REVISED DIPLOMA CURRICULUM OF ELECTRICAL ENGINEERING

(PART II)

For the State of Meghalaya

(2024-25)

National Institute of Technical Teachers' Training & Research

Block – FC, Sector – III, Salt Lake City, Kolkata – 700 106

Table of Contents

Prog. Name: Electrical Engineering

Semester – III

SL. No	Category of Course	Code No	Course Title	Study Scheme				Evaluation Scheme							Total Marks	Credits
				Pre-requisite	Contact Hours/ week			Theory				Practical				
					L	T	P	End Exam	Progressive Assessment			End Exam	Progressive Assessment			
									Class Test	Assignment	Attendance		Sessional	Viva voce		
1	Programme Core	EEPC201	Introduction to electric generation systems		3	0	0	60	20	15	5	-	-	-	100	3
2		EEPC203	Electrical circuit & materials		2	1	0	60	20	15	5	-	-	-	100	3
3		EEPC205	Electrical and electronic measurements		2	1	0	60	20	15	5	-	-	-	100	3
4		EEPC207	Electric motors and transformers		2	1	0	60	20	15	5	-	-	-	100	3
5		EEPC209	Renewal energy power plants		3	0	0	60	20	15	5	-	-	-	100	3
6		EEPC211	Introduction to electric generation systems laboratory		0	0	2	-	-	-	-	40	40	20	100	1
7		EEPC213	Electrical circuit laboratory		0	0	2	-	-	-	-	40	40	20	100	1
8		EEPC215	Electrical and electronic measurements laboratory		0	0	2	-	-	-	-	40	40	20	100	1
9		EEPC217	Electric motors and transformers laboratory		0	0	2	-	-	-	-	40	40	20	100	1
10		EEPC219	Renewal energy power plants laboratory		0	0	2	-	-	-	-	40	40	20	100	1
11	Internship	I-201	Internship-I		0	0	4	-	-	-	-	40	40	20	100	2
TOTAL					**11**	**3**	**14**	**300**	**100**	**75**	**25**	**240**	**240**	**120**	**1100**	**22**

Prog. Name: Electrical Engineering

Semester – IV

SL. No	Category of Course	Code No	Course Title	Study Scheme				Evaluation Scheme							Total Marks	Credits
				Pre-requisite	Contact Hours/ week			Theory				Practical				
					L	T	P	End Exam	Progressive Assessment			End Exam	Progressive Assessment			
									Class Test	Assignment	Attendance		Sessional	Viva voce		
1	Programme Core	EEPC202	Fundamentals of power electronics		3	0	0	60	20	15	5	-	-	-	100	3
2		EEPC204	Electric power transmission and distribution		3	0	0	60	20	15	5	-	-	-	100	3
3		EEPC206	Induction, synchronous and special electrical machines		2	1	0	60	20	15	5	-	-	-	100	3
4		EEPC208	Fundamentals of power electronics laboratory		0	0	2	-	-	-	-	40	40	20	100	1
5		EEPC210	Electric power transmission and distribution laboratory		0	0	2	-	-	-	-	40	40	20	100	1
6		EEPC212	Induction, synchronous and special electrical machines laboratory		0	0	2	-	-	-	-	40	40	20	100	1
7	Programme Elective	EEPE204	Electrical testing and commissioning		3	0	0	60	20	15	5	-	-	-	100	3
8		EEPE206	Electrical estimation and contracting		3	0	0	60	20	15	5	-	-	-	100	3
9		EEPE208	Electrical testing and commissioning laboratory		0	0	2	-	-	-	-	40	40	20	100	1
10		EEPE210	Electrical estimation and contracting laboratory		0	0	2	-	-	-	-	40	40	20	100	1
11	Minor Project	PR202	Minor Project		0	0	4	-	-	-	-	40	40	20	100	2
12	Mandatory	AU202	Essence of Indian knowledge and tradition		**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
TOTAL					**16**	**1**	**14**	**300**	**100**	**75**	**25**	**240**	**240**	**120**	**1100**	**22**

SEMESTER - III

INTRODUCTION TO ELECTRIC GENERATION SYSTEMS

L	T	P		Course Code No: EEPC201	
3	0	0			
Total Contact Hours :			**Total Marks: 100**	**Theory**	
Lecture		: 45Hrs		End Term Exam	60
Tutorial		: 0		Progressive Assessment	40
Credit		**3**		Category of Course : PC	

RATIONALE:

This course concentrates on the field of electric generation systems. It includes thermal power plants: coal, gas/diesel and nuclear-based, large and micro-hydropower plants, solar and biomass based power plants, and wind power plants. After completion of this course, the students will also be able to get some idea about economics of power generation and interconnected power system and maintain the efficient operation of various electric power generating plants.

LEARNING OUTCOMES:

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

- Explain the optimized working of the thermal power plant
- Describe the efficient operation of large and micro hydropower plants.
- Maintain the optimized working of solar and biomass-based power plants
- Discuss the optimized working of wind power plants
- Select the adequate mix of power generation based on economic operation.

DETAILED COURSE CONTENTS

Unit	Topic/Sub-Topic	Hours
I	**Thermal Power Plants: Coal, Gas/Diesel and Nuclear-based**	10
	1.1 Layout and working of a typical thermal power plant with steam turbines and electric generators	
	1.2 Properties of conventional fuels used in the energy conversion equipment used in thermal power plants: Coal, Gas, Diesel, Nuclear fuels-fusion and fission action	
	1.3 Safe Practices and working of various thermal power plants: coal-based, gas- based, diesel-based, and nuclear-based	
	1.4 Functions of the following types of thermal power plants and their major auxiliaries	
	1.4.1 Coal fired boilers: fire tube and water tube	
	1.4.2 Gas/diesel based combustion engines	
	1.4.3 Types of nuclear reactors :Disposal of nuclear waste and nuclear shielding	
II	**Large and Micro-Hydropower Plants**	9
	2.1 Energy conversion process of hydro power plant	

	2.2 Classification of hydro power plant: High ,medium and low head	
	2.3 Construction and working of hydro turbines used in different types of hydro power plant	
	2.3.1 High head-Pelton turbine	
	2.3.2 Medium head-Francis turbine	
	2.3.3 Low head-Kaplan turbine	
	2.4 Safe Practices for hydro power plants	
	2.5 Different types of micro-hydro turbines for different heads: Pelton, Francis and Kaplan turbines	
	2.5 Locations of these different types of large and micro-hydro power plants in India	
III	**Solar and Biomass based Power Plants**	9
	3.1 Solar Map of India: Global solar power radiation	
	3.2 Solar Power Technology	
	3.2.1 Concentrated Solar Power (CSP) plants, construction and working of: Power Tower, Parabolic Trough, Parabolic Dish, Fresnel Reflectors	
	3.2.2 Solar Photovoltaic (PV) power plant: layout, construction, working	
	3.3 Biomass-based Power Plants	
	3.3.1 Layout of a Bio-chemical based (e.g. biogas) power plant	
	3.3.2 Layout of a Thermo-chemical based (e.g. Municipal waste) power plant	
	3.3.3 Layout of an Agro-chemical based (e.g. bio-diesel) power plant	
	3.3.4 Features of the solid, liquid and gas biomasses as fuel for biomass power plant	
IV	**Wind Power Plants**	9
	4.1 Wind Map of India**:** Wind power density in watts per square meter	
	4.2 Layout of Horizontal axis large wind power plant	
	4.3 Geared wind power plant	
	4.4 Direct-drive wind power plant	
	4.5 Salient Features of electric generators used in large wind power plants	
	4.5.1 Constant Speed Electric Generators)	
	4.5.2 Squirrel Cage Induction Generators (SCIG)	
	4.5.3 Wound Rotor Induction Generator (WRIG)	
	4.6 Variable Speed Electric Generators	
	4.6.1 Doubly-fed induction generator (DFIG)	
	4.6.2 Wound rotor synchronous generator (WRSG)	
	4.6.3 Permanent magnet synchronous generator (PMSG)	
V	**Economics of Power Generation and Interconnected Power System**	8
	5.1 Related terms: connected load, firm power, cold reserve, hot reserve, spinning reserve. Base load and peak load plants; Load curve, load duration curve, integrated duration curve	

	5.2 Cost of generation: Average demand, maximum demand, demand factor, plant capacity factor, plant use factor, diversity factor, load factor and plant load factor	
	5.3 Choice of size and number of generator units	
	5.4 Combined operation of power station	
	5.5 Causes and Impact and reasons of Grid system fault: State grid, national grid, brownout and blackout; sample blackouts at national and international level.	

REFERENCES:

1. Electrical Power Generation by Tanmoy Deb, Khanna Publishing House, Delhi.
2. Generation of Electrical Energy by B.R. Gupta, S. Chand & Co. New Delhi.
3. Wind Power Technologies by Rachel, Sthuthi; Earnest, Joshua, PHI Learning, New Delhi.
4. Solar Photovoltaics: Fundamentals, Technologies and Applications by Chetan Singh Solanki, PHI Learning, New Delhi.
5. Wind Energy Basics by Gipe Paul, Chelsea Green Publishing Co.
6. Wind Power Plants and Project Development by Wizelius, Tore, Earnest, Joshua, PHI.
7. A Course in Electrical Power by J.B. Gupta, S.K. Kataria and Sons, New Delhi.
8. A Course in Electrical Power by Soni, Gupta, Bhatnagar, Dhanpat Rai and Sons.

ELECTRICAL CIRCUITS & MATERIALS

L	T	P		
2	1	0		**Course Code No: EEPC203**
Total Contact Hours :			**Total Marks: 100**	**Theory**
Lecture		: 30 Hrs		End Term Exam 60
Tutorial		**:** 15 Hrs		Progressive Assessment 40
Credit		**3**		

RATIONALE:

The concept of electrical circuit is very essential for the study of the other subjects in Electrical Engineering. This subject covers the single-phase a.c series circuits, single phase a.c parallel circuits, three phase circuits, network reduction and principles of circuit analysis and network theorems. The knowledge of Electrical Engineering Material plays an important role in Electrical Engineering. The technicians who will be completing the course under Diploma Engineering Scheme will be entrusted to select the proper materials for the use as conductor, semiconductor and insulator. Resistance materials are used for different purposes as potential divider, heating and controlling element. This subject provides the necessary information regarding all above materials so that the student can select the suitable materials for the definite purposes.

