 <b>MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI</b> <b>TEACHING AND EXAMINATION SCHEME FOR POST S.S.C. DIPLOMA COURSES</b>																	
<b>COURSE NAME : ELECTRICAL ENGINEERING GROUP</b>																	
<b>COURSE CODE : EE/EP</b>																	
<b>DURATION OF COURSE : SIX SEMESTERS</b>								<b>WITH EFFECT FROM 2012-13</b>									
<b>SEMESTER : FOURTH</b>								<b>DURATION : 16 WEEKS</b>									
<b>FULL TIME / PART TIME : FULL TIME</b>								<b>SCHEME : G</b>									
SR. NO	SUBJECT TITLE	abbrevi ation	SUB CODE	TEACHING SCHEME			EXAMINATION SCHEME										SW (17400)
				TH	TU	PR	PAPER HRS.	TH (1)		PR (4)		OR (8)		TW (9)			
								Max	Min	Max	Min	Max	Min	Max	Min		
1	Environmental Studies \$	EST	17401	01	--	02	01	50#*	20	--	--	--	--	25@	10	50	
2	Elements of Mechanical Engineering	EME	17413	02	--	02	02	50	20	--	--	--	--	25@	10		
3	Industrial Instrumentation	IIN	17414	04	--	02	03	100	40	50#	20	--	--	25@	10		
4	D.C. Machines & Transformers	DMT	17415	04	--	02	03	100	40	50#	20	--	--	25@	10		
5	Industry Electrical Systems-I	IES	17416	03	01	02	03	100	40	--	--	25#	10	25@	20		
6	Transmission and Distribution of Electrical Power	TDE	17417	04	--	--	03	100	40	--	--	--	--	--	--		
7	Professional Practices-II	PPT	17038	--	--	03	--	--	--	--	--	--	--	50@	20		
<b>Total</b>				<b>18</b>	<b>01</b>	<b>13</b>	--	<b>500</b>	--	<b>100</b>	--	<b>25</b>	--	<b>175</b>	--	<b>50</b>	
**	<b>Industrial Training (Optional)</b>			<b>Examination in 5<sup>th</sup> Semester Professional Practices-III</b>													
<p>Student Contact Hours Per Week: <b>32 Hrs.</b></p> <p><b>THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH.</b></p> <p>Total Marks : <b>850</b></p> <p>@ - Internal Assessment, # External Assessment, <span style="background-color: #cccccc; border: 1px solid black; padding: 0 5px;"> </span> No Theory Examination, \$ - Common to all branches, #* Online Examination, Abbreviations: TH-Theory, TU- Tutorial, PR-Practical, OR-Oral, TW- Term Work, SW- Sessional Work</p> <p><b>** Industrial Training (Optional) - Student can undergo Industrial Training of four weeks after fourth semester examination during summer vacation.</b></p> <p><b>Assessment will be done in Fifth semester under Professional Practices-III. They will be exempted from activities of Professional Practices-III of 5<sup>th</sup> Semester.</b></p> <ul style="list-style-type: none"> <li>➤ Conduct two class tests each of 25 marks for each theory subject. Sum of the total test marks of all subjects is to be converted out of 50 marks as sessional work (SW).</li> <li>➤ Progressive evaluation is to be done by subject teacher as per the prevailing curriculum implementation and assessment norms.</li> <li>➤ Code number for TH, PR, OR, TW are to be given as suffix 1, 4, 8, 9 respectively to the subject code.</li> </ul>																	

**Course Name : All Branches of Diploma in Engineering & Technology**

**Course Code : AE/CE/CM/CO/CR/CS/CW/DE/EE/EP/IF/EJ/EN/ET/EV/EX/IC/IE/IS/  
ME/MU/PG/PT/PS/CD/CV/ED/EI/FE/IU/MH/MI/DC/TC/TX/FG/AU**

**Semester : Fourth**

**Subject Title : Environmental Studies**

**Subject Code : 17401**

**Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
01	--	02	01	50#*	--	--	25	75

**#\* Online Theory Examination**

**NOTE:**

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

**Rationale:**

Environment essentially comprises of our living ambience, which gives us the zest and verve in all our activities. The turn of the twentieth century saw the gradual onset of its degradation by our callous deeds without any concern for the well being of our surrounding we are today facing a grave environmental crisis. The unceasing industrial growth and economic development of the last 300 years or so have resulted in huge ecological problems such as overexploitation of natural resources, degraded land, disappearing forests, endangered species, dangerous toxins, global warming etc.

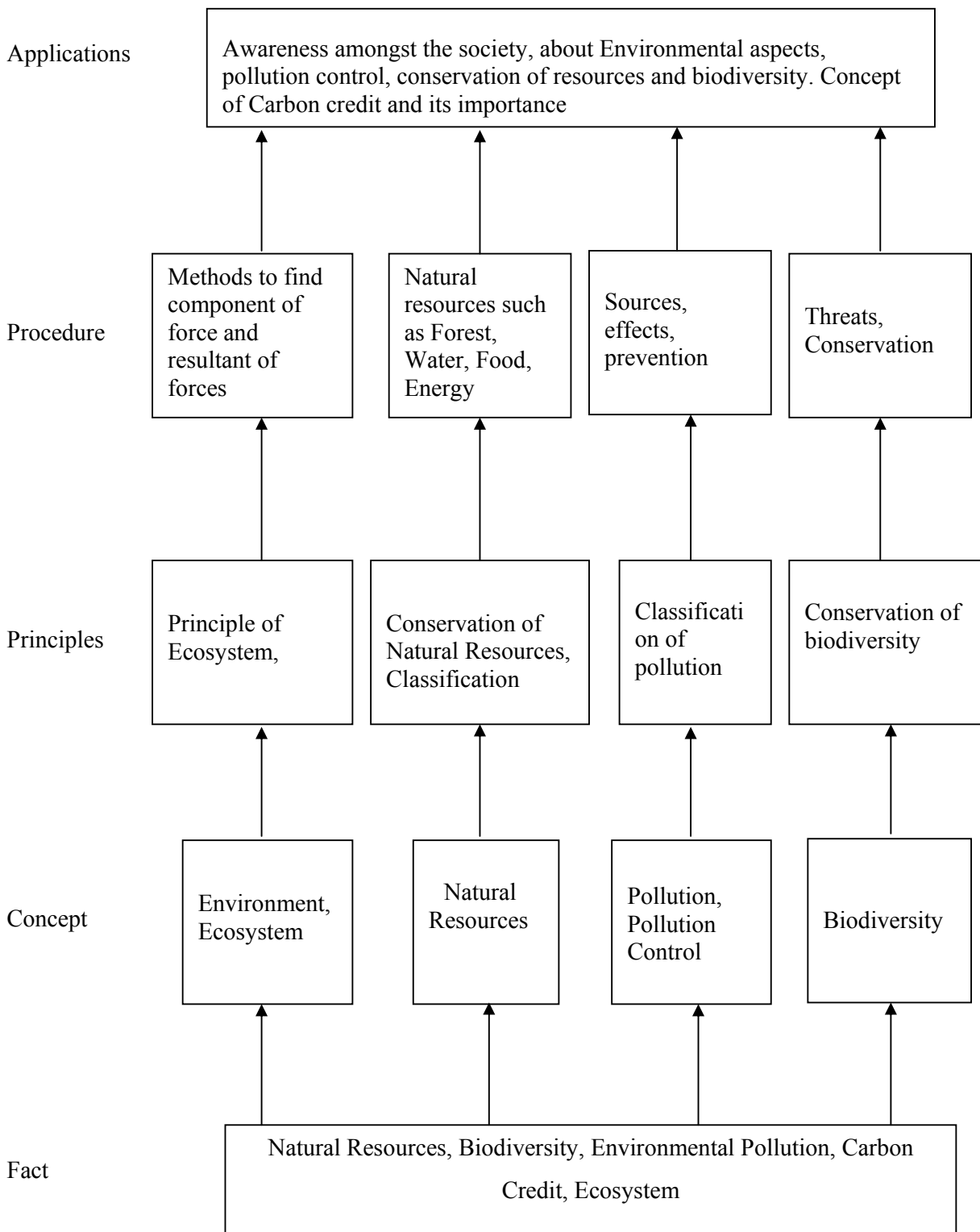
It is therefore necessary to study environmental issues to realize how human activities affect the environment and what could be possible remedies or precautions which need to be taken to protect the environment.

The curriculum covers the aspects about environment such as Environment and Ecology, Environmental impacts on human activities, Water resources and water quality, Mineral resources and mining, Forests, etc.

**General Objectives:** The student will be able to,

1. Understand importance of environment.
2. Know key issues about environment.
3. Understands the reasons for environment degradation.
4. Know aspects about improvement methods.
5. Know initiatives taken by the world bodies to restrict and reduce degradation.

**Learning Structure:**



**Theory:**

<b>Topic and Contents</b>	<b>Hours</b>	<b>Marks</b>
<p><b>Topic 1: Nature of Environmental Studies</b></p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> <li>➤ Define the terms related to Environmental Studies</li> <li>➤ State importance of awareness about environment in general public</li> </ul> <p><b>Contents:</b></p> <ul style="list-style-type: none"> <li>• Definition, Scope and Importance of the environmental studies</li> <li>• Importance of the studies irrespective of course</li> <li>• Need for creating public awareness about environmental issues</li> </ul>	01	04
<p><b>Topic 2: Natural Resources and Associated Problems</b></p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> <li>➤ Define natural resources and identify problems associated with them</li> <li>➤ Identify uses and their overexploitation</li> <li>➤ Identify alternate resources and their importance for environment</li> </ul> <p><b>Contents:</b></p> <p>2.1 Renewable and Non renewable resources</p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Associated problems</li> </ul> <p>2.2 Forest Resources</p> <ul style="list-style-type: none"> <li>• General description of forest resources</li> <li>• Functions and benefits of forest resources</li> <li>• Effects on environment due to deforestation, Timber extraction, Building of dams, waterways etc.</li> </ul> <p>2.3 Water Resources</p> <ul style="list-style-type: none"> <li>• Hydrosphere: Different sources of water</li> <li>• Use and overexploitation of surface and ground water</li> <li>• Effect of floods, draught, dams etc. on water resources and community</li> </ul> <p>2.4 Mineral Resources:</p> <ul style="list-style-type: none"> <li>• Categories of mineral resources</li> <li>• Basics of mining activities</li> <li>• Mine safety</li> <li>• Effect of mining on environment</li> </ul> <p>2.5 Food Resources:</p> <ul style="list-style-type: none"> <li>• Food for all</li> <li>• Effects of modern agriculture</li> <li>• World food problem</li> </ul>	04	10
<p><b>Topic 3. Ecosystems</b></p> <ul style="list-style-type: none"> <li>• Concept of Ecosystem</li> <li>• Structure and functions of ecosystem</li> <li>• Energy flow in ecosystem</li> <li>• Major ecosystems in the world</li> </ul>	01	04
<p><b>Topic 4. Biodiversity and Its Conservation</b></p> <ul style="list-style-type: none"> <li>• Definition of Biodiversity</li> <li>• Levels of biodiversity</li> <li>• Value of biodiversity</li> </ul>	02	06

