 MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI TEACHING AND EXAMINATION SCHEME FOR POST S.S.C. DIPLOMA COURSES																	
COURSE NAME : ELECTRICAL ENGINEERING GROUP																	
COURSE CODE : EE/EP																	
DURATION OF COURSE : SIX SEMESTERS										WITH EFFECT FROM 2012-13							
SEMESTER : THIRD										DURATION : 16 WEEKS							
FULL TIME / PART TIME : FULL TIME										SCHEME : G							
SR. NO	SUBJECT TITLE	abbrevi ation	SUB CODE	TEACHING SCHEME			EXAMINATION SCHEME										SW (17300)
				TH	TU	PR	PAPER HRS.	TH (1)		PR (4)		OR (8)		TW (9)			
									Max	Min	Max	Min	Max	Min	Max	Min	
1	Applied Mathematics \$	AMS	17301	03	--	--	03	100	40	--	--	--	--	--	--		
2	Basic Electronics (Electrical)	BEE	17321	04	--	02	03	100	40	25#	10	--	--	25@	10	50	
3	Electrical & Electronic Measurement	EEM	17322	03	--	02	03	100	40	50#	20	--	--	25@	10		
4	Electrical Circuits and Networks	ECN	17323	04	01	02	03	100	40	50#	20	--	--	25@	10		
5	Electrical Power Generation	EPG	17324	03	--	--	03	100	40	--	--	--	--	--	--		
6	Computer Programming	CPR	17022	--	--	04	--	--	--	--	--	--	--	25@	10		
7	Electrical Workshop	EWO	17023	--	--	02	--	--	--	--	--	--	--	25@	10		
8	Professional Practices-I	PPO	17024	--	--	03	--	--	--	--	--	--	--	50@	20		
Total				17	01	15	--	500	--	125	--	--	--	175	--		50
Student Contact Hours Per Week: 33 Hrs. THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH. Total Marks : 850 @ - Internal Assessment, # External Assessment, No Theory Examination, \$ - Common to all branches Abbreviations: TH-Theory, TU- Tutorial, PR-Practical, OR-Oral, TW- Term Work, SW- Sessional Work ➤ 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). ➤ Progressive evaluation is to be done by subject teacher as per the prevailing curriculum implementation and assessment norms ➤ Code number for TH, PR, OR, TW are to be given as suffix 1, 4, 8, 9 respectively to the subject code.																	

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**

Semester : Third

Subject Title : Applied Mathematics

Subject Code : 17301

Teaching and Examination Scheme:

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

Applied mathematics is designed for its applications in engineering and technology. It includes the topics integration, differential equation, probability distribution. The connection between applied mathematics and its applications in real life can be understood and appreciated.

Derivatives are useful to find slope of the curve, maxima and minima of function, radius of curvature. Integral calculus helps in finding the area. In analog to digital converter and modulation system integration is important. Differential equation is used in finding curve. Probability is used in Metrology and quality control.

The fundamentals of this topic are directly useful in understanding engineering applications in various fields.

General Objectives:

Students will be able to:

1. Apply derivatives to find slope, maxima, minima and radius of curvature.
2. Apply integral calculus to solve different engineering problems.
3. Apply the concept of integration for finding area.
4. Apply differential equation for solving problems in different engineering fields.
5. Apply the knowledge of probability to solve the examples related to the production process.

Learning Structure:

Applications

Apply the principles of mathematics to solve examples in all branches of Engineering Diploma.

Procedure

Solving problems of tangent, normal. Finding maxima, minima and radius of curvature

Solving problems on methods of integration and its properties. Finding area.

Solving examples of differential equations of first order and first degree.

Solving different examples on binomial, poisson and normal distribution

Principle

Methods of finding slope, curvature, maxima and minima

Methods of finding integration, definite integration and its properties

Methods of differential equations of first order and first degree

Formulae for binomial, normal, and poisson distribution

Concept

Geometrical meaning of derivatives, increasing and decreasing functions

Integration of standard functions. Rules of integration, integration by parts, partial fractions

Order and degree of differential equation. Formation of differential equation

Probability of repeated trails of random experiments

Facts

First order and second order derivatives

Derivatives, notation of integration, definition of integration

Integration, definition of differential equation

Permutation , Combination , probability of an event

Theory:

Topic and Contents	Hours	Marks
Topic-1 Applications of Derivative Specific objectives : <ul style="list-style-type: none"> ➤ Find slope, curvature, maximum and minimum value of functions related to different engineering applications. <ul style="list-style-type: none"> • Examples for finding slope , equations of tangent and normal to the curve • Maxima and minima. • Radius of curvature. 	06	16
Topic-2 Integral Calculus		
2.1 Integration ----- 20 Specific objectives : <ul style="list-style-type: none"> ➤ Integrate function using different method. <ul style="list-style-type: none"> • Definition of integration as anti derivative, rules of integration. • Integration of standard functions • Methods of integration <ul style="list-style-type: none"> Integration by substitution. Integration by partial fractions. Integration by parts and generalized rule by parts. 	14	44
2.2 Definite Integrals ----- 16 Specific objectives : <ul style="list-style-type: none"> ➤ Solve problems on definite integrals using the properties. <ul style="list-style-type: none"> • Definite integral- Definition, examples. • Properties of definite integrals without proof and simple examples. 	08	
2.3 Application of Definite Integrals -----08 Specific objectives : <ul style="list-style-type: none"> ➤ Find area. <ul style="list-style-type: none"> • Area under a curve. • Area between two curves. 	04	
Topic 3 - Differential Equation.		
3.1 Differential equation Specific objectives : <ul style="list-style-type: none"> ➤ Solve the differential equation of first order and first degree ➤ Solve different engineering problems using differential equation <ul style="list-style-type: none"> • Differential equation- Definition, order and degree of a differential equation. Formation of differential equation containing single constant. • Solution of differential equation of first order and first degree for following types <ul style="list-style-type: none"> Variable separable form, Equation reducible to variable separable form. Linear differential equation. Homogeneous differential equation. Exact differential equation. 	10	20

Topic 4 - Probability		
4.1 Probability Specific objectives : ----- 08 ➤ Solve different engineering problems related to probability process. <ul style="list-style-type: none"> • Definition of random experiment, sample space, event, occurrence of event and types of event (impossible, mutually exclusive, exhaustive, equally likely) • Definition of probability, addition and multiplication theorems of probability. 	02	20
4.2 Probability Distribution ----- 12 <ul style="list-style-type: none"> • Binomial distribution • Poisson's Distribution • Normal distribution 	04	
Total	48	100

Learning Resources:**1) Books:**

Sr. No	Title	Authors	Publication
1	Mathematic for Polytechnic	S. P. Deshpande	Pune Vidyarthi Girha Prakashan' Pune
2	Calculus : Single Variable	Robert. T. Smith	Tata McGraw Hill
3	Higher Engineering mathematics	B. V Ramana	Tata McGraw Hill
4	Higher Engineering mathematics	H. K. Dass	S .Chand Publication
5	Higher Engineering Mathematics	B. S. Grewal	Khanna Publication, New Delhi
6	Applied Mathematics	P. N. Wartikar	Pune Vidyarthi Griha Prakashan, pune

2) Websites :

- i) www.khan.academy

Course Name : **Electrical Engineering Group**
Course Code : **EE/EP**
Semester : **Third**
Subject Title : **Basic Electronics (Electrical)**
Subject Code : **17321**

Teaching and Examination Scheme:

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

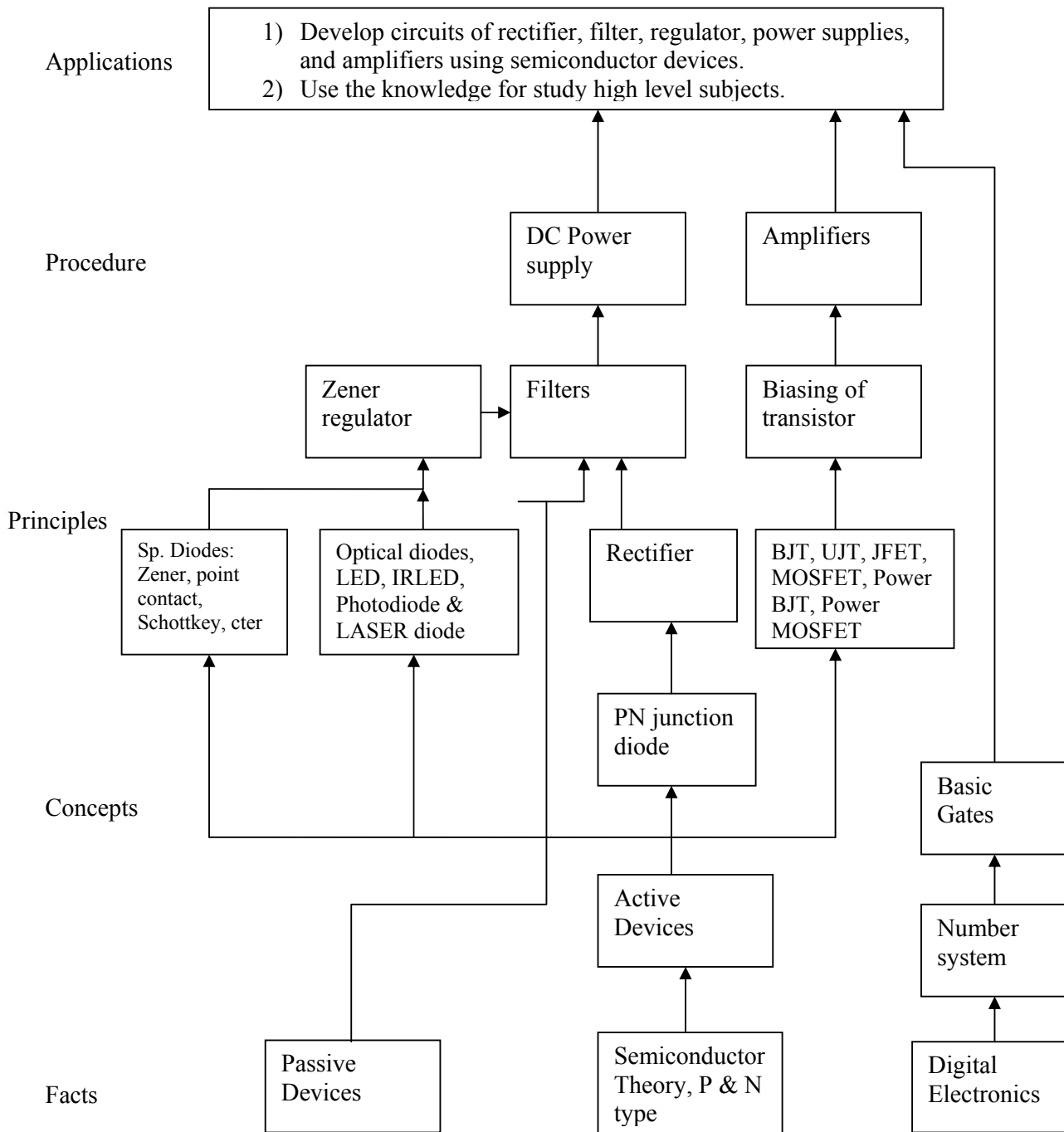
Electronics plays very important role in our day to day life. Basic electronics is the base for all engineering trades. It starts with the semiconductor material. Next the working principle of PN junction will help the students to understand the working of most of the semiconductor devices. Study of optical diodes gives basics for all optical devices such as scanner, Xerox machine, fax machine etc. Students should understand basics of power supply, since most of the electronic devices work on DC power supply. Study of MOSFET is essential since 95% of the semiconductor market is devices are controlled by MOSFETs. Introduction to digital electronics gives the students idea about working of microprocessor.

