Vision of Department

Electrical and Instrumentation Engineering department shall strive to act as a podium for the development and transfer of technical competence in academics, entrepreneurship and research in the field of Electrical and Instrumentation Engineering to meet the changing need of society.

MISSION

1. To provide modular programmes from skill development to the research level
2. To impart Education and training in innovative state-of-the-art technology in the field of Electrical and Instrumentation Engineering.
3. To promote Promotion of holistic development among the students
4. To provide extension services to rural society, industry professionals, institutions of research and higher learning in the field of Electrical and Instrumentation Engineering.
5. To interact with the industry, educational and research organizations, and Alumni in the fields of curriculum development, training and research for sustainable social development and changing needs of society.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO):

The following Programme Educational Objectives are designed based on the department mission. The Certificate/ Diploma holders of Electrical Engineering should be able to demonstrate

1. skill in professional / academic career using the knowledge of basic engineering principles.
2. ability in solving real life problems related to electrical; engineering.
3. sustained learning and adaptation to modern engineering tools, techniques and practices through instruction, group activity and self-study
4. team work while working with diverse multidisciplinary / interdisciplinary groups.
5. professional ethics and commitment organizational goals

PROGRAMME OUTCOMES (PO):

Electrical Engineering Certificate/ Diploma holders of the SantLongowal Institute of Engineering & Technology, Deemed University, Longowal will have ability to:

1. Apply knowledge of basic engineering principles to solve Electrical Engineering and industrial problems.
2. Identify and troubleshoot the real life problems using principles of mathematics, natural sciences and engineering.
3. Design simple solutions for Electrical engineering problems that meet the specified needs of public health, safety, cultural, societal, environmental considerations etc.
4. Use scientific and technical knowledge for basic design and analysis of experiments
5. Select, and apply recent techniques, resources, and modern engineering and IT tools for engineering system
6. Think logically, analytically and apply reasoning in the contextual knowledge to assess societal, health, safety, legal cultural issues etc.
7. Understand the environmental and societal issues and suggest sustainable solutions.
8. commit to professional ethics, responsibilities and norms of the engineering practice.
9. Function as effective member individually in multidisciplinary and diverse teams.
10. Communicate and present technical knowledge effectively in oral and written forms.
11. Demonstrate knowledge and understanding of project supervision
12. Recognize the need and prepare for lifelong learning.

SCHEME
of
Integrated Certificate and Diploma in Electrical Engineering

DEPARTMENT OF ELECTRICAL AND INSTRUMENTATION ENGINEERING							
THREE YEAR INTEGRATED CERTIFICATE DIPLOMA PROGRAM							
CERTIFICATE IN ELECTRICIAN, DIPLOMA IN ELECTRICAL ENGINEERING							
Semester-I (ICD)							
S.No	**Sub Code**	**Subject Name**	**L**	**T**	**P**	**Hrs.**	**Credits**
1	AM-111	Mathematics- I	4	1	0	5	5
2	PH-111	Physics-I	4	0	2	6	5
3	CY-111	Chemistry-I	4	0	2	6	5
4	HU-111	Communication Skills-I	2	0	0	2	2
5	EE-111	Basic Electrical Engineering	3	0	2	5	4
6	EE-112	Electrical Workshop Practice-I	0	0	4	4	2
7	ME-111	Engineering Drawing	0	0	4	4	2
		Total	17	1	14	32	25
Semester-II (ICD)							
S.No	**Sub Code**	**Subject Name**	**L**	**T**	**P**	**Hrs.**	**Credits**
1	AM-121	Mathematics- II	4	1	0	5	5
2	PH-121	Physics-II	4	0	2	6	5
3	CY-121	Chemistry-II	4	0	2	6	5
4	HU-121	Communication Skills-II	1	0	2	3	2
5	WS-122	Workshop Technology & Practice	0	0	3	4	2
6	CS-121	Computer Fundamentals	3	0	2	5	4
7	EE-121	Electrical Engineering Drawing	0	0	4	4	2
		Total	16	1	15	33	25
Semester-III A (ICD)							
	TP-201	Two Weeks Practical Training during summer vacations			5	80	S/US
Semester-III B (ICD)							
S.No	**Sub Code**	**Subject Name**	**L**	**T**	**P**	**Hrs.**	**Credits**
1	EE-212	D.C. Machines and Transformer	3	1	2	6	5
2	EE-213	Electrical Measurements	3	0	2	5	4
3	EE-214	Transmission & Distribution of Power	3	1	0	4	4
4	EC-211	Fundamentals of Electronics Engineering	3	0	2	5	4
5	EE-215	Electrical Estimation & Costing	3	1	0	4	4
6	EE-216	Maintenance & Repair of Electrical Equipments	2	0	2	4	3
7	MC-211	Moral values and Professional Ethics	1	0	0	1	0
		Total	18	3	8	29	24
Semester-IV (ICD)							
S.No	**Sub Code**	**Subject Name**	**L**	**T**	**P**	**Hrs.**	**Credits**
1	AM-221	Applied Mathematics	3	1	0	4	4
2	EE-222	Sensor and Transducer	3	0	2	5	4
3	EE-223	Electrical Workshop Practice-II	0	0	4	4	2
4	EE-224	Testing & Maintenance of Electrical Machines	0	0	4	4	2
5	EE-225	Utilization of Electrical Energy	3	0	0	3	3
6	EE-226	A.C. machines	3	0	2	5	4
7	EE-227	Electrical Power Generation	3	0	0	3	3

		Total	15	1	12	28	22
Semester-V A (ICD)							
	TP301	Four Weeks Industrial Training during summer vacations			10	160	
Semester-VB (ICD)							
S.No	**Sub Code**	**Subject Name**	**L**	**T**	**P**	**Hrs.**	**Credits**
1	MC-311	Environmental Studies	2	0	0	2	2
2	HU311	Entrepreneurship	2	0	0	2	2
3	EE-311	Electrical Circuit Theory	3	1	2	6	5
4	EE-312	Digital Electronics	3	0	2	5	4
5	EE-313	Control Engineering	3	0	2	5	4
6	EE-314	Electrical Engineering Materials	3	0	0	3	3
7	EE-315	Computer Programming	3	0	2	5	4
8	TP-301E	Industrial Training (Evaluation only)					S/US
		Total	19	1	8	28	24
Semester-VI (ICD)							
S.No	**Sub Code**	**Subject Name**	**L**	**T**	**P**	**Hrs.**	**Credits**
1	EE-321	Microprocessors	2	0	0	2	2
2	EE-322	Industrial Electronics	3	0	2	5	4
3	EE-323	Energy Conservation Practice	3	0	0	3	3
4	EE-324	Switchgear and Protection	3	0	2	5	4
5	EE-325	Industrial Automation	3	0	2	5	4
6	EE-326	Non Conventional Energy Sources	3	0	0	3	3
7	EE-327	Project	0	0	4	4	2
		Total	17	0	10	27	22

	Note:	The required credits for certificate programme	96
		The required credits for ICD programme	142
		Maximum courses in one semester	7
		Maximum Contact Hrs.	32
		The common courses and their credits are fixed for all ICD programmes	

Course Assessment methods:

DIRECT	INDIRECT
1. Internal Test I 2. Internal Test II 3. Quiz 4. Assignment/Tutorials 5. Seminar 6. End Semester Exam	Course End Survey

Direct Assessment Method:

Evaluation of Courses with Theory Components

a. Continuous Assessment Examinations (CAE) carrying 50% weightage.
   i. Two minors carry 40% weightage. Average marks of two minors is taken.. Under extraordinary circumstances, a faculty may take third minor of a particular student.
   ii. Qizzes/ Surprise tests carry 10% weightage. At least two multiple choice questions (MCQ) type quizzes of 15 minutes or assignments/tutorials or seminar per semester are required to check his/her involvement in the course.
b. End Term Examination (ETE) carrying 50% weightage.
   The structure of the question paper shall be as under: -
   i. The question paper shall have three sections and students to attempt five questions which carry equal marks, with weightage shall be given to the numerical type problems, wherever possible.
   ii. Section-I will have one compulsory question of short answer type questions covering whole syllabus. Section-II and Section-III shall contain three questions covering the entire course syllabus and the students need to attempt two questions from each section.

It is mandatory to secure 30% marks from theory component by the student.

Evaluation of Courses with Practical component

a. Continuous Assessment Examinations (CAE) carrying 60% weightage.
   i. Continuous assessment in Laboratory/ Practical works (Experiment performance and quizzes etc) caries 40% weightage
   ii. Regularity/ attendance caries 10% weightage.
   iii. Laboratory record caries 10% weightage.
b. End Term Examination (ETE) carrying 40% weightage.
   i. Laboratory Experiment/ Procedure writing/ Tabulation/ Equation as applicable carries 30% weightage.
   ii. Viva voce examination/ Laboratory quiz carries 10% weightage

It is mandatory to secure 30% marks from Practical component by the student.

Evaluation of Courses with Theory and Practical Components.

Procedure for evaluation of theory component and practical components is same as detailed above.

a. Theory component has 75% weightage
b. Practical Component has 25% weightage.
c. It is mandatory to secure 30% marks each from Theory and Practical component by the student.
d. In case student fails to secure minimum qualifying marks in any component, E grade will be awarded.

SYLLABUS
of
Integrated Certificate and Diploma in Electrical Engineering

Title of the course : Electrical Workshop Practise-I
Subject Code : EE-112

L	T	P	Credits	Weekly Load
0	0	4	2	4

Course Outcomes:
After successful completion of course, the students should be able to
CO1: Identify and utilize various electrical components.
CO2: Make various types of joints.
CO3: Acquire the knowledge about working of various lamps.
CO4: Design domestic and godown wiring circuits.
Pre-requisite knowledge: NIL

CO/PO Mapping : (Strong(S) / Medium(M) / Weak(W) indicates strength of correlation):												
COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M											S
CO2					S			S				M
CO3	S					W						M
CO4					M	W		S	M	W	M	M

Practical:

Ex. No.	List of study and practical exercises.	Hour(s)
1	Introduction with Electrical Symbols.	2
2	Familiarization with tools used in Electrical works	2
3	Introduction with Electrical Materials.	2
4	Introduction with Abbreviations Commonly used in Electrical Engineering.	2
5	Introduction of Electrical safety precaution.	2
6	To make ‘Straight’ joint on 1/18 PVC wire.	4
7	To make ‘T’ joint on 1/18 PVC wire.	4
8	To make ‘Britannia’ joint on GI wire.	4
9	To study fluorescent tube light.	4
10	To study Sodium lamp.	4
11	To study high pressure mercury vapour lamp. (H. P. M. V).	4
12	To wire up a circuit with two lamp controlled by two switch.	4
13	To wire up a circuit with one lamp controlled by one switch	4
14	To wire a circuit used for staircase wiring.	4
15	To study Godown wiring.	4

Recommended Books-

1. D K Sharma, Basic *Electrical and Electronics Engineering*, CBS publisher
2. H Partab, *Electrical Gadgets,*
3. R.P. Singh , *Electrical Workshop: A text Book*, I K International Publisher House Pvt. Ltd

Title of the course : Basic Electrical Engineering
Subject Code : EE-113

L	T	P	Credits	Weekly Load
3	0	2	4	5

Course Outcomes:
After successful completion of course, the students should be able to

CO1: Apply the knowledge of Electrical Engineering principles to solve D.C and A. C. circuits.
CO2: Formulate and analyse electrical circuits.
CO3: Understand basic principles of electromagnetism to implement in electrical machines and transformers.
CO4: Identify and select various electrical machines according to the applications.
CO5: Apply the ethical principles for troubleshooting and installation of safety devices as per norms of engineering practice.