<ul style="list-style-type: none"> <li>• Threats to biodiversity</li> <li>• Conservation of biodiversity</li> </ul>		
<b>Topic 5. Environmental Pollution</b> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Air pollution: Definition, Classification, sources, effects, prevention</li> <li>• Water Pollution: Definition, Classification, sources, effects, prevention</li> <li>• Soil Pollution: Definition, sources, effects, prevention</li> <li>• Noise Pollution: Definition, sources, effects, prevention</li> </ul>	03	08
<b>Topic 6. Social Issues and Environment</b> <ul style="list-style-type: none"> <li>• Concept of development, sustainable development</li> <li>• Water conservation, Watershed management, Rain water harvesting: Definition, Methods and Benefits</li> <li>• Climate Change, Global warming, Acid rain, Ozone Layer Depletion, Nuclear Accidents and Holocaust: Basic concepts and their effect on climate</li> <li>• Concept of Carbon Credits and its advantages</li> </ul>	03	10
<b>Topic 7. Environmental Protection</b> Brief description of the following acts and their provisions: <ul style="list-style-type: none"> <li>• Environmental Protection Act</li> <li>• Air (Prevention and Control of Pollution) Act</li> <li>• Water (Prevention and Control of Pollution) Act</li> <li>• Wildlife Protection Act</li> <li>• Forest Conservation Act</li> </ul> Population Growth: Aspects, importance and effect on environment <ul style="list-style-type: none"> <li>• Human Health and Human Rights</li> </ul>	02	08
<b>Total</b>	<b>16</b>	<b>50</b>

**Practical:****Skills to be developed:****Intellectual Skills:**

1. Collection of information, data
2. Analysis of data
3. Report writing

**Motor Skills:**

1. Presentation Skills
2. Use of multi media

**List of Projects:**

**Note:** Any one project of the following:

1. Visit to a local area to document environmental assets such as river / forest / grassland / hill / mountain
2. Visit to a local polluted site: Urban/Rural/Industrial/Agricultural
3. Study of common plants, insects, birds
4. Study of simple ecosystems of ponds, river, hill slopes etc

**Prepare a project report on the findings of the visit illustrating environment related facts, analysis and conclusion. Also suggest remedies to improve environment.**

**Learning Resources:****Books:**

<b>Sr. No.</b>	<b>Author</b>	<b>Title</b>	<b>Publisher</b>
01	Anindita Basak	Environmental Studies	Pearson Education
02	R. Rajgopalan	Environmental Studies from Crises to Cure	Oxford University Press
03	Dr. R. J. Ranjit Daniels, Dr. Jagdish Krishnaswamy	Environmental Studies	Wiley India

**Course Name : Electrical Engineering Group****Course Code : EE / EP****Semester : Fourth****Subject Title : Elements of Mechanical Engineering****Subject Code : 17413****Teaching and Examination Scheme**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
02	--	02	02	50	--	--	25@	75

**NOTE:**

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work. (SW)**

**Rationale:**

Electrical engineering is the basic engineering branch. Electric power supply is needed for running of mechanical and the chemical process equipment for which different electric motors are used, so in mech industry, the electrical engineer has to take care of various electrical installations with its maintenance.

The electrical engineer has to look after various aspects related to electrical engineering in respect of mechanical equipment. (Boilers, Steam turbine, steam engines)  
There are the equipments that are used for generation of electrical power.

The content on boiler, steam turbine, and stem engine will enable the electrical engineer to adopt appropriate electrical engineering support for the efficient use of these equipments.

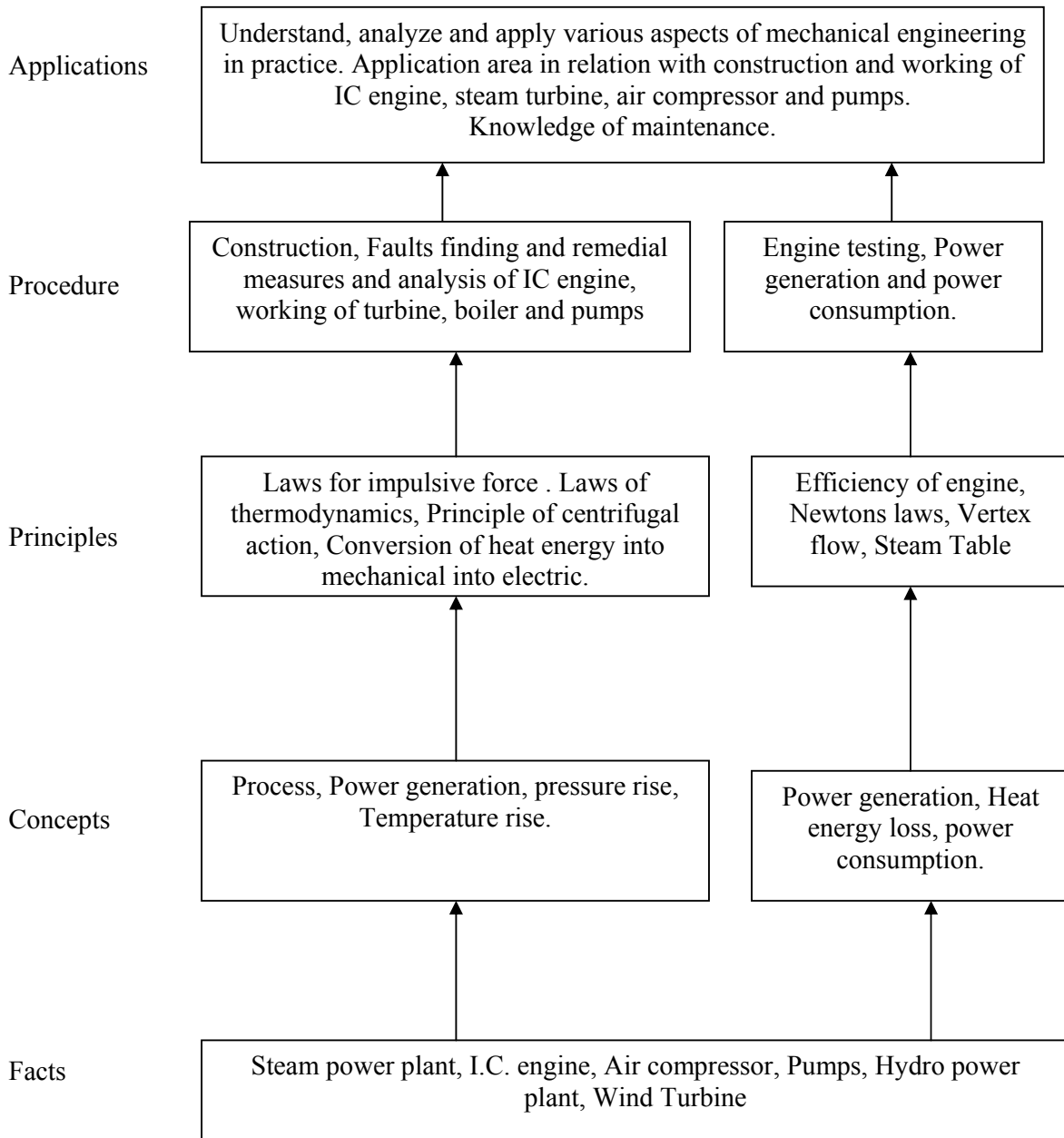
Topics on air compressors and pumps, turbine also provide necessary guide line in respect of electrical engineer. For trouble free working of these equipment with saving ion energy consumption.

**General Objectives:**

Students should be able to

1. Know the function of different mechanical equipment along with their location.
2. Understand working of high pressure boilers and steam turbine and thermal power plant.
3. Know the operation and control of fuel and steam supply.
4. Enlist sources of waste heat from boiler, IC engine.
5. Describe internal combustion engine.

**Learning Structure:**





**Theory:**

<b>Topic and Contents</b>	<b>Hours</b>	<b>Marks</b>
<p><b>Topic 1: Boilers, Steam turbines, Steam engine</b></p> <p><b>Specific Objectives:</b></p> <ul style="list-style-type: none"> <li>➤ Calculate the properties of two phase system by using steam table</li> <li>➤ Explain construction &amp; working of boilers</li> <li>➤ Identify the heat losses &amp; malfunctioning of boilers</li> </ul> <p><b>Contents:</b></p> <p>1.1 Construction and working of critical and super critical boilers.</p> <p>1.2 Boiler efficiency</p> <p>1.3 Boiler Act (for remedial measure).</p> <p>1.4 Classification of turbines.</p> <p>1.5 Impulse and reaction turbine.</p> <p>1.6 Power developed by turbine.</p> <p>1.7 Different power losses in turbine.</p>	10	16
<p><b>Topics 2: I.C. Engines</b></p> <p><b>Specific Objectives:</b></p> <ul style="list-style-type: none"> <li>➤ Calculate performance of engine</li> <li>➤ Identify the malfunctioning Causes</li> </ul> <p><b>Contents:</b></p> <p>2.1 Classification of I.C. engines.</p> <p>2.2 Testing and performance of I. C. engines.</p> <ul style="list-style-type: none"> <li>➤ Break power</li> <li>➤ Indicated power</li> <li>➤ Frictional power</li> </ul> <p>2.3 Fault finding and remedial action.</p> <p>2.4 Starting motor of I.C. engine.</p>	06	10
<p><b>Topic 3: Air Compressor</b></p> <p><b>Specific Objectives:</b></p> <ul style="list-style-type: none"> <li>➤ Know the working principles of air compressor</li> <li>➤ Identify Methods of energy saving</li> <li>➤ Identify the fault &amp; suggest remedies</li> </ul> <p><b>Contents:</b></p> <p>3.1 Introduction</p> <p>3.2 Definition : Compression ratio, Compressor capacity, Free air Deliver, swept volume.</p> <p>3.3 Reciprocating and rotary air compressor, their working and Construction.</p> <p>3.4 Methods of energy saving in compressor.</p> <p>3.5 Fault finding and remedial action.</p>	08	12
<p><b>Topic 4: Pumps</b></p> <p><b>Specific Objectives:</b></p> <ul style="list-style-type: none"> <li>➤ Selection of pumps for various applications</li> <li>➤ Know the construction &amp; working of pumps</li> <li>➤ Identify the trouble shooting of IC engines</li> </ul> <p><b>Contents:</b></p> <p>4.1 Classification of pumps.</p> <p>4.2 Type of pumps and their working.</p> <p>4.3 Power required to run the pump.</p> <p>4.4 Fault finding and remedial action.</p>	08	12
<b>Total</b>	<b>32</b>	<b>50</b>

**Practical:****Skills to be developed:****Intellectual Skills:**

1. Understand vapour process of steam boilers & different mountings & accessories
2. Analyze the performance of pumps & turbines

**Motor Skills:**

1. Use pressure & temp measuring device
2. Operate I C Engine & know the working of dynamometers

**List of Practicals:**

- (1) Write a report on visit to Sugar factory/steam power plant consisting of
  - (a) Working of boiler (b) Working of turbine (c) Foundation of boiler.
- (2) Write a report on visit to Sugar factory/steam power plant to observe
  - (a) Operation of condenser (b) Operation of cooling tower.
- (3) To determine brake power of single cylinder diesel engine by conducting trial on it.
- (4) To determine overall efficiency of a centrifugal pump by conducting a trial test on it and observe foundation of pump.
- (5) Observe the operation of air compressor for identification of sources of air leakage.
- (6) Observe the operation of reciprocating pump and identify types of faults and suggest remedial measures.