Objectives:

Students will be able to:

1. Define the scope of electronics.
2. State some applications of electronics in our day-to-day life.
3. State the latest trends in the field of electronics.
4. Draw the symbol, characteristics & applications of some important active devices.
5. Testing of active & passive components.
6. List the specifications of active & passive components.
7. Reading the data sheets of electronic components.

Learning Structure:



Theory:

Topic and Detailed Content	Hours	Marks
<p>Topic 1: Semiconductor Diode Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Select specific diode according to application. ➤ Select the diode with required specification. <p>Contents:</p> <p>1.1 Semiconductor Theory</p> <ul style="list-style-type: none"> • Review of semiconductor theory (No questions to be set in Theory Paper) • Intrinsic semiconductor, Extrinsic semiconductor, doping, dopant • Trivalent & pentavalent impurities, P- Type and N- Type semiconductor. <p>1.2 Semiconductor Diode</p> <ul style="list-style-type: none"> • PN Junction. • Junction theory: Barrier voltage, Depletion region, Junction capacitance, Forward and reverse biased junction • V- I characteristics of P-N junction diode. • Circuit diagram for characteristics(Forward & Reverse) <p>1.3 Specifications of diode</p> <ul style="list-style-type: none"> • Forward Voltage Drop, Reverse Saturation Current, Maximum Forward Current, Power Dissipation. • Ideal Diode Model. <p>1.4 Zener diode</p> <ul style="list-style-type: none"> • Construction & symbol • Circuit diagram for characteristics(Forward & Reverse) • Specification of zener diode: zener voltage(V_Z), Maximum power dissipation($P_{D(max)}$), Break over current(I_{ZK}), zener resistance. • Special purpose diodes: Schottkey diode, Point-contact diode, Varacter diode (Construction, symbol, Characteristics and applications). • Optical diodes: LED, IRLED, Photodiode and LASER diode (Symbol, operating principle and applications of each) 	08	12
<p>Topics 2: Rectifiers and Filters Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Select the specific rectifier & filter according to the requirement ➤ Lists various types of filter circuits with advantages & disadvantages. <p>Contents:</p> <p>2.1 Rectifiers</p> <ul style="list-style-type: none"> • Need of rectifier • Types of rectifier: Half wave rectifier, Full wave rectifier(Bridge and Centre tapped) • Working with waveform(IP /OP waveformsfor voltage and current, Average (DC) value of current and voltage (No derivation) • Ripple, ripple factor, ripple frequency, PIV of diode used, transformer utilization factor, efficiency of rectifier. • Comparison of three types of rectifiers (HWR. FWR (bridge & centre tapped). <p>2.2 Filters</p> <ul style="list-style-type: none"> • Need of filters • Types of filters: shunt capacitor, series inductor, LC filter, π filter (circuit diagram, operation, DC O/P voltage, ripple factor (formula), ripple 	06	08

<p>frequency, Dependence of ripple factor on load.</p> <ul style="list-style-type: none"> I/P and O/P waveforms, Limitations and Advantages of all types of filters. 		
<p>Topic : 3 Bipolar Junction Transistor</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> Identify the transistor configuration according to application. Lists types of biasing & coupling. Select the specific amplifier type according to application. <p>Contents:</p> <p>3.1 Transistor 16 Marks</p> <ul style="list-style-type: none"> Transistor definition Types: NPN, PNP junction transistors (Symbols, operating principle (NPN only) Transistor configuration: Common emitter (CE), common collector (CC), common base (CB). Characteristics in CE configuration (Circuit diagram, I/P and O/P characteristics, different points of characteristics (Cut-off, Active and Saturation), input resistance, output resistance, current gain (α and β)) <p>Transistor Biasing:</p> <ul style="list-style-type: none"> Need of biasing, DC load line, Operating point Types of biasing circuits: Fixed bias circuit, Base biased with emitter feedback, Base biased with collector feedback, Voltage divider bias, Emitter biased <p>3.2 Transistor as an amplifier (CE configuration only) 12 Marks</p> <ul style="list-style-type: none"> Graphical representation, Current gain, Voltage gain, Power gain (No derivation), Input output resistance, Phase shift between input and output. AC Load line Single Stage CE amplifier: Circuit diagram, Function of each component, Frequency response and bandwidth. <p>Need of Cascaded amplifier</p> <ul style="list-style-type: none"> Types of coupling : RC couple, Transformer couple, Direct couple (Circuit diagram and function of each component) Application of each amplifier Transistor as a switch – (Circuit diagram, operation, application) <p>3.3 Power amplifier 08 Marks</p> <ul style="list-style-type: none"> Introduction, classification : class A, class B, class AB, class C (Efficiency of each). Single stage class A power amplifier (Circuit operation, IP/OP waveforms, graphical analysis and efficiency) Transformer couple resistive load single stage power amplifier. Class A push pull amplifier. Class B push pull amplifier. Class AB push pull amplifier. Concept of cross over distortion. Need of heat sink. <p>UJT</p> <ul style="list-style-type: none"> Symbol, characteristics and working principle of UJT. 	24	36
<p>Topic : 4 Field Effect Transistor (Unipolar Transistor)</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> Differentiate between BJT & FET. Identify the type of unipolar transistor to suit the application. <p>Contents:</p>	08	12

<p>4.1 FET</p> <ul style="list-style-type: none"> • Types, Symbols and working principle • Characteristics of FET, Circuit diagram for drain characteristics, Operating regions of characteristics. • Drain resistance, Mutual capacitance, amplification factor and their relation, Pinch off voltage of FET • Comparison of BJT and FET.(Types of carriers, switching speed, Thermal stability, space in case of IC fabrication, control parameter, input impedance, offset voltage, power gain at audio frequencies) <p>4.2 MOSFET</p> <ul style="list-style-type: none"> • Types, symbol, working principle • Application of FET and MOSFET. 		
<p>Topic : 5 Regulated Power Supply</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Identify the regulator IC with specification. ➤ Select the regulator IC to meet the application. <p>Contents:</p> <ul style="list-style-type: none"> • Definition of regulator, Need of regulator, Voltage regulation factor, • Concept of load regulation and line regulation • Zener diode as a voltage regulator. • Basic block diagram of DC power supply • Transistorized Series voltage regulator, Transistorized Shunt voltage regulator, (Circuit diagram and operation) <p>Regulator IC's</p> <ul style="list-style-type: none"> • IC's 78XX, 79XX (Functional Pin diagram) • IC 723 as fixed, variable and Dual regulator. 	04	12
<p>Topic: 6 Oscillators</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ State the concept of feedback & Barkhausen criteria. ➤ Select the specific oscillator circuit according to application. <p>Contents:</p> <ul style="list-style-type: none"> • Definition and block diagram of oscillator. • Concept of feedback, Types of feedback, Positive feedback, Negative feedback, Barkhausen's criterion <p>Classification of oscillators</p> <ul style="list-style-type: none"> • LC oscillators • Hartley oscillators • Colpitt's oscillators • RC oscillator • Crystal Oscillator <p>(Circuit Diagram & Working)</p>	08	12
<p>Topic : 7 Digital Electronics</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Identify various gates with truth table. ➤ Describe the basics of Micro Processor. <p>Contents:</p> <ul style="list-style-type: none"> • Digital circuit, Digital signal, Use of digital circuit and signal. • Number System: Introduction to binary, octal decimal and hexadecimal number system <p>Logic Gates</p> <ul style="list-style-type: none"> • Logic symbol, Logical expression and truth table of AND, OR, NOT, 	06	08

EX-OR, & EX-NOR gates. <ul style="list-style-type: none"> • Universal gates : NAND gate and NOR gate • Application of Digital Electronics • Basic block diagram of Microprocessor. 		
Total	64	100

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

1. Identification & selection of components.
2. Interpretation of circuits.
3. Understand working of rectifier, filter, amplifier & oscillator circuits.

Motor Skills:

1. Ability to draw the circuits
2. Ability to measure various parameters.
3. Ability to test the components using multimeter.
4. Ability to read data sheets of components.
5. Follow standard test procedures.

List of Practicals:

1. Forward & Reverse characteristics of diode.
2. Forward & Reverse characteristics of zener diode.
3. Study of Rectifiers (Half wave & Full wave) & Filters(Capacitor & Inductor Filter)
4. Input & output characteristics of transistor in CE mode.
5. Characteristics of FET.
6. Characteristics of UJT.
7. Load & Line regulation characteristics of Zener Diode Regulator.
8. Frequency response of single stage RC coupled amplifier.
9. Determine waveforms of LC & RC oscillator circuits.
10. Verifying truth tables of logic gates using ICs.