LEARNING OUTCOMES:

After completion of the course the students will be able to

- Troubleshoot problems related to single phase a.c series circuits
- Troubleshoot problems related to single phase a.c parallel circuits
- Troubleshoot problems related to three phase circuits
- Use principles of circuit analysis to troubleshoot electric circuits.
- Apply network theorems to troubleshoot electric circuits
- Apply electrical engineering materials

DETAILED COURSE CONTENTS:

Unit	Topic/Sub-Topic	Hours
I	Single Phase A.C Series Circuits	9
	1.1 Generation of alternating voltage	
	1.2 Phasor representation of sinusoidal quantities	
	1.3 R, L, C circuit elements its voltage and current response	
	1.4 R-L, R-C, R-L-C combination of A.C series circuit	
	1.4.1 Impedance, reactance, impedance triangle	
	1.4.2 Power factor, active power, reactive power, apparent power	
	1.4.3 Power triangle and vector diagram	
	1.4.4 Resonance, Bandwidth	
	1.4.5 Quality factor and voltage magnification in series R-L, R-C, R-L-C circuit	

II	**Single Phase A.C Parallel Circuits**	8
	2.1 R-L, R-C and R-L-C parallel combination of A.C. circuits	
	2.1.1 Impedance, reactance, phasor diagram, impedance triangle	
	2.1.2 Power factor, active power, apparent power, reactive power, power triangle	
	2.2 Resonance in parallel R-L, R-C, R-L-C circuit	
	2.3 Bandwidth, Quality factor and voltage magnification	
III	**Three Phase Circuits**	8
	3.1 Phasor and complex representation of three phase supply	
	3.2 Phase sequence and polarity	
	3.3 Types of three-phase connections	
	3.4 Phase and line quantities in three phase star and delta system	
	3.5 Balanced and unbalanced load	
	3.6 Neutral shift in unbalanced load	
	3.7 Three phase power, active, reactive and apparent power in star and delta system	
IV	**Network Reduction and Principles of Circuit Analysis**	7
	4.1 Source transformation	
	4.2 Star/delta and delta/star transformation	
	4.3 Mesh Analysis	
	4.4 Node Analysis	
V	**Network Theorems**	6
	5.1 Superposition theorem	
	5.2 Thevenin's theorem	
	5.3 Norton's theorem	
	5.4 Maximum power transfer theorem	
VI	**Materials for Conductors, Resistors and Insulator**	2
	6.1 Describe the properties of Conductors, Semiconductors and Insulators	
	6.2 Describe the application and properties of important resistance materials like Tungsten, Carbon, Nichrome, Manganin, Eureka, Platinum	
	6.3 Classify the Insulating Materials in terms of temperature ranges	
VII	**Dielectric Material**	2
	7.1 Define Dielectric strength, Dielectric loss, Dissipation factor, the	
	factors affecting dielectric loss	
	7.2 State the relation between Relative permittivity and Dielectric strength	
VIII	**Magnetic Material**	3
	8.1 Define Ferromagnetic material, Paramagnetic material, Diamagnetic material, Curie point	
	8.2 Draw and explain the hysteresis loop for different materials like hard sheet, wrought iron and alloy steel	
	8.3 State the effect of adding impurities in Ferromagnetic materials	

	8.4 State the properties of Electromagnetic steel and alloys, CRGO, Dynamo Grade steel, Ferrites, ALNICO and Hard Ferrites.	

REFERENCES:

1. Networks & Systems by Ashfaq Husain, Khanna Book Publishing, New Delhi.
2. Fundamentals of Electrical Network by B.R.Gupta and Vandana Singhal, S.Chand.
3. Fundamentals of Electrical Engineering by S.B Lal Saxena and K.Dasgupta, Cambridge University Press Pvt. Ltd., New Delhi.
4. A Text Book of Electrical Technology Vol-I by B. L.Theraja and A. K.Theraja, S. Chand & Co. Ramnagar, New Delhi.
5. Circuit and network by A. Sudhakar and S. Palli Shyammohan, McGraw Hill Education, New Delhi.
6. Electric Circuits by David A. Bell, Oxford University Press New Delhi.
7. Introductory circuit Analysis by R.L. Boylested, Wheeler, New Delhi.
8. Basic Electrical Engineering by V.N. Mittle and Arvind Mittle, McGraw Hill Education, Noida.
9. Electric Circuit Analysis by S.N. Sivanandam, Vikas Publishing House Pvt. Ltd, Noida.
10. Circuit theory by S. Salivahanan and S. Pravinkumar, Vikas Publishing House Pvt. Ltd, Noida.
11. A course in Electrical Engineering Materials by S.P. Seth, P.V. Gupta, Dhanpat Rai & Sons.
12. Electrical Engineering Material by N. Alagappan and NT Kumar, TATA McGraw Hill.

ELECTRICAL & ELECTRONIC MEASUREMENTS

L	T	P		Course Code No: EEPC205	
2	1	0			
Total Contact Hours :			**Total Marks: 100**	**Theory**	
Lecture		: 30 Hrs		End Term Exam	60
Tutorial		**:** 15 Hrs		Progressive Assessment	40
Credit		**3**			

RATIONALE:

The subject "Electrical & Electronics Measurements" an important in the field of Electrical Engineering. This subject deals with the technique of measuring voltage, current and wattage by the indicating type of instruments. The technique of measurement of Electrical power in single phase and three phase circuits will be studied here. Measurement of energy and calibration and adjustment of energy meters will also be studied under this subject. Prior to above the working principle construction of all type of measuring instruments like indicating, integrating and recording type will also be studied here.

LEARNING OBJECTIVES:

After completion of the course the students will be able to

- Explain the construction and working principle of different types of electrical measuring instruments.
- Connect different types of electrical measuring instruments to measure various electrical parameters.
- Select the right instruments for the measurement of voltage, current, power and energy. Apply the appropriate technique to measure resistance, inductance and capacitance.

DETAILED COURSE CONTENTS

Unit	Topic/Sub-Topic	Hours
I	**Fundamentals of Measurements**	10
	1.1 Measurement: Significance, units, fundamental quantities and standards	
	1.2 Classification of Instrument Systems	
	1.3 Null and deflection type instruments	
	1.4 Absolute and secondary instruments	
	1.5 Analog and digital instruments	
	1.6 Static and dynamic characteristics, types of errors	
	1.7 Calibration: need and procedure	
	1.8 Classification of measuring instruments: indicating, recording and integrating instruments	
	1.9 Essential requirements of an indicating instruments	

II	**Measurement of voltage and current**	9
	2.1 DC Ammeter: Basic, Multi range, Universal shunt,	
	2.2 DC Voltmeter: Basic, Multi-range, concept of loading effect and sensitivity	
	2.3 AC voltmeter: Rectifier type (half wave and full wave)	
	2.4 CT and PT: construction, working and applications	
	2.5 Clamp-on meter	
III	**Measurement of Electric Power**	9
	3.1 Analog meters: Permanent magnet moving coil (PMMC) and Permanent magnet moving iron (PMMI) meter, their construction, working, salient features, merits and demerits	
	3.2 Dynamometer type wattmeter: Construction and working	
	3.3 Range: Multiplying factor and extension of range using CT and PT	
	3.4 Errors and compensations	
	3.5 Active and reactive power measurement: One, two and three wattmeter method	
	3.6 Effect of Power factor on wattmeter reading in two wattmeter method	
	3.8 Maximum Demand indicator	
IV	**Measurement of Electric Energy**	7
	4.1 Single and three phase electronic energy meter: Constructional features and working principle	
	4.2 Errors and their compensations	
	4.3 Calibration of single phase electronic energy meter using direct loading.	
V	**Circuit Parameter Measurement, CRO and Other Meters**	10
	5.1 Measurement of resistance	
	5.1.1 Low resistance: Kelvin's double bridge,	
	5.1.2 Medium Resistance: Voltmeter and ammeter method	
	5.1.3 High resistance: Megger and Ohm meter: Series and shunt	
	5.2 Measurement of inductance using Anderson bridge (no derivation and phasor diagram)	
	5.3 Measurement of capacitance using Schering bridge (no derivation and phasor diagram)	
	5.4 Single beam/single trace CRO	
	5.5 Digital storage Oscilloscope**:** Basic block diagram, working, Cathode ray tube, electrostatic deflection, vertical amplifier, time base generator, horizontal amplifier, measurement of voltage/ amplitude/ time period/ frequency/ phase angle delay line, specifications.	
	5.6 Other meters: Earth tester, Digital Multimeter; L-C-R meter, Frequency meter (ferromagnetic and Weston type), Phase sequence indicator, power factor meter (single phase and three phase dynamometer type), Synchro scope, Tri-vector meter	
	5.7 Signal generator: need, working and basic block diagram.	
	5.8 Function generator: need, working and basic block diagram, function of symmetry.	

REFERENCES:

1. A Text Book of Electrical Technology Vol-I (Basic Electrical Engg.) by B. L. Theraja, A. K. Theraja, S.Chand and Co. New Delhi.
2. Basic Electrical Engineering by V. N. Mittle, Mc Graw-Hill New Delhi.
3. Electrical Technology by Edward Hughes, Pearson Education, New Delhi.
4. Electrical and Electronic Measurement and Instrumentation by R.K. Rajput, S.Chand and Co. New Delhi.
5. Electrical and Electronics Measurements and Instrumentation by A.K. Sawhney, Dhanpai Rai and Sons, New Delhi.
6. Electrical Measurements and Measuring Instruments by N.V. Suryanarayna, S.Chand and Co., New Delhi.

ELECTRIC MOTORS & TRANSFORMERS

L	T	P		
2	1	0		**Course Code No: EEPC207**
Total Contact Hours :				**Theory**
Lecture		: 30Hrs	**Total Marks: 100**	End Term Exam 60
Tutorial		**:** 15 Hrs		Progressive Assessment 40
Credit		**3**		

RATIONALE:

The applications of d.c. machine in modern industries are still in practice. The Electrical Engineering Technicians has to look after the installation, operation and control of electrical machines. So the knowledge of "Electrical Machine" is very essential in this regard. This subject covers d.c. generators, d.c. motors, single phase transformers, three phase transformers and special purpose transformers. This subject deals with the working principles, operation of the machines.