**Learning Resources:****1. Books:**

Sr. No.	Author	Title	Publisher
1	Domkundwar V. M	A Course In Thermal Engg.	Dhanpat Rai & Co.
2	R. K. Bansal	Fluid Mechanics & Hydraulic Machine	Laxmi Publication
3	T. S. Rajan	Basic Mechanical Engg.	New Age International
4	Dr. Kripal Singh	Automobile Engineering	Standard Publishers Distributors
5	R. S. Khurmi	A Text Book Of Thermal Engineering	S Chand & Co. Ltd
6	C. M. Agrwal	A text Book Of Thermal Engg	Wiley Precise Text Book

**Course Name : Electrical Engineering Group**  
**Course Code : EE/EP**  
**Semester : Fourth**  
**Subject Title : Industrial Instrumentation**  
**Subject Code : 17414**

**Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
04	--	02	03	100	50#	--	25@	125

**NOTE:**

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

**Rationale:**

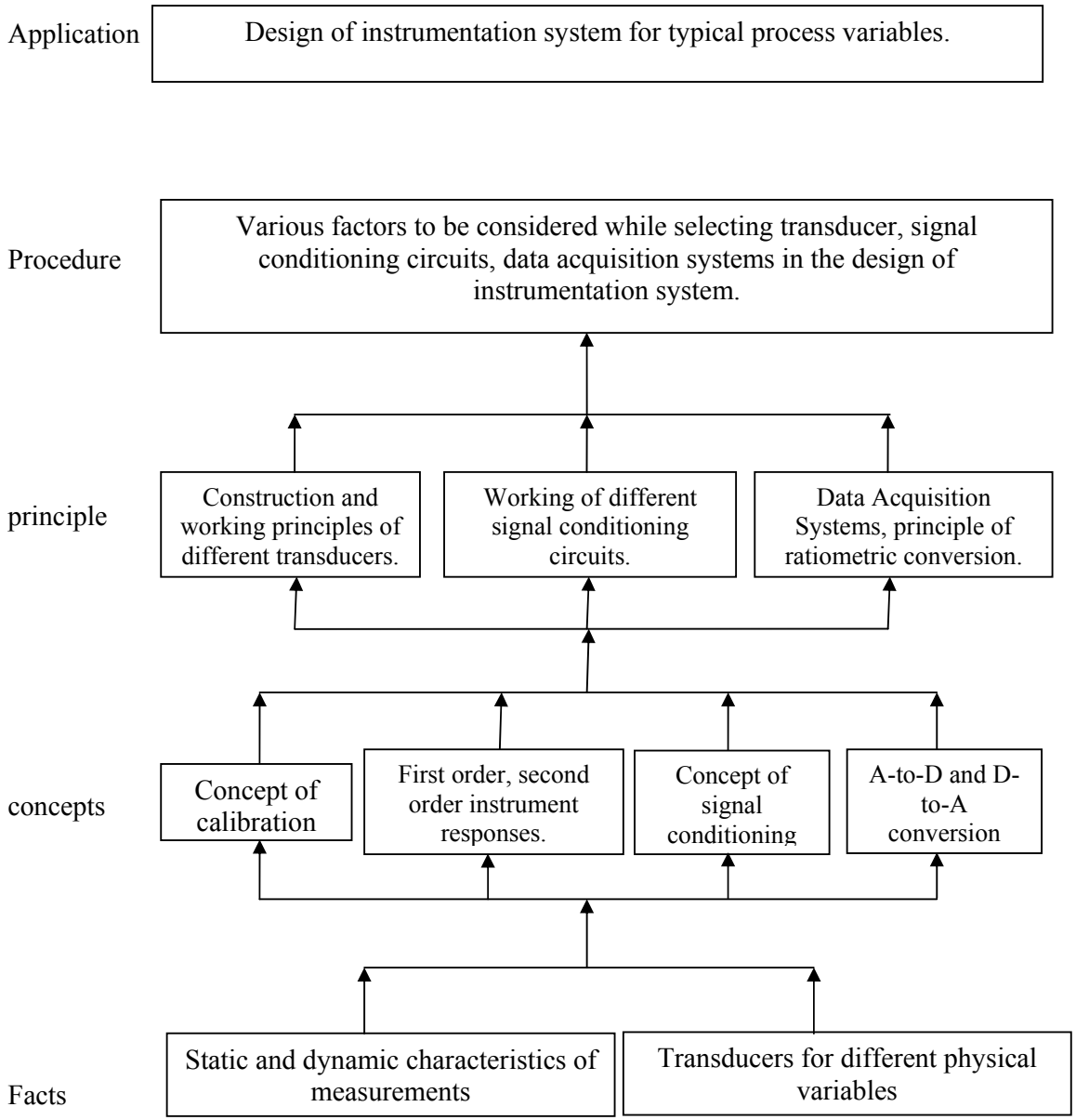
A diploma engineer is required to work in various capacities such as development, innovation & maintenance engineer, in today's highly automated industrial environment. Therefore the basic knowledge of industrial instrumentation and control is a necessary prerequisite.

He should be conversant with the basic principles of transduction of physical variables into electrical signals, signal conditioning circuits, basic data acquisitions systems.

**General Objectives:**

1. Identify different components of instrumentation system.
2. Understand different qualitative parameters of instruments.
3. Identify appropriate transducers for different physical variables.
4. Understand different signal conditioning circuits.
5. Understand different Data Acquisition System types and their use.
6. Design of complete system for measurement of process variables.

**Learning Structure:**



**Theory:**

Topic and Detailed Content	Hours	Marks
<p><b>Topic 1: Introduction to Instrumentation System</b>            Specific Objectives:            ➤ State basic block diagram of instrumentation system.            ➤ Identify static and dynamic characteristics of instruments</p> <p>Contents:            1.1 Basic instrumentation system            • Basic block diagram of generalized Instrumentation system            • Need of each block.            1.2 Static characteristics of instruments            • Accuracy and measurement uncertainty            • Precision, repeatability and reproducibility            • Tolerance            • Range and span            • Linearity            • Sensitivity, resolution            • Zero drift ,sensitivity drift            • Hysteresis effect            • Dead zone            1.3 Dynamic characteristics of instruments            • Characteristic equation of an instrument in general form            • Zero order, first order and second order representation of instruments            • Response of first, second order instruments to step, ramp and sinusoidal inputs            • Dynamic error, settling time            1.4 Calibration            • Principles of calibration            • Calibration chain and traceability</p>	08	16
<p><b>Topics 2: Transducers</b>            Specific Objectives:            ➤ Classify the transducers on the basis their application            ➤ Select appropriate transducer as per application            ➤</p> <p>Contents:            2.1: Transducers            • Transducers: Definition, classification of electrical transducers.            2.2: Measurement of strain            • Definition of stress and strain            • Operation of resistance strain gauge            • Construction of bonded metal foil strain gauge            • Strain gauge circuits: Wheatstone bridge full bridge configuration, temperature compensation            2.3 Measurement of Force and Torque            • Force measurement using load cell            • Types of load cells: column type and beam type            2.4 Measurement of torque using torque cell            2.5 Temperature Measurement            • Thermistor-working principle, characteristics, sources of error</p>	20	32

<ul style="list-style-type: none"> <li>• Thermocouple- Seebeck effect, Cold Junction compensation (CJC), CJC by electronic means, thermocouple types and their ranges.</li> <li>• Resistance thermometer (RTD): working principle, characteristics ranges of common RTD elements, self heating effect, advantages of platinum resistance thermometer, three wire and four wire configurations.</li> </ul> <p>2.6 Displacement measurement</p> <ul style="list-style-type: none"> <li>• Linear variable differential transformer (LVDT)- working principle, characteristics, null voltage phase sensitive demodulation.</li> <li>• Rotary motion measurement using optical rotary encoder</li> </ul> <p>2.7 Pressure measurement</p> <ul style="list-style-type: none"> <li>• Definition of pressure and its units</li> <li>• Absolute, differential and gauge pressure</li> <li>• Absolute pressure measurement using bourdon tube gauge</li> <li>• Diaphragm type pressure transducer using four element strain gauge rosettes.</li> </ul> <p>2.8 Flow measurement</p> <ul style="list-style-type: none"> <li>• Difference between mass flow rate and volumetric flow rate</li> <li>• Volumetric flow rate measurement using electromagnetic flow meter, turbine type flow meter and hot wire anemometer</li> </ul> <p>2.9 Measurement of magnetic field</p> <ul style="list-style-type: none"> <li>• Hall effect and hall effect transducer</li> <li>• Measurement of ac current by hall effect transducer</li> </ul> <p>2.10 Level measurement</p> <ul style="list-style-type: none"> <li>• Float type, capacitive and ultrasonic level measurement.</li> </ul> <p>2.11 Rotational velocity</p> <ul style="list-style-type: none"> <li>• Optical sensing, inductive and magnetic type pulse pickups</li> <li>• Analog tachometers (DC and AC)</li> </ul>		
<p><b>3. Signal Conditioning Circuits</b></p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> <li>➤ Draw basic block diagram of OP-AMP</li> <li>➤ Identify different applications of OP-AMP in signal conditioning circuits.</li> </ul> <p>Contents:</p> <p>3.1. Operational Amplifier and its characteristic parameters</p> <ul style="list-style-type: none"> <li>• Block diagram and features of OPAMP (all stages) Circuit Symbols and Terminals. OPAMP IC's: 741 pin diagram and pin function.</li> <li>• Ideal op-amp: electrical characteristics. Ideal voltage transfer curve.</li> <li>• Definitions of parameters of op-amp: Input offset voltage, Input offset current, Input bias current, Differential input resistance, Input capacitance, CMMR, SVRR, large signal voltage gain, output voltage swing, output resistance, slew rate, gain bandwidth product, output short circuit current.</li> </ul> <p>3.2 OP-AMP basic circuits</p> <ul style="list-style-type: none"> <li>• Open loop and closed loop configuration of op-amp, its comparison. Virtual ground concept</li> <li>• Open loop configuration</li> <li>• Close loop configuration: Inverting, non- inverting, differential amplifier, unity gain amplifier (voltage follower), inverter(sign changer), Adders, Subtractor, Integrator, Differentiator</li> <li>• Instrumentation amplifier (using one two and three op-amps)</li> </ul>	12	16

<ul style="list-style-type: none"> <li>• Voltage to current converter (with floating load, with grounded load), Current to voltage converter.</li> <li>• Sample and hold circuit (IC LF 398 , Pin diagram, specification and pin functions)</li> <li>• Concept of comparator: zero crossing detector, Schmitt trigger, window detector,</li> <li>• Phase detector, active peak detector, peak to peak detector <ul style="list-style-type: none"> <li>• Classification of filters, Concept of passive &amp; active filters</li> <li>• Survey of commercially available op-amps (Any Three)</li> </ul> </li> </ul>		
<p><b>Topic 4. Data Acquisition System</b></p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> <li>➤ Draw generalized block diagram of data acquisition system (DAS)</li> <li>➤ State different types of DAS</li> <li>➤ State various techniques of input signal conditioning in DAS</li> <li>➤ State working principle of analog-to-digital and digital-to-analog conversion.</li> </ul> <p>Contents:</p> <p>4.1 Generalized Data acquisition system</p> <ul style="list-style-type: none"> <li>• Generalized Data acquisition system: Block diagram. &amp; explanation.</li> <li>➤ Signal conditioning in DAS, Ratio metric conversion, Logarithmic conversion</li> <li>➤ DAS Types-Single channel, multi-channel DAS only block diagram.</li> </ul> <p>4.2 Analog-to-digital and digital-to-analog conversion</p> <ul style="list-style-type: none"> <li>• Study of different techniques of Analog to Digital convertors ADC and Digital to Analog converters DAC only working principle.</li> </ul>	08	12
<p><b>Topic 5. Operation of Instrumentation System</b></p> <p>Specific Objectives</p> <ul style="list-style-type: none"> <li>➤ State different factors to be considered in transducer selection</li> <li>➤ Draw block diagrams and circuit diagrams for instrumentation system for different physical variables.</li> </ul> <p>Contents:</p> <p>5.1 Transducer selection</p> <ul style="list-style-type: none"> <li>• Points to be considered while selecting a transducer for its intended applications.</li> </ul> <p>5.2 Working of Instrumentation system for</p> <ul style="list-style-type: none"> <li>• Temperature Measurement by RTD, thermistor, Thermocouple.</li> <li>• Force measurement using load cell.</li> <li>• Pressure measurement using diaphragm type transducer.</li> <li>• Speed measurement by non-contact type transducer</li> <li>• Displacement measurement by LVDT.</li> <li>• Rotary motion using optical encoder.</li> <li>• Flow measurement by turbine flow meter.</li> <li>• Liquid level measurement by resistive sensor.</li> <li>• AC current RMS indication using Hall Effect transducer.</li> </ul>	16	24
<b>Total</b>	<b>64</b>	<b>100</b>

**Practical:****Skills to be developed:****Intellectual Skills:**

- 1) Selection of transducer for given physical variable.
- 2) Analysis of the transducer characteristics.
- 3) Selection of signal conditioning circuit.

