for Engineers” Mcgraw Hill.
3. K. S. Fu, R.C. Gonzalez Y& CSG Lee, “Robotics” McGraw Hill.
4. J.J. Craig, “Robotics” Addison-Wesley. 5. Grover, Mitchell Weiss, Nagel Octrey,
5. “Industrial Robots” Mcgraw Hill.
6. Asfahl, “Robots & Manufacturing Automation” Wily Eastern.

Intended Outcomes:

- Students will demonstrate knowledge of robot controllers.
- Students will demonstrate an ability to generate joint trajectory for motion planning.
- Students will demonstrate knowledge of the relationship between mechanical structures of industrial robots and their operational workspace characteristics.

DEE 4013 POWER LINE CARRIER COMMUNICATION

Introduction: Power Line Carrier communication systems consist of a high frequency signal injection over the electrical power lines. This kind of technology has been used since the 1950 decade in order to provide signalling and ripple control in High Voltage lines, at transmission level.

Objective: Students will be able to

- Use of PLCC in modern electrical power system is mainly for telimetry and telicontrol

Credits: 3 **Semester IV** **L-T-P: 3-0-0**

Module No.	Contents	Teaching Hours
Unit – I	**Channel Characterization:** Introduction, channel modeling fundamentals, model for outdoor channel, models for indoor channels, noise and disturbances, measuring techniques, PLC channel emulation tools. Coupling: Introduction, filtering basics, transformer and capacitor coupler design, impedance adaptation concepts. [**Digital Transmission Techniques:** Introduction, Architecture of PLC system, Narrowband and broadband PLC systems, Modulation and coding for narrow band and broad band PLC systems, Error Handling	18
Unit – II	**PLC Networks :** Introduction, Organization and structure of PLC networks, Media Access Control layer, Multiple Access Schemes, Protocols for PLC, Traffic control, Supporting Energy Management Systems, Quality of service(QOS), International standards on PLC networking Technology	18

Reference Books:

Gilbert Held," Understanding Broadband over Power line", Auerbach Publications.

Intended Outcomes:

- To designing or analyzing a PLC network and the structure and components of it, as well as its topology.
- it can provide telecommunication services and value added services but it can also be very useful for distribution and transmission system operators in order to guarantee the operation and control of the power grid.

DEE 4181: ELECTRICAL MACHINES - I LAB

Introduction:
1. To prepare the students to have a basic knowledge of transformers.
2. To prepare the students to have a basic knowledge of induction motors.
3. To prepare the students to have a basic knowledge of alternators.
4. To design a practical transformer.
5. To know about an induction generator.

Objective: The objectives are -
1. T o prepare students to perform the analysis of any electromechanical system.
2. T o empower students to understand the working of electrical equipment used in everyday life

Credits: 3 **Semester IV** **L-T-P: 0-0-6**

LIST OF PRACTICALS

S.No.	Contents	Teaching Hours
1.	To identify the constructional parts of D.C. machine.	72
2.	Find the performance of d. c shunt motor by conducting load test & reverse the direction of rotation of d. c. motor (shunt and series).	
3.	Draw the characteristics of speed control of dc shunt motor by: (i) Armature control method (ii) Field control method	
4.	To find performance of dc series motor with starter (to operate the motor on no load for a moment) & operation 3-point starter for starting D.C. shunt motor.	
5.	Measurement of the angular displacement of the rotor of a slip-ring induction motor on application of DC to stator of motor winding in sequence and simultaneously to each phase of rotor winding	
6.	To identify the constructional details of 1-phase and 3-phase transformer.	
7.	To perform open circuit and short circuit test for determining: (i) equivalent circuit (ii) the regulation and (iii) efficiency of a transformer from the data obtained from open circuit and short circuit test at full load	
8.	To find the efficiency and regulation of single phase transformer by actually loading it.	
9.	Finding the voltage and current relationships of primary and secondary of a three phase transformer under balanced load in various configurations conditions such as (a) Star-star (b) Star delta (c) Delta star (d) Delta - Delta configuring conditions.	
10	**MATLAB based practical's** Simulate Torque –speed chacteristics of dc shunt motor by using Matlab.	

12. 13.	Simulate V-I characteristics of dc shunt generator using Matlab. Simulate speed control of DC shunt motor using Matlab. Simulate operational characteristics of Step-up/Step-down transformer using Matlab.	

Intended Outcomes:

- The ability to formulate and then analyze the working of any electrical machine using mathematical model under loaded and unloaded conditions.
- The skill to analyze the response of any electrical machine.
- The ability to troubleshoot the operation of an electrical machine.
- The ability to select a suitable measuring instrument for a given application.
- The ability to estimate and correct deviations in measurements due to the influence of the instrument and due to the accuracy of the instrument.

DEE 4182: ELECTRICAL ENGINEERING DESIGN AND DRAWING – II LAB

Introduction: It is graphical representation of physical objects and their relationship.the ability to read drawing is the most important requirement of all technical people inengineering profession

Objective: To get primary concept of Engineering Drawing.To know about equipments in Engineering Drawing.To know various signs, lines and dimensions. To know about sectional view.

Credits: 1 **Semester IV** **L-T-P: 0-0-2**

LIST OF PRACTICALS

Module No.	Contents	Teaching Hours
1	**Contractor Control Circuits**	8
1.1	Design of circuit drawing of schematic diagram and power wiring diagram of following circuits, specification of contactors	
1.2	DOL starting of 3-phase induction motor	
1.3	3-phase induction motor getting supply from selected feeder	
1.4	Forwarding/reversing of a 3-phase induction motor	
1.5	Sequential operating of two motors using time delay relay	
1.6	Manually generated star delta starter for 3-phase induction motor	
2.	**Earthing**	8
2.1	Different types of earthing, drawings of plate and pipe earthing	
2.2	Method of reducing earth resistance	
2.3	Relevant IS specifications of earth electrode for earthing	
2.4	Earthing layout of distribution transformer	
2.5	Key diagram of 11KV, 33KV, 66KV, 132 KV sub-stations	
3.	**Drawings of Machine Parts**	8
3.1	Rotor of a squirrel cage induction motor	
3.2	Terminal plate of an induction motor	
3.3	Motor body (induction motor) as per IS specifications	
3.4	Designing of motor winding (lap, wave)	
3.5	Arrangement of commutator segment for different type of winding	

Intended Outcomes: After completion of course, student will be able to:

- Identify and use differing drawing tools/instruments.
- Use the concept of projection for Chemical Engineering Drawings.

DEE 4083: INSTRUMENTATION LAB

Credits: 1 **Semester IV** **L-T-P: 0-0-2**

Introduction This course is aimed at students, professional electrical & electronics engineers, service technicians, energy auditors, operational & maintenance personnel, facility engineers and general audience.

Objective: 1. To study need of metrology and basic terminology of metrology
2. To make students understand the Identification, classification construction, working principle and application of various transducers used for Displacement measurement, Temperature measurement, Level measurement, and Miscellaneous measurement.

LIST OF PRACTICALS

Module No.	Contents	Teaching Hours
1	To measure the level of a liquid using a transducer	24
2	Study of variable capacitive transducer	
3	Draw the characteristics of a potentiometer	
4	To measure linear displacement using LVDT	
5	To study the use of electrical strain gauge	
6	To study weighing machine using load cell	
7	To measure temperature using a thermo-couple	
8	Study and use of digital temperature controller	
9	Use of Thermistor in ON/OFF transducer	
10	Plot the Characteristics of Thermistor.	
11	To study pH meter.	