LEARNING OUTCOMES:

After completion of the course the students will be able to

- Explain the construction and working principle of dc machines.
- Describe the performance characteristics of dc motor and dc generator.
- Explain the construction and working principle of transformer.
- Describe the performance of single phase and three phase transformer.
- Discuss about special purpose transformers

DETAILED COURSE CONTENTS

Unit	Topic/Sub-Topic	Hours
I	**DC Generators**	9
	1.1 D.C. generator: construction, parts, materials and their functions	
	1.2 Principle of operation of DC generator	
	1.2.1 Fleming's right hand rule	
	1.2.2 Schematic diagrams, e.m.f. equation of generator	
	1.2.3 Armature reaction	
	1.2.4 Commutation	
	1.2.5 Applications of D.C. generators	
	1.3 Classification of measuring instruments: indicating, recording and integrating instruments	
II	**D.C. Motors**	9
	2.1 D.C. motor: Types of DC motors	
	2.1.1 Fleming's left hand rule	

	2.1.2 Principle of operation of Back e.m.f. and its significance	
	2.1.3 Voltage equation of DC motor	
	2.1.4 Torque and Speed; Armature torque, Shaft torque, BHP, Brake test, losses, efficiency	
	2.2 DC motor starters: Necessity, two point and three point starters	
	2.3 Speed control of DC shunt and series motor: Flux and Armature control	
	2.4 Brushless DC Motor: Construction and working	
III	**Single Phase Transformers**	10
	3.1 Types of transformers: Shell type and core type	
	3.2 Construction: Parts and functions	
	3.3 Materials used for different parts: CRGO, CRNGO, HRGO, amorphous cores	
	3.4 Transformer: Principle of operation	
	3.5 EMF equation of transformer: Derivation, Voltage transformation ratio	
	3.6 Significance of transformer ratings	
	3.7 Transformer No-load and on-load phasor diagram, Leakage reactance	
	3.8 Equivalent circuit of transformer: Equivalent resistance and reactance	
	3.9 Voltage regulation and Efficiency: Direct loading, OC/SC method, All day efficiency	
IV	**Three Phase Transformers**	9
	4.1 Bank of three single phase transformers,	
	4.2 Single unit of three phase transformer	
	4.3 Distribution and Power transformers: Construction and cooling,	
	4.4 Three phase transformers connections as per IS:2026 (part IV)-1977	
	4.5 Three phase to two phase conversion (Scott Connection),	
	4.6 Selection of transformer as per IS: 10028 (Part I)-1985,	
	4.7 Criteria for selection of distribution transformer, and power transformer, Amorphous Core type Distribution Transformer,	
	4.8 Specifications of three-phase distribution transformers as per IS:1180 (part I)-1989	
	4.9 Need of parallel operation of three phase transformer	
	4.10 Conditions for parallel operation.	
	4.11 Polarity tests on mutually inductive coils and single phase transformers	
	4.12 Polarity test, Phasing out test on Three-phase transformer	
V	**Special Purpose Transformers**	8
	5.1 Single phase and three phase auto transformers: Construction, working and applications.	
	5.2 Instrument Transformers: Construction, working and applications of Current transformer and Potential transformer	
	5.3 Isolation transformer: Constructional Features and applications	

REFERENCES:

1. Electrical Machines, Vol-I, II, by G.C.Garg & P.S.Bimbhra, Khanna Book Publishing House, New Delhi.
2. Basic Electrical Engineering by V.N. Mittle and Arvind. Mittle, McGraw Hill Education, New Delhi.
3. Electrical Machines by D.P. Kothari, and I.J. Nagrath, McGraw Hill Education, NewDelhi.
4. Electrical Machines by S.K. Bhattacharya, McGraw Hill Education, New Delhi.
5. Principles of Electrical Machines by V.K. Mehta, and Rohit Mehta, ,S. Chand and Co.Ltd., New Delhi.
6. Electrical Technology Vol-II (AC and DC machines) by B.L. Theraja, S. Chand and Co. Ltd., New Delhi.
7. Electrical Machines Theory and Practice by M.N. Bandyopadhyay, PHI Learning Pvt. Ltd., New Delhi.
8. DC Machines and Transformers by K. Murugesh Kumar.

RENEWBLE ENEGY POWER PLANTS

L	T	P		Course Code No: EEPC209	
3	0	0			
Total Contact Hours :			**Total Marks: 100**	**Theory**	
Lecture		: 45 Hrs		End Term Exam	60
Tutorial		: 0		Progressive Assessment	40
Credit		**3**			

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain the efficient operation of various types of renewable energy power plants.

Course contents:

Unit–I Solar PV and Concentrated Solar Power Plants

- Solar Map of India: Global solar power radiation, Solar PV
- Concentrated Solar Power (CSP) plants, construction and working of: Power Tower, Parabolic Trough, Parabolic Dish, Fresnel Reflectors.
- Solar Photovoltaic (PV) power plant: components layout, construction, working. Roof top solar PV power system

Unit–II Large Wind Power Plants

- Wind Map of India: Wind power density in watts per square meter Lift and drag principle; long path theory.
- Geared type wind power plants: components, layout and working. Direct drive type wind power plants: components, layout and working.
- Constant Speed Electric Generators: Squirrel Cage Induction Generators (SCIG),
- Wound Rotor Induction Generator (WRIG); Variable Speed Electric Generators: Doubly-fed induction generator (DFIG), wound rotor synchronous generator (WRSG), permanent mag-net synchronous generator (PMSG).

Unit–III Small Wind Turbines

- Horizontal axis small wind turbine: direct drive type, components and working Horizontal axis small wind turbine: geared type, components and working
- Vertical axis small wind turbine: direct drive and geared, components and working Types of towers and installation of small wind turbines on roof tops and open fields.
- Electric generators used in small wind power plants

Unit–IV Micro-hydro Power Plants

- Energy conversion process of hydro power plant.
- Classification of hydro power plant: High, medium and low head.
- Lay outs of micro-hydro power plants
- Constructionandworkingofhydroturbinesusedindifferenttypesofhydropowerplant:
  a) High head– Pelton turbine
  b) Medium head- Francis turbine
  c) Low head– Kaplan turbine.
- Safe Practices for micro hydro power plants.

Unit–V Biomass-based Power Plants

- Properties of solid fuel for biomass power plants: bagasse, woodchips, ricehusk, municipal waste
- Properties of liquid and gaseous fuel for biomass power plants: Jatropha, bio diesel gobar gas
- Layout of a Bio-chemical based (e.g. biogas) power plant:
  a) Layout of a Thermochemical based (e.g. Municipal waste) power plant
  b) Layout of a Agrochemical based (e.g. bio-diesel) power plant

References:

1. Deambi,Suneel:FromSunlighttoElectricity:apracticalhandbookonsolarphotovoltaicapplication;TERI, New Delhi ISBN:9788179935736
2. DavidM.Buchla,ThomasE.Kissell,ThomasL.Floyd-RenewableEnergySystems,PearsonEducationNew Delhi ,ISBN:9789332586826,
3. Rachel,Sthuthi;Earnest,Joshua–WindPowerTechnologies,PHILearning,NewDelhi,ISBN:978-9388028-49-3; E-book978-93-88028-50-9
4. Khoiyangbam,RSNavindu;GuptaandSushilKumar;BiogasTechnology:TowardsSustainableDevelopm ent;TERI, New Delhi; ISBN:9788179934043
5. Gipe,Paul:WindEnergyBasics,ChelseaGreenPublishingCo;ISBN:978-1603580304
6. Wizelius,Tore&Earnest,Joshua-PHILearning,NewDelhi,ISBN:978-8120351660
7. Kothari,D.P.etal:RenewableEnergySourcesandEmergingTechnologies,PHILearning,NewDelhi,ISBN: -978-81-203-4470-9
8. Bhadra,S.N.,Kastha,D.,Banerjee,S,WindElectricalSystemsinstallation;OxfordUniversityPress, NewDelhi,ISBN:9780195670936.
9. O.P.Gupta,EnergyTechnology,KhannaPublishingHouse,NewDelhi(ISBN:978-9386173-683)

Courseoutcomes:

thetheory,practicalexperiencesandrelevantsoftskillsassociatedwiththiscoursearetobetaught andim
plemented,sothatthestudentdemonstratesthefollowingindustryorientedCOsassociatedwiththeabo ve mentionedcompetency:

a) MaintaintheoptimisedworkingofsolarPVandCSpowerplants.
b) Maintaintheoptimisedworkingoflargewindpowerplants
c) Maintaintheoptimisedworkingofsmallwindturbines.
d) Maintaintheoptimisedworkingofmicrohydropowerplants.
e) Maintaintheoptimisedworkingofbiomass-basedpowerplants.

INTRODUCTION TO ELECTRIC GENERATION SYSTEMS LABORATORY

L	T	P		Course Code No.: EEPC211	
0	0	2			
Total Contact Hours :				**Practical**	
Practical		: 30 Hrs	**Total Marks: 100**	End Term Exam	40
Credit		**1**		Progressive Assessment	60

RATIONALE:

This course concentrates on the field of electric generation systems. It incorporates thermal power plants such as coal, gas/diesel and nuclear-based, large and micro-hydropower plants, solar and biomass based power plants, and wind power plants. After completion of this course, the students will also be able to get some idea about the routine maintenance parts and the efficient operation of various electric power generating plants.

LEARNING OUTCOMES:

After completion of the course the students will be able to

- Identify the routine maintenance parts of the coal fired thermal power plant
- Identify the routine maintenance parts of the gas fired thermal power plant
- Assemble a micro-hydro power plant
- Identify the routine maintenance parts of the large wind power plant Assemble the solar PV plant

DETAILED COURSE CONTENTS

Sr. No.	Practicals	Hours
1.	Identify the routine maintenance parts of the coal fired thermal power plant after watching a video programme.	2
2.	Identify the routine maintenance parts of the gas fired thermal power plant after watching a video programme	2
3.	Assemble and dismantle a small diesel generator power plant	2
4.	Identify the routine maintenance parts of the nuclear fired thermal power plant after watching a video programme.	2
5.	Identify the routine maintenance parts of the large hydro power plant after watching a video programme	2
6.	Identify the routine maintenance parts of the micro hydro power plant after watching a video programme.	2
7.	Assemble a micro hydro power plant and then dismantle it.	2
8.	Assemble the parabolic trough or parabolic dish Concentrated Solar Power (CSP) plant.	2
9.	Dismantle the parabolic trough or parabolic dish CSP plant.	2
10.	Assemble the solar PV plant to produce electric power and then dismantle it.	2

11.	Assemble a small biogas plant to generate electric power	2
12.	Dismantle the biogas plant.	2
13.	Identify the routine maintenance parts of the large wind power plant after watching a video programme.	2
14.	Assemble a horizontal axis small wind turbine to produce electric power	2
15.	Dismantle a horizontal axis small wind turbine.	2
16.	Assemble a vertical axis small wind turbine to produce electric power and then dismantle it.	2
17.	Identify the routine maintenance parts of the horizontal axis small wind turbine after watching a video programme.	2
18.	Identify the routine maintenance parts of the vertical axis small wind turbine after watching a video programme.	2

ELECTRICAL CIRCUITS LABORATORY

L	T	P	Total Marks: 100	Course Code No.: EEPC213	
0	0	2			
Total Contact Hours :				**Practical**	
Practical		: 30 Hrs		End Term Exam	40
Credit		**1**		Progressive Assessment	60

RATIONALE:

The concept of Electrical Circuit is very essential for the study of the other subjects in Electrical Engineering. This subject covers the single phase a.c series circuits, single phase a.c parallel circuits, three phase circuits, network reduction and principles of circuit analysis and network theorems.