**Motor Skills:**

Testing and calibration of the given instrument.

**List of Practicals:**

1. Measure output voltage and Displacement in LVDT and draw a graph to verify the characteristics of Output Voltages Vs Displacement
2. Measure output Voltage and Force in Strain Guage nd draw graph to verify the characteristics of Force Vs Output Volatage
3. Verify the relation between the output voltage and temperature by using a RTD (PT 100) thermistor and Thermocouple
4. Use a Level measuring transducer to measure level and output voltage & verify the characteristics of the transducer.
5. Plot the graph and verify the characteristics of LDR/Photo diode and photo transistor
6. Pressure measurement using diaphragm type Pressure gauge
7. Verify the function of OPAMP as inverting/non inverting amplifier, adder, subtractor.
8. Verify the function of OPAMP as comparator, Schmitt trigger
9. Plot characteristics of primary and secondary current for a current transformer.
10. Measure angular velocity using optical tachometer.

**Learning Resources:****1. Books:**

Sr. No.	Author	Title	Publisher
1	Alok Barua	Fundamentals of Industrial Instrumentation	Wiley India
2	H.S.Kalsi Tata	Electronic Instrumentation	McGraw Hill
3	William Dunn	Fundamentals of Industrial Instrumentation and process control	McGraw-Hill
4	A.K.Sawhney	Electrical and Electronics Measurement and Instrumentation (19 <sup>th</sup> Edition)	Dhanpat Rai & co
5	Cooper Helfrick	Modern electronic instrumentation and measurement techniques	Prentice Hall
6	Ramakant Gaikwad	Op-AMPs and linear integrated circuits ( 4 <sup>th</sup> Edition)	Prentice –Hall India

**2. IS, BIS and International Codes:**

**ISO/IEC 17025** General requirements for the competence of testing and calibration laboratories.

**3. Websites:**

1. Free video lectures by Prof. Alok Barua, IIT Kharagpur
2. <http://freevidelectures.com/Course/2347/Industrial-Instrumentation>



**Course Name : Electrical Engineering Group****Course Code : EE /EP****Semester : Fourth****Subject Title : D. C. Machine and Transformer****Subject Code : 17415****Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
04	--	02	03	100	50#	--	25@	175

**NOTE:**

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

**Rationale:**

This subject is intended to teach the student facts, concepts, principles and procedures for the operations, testing and maintenance of electric machines such as dc motors, generators and transformers. Students will also be able to analyze characteristics of electric machines and transformers.

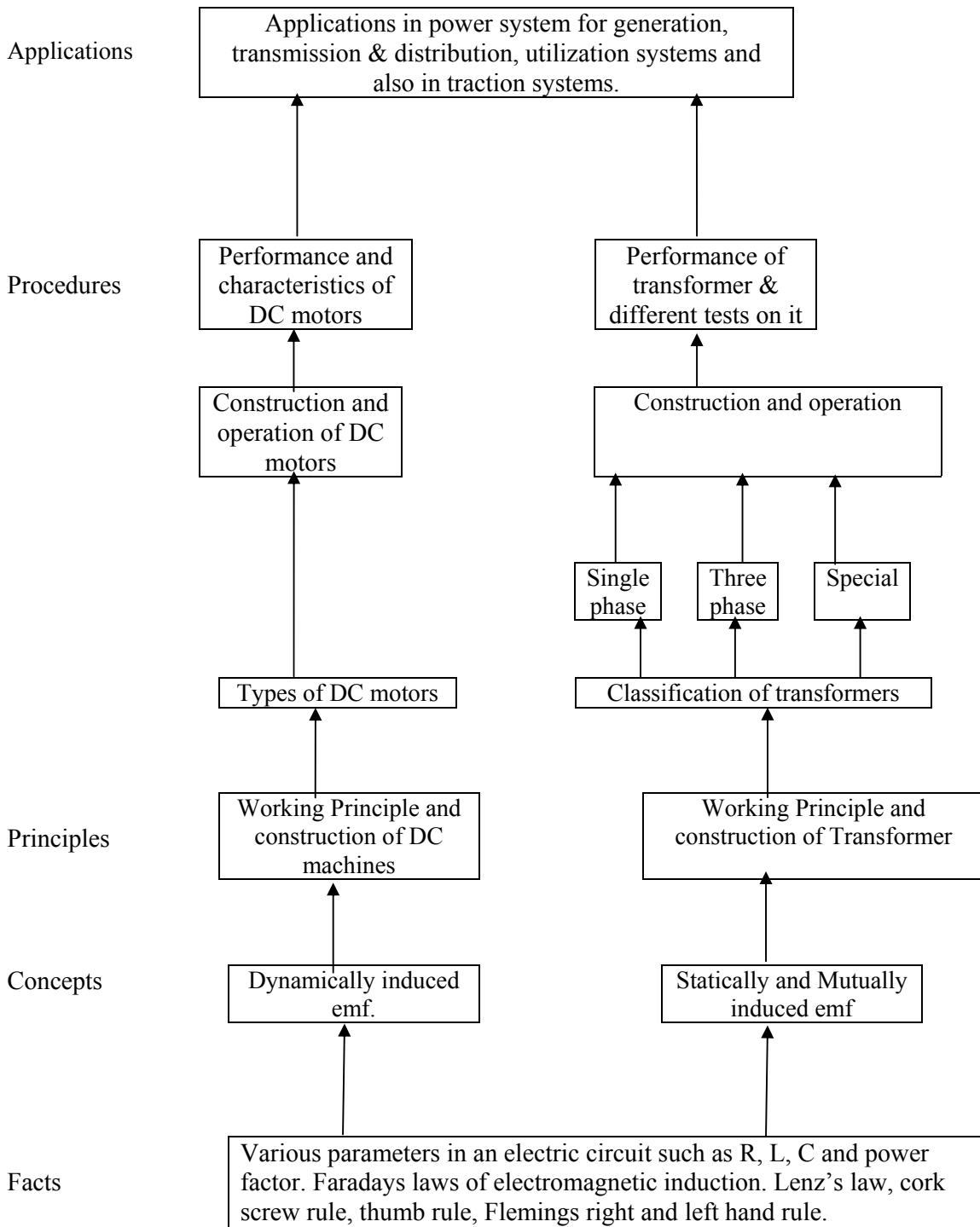
These machines are used in power system for generation, transmission & distribution, utilization systems and also in traction systems. Knowledge gained by the students will be used in the study of technological subjects such as power system operation & control, utilization system, switchgear & protection, testing and maintenance of electrical equipment and modern electric traction.

The students will be able to know the use of transformer in measurement, use of CT's and PT's in control circuits, fault locations etc. The knowledge and skill gained by the student will be used while working as technicians in discharging technical functions such as electrical supervisor, testing engineer and procurement engineer.

**General Objectives:****Students will be able to-**

1. Understand the laws governing the operation of electrical machines.
2. Understand the working principles of different DC machines and transformer.
3. Know the constructional details of the DC machines and transformer.
4. Know the areas of application of the various dc machines and different types of transformers.

**Learning Structure:**



**Theory:**

Topic and Contents	Hours	Marks
<p><b>Topic 1: DC Generators</b>  <b>Specific Objectives:</b></p> <ul style="list-style-type: none"> <li>➤ Identify the different parts of DC Machines.</li> <li>➤ Identify different types of DC generators from connection diagram.</li> </ul> <p><b>Contents:</b></p> <p>1.1 Introduction</p> <ul style="list-style-type: none"> <li>• Principle of operation of DC generator</li> <li>• Fleming's right hand rule</li> </ul> <p>1.2 Construction of DC machine</p> <ul style="list-style-type: none"> <li>• Parts and functions</li> <li>• Different materials used for different parts.</li> </ul> <p>1.3 E.m.f. equation of generator (derivation)</p> <ul style="list-style-type: none"> <li>• Numericals on e.m.f. equation</li> </ul> <p>1.4 Types of DC generators</p> <ul style="list-style-type: none"> <li>• Connection diagrams of different types of DC generators</li> <li>• Applications of DC generators</li> </ul>	06	08
<p><b>Topics 2: DC Motors</b>  <b>Specific Objectives:</b></p> <ul style="list-style-type: none"> <li>➤ Plot different characteristics of DC motors.</li> <li>➤ Control the speed of DC motors.</li> <li>➤ Determine the efficiency of DC motor.</li> <li>➤ Select DC motor for particular industrial applications.</li> </ul> <p><b>Contents:</b></p> <p>2.1 Introduction</p> <ul style="list-style-type: none"> <li>• Principle of operation of DC motor</li> <li>• Fleming's left hand rule</li> <li>• Back e.m.f. and its significance</li> <li>• Voltage equation and power equation of DC motor</li> <li>• Types of DC motors</li> </ul> <p>2.2 DC Motor Torque and Speed</p> <ul style="list-style-type: none"> <li>• Armature torque (derivation)</li> <li>• Shaft torque</li> <li>• Brake horse power</li> <li>• Numericals on torque and speed.</li> </ul> <p>2.3 Efficiency of DC Motor</p> <ul style="list-style-type: none"> <li>• Losses in DC motor</li> <li>• Power stages</li> <li>• Efficiency of DC motor</li> <li>• Condition for maximum efficiency</li> <li>• Numericals on efficiency.</li> </ul> <p>2.4 DC motor characteristics</p> <ul style="list-style-type: none"> <li>• Torque verses armature current</li> <li>• Speed verses armature current</li> <li>• Speed verses torque</li> <li>• Selection of motors for particular applications.</li> </ul> <p>2.5 Speed control of DC series motor</p> <ul style="list-style-type: none"> <li>• Flux control method</li> </ul>	12	18