Learning Resources:**Books:**

Sr. No.	Author	Title	Publisher
1	N. N. Bhargava, D.C. Kulashreshtha, S.C. Gupta – TTTI Chandigharh	Basic Electronics & Linear Circuits	Tata McGraw Hill
2	Albert Malvino David J Bates	Electronic Principles	Tata McGraw Hill
3	Debashis De	Basic Electronics	Pearson
4	B Basavaraj H N Shivashankar	Basic Electronics	Vikas
5	Vijar Baru Rajendra Kaduskar Sunil T. Gaikwad	Basic Electronics Engineering	Dreamtech
6	J. P. Bandyopadhyay	Basic Electronics Engineering	Vikas
7	David A Bell	Electronic Devices & circuits	Oxford

Course Name : Electrical Engineering Group

Course Code : EE /EP

Semester : Third

Subject Title : Electrical & Electronic Measurement

Subject Code : 17322

Teaching and Examination Scheme:

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

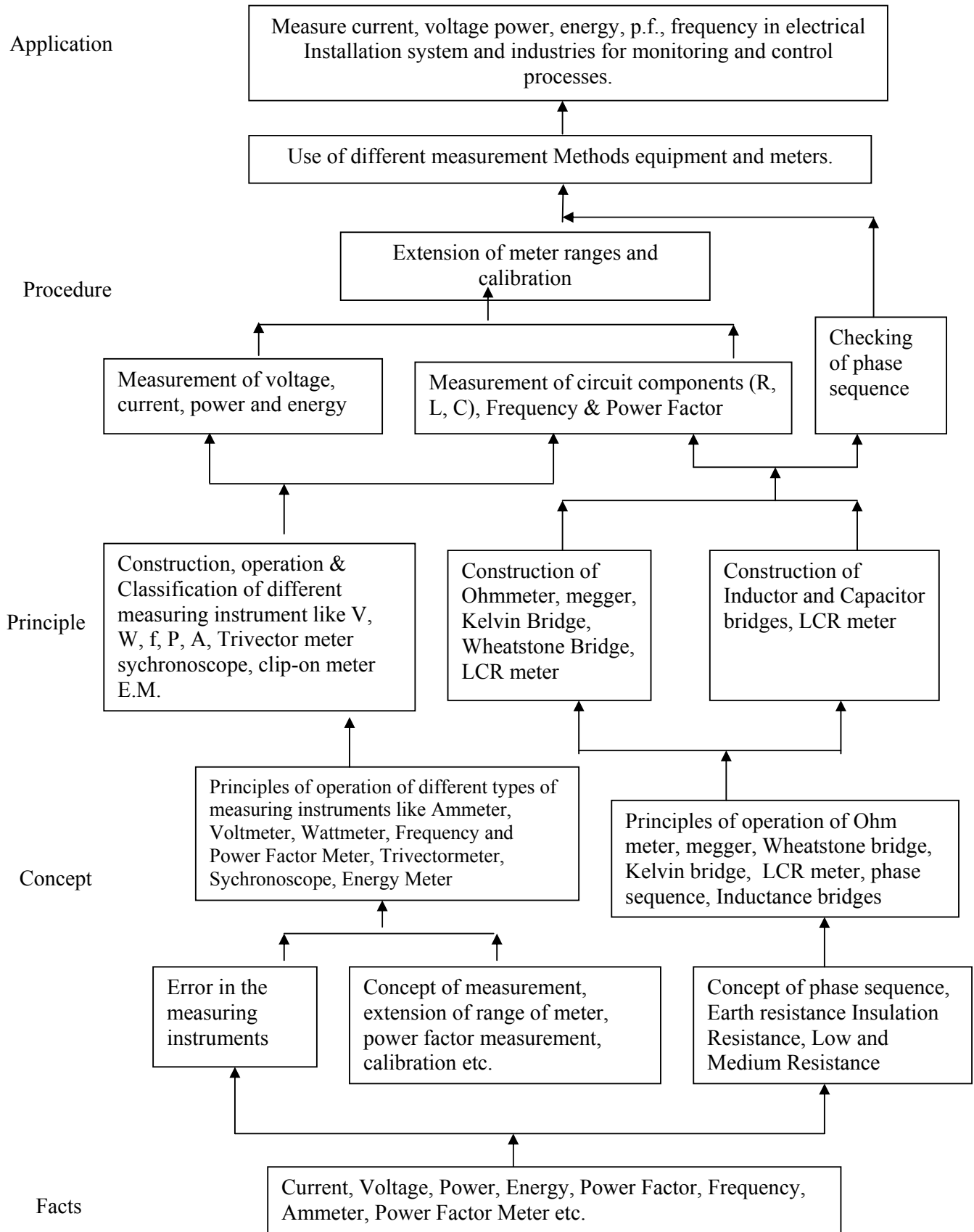
This is the core technology subject. The electrical diploma holder has to work in industry as technical person in middle level management. He has to work as production, maintenance, testing engineer in various industries like power generation, transmission, distribution, traction etc. and has to deal with different electrical machines and equipments. While performing above task he has to measure different electrical parameters and quantities therefore he must require the skills for these measurements and broad idea of different meters and equipments.

General Objectives:

The Students will be able to: -

1. To know the vocabulary of electrical measurement system
2. Identify various measuring instruments
3. To read different meters properly
4. Select proper meter / equipment for particular measurement
5. calibrate various types of meters/ instruments as per ISS

Learning Structure:



Theory:

Topics and contents	Hours	Marks
<p>Topic 1: Fundamentals of Measurements.</p> <ul style="list-style-type: none"> ➤ Understand different terms in measurement system. ➤ Explain development of different torques in measurement system. <p>Contents:</p> <ul style="list-style-type: none"> • Significance and purpose of electrical measurement systems. • Various electrical effects employed in measuring instruments. • Desirable characteristics of measuring instruments: accuracy, sensitivity, selectivity, reproducibility, precision, errors, drift • Common errors in analog measuring instruments. • Classification of measuring instruments. • Different torques in analog instruments: Deflecting, controlling and damping torque. <ul style="list-style-type: none"> ➤ Methods of developing these torques 	07	14
<p>Topic 2: Measurement of Voltage and Current.</p> <ul style="list-style-type: none"> ➤ Identify different parts of indicating instruments. ➤ Select proper meter for particular application. <p>Contents:</p> <ul style="list-style-type: none"> • Constructional features and working principles used in PMMC and MI instruments. • Comparison between PMMC and MI instruments. • Basic arrangements of using above instruments for measurement of voltage and current in single phase circuits. • Extension of Range of ammeters and voltmeters. <ul style="list-style-type: none"> ➤ D. C. Ammeters: Using Shunts: calculations of shunt resistance and simple numerical ➤ D. C. Voltmeters: Using Multipliers: calculations of multiplier resistance and simple numericals ➤ A. C. Ammeters: Using Current transformers: Construction and principle of operation, precautions ➤ A. C. Voltmeters :Using Potential transformers Construction and principle of operation, precautions • Calibration of Ammeter and Voltmeter: Concept of Standard meter, Calibration Procedure 	10	24
<p>Topic 3: Concept of Power and Power Measuring Instruments:</p> <ul style="list-style-type: none"> ➤ Know Significance of power factor in power measurement. ➤ Use appropriate method for power measurements using wattmeter <p>Contents:</p> <ul style="list-style-type: none"> • Concept of impedance triangle in A.C. circuit-R-L,R-C and R-L-C series circuit. • Concept of Power factor and its significance. • Active, Reactive and apparent power, their equations, relations and units. • Power Triangle : concept of lagging and leading power factor • Constructional features of Dynamometer type instruments and its use as a wattmeter for single phase circuits. • Multiplying factor of wattmeter. • Different errors in wattmeter and their compensations. 	06	12
Topic 4: Measurement of three phase a. c. Power	06	12

<ul style="list-style-type: none"> ➤ Use appropriate methods for measurement of 3-ph Power ➤ Verify power measured analytically and by using phasor diagrams <p>Contents:</p> <ul style="list-style-type: none"> • One wattmeter method: Measurement of active and reactive power. Advantages and Limitations • Two wattmeter method: Measurement of active and reactive power. Advantages and Limitations • Effect of Power factor on wattmeter reading in two wattmeter method. • Extension of ranges <p>(Simple numericals on above)</p>		
<p>Topic 5: Measurement of Electrical Energy</p> <ul style="list-style-type: none"> ➤ Make connections of single phase energy meter. ➤ Calibrate 1-ph energy meter ➤ Choose energy meter of appropriate rating <p>Contents:</p> <ul style="list-style-type: none"> • Concept of electrical energy • Constructional features and working principle of single phase and three phase induction type energy meter. • Different types of errors and their compensations. • Calibration of single phase induction type energy meter by direct loading. • Digital Energy meter: Working principle, advantages over analog meter 	05	10
<p>Topic 5: Measurement of Circuit Parameters.</p> <ul style="list-style-type: none"> ➤ Measure different resistances by selecting correct method of measurement. ➤ Use LCR meter for measurement of L, C and R. ➤ Classify the resistance <p>Contents:</p> <ul style="list-style-type: none"> • Classification of resistance.-Low, Medium and High. • Methods of measurement of low and medium resistance by simple V-I method and by using digital multimeter. • Constructional features working principles and applications of megger and earth tester. • Comparison and applications of –analog and digital multimeter. • Working of L-C-R meter for measurement of inductance and capacitance 	07	14
<p>Topic 6: Constructional features, working principles and applications of Other meters.</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Select a meter for measuring P.F, Frequency and Phase sequence ➤ Use Clip On Meter efficiently ➤ Use of C.R.O. and function generator <p>Contents:</p> <ul style="list-style-type: none"> • Single phase and three phase power factor meter.(Only dynamometer type) • Frequency meter- Reed type, Ferro-dynamic type, Weston type • Phase sequence indicator(Rotating type only) • Clip on ammeter. 	07	14

<ul style="list-style-type: none"> • Synchroscope- Weston type only • C.R.O.- Block diagram, function of each block, front panel diagram, application, observation of waveform, Digital storage Oscilloscope (Block Diagram only) • Function generator- Block diagram, function of each block, front panel diagram, application of function generator in measurement. Block diagram of Sine wave generator. 		
Total	48	100

Practicals:**Skills to be developed:****Intellectual Skills:**

1. Apply different Measuring skill.
2. Select proper equipment.

Motor Skills:

1. Measurement of electrical quantities
2. Connections skill.
3. Handling of meters

List of Practical's:

1. To know measuring instruments on the basis of symbols on dial like, type, class position and scale.
2. To identify the components of PMMC and MI instruments, using working models.
3. To extend range of voltmeter and ammeter by using PT and CT.
4. To measure power in a single phase circuit by electro-dynamic watt-meter.
5. To measure active and reactive power of three phase balanced load using single wattmeter.
6. To measure active power of three-phase balanced load using two watt-meters.
7. To calibrate single phase energy meter by direct loading.
8. To use digital multi-meter and clamp on meter for measurement of AC/DC current, AC/DC voltage and resistance.
9. To use megger for various measurements.
10. To measure supply frequency and power factor in single-phase circuit.