LEARNING OBJECTIVES:

After completion of the course the students will be able to

- Troubleshoot problems related to single phase A.C series circuits
- Troubleshoot problems related to single phase A.C parallel circuits
- Troubleshoot problems related to three phase circuits
- Use principles of circuit analysis to troubleshoot electric circuits.
- Apply network theorems to troubleshoot electric circuits

DETAILED COURSE CONTENTS

Sr. No.	Practicals	Hours
1.	Use dual trace oscilloscope to determine A.C voltage and current response in given R, L, C circuit.	2
2.	Use voltmeter, ammeter, wattmeter to determine active, reactive and apparent power consumed in given R-L series circuit. Draw phasor diagram	2
3.	Use voltmeter, ammeter to determine active, reactive and apparent power consumed in given R-C series circuit. Draw phasor diagram.	2
4.	Use voltmeter, ammeter, wattmeter to determine active, reactive and apparent power consumed in given R-L-C series circuit. Draw phasor diagram.	2
5.	Use variable frequency supply to create resonance in given series R-L-C circuit or by using variable inductor or variable capacitor.	2
6.	Use voltmeter, ammeter, wattmeter to determine current, p.f., active, reactive and apparent power in R-C parallel A.C. circuit.	2
7.	Use voltmeter, ammeter, wattmeter, p.f meter to determine current, p.f., active, reactive and apparent power for given R-L-C parallel circuit with series connection of resistor and inductor in parallel with capacitor.	2
8.	Use variable frequency supply create resonance in given parallel R-L-C circuit or by using variable inductor or capacitor	2

9.	Use voltmeter, ammeter, wattmeter, p.f meter to determine line and phase quantities of voltage and current for balanced three phase star and delta connected load and calculate active, reactive, and apparent power. Draw phasor diagram.	2
10.	Use voltmeter, ammeter, wattmeter, p.f meter to determine line and phase quantities of voltage and current for unbalanced three phase star and delta connected load and calculate active, reactive, and apparent power. Draw phasor diagram.	2
11.	Use voltmeter, ammeter to determine current through the given branch of a electric network by applying mesh analysis.	2
12.	Use voltmeter, ammeter to determine current through the given branch of a electric network by applying node analysis.	2
13.	Use voltmeter, ammeter to determine current through the given branch and voltage across the given element of circuit by applying superposition theorem.	2
14.	Use voltmeter, ammeter to determine equivalent circuit parameter in a given circuit by applying Thevenin's theorem	2
15.	Use voltmeter, ammeter to determine equivalent circuit parameter in a given circuit by applying Norton's theorem	2
16.	Use voltmeter, ammeter to determine load resistance for maximum power transfer for a given circuit by applying maximum power transfer theorem.	2

ELECTRICAL & ELECTRONIC MEASUREMENTS LABORATORY

L	T	P	Total Marks: 100	Course Code No.: EEPC215	
0	0	2			
Total Contact Hours :				**Practical**	
Practical		: 30 Hrs		End Term Exam	40
Credit		**1**		Progressive Assessment	60

RATIONALE:

The Electrical & Electronics Measurements Laboratory is very important in the field of Electrical Engineering. This subject deals with the technique of measuring voltage, current and wattage by the indicating type of instruments. The technique of measurement of Electrical power in single phase and three phase circuits will be studied in this laboratory. Measurement of energy and calibration and adjustment of energy meters will also be studied under this subject. Prior to above the working principle construction of all type of measuring instruments like indicating, integrating and recording type will also be studied here.

LEARNING OUTCOMES:

After completion of the course the students will be able to

- Check the working of the electrical measuring instrument.
- Use different types of measuring instruments for measuring voltage and current. Use different types of measuring instruments for measuring electric power Use different types of measuring instruments for measuring electric energy.
- Use CRO for the Measurement of supply frequency in single-phase circuit

DETAILED COURSE CONTENTS

Sr. No.	Practicals	Hours
1.	Identify measuring instruments on the basis of symbols on dial, type, accuracy, class position and scale.	2
2.	Identify the components of PMMC and MI instruments.	2
3.	Troubleshoot PMMC and MI instruments.	2
4.	Measure AC and DC quantities in a working circuit.	2
5.	Extend range of ammeter and voltmeter by using (i) shunt and multiplier (ii) CT and PT.	2
6.	Use Clamp-on meter for measurement of AC/DC current, AC/DC voltage.	2
7.	Use electro-dynamic watt-meter for measurement of power in a single phase circuit	2
8.	Troubleshoot electrodynamic watt-meter for measurement of power in a single phase circuit	2

9.	Use single wattmeter for measurement of active and reactive power of three phase balanced load.	2
10.	Use two watt-meters for measuring active power of three-phase balanced load.	2
11.	Calibrate single phase electronic energy meter by direct loading.	2
12.	Troubleshoot single phase electronic energy meter.	2
13.	Use digital multi-meter for measurement of AC/DC current, AC/DC voltage.	2
14.	Use Kelvin's double bridge for measurement of low resistance.	2
15.	Use voltmeter and ammeter method for measurement of medium resistance.	2
16.	Use Megger for insulation resistance measurements.	2
17.	Use earth tester for measurement of earth resistance.	2
18.	Use CRO for the Measurement of supply frequency in single-phase circuit.	2
19.	Use Tri-vector meter for measuring kW, kVAr and kVA of a power line.	2

ELECTRIC MOTORS & TRANSFORMERS LABORATORY

L	T	P	Total Marks: 100	Course Code No.: EEPC217	
0	0	2			
Total Contact Hours :				**Practical**	
Practical		: 30 Hrs		End Term Exam	40
Credit		**1**		Progressive Assessment	60

RATIONALE:

The applications of d.c. machine in modern industries are still in practice. The Electrical Engineering Technicians has to look after the installation, operation and control of electrical machines. So the practical knowledge of "Electrical Machine" is very essential in this regard. This subject covers d.c. Generators, d.c. motors, single phase transformers, three phase transformers and special purpose transformers. The aim of this course is to help the student to use electric motors and transformers.

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LEARNING OBJECTIVES:

After completion of the course the students will be able to

1. Check the working of the electrical dc machines and transformers
2. Maintain different types of DC generators.
3. Maintain different types of DC motors.
4. Maintain single phase transformer.
5. Maintain three phase transformers.
6. Maintain different types of special purpose transformers used in different applications.

DETAILED COURSE CONTENTS

Sr. No.	Practicals	Hours
1.	Dismantle a DC machine.	2
2.	Reverse the direction of rotation of the DC shunt motor.	2
3.	Perform brake test on DC shunt motor	2
4.	Control the speed of DC shunt motor by different methods.	2
5.	Control the speed of DC series motor by different methods.	2
6.	Perform the brake test on DC series motor.	2
7.	Check the functioning of single phase transformer	2
8.	Determine regulation and efficiency of single phase transformer by direct loading	2
9.	Perform open circuit and short circuit test on single phase transformer to determine equivalent circuit constants, voltage regulation and efficiency	2

10.	Perform parallel operation of two single phase transformers to determine the load current sharing.	2
11.	Perform parallel operation of two single phase transformers and determine the apparent and real power load sharing.	2
12.	Perform polarity test on a single phase transformer whose polarity markings are masked.	2
13.	Perform phasing out test on a three phase transformer whose phase markings are masked.	2
14.	Connect the auto-transformer in step-up and step-down modes noting the input/output readings.	2
15.	Check the functioning of the CT, PT and isolation transformer.	2
16.	Test the pulse transformer.	2

REFERENCES:

1. From Sunlight to Electricity: a practical handbook on solar photovoltaic application by Suneel Deambi, TERI, New Delhi.
2. Renewable Energy Systems, Pearson Education by David M. Buchla, Thomas E. Kissell, Thomas L. Floyd, New Delhi.
3. Wind Power Technologies by Sthuthi Rachel, Joshua Earnest, PHI Learning, New Delhi.
4. Biogas Technology: Towards Sustainable Development by Khoiyangbam, R S Navindu; Gupta and Sushil Kumar; TERI, New Delhi.
5. Wind Energy Basics by Paul, Gipe, Chelsea Green Publishing Co.
6. Renewable Energy Sources and Emerging Technologies by D.P. Kothari, PHI Learning, New Delhi.
7. Wind Electrical Systems installation by S.N. Bhadra, D. Kastha, S, Banerjee, Oxford University Press, New Delhi.
8. Energy Technology by O.P. Gupta, Khanna Publishing House, New Delhi.

RENEWABLE ENERGY POWER PLANTS LABORATORY

L	T	P	Total Marks: 100	Course Code No.: EEPC219	
0	0	2			
Total Contact Hours :				**Practical**	
Practical		: 30 Hrs		End Term Exam	40
Credit		**1**		Progressive Assessment	60

RATIONALE:

Renewable Energy is the crucial input in the process of economic, social and industrial development. High energy consumption as traditionally been associated with high quality of life. Since the conventional energy resources are under depletion, it is high time to harness the non-conventional energy sources like solar and bio energy. The aim of this course is to help the student to maintain the efficient operation of various renewable energy power plants.

LEARNING OUTCOMES:

After completion of the course the students will be able to

- Maintain the optimised working of solar PV and CS power plants.
- Maintain the optimised working of large wind power plants
- Maintain the optimised working of small wind turbines.
- Maintain the optimised working of micro hydro power plants.
- Maintain the optimised working of biomass-based power plants.

DETAILED COURSE CONTENTS

Sr. No.	Practicals	Hours
1.	Dismantle the parabolic trough CSP plant	2
2.	Assemble the parabolic trough Concentrated Solar Power (CSP) plant.	2
3.	Assemble the parabolic dish CSP plant.	2
4.	Dismantle the parabolic dish CSP plant.	2
5.	Assemble the solar PV plant to produce electric power	2
6.	Dismantle the solar PV plant	2
7.	Identify the routine maintenance parts of the large wind power plant after watching a video programme	2
8.	Assemble a horizontal axis small wind turbine to produce electric power	2
9.	Dismantle a horizontal axis small wind turbine.	2

10.	Assemble a vertical axis small wind turbine to produce electric power	2
11.	Dismantle a vertical axis small wind turbine.	2
12.	Identify the routine maintenance parts of the micro hydro power plant after watching a video programme.	2
13.	Assemble a micro hydro power plant.	2
14.	Dismantle a micro hydro power plant	2
15.	Assemble a small biogas plant to generate electric power	2
16.	Dismantle the biogas plant.	2

INTERNSHIP I

L 0	T 0	P 4		**Course Code No.: I-201**
Total Contact hrs.: 60 **Credit: 2**			**Total Marks: 100**	**Evaluation Scheme:** End Term Exam: 40 P.A.: 60

RATIONALE:

Internship provides an in-depth knowledge on engineering students. This internship enables the students to understand and learn the current trend in the job market. Internship provides great opportunity to get real life experience and exposure.