<ul style="list-style-type: none"> <li>• Armature resistance control method (No numerical)</li> </ul> <p>2.6 DC motor starters</p> <ul style="list-style-type: none"> <li>• Necessity of DC motor starters</li> </ul> <p>2.7 Brushless DC Motor</p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Working</li> <li>• Applications</li> </ul>		
<p><b>Topic 3: Single Phase Transformer.</b></p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> <li>➤ Draw phasor diagram of transformer for different load conditions.</li> <li>➤ Perform various tests on transformers</li> <li>➤ Evaluate parameters of transformer under different loading conditions.</li> <li>➤ Determine regulation and efficiency of single-phase transformer.</li> </ul> <p>Contents:</p> <p>3.1 Introduction</p> <ul style="list-style-type: none"> <li>• Principle of operation</li> <li>• Faradays law of electromagnetic induction.</li> </ul> <p>3.2 Construction of single phase transformer.</p> <ul style="list-style-type: none"> <li>• Magnetic circuit</li> <li>• Electric circuit</li> <li>• Dielectric circuit</li> </ul> <p>3.3 Types of transformers</p> <ul style="list-style-type: none"> <li>• Shell type and core type- their comparison</li> <li>• Step up and step down transformer</li> <li>• Amorphous Core type Distribution Transformer</li> </ul> <p>3.4 EMF equation of transformer</p> <ul style="list-style-type: none"> <li>• Derivation</li> <li>• Voltage transformation ratio</li> <li>• Numericals on above.</li> </ul> <p>3.5 Ideal transformer</p> <ul style="list-style-type: none"> <li>• Characteristics of ideal transformer.</li> <li>• Phasor diagram</li> </ul> <p>3.6 Practical Transformer</p> <ul style="list-style-type: none"> <li>• Transformer on no load-phasor diagram</li> <li>• Leakage reactance</li> <li>• Transformer on load- phasor diagram</li> <li>• Numericals on above.</li> </ul> <p>3.7 Equivalent circuit of transformer</p> <ul style="list-style-type: none"> <li>• Equivalent resistance and reactance</li> <li>• Numericals on above.</li> </ul> <p>3.8 Voltage regulation and Efficiency of transformer</p> <ul style="list-style-type: none"> <li>• Why transformer rating is in KVA?</li> <li>• Voltage regulation of transformer</li> <li>• Losses in transformer</li> <li>• Efficiency of transformer</li> <li>• Condition for maximum efficiency</li> <li>• All day efficiency</li> <li>• Numericals on above.</li> </ul> <p>3.9 Tests on Single phase Transformer</p> <ul style="list-style-type: none"> <li>• Polarity test</li> </ul>	26	42

<ul style="list-style-type: none"> <li>• Direct loading test</li> <li>• Open circuit test</li> <li>• Short circuit test</li> <li>• Voltage regulation and efficiency based on OC &amp; SC tests.</li> <li>• Numericals on above.</li> </ul> <p>3.10 Parallel operation of transformer</p> <ul style="list-style-type: none"> <li>• Advantages of parallel operation of transformer.</li> <li>• Conditions for parallel operation of transformer.</li> <li>• Load sharing with equal turn ratio</li> <li>• Concept of load sharing with unequal turn ratio</li> <li>• Numericals on above.</li> </ul>		
<p><b>Topic 4: Three Phase Transformer.</b></p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> <li>➤ To identify different parts of three-phase transformer.</li> <li>➤ To identify polarity and phases of three-phase transformer.</li> <li>➤ To select three-phase transformer for particular applications.</li> </ul> <p>Contents:</p> <p>4.1 Introduction</p> <ul style="list-style-type: none"> <li>• Bank of three single phase transformer</li> <li>• Single unit of three phase transformer</li> <li>• Construction, different parts and their functions</li> <li>• Types of transformer cooling</li> <li>• Three phase transformers connections as per IS:2026 (part IV)-1977</li> <li>• Three phase to two phase conversion (Scott Connection)</li> <li>• Comparison between Distribution transformer and Power transformer</li> </ul> <p>4.2 Selection of transformer as per IS: 10028 (Part I)-1985</p> <ul style="list-style-type: none"> <li>• Criteria for selection of distribution transformer</li> <li>• Criteria for selection of power transformer</li> </ul> <p>4.3 Parallel operation of three phase transformer</p> <ul style="list-style-type: none"> <li>• Conditions for parallel operation</li> </ul> <p>4.4 Specification of three-phase distribution transformer as per IS:1180 (part I)-1989</p> <p>4.5 Tests on Three-phase Transformer</p> <ul style="list-style-type: none"> <li>• Polarity test</li> <li>• Phasing out test</li> </ul> <p>4.6 Three- phase auto transformer</p> <ul style="list-style-type: none"> <li>• Construction</li> <li>• Operation</li> <li>• Application</li> </ul>	12	16
<p><b>Topic 5: Special Transformers.</b></p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> <li>➤ To use various special transformers for particular applications..</li> </ul> <p>Contents:</p> <p>5.1 Single phase auto transformer</p> <ul style="list-style-type: none"> <li>• Construction and working</li> <li>• Comparison with two winding transformer</li> <li>• Advantages and disadvantages of auto transformer</li> </ul>	08	16

5.2	<ul style="list-style-type: none"> <li>• Applications of auto transformer</li> <li>• Instrument Transformers</li> <li>• Current transformer- construction, working and applications</li> <li>• Potential transformer- construction, working and applications</li> </ul>		
5.3	<ul style="list-style-type: none"> <li>• Isolation transformer</li> <li>• Features and applications</li> </ul>		
5.4	<ul style="list-style-type: none"> <li>• Single phase welding transformer</li> <li>• Features and applications.</li> </ul>		
<b>Total</b>		<b>64</b>	<b>100</b>

**Practical:****Skills to be developed:****Intellectual Skills:**

1. To understand the concepts of DC machines and transformers.
2. To identify different parts and windings of DC machines and transformers.
3. Ability to test, plot and verify the characteristics.
4. Ability to interpret the test results.

**Motor Skills:**

1. To draw the circuit diagram.
2. To measure different parameters using different meters.
3. To connect different meters according to circuit diagram.
4. To follow sequence of operations.
5. To measure the values and note down the readings.
6. To operate DC machines and transformers.

**List of Practicals:**

1. Observe and identify different constructional parts of D. C machine and identify different windings by resistance measurement.
2. Start a D. C shunt motor and reverse its direction of rotation.
3. Control the speed of D.C series motor by flux control and armature resistance control.
4. Perform load test on D. C series motor and plot its performance characteristics.
5. Perform brake test on D. C shunt motor and plot speed – Torque characteristics.
6. Determine transformation ratio, regulation and efficiency of single phase transformer by direct loading.
7. Perform open circuit and short circuit test on single phase transformer and determine equivalent circuit constants, regulation and efficiency.
8. Perform parallel operation of single phase transformer and determine the load sharing.
9. Visit a transformer manufacturing unit /repairing workshop and observe the constructional details of a three phase distribution transformer and identify various parts.
10. Perform polarity test and phasing out test on a three phase transformer.

**Learning Resources:****1. Books:**

Sr. No.	Author	Title	Publisher
1.	V. N. Mittle & Arvind Mittal	Basic Electrical Engineering	Tata McGraw Hill Education Pvt. Ltd. New Delhi
2.	D. P. Kothari &	Electrical Machines	Tata McGraw Hill Education Pvt.

	I. J.Nagrath		Ltd. New Delhi
3.	S. K. Bhattacharya	Electrical Machines	Tata McGraw Hill Education Pvt. Ltd. New Delhi
4.	V. K. Mehta & Rohit Mehta,	Principles of Electrical Machines	S.Chand and Co.Ltd., New Delhi
5.	K. Murungesh Kumar	DC Machines and Transformers	Vikas Publishing House Pvt. Ltd. New Delhi.
6.	Tarnekar & Kharabanda.	Laboratory Course in Electrical Engineering	S.Chand and Co.Ltd., New Delhi
7	B. L. Theraja	Electrical Technology	S.Chand and Co.Ltd., New Delhi
8	Edward Hughes	Electrical and Electronics Technology	ELBS Publication.
9	M. N. Bandyopadhyay	Electrical Machines theory and practice	PHI Learning Pvt. Ltd., New Delhi

## 2. CDs, PPTs, Models, Charts etc.:

### Videos-

1. <http://www.youtube.com/watch?v=RAc1RYilugI>
2. <http://www.youtube.com/watch?v=Ue6S8L4On-Y&feature=related>
3. [http://www.youtube.com/watch?v=d\\_aTC0iKO68&feature=related](http://www.youtube.com/watch?v=d_aTC0iKO68&feature=related)
4. <http://www.youtube.com/watch?v=Xi7o8cMPI0E&feature=related>
5. <http://www.youtube.com/watch?v=VucsoEhB0NA&feature=related>
6. [http://www.youtube.com/watch?v=A951LRFRL\\_M&feature=related](http://www.youtube.com/watch?v=A951LRFRL_M&feature=related)

## 3. IS, BIS and International Codes:

- IS: 2026 (Part IV)-1977 Indian standard specification for power transformers PART IV Terminal markings, tappings and connections
- IS: 10028 (Part I )-1981 Indian standard code of practice for selection, installation and maintenance of transformers, PART I selection
- IS: 1180 (Part I)-1977 Indian standard specification for power transformer

## 4. Websites:

- [www.standardsbis.in/](http://www.standardsbis.in/)
- [www.bis.org.in/](http://www.bis.org.in/)
- [www.youtube.com/watch](http://www.youtube.com/watch)
- [www.google.co.in](http://www.google.co.in)

**Course Name : Electrical Engineering Group****Course Code : EE/EP****Semester : Fourth****Subject Title : Industrial Electrical Systems - I****Subject Code : 17416****Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	01	02	03	100	--	25#	25@	150

**NOTE:**

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

**Rationale:**

A diploma engineer is required to work as supervisor & knowledge worker in different organizations and is responsible to provide electrification. Maintain supply prepare design, estimates, read drawing, IE rules, data tables, specification, for all types electrical installation, Provision & maintaining earthing & all protective devices like MCCB,ELCB etc. Also Knowledge of maintenance, LT Lines, transformers, types of cables & wires are essential. Hence this core subject has been included at fourth semester in this curriculum.

**General Objectives:****The Students will be able to: -**

1. Read & interprets Electrical Installation drawings.
2. Understand & apply IE rules.
3. Make use of data tables & specification of wire, cables, LT lines & Distribution Transformer, MCCB, ELCB.
4. Understand principles & procedures of earthing.
5. Know basic terms to prepare design & estimate of installation.
6. Understand & apply procedures for contracts & tenders.