Intended Outcomes:The students will be able to

- Learn the measurement systems, errors of measurement,
- Explain working principles of sensors and transducers.
- Study the working principle of displacement transducers and their applications.
- Understand principle of working of various transducers used to measure Temperature, comparative study of various transducers.
- Learn the various types of level measurement transducers and their applications, basic principle of working.
- Understand applications of various transducers in industry.
- Miscellaneous other sensors.

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DEE 4285: ELECTRONICS II LAB

Introduction:Electronics I is designed to be a full year introductory course for students who wish to further understand how their world is shaped by electricity and the electronicdevices that surround them. The course blends electronic concepts and theory with practical hands on activities.

Objective: To understand operation of semiconductor devices. To understand DC analysis and AC models of semiconductor devices. To apply concepts for the design of Regulators and Amplifiers to verify the theoretical concepts through laboratory and simulation experiments. To implement mini projects based on concept of electronics circuit concepts

Credits: 2 **Semester IV** **L-T-P: 0-0-4**

LIST OF PRACTICALS

Module No.	Contents	Teaching Hours
1.	To study the effect of coupling capacitor on lower cut off frequency and upper cut off frequency by plotting frequency response curve of a two stage RC coupled	
2.	amplifier	
3.	To measure (a) optimum load (b) output power (c) signal handling capacity of a push-pull amplifier	
4.	To observe the effect of negative current feedback on the voltage gain of a single stage transistor amplifier by removing emitter bye-pass capacitor.	
5.	To measure (a) voltage gain (b) input and output impedance for an emitter follower circuit	
6.	To measure frequency generation in (a) Hartley (b) R-C Phase Shift oscillator	48
7.	To observe the differentiated and integrated square wave on a CRO for different values of R-C time constant.	
8.	Clipping of both portion of sine-wave using: a) Diode and DC source b) Zener diodes Clamping a sine-wave to: a) Negative DC voltage b) Positive DC voltage	
9.	To generate square-wave using an Astable Multivibrator and to observe the wave form on a CRO.	
10.	To observe triggering and working of a Bistable Multivibrator circuit and observe its output wave form on a CRO.	
11.	To use the Op-Amp (IC 741) as inverting one and non-inverting amplifiers, adder, comparator, integrator.	

12.	To study the pin configuration and working of IC 555 and its use as Monostable and Astable Multivibrator.	
13.	To realize the regulated power supply by using three terminal voltage regulator ICs such as 7805, 7905, 7915 etc.	
14.	Application of op-amp as Schmitt trigger. Study of op-amp IC 741 as inverting and non inverting amplifier design	
15.	differentiator.	
16.	Design differentiator & integrator using OP-AMP and also determine the time constant and cut off frequency.	
	To implement the regulated power supply on bread board or PCB by using different components. i)Transformer ii) Full wave rectifier iii) Filter iv) Regulator	

Intended Outcomes: A student who successfully completes the course will have the ability to:

- Understand electronic systems with a continuously variable signal
- Understand proportional relationship between a signal and a voltage or current that represents the signal.
- To learn function of basic component's use in linear circuits.
- Understand component symbol, working principle, classification and specification.
- To learn different theorems for simplification of basic linear electronics circuits.

DEE 4086 PLC &SCADA SYSTEM LAB LAB

Introduction:A PLC, Technical Definition of PLC, what are its advantages, characteristics functions of A PLC, Chronological Evolution of PLC, Types of PLC, Unitary PLC, Modular PLC, Small PLC, Medium PLC, Large PLC, Block Diagram of PLC: Input/output (I/O) section, Processor Section, Power supply, Memory central Processing Unit: Processor Software / Executive Software, Multi asking, Languages, Ladder Language.

Objective: Students will be able to

- Gain the Knowledge of various skills necessary for Industrial applications of Programmable logic controller(PLC)
- Understand the basic programming concepts and various logical Instructions used in Programmable logic controller (PLC)
- Solve the problems related to I/O module, Data Acquisition System and Communication Networks using Standard Devices.
- Design and analysis of general structure of an automated process for real time applications using Programmable logic controller (PLC) and SCADA

Credits: 2 **Semester IV** **L-T-P: 0-0-4**

LIST OF PRACTICALS

S.No.	Contents	Teaching Hours
1.	Operating a simple loads using relays, switches and pushbuttons	
2.	PLC Input – Output Wiring Methods	
3.	Programming the PLC Via Ladder logic	
4.	Position control for satellite dish DC motors	
5.	Starting Three Phase Induction Motors Via Star-Delta Starter	
6.	Programming PLC Via SFC	
7.	Different applications of Push buttons.	
8.	Working of different types of Timers.	
9.	Working of different types of Counters.	
10.	Sequential operation of ON/OFF of a set of lights.	
11.	Latching and Unlatching of a Motor.	
12.	Automatic indication of water tank level.	
13.	Traffic lights indication.	48
14.	Study of ardino kit.	
15.	Write the program of blinkig the LED with 5s result come on	
16.	13s	
17.	Write the programm of blinking the LED with different timing	
18.	Write the program of controlling the stepper motor	
19.	Wrtite the program of controlling the dc motor with 100-ohm	
20.	resistance	
21.	Build the program of Home Automation by using blue thooth	
22.	device	
	Build the ldder program of automatic door lock by using	
23.	password	
24.	Build the line follower robot by using aurdino kit	

25.	Write the program of controlling relay sheild from bluetooth enablle device (aurdino APK)	
26.	To measure heart beat per minnut	
27.	Wrote the programming of objective of detective pin 13 will go (on board LED on) and object detected message will be delayed in serial monitor	
28.	Assignment on introduction to robot configuration	
29.	demonstration of robot with 2 dof, 3 dof, 4 dof etc.	
30.	Two assignments on programming the robot for applications	
31	Two assignments on programming the robot for applications in val ii	
32.	Two programming exercises for robots	
33.	Two case studies of applications in industry	
34.	Exercise on robotic simulation software	

Intended Outcomes

- have the knowledge of Joints, Links, Sensors, Control units, Actuators. and elements of Automation CO2: describe motions and control system of Robots.