Pre-requisite knowledge: NIL

CO/PO Mapping : (Strong(S) / Medium(M) / Weak(W) indicates strength of correlation):												
COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S				M							
CO2		S	S									
CO3					S	M						S
CO4	S					M				W		S
CO5								S		W		M

Theory:

Unit	Main Topics	Course Outlines	Hour(s)
Unit-1	**Basic Concepts**	Electric Charge, Current and Electromotive force, Potential and Potential Difference; conductor, semiconductor insulator and dielectric; Electrical Power and Energy; Ohm's Law, Resistance, and color coding; Capacitance and Inductance, their ratings; Effects of Temperature on Resistance, Series and Parallel Connection of Resistances and capacitances, Kirchoff's Laws and Their Applications	06
	AC Fundamentals	Concept of Alternating Voltage and Alternating Current (AC), Difference between AC and Direct Current (DC), Various Terms Related with AC Waves; Root Mean Square (RMS) and Average Values, Concept of Phase and Phase Difference, Single Phase and Three Phase Supply; three phase Star-Delta connections, Inter-Relation between phase voltage/current and line voltage/current; Alternating Voltage applied to Pure Resistance, Pure Inductance, Pure Capacitance and their combinations, Concept of Power and Power Factor in AC Circuit.	08

	Measuring Instruments	Principle and Construction of Instruments used for Measuring Current, Voltage, Power and Energy, Methods and precautions in use of these and other instruments e.g. digital multimeters, oscilloscopes, signal generators etc.	03
	Electrical Safety	Electrical Shock and Precautions against it, Treatment of Electric Shock; Concept of Fuses and Their Classification, Selection and Application; Concept of Earthing and Various Types of Earthing, Miniature Circuit Breakers (MCBs), Earth Leakage Circuit Breaker (ELCBs) and their Application.	04
Unit-2	**Electromagnetic Induction**	Concept of Magnetic Field, Magnetic Flux, Reluctance, Magneto Motive Force (MMF), Permeability; Self and Mutual Induction, Basic Electromagnetic laws, Effects on a Conductor Moving in A Magnetic Field, various losses in magnetic circuits;	04
	Electrical Machines and Transformers	Elementary concepts of an electrical machine, Basic principle of a motor and a generator, Torque due to interaction of two magnetic fields and the concept of torque angle, Common features of rotating electrical machines, Classification of Electrical machines; Principles, Construction and Working of various machines; Starters: Need, Construction and Operation, Need of a transformer, classification, Principles, Construction and Working of a Transformer, Applications of Transformers;	10
	Utilization of Electricity	Utilization concepts of Electricity for electrolysis process e.g., Electroplating and Electro refining, Electrometallurgy and electrotyping etc., Electrochemical Cells and Batteries; Application of Electricity for Heating, Ventilating and air-conditioning, Melting and other Metallurgical processes, Welding and illumination.	04
	Basic Trouble-shooting	Basic Testing and faults diagnosis in electrical systems, various tools and their applications, replacement of different passive components e.g. fuses, lamps and lamp holders, switches, cables, cable connectors, electromagnetic relays.	04

Recommended Books-

1. D P Kothari and I J Nagrath, *Basic Electrical Engineering,* TMH.
2. D P Kothari and I J Nagrath, *Electrical Machines,* TMH.
3. Edward Hugh, *Electrical Technology,* Pearson Education.
4. S K Bhattacharya, *Electrical Machines,* TMH.

List of Practicals: EE-113

1. Study of various passive components and measuring instruments and their connections in electrical circuits.
2. Verification of Ohm's Law.
3. Verification of Kirchoff's laws (KCL and KVL).
4. Verification of equivalent resistances in series and parallel connections.
5. Measurement of various characteristic values of a Sinusoidal waveform with the help of Cathode Ray Oscilloscope (CRO).
6. Measurement of voltage, current and power in Resistance-Inductance (RL) and Resistance-Inductance-Capacitance (RLC) circuits and Verification of phase angle and power factor concept.
7. Study of various types of earthings.
8. Study of various types of protection devices e.g. fuses, MCBs and ELCBs
9. Verification of Faraday's laws and Lenz's law.
10. Study of various types of DC motors and their starters.
11. Study of various types of AC motors and their starters.
12. Study of various types of transformers and Verification of turns ratio.
13. Starting and reversing various AC and DC motors.
14. Fault diagnosis and removal in general electrical connection /apparatus.

Title of the course : Electrical Engineering Drawing
Subject Code : EE-121

L	T	P	Credits	Weekly Load
0	0	4	2	4

Course Outcomes:
After successful completion of course, the students should be able to
CO1: Identify and use the symbols of various electrical equipments.
CO2: Understand the light and fan circuits using various switches.
CO3: Learn special circuits (like stair case, godown wiring etc.) operation and wiring layout.
CO4: Create the assembly drawings of simple electrical equipments.
CO5: Draw the layouts of power plants, substations and various types of earthing.
Pre-requisite knowledge: NIL

CO/PO Mapping : (Strong(S) / Medium(M) / Weak(W) indicates strength of correlation):

Cos	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2	S	M				S						M
CO3	S	M	S			S						M
CO4	S											
CO5	S		S			S						

Unit	Main Topics	Course Outlines	Hour(s)
Unit-1	**Electrical Symbols**	List of symbols for electrical equipments and accessories used in electrical works. Light, fan and power circuits, alarm and indicating circuit, contactor control circuits as per I.S.S. Different types of cables, switches, distribution board, switch board, boxes, batten and its accessories, conduit and its accessories, lamp holders, socket out lets, plug ceiling roses. Fuse and energy meter used in domestic and power wiring installations.	10
	Light and fan circuits	Fluorescent tube wiring Light and fan controlled by necessary switches and regulators wiring layout of a 2 bedroom house	10
	Special Circuits	(i) Godown wiring (ii) Stair case wiring (iii) Corridor lighting	10

		(iv) One lamp controlled by three or more switches.	
Unit-2	**Assembly Drawings**	(i) Assembly drawing of simple electrical equipment from actual piece or from a pictorial view (carbon brush holder, open knife switch, miniature circuit breaker, motor terminal block, and similar other electrical items (ii) Poles, towers cables and insulators	8
	Earthing metals	Pipe earthing, Plate earthing	6
	Substation layout	Layout diagram of 66KV substation Circuit breakers	8
	Power plants layout	Hydro power plant layout Thermal power plant layout	8

Recommended Books-

1. S K Bhattacharaya, *Electrical Engineering Design and Drawing*,SKkataria and Sons
2. S K Sahdev, *Electrical Engineering Design and Drawing*, Uneek Publication
3. Surjeet Singh, *Electrical Engineering Design and Drawing,* DhanpatRaiand Co.
4. Ubhi and Marwaha ,*Electrical Engineering Design and Drawing*,IPH, New Delhi.

Title of the course : DC Machines and Transformers
Subject Code : EE-212

L	T	P	Credits	Weekly Load
3	1	2	5	6

Course Outcomes:
After successful completion of course, the students should be able to
CO1: Understand the construction and working principle of single and two winding transformers.
CO2: Operate the single-phase transformers in parallel.
CO3: Acquire the knowledge to design and operate DC machine.
CO4: Learn and perform various tests of DC machines.
Pre-requisite knowledge: EE-113 (Basic Electrical Engineering)

CO/PO Mapping : (Strong(S) / Medium(M) / Weak(W) indicates strength of correlation):												
COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											S
CO2					M			S	W			M
CO3	S		S									S
CO4	M							S				S

Theory:

Unit	Main Topics	Course Outlines	Hour(s)
Unit-1	**Transformers**	Working principle, construction of single phase transformer, Electro Motive Force (EMF) equation, phasor diagrams on no-load and on loaded conditions, open circuit and short circuit tests, equivalent circuit parameters estimation, voltage regulation and efficiency, back to back test. Effect of saturation on exciting current and in-rush current phenomenon. Parallel operation of single phase transformers.	12
	Auto Transformers	Principle of operation, equivalent circuit and phasor diagrams, comparison with two winding transformer.	10
Unit-2	**D.C. Generator**	Working principle , construction of Direct Current (DC) Machines, Armature windings, single and double layer winding diagrams, E.M.F. and torque equations, armature reaction, effect of brush shift, compensating winding, commutation, causes of bad commutation, methods of improving commutation, methods of excitation of d.c. generators and their characteristics.	12
	D.C. Motor	Working principle characteristics, starting of shunt and series motor, starters, speed control methods: field and armature control. Braking: plugging, dynamic and regenerative braking, Testing:Swinburn's test, Hopkinson test, Field test. Estimation of losses and efficiency	12

Recommended Books-

1. Edward Hughes, *Electrical Engineering*, Tata McGraw Hill
2. I. J. Nagrath and D.P. Kothari , *Electrical Machines*, Tata McGraw Hill
3. J. B. Gupta, *Electrical Engineering*, S.K.Kataria
4. S. KSahdev*, Electrical Machines,* Unique publisher
5. S.K. Bhattacharya, *Electrical Machines*, Tata McGraw Hill

List of Practicals: EE-212

1. Measurement of induced EMF and magnetising current under open circuit condition in D.C. generators.
2. Determination of the relationship between terminal voltage and load current keeping speed constant for

(a) Separately excited generator keeping excitation constant
(b) D.C. shunt generator.

3. To measure the variation in no load speed of a separately excited D.C. motor for the variation in

(a) Armature circuit resistance
(b) Field circuit resistance.

4. Measurement of the speed of a D.C. series motor as a function of the load torque.
5. (a) No-load and short circuit test on a single phase transformer.

(b) Determination of efficiency and regulation of transformer.

6. To determine the insulation resistance of a transformer at no load and at full laod condition.

Title of the course : Electrical Measurement
Subject Code : EE-213

L	T	P	Credits	Weekly Load
3	0	2	4	5

Course Outcomes:
After successful completion of course, the students should be able to
CO1: Acquire knowledge of the characteristics of measuring instruments and their classification.
CO2: Be conversant in construction, working of measuring instruments and their proficient use.
CO3: Acquire knowledge various methods of electrical parameters measurement.
CO4: Be competent to handle various instruments for the measurement of electrical quantities.
Pre-requisite Knowledge: EE-113 (Basic Electrical Engineering)

CO/PO Mapping : (Strong(S) / Medium(M) / Weak(W) indicates strength of correlation):												
COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S					M		M				W
CO2	S		S	M		M		M		M		W
CO3	M				M	M						
CO4	M				M	M			M	M		M

Theory:

Unit	Main Topics	Course Outlines	Hour(s)
Unit-1	**Analog instruments**	Analog instruments, classification of analog instruments, Principles of operations, operating forces, constructional details, control systems, damping systems, Symbols used for analog instruments.	08
	Analog voltmeter, ammeter and ohmmeter	Types of instruments, Permanent Magnet Moving Coil (PMMC) instruments, shunts and multipliers, ohmmeters-series and shunt type, torque equation moving iron instruments, torque equations, Advantages , disadvantages and their comparison, .	08
	Measurement of power and energy	Electrodynamometer type of instruments, Power in Alternating current (AC) and Direct Current (DC) circuits, single phase wattmeter, measurement of power in single and three phase circuits. Energy meter for ac circuits, single phase induction type watt hour meter.	08
Unit-2	**Measurement of phase and frequency**	Single phase electrodynamometer and moving iron power factor meters, Frequency meters and their types, phase sequence indicators.	08
	Measurement of resistance	Classification of resistances, measurement of medium resistance with voltmeter-ammeter method, Wheatstone bridge and substitution method, measurement of low resistance with the Kelvin double bridge, Potentiometer method, Measurement of high resistance with the direct deflection method, Loss of charge	08

		method and megger.	
	AC Bridges	General form of AC bridge, Measurement of inductance , capacitance and frequency, Maxwell bridge, Hay bridge, De Sauty bridge, Schering bridge etc., sources of error and their minimization	08

Recommended Books-

1. A. K.Sawhney and PuneetSawhney,*ACourse on Electrical and Electronic Measurements and Instrumentation*, DhanpatRai and co..
2. David A Bell, *Electronic Instrumentation and Measurement*, Prentice Hall of India

List of Practicals: EE-213

1. Use of multimeter for measuring voltage, current and resistance.
2. To calibrate single-phase energy meter by direct loading method.
3. To measure the value of earth resistance.
4. To measure power, power factor in a single-phase circuit, using wattmeter and power factor meter and verify results with calculations.
5. Measurement of power and power factor of a three-phase balance load by two-wattmeter method.
6. Measurement of voltage, frequency of a Sinusoidal signal with Cathode Ray Oscilloscope (CRO).
7. Measurement of power in a three phase circuit using Current Transformer (CT), Potential Transformer (PT) and three- phase energy meter.
8. Connecting appropriate instruments at the supply of an installation to measure supply voltage, frequency, power, maximum demand, Phase sequence and energy consumed.
9. Use of LCR meter for measuring inductance, capacitance and resistance.
10. Connection of three-phase energy meter in an electrical system for Measurement of energy.
11. To determine the input impedance of a multimerter.
12. To determine the error in Measurement in voltage when a multimeter is used and then Digital Volt Meter (DVM) [Vacuum Tube voltmeter (VTVM)] is used.