Learning Resources:**1. Books:**

Sr. No.	Name of the Author	Title of the Book	Name of the Publisher
1.	A.K.Sawhney	Electrical & Electronics Measurements & Instrumentation	Dhanpatrai & sons
2.	N.V. Suryanarayna	Electrical Measurements & Measuring Instruments	S, Chand & co.
3.	C.T. Baldwin	Fundamentals of Electrical Measurements	--
4.	R.K. Rajput	Electrical Measurements & Measuring Instruments	S. Chand & co.

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

ISO: 1248, 1765, 6236, 9223, 8945, 2442

3. Websiteswww.test-meter.co.uk/en.wikipedia.org/wiki/Emerson_Electric_Companywww.electrical-installation.orgwww.idemi.org/www.davis.com/www.sensors-research.com/links.htm

Course Name : Electrical Engineering Group**Course Code : EE / EP****Semester : Third****Subject Title : Electrical Circuits and Networks****Subject Code : 17323****Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
04	01	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:

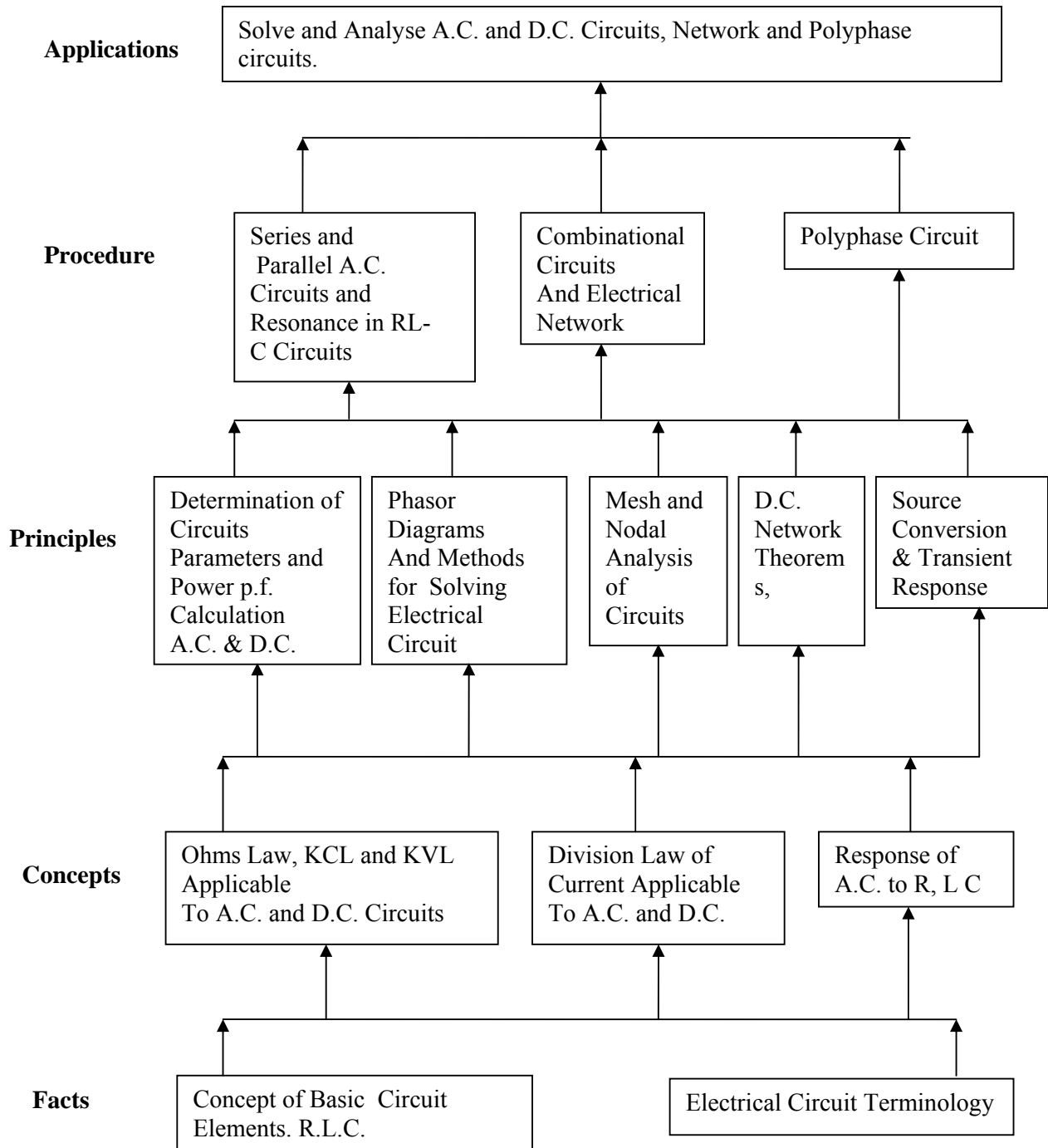
In order to understand electrical machines, power system, controls and measurements, knowledge of electrical circuit and network is very important. Study of electrical network lays the foundation to understand subjects of application level.

The study of this subject will facilitate student to understand concept and principles of circuits and circuit analysis. It helps also students in fault finding and troubleshooting.

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

- 1) Understand basic elements of the circuit, terminology used and various quantities involved.
- 2) Use network theorems for solution of DC network.
- 3) Realize the importance of series ac circuit and parallel ac circuit.
- 4) Know the relations between phase and line values of various quantities in three phase ac circuit.
- 5) Calculate various parameters of a.c. circuits.

Learning Structure:



Theory:

Note: All Network Theorems should be taught for DC supply & Superposition Theorem should be taught for both AC & DC supply.

Topic and Contents	Hours	Marks
<p>Topic 1. Review Of Basic Concepts Of Electric Circuit:</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Understand generation of a.c. supply and concept of phasor ➤ Define various terms related with a.c. supply. ➤ Draw sinusoidal a.c. waveform and phasor diagram. ➤ Calculate r.m.s., average ,instantaneous value and amplitude of a.c. supply. <p>Contents:</p> <p>1.1 Basic Electric Circuit Elements R, L, C.</p> <p>1.2 Simple one loop a.c. generator to produce sinusoidal a.c e.m.f.</p> <p>1.3 Sinusoidal a.c. waveform and definitions of various terms such as frequency, time-period, cycle, amplitude, average value, r,m,s value, crest factor ,form factor .(Simple numericals)</p> <p>1.4 Concept of phasor.</p> <p>1.5 Response of pure R, L, and C to sinusoidal a.c. supplies.</p> <p>1.6 Phasor representation of alternating quantity and concept of phase angle.(Simple numericals)</p>	06	12
<p>Topic 2. Single Phase A.C. Series Circuits :</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Calculate current, reactance and impedance of series a.c. circuit. ➤ Draw phasor diagram of series a.c. circuit. ➤ Calculate various powers, and p.f. of series a.c. circuit. <p>Contents:</p> <p>2.1 Series a.c. circuits R-L, R-C and R-L-C circuits. Impedance, reactance, phasor diagram, impedance triangle, power factor, active(real) power, apparent power , reactive power, power triangle (Derivations and Numericals).</p> <p>2.2 Series Resonance, quality factor (Derivations and Numericals).</p> <p>2.3 Solution for AC Series circuit by using complex algebra.</p>	12	20

<p>Topic 3. Single Phase A.C. Parallel Circuits: Specific Objectives: The students will be able to :</p> <ul style="list-style-type: none"> ➤ Calculate current, reactance and impedance of parallel a.c.circuit. ➤ Draw phasor diagram of parallel a.c.circuit. ➤ Calculate various powers, and p.f. of parallel a.c. circuit. <p>Contents: 3.1 Parallel AC circuits</p> <ul style="list-style-type: none"> ➤ Resistance in parallel with pure inductance. ➤ Resistance in parallel with capacitance. ➤ Series combination of resistance and inductance in parallel with capacitance <p>Concept of Admittance, Conductance & Susceptance, Solution by admittance method and impedance method.(Numericals only) 3.2 Parallel resonance, quality factor. 3.3 Comparison of series and parallel circuits</p>	08	12
<p>Topic 4. Polyphase A.C. Circuits : Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Calculate current, reactance and impedance of each phase of polyphase a.c. circuit. ➤ Calculate line quantities. ➤ Draw phasor diagram of polyphase a.c. circuit. ➤ Calculate various powers, and p.f. of polyphase a.c. circuit. <p>Contents 4.1 Advantages of polyphase circuits over single phase circuits 4.2 Generation of three phase e. m. f. 4.3 Phase sequence, polarity marking. 4.4 Types of three-phase connections. 4.5 Concept of unbalanced load and balanced load. 4.6 Line, phase quantities and power in three phase system with balanced star and Delta connected load & their interrelationship.(Derivations and numerical)</p>	10	18
<p>Topic 5 : Principles of Circuit Analysis (ONLY DC Circuits): Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Realize importance of source transformations and λ / Δ or Δ / λ transformations. ➤ Solve examples of simple d.c. circuits by mesh or node analysis. <p>Contents: 5.1 Source transformation (No Numericals). 5.2 Star/delta & Delta/star transformations (No Numericals). 5.3 Mesh analysis (Numericals with two equations). 5.4 Node analysis (Numericals with two equations).</p>	08	12
<p>Topic 6 : Network Theorems: Note: Simple Numericals on DC Circuits only with maximum two simultaneous equations Specific Objectives:</p>	16	20

<ul style="list-style-type: none"> ➤ Calculate the current in a given network by applying proper theorem. ➤ Realize importance of maximum power transfer theorem. <p>Contents:</p> <p>6.1 Superposition Theorem for both AC Voltage & DC Source.</p> <p>6.2 Thevenin's Theorem</p> <p>6.3 Norton's Theorem</p> <p>6.4 Maximum Power Transfer Theorem</p>		
<p>Topic 7 : Initial And Final Conditions Of Elements In A Network :</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Understand importance of initial and final conditions. ➤ Use such initial and final conditions in switching circuits and electronic circuits. <p>Contents</p> <p>Concept of initial and final conditions in switching circuits.</p> <p>Meaning of $t = 0^-$, $t = 0^+$ and $t = \infty$.</p> <p>R,L, and C at initial conditions</p> <p>R,L, and C at final conditions</p>	04	06
Total	64	100

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

1. Distinguish between series and parallel a.c. circuits
2. Interpret electrical circuit diagram.
3. Identify safety equipments required.
4. Decide the procedure for setting experiments.