DEE 5202 ELECTRICAL MACHINES – II

Introduction:In electrical engineering, electric machine is a general term for machines using electromagnetic forces, such as electric motors, electric generators, and others. They are electromechanical energy converters: an electric motor converts electricity to mechanical power while an electric generator converts mechanical power to electricity. The moving parts in a machine can be rotating (rotating machines) or linear (linear machines). Besides motors and generators, a third category often included is transformers,

Objective: To prepare the students to have a basic knowledge of three phase transformers. To prepare the students to have a basic knowledge of three phase induction motor and synchonous motor. To prepare the students to have a basic knowledge of special machines

Credits: 3 **Semester V** **L-T-P: 3-0-0**

Module No.	Contents	Teaching Hours
Unit – I	**ALTERNATOR (SYNCHRONOUS GENERATOR)** Introduction, Construction-Stator & Rotor, Salient features of alternator, Rotating field versus Rotating armature, Excitation system, Working principle of alternator, Armature reaction, lead, lag, zero p.f. Armature winding-Concentrated & distributed, Coil span factor & Distributed factor , EMF equation, Open circuit test & Short circuit test, Voltage Regulation-Synchronous Impedance method, MMF method, Potier trangle method & Short circuit ratio, Parallel operation of alternators, Merits & Application. **SYNCHRONOUS MOTOR** Introduction, Working principle, Method of starting, hunting &damper winding, Effect of variation of load-speed torque characteristics, Graphical explanation of the effect of variation of Excitation on armature & Power factor(Over and under excitation), V-curves & Inverted curve, Applications.	18
Unit – II	**THREE PHASE INDUCTION MACHINES** Introduction, Construction, working principle, Production of rotating magnetic field with three phase winding, Slip, Rotor frequency, Power flow diagram for an induction motor, Factors determining torque, Torque-slip & Torque- speed characteristics, Condition for maximum torque, Starting- D.O.L, Star-Delta, Autotransformer, Speed control of induction motor, Cogging, Crawling, Installation and preventive maintenance of induction motor, Applications. **Single phase Induction Motor** Introduction, Construction and principle of working, Cross field theory& DRFT, Methods of making single phase motor Self Starting-	18

	Split phase induction motor, Capacitor start motor, Capacitor start and run motor, shaded pole motor, Reluctance start motor, Application of single phase induction motor. **Special Machine** Construction and working principle of Stepper motor, Types and application of Stepper motor. Universal motor, Single phase synchronous motor-Reluctance motor, Hysteresis motor, Servomotor.	

Text Books:

1.Electrical Machines by SK Bhattacharya, Tata Mc Graw Hill

2.Electrical Machinery by P.S. Bhimbra

3. Electrical Machines by Ashfaq Hussain

Reference Books:

1. Electrical Machines by Nagrath and Kothari, Tata Mc Graw Hill
2. Electrical Machines by Smarajit Ghosh-Pearson Publishers, Delhi.
3. Electrical Machine by V.K. Mehta S Chand and Co., New Delhi

Intended Outcomes: After completion of course, student will be able to:

- Acquire knowledge about the fundamental principles and classification of electromagnetic machines.
- Acquire knowledge about the constructional details and principle of operation of dc machines.
- Acquire knowledge about the working of dc machines as generators and motors.
- Acquire knowledge about testing and applications of dc machines.

DEE 5004: POWER PLANT ENGINEERING

Introduction: Power Plant Engineering basically focuses on power generation principles for real world applications. More specifically this course is focused on application of energy principles and power generation cycles. The main purpose of implementing this course in curriculum is to learn about how the power is generated in a power plant and its applications

Objective:

- To introduce students to different aspects of power plant engineering.
- To familiarize the students to the working of power plants based on different fuels.
- To expose the students to the principles of safety and environmental issues.

Credits: 3 **Semester V** **L-T-P: 3-0-0**

Module No.	Contents	Teaching Hours
Unit – I	**Thermal Stations:** Main parts and working of stations-thermodynamic cycles, fuel handling, combustion and combustion equipment, problem of ash disposal, circulating water schemes and supply of makeup, water, choice of pressure of steam generation and steam temperature, selection of appropriate vacuum; economizer, air pre-heater feed water heaters and dust collection. Characteristics of turbo alternators, steam power plant heat balance and efficiency. **Hydro-Electric Plants:** Hydrology, stream flow, hydrograph, flow duration curves. Types of hydroelectric plants and their fields of use, capacity calculations for hydropower, Dams, head water control, penstocks, water turbines, specific speeds. Turbine governors. Hydro plant auxiliaries, plant layout, automatic and remote control of hydro plants, pumped storage projects, cost of hydro-electric project. Cooling of alternators. **Nuclear Power Plants:** Elements of nuclear power plant, nuclear reactor, fuels, moderators, coolants, control. Classification of nuclear power stations. Cost of nuclear power.	18
Unit – II	**Diesel Power Plants:** Diesel engine performance and operation. Plant layout. Log sheets, applications selections of engine size. **Gas Turbine Plants:** Plant layout, methods of improving output and performance. Fuels and fuel systems. Methods of testing. Open and closed cycle plants. Operating characteristics. Applications. Free piston engine plants, limitation and applications. Non conventional energy sources. **Combined Working of Power Plants:** Advantages of combined working of different types of power plants. Need for co-ordination of various types of power plants in power systems, base load stations and peak load stations. **Performance of power stations and economic consideration:** significance and definitions of load factor, diversity factor on	18

	cost of generation, plant capacity factor-problem, cost of generation and classification load curve, tariff **Recent Development:** Interconnection of P.S. - Meaning of Interconnection, combined	

Books:

1.A Course in Power Plant Engineering by Arora and Domkundwar, Dhanpat Rai and Co. Pvt. Ltd., New Delhi.
2. Power Plant Engineering by P.K. Nag, Tata McGraw Hill, Second Edition, Fourth reprint 2003.

Reference Books:

1. Power station Engineering and Economy by Bernhardt G.A. Skrotzki and William A. Vopat Tata McGraw Hill Publishing Company Ltd., New Delhi, 20th reprint 2002.
2. An introduction to power plant technology by G.D. Rai Khanna Publishers, Delhi - 110 005.
3. Power Plant Technology, M.M. El-Wakil McGraw Hill 1984.

Intended Outcomes: The knowledge of following subjects is essential to understand Power Plant Engineering

- hydroelectric
- thermal engg
- nuclear power plant
- Gas turbine power plant

DEE 5106: ELECTRICAL POWER SYSTEM AND PROTECTION

Introduction: Identify and explain the different methods of generation, distribution, control and compensation involved in the operation of power systems. Design the mathematical models of the mechanical and electrical components involved in the operation of power systems and demonstrate the understanding of the open loop and closed loop control practices associated with the voltage and frequency control of single area or interconnected multi area power systems.

Objective: To understand the electrical power plant operation and control with respect to its economic aspect.

• To know the importance of compensation in power system and study the different compensating techniques

. • Study about different transients and their protection those are introduced in power system.

Credits: 3 **Semester V** **L-T-P: 3-0-0**

Module No.	Contents	Teaching Hours
Unit – I	**Introduction** Power System, Element of Power System, Single line diagram, per unit system. **Transmission Lines & Distribution System:** Brief Study of Transmission Lines, Skin and Ferranti Effect, Kelvin's law, Modification in Kelvin's law. Feeders distributors and service mains, radial and ring main distributors **Conductor& Insulator** Types of conductors, Types of insulators, their properties, selection and testing, voltage distribution of string insulators, String Efficiency, Methods of improvement of string efficiency **Inductance & Capacitation Calculation** Concept of transformer linkage, inductance calculation, calculation of different conductor configration, concept of GND, GMR Capacitance calculation of different configuration of conductors. **Sag and Tension:**Calculation of Sag for equal and unequal support, Vibration dampers. **Underground Cables, Corona** Power cable construction, comparison of overhead lines and underground cables, laying of cables, Fault location, Murray loop test, testing of cables, Effects of corona and remedial measures.	18
Unit –II	**Relays:** Electromagnetic relay, Related Terms, Electromagnetic Relay, Thermal Relay, Directional Relay, Over Current Relay, Differential relay, Distance Relay, **Protection of power transformer:** Types of faults, Merz Price Protection, Buchholz relay **Faults:** Types of faults, and their causes, Zones of protection **Isolators, Circuit Breaker & Switches**: Construction, types, working, and application, Arc Formation Process,	18