Title of the course : Power System-I (Transmission and Distribution)
Subject Code : EE-214

L	T	P	Credits	Weekly Load
3	1	0	4	4

Course Outcomes:
After successful completion of course, the students should be able to
CO1: Acquire the knowledge of generation, transmission and distribution of electric power.
CO2: Analyse the performance of various types of conductors used in overhead transmission lines
CO3: Grasp the knowledge of various components of transmission line and substation.
CO4: Understand the concept and requirement of Extra High Voltage Alternating Current (EHVAC) transmission.
CO5: Learn about different cables and their construction.
Pre-requisite knowledge: NIL

CO/PO Mapping : (Strong(S) / Medium(M) / Weak(W) indicates strength of correlation):												
Cos	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											S
CO2		S	M		S							
CO3	M											S
CO4	M					S	M					M
CO5								W				S

Theory:

Unit	Main Topics	Course Outlines	Hour(s)
Unit-1	**Basics Of Transmission**	Introduction to transmission, Necessity of transmission of electricity, Classification and comparison of different transmission systems.	08
	Transmission Line Components.	Introduction to line components, types of conductors-Copper, Aluminium and state their trade names, Solid, Stranded and bundled conductors, Line supports – requirements, types, and field of applications, Line insulators – requirements, types, and field of applications, Failure of insulator and reasons of Failure, Distribution of potential over a string of suspension insulators, Concept of string efficiency, Methods of improving string efficiency, Corona – corona formation, advantages and disadvantages, factors affecting corona, important terms related to corona, Spacing between Conductors, Calculation of Span length and sag	08
	Tansmission Line Parameters	Resistance (R), Inductance (L) and Capacitance (C) of Single phase and three phase transmission line and their effects on line, Skin effect, proximity effect and Ferranti effect, Concept of transposition of conductors and necessity.	08

	Performance Of Transmission Line.	Classification of transmission lines, Losses, Efficiency and Regulation of line, Performance of single phase short transmission line (Numerical based on it), Effect of load power factor on performance, Medium transmission lines-End condenser, Nominal T and Nominal-Π (pi), Network with vector diagram, General circuit and Generalised Circuit Constants(A, B, C, D)	08
Unit-2	**Extra High Voltage Transmission.**	Introduction and Requirement, extra high voltage AC (EHVAC) Transmission, Reasons for adoption and limitations, High Voltage DC Transmission – Advantages, Limitations.	08
	Components Of Distribution System	Introduction, Classification of distribution system, A.C distribution, Connection schemes of distribution system, Requirements of Distribution systems, Design consideration, A.C. distribution calculations, Methods of solving A.C.-Single phase and three phase connected (balanced) distribution system, (Numericals based on single phase and three-phase balanced distribution system)	08
	Underground Cables	Introduction and requirements, Classification of cables, Cable conductors, Cable construction, Cable insulation, Metallic sheathing and mechanical protection, Comparison with overhead lines, Cable laying	08
	Substations	Introduction, Classification of indoor and outdoor sub-stations, Advantages and Disadvantages, Selection and location of site, Main connection schemes, Equipment's circuit element of substations, Incoming and outgoing lines, Transformers, Current Transformer (CT) and Potential Transformer (PT), Relays, Circuit Breakers (CB's), fuses, Isolators, batteries, lightning arresters. Insulators, Bus bar's material, types in detail, Connection diagram and layout of sub-stations.	08

Recommended Books-

1. J. B. Gupta, *Transmission and Distribution of Electrical Energy,* Katson Publication.
2. Pitman, A. T. Star*, Generation and transmission of electrical energy*,S. K. Khanna
3. Soni-Gupta-Bhatnagar, *A Course in Electrical Power*, DhanpatRai
4. S. L. Uppal., *A Course in electrical power*, S. K. Khanna
5. V. K. Mehta, *Principals of power system*, S. Chand and Company

Title of the course : Electrical Estimation and Costing
Subject Code : EE-215

L	T	P	Credits	Weekly Load
3	1	0	4	4

Course Outcomes:

After successful completion of course, the students should be able to

CO1: Choose different wiring systems according to the requirement.

CO2: Install various domestic circuits and sub-circuits.

CO3: Design lighting schemes for factories, streets etc.

CO4: Acquire knowledge about various methods of earthing.

CO5: Make estimate and install power circuits for motors.

CO6: Prepare an estimate for installation of Overhead (O.H.) lines and underground cables for transmission and distribution.

Pre-requisite knowledge: EE-112 (Electrical Workshop Practise-I)
EE-113 (Basic Electrical Engineering)

CO/PO Mapping : (Strong(S) / Medium(M) / Weak(W) indicates strength of correlation):												
COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M					S	M	S				S
CO2	S							S	S		M	M
CO3								M	S		M	W
CO4						S	M	W				S
CO5								M		S	S	
CO6	M							S		S	S	

Theory:

Unit	Main Topics	Course outlines	Hour(s)
Unit-1	**Introduction**	Estimating, Electrical schedules; Catalogues, Recording of estimates, Determination of required quantity of material, Determination of cost of material and labour, Contingencies, overhead charges, Profit, Tender form and Exercises	2
	Wiring Systems	Introduction: Systems of distribution of electrical energy, Methods of wiring, Systems of wiring, Comparison between various systems of wiring, Choice of wiring system and exercises	4
	Wiring Material and Accessories	Wire and cable : Conductor materials used in cables, Insulating material, mechanical protection, Types of cables, voltage grading of cables, General specification of cables, Main switch and distribution boards, Conduits, Conduit accessories and fittings, Lighting accessories and fitting, Fuse, Types of fuses, Important definitions, Determination of size of fuse wire, Fuse units, Earthing conductor, Energy meter and exercises.	6
	Earthing Systems	Earthing: I.S. specifications regarding earthing of electrical installation, Points to be earthed, Factors influencing the earth	6

		resistance, Methods of reducing earth resistance of system, Earth electrode and earth lead, Types of earthing, Determination of size of earth wire and earth plate for domestic and motor installation, Material required for Galvanized Iron (G.I.) pipe earthing, Specification of earth wire and earth plate,	
	Testing of Installations	Testing of wiring installation, Inspection of internal wiring installation, Reasons for excess recording of energy of energy consumption by energy meter.	3
	Lighting Sub-Circuits	Circuits and sub-circuit, Types of lighting circuits, Various circuit diagrams: Two-way switching, bed room lighting, Fluorescent lamps and accessories and exercises	3
Unit-2	**Lighting Schemes and Calculations**	Lighting; Lighting Schemes , Electric lamps, Comparison between tungsten filament lamps and fluorescent tubes, Design of lighting schemes, Factory lighting, street lighting, Methods of lighting calculation, examples.	4
	Internal Wiring Estimation	General rules for wiring; Determination of number of points, determination of total load, Determination of number of sub-circuits, Determination of rating of main switch and distribution board, Determination of size of conductor, layout , Specimen internal wiring estimates	4
	Electrical Installation for Power Circuits	Introduction, Important points about motor installation wiring, Determination of input power, Determination of input current to the motors, Determination of rating of cables, Determination of rating of fuses, Determination of size of conduit, distribution boards, main switch and starter, Specimen estimates, Exercise and problems	4
	Overhead and Underground Transmission and Distribution	Introduction: Main components of overhead line, Line supports, Clearance of conductor from ground, Spacing between conductors, Factors governing height of pole, Conductors: Determination of size of conductor for overhead line, Insulators; Cross arm, Clamps, Stay wire, Lighting arrestors, Phase plate, Danger plate, Earthing of transmission line, Important specifications, Underground cables: Method of laying underground cables, cable terminal box, specimen,	5
	Installation of Service Connections	Service line: Methods of installation of service lines, Specimen estimates, Exercise and Problems	2
	Substations	Introduction: Classification, Indoor substations, outdoor substations, Advantages and disadvantages of outdoor substations, Selection and location of site, Main connection schemes. Graphical symbols for various types of apparatus and circuit elements on substation main connection diagram, Equipment for substations and switchgear installations, Substations auxiliaries supply, Specimen estimates, Exercises and Problems	5

Recommended Books-

1. J. B. Gupta, *ElectricalInstallation*,*Estimatingand Costing*, S.K.Kataria
2. N. Alagappanand B. Ekambaram*, ElectricalEstimatingand Costing,*TMH
3. S. L. Uppal, *Estimatingand Costing*, KhannaPublishers
4. S.K. Bhattacharya, *Estimatingand Costing*, Tata McGraw Hill
5. SurjeetSingh, *Estimatingand Costing*, DhanpatRai and Co.

Title of the course : Maintenance and Repair of Electrical equipment
Subject Code : EE-216

L	T	P	Credits	Weekly Load
2	0	2	3	4

Course Outcomes:

After successful completion of course, the students should be able to

CO1: Acquire the knowledge to use various electrical tools.
CO2: Dismantle, test and find fault in domestic electrical equipment.
CO3: Diagnose faults in various electronic components.
CO4: Troubleshoot various advanced electrical equipments.

CO/PO Mapping : (Strong(S) / Medium(M) / Weak(W) indicates strength of correlation):												
COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S					S						S
CO2	M					S	M	S	M		W	S
CO3	S					W						M
CO4	M					M	M	S	M	M	W	M

Theory:

Unit	Main Topics	Course Outlines	Hour(s)
Unit-1	**Introduction**	Principle different effects of electric currents, materials used in electrical equipments, tools / instruments necessary for repair works, jointing methods, soldering, testing of instruments, Interpretation, location and identification of faults, recording / estimation of materials / components required and their cost ,approximate costing of repair of equipment.	12
	Trouble Shooting	Domestic electrical equipment, Principle, types, construction, operation, testing, fault finding, dismantling, assembly and testing after repairs of following equipments electric Iron all types, electric ovens, electric fans and regulators, water heaters, geysers mixers, food processors, toasters.	12
Unit-2	**Misc. Circuits**	Circuits used for control and regulation of electronic circuits like rectifiers, amplifier timer, oscillator, identification of component, component testing, with multimeters replacement of components, microwave and use microwave for heating, laser and laser equipment	12
	Trouble Shooting of Advanced Equipments	Advanced equipments principle, types, construction, operation, Testing, fault finding, dismantling, assembly and testing after repairs of following equipments- Uninterrupted Power Supply (UPS) / Inverters, battery chargers, microwaves,ovens, air coolers, Washing machines – semi automatic / fully automatic, remote controllers of different equipments, Video Compact Disc (VCD) /Digital Versatile or Video Disc (DVD) / Audio Compact	12

		Disc (ACD) players.	