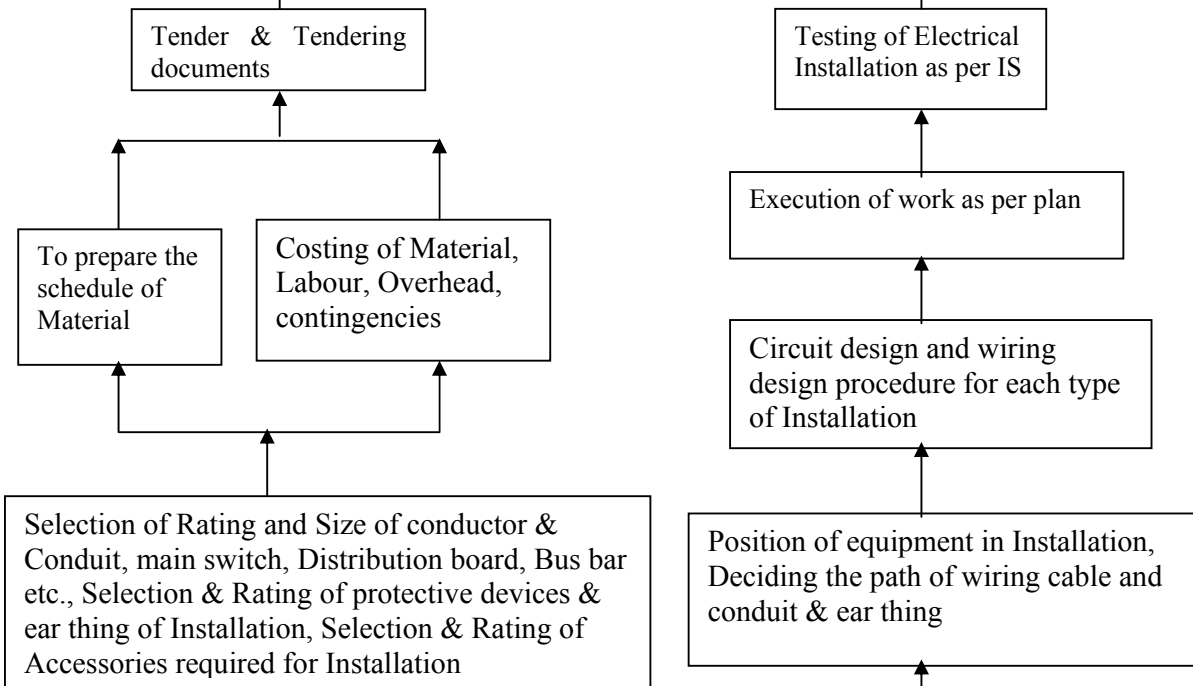


**Learning Structure:**

**Application:**

Estimating & costing of Residential, Commercial & Industrial Electrical Installation and prepare tendering documents, Testing of Electrical Installation and Evaluation & billing of executed work

**Procedure:**



**Principles**

Design consideration of Electrical Installation, Principles of circuit design for each type of Installation, Principles of execution of work

**Concepts**

Residential, commercial and Industrial wiring, Lighting and power circuit, wires, cables, overhead and underground wiring, earthing

**Facts**

Electrical Engineering Drawing, IE rules applicable to Residential, Commercial & Industrial Installation, General rules & Guidelines for Residential, Commercial & Industrial Installation, Data tables of conductor, Material and Accessories, Various plans & diagrams related to electrical Installation

**Theory:**

Topics and Contents	Hours	Marks
<b>1. Drawings and IE rules</b> Specific Objectives <ul style="list-style-type: none"> <li>➤ Understand different types of electrical Installation</li> <li>➤ Know and read Electrical drawings &amp; symbols</li> <li>➤ Know IE rules</li> </ul> <hr style="border-top: 1px dashed black;"/> <ul style="list-style-type: none"> <li>• Classification of electrical installations</li> <li>• General requirements of electrical installation</li> <li>• Reading &amp; interpretation of electrical engineering drawings &amp; symbols related to installations</li> <li>• Representation of different types of diagrams, such as schematic, circuit, wiring diagram and its single line representation as per IS code.</li> <li>• IE rules related to electrical installation</li> </ul>	04	10
<b>2. Service connections</b> Specific Objectives <ul style="list-style-type: none"> <li>➤ Select appropriate method for service connection</li> <li>➤ Differentiate between various service connections</li> </ul> <hr style="border-top: 1px solid black;"/> <ul style="list-style-type: none"> <li>• Concept of service connection</li> <li>• Types of service connections and their features</li> <li>• Methods of installation of service connection</li> <li>• Differentiate between underground and overhead service connection</li> <li>• Service connection for 11 KV H. T. Consumer</li> </ul>	04	10
<b>3. Electrification of residential Installation</b> Specific Objectives <ul style="list-style-type: none"> <li>➤ Select wires and wiring methods as per the requirement</li> <li>➤ Prepare comparison chart of various wiring accessories</li> <li>➤ Use given guidelines for residential installation</li> <li>➤ Calculate total electrical load</li> </ul> <hr style="border-top: 1px solid black;"/> <ul style="list-style-type: none"> <li>• Types of wires and wiring methods as per IS No.</li> <li>• General rules and guidelines for installation of residential electrification and positioning of equipments</li> <li>• Calculation of total electrical load in the residential installation</li> <li>• Procedure for the design of number of sub circuits</li> <li>• Method of drawing single line diagram</li> <li>• Selection of type of wire and wiring method</li> <li>• Load calculation and selection of size of wire by considering overload and future expansion</li> <li>• Determine length of batten and length of wire</li> <li>• Selection of rating for main switch, distribution board ,MCB,ELCB, and wiring accessories</li> <li>• Purpose of earthing and types of earthing</li> <li>• Determine length and size of earth wire</li> <li>• Prepare list of material for residential installation with their costing</li> <li>• Total estimation and costing of overall residential installation with proper cost of material , labour charges , contingencies charges</li> <li>• Determine per point charges</li> <li>• Wiring diagram for residential installation: Single Line and multiline</li> </ul>	12	24

representation.		
<p><b>4. Electrification of Commercial Installation</b></p> <p>Specific Objectives</p> <ul style="list-style-type: none"> <li>➤ Difference between residential and commercial installation</li> <li>➤ Prepare comparative chart for different ratings, size &amp; other technical specifications from manufactures/ dealers.</li> <li>➤ Use given guideline for commercial installation</li> <li>➤ Collect various specifications of wiring material</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Concept of commercial installation</li> <li>• Difference between residential and commercial installation</li> <li>• Difference between wires and cables</li> <li>• Types of cables required for commercial installations according to size and core</li> <li>• General requirements and selection factors for commercial installation</li> <li>• Load calculation and selection of size of service connection and nature of supply</li> <li>• Decide number of lighting and power sub circuits as per the IE rule</li> <li>• Decide size of wire/cable required for every sub circuit</li> <li>• Decide length of wire required for every sub circuit</li> <li>• Draw the single line diagram</li> <li>• Decide ratings of wiring accessories, main switch, bus bar MCB, ELCB etc.</li> <li>• Decide proper method of earthing for commercial installation</li> <li>• Prepare list of material for commercial installation with their costing</li> <li>• Draw the single line diagram</li> <li>• Find out the estimation chart with proper cost of material , cost of labour, contingencies charges and profit margin</li> <li>• Draw the circuit diagram</li> </ul>	12	20
<p><b>4. Electrification of Industrial Installation</b></p> <p>Specific Objectives</p> <ul style="list-style-type: none"> <li>➤ Based on criteria for selection decide if the installation is industrial installation</li> <li>➤ State difference between power wiring and actual industrial wiring</li> <li>➤ Guideline for industrial installation</li> <li>➤ Calculate detail estimate and costing of industrial installation</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Concept of industrial load</li> <li>• Concept of motor wiring circuit and single line diagram</li> <li>• Guidelines about power wiring and motor wiring</li> <li>• Design considerations of electrical installation in small industry/factory/workshop</li> <li>• Machine current calculations</li> <li>• selection of size for wires , cables required for the machines and its controlling unit</li> <li>• Decide length and size of cable required for the every industrial load</li> <li>• Decide ratings of wiring accessories, main switch, bus bar MCB, ELCB etc. for every industrial load.</li> <li>• Decide proper method of earthing for industrial installation</li> <li>• Prepare list of material for industrial installation with their costing</li> <li>• Find out the estimation chart with proper cost of material , cost of labour,</li> </ul>	12	24

contingencies charges and profit margin • Draw the circuit diagram		
<b>6. Contracts, Tenders and Execution</b> Specific Objectives ➤ Draft tender documents ➤ Fill tender documents following appropriate procedure and be present and act as per the requirements and rules while opening of the tender. ➤ Prepare billing		
• Concept of contract and tenders • Types of contracts and contractors • Types of tenders • Requirements of valid contract and good contractor • Tender notice • Procedure for submission and opening of tenders • Comparative statements for selection of contractors • Principles of execution of work • Billing of executed works.	04	12
<b>Total</b>	<b>48</b>	<b>100</b>

**Tutorials:**

1. Electrical installation scheme for small bungalow or house. Draw wiring diagram and prepare detailed estimation and costing.
2. Electrical installation scheme for commercial building/ floor mill. Draw wiring diagram and prepare detailed estimation and costing.
3. Electrical installation scheme for small industry/factory/workshop/agriculture pump . Draw single line diagram and prepare detailed estimation and costing. Draw the circuit diagram

**Assignments:**

Skills to be developed:

**Intellectual Skills:**

1. Identify and apply different designing methods as per the requirements
2. Select proper ratings
3. Ability to analyse and select appropriate methods for estimation and costing

**Motor Skills:**

1. Drawing skill.
2. Measuring dimensions

**List of Assignments:** Problems & sheets on following topics.

- 1) Electrical estimation & design of residential consumers (for flats/Bungalows/Row houses)
- 2) Electrical estimation & design of Commercial consumers (for Malls/Colleges/Hospitals, Banks)

- 3) Electrical estimation & design of Agricultural consumers (Pump jets/submersible pump)
- 4) Electrical estimation & design of small & medium Industrial consumers.
- 5) Electrical Installation & layout preparation of your college campus.
- 6) Preparation of a NIT (Notice Inviting Tender)

Note: Estimations be made for loads up to 100 KVA

### Learning Resources:

#### 1. Books:

Sr. No.	Name of the Author	Title of the book	Name of the Publisher
1	J.B.Gupta	Electrical Installation Estimating & costing	S.K.Kataria & sons New Delhi
2	Raina Bhattachraya	Estimating design & costing	New Age
3	Allasappan & Ekambarm	Estimating design & costing	Tata McGraw hill
4	S L Uppal	Estimating & costing	Khanna Publiser
5	Surjit Singh	Electrical Estimating & costing	Dhanpat Rai & co.

#### 2. ISO, IS, BS standards, Data Sheets, IE Rules Handbook

IS/International code: IS5909, 7733, 2174, 732, 4648

#### 3. Charts, Models, CDs, Transparencies,

#### 4. Websites:

<http://www.bestestimatepro.com/>

[bieap.gov.in/estimatingandcosting.pdf](http://bieap.gov.in/estimatingandcosting.pdf)

[http://indiacatalog.com/web\\_directory/electrical/electrical.html](http://indiacatalog.com/web_directory/electrical/electrical.html)

**Course Name : Electrical Engineering Group****Course Code : EE / EP****Semester : Fourth****Subject Title : Transmission & Distribution of Electrical Power****Subject Code : 17417****Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
04	--	--	03	100	--	--	--	100