Students will be exposed to structured and practical learning experience that prepares individuals for their future careers, helps them make informed career choices, and equips them to build their profile for their jobs and also for their higher studies.

INTERNSHIP PROTOCOL:

Students are required to take up an Internship/ Entrepreneurial activities / Project work/ Seminar and Inter/ Intra Institutional Training.

As per AICTE guideline the institutes have the flexibility to schedule internship, Project work, Seminar etc. according to the availability of the opportunities. Students are required to be involved in Inter/ Intra Institutional Activities viz.,

- Training with higher Institutions;
- Soft skill training organized by **Training and Placement Cell of the respective institutions**;
- Contribution at incubation/ innovation /entrepreneurship cell of the institute;
- Participation in conferences/ workshops/ competitions etc.;
- Learning at Departmental Lab/ Idea Lab/ Institutional workshop;
- Working for consultancy/ research project within the institutes and
- Participation in all the activities of Institute's Innovation Council for eg: IPR workshop/Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc.

SEMESTER - IV

FUNDAMENTALS OF POWER ELECTRONICS

L	T	P		Course Code No: EEPC202	
3	0	0			
Total Contact Hours :				**Theory**	
Lecture		: 45Hrs	**Total Marks: 100**	End Term Exam	60
Tutorial		: 0		Progressive Assessment	40
Credit		**3**			

RATIONALE:

Power Electronics is an interdisciplinary area using the thyristor family devices to control the ON and OFF processes of semiconductor switches and principles of control theory. The area power electronics had a two sided development such as the development of improved performance power semiconductor devices and the development of control circuit of these devices. This subject covers power electronic devices, thyristor family devices, turn-on and turn-off methods of thyristors, phase controlled rectifiers and industrial control circuits including SMPS and UPS.

LEARNING OUTCOMES:

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

- Explain the operating principle of power electronic devices
- Select power electronic devices for specific applications
- Describe the turn-on and turn-off methods of thyristors
- Explain the operation and applications of phase controlled rectifiers. Discuss the operating principle of industrial control circuits.

DETAILED COURSE CONTENTS

Unit	Topic/Sub-Topic	Hours
I	Power Electronic Devices	10
	1.1 Power electronic devices	
	1.2 Power transistor	
	1.2.1 construction and working principle	
	1.2.2 V-I characteristics and uses	
	1.3 IGBT	
	1.3.1 Construction and working principle	
	1.3.2 V-I characteristics and uses	
	1.4 Concept of single electron transistor (SET)	
	1.5 Aspects of Nano- technology	
II	**Thyristor Family Devices**	10
	2.1 SCR	

	2.1.1 Construction of SCR	
	2.1.2 Two transistor analogy of SCR	
	2.1.3 Types, working and characteristics	
	2.1.4 SCR mounting and cooling	
	2.2 Types of Thyristors: SCR, LASCR, SCS, GTO, UJT, PUT, DIAC and TRIAC	
	2.3 Thyristor family devices	
	2.3.1 Symbol and construction	
	2.3.2 Operating principle	
	2.3.3 V-I characteristics	
	2.4 Protection circuits	
	2.4.1 Over-voltage	
	2.4.2 Over-current	
	2.4.3 Snubber	
	2.4.4 Crowbar	
III	**Turn-on and Turn-off Methods of Thyristors**	8
	3.1 SCR Turn-On methods	
	3.1.1 High Voltage thermal triggering,	
	3.1.2 Illumination triggering	
	3.1.3 dv/dt triggering	
	3.1.4 Gate triggering	
	3.2 Gate trigger circuits	
	3.2.1 Resistance and Resistance-Capacitance circuits	
	3.3 SCR triggering using UJT	
	3.4 PUT: Relaxation Oscillator and Synchronized UJT circuit	
	3.5 Pulse transformer and opto-coupler based triggering.	
	3.6 SCR Turn-Off methods:	
	3.6.1 Class A- Series resonant commutation circuit	
	3.6.2 Class B-Shunt Resonant commutation circuit	
	3.6.3 Class C-Complimentary Symmetry commutation circuit	
	3.6.4 Class D-Auxiliary commutation	
	3.6.5 Class E-External pulse commutation	
	3.6.6 Class F-Line or natural commutation	
IV	**Phase Controlled Rectifiers**	
	4.1 Phase control: firing angle, conduction angle.	10
	4.2 Single phase half controlled, full controlled and midpoint controlled rectifier with R, RL load	
	4.2.1 Circuit diagram, working, input- output waveforms, equations for DC output and effect of freewheeling diode	
	4.3 Different configurations of bridge controlled rectifiers: Full	
	bridge, half bridge with common anode, common cathode, SCRs in one arm and diodes in another arm	

V	**Industrial Control Circuits**	7
	5.1 Applications: Burglar's alarm system, Battery charger using SCR, Emergency light system, Temperature controller using SCR and; Illumination control/fan speed control TRIAC	
	5.2 SMPS	
	5.3 UPS: Offline and Online	
	5.4 SCR based AC and DC circuit breakers.	

REFERENCES:

1. An Introduction to Thyristors and their applications by M. Ramamoorty, East-West Press Pvt. Ltd., New Delhi.
2. Thyristors: Theory and Applications by Rajendra Kumar Sugandhi and Krishna Kumar Sugandhi, New Age International (P) ltd. Publishers, New Delhi.
3. Fundamentals of Power Electronics by S.K. Bhattacharya, Vikas Publishing House Pvt. Ltd. Noida.
4. Power Electronics and its Applications by Alok Jain, Penram International Publishing (India) Pvt. Ltd, Mumbai.
5. Power Electronics Circuits Devices and Applications by Muhammad Rashid, Pearson Education India, Noida.
6. Power Electronics by M. D Singh and K.B. Khanchandani, Tata McGraw Hill Publishing Co. Ltd, New Delhi.
7. Industrial Electronics: A Text –Lab Manual by Paul B. Zbar, McGraw Hill Publishing Co. Ltd., New Delhi.
8. SCR Manual by D.R. Grafham, General Electric Co.

ELECTRIC POWER TRANSMISSION AND DISTRIBUTION

L	T	P		Course Code No: EEPC204	
3	0	0			
Total Contact Hours :			**Total Marks: 100**	**Theory**	
Lecture		: 45Hrs		End Term Exam	60
Tutorial		: 0		Progressive Assessment	40
Credit		**3**			

RATIONALE:

The electric power transmission and distribution subject covers basics of transmission and distribution, transmission line parameters and performance, extra high voltage transmission, a.c distribution system and different components of transmission and distribution line. The aim of this course is to help the student to maintain the proper functioning of the electrical transmission and distribution systems. The aim of this course is to help the student to maintain the proper functioning of the electrical transmission and distribution systems

LEARNING OBJECTIVES:

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

- Explain the basics of electrical power transmission and distribution
- Describe the transmission line parameters and performance of transmission line
- Explain the operation and applications of EHVAC and HVDC
- Discuss the a.c distribution system
- Explain different components of transmission and distribution line

DETAILED COURSE CONTENTS

Unit	Topic/Sub-Topic	Hours
I	**Basics of Transmission and Distribution**	10
	1.1 Single line diagrams with components of the electric supply transmission and distribution systems	
	1.2 Classification of transmission lines	
	1.3 Primary and secondary transmission	
	1.4 Standard voltage level used in India	
	1.5 Classification of transmission lines: based on type of voltage, voltage level, length and others	
	1.6 Characteristics of high voltage for power transmission	
	1.7 Method of construction of electric supply transmission system- 110 kV, 220 kV, 400 kV	
	1.8 Method of construction of electric supply distribution systems- 220 V, 400V, 11 kV, 33 kV	

II	**Transmission Line Parameters and Performance**	9
	2.1 Line Parameters: Concepts of R, L and C of line parameters and types of lines	
	2.2 Performance of short line: Efficiency, regulation and its derivation, effect of power factor, vector diagram for different power factor	
	2.3 Performance of medium line: representation, nominal 'T', nominal 'π' and end condenser methods	
	2.4 Transposition of conductors and its necessity	
	2.5 Skin effect and proximity effect	
III	**Extra High Voltage Transmission**	9
	3.1 Extra High Voltage AC (EHVAC) transmission line**:** Necessity, high voltage substation components such as transformers and other switchgears	
	3.1.1 Advantages, limitations and applications of EHVAC	
	3.1.2 EHVAC lines in India	
	3.2 Ferranti and Corona effect	
	3.3 High Voltage DC (HVDC) Transmission Line**:** Necessity components, advantages, limitations and applications	
	3.3.1 Layout of monopolar, bi-Polar and homo-polar transmission lines of HVDC	
	3.3.2 HVDC Lines in India	
	3.4 Features of EHVAC and HVDC transmission line	
	3.5 Flexible AC Transmission line: Features, d types of FACTS controller	
	3.6 New trends in wireless transmission of electrical power	
IV	**A.C Distribution System**	9
	4.1 AC distribution: Components classification, requirements of an ideal distribution system, primary and secondary distribution system	
	4.2 Feeder and distributor, factors to be considered in design of feeder and distributor	
	4.3 Types of different distribution schemes: radial, ring, and grid, layout, advantages, disadvantages and applications	
	4.4 Voltage drop, sending end and receiving end voltage	
	4.5 Distribution Sub-Station: Classification, site selection, advantages, disadvantages and applications	
	4.6 Single Line diagram (layout) of 33/11KV Sub-Station, 11KV/400V sub-station	
	4.7 Symbols and functions of their components	
V	**Components of Transmission and Distribution Line**	8
	5.1 Overhead Conductors**:** Properties of material, types of conductor with trade names, significance of sag	

	5.2 Line supports: Requirements, types of line structures and their specifications, methods of erection	
	5.3 Line Insulators	
	5.3.1 Properties of insulating material	
	5.3.2 Selection of material	
	5.3.3 Types of insulators and their applications	
	5.3.4 Causes of insulator failure	
	5.3.5 Derivation of equation of string efficiency for string of three suspension insulator	
	5.3.6 Methods of improving string efficiency	
	5.4 Underground Cables**:** Requirements, classification, construction, comparison with overhead lines, cable laying and cable jointing.	