Motor Skills:

1. Connect as per circuit diagram along with various required proper range meters.
2. Measure electrical current, voltage drop, power etc.
3. Select proper supply for a given experiment.(a.c. or d.c.)
4. Use safety devices while working.

List of Practicals:**All Experiments Are Compulsory.**

1. To determine impedance, phase angle and plot phasor diagram of R-L a.c. series circuit. To calculate also active, reactive and apparent power consumed in R-L series circuit
2. To determine impedance, phase angle and plot phasor diagram of R-C a.c. series circuit. To calculate also active, reactive and apparent power consumed in R-C series circuit.
3. To determine impedance, phase angle and plot phasor diagram of R-L-C a.c. series circuit. To calculate also active, reactive and apparent power consumed in R-L-C series circuit.
4. To obtain resonance in R-L-C a.c. series circuit either
 - By varying L or C or
 - By using variable frequency supply.
5. a. To measure current of each branch of R-C parallel a. c. circuit

- b. To calculate p. f., active, reactive and apparent power taken by same R-C parallel a. c. circuit (Resistor in parallel with capacitor)
6. a. To measure current of each branch of RL-C parallel a. c. circuit
b. To calculate also p.f., active, reactive and apparent power taken by the a. c. circuit. (Series connection of resistor and inductor in parallel with capacitor)
7. To verify line and phase values for balanced three phase load and to calculate all types of power.
- Star connected
 - Delta connected
8. To verify superposition theorem.
9. To verify Thevenin's and Norton's theorem.
10. To verify maximum power transfer theorem.

Learning Resources:**1. Books:**

Sr. No	Author	Title	Edition	Publisher
1	B. L. Theraja A. K. Theraja	A Text Book of Electrical Technology Vol-I (Basic Electrical Engg.)	Multicolour Edition 2005 And Subsequent Reprint	S. Chand & Co. Ramnagar New Delhi
2	V. N. Mittle	Basic Electrical Engg.	Any Edition After 2005	Tata McGraw-Hill
3	Edward Hughes	Electrical Technology	Second And Any Subsequent Edition	Pearson Education, New Delhi
4	A. Sudhakar	Circuit and network	Fourth Edition	Tata McGraw Hill
5	R.S. Ananda Murthy	Basic Electrical Engineering	Second Edition	Pearson
6	P.Ramesh Babu	Electric Circuits	First Edition	Scitech
7	Richard C. Dorf and James A. Svoboda	Electric Circuits	Sixth Edition	WILLEY student WILLEY INDIA Edition
8	Sunil T. Gaikwad	Basic Electrical Engineering	First Edition	Dreamtech Press 19-A Daryaganj, N.Delhi
9	David A. Bell	Electric Circuits	Seventh Edition	Oxford University Press
10	K Murugesh Kumar	Elements of Electrical Engg.	First Edition	Vikas Publishing House Pvt Ltd. Noida

2. Websites:

www.wikipedia.com , www.youtube.com , www.norsa.com, www.dreamtechpress.com

Course Name : Electrical Engineering Group**Course Code : EE/EP****Semester : Third****Subject Title : Electrical Power Generation****Subject Code : 17324****Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	--	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 energy plays vital role in the development and industrialization of the country. The development of the country is best judged by its power generation capacity and usage. It is a driving force in the development hence it is necessary to understand the basic concepts and principles of energy generation.

The subject content on factors governing selection and location of site, block diagrams or typical layout of various power plants and economics of power generation will be useful in effective and efficient running of power plants.

This subject is the building block for further studies in transmission, distribution, utilization and protection of power system for smooth and stable operation.

General Objectives:

The students will be able to:

1. Classify the different sources of electric power generation.
2. Decide the various factors governing selection of site for power plant and list their merits.
3. Describe principle and operation of power generation.
4. Identify and describe the function of each component of power plant.
5. Select the power generation technique based on economy.
6. Compare between various sources of power generation.

Learning Structure:

Applications

Diploma holders can operate control & maintain various equipment in power stations. Also they can select proper method of power generation in given situation by comparing generation methods on different parameters.

Procedure

Operation & Control of Thermal Power Station, Hydro Power Station, Nuclear Power Station and Diesel Power Station Equipment

Operation of Wind Power Station and Solar Power generation systems.

Steps in Economics In Power-Generation

Principles

Methods of generating power from Conventional Energy Sources.

Methods of generating power from Renewable Energy Sources.

Factors Related to Power plants economics

Concepts

Electric Power Generation from Thermal, Hydro, Nuclear sources and Renewable energy sources

Different types of Loads such as Domestic, Commercial & Industrial Loads

Facts

Power plant, generators, sources of energy

Theory:

Topics and Contents	Hours	Marks
<p>Topic 1: Basics of Power Generation</p> <p>Specific objectives:</p> <ul style="list-style-type: none"> • State the importance of electrical energy in the growth of a country. • List the various energy sources. <p>Contents:</p> <ul style="list-style-type: none"> • Importance of electrical power in day today life. • Various sources of energy- conventional and renewable. • Types of fuels: solid, liquid and gaseous, their calorific values, advantages and disadvantages of these fuels. • Overview of electrical power Generation in India and future perspectives. 	02	06
<p>Topic 2 : Thermal Power Station</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ List various Thermal Power Stations in India. ➤ State the function of various elements of a Thermal Power Plant. <p>Contents:</p> <p>2.1 List of Thermal Power Station in Maharashtra state with their capacity.</p> <p>2.2 Factors governing selection of site for Thermal station.</p> <p>2.3 Schematic block diagram of Coal Fired Power Station.</p> <p>2.4 Constituents of steam power plant and Their function.</p> <ul style="list-style-type: none"> • Coal handling unit (Various stages in coal handling unit). • Boiler (Fire tube and water tube boilers). • Super-heater and re-heater • Steam prime movers. • Condensers • Spray ponds and cooling towers. • Turbo alternator (salient features). <p>2.5 Flue gas flow diagram of thermal Power plant with function of each part</p> <ul style="list-style-type: none"> • Draught Systems: Natural draught, Mechanical draught, Forced , induced and balanced draught: definition and working only • Economizer • Feed water heater • Ash precipitators. <p>2.6 Ash Disposal and Dust Collection.</p> <ul style="list-style-type: none"> ○ Merits and demerits of Steam Power Plant 	09	20
<p>Topic 3 : Hydro Electric Power Plants</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ List various Hydro Power plants ➤ Describe the process of Hydrology. ➤ Classify Hydro Electric plants on various parameters. <p>Contents:</p> <p>3.1 List of Hydro Electric Power Stations in Maharashtra state with their capacity.</p> <p>3.2 Factors governing selection of site for Hydro Electric power plant.</p> <p>3.3 Definition of the terms and their significance in capacity of power plant: Hydrology, surface Runoff, Evaporation and precipitation</p> <p>3.4 Schematic arrangement of Hydro Electric Power Plant and function of Elements listed below:</p> <ul style="list-style-type: none"> • Storage Reservoir, Dam, Fore bay, Spillway, Intake, Surge tank, Penstock, Trash rack, Tail Race, Prime movers or water turbines, power house 	08	16

<p>3.6 Classification of Hydro Electric power plants</p> <ul style="list-style-type: none"> • According to water flow regulation • According to load. • According to head. • Pumped storage power plants. <p>3.7 Advantages and disadvantages of Hydro Electric Power Plant.</p> <p>3.8 Salient features of Hydro generator</p>		
<p>Topic 4 : Nuclear Power Station</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ List various Nuclear Power Stations in India ➤ Identify elements of typical Nuclear Power Plant. <p>Contents:</p> <p>4.1 List of nuclear power stations in Maharashtra state and the Country with their capacities.</p> <p>4.2 Factors governing Selection of site for the nuclear power plant</p> <p>4.3 A brief review of atomic physics</p> <ul style="list-style-type: none"> • Radioactive isotopes, mass energy equivalence, binding energy and mass defect, nuclear chain reaction, multiplication factor, critical size. <p>4.4 Nuclear fuels: Uranium, thorium, plutonium</p> <p>4.5 Main parts of reactors and their Function</p> <ul style="list-style-type: none"> ➤ Fuel, reactor core, moderator, shielding, control rods, reflectors, coolant, reactor vessel. <p>4.6 Classification of nuclear reactors: operation and constructional features</p> <ul style="list-style-type: none"> ➤ Advanced Gas Cooled Reactor (AGC) ➤ Boiling Water Reactor (BWR) ➤ Pressurized water reactor (PWR) ➤ Fast Breeder Reactor (FBR) <p>4.7 Control of Nuclear Reactor</p> <ul style="list-style-type: none"> ➤ By using control rods ➤ Control through flow of coolant. <p>4.8 Disposal of Nuclear waste and Nuclear Shielding.</p> <p>4.9 Schematic arrangement of typical Nuclear Power Plant.</p> <p>4.10 Advantages and disadvantages of Nuclear Power Station.</p>	10	20
<p>Topic 5 : Diesel Electric Power Plant</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> • Identify the elements of medium size Diesel Power Plant. • Use of diesel power plant as Captive Power • Selection of Diesel generating set as uninterrupted power supply or standby unit <p>Contents:</p> <p>5.1 Elements of diesel Electric Power Plant With their functions. Diesel engine, Fuel system, Air Intake System, Exhaust system, Engine Starting system.</p> <p>5.2 Layout of a medium size Diesel Electric Power Plant</p> <p>5.3 Different types of engine and their working.</p> <p>5.4 Applications of diesel power plants.</p> <p>5.5 Advantages and disadvantages of Diesel Electric Power Plant.</p> <p>5.6 Captive Power Generation</p> <ul style="list-style-type: none"> • Advantages and disadvantages • Types of Captive Power Plant 	05	10