	Method of arc extinction, Related Terms, Current Chopping, Restriking Voltage, RRRV, Resistance Switching, Making and Breaking Capacity of CB,.Types of circuit-breakers	

Text Books:

1. Electrical Power System and Analysis by CL Wadhwa, 3rd edition, New Age International Publishers,
New Delhi
2. Electrical Power System by VK Mehta, S Chand & CO., New Delhi
3.Rao S. S. "Switchgear and Protection", Khanna Publishers
4.Ravindranath B. and M. Chander "Power system Protection and Switchgear",, iley Eastern Ltd

Reference Books:

1. Substation Design and Equipment by Satnam and PV Gupta, DhanpatRai& Sons, New Delhi
2. Electrical Power –I by SK Sahdev, Unique International Publications, Jalandhar
3. Electrical Power System by JB Gupta, Kataria and Sons, New Delhi
4.Ram B. and D. N. Vishwakarma, "Power System Protection and Switchgear", Tata McGraw Hill
5.Paithankar Y. G. and S R Bhide, "Fundamentals of Power System Protection", Prentice Hall of India.

Intended Outcomes:

- Specify the equivalent electrical parameters of transmission line to prepare and analyze models to predict the range and ratings of the equipments to be used,
- the protection required against line transients and determine the appropriate methods of compensation required for operational stability.
- Solve the problems related to the economic dispatch of power, plant scheduling, unit commitment and formulate strategies to minimize transmission line losses and penalties imbibed.

DEE5011: CONTROL SYSTEM

Introduction:

- Formulate different types of analysis in frequency domain to explain the nature of stability of the system
- To employ time domain analysis to predict and diagnose transient performance parameters of the system for standard input functions and identify the needs of different types of controllers and compensator to ascertain the required dynamic response from the system

Objective: To introduce different types of system and identify a set of algebraic equations to represent and model a complicated system into a more simplified form to interpret different physical and mechanical systems in terms of electrical system to construct equivalent electrical models for analysis.

Credits: 3 **Semester V** **L-T-P: 3-0-0**

Module No.	Contents	Teaching Hours
Unit – I	**Control System**: Open loop & closed control; servomechanism, Physical examples. Transfer functions, Block diagram algebra, Signal flow graph, Mason's gain formula Reduction of parameter variation and effects of disturbance by using negative feedback **Time Response analysis:** Standard test signals, time response of first and second order systems, time response specifications, steady state errors and error constants **Stability and Algebraic Criteria**: Concept of stability and necessary conditions, Routh-Hurwitz criteria and limitations.	18
Unit – II	**Root Locus Technique**: The root locus concepts, construction of root loci **Frequency response Analysis**: Frequency response, correlation between time and frequency responses, polar plot, Bode plots **Control System Components:** Constructional and working concept of ac servomotor, synchros and stepper motor	18

Text Books:

1. Nagrath & Gopal, "Control System Engineering", New age International.
2. K. Ogata, "Modern Control Engineering", Prentice Hall of India.
3. D. Roy Choudhary, "Modern Control Engineering", Prentice Hall of India.

Reference Books:

1. Norman S. Mise, Control System Engineering, Wiley Publishing Co.
2. Ajit K Mandal, "Introduction to Control Engineering" New Age International.

3. R.T. Stefani, B. Shahian, C.J. Savant and G.H. Hostetter, "Design of Feedback Control Systems" Oxford University Press.
4. Samarjit Ghosh, "Control Systems theory and Applications", Pearson Education

Intended Outcomes:

- Categorize different types of system and identify a set of algebraic equations to represent and model a complicated system into a more simplified form.
- Characterize any system in Laplace domain to illustrate different specification of the system using transfer function concept.
- Interpret different physical and mechanical systems in terms of electrical system to construct equivalent electrical models for analysis.
- Employ time domain analysis to predict and diagnose transient performance parameters of the system for standard input functions.
- Formulate different types of analysis in frequency domain to explain the nature of stability of the

DEE 5012 ELECTRIC TRACTION

Introduction: Electric Traction: The action of pulling something over a surface especially on road or track involving the use of electricity. Topics covered: Mechanical features of electric drive, Load equalization, flywheel calculations, examples.

Objective: To understand the basic principles of light control and types of light schemes.
• To impart how to design the traction system considering economic and technology upgradation., metro train etc

Credits: 3 **Semester V** **L-T-P: 3-0-0**

Module No.	Contents	Teaching Hours
Unit - 1	**Introduction:** Electric traction system and its advantages over other system, types of electric traction systems. Traction systems for India. **Electric traction drives:** Suitability of electric traction drives- D.C. series motor, A.C. series motor, 3 phase induction motor, characteristics of electric traction drives, special design requirements, methods of starting and speed control, different methods of braking, plugging, rheostatic, regenerative. **Power supply of electric traction:** Different systems of power supplies, their chronological evolution, power supply arrangement i.e. traction substation major equipment transformer, circuit breaker, interrupter, protection system, remote control system, design consideration.	18
Unit - 2	**Mechanics of traction**: System of units, speed time curves, their construction, simplification and interpretation for main line, suburban routs, tractive effort, specific energy consumption and factors affecting it. Weight transfer due to torque coefficient of adhesion. **Rectification Equipment** Equipments required for rectification their brief theory and working. **Over head Equipments**: Design aspects of over head equipments catenary and its types, practical aspects of working, maintenance of over head equipments, current collection system, and their requirements. **Track Circuits**: D.C. and A.C. track circuits, signals for traffic control, **Rail and Return Path**: Earth return protection of underground equipment, Negative booster, voltage distribution on rails.	18

TEXT BOOKS

1.Art and Science of Utilization of Electrical Energy by H Partap, Dhanpat Rai & Sons, Delhi
2.A. Text Book. of Electrical Power by Dr. SL Uppal, Khanna Publications, Delhi

REFERENCE BOOK

1.Modern Electric Traction by H Partap, Dhanpat Rai & Sons, Delhi
2.Utilization of Electrical Energy by OS Taylor, Pitman Publications
3.Generation, Distribution and Utilization if Electrical Power by CL Wadhwa, Wiley Eastern Ltd., New Delhi

Intended Outcomes:

- Illustrate working principle electric power utilization and their application in real life.
- Choose proper traction systems depending upon application considering economic and technology up-gradation.
- Employ mathematical and graphical analysis considering different practical issues to design of traction system; analyze the performance parameter of the traction system

DEE5013: ELECTRIC AND HYBRID VEHICLES

Introduction: A hybrid electric vehicle (HEV) is a type of hybrid vehicle and electric vehicle which combines a conventional internal combustion engine (ICE) propulsion system with an electric propulsion system. The presence of the electric powertrain is intended to achieve either better fuel economy than a conventional vehicle or better performance.

Objective: Hybrid electric vehicles (HEVs) combine the benefits of gasoline engines and **electric** motors and can be configured to meet different **objectives** such as improved fuel economy, increased power, or additional auxiliary power for electronic devices and power tools.