Recommended Books

1. B.L.Theraja, *Electrical Technology*, S.Chand.
2. K. S. Jamwal, *Maintenance of Electronic Equipment,* DhanpatRai and Co.
3. P. S.Dhogal, *Basic Electrical Engineering*, TMH.
4. R. P. Gupta*, Maintenance of Electrical Equipments*, DhanpatRai and Co.
5. R. S. Khandpur, *Modern Electronic Equipment*, TMH

List of Practicals: EE-216

A) Laboratory Experiences:

Dismantling, assembly, testing, preparation of list of components, parts and their cost for:

1) Electric iron all types
2) Electric oven
3) Electric toasters
4) Electric fan (Ceiling Fan, Table Fan, PF, and Exhaust Fanand regulators)
5) Water heaters and geysers
6) Mixer and food processors
7) UPS / Inverters / battery chargers
8) Air coolers (portable / desert type)
9) Semi-automatic and fully automatic washing machine
10) VCD / DVD / AVD players
11) Microwave Ovens
12) All types remote controllers

B) Field work:

13) Visit servicing centers of manufacturing companies, write the procedure of servicing of any one of them.
14) Visit a manufacturing unit and prepare a report based on it.

C) Mini project:

15) For given specific application of any two equipments collect literature of differentmanufacturing companyand prepare a comparative chart.
16) Prepare test reports and bills for servicing of above any two equipments.

D) Learning Resources:

17) Service Manuals of manufacturers

Title of the course : Sensors and Transducers
Subject Code : EE-222

L	T	P	Credits	Weekly Load
3	0	2	4	5

Course Outcomes:
After successful completion of course, the students should be able to
CO 1: Introduce different type of transducers.
CO 2: Learn the construction and working principle of Resistive transducer, Inductive transducer, Piezoelectric transducer, Capacitance Transducer
CO 3: Study classification and construction of different digital encoding transducers.
CO 4: Know different type of photoemissive, photovoltaic and photoconductive cells.
CO 5: Describe the load cell, strain gauge and inductive torque meter.

CO/PO Mapping : (Strong(S) / Medium(M) / Weak(W) indicates strength of correlation):

Cos	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S					S						S
CO2	S	M				M						
CO3		M			M	M						S
CO4		M				M						S
CO5		M										

Theory:

Unit	Main Topics	Course Outlines	Hours
Unit-1	**Introductions**	Definitions and types of transducers, Characteristics And Choice Of Transducers, Factors Influencing The Choice Of Transducers	06
	Resistive Transducers	Construction, working principles, types, applications, advantages and disadvantages of potentiometers and strain gauge, Resistance temperature Detectors (RTD), Thermocouples and Thermistors	06
	Inductive Transducers	Basic principles of Variable Inductance Transducers, Electromagnetic pick up, Induction potentiometer, Linear variable differential transformer (LVDT), Variable reluctance transducers.	06
	Piezoelectric Transducers	Basic principle and uses of piezoelectric transducers, Piezoelectric crystals and their properties, General forms of piezoelectric transducers	06

Unit-2	**Capacitance Transducers**	Basic principles and types of Variable Capacitance Transducers, frequency response, advantaged disadvantages and uses of capacitive transducers Capacitance pick up, Condenser microphones, Differential capacitor pick up.	06
	Digital Encoding Transducers	Definition , classification, construction of digital encoding transducers, optical displacement transducers, shaft encoders	06
	Photo electric devices	Definitions and types photoemissive cells, Photovoltaic, photoconductive cells	06
	Other Transducers	Load cell, strain gauge and inductive torque meter magnetostrictive transducers electrical tachometers (Alternating Current and Direct Current both)	06

Recommended Books-

1. A.K. Sawhney, *A Course in Electrical and Electronic Measurements and Instrumentation*, DhanpatRai
2. E.O. Doeblin, *Measurement Systems*, McGraw Hill
3. Nakra, *Instrument Measurement and Analysis*, PHI
4. Rangam, Sarmaand Mani, *Instrumentation -Devices and Systems*, TMH
5. W.D. Cooper, A.D. Helfrick, *Electronic instrumentation and measurement techniques*, PHI

List of Practicals: EE-222

1. To study the characteristics of LVDT.
2. To study the characteristics of Variable Capacitor.
3. To study the characteristics of Light Dependent Resistor(LDR).
4. To study the characteristics of Strain Gauge.
5. To study the characteristics of Crompton Potentiometer.
6. To study the characteristics of Resistance Temperature Detector (RTD).
7. To study the characteristics of Thermistor.
8. To study the characterstics of Thermocouple.

Title of the course : Electrical Workshop Practise-II
Subject Code : EE-223

L	T	P	Credits	Weekly Load
0	0	4	2	4

Course Outcomes:

After successful completion of course, the students should be able to

CO 1: Know the importance of safety devices in domestic installation..
CO 2: Learn different types of house wiring and wiring tools.
CO 3: Understand distribution of electrical energy in domestic electric installation.
CO 4: Study different type of home appliances.

CO/PO Mapping : (Strong(S) / Medium(M) / Weak(W) indicates strength of correlation):

Cos	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						S						S
CO2						M						
CO3					M	M						S
CO4						M						S

List of Practicals: EE-223

Exp. No.	List of study and practical exercises.	Hours
1	Introduction of Electrical safety precaution.	2
2	Importance of Safety device in domestic installation Study of safety devices such as Fuses, Miniature circuit breaker (MCB), Moulded Case Circuit Breaker (MCCB), Earth Leakage Circuit Breaker (ELCB) andEarthing.	4
3	Study of wiring tools and accessories	2
4	Electrical wiring practices (House wiring) Distribution of electrical energy in a domestic electrical installation.	4
5	Study of home appliances – Table Fan.	2
6	Study of home appliances – Ceiling Fan.	4
7	Study of home appliances – Mixie.	4
8	Study of home appliances – Electric Iron.	4
9	Study of home appliances – Geyser.	4
10	Study of home appliances – Desert Cooler.	4
11	Study of home appliances – Refrigerator.	4

12	Study of home appliances – Air Conditioner.	4
13	Study of home appliances – Energy meter.	4
14	Study of motor starter – Direct Online Starter (DOL).	4
15	Study of – Contactors, Circuit Breaker used in Electrical Engineering.	4

Recommended Books-

1. D. K. Sharma, *Basic Electrical and Electronics Engineering*, CBS publisher
2. H.Partab,*Electrical Gadgets*, DhanpatRai and Sons
3. R. P. Singh, *Electrical Workshop: A text Book*, I. K. International Publisher House Pvt. Ltd

Title of the course : Testing and maintenance of Electrical Machines
Subject Code : EE-224

L	T	P	Credits	Weekly Load
0	0	4	2	5

Course Outcomes:

After successful completion of course, the students should be able to

CO 1: Understand circuit diagram, connection to perform routine test and different parameter of single and three phase induction motor.

CO 2: Perform polarity test and back to back test of two single phase transformers and parallel operation of transformers and alternator.

CO 3: Perform open circuit and short circuit test on induction motor and brake test on DC series motor and plot its characteristics.

CO 4: Observe and carry out maintenance of motor in workshop.

CO 5: Learn to prepare trouble-shooting chart for single and three phase transformers, single and three phase motors.

CO/PO Mapping : (Strong(S) / Medium(M) / Weak(W) indicates strength of correlation):

Cos	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S			M								
CO2	S	W	M									
CO3	S		M									
CO4	S											M
CO5	S	M	M						M			S

List of Practical: EE-224

1. Draw circuit diagram, select appropriate meters, connect it to perform routine test on single phase Induction motor
2. As per the given circuit diagram perform routine test on three phase Induction motor, and calculate the different parameters
3. Select two single phase transformers, perform polarity test, and mark its terminals, select appropriate meters and perform back to back test, compare its regulation with direct loading method.
4. Perform parallel operation of transformer as per Indian Standards (I.S.)
5. Perform parallel operation of alternator as per I.S.
6. Carry out open circuit (OC) and short circuit (SC) test on Induction motor, plot circle diagram, and calculate parameters
7. Perform brake test on DC series motor and plot characteristic of output against torque, speed,load current as per I. S. list suitable applications.

B) Field work:

8. Observe and carry out weekly, monthly and yearly maintenance of motor in your workshop and prepare itsreport

C) Mini project:

9. Prepare trouble-shooting chart for single and three phase transformers

10. Prepare trouble-shooting chart for single and three phase motors

Recommended Books-

1. B. L. Theraja, *Electrical technology Vol I to IV*, S. Chand and Co., New Delhi
2. B. V. S. Rao, *Operation and Maintenance of electrical machines Vol-I and Vol-IV*, Media Promoters and Publishers Ltd. Mumbai.
3. C.J. Hubert, *Preventive maintenance handbook and journal.*

Title of the course : Electrical Utilization and Traction
Subject Code : EE-225

L	T	P	Credits	Weekly Load
3	0	0	3	3

Course Outcomes:
After successful completion of course, the students should be able to
CO 1: Analyse the various method of illumination and electric traction system.
CO 2: Understand the different method of electric welding.
CO 3: Learn about electric traction system
CO 4: Know requirement and classification of Braking Systems with qualitative description.

CO/PO Mapping : (Strong(S) / Medium(M) / Weak(W) indicates strength of correlation):												
Cos	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M										M
CO2	S	M	W				M					S
CO3	S						M					S
CO4	S	M				M						

Theory

Unit	Main Topics	Course outlines	Hours
Unit-1	**Illumination:**	Definitions of Terms Used in Illumination:Light, Luminous Flux, Luminous Intensity, Lumen, Candle Power, Illumination, Lux or Meter Candle, Mean Horizontal Candle Power (MHCP), Mean Spherical Candle Power (MSCP), Mean Hemi-spherical Candle Power (MHSCP), Reduction Factor, Lamp Efficiency, Specific Consumption, Glare, Space-Height Ratio, Utilization Factor, Maintenance Factor, Depreciation Factor, Waste Light Factor, Absorption Factor, Reflection Factor, Solid Angle.Laws of Illumination: Law of Inverse Squares (Lambert's Cosine Law. (No Numerical) Sources of Light: Construction, Working and Applications of Following Lamps (Incandescent Lamps, Halogen Lamps, Low Pressure Mercury Vapour Lamps (Fluorescent Tube), High Pressure Mercury Vapour Lamps, Sodium Vapour Lamps, Compact Fluorescent Lamps (C.F.L.), Metal Halide Lamps, Light emitting diode(LED) Lamps	12
	Electric Heating	Advantages of Electric Heating. Modes of Transfer of Heat: Conduction, Convection and Radiation. Classification of Electric Heating Methods and their applications: Resistance Heating:(Construction and Operation), Direct Resistance Heating: Salt Bath Furnace, Indirect Resistance Heating: Resistance Ovens, Basic concept of various Industrial furnaces.	12

Unit-2	**Electric Welding**	Methods of Electric Welding: Electric Arc Welding, Resistance Welding. Principle of Resistance Welding, Advantages of Resistance Welding, Types of Resistance Welding - (Only List), Basic concept of various welding machines.	12
	Electric Traction	Requirements of an Ideal Traction System. Traction Systems: Non-electric Traction Systems, Electric Traction Systems: Straight Electric Traction, Its advantages and Disadvantages. Diesel Electric Traction, Its advantages and Disadvantages. Systems of Track Electrification: Direct Current (DC) System, Composite System – Single Phase to Three Phase System and Single Phase Alternating Current (AC) to DC System (Kando System). Advantages and Disadvantages of Single Phase 25 KV AC System Over DC System. **Electric Braking**: Requirement, Classification of Braking Systems with qualitative description.	12

Recommended Books-

1. G. C. Garg, *Utilisation of Electric Power and Electric Traction*, Khanna Publishers
2. H. Partab, *Art and Science of Utilisation of Electrical Energy*, DhanpatRaiand Sons
3. J. B. Gupta, *Utilisation of Electric Power and Electric Traction*, S. K. Katariaand Sons
4. J. Upadhyay, S. N. Mahendra, *Electric Traction,* Allied Publisher Ltd.