<p>Topic 6 : Economics Of Power Generation & Interconnected Power Systems</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> • State the significance of different load curves in power generation. • Identify the factors affecting cost of generation. • Decide rating and units of generators to meet the given load • State factors considered for selection of plant. • State merits of interconnection of Power systems. <p>Contents:</p> <p>6.1 Terms commonly used in system operation: connected load, firm power, cold reserve, hot reserve, spinning reserve.</p> <p>6.2 Curves used in system operation such as Load-curve, load duration curve, integrated duration curve. (Simple numerical based on plotting above curves.)</p> <p>6.3 Factors affecting the cost of Generation: Average demand, Maximum demand, demand factor, plant capacity factor, plant use factor, diversity factor, load factor and plant load factor (Simple numerical based on above)</p> <p>6.4 Choice of Size & number of Generator Units, (Simple numerical), difficulties involved in it.</p> <p>6.5 Combined operation of power stations.</p> <p>6.6 Comparison of various types of power stations</p> <p>6.7 Advantages of Interconnection.</p> <p>6.8 Base load & peak loads, load allocation among various types of power Stations.</p> <p>6.9 Inter connection of power stations at state and national level</p>	06	12
<p>Topics 7: Renewable Energy Sources</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Understand the necessity of renewable energy sources. ➤ Understand different methods of solar energy conversion systems. ➤ Select different types of solar energy collectors. ➤ Decide the rating of PV cell. ➤ List limitations of Solar Power Generation. ➤ Understand different methods of wind energy conversion systems. ➤ List limitations of wind Power Generation. <p>Contents:</p> <p>7.1 Importance of renewable energy sources.</p> <p>7.2 Types of renewable energy sources such as solar, wind, biomass, geothermal, ocean energy, hydrogen energy etc.</p> <p>7.3 Solar Radiation</p> <ul style="list-style-type: none"> • Solar radiation at the earth's surface: Spectral Distribution of Extra Terrestrial Solar Radiation • Schematic representation of Distribution of Solar energy as direct, diffused, total radiation. • Solar constant: definition and formula (No numerical) <p>7.4 Solar Collectors</p> <ul style="list-style-type: none"> • Classification of Solar collectors • Construction, working and applications of : Flat plate collectors and Concentrating type collectors, comparison between them. • Schematic diagram of solar thermal power plant, working, advantages and disadvantages over PV systems. <p>7.5 Solar PV System</p>	08	16

<ul style="list-style-type: none"> • Principle of Solar cell and its rating. • Series parallel connection of solar cell and its necessity. • Construction of Solar PV array, module, panel. • Types of solar cells and its efficiency. <p>7.6 Solar PV Applications</p> <ul style="list-style-type: none"> • Functional block diagram of Photovoltaic Power Generating System. • Advantages and disadvantages. <p>7.7 Wind Energy</p> <ul style="list-style-type: none"> • Meaning of the terms: Power in the wind, Maximum power, Coefficient, forces on blades and thrust on turbines. • Site selection consideration. • Block diagram showing basic Wind energy conversion system and Function of each block. • Types of Wind turbines horizontal and vertical axis wind schematic representation different parts and their functions. • Advantages and limitations of wind energy. 		
Total	48	100

Learning Resources:**Books:**

Sr. No.	Author	Title	Publisher
1	J. B. Gupta	A course in Electrical Power	S. K. Kataria & Sons
2	B. R. Gupta	Generation of Electrical Energy	Eurasia Publishing House Pvt. Ltd
3	Soni, Gupta, Bhatanagar	A course in Electrical Power	Dhanapatrai and Sons
4	S. N. Singh	Electric Power Generation, transmission and distribution	PHI Learning
5	M. V. Deshpande	Elements of Electrical Power Station Design	PHI Learning
6	G. D. Rai	Non-Conventional Energy Sources	Khanna Publications
7	S. P. Sukhatme	Solar Energy	Tata McGraw Hill

Websites:

1. www.nptel.iitm.ac.in
2. www.solardyne.com
3. www.otherpower.com
4. www.solarenergy.com
5. www.windpower.org
6. www.alternativesourcesofenergy.net
7. www.mnre.gov.in
8. www.howstuffworks.com
9. www.mahaurja.org/com

Course Name : Electrical Engineering Group**Course Code : EE / EP****Semester : Third****Subject Title : Computer Programming****Subject Code : 17022****Teaching and Examination Scheme**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
--	--	04	--	--	--	--	25@	25

Rationale:

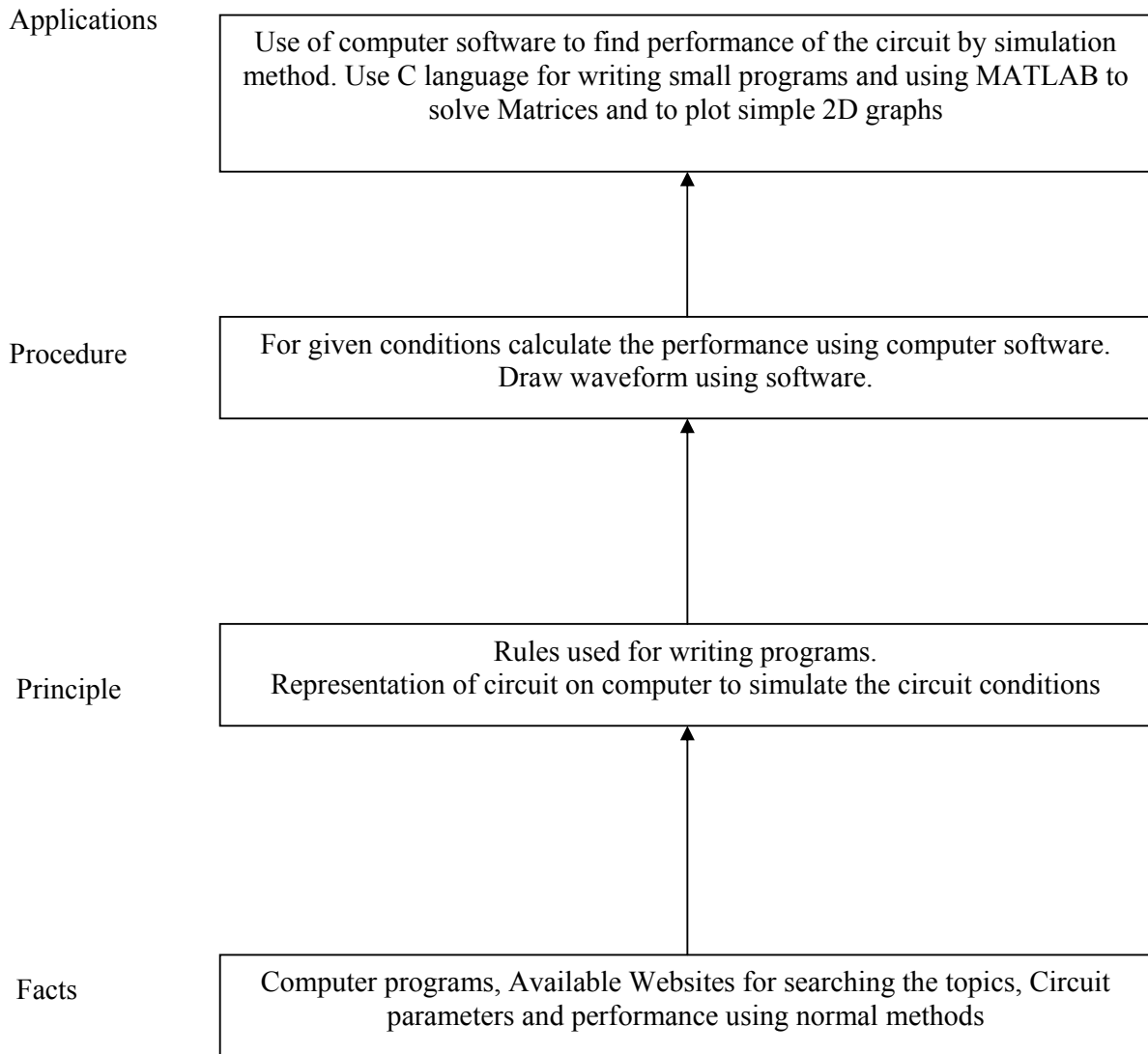
For any engineering, computer software skills are mandatory. Computer has become important part of any learning process. Therefore, it is necessary for any engineering student to have basic idea about computer languages. 'C' is most widely used general purpose powerful, efficient and compact language. This subject covers C as a basic logic development language.

MATLAB is said to be the language of engineers. It is widely used in mathematics, science and engineering. The MATLAB is used in this subject to solve common mathematical problems and to write simple program to plot simple graph.

General Objectives:

1. Describe concepts, variables and constants.
2. Write simple input/output program.
3. Write simple programs related to condition handling.
4. Write a program related to looping.
5. Understand concept of function.
6. MATLAB as a mathematical problem solving tool.
7. To draw 2 D plots using MATLAB.