Credits: 3 **Semester: V** **L-T-P: 3-0-0**

Module No.	Contents	Teaching Hours
Unit – I	**Introduction of Electric Vehicle:** Electric vehicle Architecture: Major components of electric vehicle. In vehicle Safety devices and usage of safety devices. Mandatory Safety precautions while handling Electric Vehicle. Safety measure to be taken before & while driving an electric vehicle. Instrument Cluster: Different Symbols/Icons Meaning and functions, Various gauges and meters reading Different pages of cluster display & diagnostic page reading **LI-Ion Battery:** HV Battery pack detailed explanation of Lithium Ion battery, Invehicle Removal and reinstallation of battery Safety precautions for handling a high voltage battery, Battery connections Battery management system, Battery cooling system, charging and discharging cycle **Traction Motor:**Traction Motor & Controller : brief introduction of traction motor and controller, function of motor, Traction cooling system(Purpose, Main Components of TCS,Coolant circuit,), fault diagnosis of TCS Traction motor controller R&R, Safety precautions for traction motor.	18
Unit – II	**Air Compressor & Pneumatic System:** Air Compressor, Working, Circuit, Maintenance. Safety precautions for Air Compressor. Pneumatic Circuit, Pneumatic system & electric control circuit. Air suspension **Power steering:** Brief introduction, Working of EHPS, in vehicle Circuit P/S oil replacement, Safety precautions, removal & refitting of PS Motor. location, preparations for self, Vehicle safety, safety precautions while working on EV, Repair/ replacement of HV components. **EV Charging System**: Electric Vehicle Charger: Main components of EV Charger, EV Charging Sockets, Charging of Electric Vehicle, Basic Charging system faults and rectification, safety precautions	18

	for EV charging.,types of cable (HV & LV), wireing hardness, power distribution unit	

Outcome: Drivers for EV adoption include pro-environmental attitudes, symbolic meanings, identity, innovativeness and emotions. Purchase cost of EVs is found to be a barrier to adoption while lower running cost is shown to be a driver.

Text Books:

1. Electric & Hybrid Vehicles (English, Paperback, A.K. Babu)
2 Hybrid Electric Vehicles Technologies, Modeling and Control - A Mechatronic Approach
3. Hybrid, Electric and Fuel-cell Vehicles, International Edition

Reference Books:

- Electric and Hybrid Vehicles Paperback – 24

DEE 5281: ELECTRICAL MACHINES – II LAB

Introduction:Understanding the basic theory and operation of electrical machines. Understanding how electrical machines fit into the larger context of power systems. Understanding and using procedures and analysis techniques to perform and describe electromagnetic and electromechanical tests on electrical machines

Objective: To prepare the students to have a basic knowledge of transformers. To prepare the students to have a basic knowledge of induction motors. To prepare the students to have a basic knowledge of alternators., synchronous machine, induction machine etc.

Credits: 2 **Semester V** **L-T-P: 0-0-4**

LIST OF PRACTICALS

Module No.	Contents	Teaching Hours
1. 2. 3. 4.	**Induction Machines:** Perform load test on 3-phase induction motor for compute torque, Output power, input power, Efficiency, Input power factor, Slip. Perform NO LOAD and BLOCK ROTOR Test on 3 phase induction motor. To Control the speed control of 3 phase slip ring induction motor by rotor resistance control. To study running and speed reversal of a 3-phase induction motor and record speed in both conditions.	24
1. 2. 3. 4. 5.	**SYNCHRONOUS MACHINE** Synchronizing panel for parallel operation of a.c. generators Perform Open Circuit & Short Circuit test on a 3-phase alternator. To study the effect of variation of field current upon the stator current and power factor with synchronous motor running at no load, hence to draw V and inverted V curves of the motor. To determine the regulation of 3-phase alternator by EMF method at different power factor. To determine the regulation of three phase alternator by Potier methods and also to draw the vector diagrams.	24

Intended Outcomes:

After completion of course, student will be able to:

- Acquire knowledge about the fundamental principles and classification of electromagnetic machines.
- Acquire knowledge about the constructional details and principle of operation of dc machines.
- Acquire knowledge about the working of synchronous motor
- Acquire knowledge about testing and applications of dc machines

DEE 5184: ELECTRICAL POWER SYSTEM LAB

Introduction: Identify and explain the different methods of different type of relay and protating divices distribution, control and compensation involved in the operation of power systems. Design the mathematical models of the mechanical and electrical components involved in the operation of power systems

Objective: To understand the electrical power plant operation and control with respect to its economic aspect.

• To know the importance of compensation in power system and study the different compensating techniques

. • Study about different transients and their protection those are introduced in power system.

Credits: 2 **Semester V** **L-T-P: 0-0-4**

S.No.	Contents	Teaching Hours
1.	To Determine the Negative Sequence and zero sequence reactance of Alternator.	48
2.	To Study the single line to ground fault and verify results with the theoretical value.	
3.	To Study the Distance Relays (MHO Relays)	
4.	To Study the Operation of a solid state over voltage relay and hence to obtain its voltage characteristic.	
5.	To Study the Operation of solid state under voltage relay and hence to obtain its voltage characteristic.	
6.	Fault Location in cable by Murray loop.	
7.	Over Voltage relay.	
8.	Identify the components of different types of circuit breakers with them Specifications (through visits, video or model). i) Low tension air circuit breaker. (including protective devices) ii) Minimum Oil Circuit Breaker (M O C B) iii) Miniature Circuit Breaker (M C B) iv) Molded Case Circuit Breaker (M C C B) v) Earth Leakage Circuit Breaker (E L C B) vi) SF_6 Circuit breaker vii) Vacuum Circuit Breaker.	
9.	Comparative study of specifications of earthing at different substations / different locations & new trends in earthing schemes (information search)	
10.	Comparative study of specification of lightning arresters of different manufacturers through Brochures / Literature	
11.	For a given 3-ph induction motor with D.O.L. starter a). Check the operation of over current relay for various loads. b). Check the operation of single phasing preventer by creating single phasing Fault. c). Check the operation of D.O.L. starter under short circuit condition	

Intended Outcomes:

- Specify the equivalent electrical parameters of transmission line to prepare and analyze models to predict the range and ratings of the equipments to be used,
- the protection required against line transients and determine the appropriate methods of compensation required for operational stability.

- Solve the problems related to the economic dispatch of power, plant scheduling, unit commitment and formulate strategies to minimize transmission line losses and penalties imbibed.

DEE 5085: SOLAR ENERGY SYSTEM LAB

Introduction:The Solar System is the gravitationally bound system of the Sun and the objects that orbit it, either directly or indirectly. Of the objects that orbit the Sun directly, the largest are the eight planets, with the remainder being smaller objects, such as the five dwarf planets and small Solar System bodies.

Objective: This lab aims at explain the basic concepts related to the operation of Solar PV panels. It also provides opportunity to the students for gaining hands on experience on battery charging / discharging tests.