**NOTE:**

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

**Rationale:**

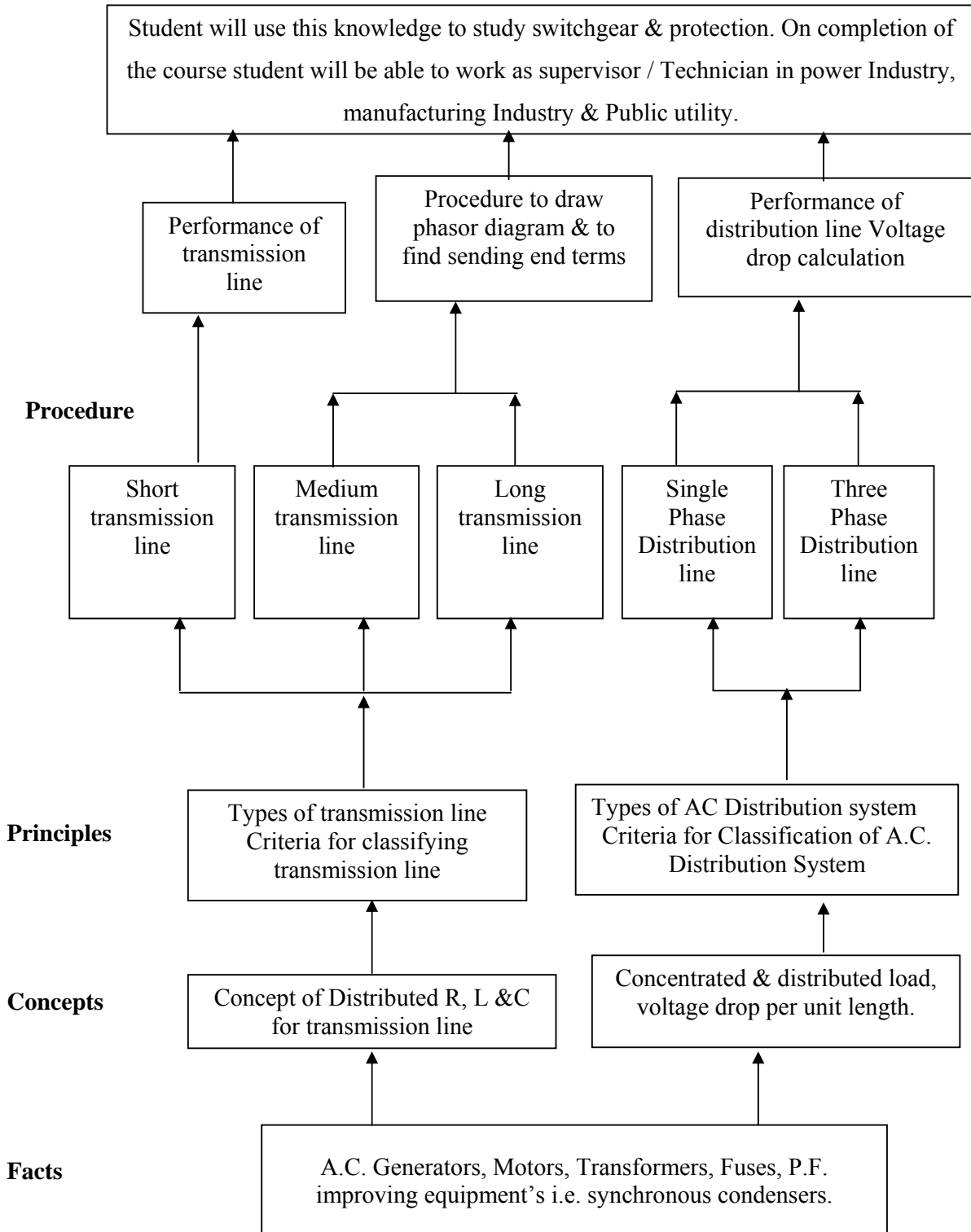
Electrical Diploma Engineers should know Transmission Voltages, Distribution Voltage. They should be able to identify various components & their functions. They will be able to measure system performance. They will use this knowledge in studying Switchgear & Protection on completing the study of Generation, Transmission, Distribution, Switchgear, Protection & utilization of electrical energy, Students will be work as electrical engineer in power industry.

**General Objectives: Student will be able to: -**

1. Know various types of Transmission & distribution system.
2. Identify various components & know their functions.
3. Know types of conductors used in transmission and distribution circuits
4. Know the effect of changes in parameters on performance of the lines
5. Draw substation layout as per the requirements.

**Learning Structure:**

**Applications**



**Theory:**

Topic and Contents	Hours	Marks
<p><b>Topic 1: Basic Transmission</b> Specific Objectives:</p> <ul style="list-style-type: none"> <li>➤ Draw single line diagram of a given transmission network</li> <li>➤ Classify the lines based on their length, voltage rating</li> </ul> <p><b>Contents:</b></p> <ul style="list-style-type: none"> <li>• Single Line Diagram of Transmission &amp; Distribution of Electric supply system.</li> <li>• Meaning of Primary &amp; Secondary Transmission and its Standard Voltage level used in India.</li> <li>• Classification of Transmission Lines according to voltage level, Length of Transmission line, Type of Supply Voltage &amp; Method of Construction.</li> <li>• Advantage of High Voltage for power transmission</li> </ul>	04	08
<p><b>Topics 2: Transmission Line Components</b> Specific Objectives:</p> <ul style="list-style-type: none"> <li>➤ Identify the main Components of Transmission &amp; Distribution Line.</li> <li>➤ Select size and type of conductor for transmission line based on its rating</li> <li>➤ Calculate string efficiency</li> </ul> <p><b>Contents:</b></p> <p><b>Overhead Conductors: ----- 04 marks</b></p> <ul style="list-style-type: none"> <li>• Properties of Conducting Material.</li> <li>• Comparison of Copper &amp; Aluminum as a Conducting Material.</li> <li>• Different types of Conductor such as Copper, All Aluminium Conductor (AAC), Alluminium Conductor Steel Reinforced (ACSR), All Aluminium Alloy Conductor (AAAC), Bundled Conductor, Steel Conductor and their applications.</li> <li>• Trade Names of various types of conductors.</li> <li>• Stranded Conductor: Advantages &amp; Disadvantages.</li> </ul> <p><b>Underground Cables: ----- 04 Marks</b></p> <ul style="list-style-type: none"> <li>• Introduction &amp; requirements.</li> <li>• Classification of cables.</li> <li>• Cable conductors.</li> <li>• Cable construction.</li> <li>• Cable insulation, Metallic sheathing &amp; mechanical protection.</li> <li>• Comparison with overhead lines</li> <li>• Cable laying and Cable Joining</li> </ul> <p><b>Line supports: ----- 06 marks</b></p> <ul style="list-style-type: none"> <li>• Requirements of Supporting Structures</li> <li>• Types of Supporting Structure:</li> <li>• Poles: RCC Pole, RSJ (Rail Pole), Steel Tubular Pole their specification, method of erection and their comparison based of Cost, Life, Tensile strength, Insulating properties, maintenance, Weight, transportation and handling.</li> <li>• Steel Tower: Specifications, Material used, single circuit, double</li> </ul>	14	24



<p>circuit, Voltage levels.</p> <ul style="list-style-type: none"> <li>Advantages, Disadvantages &amp; Application of Steel Tower.</li> </ul> <p><b>Line Insulators : ----- 10 marks</b></p> <ul style="list-style-type: none"> <li>Electrical, Mechanical, Chemical, Thermal &amp; General Properties of Insulating Material.</li> <li>Selection of material for line insulators, standard dielectric strengths of insulating materials used.</li> <li>Types of Insulators used in Transmission and Distribution: Pin type, Suspension type, Strain type, Shackle type, Stay Insulator and their Applications.</li> <li>Causes of Insulator failure.</li> <li>String Insulator: Constructional features and applications.</li> <li>Self Capacitance, Shunt Capacitance &amp; Factor 'K' or 'M', Effect of factor 'K': Definition and effect on voltage distribution in the units of the string.</li> <li>Distribution of Potential over a string of Three Suspension Insulator.</li> <li>Define String Efficiency and develop its Mathematical Expression (Simple Numericals)</li> <li>Methods of Improving String efficiency.</li> </ul>		
<p><b>Topics 3: Transmission Line Parameters</b></p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> <li>Use appropriate method for reducing skin effect</li> <li>Prepare schedule for transposition of line</li> </ul> <p><b>Contents:</b></p> <ul style="list-style-type: none"> <li>Concept of R, L &amp; C of Transmission Line, State their Effect on performance of Transmission line ( No Derivation &amp; Numericals)</li> <li>Skin Effect: Meaning of the term, its dependence on conductor size and configuration and material, Methods used to reduce the skin effect.</li> <li>Proximity Effect: Meaning of the term, its effect on performance of line, methods of reducing the effect.</li> <li>Ferranti Effect</li> <li>Phenomenon of Corona, Disruptive Critical Voltage and Visual Critical Voltage, Conditions affecting Corona, Power loss due to Corona, Methods of reducing Corona, Advantages &amp; Disadvantages of Corona.</li> <li>Concept of Transposition of Conductors and its necessity.</li> </ul>	08	12
<p><b>Topics 4: Performance of Transmission Line</b></p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> <li>Determine performance of the line based on efficiency and regulation</li> <li>Representation of line based on A, B, C ,D constants</li> </ul> <p><b>Contents:</b></p> <ul style="list-style-type: none"> <li>Classification of Transmission line according to distance such as Short, Medium &amp; long Transmission Line.</li> <li>Definition of efficiency &amp; Regulation of Transmission line.</li> <li>Effect of Power Factor on Transmission efficiency and Regulation, Draw Vector diagram for Lag, Lead &amp; Unity Power factor.</li> <li>Derivation of Regulation Short Transmission line.</li> <li>Numericals on 1-phase &amp; 3-phase Short Transmission line:</li> </ul>	10	20

<p>Calculate Efficiency &amp; Percentage Regulation.</p> <ul style="list-style-type: none"> <li>• Analysis of Short transmission line: Equivalent Circuit &amp; Vector Diagram (No Mathematical Treatment)</li> <li>• Analysis of Medium transmission line: Equivalent Circuit with Nominal 'T', Nominal '<math>\pi</math>', and End Condenser Method, its Phasor diagram (No Mathematical Treatment)</li> <li>• Concept and Basic Equations of generalized circuit constants 'A', 'B', 'C', 'D' (No Derivation and Numericals)</li> </ul>		
<p><b>Topics 5: Extra High Voltage Transmission</b> Specific Objectives:</p> <ul style="list-style-type: none"> <li>➤ Understand the concept of HV Transmission</li> <li>➤ Know the use of HV Lines for Transmission and National Grid</li> <li>➤ Compare EHV A.C and HV D.C lines for performance</li> </ul> <p><b>Contents:</b></p> <ul style="list-style-type: none"> <li>• Definition of EHV line, Its necessity and Importance.</li> <li>• Advantages, Limitations and Applications of Extra High Voltage AC (EHVAC) Transmission Line.</li> <li>• Advantages, Limitation &amp; Application of High Voltage DC (HVDC) Transmission Line.</li> <li>• Layout of HVDC Transmission Line: Monopolar, Bi-Polar &amp; Homopolar</li> <li>• HVDC Transmission Line Routes in India,</li> <li>• Comparison of EHVAC &amp; HVDC Transmission line.</li> </ul>	06	08
<p><b>Topics 6: A.C Distribution System</b> Specific Objectives:</p> <ul style="list-style-type: none"> <li>➤ Decide type of distributor to be used based on requirements</li> <li>➤ Determine performance of Distributer with given parameters</li> </ul> <p><b>Contents:</b></p> <ul style="list-style-type: none"> <li>• Components of Distribution System.</li> <li>• Classification of distribution System</li> <li>• Requirements of an ideal Distribution System.</li> <li>• Meaning of Primary &amp; Secondary Distribution System with their voltage level and Number of conductors.</li> <li>• Comparison between Feeder &amp; Distributor.</li> <li>• Factors to be considered while designing Feeder &amp; Distributor.</li> <li>• Types of different distribution Scheme such as Radial, Ring, and Grid. Layout, Advantages, Disadvantages &amp; Applications.</li> <li>• Numericals on 1-phase A.C Distribution System to Calculate Voltage drop &amp; Voltage at sending end / Receiving end with Power factor referred to Voltage at receiving end.</li> </ul>	12	16
<p><b>Topics 7: Primary and Secondary Distribution Sub-Station</b> Specific Objectives:</p> <ul style="list-style-type: none"> <li>➤ Identify components of sub stations with their ratings</li> <li>➤ Identify components from single line diagram</li> </ul> <p><b>Contents:</b></p> <ul style="list-style-type: none"> <li>• Definition and Classification of Sub-Station according to Nature of duty, Application (Service), Construction</li> <li>• Site Selection for Sub-Station.</li> <li>• Advantages, Disadvantages &amp; Applications of Indoor &amp; Outdoor Sub-Station.</li> </ul>	10	12

<ul style="list-style-type: none"> <li>• Single Line diagram (layout of ) 33/11KV Sub-Station.</li> <li>• Single Line diagram (layout of) 11KV/400V Distribution Transformer.</li> <li>• Symbols &amp; Functions of components of 33/11KV Sub-Station: Incoming Feeder, Busbar, Power Transformer, Lightning Arrester, Earth Switch Insulator (No Load Switch), Circuit Breaker, Horn Gap Fuse, Instrumental Transformer (CT &amp; PT), Control Panel, Control Room and Outgoing Line,</li> <li>• Symbols &amp; Functions of 11KV/400V Distribution Transformer Sub-Station: Functions of Incoming line, AB Switch, Drop down Fuse, Distribution Transformer, Cross Bracing, Anti climbing device, Danger board, Sub Station Earthing and Distribution box.</li> </ul>		
<b>Total</b>	<b>64</b>	<b>100</b>

**NOTES:**

1. Visit to 33 / 11 KV Substation.
2. Visit to 11KV/400V Distribution Substation in Campus.
3. Observe Samples of ACSR Conductors and Insulators.  
These visits may be arranged under Professional Practice.