Learning Structure:



Theory:**Note: Theory to be completed in the allotted practical hours.**

Topic and Contents
<p>Topic 1: Basics of C</p> <ul style="list-style-type: none"> ➤ History of C. ➤ C character set, tokens, variable, constant, keywords, data types ➤ Operators (Arithmetic, Relational, Logical). ➤ Formatted input, output statement (printf, scanf).
<p>Topic 2: Decision Making</p> <ul style="list-style-type: none"> ➤ Decision making using If-Else statement, switch case statement,. ➤ Decision making using loop statements like while, do-while, for.
<p>Topic 3: Arrays</p> <ul style="list-style-type: none"> ➤ Declaring one dimensional array, simple programs on arrays such as largest of array, sorting array.
<p>Topic 4: Functions</p> <ul style="list-style-type: none"> ➤ Necessity of functions, defining user defined functions, calling functions, call by value, call by reference
<p>Topic 5: MATLAB Environment</p> <ul style="list-style-type: none"> ➤ Command window, Command history, Workspace, Edit window, Help window ➤ Elementary built in functions.
<p>Topic 6 Matrices in MATLAB:</p> <ul style="list-style-type: none"> ➤ Entering data in Matrices ,Matrix Subscripts /Indices, Some useful commands related to Matrices such as det, rank, trace, inv, norm, transpose, zeros, ones, eye, arithmetic operations on matrices ,arrays, Relational operators
<p>Topic 7 Programming in MATLAB & Graphics</p> <ul style="list-style-type: none"> ➤ MATLAB editor: Creating M Files Function subprograms ➤ 2 D PLOTS : printing labels, grid and axes box, entering text in a plot , axis control ➤ Multiple plots :using plot , hold ,line commands ➤ Specialized 2 D plots using Polar, area, bar, hist, pie, stem function
<p>Topic 8 Fundamentals of Simulink</p> <ul style="list-style-type: none"> ➤ Simulink Modelling : Collecting blocks to create a model , modifying block parameters, labeling blocks, commonly used blocks

Note:

1. Related theory as mentioned above will be taught while performing the respective practicals.
2. The term work will consist of print outs of programs developed by the students in the laboratory.

(The teacher shall ensure that each student actually performs the practical before taking the print outs.)

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

1. To understand the output of a program.
2. To understand and use the conditions in a program.
3. To understand the idea of a loop
4. To read and initialize the array
5. To analyze the program

Motor Skills:

1. Ability to operate a keyboard and machine
2. Ability to edit and debug a program
3. Ability to compile and execute the program
4. Ability to write a programs using Library functions

List of Practical:

1. Write a program to display a number in decimal, octal and hexadecimal form by using different format specifics.
- 2A. Write a program to display largest of three integer numbers.
- 2B. Write a program to display remarks such as distinction, first class, second class, pass class and fail according to the marks.
3. Write a program for arithmetic operations such as addition, subtraction, multiplication and division of two numbers using switch case statement.
4. Write program to display reverse of a given number using for loop.
- 5A. Write a program to display multiplication table of a given number using do while loop.
- 5B. Write a program to display sum of first n numbers using while loop.
6. Write a program to accept one dimensional array and display the array in ascending order.
7. Write a program to swap two numbers using call by value, call by reference.
8. Understand commands in MATLAB. (General, Directory, Workspace, Termination, Help)
9. Use MATLAB to enter a data in matrix and practice the functions such as sum, mean, length, max and min.
10. Understand special matrix functions such as zeros, eye, ones, det, inv and find in MATLAB.

11. Write commands to create two matrices of 3 * 3 size and perform addition, subtraction, multiplication, right division, left division using MATLAB.
11. Write a program in MATLAB to plot a curve given by equation $y = \sin(x)$, $y = \cos(x)$, $y = x^2$ (Use hold command)
13. Write a program in MATLAB to illustrate the use of subplot command.
14. Create a Simulink model to verify Ohm's Law.

Learning Resources:**1. Books:**

Sr. No.	Author	Title	Publisher
1	Balgurusamy	Programming in ANSI C	Tata McGraw Hill
2	Harshal Arolkar Sonal Jain	Simplyfying C	DreamTech
3	Kashi Nath Dey Samir Bandopadhyay	C programming Essentials	Pearson
4	Bansal Goel Sharma	MATLAB & its application in Engineering	Pearson
5	Agam Kumar Tyagi	MATLAB and Simulink	Oxford
6	K K Sharrna	MATLAB Demystified	Vikas
7	Amos Gilat	MATLAB an Introduction with application	Willey India Edition

2. Websites: www.vikaspublishing.com/teachersmanual.aspx

Course Name : Electrical Engineering Group**Course Code : EE / EP****Semester : Third****Subject Title : Electrical Workshop****Subject Code : 17023****Teaching and Examination Scheme:**

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

NOTES: Related theory will be taught during practical period.**Rationale:**

A technician should also have the practical skills regarding wiring , in order to provide him/her the various ways, techniques of fault finding while working on the shop floor. These skills will be developed when he/she actually performs the work.

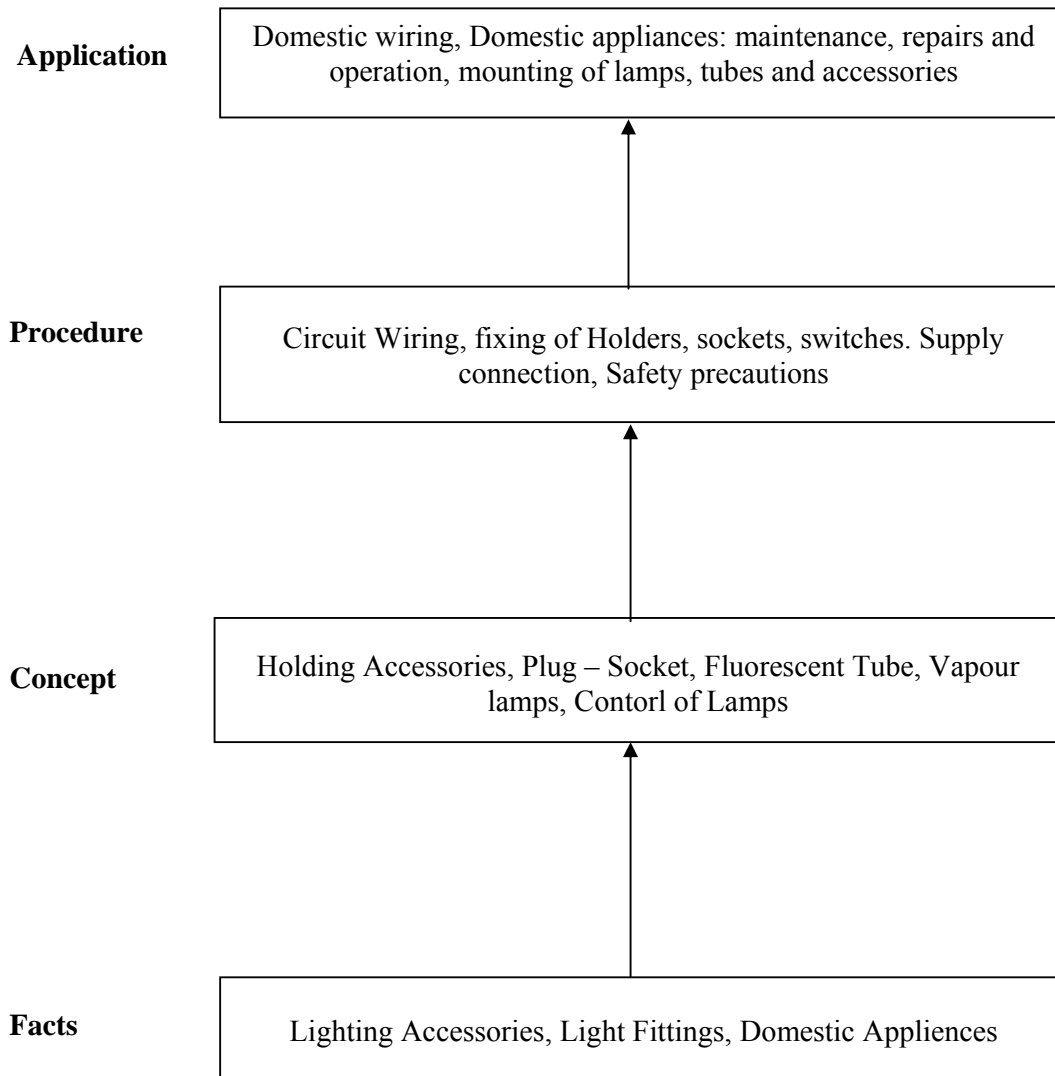
Skills to be developed:**Intellectual Skills:**

- Identify various electrical accessories, & appliances.
- Draw & understand the wiring diagrams& specifications.
- Prepare schedule of material.
- Use methods of wiring.

Motor Skills:

- Lay wires/cables for making connections
- Fix the accessories at proper place
- Test the circuit

Learning Structure:



Contents: Practical:

Sr No	Title of Practical & Contents	Hours
1	<p>Study of different lighting accessory: Draw label diagram, Typical location function & applications, Specifications for any one accessory from given below categories of accessory.</p> <p>A] Controlling accessory [Switches] - Iron clad double pole, Double pole with Indicator, Piano type switch [One way & two way control].</p> <p>B] Holding accessory [Holder] - Batten, Pendant, Angle, Screw type.</p> <p>C] Outlet accessory [Plug-Socket] –Two pin, Three pin, Ceiling rose, Adapter.</p> <p>D] Safety Accessory – Fuses-ceramic, HRCtype, Circuit breaker - Miniature, Earth leakage</p> <p>E] Indicators sign- LED lamp , Neon, colored lamps[Red , Yellow, Blue]</p> <p>F] Meters- Ammeter, Voltmeter, Wattmeter, Power Factor meter, Frequency Meter, Multimeter, Megger</p>	06
2	<p>Study of Different Light Fittings: Draw label diagram, Typical location working function & applications, Specifications, List of spare parts of an accessory from list given below.</p> <p>A] Fluorescent Tube Light Fitting - i] Choke coil ballast type ii] Electronic ballast type iii] Compact fluorescent tube light fitting.</p> <p>B] Gas Filled Bulb Type Light Fitting - i] Sodium vapour light fitting ii] Metal halide light fitting. iii] LED type light fitting iv] Incandescent light fitting.</p>	08
3	<p>Study of Different Domestic Appliances: Draw label diagram, Typical location & applications, Specifications, List of spare parts Internal connection diagram for any two accessory from list given below.</p> <p>i] Mixer& food processor ii] Water heater-Instant & Storage type. iii] Washing machine iv] Soldering gun & Electric iron. v] Vacuum Cleaner.</p>	08
4	<p>Mini Project Draw labeled circuit diagram, List accessory used, Their specifications, & Wiring up of simple electrical circuit on test board with appropriate testing results under guidance of supervisor/Teacher.</p> <p>i] Circuit consists of Mains DP switch, one lamp, one socket, two switches. ii] Circuit consist of Mains DP switch, one call bell, one lamp control from two places, three switches [Two switches are two way controlled]. iii] Circuit consists of Mains DP switch, One power socket of five in one type.</p>	10
Total		32