Credits: 1 **Semester V** **L-T-P: 0-0-2**

. LIST OF PRACTICALS

S.No.	Contents	Teaching Hours
1.	To demonstrate the I-V and P-V characteristics of PV module with varying radiation and temperature level.	24
2.	To demonstrate the I-V and P-V characteristics of series and parallel combination of PV modules.	
3.	To show the effect of variation in tilt angle and shading on PV module power.	
4.	Grid Synchronization of Solar PV Inverter and it Performance Analysis	
5.	To perform the charge controller test to obtain LVD, HVD, OCP point etc	
6.	To perform the self discharge, deep discharge, life cycle test etc on a 12 V battery.	
7.	To draw the charging and discharging characteristics of battery.	
8.	To Analysis of Temperature variation upon Solar PV panel output.	
9.	Study of wind speed variation upon solar PV panel output	
10	Output power calculation by series & parallel PV cell connections.	
11.	Study of Head gain in solar thermal water heater	

***Intended* Outcomes:** Upon successful completion of this course, students will be able to:

- Conduct basic laboratory experiments involving electrical circuits using laboratory test equipment such as Ammeter, voltmeter, multi-meters, power supplies, signal generators, and oscilloscopes.
- Explain the concepts of battery charging and discharging phenomenon.

DEE 5086: CONTROL SYSTEM LAB

Introduction: To teach the fundamental concepts of Control systems and mathematical modeling of the sys to study the concept of time response and frequency response of the system 3. To teach the basics of stability analysis of the systemtem

Objective: This lab aims at explain the basic concepts related to the operation of Solar PV panels. It also provides opportunity to the students for gaining hands on experience on battery charging / discharging tests

Credits: 1 **Semester V** **L-T-P: 0-0-2**

LIST OF PRACTICALS

S.No.	Contents	Teaching Hours
1.	Transfer Function from Zeros and Poles	24
2.	Z Step Response of a Transfer Function	
3.	Step Response of a Transfer Function	
4.	Impulse Response of a Transfer Function	
5.	Ramp Response of a Transfer Function	
6.	Time Response of a Second Order System	
7.	Root Locus from A Transfer Function	
8.	Bode Plot from A Transfer Function	
9.	Transfer Function from State Model	
10	State Model From Transfer Function	

Intended Outcomes:

- Represent the mathematical model of a system 2. Determine the response of different order systems for various step inputs 3. Analyze the stability of the system

DEE 5089: ELECTRIC VEHICLE LAB

Introduction: It is essential for an electricle engineer to learn to recent advancements and new technologies as well as the mechanisms used in electric powered vehicles. This course also gives the students opportunity to learn how to do maintenance work of electric vehicles.

Objective: After undergoing the Project Work, the student will be able to: The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences. Maintenance of electric vehicles.

Credits: 1 **Semester V** **L-T-P: 0-0-2**

. LIST OF PRACTICALS

S.No.	Contents	Teaching Hours
1.	Develop block diagram of Electric vehicle and identify parts	
2.	Case study- Compare minimum four vehicles for economic and environmental analysis	
3.	Develop schematic diagram of electric vehicle.	
4.	Prepare report on Plug in Electric vehicle by visiting a charging station	
5.	Inspect and install inverter of given lead acid battery	
6.	Prepare a report on Li ion and lead acid batteries used from market survey.	24
7.	Collect specifications of converters and inverters used for Electric vehicles.	
8.	Diagnose & repair the EV by useing following instrument (i) IR tester (ii) clamp meter (iii) multimeter (iv) CRO (v) magger tester	
9.	Prepare test procedure for equipment used in Electric vehicle	
10.	List safety procedures and schedule for handling HEVs and Evs	
11.	Prepair battery selection based on the vechiles load	

Intended Outcomes:

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

- Have brief idea on vehicle development

- Understand the basic operation of battery electric vehicles.
- Understand the basic operation of fuel cell electric vehicles.
- Understand the concepts of hybrid electric vehicles

DEE 6101: UTILIZATION OF ELECTRICAL ENERGY

Introduction: Most suitable type and specification of illumination source for efficient conversion and Recognize different process of utilizing electric energy for heating and electrolytic process in industries purposes mostly in commercial along with few house hold applications.

Objective: To understand the basic principles of light control and types of light schemes.

• To impart how to design the traction system considering economic and technology upgradation.

Credits: 3 **Semester VI** **L-T-P: 3-0-0**

Module No.	Contents	Teaching Hours
Unit – I	**Illumination:** Nature of light, Definitions: flux, solid angle, luminous intensity, illumination, luminous efficiency, depreciation factor coefficient of utilization, space to height ratio, reflection factor, laws of illumination. Levels of illumination. Methods to increase illumination efficiency Different sources of light: Difference in incandescent and discharge lamps – their construction & characteristics, fittings required for filament lamp, mercury lamp, fluorescent lamp sodium lamp, neon lamp. Main requirements of proper lighting; illumination level, absence of flare, contrast and shadow. **Electric Heating** Heating methods: Resistanceheating (direct resistance heating, indirect resistance heating) domestic water heaters. Induction heating, principle, core type and coreless induction furnace. Electric arc heating: direct and indirect arc heating, arc furnace. Dielectric heating.	18
Unit – II	**Electric Cooling** Concept of refrigeration and air-conditioning. **Electric Welding:** Welding methods, principles of resistance welding, welding equipment, Electric arc welding principle, characteristics of arc; carbon and metallic arc welding, power supply, advantage of coated electrode, comparison of AC and DC arc welding; welding equipment. **Electrochemical Processes,** Needof,electrodeposition,Faraday's laws of ectrodeposition,Objectivesof electroplating, Description of process for electroplating, Factors governing electro deposition, Equipments and accessories for electroplating plant,Principle of anodising and its applications.Electroplating on non-conducting materials.	18

TEXT BOOKS

1. Art and Science of Utilization of Electrical Energy by H Partap, Dhanpat Rai & Sons, Delhi
2. A. Text Book. of Electrical Power by Dr. SL Uppal, Khanna Publications, Delhi

REFERENCE BOOK

1. Modern Electric Traction by H Partap, Dhanpat Rai & Sons, Delhi
2. Utilization of Electrical Energy by OS Taylor, Pitman Publications
3. Generation, Distribution and Utilization if Electrical Power by CL Wadhwa, Wiley Eastern Ltd., New Delhi

Intended Outcomes:

- Examine various applications in indoor and outdoor application areas where use of light sources is essential.
- Classify types of electric light sources based on nature of operation and their objectives, performance and reliability.
- Select most suitable type and specification of illumination source for efficient
- conversion and Recognize different process of utilizing electric energy for heating and electrolytic process in industries purposes mostly in commercial along with few house hold applications.

DEE 6202: Power Electronics & Drives

Introduction: Introduction: Concept of Power Electronics, Applications of power electronics, Advantages and disadvantages of power-electronic converters, Power electronic systems, Power semiconductor devices, Types of power electronic converters, Power electronic modules

Objective

1. To understand and acquire knowledge about various power semiconductor devices.
2. To prepare the students to analyze and design different power converter circuits.