REFERENCES:

1. Utilization of Electric Power & Electric Traction by G.C. Garg, Khanna Book Publishing Co., New Delhi.
2. Principles of Power System by V.K. Mehta, S. Chand and Co. New Delhi.
3. A Course in Electrical Power by Soni; Gupta; Bhatnagar, Dhanpat Rai and Sons New Delhi.
4. A Course in Power Systems by J.B. Gupta, S.K. Kataria and sons, New Delhi.
5. A Textbook of Electrical Technology Vol. III, by B.L Theraja,.; A.K. Theraja, S.Chand and Co. New Delhi.
6. A Course in Electrical Power by, S.L. Uppal,.Khanna Publisher New Delhi.
7. Electrical Power Transmission and Distribution by S. Sivanagaraju; S. Satyanarayana, Pearson Education, New Delhi.
8. Electrical Power System: A First Course by Ned Mohan, Wiley India Pvt. Ltd. New Delhi.
9. Power System Analysis and Design by B.R. Gupta, S. Chand and Co. New Delhi.
10. Electrical Power Distribution System by V. Kamraju, Tata McGraw-Hill, New Delhi.

INDUCTION, SYNCHRONOUS AND SPECIAL ELECTRICAL MACHINES

L	T	P		Course Code No: EEPC206	
2	1	0			
Total Contact Hours :			**Total Marks: 100**	**Theory**	
Lecture		: 30 Hrs		End Term Exam	60
Tutorial		: 15 Hrs		Progressive Assessment	40
Credit		**3**			

RATIONALE:

Presently single phase and three phase induction motors, synchronous machines and fractional horse power (FHP) motors are commonly used in modern industries. The Electrical Engineering Technicians has to look after the installation, operation and control of electrical machines in any industries. So the knowledge of electrical machine is very essential in this regard. This subject covers single phase induction motors, three phase induction motor, three phase alternators, synchronous motors and fractional horse power (FHP) motors. This subject deals with the working principles, operation of the above machines. The aim of this course is to help the student to maintain induction, synchronous and FHP machines used in different applications.

LEARNING OUTCOMES:

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

- Explain the construction and working principle of single phase and three phase induction motors.
- Describe the Torque vs. Speed characteristics of single phase and three phase induction motors
- Explain the different methods of starting and speed control of induction motors
- Describe the construction and working principle of Synchronous Machine
- Explain the performance characteristics of Synchronous Machine
- Discuss the construction and working principle of Special types of motors

DETAILED COURSE CONTENTS

Unit	Topic/Sub-Topic	Hours
I	**Three Phase Induction Motor**	10
	1.1 Working principle: production of rotating magnetic field, Synchronous speed, rotor speed and slip	
	1.2 Constructional details of 3 phase induction motors: Squirrel cage induction motor and Slip ring induction motor	
	1.3 Rotor quantities: frequency, induced emf, power factor at starting and running condition	
	1.4 Characteristics of torque versus slip (speed), Torques: starting, full load and maximum with relations among them	

	1.5 Induction motor as a generalized transformer with phasor diagram	
	1.6 Four quadrant operation, Power flow diagram	
	1.7 Starters: need and types; stator resistance, auto transformer, star delta, rotor resistance and soft starters	
	1.8 Speed control methods: stator voltage, pole changing, rotor resistance and VVVF	
	1.9 Motor selection for different applications as per the load torque-speed requirements	
	1.10 Maintenance of three phase induction motors	9
II	**Single phase Induction Motors**	
	2.1 Double field revolving theory	
	2.2 Principle of making single phase induction motors self-start	
	2.3 Construction and working of single phase induction motors	
	2.3.1 Resistance start induction run	
	2.3.2 Capacitor start induction run	
	2.3.3 Capacitor start capacitor run	
	2.3.4 Shaded pole	
	2.3.5 Repulsion type	
	2.3.6 Series motor	
	2.3.7 Universal motor	
	2.3.8 Hysteresis motor	
	2.4 Torque-speed characteristics for all of the above motors.	
	2.5 Motor selection for different applications as per the load torquespeed requirements	
	2.5 Maintenance of single phase induction motors	
III	**Three phase Alternators**	9
	3.1 Principle of working, moving and stationary armatures	
	3.2 Constructional details: parts and their functions	
	3.2.1 Rotor constructions	
	3.2.2 Windings: Single and Double layer	
	3.3 E.M.F. equation of an Alternator with numerical by considering short pitch factor and distribution factor	
	3.4 Alternator loading	
	3.4.1 Factors affecting the terminal voltage of alternator	
	3.4.2 Armature resistance and leakage reactance drops.	
	3.5 Armature reaction at various power factors and synchronous impedance	
	3.6 Voltage regulation: direct loading and synchronous impedance methods	
	3.7 Maintenance of alternators	
IV	**Synchronous Motors**	9
	4.1 Principle of working /operation, significance of load angle.	

	4.2 Torques: starting torque, running torque, pull in torque, pull out torque.	
	4.3 Synchronous motor on load with constant excitation (numerical), effect of excitation at constant load (numerical).	
	4.4 Curves and Inverted V-Curves.	
	4.5 Hunting and Phase swinging.	
	4.6 Methods of Starting of Synchronous Motor	
	4.7 Losses in synchronous motors and efficiency (no numerical).	
	4.8 Applications areas	
V	**Fractional horse power (FHP) Motors**	8
	5.1 Construction and working	
	5.1.1 Synchronous Reluctance Motor	
	5.1.2 Switched Reluctance Motor	
	5.1.3 BLDC	
	5.1.4 Permanent Magnet Synchronous Motors	
	5.1.5 Stepper motors	
	5.1.6 AC and DC servomotors	
	5.2 Torque speed characteristics of above motors	
	5.3 Applications of above motors	

REFERENCES:

1. Electric Machines by P.S. Bimbhra, Khanna Book Publishing Co., New Delhi.
2. Basic Electrical Engineering by V.N. Mittle and Arvind Mittle, McGraw Hill EducationNew Delhi.
3. Electrical Machines by D. P. Kothari and I. J. Nagrath, McGraw Hill Education. New Delhi.
4. Electrical Machines by S. K. Bhattacharya, McGraw Hill Education, New Delhi.
5. Electrical Technology Vol-II (AC and DC machines) by B.L. Theraja, S.Chand and Co. Ltd., New Delhi.
6. Special Purpose Electrical Machines by S. K, Sen, Khanna Publishers, New Delhi.
7. Special Electrical Machines by E. G Janardanan, Prentice Hall India, New Delhi.
8. Electrical Technology by E. Hughes, ELBS.
9. Electrical Technology by H. Cotton, ELBS.

FUNDAMENTALS OF POWER ELECTRONICS LABORATORY

L	T	P		Course Code No.: EEPC208	
0	0	2			
Total Contact Hours :				**Practical**	
Practical		: 30 Hrs	**Total Marks: 100**	End Term Exam	40
Credit		**1**		Progressive Assessment	60

RATIONALE:

Power Electronics is an interdisciplinary area using the thyristor family devices to control the ON and OFF processes of semiconductor switches and principles of control theory. The area power electronics had a two sided development such as the development of improved performance power semiconductor devices and the development of control circuit of these devices. This subject covers power electronic devices, thyristor family devices, turn-on and turn-off methods of thyristors, phase controlled rectifiers and industrial control circuits including SMPS and UPS. The aim of this course is to help the student to maintain the proper functioning of power electronic devices

LEARNING OUTCOMES:

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

- Select power electronic devices for specific applications
- Maintain the performance of Thyristors
- Troubleshoot turn-on and turn-off circuits of Thyristors Maintain phase controlled rectifiers Maintain industrial control circuits.

DETAILED COURSE CONTENTS

Sr. No.	Practicals	Hours
1.	Test the proper functioning of power transistor	2
2.	Test the proper functioning of IGBT.	2
3.	Test the proper functioning of DIAC to determine the break over voltage.	2
4.	Determine the latching current and holding current using V-I characteristics of SCR.	2
5.	Test the variation of R, C in R and RC triggering circuits on firing angle of SCR.	2
6.	Test the effect of variation of R, C in UJT triggering technique.	2
7.	Perform the operation of Class – A, B, C, turn off circuits.	2
8.	Perform the operation of Class –D, E, F turn off circuits.	2

9.	Use CRO to observe the output waveform of half wave controlled rectifier with resistive load and determine the load voltage	2
10.	Draw the output waveform of Full wave controlled rectifier with R load, RL load, free-wheeling diode and determine the load voltage.	2
11.	Determine the firing angle using DIAC and TRIAC phase controlled circuit on output power under different loads such as lamp, motor or heater	4
12.	Simulate above firing angle control on SCILAB software	2
13.	Test the performance of given SMPS, UPS.	2
14.	Troubleshoot the Burglar's alarm, Emergency light system, Speed control system, Temperature control system	4

ELECTRIC POWER TRANSMISSION AND DISTRIBUTION LABORATORY

L	T	P	Total Marks: 100	Course Code No.: EEPC210	
0	0	2			
Total Contact Hours :				**Practical**	
Practical		: 30 Hrs		End Term Exam	40
Credit		**1**		Progressive Assessment	60

RATIONALE:

The electric power transmission and distribution subject covers basics of transmission and distribution, transmission line parameters and performance, extra high voltage transmission, a.c distribution system and different components of transmission and distribution line. The aim of this course is to help the student to maintain the proper functioning of the electrical transmission and distribution systems. The aim of this course is to help the student to maintain the proper functioning of the electrical transmission and distribution systems.

LEARNING OUTCOMES:

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

- Interpret the normal operation of the electric power transmission and distribution systems
- Maintain the functioning of the medium and high voltage transmission system Interpret the parameters of the extra high voltage ac transmission system (EHVAC) Maintain the functioning of the low voltage ac distribution system.
- Maintain the components of the transmission and distribution lines.

DETAILED COURSE CONTENTS

Following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

1. Prepare a report based on transmission line network in India.
2. Collect the information on components of transmission line.
3. Evaluate transmission line performance parameters of a given line.
4. Library/ Internet survey of electrical high voltage line and HVDC lines.
5. Visit to 33/11 KV and 11KV/400V Distribution Substation and write a report

Similarly, some micro-projects could be added by the concerned faculty:

a. Prepare a model showing:
   i. Single line diagram of electric supply system.

ii. Single line diagram of a given distribution system. iii. Short line and medium transmission line.

iv. Write a report on the same by giving the details of lines in India.

b. Collect different samples of Overhead Conductors, Underground Cables, Line supports and Line Insulators.

c. Prepare a power point presentation:

i. Extra High Voltage AC Transmission line.

ii. High Voltage DC Transmission line. iii. Flexible AC Transmission line.

iv. New trends in wireless transmission of electrical power.

d. Collect information on:

i. A.C Distribution System adjacent to your institute.