**Learning Resources:****1. Books:**

Sr. No.	Author	Title	Publisher
1.	V.K.Mehta	Principles of Power System	S.Chand
2.	V. Kamraju	Electrical Power Distribution System	Mc.GrawHill
3.	S.Sivanagaraju S.Satyanarayana	Electrical Power Transmission and Distribution	Pearson
4.	Soni,Gupta, Bhatnagar	A Course in Electrical Power	Dhanpat Rai
5.	S.L.Uppal	A Course in Electrical Power	S.K.Khanna
6.	J.B.Gupta	Transmission and Distribution of Electrical Energy	S.K.Khanna

**2. IS, BIS and International Codes:**

1. IS 2713 (Part I, II, III) – 1980 for Specifications of Tubular Steel poles for Over Head Power Lines.
2. Standard Clearances as per BS: 162-1961 and BS: 159-1957
3. IS 398-1961 – Technical data of AAC and ACSR Conductors.
4. IS 398 (Part -4)-1994 - Technical data of AAAC

**3. Websites:**

1. Sonaversity \_ org
2. [www.animations.physics.unsw.edu.au](http://www.animations.physics.unsw.edu.au)
3. phy-clips

**Course Name : Electrical Engineering Group****Course Code : EE / EP****Semester : Fourth****Subject Title : Professional Practices-II****Subject Code : 17038****Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
--	--	03	--	--	--	--	50@	50

**Rationale:**

Most of the diploma holders join industries. Due to globalization and competition in the industrial and service sectors the selection for the job is based on campus interviews or competitive tests.

While selecting candidates a normal practice adopted is to see general confidence, ability to communicate and attitude, in addition to basic technological concepts.

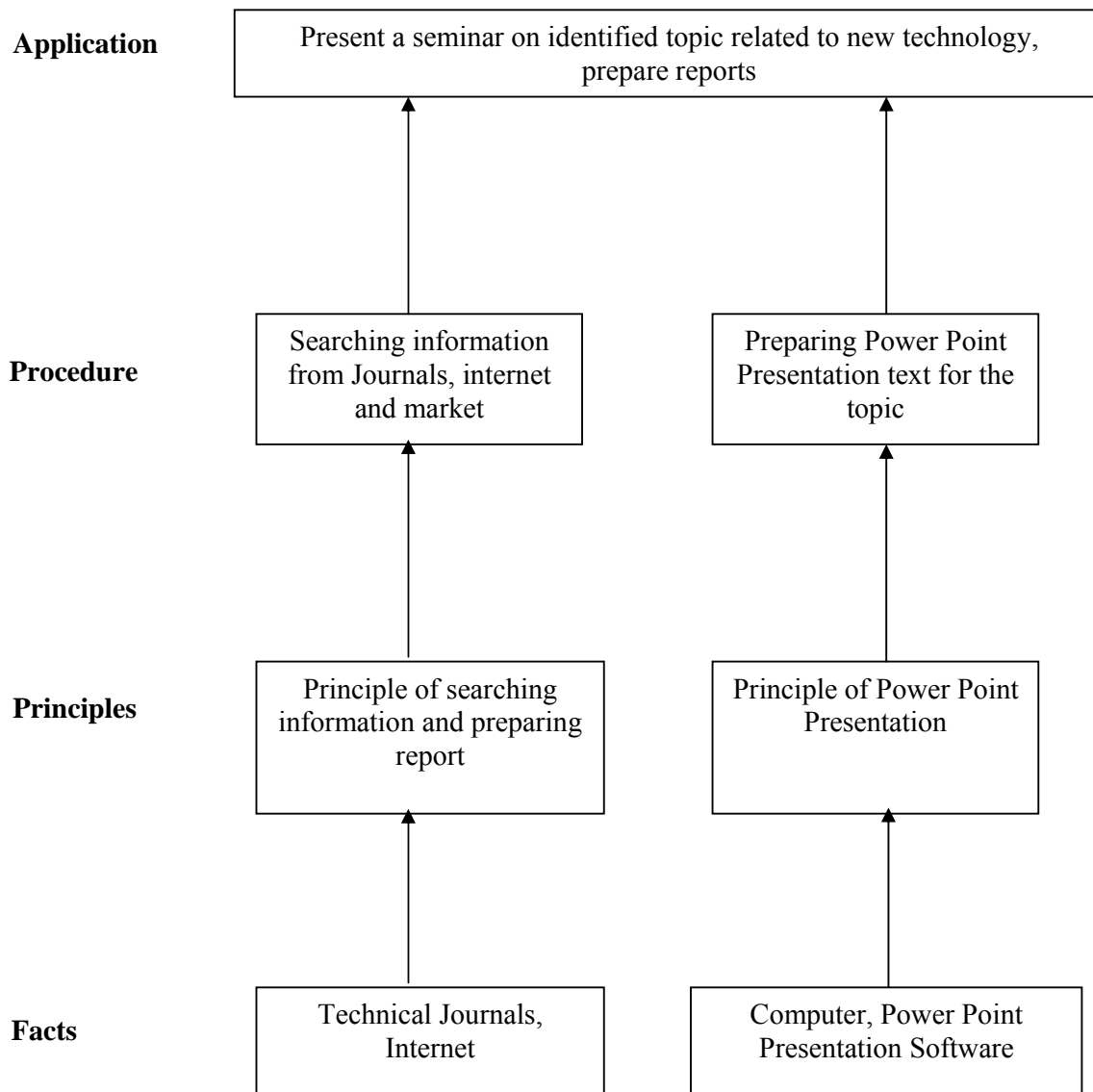
The purpose of introducing professional practices is to provide opportunity to students to undergo activities which will enable them to develop confidence. Industrial visits, expert lectures, seminars on technical topics and group discussion are planned in a semester so that there will be increased participation of students in learning process.

**Objectives:**

Student will be able to:

1. Acquire information from different sources.
2. Prepare notes for given topic.
3. Present given topic in a seminar.
4. Interact with peers to share thoughts.
5. Prepare a report on industrial visit, expert lecture.

**Learning Structure:**



Activity	Contents	Hours
01	<p><b>Industrial Visits</b> Structured industrial visits be arranged and report of the same should be submitted by the individual student, as part of the term work. The industrial visits may be arranged in the following areas / industries :</p> <ul style="list-style-type: none"> <li>i) Visit to HT Sub Station (Compulsory)</li> <li>ii) Visit to Transformer Manufacturing Industry</li> <li>iii) Visit to Electronics Industry</li> <li>iv) Visit to Design Office of MSEDCL, MSEGNCOL</li> <li>v) Visit to Industry to observe:- <ul style="list-style-type: none"> <li>a)Function of DAS and Data logger</li> <li>b) Electrical quantities, non-electrical quantities by recorder.</li> </ul> </li> <li>vi) Adarsh Gram</li> </ul>	16
02	<p><b>Lectures by Professional / Industrial Expert / Student Seminars based on information search, expert lectures to be organized from any of the following areas:</b></p> <ul style="list-style-type: none"> <li>i) Interview Techniques.</li> <li>ii) Effect of Transmission and Distribution Losses on cost of Energy Generation</li> <li>iii) Recent Trends in Transformer Manufacturing</li> <li>iv) Electrical Safety in Industry</li> <li>v) Applications of D. C. Motors : Present and Future Trends</li> <li>vi) Any other suitable topic</li> </ul>	08
03	<p><b>Information Search:</b> Information search can be done through manufacturers, catalogue, internet, magazines; books etc. and submit a report. Following topics are suggested :</p> <ul style="list-style-type: none"> <li>i) Recent Trends in Insulation Material and Insulators</li> <li>ii) Electrical Wiring Accessories</li> <li>iii) Non Conventional Energy Sources with focus on solar energy</li> <li>iv) Elevators installation and maintenance</li> <li>v) Any other suitable areas</li> </ul>	08
04	<p><b>Seminar:</b> Seminar topic should be related to the subjects of fourth semester. Each student shall submit a report of at least 10 pages and deliver a seminar (Presentation time – 10 minutes)</p>	08
05	<p><b>Mini Projects:</b> A group of 6to8 students be formed for group discussion;</p> <ol style="list-style-type: none"> <li>1. Prepare a report on Electrification of multi storied building</li> <li>2. Market Survey of Power Converters on the basis of Rating, Cost, Efficiency, Battery quality</li> </ol>	08
<b>Total</b>		<b>48</b>

**Course Name : All Branches of Diploma in Engineering & Technology**

**Course Code : AE/CE/CH/CM/CO/CR/CS/CW/DE/EE/EP/IF/EJ/EN/ET/EV/EX/IC/IE/IS/  
ME/MU/PG/PT/PS/CD/CV/ED/EI/FE/IU/MH/MI/DC/TC/TX/FG**

**Industrial Training (Optional) after 4<sup>th</sup> semester examination.**

**Note:- Examination in Professional Practices of 5<sup>th</sup> Semester.**

### **INDUSTRIAL TRAINING (OPTIONAL)**

#### **Rational:-**

There was a common suggestion from the industry as well as other stakeholders that curriculum of Engineering and Technology courses should have Industrial training as part of the curriculum. When this issue of industrial training was discussed it was found that it will be difficult to make industrial training compulsory for all students of all courses as it will be difficult to find placement for all the students. It is therefore now proposed that this training can be included in the curriculum as optional training for student who is willing to undertake such training on their own. The institutes will help them in getting placement or also providing them requisite documents which the student may need to get the placement.

**Details:-** Student can undergo training in related industries as guided by subject teachers / HOD.

- The training will be for four weeks duration in the summer vacation after the fourth semester examination is over.
- The student undergoing such training will have to submit a report of the training duly certified by the competent authority from the industry clearly indicating the achievements of the student during training. This submission is to be made after joining the institute for Fifth semester.
- The student completing this training will have to deliver a seminar on the training activities based on the report in the subject Professional Practices at Fifth Semester.
- The student undergoing this training will be exempted from attending activities under Professional Practices at Fifth semester except the seminar. The report, the delivery of the seminar and actual experience in training will be evaluated as term work and will be given marks out of 50.
- The students who will not undergo such training will have to attend Professional Practices Classes/activities of fifth semester and will have to complete the tasks given during the semester under this head.
- There work will be evaluated on their submissions as per requirement and will be given marks out of 50. Or student may have to give seminar on training in Industry he attended.
- Institute shall encourage and guide students for Industry training.