Credits: 3 **Semester VI** **L-T-P: 3-0-0**

Module No.	Contents	Teaching Hours
Unit – I	**Power Electronics Devices:** Power semiconductor Devices, Their symbols, Operation, steady state and switch characteristics of Power Transistor, Operation and steady state characteristics of Power MOSFET, IGBT, GTO, DIAC and TRIAC **Thyristor** – Operation, V- I characteristics, Series and parallel operation of thyristor, Turn ON methods of Thyrist**or**: Pulse Transformer, Protection of thyristor, Commutation of Thyristor: Class A, B. **Converters:** Phase Controlled Converters: Single phase half wave controlled rectifier with resistive and inductive loads, effect of freewheeling diode. Single phase fully controlled and half controlled bridge converters **Choppers:** Introduction, Control Techniques: Constant Frequency System, Variable Frequency System, Classification of Choppers: Class A, Class B, Class C, Class D and Class E	18
Unit – II	**Inverters: Single** phase half bridge and full bridge inverters **AC voltage controller:** Single phase ac voltage controller **Cycloconverters:** Basic principle of operation, single phase to single phase, three phase to single phase and three phase to three phase cyclo converters, **Dynamics of Electrical Drives & Braking:** Types of loads, Load torque, Quadrant diagram of speed torque characteristic. Electric Braking: Types of braking. **Drives Application in Power Electronics: DC Drives**: Speed control & Braking operation of DC separately/shunt/series motor with single phase half and full controlled converter, Chopper Drives. **AC Drives**: Methods of speed control of three phase Induction Motor.Speed control and braking operation by using converters and chopper	18

Text Books:

1) Power Electronics, by Dr. P S Bimbhra, 6th Edition, Khanna Publishers.
2) Electric Drives by M Chilikan, Mir Publishers.
3) A first course on electric drives by S K Pillai, 2nd Edition John Wiley Publication.

Reference Books:

1) Power Electronics, 2nd Edition by Khanchandani, Singh, Tata McGraw-Hill.
2) Power Electronics: Circuits, Devices and Applications, 3rd Edition,
by M H Rashid, Pearson
3) GEC SCR Manual, 6th Edition

Intended Outcomes:

- Acquire knowledge about fundamental concepts and techniques used in power electronics.
- Ability to analyze various single phase and three phase power converter circuits and understand their applications.
- Foster ability to identify basic requirements for power electronics based design application.
- To develop skills to build, and troubleshoot power electronics circuits.
- Foster ability to understand the use of power converters in commercial and industrial applications.

DEE 6103: MAINTENANCE AND SERVICING OF ELECTRICAL MACHINES

Introduction: To maintain the value of equipment and machinery by periodic inspections, repairs, overhauls, etc.

To maintain the optimum productive efficiency of the plant equipment and machinery

To maintain the operational accuracy of the plant equipment.

Objective:

- Assure the security of the installation for people, meaning that the normal or abnormal functioning does not endanger people. Of course, this objective is not sole for maintenance, but for the whole organization.
- Assure that the installation is secure for environment, so that a situation where the environment is damaged cannot happen. Of course, this objective is also not sole for maintenance, but for the whole organization.
- Achieve a certain value of availability.
- Achieve a certain value of reliability.
- Guarantee a long shelf life, at least according with the plant's repayment term.
- Achieve all of that, trimming the budget given. Often, the optimal budget for the maintenance of that installation.

Credits: 3 **Semester VI** **L-T-P: 3-0-0**

Module No.	*Contents*	Teaching Hours
Unit – I	**Scope and Organization ofElectrical Maintenance Department:** Requirement of electrical maintenance department, organization of work of electrical m/c department, office work and record keeping of electrical maintenance department, history & plant maintenance log book & job cards. **Installation and commissioning:** General guidelines for loading and unloading of heavy electrical machines. Brief description of the accessories used for loading and unloading of heavy electrical equipment. List of precautions to be taken while executing such jobs. Handling & transport of electrical machine, equipment & line accessories to site. Installation of electrical equipment like induction motors, transformers, switch gears, transmission and distribution lines etc. Alignment of the equipment, testing and commissioning of different types of electrical equipment, transmission and distribution lines etc. Precautions while installation is in progress. **Preventive Maintenance of Electrical Equipment and other installations:** Meaning of preventive maintenance, advantages of programmed preventive maintenance, preparation of preventive maintenance schedule for transformers, transmission lines, induction motors, circuit breakers, underground cables, storage batteries etc.	18
Unit – II	**Trouble Shooting:** Causes for failure of electrical equipments, classification of faults under (i) Electrical, (ii) magnetic (iii) mechanical, tool and	18

	instruments used for trouble shooting and repair. Use of trouble shooting charts. Diagnosis of faults in (i) D.C. machines (ii) Synchronous machines (iii) trans- formers, (iv) Induction motors, (v) Circuit breakers, (vi) Overhead & underground distribution lines. **Earthing Arrangements.** Reasons for earthing of electrical equipment, earthing systems, permissible earth resistance for different types of installations, methods of improving the earth resistance, measurement of earth resistance. **Insulation Testing:** Classification of insulation as per ISS 1271/1958. Insulation resistance measurement, effect of temperature on resistance, reasons for determination of insulation resistance, vacuum impregnation, transformer oil testing and interpretation of the test results. **Electrical Accidents and Safety:** Classification of electrical accidents, statutory regulations (IS 5216-1969), treatment for electric shock, artificial respiration, types and use of different types of fire extinguishers. Dangerous currents and voltages, effect of current on human body. Step and touch potentials, . General ideas about protection against lightning, explosive safety against static and current electricity, important Indian electricity rules.	

Reference Books:

1. Testing, Commissioning, Operation and Maintenance of Electrical Equipment by S Rao, Khanna Technical Publication, New Delhi
2. Preventive Maintenance of Electrical Apparatus by SK Sharotri, Katson Publishing House, Ludhiana

Intended Outcomes:

- The department of maintenance has to achieve the objectives intended adjusting its expenses to what was settled in the annual budget of the plant. As said in the previous section

DEE 6004: MICROPROCESSOR

Introduction: Assembly language programming will be studied as well as the design of various types of digital and analog interfaces Understand the architecture of 8085 and 8051•

Objective: The objective of this course is to become familiar with the architecture and the instruction set of an Intel microprocessor

Credits: 3 **Semester VI** **L-T-P: 3-0-0**

Module No.	Contents	Teaching Hours
Unit – I	**Introduction to the Intel 8085**: Introduction to microprocessors evolution of microprocessors; specific features of microprocessors, application of microprocessors. Architecture of microprocessors explanation of each functional block diagram and internal architecture of 8085, ALU, registers, control unit, clocks, bus structure; address, data and control bus of 8085, pin diagram of 8085. **Programming the 8085:** Instruction, group of instruction, addressing modes of instruction, 8085 instruction set. Machine language, comparison ,assembly language programming (Simple Problems)	18
Unit – II	**Timing Instruction & Execution:** Machine diagrams for instruction cycle machine cycle read, write (IO/MEM) Opcode Fetch machine cycle. Timing diagram for different instructions like (MOV A, B MVI R, 8bit data, LDA 16-bit data, STAX Rp, POP Rp, IN 8bit port address, OUT 8bit port address, DCR) Types of 8085 interrupt system, 8085 SID & SOD lines. **Peripheral interfacing**: Description of 8255 (Mode of operation, Mode 0, 1, 2 & BSR mode, 8257 (DMA Controller) description. **Application of 8255** 1. Interface a key to 8255and indicate its position using a LED i.e If switch is closed-LED should be ON if Switch is open LED should be off. **Advanced Microprocessors:** Introduction, INTEL 8086 architecture, pin diagram of 8086 microprocessors. Basic Interfacing, Memory-mapped I/O	18

Text Books: -

1) Microprocessor Architecture, Programming, and Applications with the 8085, 5th Edition by
Ramesh S. Gaonkar, Penram Internation Publisher.
2) Microprocessors & Interfacing, 2nd Edition by Douglas V Hall,
Tata McGraw –Hill Publications.