Title of the course : AC Machines
Subject Code : EE-226

L	T	P	Credits	Weekly Load
3	0	2	4	5

Course Outcomes:

After successful completion of course, the students should be able to

CO 1: Understand the construction, working principle and starting method of three phase induction motor.

CO 2: Learn the working principle , construction, open circuit characteristics and short circuit characteristics of alternator.

CO 3: Know about operating characteristics, V-curve and inverted-V curve of synchronous motor.

CO 4: Understand parallel operation of alternators, concept of hunting and damper winding.

CO 5: Learn working principle of Single Phase Induction Motors, Universal Motors, Reluctance and Hysteresis motors.

CO/PO Mapping : (Strong(S) / Medium(M) / Weak(W) indicates strength of correlation):

Cos	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											W
CO2	S	M										W
CO3	S	M	M									
CO4	S		W									
CO5	S											M

Theory

Unit	Main Topics	Course Outlines	Hours
Unit-1	**Alternating Current (AC) Machines**	Brief introduction about three phase induction motors, its principle of operation,Types of induction motors and constructional feature of squirrel cage and slip ring motors, Starting of three phase induction motors : star Delta and DOL (direct-on-line), starters, Reversal of direction of rotation of three motors. Application of induction motors.	12
	Alternators	Construction, Phasor diagram of cylindrical rotor alternator, ratings, nature of armature reaction, determination of synchronous reactance; open circuit characteristics, short circuit characteristics, short circuit ratio, short circuit loss. Effect of variation of power factor on voltage. Determination of voltage regulation: Electro Motive Force (EMF) method, Magneto Motive	12

		Force (M.M.F.) method. Zero Power Factor (Z.P.F.) method. Alternator on infinite bus bar, operating characteristics, operation at constant load and variable excitation, power flow through inductive impedance.	
Unit-2	**Synchronous motors**	Operating characteristics, power-angle characteristics, conditions for maximum power developed. V-curves and inverted V-curves, methods of starting, synchronous motors applications, synchronous condensers.	08

	Parallel operation of alternators	Conditions for proper synchronizing for single phase and three phase alternators, conditions for parallel operation, synchronizing power, current and torque, effect of increasing excitation of one of the alternators, effect of change of speed of one of the alternators, effect of unequal voltages, load sharing. Hunting and damper windings.	08
	Single phase motors	Single Phase Induction Motors, Universal Motors, Reluctance and Hysteresis motors.	08

Recommended Books-

1. A.E Fitzgerald, C. Kingsley and S.D.Umans,*Electric Machinery*, McGraw Hill
2. E.H.Langsdorff, *Principles of D.C. machines*, McGraw Hill
3. I.J.Nagrath and D.P. Kothari, *Electrical Machines*, Tata McGraw Hill
4. M. G. Say,*Alternating Current Machines*, Sir Isaac Pitman and Sons Ltd
5. P.S.Bimbhra, *Electrical Machinery*, Khanna Publishers

List of Practical: EE-226

1. Regulation of alternator by EMF/ MMF methods
2. Operation of alternator on infinite busbar
3. V-curve for synchronous motor
4. Load test on three phase and single-phase induction motor
5. No load and blocked rotor tests on three phase induction motors
6. Speed control of three-phase induction motors
7. Load test on synchronous induction motor
8. Load test on three phase induction generators
9. Study and control of stepper motor
10. Study on brushless alternator.
11. Measurement of transient and sub-transient reactance in direct and quadrature axis.
12. Predetermination of performance characteristics of three-phase induction motor Usingcomputer.
13. Determination of the magnetisation curve of analternator (a) at no-load rated speed,(b) at no Loadhalf rated speed and (c) at full non-inductiveload and rated speed.
14. Determination of the relationship between terminalvoltage and load current of an alternator Keeping excitation and speed constant.
15. Determination of regulation and efficiency of analternator from open circuit and short Circuittests.
16. Parallel operation of polyphase alternators and laodsharing.

Title of the course : Power System-II(Generation)
Subject Code : EE-227

L	T	P	Credits	Weekly Load
3	0	0	3	3

Course Outcomes:
After successful completion of course, the students should be able to
CO1: Introduce conventional and non conventional energy sources and their availability.
CO2: Understand about power generation planning.
CO3: Learn about hydro electric generation, thermal power generation, Diesel electric power generation and Nuclear power generation.
CO4: Draw Layout and know Elements of gas power station and non conventional power generation.

CO/PO Mapping : (Strong(S) / Medium(M) / Weak(W) indicates strength of correlation):												
Cos	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						S	S					S
CO2						S	S					S
CO3						S	S					S
CO4						S	S					S

Theory

Unit	Main Topics	Course Outlines	Hours
Unit-1	**Introduction**	Energy sources conventional and non conventional, their availability, demand of electricity, major electrical equipments in power stations different types of generating plants and comparison	5
	Power Generation Planning	Load forecasting, load curves, load duration curve, Base load and Peak load Power Plants, connected Load, maximum demand, demand factor, Group diversity factor, load factor, significance of load factor, plant factor, capacity factor, selection of unit size, No. of Units, reserves, cost of power generation, Depreciation, tariff.	6
	Hydro Electric Generation	Selection of site, basic definitions, classification, elements of hydroelectric plant and operation of hydro-electric plant, hydro-electric generator	5
		Introduction, selection of site, basic parts and general layout of steam power plant and working, efficiency,	5

	Thermal Power Generation	fuels, fuel handling, combustion, ash handling and dust collection, draught systems, turbo alternators merits and demerits of steam power plants,	
Unit-2	**Diesel Electric Power Generation**	selection of site for diesel plant, plant layout, performance and thermal efficiency of diesel plant merits and demerits of plant	5
	Nuclear Power Generation	Feasibility of nuclear power station, nuclear fuels, constituents and layout of nuclear power plant,	5
	Gas Power Stations	Layout and Elements of gas power station, basic principle and operation, fuels, thermal efficiency, closed cycle gas turbine plants	4

	Non Conventional Power Generation	Solar radiations, solar energy collectors; flat plate and focusing type, solar power generation site selection for solar and wind Basic principles of wind energy conversion basic components of wind energy conversion systems (WECS), wind machines Fuel cells, types and construction of fuel cells thermo-electric generation tidal power generation energy principles and components Basic principles of Magnetohydrodynamic generator (MHD)	7

Recommended Books-

1. A.Chakrabarti, Bhatnagar, M. L.Soni, and P. V. Gupta U. S., *Power System Engineering,* DhanpatRaiand Co
2. A. Christopher, Simon *Alternate Source of Energy*, Rowman and LittleField Publishers Inc..
3. B. R. Gupta*, Generation of Electrical Energy,* S. Chand
4. C.L.Wadhwa,*Generation, Distribution and Utilization of Electric Energy*,New Age International (P) Limited, Publishers
5. G.D.Rai,*Non Conventional Energy Sources,* Khanna Publishers
6. S. Rao and Parulekar, B.B., *Energy Technology: Non Conventional, Renewable and Conventional*, Khanna Publishers
7. Venikov, V.A. and Putyain, E.V., *Introduction to Energy Technology*, Mir Publishers

Title of the course : Electrical Circuit Theory
Subject Code : EE-311

L	T	P	Credits	Weekly Load
3	1	2	5	6

Course Outcomes:
After successful completion of course, the students should be able to
CO1: Acquire the knowledgeof the basics of electrical circuits and its elements.
CO2: Apply various theorems and transformations to solve the DC networks
CO3: Analyse series and parallel circuits in AC and terms associated with it like power factor, power triangle, resonance and quality factor.
CO4: Analyse various signals and their responses for different circuits in DC.
Pre-requisite knowledge: EE-113 (Basic Electrical Engineering)

CO/PO Mapping : (Strong(S) / Medium(M) / Weak(W) indicates strength of correlation):												
COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											S
CO2	M	S										
CO3	M			S								M
CO4					S							M

Theory:

Unit	Main Topics	Course Outlines	Hour(s)
Unit-1	**Introduction**	Voltage and current sources, relation between current, voltage, power and energy of Direct Current (DC) sources, conversion of voltage sources to current sources and vice versa; formation of branch, node and loop	08
	DC network analysis	Applications of Kirchoff 's Current Law (KCL) by using nodal current method and Kirchoff 's Voltage Law (KVL) using loop current method and branch current method for solving network problems, Star/delta and Delta/star transformations(Simple Numericals), Applications of Network theorems and transformations: Star-delta conversion, superposition theorem, Thevenin's theorem, Norton's theorem, reciprocity theorem, maximum power transfer theorem and Tellegen's theorem for the solution of networks with DC.	12
	AC network analysis	Series Alternating Current (AC) circuits Resistance –Inductance (R-L), Resistance-capacitance(R-C) and Resistance-Inductance-Capacitance (R-L-C) circuits. Impedance, reactance, phasor diagram, impedance triangle, power factor, Average power, Apparent power, Reactive power, Power triangle (Numerical), Series Resonance, quality factor (Numerical), Parallel AC circuits R-L, R-C and R-L-C circuits. Admittance, Susceptance, Solution by admittance method, phasor diagram and complex Algebra method. (Numerical), Parallel	16

		resonance, quality factor, Comparison of series and Parallel circuits. Generation of three phase Electro motive force (EMF), Phase sequence, polarity marking, Types of three-phase connections, Concept of unbalanced load and balanced load, Line, phase quantities and power in three phase system with balanced star and Delta connected load and their interrelationship, Advantages of polyphase circuits over single phase circuits	
	Transients in DC circuits	Introduction to Impulse, step, ramp and sinusoidal signals, transients introduced by these signals in RL, RC and RLC circuits	08

Recommended Books-

1. A. Chakravorty, *Circuit Theory*, DhanpatRai and Co.
2. Edward Hughes, *Electrical Technology*, Longman Publishers
3. G. K Mithal, *Network and CircuitTheory*, Khanna Publishers
4. J. B. Gupta*, Electrical Engineering,* S. K.Kataria and Sons
5. M. L. Soni, P.V. Gupta and U. S. Bhatnagar*, Electrical Circuit Analysis*, DhanpatRai and Co.
6. P. V. Gupta, P. C.Dhar, *Introduction to Networks*, DhanpatRai and Sons
7. VanValkenberg, *Network and Circuit Theory*, Tata McGraw Hill

List of Practicals: EE-311

1. OHM'S LAW AND APPLICATIONS: Ohm's law and its applications are investigated in this experiment. The Voltage-current (V-I) characteristic of linear resistors is derived. Applications of Ohm's law include voltage and current division. Measurements of the equivalent resistance of a resistive arrangement are performed.
2. ANALYSIS OF NETWORKS: The purpose of this experiment is to introduce students to the nodal voltage and mesh current methods for solving circuits.
3. NETWORK THEOREMS: This experiment verifies some important network theorems: the Thévenin equivalent of a circuit, the maximum power transfer theorem, and the source superposition.
4. FIRST ORDER R-L AND R-C CIRCUITS: The objective of this experiment is to observe the response of the first order R-C and R-L circuits. The experiment demonstrates a method for measuring the time constant.
5. SECOND ORDER RLC CIRCUITS: This experiment demonstrates the response of a series and a parallel RLC circuit. The over-damped, critically damped and under-damped responses are derived for each circuit.
6. SINUSOIDAL STEADY STATE: This experiment demonstrates the properties of ac networks. The concept of impedance is discussed. Phasors are demonstrated through oscillograms