INDUCTION, SYNCHRONOUS AND SPECIAL ELECTRICAL MACHINES LABORATORY

L	T	P	Total Marks: 100	Course Code No.: EEPC212	
0	0	2			
Total Contact Hours :				**Practical**	
Practical		: 30 Hrs		End Term Exam	40
Credit		**1**		Progressive Assessment	60

RATIONALE:

Presently single phase and three phase induction motors, synchronous machines and fractional horse power (FHP) motors are commonly used in modern industries. The Electrical Engineering Technicians has to look after the installation, operation and control of electrical machines in any industries. So the knowledge of electrical machine is very essential in this regard. This subject covers single phase induction motors, three phase induction motor, three phase alternators, synchronous motors and fractional horse power (FHP) motors. This subject deals with the working principles, operation of the above machines. The aim of this course is to help the student to maintain induction, synchronous and FHP machines used in different applications.

LEARNING OUTCOMES:

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

- Maintain three phase induction motor used in different applications
- Maintain single phase induction motor used in different applications
- Maintain three phase alternators used in different applications
- Maintain synchronous motors used in different applications
- Maintain FHP motors used in different applications

DETAILED COURSE CONTENTS

Sr. No.	Practicals	Hours
1.	Identify the different parts (along with function and materials) for the given single phase and three phase induction motor.	2
2.	Connect and run the three phase squirrel cage induction motors (in both directions) using the DOL, star-delta, auto-transformer starters (any two)	2
3.	Perform the direct load test on the three phase squirrel cage induction motor and plot the i) efficiency versus output, ii) power factor versus output, iii) power factor versus motor current and iv) torque – slip/speed characteristics	2
4.	Conduct the No-load and Blocked-rotor tests on given 3-f squirrel cage induction motor and determine the equivalent circuit parameters.	2
5.	Conduct the No-load and Blocked-rotor tests on given 3-f squirrel cage	2

	induction motor and plot the Circle diagram.	
6.	Control the speed of the given three phase squirrel cage/slip ring induction motor using the applicable methods: i) auto-transformer, ii) VVVF.	2
7.	Measure the open circuit voltage ratio of the three phase slip ring induction motor.	2
8.	Conduct the direct load test to determine the efficiency and speed regulation for different loads on the given single phase induction motor; plot the efficiency and speed regulation curves with respect to the output power.	2
9.	Perform the direct loading test on the given three phase alternator and determine the regulation and efficiency.	2
10.	Determine the regulation and efficiency of the given three phase alternator from OC and SC tests (Synchronous impedance method)	2
11.	Conduct the test on load or no load to plot the 'V' curves and inverted 'V' curves (at no-load) of 3-f synchronous motor.	2
12.	Dismantling and reassembling of single phase motors used for ceiling fans, universal motor for mixer.	2
13.	Control the speed and reverse the direction of stepper motor	2
14.	Control the speed and reverse the direction of the AC servo motor	2
15.	Control the speed and reverse the direction of the DC servo motor	2

Program Elective:

ELECTRICAL TESTING AND COMMISSIONING

L	T	P	Total Marks: 100	Course Code No: EEPE204	
3	0	0			
Total Contact Hours :				**Theory**	
Lecture		: 45Hrs		End Term Exam	60
Tutorial		: 0		Progressive Assessment	40
Credit		**3**			

RATIONALE:

Electrical testing and commissioning plays a major role in healthy distribution of electrical energy from electric utilities to consumers. Electrical diploma holders should work as technicians and supervisors for planning, installation and testing of different electrical installations such as residential, commercial and industrial installation schemes. Consequently, the knowledge of electrical testing and commissioning is highly essential for electrical diploma engineers. This subject covers electrical safety and insulation, installation and erection, testing and commissioning, troubleshooting plans and maintenance. The aim of this course is to help the student to follow standard safety procedures in testing and commissioning of electrical equipment.

LEARNING OUTCOMES:

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

- State safety measures and safety precautions
- Follow safety procedures with respect to earthing and insulation of electrical equipment
- Select proper tools, equipment, for installation, testing, maintenance of electrical machines and transformers
- Commission electrical equipment in accordance with IS codes after testing
- Make plans for troubleshooting electrical machines
- Undertake regular preventive and breakdown maintenance.

DETAILED COURSE CONTENTS

Unit	Topic/Sub-Topic	Hours
I	**Electrical Safety and Insulation**	9
	1.1 Do's and don'ts regarding safety in domestic electrical appliances as well for substation/power station operators	
	1.2 Electrical safety in industry/power stations/ substations at the time of operation/ control/maintenance	
	1.3 Fire detection alarm, fire-fighting equipment	
	1.4 Factors affecting life of insulating materials,	

	1.5 Classifications of insulating materials as per IS:1271-1958	
	1.6 Measuring insulation resistance by different methods such as i) Polarization, ii) Dielectric absorption, iii) Megger and to predict the condition of insulation	
	1.7 Reconditioning of insulation	
	1.8 Insulating oil - properties of insulating oil, causes of deterioration of oil	
	1.9 Testing of transformer oil as per IS 1866-1961	9
II	**Installation and Erection**	
	2.1 Concept of foundation for installation of machinery	
	2.2 Requirements of foundation for static and rotating electrical machinery	
	2.3 Concept of leveling and aligning	
	2.3.1 Procedure for leveling and aligning alignment of direct coupled drive	
	2.3.2 Effects of mis-alignment	
	2.4 Installation of transformer as per I.S.-1886-1967	
	2.5 Procedure of installation of transformer	
	2.6 Requirements of installation of pole mounted transformer	
	2.7 Requirements of installation of rotating electrical machines as per I.S. 900 - 1965	
	2.8 Devices and tools required for loading, unloading, lifting, and carrying heavy equipment and precautions to be taken while handling them.	
III	**Testing and Commissioning**	10
	3.1 Concept of testing	
	3.2 Objectives of testing	
	3.3 Roles of I.S.S. in testing of electrical equipment	
	3.4 Types of tests and concepts	
	3.4.1 Routine tests	
	3.4.2 Type tests	
	3.4.3 Supplementary test	
	3.4.4 Special tests	
	3.4.5 Methods of testing - Direct/Indirect/Regenerative testing.	
	3.5 Tolerances for the various items for equipment –transformer, induction motor, dc motor, synchronous machines	
	3.6 Commissioning, Tests before Commissioning for transformer, induction motor, alternator	
	3.7 Testing of transformer as per I.S.1886- 1967 and I.S.2026- 1962	
	3.8 Testing of three-phase Induction motor as per I.S.325 - 1970.	
	3.9 Testing of single-phase induction motor as per I.S.990-1965.	
	3.10 Testing of synchronous machines as per ISS	
	3.11 Testing of D.C. machines	
IV	**Troubleshooting Plans**	8
	4.1 Internal and external causes for failure/abnormal operation of equipment	
	4.2 List of mechanical faults, electrical faults and magnetic faults in the electrical equipment: remedies, applications	

	4.3 Use of tools like bearing puller filler gauges, dial indicator, spirit level, megger, earth tester, and growler. Common troubles in electrical equipment and machines.	
	4.4 Preparation of trouble shooting charts for D.C. Machines, AC Machines and transformers	
V	**Maintenance**	9
	5.1 Concept of maintenance,	
	5.2 Types of maintenance,.	
	5.3 Routine, preventive and breakdown maintenance	
	5.4 Causes of failure of electrical machines	
	5.5 Preventive maintenance-procedure or developing maintenance schedules for electrical machines.	
	5.6 Factors affecting preventive maintenance schedules,	
	5.7 Concept of TPM, Pillars of TPM	
	5.8 Identification of different types of faults developed such as mechanical / electrical/ magnetic faults	
	5.9 Maintenance schedules of the following as per I.S.S.	
	a) Distribution transformer as per I.S.1886-1967	
	b) Single phase and three phase Induction motors as per I.S.900-1965	
	c) Batteries	

References:

1. Design and Testing of Electrical Machines by M. V. Deshpande, PHI Learning Pvt. Ltd.
2. Operation and Maintenance of Electrical Equipment Vol-I by B V S Rao, Asia Club House.
3. Maintenance and Repairs by Rosenberg, Mc Graw-Hill.
4. Preventive Maintenance of Electrical Apparatus by S.K. Glencoe Sharotri, Mc Graw- Hill.

ELECTRICAL ESTIMATION AND CONTRACTING

L	T	P		Course Code No: EEPE206	
3	0	0			
Total Contact Hours :			**Total Marks: 100**	**Theory**	
Lecture		: 45Hrs		End Term Exam	60
Tutorial		: 0		Progressive Assessment	40
Credit		**3**			

RATIONALE:

Electrical installation plays a major role in distributing the electrical energy from electric utilities to consumers. Electrical diploma holders should work as technicians and supervisors for planning, installation and testing of various electrical wiring installations such as residential, commercial and industrial installation schemes. Therefore, the knowledge of electrical estimation and contracting is highly essential for electrical diploma engineers. This subject covers electric installation and safety, estimation and costing, non-industrial installations, industrial installations, public lighting installation, distribution lines and LT substation. The aim of this course is to help the student to design electrical installation with costing for tendering.