Reference Books: -

1) 8085 Microprocessor Programming & Interfacing, 1st Edition by N K Srinath,
Prentice Hall of India Pvt. Ltd.

2) Fundamentals of Microprocessor and Microcomputers, 1st Edition by B Ram, Dhanpat Rai and Sons.

Intended Outcomes:

- Learn importance of Microprocessors in designing real time applications
- Describe the 8085,8086 & 8255 Microprocessors architectures and its feature.

DEE 6181: POWER ELECTRONICS & DRIVES LAB

Introduction: Introduction: Concept of Power Electronics, Applications of power electronics, Advantages and disadvantages of power-electronic converters, Power electronic systems, Power semiconductor device like mosfet, IGBT, TRIAC, SCR, Types of power electronic converters, Power electronic modules

Objective: To develop the ability to estimate and analyze the dynamics in power electronic converters/drives systems.

Credits: 2 **Semester VI** **L-T-P: 0-0-4**

List of Experiments

S.No.	Contents	Teaching Hours
1.	To study and plot the characteristics of SCR and determine Break over voltage, holding and latching current.	
2.	To study and plot the characteristics of DIAC.	
3.	To study and plot the characteristics of TRIAC in both the directions.	
4.	To study and plot the characteristics of power MOSFET	
5.	To study and plot the characteristics of IGBT	
6.	To study and plot the characteristics of PUT 1-Phase Filament Lamp Light Dimmer using TRIAC.	
7.	To control the output voltage of DC Supply by SCR based a. Buck Chopper b. Boost Chopper c. Buck-Boost chopper.	
8.	To observe the output voltage with Single Phase Half & Full wave converter (with R, RL, RL and FWD load).	
9.	To observe the output voltage with Single phase AC to AC step down cycloconverter.	48
10.	To observe the output voltage with half wave and full wave inverter.	
11.	To obtain variable AC from DC ripple input by SCR based series inverter.	
12.	To obtain variable AC from DC ripple input by SCR based parallel inverter.	
	For advance Learners:	
1.	To control the output voltage of DC Supply by MOSFET based Buck chopper.	
2.	To control the output voltage of DC Supply by MOSFET based Boost chopper.	
3.	To control the output voltage of DC Supply by MOSFET based Buck-Boost chopper.	

Outcome projects from lab:

1. Battery charger using SCR.
2. Simple Rain Alarm system.
3. To control the speed of DC Motor by PWM chopper.
4. To control the speed of single phase Induction Motor by cycloconverter.

Outcomes:

- On successful completion of the Programme ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

DEE 6383: Microprocessor Lab

Introduction: To study 8085 microprocessor system ,8086 microcontroller

Objective: 1. To understand the applications of Microprocessors.
2. To understand need of Microprocessors in computer system.
3. To understand architecture and features of typical Microprocessors.
4. To learn interfacing of real world input and output devices.
5. To study various hardware & software tools for developing applications

Credits: 2 **Semester VI** **L-T-P: 0-0-4**

S. No.	Contents	Teaching Hours
1.	To study 8085 microprocessor system	48
2.	To study 8086 microprocessor system	
3.	To develop and run a programme to find out largest and smallest number	
4.	To develop and run a programme for converting temperature from F to C degree	
5.	To develop and run a programme to compute square root of a given number	
6.	To develop and run a programme for computing ascending/descending order of a number.	
7.	To perform interfacing of RAM chip to 8085/8086	
8.	To perform interfacing of keyboard controller	
9.	To perform interfacing of DMA controller	
10.	To perform interfacing of UART/USART	
11.	To devlope a proper program for addition & substraction of 8-bit number	
12.	To devlope a program for addition & substraction of 16-bit number	
13.	To generate square wave of 8255.	

Intended Outcomes:

- Learn importance of Microprocessors in designing real time applications
- Describe the 8085,8086 & 8255 Microprocessors architectures and its feature.
- Develop interfacing to real world devices. 4. Learn use of hardware & software tools.

DEE 6084: REPAIRING AND MAINTENANCE OF ELECTRICAL APPLIANCES LAB

Introduction: This is most importment lab for diploma student, all the maintaince work like fan, refrigerator, airconditioner, sychronous generator tv etc will be covered

Objective: Electrical equipment deterioration is normal, but equip. ment failure is not inevitable. As soon as new equipment is installed, a process of normal deterioration begins. Unchecked, the deterioration process can cause malfunction or an electrical failure. Deterio. ration can be accelerated by factors such a'sn a hostile environment, overload, or severe duty cycle. An effective EPM program identifies and recognizes these factors and provides measures for coping with

Credits: 2 **Semester: VI** **L-T-P: 0-0-4**

LIST OF PRACTICALS

Module No.	Contents	Teaching Hours
1.	Overhauling and maintence of single phase induction motor(fan).	48
2.	Overhauling and maintence of single phase induction motor useing loop winding method	
3.	Overhauling and maintence of single phase induction motor (24 slots) small motor	
4.	Overhauling and maintence of single phase induction motor (36 slots) 5 HP motor	
5.	Overhauling and maintence of three phase induction motor (24 slots) 5 HP motor	
6.	Overhauling and maintence of three phase induction motor (36 slots) 5 HP motor	
7.	Overhauling and maintence of rotating armature type alternator	
8.	Overhauling and maintence of DC shunt motor	
9.	Overhauling and maintence of DC compound generator	
10.	Overhauling and maintence of two winding transformer	
11.	Overhauling and maintence of auto transformer	
12.	Maintenance and servicing of Electrical Panel of different Machines.	
13.	Maintenance and Servicing of grinding machine.	

Intended Outcomes

- Acquire knowledge about the maintaince of tv
- Acquire knowledge about the maintaince of dc machines as generators and motor
- Acquire knowledge about testing and applications of dc machines

Electives offered by Electrical Engineering Department

ELECTIVE-I

S.N.	SEMESTER	CODE	SUBJECT	TEACHING SCHEME			CREDITS	CONTACT HRS/WEEK
				L	T	P		
1.	IV	DEE 4011	PLC & SCADA SYSTEM	3	0	0	3	3
2.	IV	DEE 4012	AUTOMATION & ROBOTICS ENGINEERING	3	0	0	3	3
3.	IV	DEE 4013	POWER LINE CARRIER COMMUNICATION	3	0	0	3	3

ELECTIVE-II

S.N.	SEMESTER	CODE	SUBJECT	TEACHING SCHEME			CREDITS	CONTACT HRS/WEEK
				L	T	P		
1.	V	DEE5101	ELECTRICAL AND ELECTRONICS ENGINEERING MATERIALS	3	0	0	3	3
2.	V	DEE5011	CONTROL SYSTEM	3	0	0	3	3
3.	V	DEE5012	ELECTRIC TRACTION	3	0	0	3	3
4.	V	DEE5013	ELECTRIC AND HYBRID VEHICLES	3	0	0	3	3