Title of the course : Digital Electronics
Subject Code : EE-312

L	T	P	Credits	Weekly Load
3	0	2	4	5

Course Outcomes:
After successful completion of course, the students should be able to
CO1: Understand the basics of number system and various logic family circuits.
CO2: Acquire knowledge of various logic gates and flip flops.
CO3: Learn the concept of Registers and counters.
CO4: Be conversant with arithmetic logic circuits, A/D and D/A converters.
CO5: Learn the operation of decoders, display devices and related circuits.
Pre-requisite knowledge:

CO/PO Mapping : (Strong(S) / Medium(M) / Weak(W) indicates strength of correlation):												
Cos	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											M
CO2	S			S	S							M
CO3	S			S	S							M
CO4	S		M	S	S							M
CO5	S	S				M						M

Theory:

Unit	Main Topics	Course Outlines	Hour (s)
Unit-1	**Review of number system**	Decimal, Binary, Octal, and hexadecimal number system and their inter-conversions.	08
	Logic families and circuits	Transistor-transistor-logic (TTL) logic family, NAND gates, 7400, 5400 and 4000 series of Integrated Circuits (IC) logic families, tri-state logic.	08
	Logic gates and flip flops	Definitions, symbols and truth table of NOT, OR, AND, NAND, NOR, XOR, XNOR gates, De-Morgan's theorems; realization of basic gates using universal gates; realization of simple Boolean equations using universal gates, introduction to Karnaugh map (k-map) (3 variables), Logic diagram, truth table; timing diagram and operation of following latches and flip flops; NOR latch, NAND latch, Set-Rest (SR), Toggle (T), Delay (D), JK, Master/ Slave JK flip flops.	08

	Registers	Shift registers, Serial in serial out, Serial in Parallel out, Parallel in Parallel out Parallel in Serial out, Left shift register, right shift register, universal shift register	08
Unit-2	**Counters**	Synchronous and Asynchronous counters, Modulus counters, decade counter and its application, Ring counter and its application.	08
	Arithmetic circuits	Half adder and full adder circuit, design and implementation, Half and full subtractor circuit, design and implementation, 4 bit adder/subtracted.	08

	A/D and D/A Converters	Resistor divider Digital to Analog (D/A) converter, Analog to digital (A/D) conversion, Voltage to time to digital converter, D/A specifications, Dual slope integrator A/D converter, Counter type A/D converter, A/D converter specifications.	08
	Decoders, display devices and associated circuits	Light Emitting Diode (LED), Liquid Crystal Display (LCD), seven segment display, basic operation of various commonly used types, Four bit decoder circuits for 7-segment display and decoder/driver ICs, Multiplexers (MUXs) and De-multiplexers (DEMUXs); basic functions and block diagram of MUX and DEMUX.	08

Recommended Books-

1. A. Anand Kumar, *Fundamentals of Digital Electronics*, PHI
2. Herbert Raub andDonalsSachilling, *Digital Integrated Electronics*, Prentice Hall ofIndia, New Delhi.
3. Malvino Leach, *Digital Electronics and Applicatio*ns, McGraw Hill,New Delhi

List of Practicals:EE-312

1. Verification of the truth tables of TTL gates.
2. Verify the NAND and NOR gates as universal logic gates.
3. Design and verification of the truth tables of Half and Full adder circuits.
4. Design and verification of the truth tables of Half and Full subtractor circuits.
5. Verification of the truth table of the Multiplexer 74150.
6. Verification of the truth table of the De-Multiplexer 74154.
7. Design and test of an S-R flip-flop using NOR/NAND gates.
8. Verify the truth table of a J-K flip-flop (7476)
9. Verify the truth table of a D flip-flop (7474)
10. Operate the counters 7490, 7493.
11. Design of 4 bit shift register(shift right).
12. Design of modulo-4 counter using J K flip flop.

Title of the course : Control Engineering
Subject Code : EE-313

L	T	P	Credits	Weekly Load
3	0	2	4	5

Course Outcomes:
After successful completion of course, the students should be able to
CO1: Develop the theoretical aspects of Control systems and feedbacks.
CO2: Understand DC and AC servo motors, Elements of measurement system and CRO for Measurement.
CO3: Determine transfer function from block diagram reduction technique and mason's gain formula..
CO4: Analayze the time domain response for various standard test signals.
CO5: Understand the frequency responseandto perform stability analysis in frequency domain

CO/PO Mapping : (Strong(S) / Medium(M) / Weak(W) indicates strength of correlation):												
Cos	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											M
CO2	S			S	S							S
CO3	S			S	S							M
CO4	S		M	S	S							M
CO5	S	S				M						M

Theory:

Unit	Main Topics	Course Outlines	Lecture(s)
Unit-1	**Introduction:**	Basic elements of a feedback control system, open loop, feedback and feed-forward, linear and non-linear, continuous and sampled-data control systems, digital control, practical examples of the above. Control system components, Direct current (DC)andAlternating Current (AC) Servo motors, techo-generator, potentiometer, synchros, stepper motor, AC position control system, Elements of generalized measurement system, characteristics of instruments, accuracy, precision, sensitivity, range span. Construction and working of Cathode Ray Tube (CRT), Block diagram of Cathode Ray Oscilloscope (CRO), measurement of voltage and frequency with CRO.	(12 Hrs)
	Mathematical models for	Differential equations of simple mechanical, electrical, thermal, linearization of a non-linear mathematical	(12 Hrs)

	Physical Systems:	model, transfer function derivation of physical systems, Block diagram, Signal flow graphs.	
Unit-2	**Time Response Analysis:**	Standard test signals, time response of first and second-order systems, time response specifications, steady-state errors and error constants, error performance indices. Stability of Systems**,** Concept of stability, condition for stability, Routh's Hurwitz's ability criteria.	(12 Hrs)
	Frequency Response Analysis	Co-relations between time and frequency response, frequency response specification.	(12 Hrs)

Recommended Books-

1. Bakshi and Goyal, *Theory and Problems of Feedback Control Systems*, TMH
2. Kuo, *Modern Control Engineering*, PHI
3. Nagrath I.J.,and Gopal, *Control System Engineering*, Wiley Eastern
4. Ogata, *Automatic Control Systems*, PHI
5. Schaum Series*, Theory and Problems of Feedback Control Systems,* TMH

List of Practicals: EE-313

1. To study the operation of Temperature control system (Proportional controller).
2. To study the operation of D.C. Position Servomotor.
3. To study the operation of Temperature control system (Relay).
4. To control the Temperature of a system using Proportional+ Integral (P+I) controller.
5. To control the Temperature of a system using Proportional+ Integral+ Derivative (P+I+D) controller.
6. To study the time response of first order system.
7. To study the time response of second order system.
8. To study the operation of potentiometer error detector.
9. To study the A.C. servomotor and plot the torque. Vs. speed characteristics.

Title of the course : Electrical Engineering materials
Subject Code : EE-314

L	T	P	Credits	Weekly Load
3	0	0	3	3

Course Outcomes:
After successful completion of course, the students should be able to
CO1: Develop understanding of classification of materials according to their atomic structure.
CO2: Learn features of conducting materials along with important terminologies.
CO3: Understand insulating materials and their properties.
CO4: Identify magnetic materials and categorize them.
CO5: Be conversant in semiconductor materials and special purpose materials.
Pre-requisite knowledge:

CO/PO Mapping : (Strong(S) / Medium(M) / Weak(W) indicates strength of correlation):

Cos	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2	S											S
CO3	S											
CO4	S											
CO5	S							M				

Theory:

Unit	Main Topics	Course Outlines	Hour (s)
Unit-1	**Classification**	Classification of materials into conducting, semiconducting and insulating materials with reference to their atomic structure and energy bands.	6
	Conducting materials:	Conducting Materials: Resistivity and factors affecting resistivity, such as temperature, alloying. Super conductivity and super conducting material. Low resistivity materials e.g. copper, aluminum and steel, their general properties as conductor e.g. resistivity, temperature co-efficient, mechanical properties, corrosion, solar ability, contact resistance and practical application. High resistivity materials: manganin, carbon, tungsten, their practical applications.	9

	Insulating Materials	Properties of insulating material:- Electrical properties, Mechanical properties, Physical properties, Thermal properties, Chemical properties, Insulating materials and their application-Definition and classification of Thermo setting materials e.g. Phenol Formaldehyde, Resins (i.e. Bakelite), Thermo Plastic materials e.g. Polyvinyl Chloride (P.V.C.), ,Natural Insulating Materials- Mica and Asbestos,Gaseous Materials e.g. Air, Hydrogen and SF6.	9

Unit-2	**Magnetic Materials:**	B-H curve of magnetic materials, Classification of magnetic materials into soft and hard magnetic materials. Soft magnetic materials - high silicon alloy steel for transformers and low silicon alloy steel, for electric rotating machine cold rolled grain oriented and non-oriented steel, Nickel iron alloy, soft ferrites, their properties and uses. Hard magnetic materials - tungsten steel, chrome steel, cobalt steel, hard ferrites, their properties and applications.	8
	Semiconductor Materials	Introduction, semiconductor and their applications, Different semiconductor materials used in manufacturing various semiconductors (Si and Ge), Material used for electronic components like resister, capacitor, diode, transistors and inductors.	8
	Special Purpose Materials:	Thermocouple, bimetals, lead soldering and fuses material, mention their applications, Introduction of various engineering materials necessary for fabrication of electrical machines such as motors, generators, transformers etc	8

Recommended Books-

1. A. J. Dekker, *Electrical Engineering materials*
2. G. P. Chhalotra, *Electrical Engineering Materials*
3. S.P. Seth and P.V. Gupta., *Electrical Engineering materials*

Title of the course : Computer Programming
Subject Code : EE-315

L	T	P	Credits	Weekly Load
3	0	2	4	5

Course Outcomes:
After successful completion of course, the students should be able to
CO 1: Learn Steps in development of a program, Flow Chart.
CO 2: Understand program structure, input/output function and control statements.
CO 3: Know the concept of Array and function.
CO 4: Introduce Pointers to various data types and structures.