LEARNING OUTCOMES:

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

- Explain the different types of electrical installation
- Illustrate different standard electrical symbols
- Explain different types of electrical wiring systems
- Prepare detail estimate for domestic building, sub-station, service line and distribution panel.
- Design various practical lighting schemes and LT substation

DETAILED COURSE CONTENTS

Unit	Topic/Sub-Topic	Hours
I	**Electric Installation and Safety**	8
	1.1 Scope and features of National electric code 2011	
	1.2 Types of electrical installation	
	1.3 Fundamental principles for electrical installation	
	1.4 Permit to work, safety instructions and safety practices	
	1.5 Purpose of estimating and costing	
II	**Estimation and Costing**	10
	2.1 Meaning and purpose of- Rough estimate	
	2.2 Detailed estimate	
	2.3 Supplementary estimate	
	2.4 Annual maintenance estimate and revised estimate	

	2.5 Factors to be considered while preparation of detailed estimate and economical execution of work	
	2.6 Contracts	
	2.6.1 Concepts of contracts	
	2.6.2 Types of contracts	
	2.6.3 Contractor	
	2.6.4 Role of contractor	
	2.7 Tenders and Quotations	
	2.7.1 Type of tender	
	2.7.2 Tender notice	
	2.7.3 Preparation of tender document, and method of opening of tender	
	2.7.4 Quotation	
	2.7.5 Quotation format	
	2.7.6 comparison between tender and quotation	
	2.8 Comparative statement	
	2.8.1 Format comparative statement	
	2.8.2 Order format	
	2.8.3 Placing of purchasing order	
	2.9 Principles of execution of works, planning, organizing and completion of work, Billing of work	
III	**Non-Industrial Installations**	9
	3.1 Types of Non-industrial installations-Office buildings, shopping and commercial centre, residential installation, Electric service and supply	
	3.2 Design consideration of electrical installation in commercial buildings	
	3.3 Design procedure of installation- steps involved in detail	
	3.4 Estimating and costing of unit	
	3.5 Earthing of commercial installation	
	3.6 Design electrical installation scheme of commercial complex.	
	3.7 Erection, Inspection and testing of installation as per NEC	
IV	**Industrial Installation**	9
	4.1 Classification of industrial buildings based on power consumption	
	4.2 Drawing of wiring diagram and single line diagram for single phase and three phase Motors.	
	4.3 Design consideration in industrial installations	
	4.4 Design procedure of installation-detailed steps	
	4.5 Design electrical installation scheme of factory/ small industrial unit	
	4.6 Preparation of material schedule and detailed estimation	
	4.7 Installation and estimation of agricultural pump and flourmill	
V	**Public Lighting Installation**	9
	5.1 Classification of outdoor installations streetlight/ public lighting installation	
	5.2 Street light pole structures	
	5.2.1 Selection of equipments	

	5.2.2 Sources used in street light installations.	
	5.3 Cables	
	5.3.1 Recommended types and sizes of cable	
	5.3.2 Control of street light installation	
	5.4 Design, estimation and costing of streetlight	

REFERENCES:

1. Electrical Design Estimating and Costing by K.B. Raina, S. K. Bhattacharya, New Age International Publisher.
2. Electrical Estimating and Costing by Allagappan,, N. S. Ekambarram, Tata Mc-Graw Hill Publishing Co. Ltd.
3. Electrical Estimating and Costing b. Singh, Surjit Ravi Deep Singh, Dhanpat Rai and Sons.
4. A Course in Electrical Installation Estimating and Costing by J.B. Gupta, S.K. Kataria and Sons.
5. Code of Practice for Electrical Wiring Installation, Bureau of Indian Standard. IS: 732-1989.
6. National Electrical Code 2011, Bureau of Indian Standard. SP-30:2011.

ELECTRICAL TESTING AND COMMISSIONING LABORATORY

L	T	P		Course Code No.: EEPE208	
0	0	2			
Total Contact Hours :				**Practical**	
Practical		: 30 Hrs	**Total Marks: 100**	End Term Exam	40
Credit		**1**		Progressive Assessment	60

RATIONALE:

Electrical testing and commissioning plays a major role in healthy distribution of electrical energy from electric utilities to consumers. Electrical diploma holders should work as technicians and supervisors for planning, installation and testing of different electrical installations such as residential, commercial and industrial installation schemes. Consequently, the knowledge of electrical testing and commissioning is highly essential for electrical diploma engineers. This subject covers electrical safety and insulation, installation and erection, testing and commissioning, troubleshooting plans and maintenance. The aim of this course is to help the student to follow standard safety procedures in testing and commissioning of electrical equipment.

LEARNING OUTCOMES:

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

- Follow safety procedures with respect to earthing and insulation of electrical equipment
- Select proper tools, equipment, for installation, testing, maintenance of electrical machines and transformers
- Test and commission electrical equipment in accordance with IS codes
- Make plans for troubleshooting electrical machines
- Undertake regular preventive and breakdown maintenance.

DETAILED COURSE CONTENTS

Sr. No.	Practicals	Hours
1.	Determine breakdown strength of transformer oil.	4
2.	Perform insulation resistance test on any one motor/transformer.	4
3.	Prepare trouble shooting charts for electrical machines such as Transformer, D.C. machines, Induction motor, and Synchronous machines	4
4.	Measure impedance voltage and load losses of three-phase transformer	4
5.	Find regulation and efficiency of single-phase transformer by direct loading and back-to-back connection method and compare the results.	4
6.	Determine efficiency of D.C. machine by Swinburne’s test.	4
7.	Determine efficiency of D.C. machine by Hopkinson’s test.	4

8.	Perform reduced voltage running up test on three-phase Induction motor as per I.S.325 -1967.	4
9.	Measure no load losses and no load current of a transformer as per IS.	4
10.	Perform no load test on single phase Induction motor for the measurements of no load current, power input, and speed at rated voltage as per I.S.	4
11.	Perform temperature rise test on single-phase transformer.	4
12.	Find efficiency of M.G. set	4

ELECTRICAL ESTIMATION AND CONTRACTING LABORATORY

L	T	P		Course Code No.: EEPE210	
0	0	2			
Total Contact Hours :				**Practical**	
Practical		: 30 Hrs	**Total Marks: 100**	End Term Exam	40
Credit		**1**		Progressive Assessment	60

RATIONALE:

Electrical installation plays a major role in distributing the electrical energy from electric utilities to consumers. Electrical diploma holders should work as technicians and supervisors for planning, installation and testing of various electrical wiring installations such as residential, commercial and industrial installation schemes. Therefore, the knowledge of electrical estimation and contracting is highly essential for electrical diploma engineers. This subject covers electric installation and safety, estimation and costing, non-industrial installations, industrial installations, public lighting installation, distribution lines and LT substation. The aim of this course is to help the student to design electrical installation with costing for tendering.

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LEARNING OUTCOMES:

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

- Follow National Electrical Code 2011 in electrical installations
- Estimate the electrical installation works
- Estimate the work of non-industrial electrical installations
- Estimate the work of industrial electrical installations
- Prepare abstract, tender, quotation of public lighting and other installations
- Prepare abstract, tender, quotation of low tension (LT) substations

DETAILED COURSE CONTENTS

Sr. No.	Practicals	Hours
1.	Prepare a tender notice for purchasing a transformer of 200 KVA for commercial installation.	4
2.	Prepare a quotation for purchasing different electrical material required.	4
3.	Prepare a comparative statement for above material Prepare purchase order for the same.	4
4.	Design drawing, estimating and costing of hall / cinema theater / commercial installation. Prepare report and draw sheet.	4
5.	Design electrical installation scheme for any one factory / small industrial unit. Draw detailed wiring diagram. Prepare material schedule and detailed estimate. Prepare report and draw sheet.	4

6.	Estimate with a proposal of the electrical Installation of streetlight scheme for small premises after designing.	4
7.	Estimate with a proposal of the L.T. line installation. Prepare report and draw sheet.	4
8.	Estimate with a proposal of the 500 KVA, 11/0.433 KV outdoor substation and prepare a report	4

MINOR PROJECT

L	T	P		Course Code. No.: PR 202
0	0	4		
Total Contact hrs.: **Practical : 60** **Credit : 2**			**Total Marks: 100**	**Practical:** End Term Exam. :40 P.A. :60

RATIONALE

Minor Project offers students an opportunity to apply theoretical knowledge in a practical setting, thereby enhancing their technical skill and problem solving skill. This course has been designed for students to understand the basics of carrying out any engineering project which includes Literature survey, methodology, setting up objective and scope of the project work.

COURSE OUTCOMES:

After completing this course, student will be able to:

- Identify the objective and scope of work
- Undertake interdisciplinary literature survey.
- Prepare methodology of the project work.
- Demonstrate necessary field and laboratory experiments.
- Handle necessary equipment.

COURSE CONTENT DETAILS

UNIT NO.	CONTENT	HOURS
UNIT –I	**Objective and Scope of work** • Introduction to the project. • Clear statement of project objectives. • Explanation of the scope and limitations of the project. • Justification for why the project is important or relevant.	**12**
UNIT –II	**Literature Survey** • Review of existing literature and research related to the project. • Identification of gaps in current knowledge. • Discussion of relevant theories, models, and previous work in the field. • Proper citations and references to sources.	**12**
UNIT –III	**Methodology** • Detailed explanation of the research methods and approaches to be used. • Description of data collection techniques (if applicable). • Explanation of any experiments or simulations to be conducted. • Ethical considerations and research ethics, if applicable.	**12**
UNIT –IV	**Handling of Instruments and Experiments** • Description of the tools, equipment, or software to be used. • Details on how experiments or simulations will be conducted. • Safety precautions and protocols, if relevant. • Data collection and analysis methods.	**12**

UNIT –V	**Comprehensive Progress Presentation** • Regular progress reports or presentations to track the development of the project. • Presentation of findings, data, and results obtained so far. • Discussion of any challenges encountered and how they were addressed. • Feedback received from mentors or advisors and any adjustments made to the project plan.	**12**

ESSENCE OF INDIAN KNOWLEDGE AND TRADITION

L	T	P		Course Code No.: **AU202**
2	0	0		
Total Contact hrs.: 30 **Credit : 0**				**Progressive Assessment Only**

RATIONALE:

Considering the need of protecting Indian knowledge and tradition, the diploma level students of Automobile Engineering should be facilitated the concepts Indian traditional knowledge and to make them understand the importance of roots of knowledge system and methods of application in today's life and how to protect traditional knowledge system. Interpretation of the concepts of Intellectual property to protect the traditional knowledge as well as importance of Traditional knowledge in Agriculture and Medicine must be known.

COURSE OUTCOME:

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

- Discuss the concepts of traditional Indian knowledge and roots of knowledge system and indigenous knowledge system
- Explain the technique of protection of traditional Indian knowledge
- Discuss legal frameworks of traditional knowledge
- State intellectual property rights
- State traditional knowledge in Different Sectors

COURSE CONTENT

UNIT	TOPIC/SUB-TOPIC	HRS.	TOTAL HRS.
1	Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge (Unani / Siddha/ Ayurveda), Indigenous Knowledge (IK), characteristics, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge of Meghalaya	07	**30**
2	Protection of traditional knowledge (TK): The need for protecting traditional knowledge, Significance of TK Protection, value of TK in global economy, Role of Governmentto harness TK.	07	
3	Legal framework and TK: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.	06	
4	Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, Geographical Indications (GI).	04	

5	Traditional Knowledge in Different Sectors: Traditional knowledge and engineering, Traditional medicine system, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK	06	

REFERENCE BOOKS:

1. Traditional Knowledge System in India, by Amit Jha, 2009.
2. "Knowledge Traditions and Practices of India" Kapil Kapoor.
3. Madhya Himalayi Sanskriti mein Gyan, Vigyan evam Paravigyan by Prof PC Pandey.

Suggested Online Link:

Web Links:
1.https://www.youtube.com/watch?v=LZP1StpYEPM
2.http://nptel.ac.in/courses/12110600/