CO/PO Mapping : (Strong(S) / Medium(M) / Weak(W) indicates strength of correlation):												
Cos	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	M									M
CO2	S											M
CO3	M											
CO4	W											M

Theory:

Unit	Main Topics	Course Outlines	Hours
Unit-1	**Algorithms and Program Development**	Steps in development of a program, Flow Chart, Algorithm Development, Program debugging.	08
	Program Structure	Data types, Input/Output (I/O) statements, assignment statements; variables; arithmetic logical and relational operators – their precedence. logical and relational operators, standard I/O functions, formatted I/O. Input/ output using files.	08
	Control Statements	for statement, if-then-else, while, do-while, break, switch statements.	08
Unit-2	**Functions and Arrays**	Function declaration, parameters, parameter passing, call-by-value, call-by- reference, storage classes (local, global and static variables), function prototype, Single and multi-dimensional arrays, character arrays.	08
	Pointers	Introduction to Pointers and Pointers to various data types.	08
	Introduction to Structures	Definition of a structure, pointers to structures, union, arrays of structures.	08

Recommended Books-

1. E. Balaguruswamy, *Programming with C Language*, TMH, New Dehli
2. Hubbard, John **,** *Schaum's Outline of Programming with C++*, McGraw Hill
3. R.Subburaj, *Programming in C*, Vikas Publishing, New Delhi

List ofPractical: EE-315

1. Write a program (WA)P that accepts the marks of 5 subjects and finds the sum and percentage marks obtained bythe student.
2. WAP that calculates the Simple Interest and Compound Interest. The Principal, Amount, Rate of Interest and Time are entered through the keyboard.
3. WAP to calculate the area and circumference of a circle.
4. WAP that accepts the temperature in Centigrade and converts into Fahrenheit using the formula C/5=(F-32)/9.
5. WAP that swaps values of two variables using a third variable.
6. WAP that checks whether the two numbers entered by the user are equal or not.
7. WAP to find the greatest of three numbers.
8. WAP that finds whether a given number is even or odd.
9. WAP that tells whether a given year is a leap year or not.
10. WAP that accepts marks of five subjects and finds percentage and prints grades according to the following criteria:

    Between 90-100%----------Print 'A'
    80-90%----------Print 'B'
    60-80%----------Print 'C'
    Below 60%----------Print 'D'

11. WAP that takes two operands and one operator from the user and perform the operation and prints the result by using Switch statement.
12. WAP to print the sum of all numbers up to a given number.
13. WAP to find the factorial of a given number.
14. WAP to print sum of even and odd numbers from 1 to N numbers.
15. WAP to print the Fibonacci series.
16. WAP to check whether the entered number is prime or not.
17. WAP to find the sum of digits of the entered number.
18. WAP to find the reverse of a number.
19. WAP to print Armstrong numbers from 1 to 100.
20. WAP to convert binary number into decimal number and vice versa.
21. WAP that simply takes elements of the array from the user and finds the sum of these elements.
22. WAP that inputs two arrays and saves sum of corresponding elements of these arrays in a third array and prints them.
23. WAP to find the minimum and maximum element of the array.
24. WAP to search an element in a array using Linear Search.
25. WAP to sort the elements of the array in ascending order using Bubble Sort technique.
26. WAP to add and multiply two matrices of order nxn.
27. WAP that finds the sum of diagonal elements of amxn matrix.
28. WAP to implement strlen (), strcat (),strcpy () using the concept of Functions.

Title of the course : Microprocessors
Subject Code : EE-321

L	T	P	Credits	Weekly Load
2	0	0	2	2

Course Outcomes:
After successful completion of course, the students should be able to
CO1: Understand basics of microprocessor, its block diagram and history.
CO2: Acquire knowledge of 8085 microprocessor, its architecture and functioning.
CO3: Learn the instruction cycle and timing diagram of microprocessor.
CO4: Understand andcreate programs for 8085 microprocessor.
CO5: Develop the knowledge of interrupts and data transfer techniques.
Pre-requisite knowledge:

CO/PO Mapping : (Strong(S) / Medium(M) / Weak(W) indicates strength of correlation):												
Cos	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											M
CO2	S		S	M								
CO3	S			S								
CO4	S	M	S									M
CO5	S											M

Theory:

Unit	Main Topics	Course Outlines	Hour (s)
Unit-1	**Introduction:**	Typical organization of microcomputer system its Functions with block diagram, microprocessor evolution on modern society. Architecture**,** Concept of Bus, Bus organization of 8085, functional block diagram of 8085 and function of each block, internal operation of 8085 timing diagram, memory read/write and Input / Output (I/O) read/write addressing modes, flags in 8085.	(08)
	Instruction Cycle and Timing Diagram	Instruction cycle, machine cycle T-State, fetch and execute cycle (with diagram), Memory Organization**,** Memory mapping, decoding memory interfacing (Random Access Memory (RAM)/Read Only Memory (ROM)), concept of I/O mapped and memory mapped I/O.	(08)

Unit-2	**Programming 8085 Microprocessor**	Brief idea of assembly language and machine language, memory codes, instruction format, instruction set of 8085, data transfer group, arithmetic group, logic group, STACK Branch operation and machine control group, programming exercise in assembly language.,.	(08)
	Interrupts	Concept of interrupts, maskable and non-maskable interrupts, software interrupts, various hardware interrupts of 8085, Masking of interrupts. Brief introduction to Data Transfer Techniques.	

Recommended Books-

1. B. Ram*, Microprocessor and 8085 and Hardware,* DhanpatRai.
2. M. Rafiquzzuman, *Microprocessors Theory and applications*, PHI.
3. Ramesh S.Gaonker*, Microprocessor Architecture Programming and Applications with the 8085*, New Age.

Title of the course : Industrial Electronics
Subject Code : EE-322

L	T	P	Credits	Weekly Load
3	0	2	4	5

Course Outcomes:
After successful completion of course, the students should be able to
CO1: Acquire knowledge of thyristor, its characteristics and symbols.
CO2: Understand the operation of converters, their types and their output waveforms.
CO3: Learn the basics of inverter, its classification and techniques used.
CO4: Be conversant with DC-DC converters, choppers operation and their types.
CO5: Learn the applications of industrial electronics in DC drives, AC drives, heating, welding etc.
Pre-requisite knowledge:

CO/PO Mapping : (Strong(S) / Medium(M) / Weak(W) indicates strength of correlation):												
Cos	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											M
CO2	S		M	M								
CO3	S		M	M								M
CO4	S			M								
CO5	S					S		M				M

Theory:

Unit	Main Topics	Course Outlines	Hour (s)
Unit-1	**Power Semiconductor Devices**	Thyristor (SCR), their Symbol, Construction and Operation, V-I Characteristics, Thyristor Turn on and Turn off (commutation) methods; Thyristor Specifications and Ratings; thyristor protection circuits; Heat Sinks and Mountings, Thyristor Family and other power semi-conductor devices: Symbols andVoltage-current (V-I) Characteristics.	06
	Converters	Converters : Un-controlled and controlled, Half wave and Full wave, Half controlled and full controlled, Single Phase and three phase, with Resistive Load and RL Load, with and without Free wheeling Diode, Comparison of three phase and single phase Converters, Effect of Source Impedance on Converter Operation; Cyclo-converters: Single phase and three phase, principle of operation, Input output waveforms.	09

	Inverters	Classification of Inverters: Voltage source and current source, single phase and three phase, Half Bridge and Full Bridge; Line Commutated and Forced Commutated; Series and Parallel; Operation of these inverters; Voltage and Frequency Control of single phaseInverters, Pulse Width Modulation(PWM) controlled Inverters, Waveform Control (Harmonic Reduction) of Inverters	09

Unit-2	**DC-DC Converters**	Converter Classification : Buck, Boost and Buck-Boost, Isolated and non isolated topologies, single switch, two and four switches topologies; their operation and applications	06
	Choppers	Chopper Principle, Control Techniques: Constant Frequency and Variable Frequency; Classification of Choppers: Class A, Class B, Class C, Class D and Class E; Commutations Methods for Choppers	08
	Applications to Industrial Systems	Direct Current (DC) Drives: Open loop and closed loop control schemes for Speed and torque control of DC motors, various topologies for these controls; Alternating Current (AC) Drives: Speed and torque control of three phase Induction Motor; Open/Closed loop control of stepper motor, AC/DC servomotor, and other special motors; Other Applications: Induction Heating Control, Electric Welding Control, Battery Charging Control, Static VAR Compensation System.	10

Recommended Books-

1. Frank D. Petruzella, *Industrial Electronics,* McGraw- Hill.
2. G.K.Dubey, *Power semiconductor drives,* Prentice Hall Inc.
3. M. H. Rashid, *Power Electronics,* TMH.
4. Morris, *Industrial Electronics,* McGraw- Hill.

List of Practicals: EE-322

1. To identify the terminals and plot V-I Characteristics of Thyristor.
2. To identify the terminals and plot V-I Characteristics of Diac.
3. To identify the terminals and plot V-I Characteristics of Triac.
4. To study various turn on methods of Thyristor.
5. To study the waveforms of a single phase Full Wave converter Using Thyristor.
6. To study the waveforms of a single phase Half controlled Bridge converter Using Thyristor.
7. To study the waveforms of a single phase full controlled Bridge converter Using Thyristor.
8. To study the waveforms of a three phase half controlled Bridge converter Using Thyristor.
9. To study the waveforms of a three phase full controlled Bridge converter Using Thyristor.
10. To study the waveforms of a single phase Bridge inverter.
11. To study the waveforms of DC-DC converter in buck/boost mode.
12. To Perform Speed control of DC shunt motor by voltage control using single phase half/full controlled converter.
13. To Perform speed control of three phase Induction motor using Rectifier and PWM Inverter.
14. To Perform speed control of any special machine using Rectifier and PWM Inverter.

Title of the course : Energy Conservation Practice
Subject Code : EE-323

L	T	P	Credits	Weekly Load
3	0	0	3	3

Course Outcomes:
After successful completion of course, the students should be able to
CO1: Understand the basic concept of energy conservation, energy audit and their need.
CO2: Acquire knowledge of energy conversation in transmission, distribution system and minimization of losses
CO3: Learn the idea of tariff, energy conversation in industries and their relation.
CO4: Be conversant with relation between energy, environment and society, its importance.
CO4: Understand the procedure of energy audit, related rules and Electricity act 2003.
Pre-requisite knowledge:

CO/PO Mapping : (Strong(S) / Medium(M) / Weak(W) indicates strength of correlation):												
Cos	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S		S		S	M					S
CO2	S		S			M		M				
CO3	S					S		M				
CO4	S					S	S					M
CO5	S	M						S				

Theory:

Unit	Main Topics	Course Outlines	Hour (s)
Unit-1	**Basics of Energy Conservation**	Review of various energy sources, Need of energy conservation and energy audit; Lighting energy: methods/Techniques of efficient lighting; Heating: methods/Techniques of energy Saving in Furnaces, Ovens and Boilers; Cooling: Methods/ Techniques of Energy Saving in Ventilating systems and Air Conditioners; Motive power, Energy Efficient Motors, and Efficient use of energy in motors with the help of voltage reducers, automatic star/ delta converters; Power factor improvement devices and soft starters/Variable Frequency Drives; Amorphous Core Transformers; Cogeneration -Types and Advantages	16
	Energy Conservation In	Reactive power compensation, demand side management, system voltage optimization and phase current balancing,	08

	Transmission and Distribution Systems	Losses in transmission and distribution system and its minimization	
Unit-2	**Tariff and Energy Conservation in Industries**	Energy cost and Recent Electricity Board tariffs, Application of Tariff System to reduce Energy bill, Energy Conservation by improving load factor and power factor;	06

	Energy and the Environment	Environment and social concerns related to energy utilization, The green house effect, Global Warming and its effect , Pollution, Acid Rains, Global Energy and environment Management	04
	Energy Audit	Procedure of Energy audit, Activity based costing (ABC) analysis, Energy Flow Diagram and its importance, Measurements in energy audit and various measuring instruments, Questionnaires for the energy audit, internal energy audit checklist, Equipment used for energy conservation, Calculation of payback period for energy conservation equipment. Indian Electricity (IE) rules and regulations for energy audit, Electricity act 2003	14

Recommended Books-

1. C.L. Wadhawa, *Generation Distribution and Utilization of Electrical Energy*, New Age
2. G.Petrecca, *Industrial Energy Management: Principles and applications*, Kluwer Academic Publisher
3. www.beeindia.in, *Bureau of Energy Efficiency Handbooks*.

Title of the course : Switchgear and Protection
Subject Code : EE-324

L	T	P	Credits	Weekly Load
3	0	2	4	5

Course Objectives:
After successful completion of course, the students should be able to
CO 1: Understand the principle of protective schemes and various faults in the Power System Scenario.
CO 2: Acquire theknowledge about various designs of circuit breakers on the basis of arc quenching phenomena.
CO 3: Be competent in use ofstatic and digital relays.
CO 4: Examine the protection of feeders, alternators and other power system components with various protective relays.
CO 5: Know about various types of grounding systems and methods of protection against over voltages.
Pre-requisite Knowledge:EE-113 (Basic Electrical Engineering)

CO/PO Mapping : (Strong(S) / Medium(M) / Weak(W) indicates strength of correlation):												
COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											M
CO2			S		M							M
CO3	M				S				W			
CO4	S		S							W		S
CO5	S					W						M

Theory:

Unit	Main Topics	Course Outlines	Hour(s)
Unit-1	**Introduction**	Classification of substations, graphical symbols of substation components, Key diagram, substation equipments and auxiliaries	5
	Conventional Relays	Introduction, classification, constructional features; and principle of operation of Electromagnetic, Induction,Thermal, Overcurrent relays, Directional relays, Distance relays, Differential, Translay,	5
	Circuit Breakers (CBs)	Classification of circuit breakers, circuit breaker ratings, restriking voltage, current chopping, duties of switch gear, automatic switch, air circuit breaker, bulk oil CB, minimum oil CB, air blast CB, SF6 CB, vacuum and Direct Current (DC) circuit breakers	5
	Protection of Feeders	Time graded protection, Differential and Distance protection of feeders, Impedance,Reactance and Mho relays, Elementary idea about carrier current protection of lines.	6
	Protection of	Types of faults on alternator, Stator and rotor protection, Negative	5

	Alternators	sequence protection, Loss ofexcitation and overload protection.	

Unit-2	**Protection of Transformers**	Types of fault on transformers, Protection schemes of transformer, percentage differential protection, Buchholz relay	5
	Protection Against Over-Voltages	Ground wires, Rod gap, Impulse gap, Valve type and Metal Oxide Arresters, Line Arrester/SurgeAbsorber. Ungrounded neutral system, Grounded neutral system and Selection of Neutral Grounding.	5
	Static Relays	Classification of static relays, amplitude and phase comparators, block-spike and block-average comparators, rectifier type relays, Introduction to digital relay: basic principles, Application of microprocessors and computers	6

Recommended Books-

1. A. Chakrabarti, M.L. Soni, P.V. Gupta and U.S. Bhatanagar, *A Textbook on Power System Engineering,*DhanpatRai and Co.
2. Badri Ram and D.N. Vishwakarma*, Power system Protection and Switchgear*, Tata McGraw Hill.
3. B. R. Gupta, *Power System Analysis and Design*, Wheeler Publishing.
4. C.L. Wadhawa, *A Course in Electrical Pow*er, 6th Edition, New Age international Pvt. Ltd, 2010.
5. I. J. Nagrath. and D. P Kothari , *Power System Analysis,*Tata McGraw-Hill Publication.
6. J. B. Gupta ,*A Course in Power System*, S.K. Kataria and Sons.
7. O. L. Elgerd., *Electrical Energy System Theory - An introduction*, Tata McGraw-Hill Publication.
8. W. D. Stevenson Jr., *Elements of Power System Analysis*, Tata McGraw-Hill Publication.

List of Practicals: EE-324

1.To study the performance of a transmission line. Also compute its ABCD parameters.
2. Study of Characteristics of over current and earth fault protection.
3. To study the operating characteristics of fuse. (High rupturing capacity (HRC) or open type)
4. To find the earth resistance using three spikes
5. To study over current static relay.
6. To study the different types of faults on transmission line demonstration panel/model.
7. To study the radial feeder performance when

(a) Fed at one end.

(b). Fed at both ends

8. To study the performance of under voltage and over voltage relay.
9. To study the characteristics of bimetal mini circuit breakers.
10. To study the characteristics of Distance Relay.
11. To find the breakdown strength of transformer oil.

Title of the course : Industrial Automation
Subject Code : EE-325

L	T	P	Credits	Weekly Load
3	0	2	4	5

Course Outcomes:
After successful completion of course, the students should be able to
CO1: Learn the basics of automation, control system and block diagram representation.
CO2: Understand various components of control system.
CO3: Acquire the knowledge of various types of electrical actuators and their applications.
CO4: Understand various types of controller, control actions and tuning methods.
CO5: Learn automatic control action using PLC, DCS and SCADA.
Pre-requisite knowledge:

CO/PO Mapping : (Strong(S) / Medium(M) / Weak(W) indicates strength of correlation):

Cos	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	M	S							
CO2	S		M									
CO3	S	M				M						M
CO4	S	M		M								
CO5	S				S	M		M				M

Theory:

Unit	Main Topics	Course Outlines	Hour (s)
Unit-1	**Review of basic concepts of Automation and Control System**	Need of automation, Advantages of automation, Basic Requirements for automation, Basic Concept of control system, block diagram and Transfer function, Different terms in control system, Types of control system, Applications of control system, Development of block diagram for simple applications like level,temperature, flow control etc.	06
	Control System Components	*Contacts*-types, current capacity and load utilization categories, Solenoids-Direct current/ Alternating Current (DC/ AC), *Input* (*I/P) devices*- switches-push buttons, foot switch, selector switch, pilot switch, proximity, photoelectric, temperature actuated, level control, pressure sensing, overload sensing; Relays- electromechanical, reed; *Output* (*O/P) devices*-contactors, valves, pilot lamps; Symbols in power and control circuits; Developing control circuit-basic and thumb rule; Power and control circuit for different applications like hoist, crane, conveyer belt, induction motors	09

	Electrical Actuators	Operating principle and characteristics of various actuators i.e. Potentiometers, AC and DC Servomotors, Synchros - transmitter, control transformer, error detector, PM and variable reluctance Stepper motors, Tacho-generator; Applications of above components in control system.	09
Unit-2	**Controllers**	*Hydraulic Controllers*-advantages and disadvantages, hydraulic servomotor, types of pumps used, control valves, components like accumulator, filter, seals; *Pneumatic Controllers*-resistance and capacitance of pressure system, pneumatic flapper-nozzle system, pneumatic relays, actuating valves, cylinders, comparison between pneumatic and hydraulic systems; *Electrical and electronic controllers*-brief overview of op-amps, inverting, non-inverting, lead-lag networks; *Digital controllers*-brief overview of microprocessor and micro- controller to be worked as controller	08
	Control actions	On-Off control, Proportional (P), Integral (I), Proportional Integral (P-I), Proportional Derivative (P-D), Proportional Integral Derivative (P-I-D) control actions; P-I-D action using hydraulic, pneumatic and electronic controllers; Tuning of these controllers	06
	Programmable Logic Controller(PLC), Distributed Control System (DCS) and SCADA	Introduction, Advantages and disadvantages, PLC VsPersonal Computer (PC), Block diagram of PLC, Basic blocks like CPU, Input / Output (I/O) modules, bus system, power supplies and remote I/Os; Different PLCs available in market; development of Ladder logic; some simple programs such as I/O connections, starting of Induction Motor (IM), stepper motor control; Introduction to Distributed Control System(DCS) and Supervisory Control And Data Acquisition (SCADA)- brief introduction to its hardware and software	10

Recommended Books-

1. Jacob, *Industrial Control Engg,*PHI.
2. J. Stenerson, *Industrial automation and process control*, PHI.
3. Kothari andNagrath, *Electrical Machines*, TMH.
4. NagrathandGopal, *Control System Engg.,*Wiley Eastern.
5. R. Shell, *Handbook of Industrial automation*, Taylor and Francis.
6. Webb and Reis, *Programmable Logic Controller: Principle and applications*, Wiley Eastern.

List of Practicals: EE-325

1. To plot the characteristics of potentiometer anduse of potentiometer as error detector.
2. To plot Voltage-current (V-I) characteristics of DC and AC servomotors. compare them with DC and AC motor characteristics
3. To plot the characteristics of synchro transmitter and to use of synchro transmitter- control transformer pair as error detector.
4. Measure step angle for a stepper motor in forward and reverse direction.
5. Draw a power circuit and control circuit using control symbols for a three-phase IM using Direct-on-line (DOL) starter.
6. Observe various components /parts/symbols/connections of a PLC demonstration kit available in the laboratory.

7. Draw a ladder logic diagram for two different examples.
8. By using above ladder logic diagram observe the status of I/Os using PLC.
9. Perform stepper motor/ temperature control using PLC.
10. Identify the parts of hydraulic/ pneumatic servomotor from cut-section/model.
11. Study of various PLC brands available in the market and listing its salient features.
12. Preparation of list of various hardware and software available for SCADA and DCS with its application in industries.
13. Use of various control components available in laboratory to built an AC/DC position control system.
14. Execution of P, I, PI, PD and PID controller using op-amps andResistance Capacitive (R-C) circuits and Plot V-I characteristics for it.

Title of the course : Non Conventional Energy Sources
Subject Code : EE-326

L	T	P	Credits	Weekly Load
3	0	0	3	3

Course Outcomes:
After successful completion of course, the students should be able to
CO1: Understand need of alternative energy sources and principle of MHD generators.
CO2: Acquire knowledge of the thermoelectric generators, their operation and applications.
CO3: Learn the concept of photovoltaic cell and scope of solar energy in India.
CO4: Be conversant with working of fuel cells and their applications.
CO5: Learn various other energy sources for generation of electricity.
Pre-requisite knowledge:

CO/PO Mapping : (Strong(S) / Medium(M) / Weak(W) indicates strength of correlation):												
Cos	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M				S	S					M
CO2	S		M	W			S	W				
CO3	S		M	W		S	S	W				M
CO4	S		M				S	M				
CO5	S						S					M

Theory:

Unit	Main Topics	Course Outlines	Hour(s)
Unit-1	**Introduction:**	Limitation of conventional energy sources, need and growth of alternative energy source, basic scheme and application of direct energy conservation.	06
	Mhd generators	Basic principles, gaseous, conduction and hall effect, generator and motor effect, different types of Magneto Hydro Dynamic (MHD) generator, types of MHD material, conversion effectiveness, analysis of constant area MHD generator, practical MHD generator, application and economic aspects.	10
	Thermo-electric generators	Thermoelectric effects, Seeback effect, Peltier effect, Thomson effect, thermoelectric converters, figures of merit, properties of thermoelectric material, brief description of the construction of thermoelectric generators, application and economic aspect	08

Unit-2	**Photo voltaic effect and solar energy**	Photovoltaic effect, different types of photovoltaic cells, cell fabrication, characteristics of photovoltaic cells, conversion efficiency, solar batteries, application, solar radiation analysis, solar energy in India, solar collectors, solar furnaces and applications.	10
	Fuel cells	Principle of action, Gibb's free energy, general description of fuel cells, types, construction, operational characteristics and application	06
	Miscellaneous sources	Geothermal system, characteristic of geothermal resources, choice of generator set, electric equipment precautions low hydro-plants, definition of low head hydrometer, choice of site, choice of turbine wind power, history of wind power, wind machines, theory of wind power, characteristic of suitable wind power site, tidal energy, idea of tidal energy, tidal electric generator.	08

Recommended Books-

1. A Chakrabarti, M. L. Soni, P. V. Gupta and U. S.Bhatnagar, *Power System Engineering*, DhanpatRaiand Co.
2. B. R. Gupta, *Generation of Electrical Energy*, S. Chand.
3. G. D. Rai, *Nonconvential Energy Sources*, Khanna Publishers.

Title of the course : Project
Subject Code : EE-327

L	T	P	Credits	Weekly Load
0	0	4	2	4

Course Outcomes:
After successful completion of course, the students should be able to

CO 1: Implement the project requiring individual and teamwork skills.
CO 2: Acquire recent knowledge and formulate the project considering the environmental and social considerations
CO 3: Carry out design and analysis of project using appropriate hardware/software tools.
CO 4: Communicate the project work effectively through writing and presentation.
CO 5: Ethical Handle professional responsibilities

CO/PO Mapping : (Strong(S) / Medium(M) / Weak(W) indicates strength of correlation):												
COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		S				S			S			S
CO2											S	S
CO3	S		S	S	S		S					S
CO4										S		S
CO5								S				S