Resources:**Books:**

Sr No.	Title of ref. book	Author	Publication	Edition
1	Electric wiring estimation & costing	S. L. Uppal	Khanna Publ. New Delhi	---
2	Study of electrical appliances	K. B. Bhatia	Khanna Publ. New Delhi	---

Course Name : Electrical Engineering Group

Course Code : EE / EP

Semester : Third

Subject Title : Professional Practices-I

Subject Code : 17024

Teaching and Examination Scheme:

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

Notes 1: The teachers are encouraged to develop a “Speakers Bank”, a list of various experts from Industry and Educational Institutes who can speak on different topics. Similarly they should also prepare a directory of various nearby industries from their branch of Engineering, for the student’s visits. Preferably, the students should visit the industries in a batch of not more than 20. Where possible, the polytechnics should encourage the students to visit nearby industries during winter or summer vacations, for a period of 1 to 2 weeks and prepare a detail report and this can be included in the report of “Industrial Visit” in Professional Practice, scheduled for the next semester.

Rationale:

In the changing world scenario, the Diploma Engineers are expected to acquire various skills which include ability to communicate effectively, to present a topic, to share ideas, to prepare reports etc. and shape up their own personality. They are also expected to acquire technical information on various topics related to their branch of study, in addition to the various subjects included in their curriculum.

These acquired skills and enhanced confidence level are going to help them get a good job, based on personal interviews and aptitude tests.

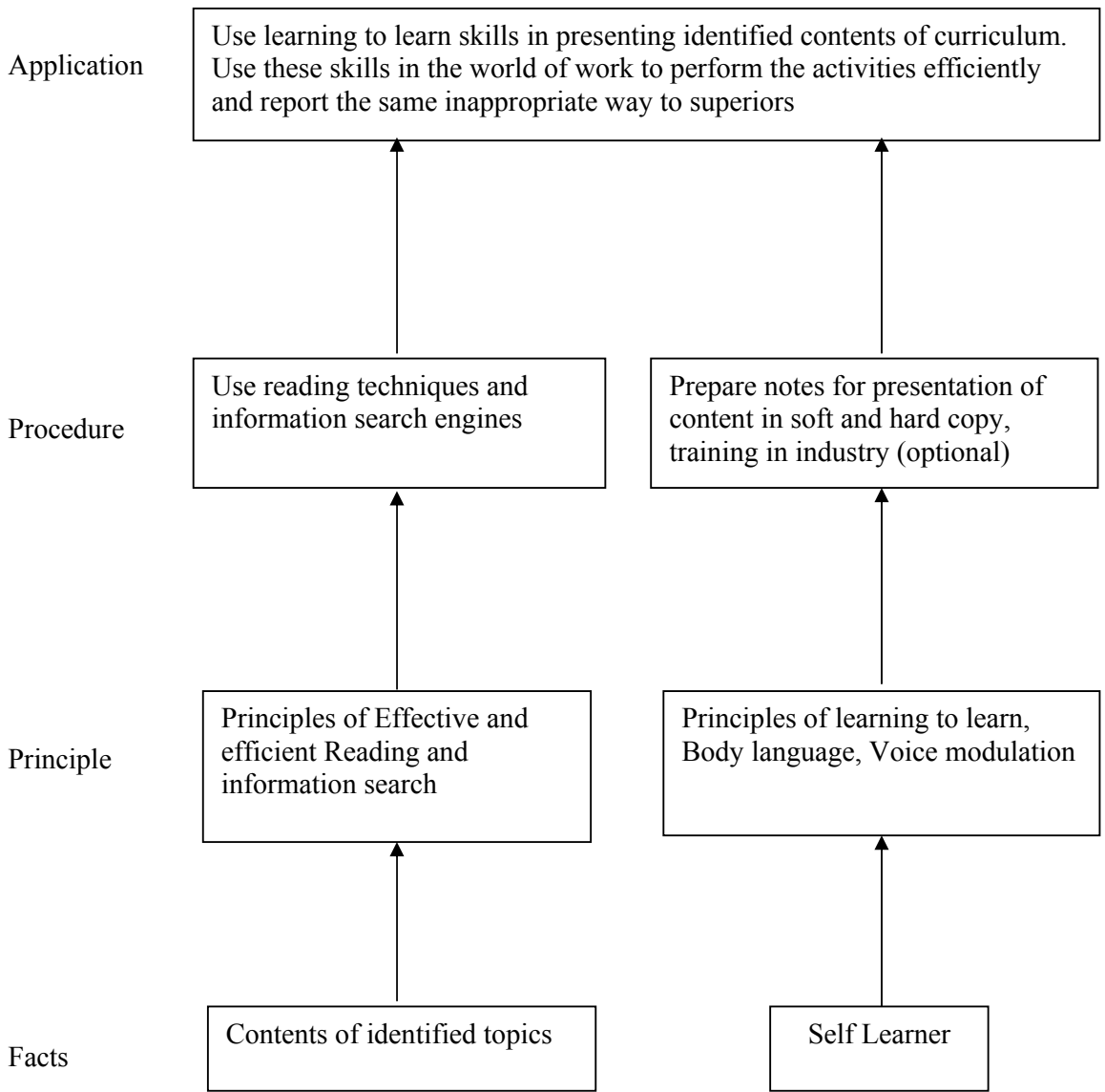
Visits to various nearby industries, lectures on technical subjects by experts, seminars on variety of subjects, group discussion, browsing internet and collection of information, preparing reports are some of the activities suggested under Professional Practice.

General 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:



Topic and Contents	Hours
<p>Topic 1: Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Make student aware about industrial atmosphere ➤ Understand the general working of an industry <p>Structured industrial visits be arranged and report of the same should be submitted by the individual student, to form a part of the term work. Following are the suggested type of Industries/ Fields – (Minimum three visits). Contents:</p> <p>1.1 Industrial Visits:</p> <ol style="list-style-type: none"> i) Visit to 110/33/11kv sub- station (Compulsory) ii) Visit to transformer manufacturing industry. iii) Visit to electronics industry. iv) Visit to hydro-electric/ thermal power plant (Compulsory) v) Visit to non conventional power generation station-wind /solar power. vi) Visit to multi storied building for the study of electrical installations 	14
<p>Topics 2: Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Students will get feel of new technology introduced in industry ➤ Get introduced to recent development in technology <p>Contents:</p> <p>Lectures by Professional / Industrial Expert to be organized on any Two topics of the following suggested areas or any other suitable topics:</p> <ol style="list-style-type: none"> i) Role of Power Factor Improvement a tool in reducing cost of generation. ii) New trends to built pollution free environment. iii) Software for drafting. iv) Special purpose wiring in chemical/hazardous industries. v) Non conventional energy sources with special focus on use of biomass, solid waste. vii) Automotive wiring & lightning. viii) Effect of transmission and distribution losses on cost of energy generation. 	10
<p>Topic 3: Information Search</p> <p>The students should collect information individually and write a report/prepare a note on the any one from below given topics as part of term work. Any other topic for information search may be selected by the faculty members. Some of the suggested topics are -</p> <ol style="list-style-type: none"> a) Electrical wiring accessories b) Elevators installation and operation c) Street Light accessories and factures d) Alternative fuels and energy options. e) Collection of data for comparison of transformer companies. 	06
<p>Topic 4. Group Discussion :</p> <p>The students should discuss in group of four to six students and write a brief report on the any one from below given topics as part of term work. Any other topic for group discussions may be selected by the faculty members. Some of the suggested topics are -</p> <ol style="list-style-type: none"> i) Electrically operated motor cars and scooters/motor bikes. ii) Load shading and remedial measures. iii) Safety in day to day life. 	08

iv) Conventional and non-conventional energy sources v) Electrical energy conservation. vi) Pollution control (All types).	
Topic 5. Seminar: The students should select a topic for Seminar based on recent developments & emerging technologies in Electrical & electronics engineering field. Each student shall submit a report of at least 06 pages and deliver a seminar (Presentation time – 10 minutes).	10
Total	48

 MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI TEACHING AND EXAMINATION SCHEME FOR POST S.S.C. DIPLOMA COURSES																	
COURSE NAME : ELECTRICAL ENGINEERING GROUP																	
COURSE CODE : EE/EP																	
DURATION OF COURSE : SIX SEMESTERS										WITH EFFECT FROM 2012-13							
SEMESTER : FOURTH										DURATION : 16 WEEKS							
FULL TIME / PART TIME : FULL TIME										SCHEME : G							
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@	10		
6	Transmission and Distribution of Electrical Power	TDE	17417	04	--	--	03	100	40	--	--	--	--	--	--		
7	Professional Practices-II	PPT	17038	--	--	03	--	--	--	--	--	--	--	50@	20		
Total				18	01	13	--	500	--	100	--	25	--	175	--	50	
**	Industrial Training (Optional)			Examination in 5th Semester Professional Practices-III													
<p>Student Contact Hours Per Week: 32 Hrs.</p> <p>THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH.</p> <p>Total Marks : 850</p> <p>@ - Internal Assessment, # External Assessment, 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>** Industrial Training (Optional) - Student can undergo Industrial Training of four weeks after fourth semester examination during summer vacation.</p> <p>Assessment will be done in Fifth semester under Professional Practices-III. They will be exempted from activities of Professional Practices-III of 5th Semester.</p> <ul style="list-style-type: none"> ➤ 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). ➤ Progressive evaluation is to be done by subject teacher as per the prevailing curriculum implementation and assessment norms. ➤ Code number for TH, PR, OR, TW are to be given as suffix 1, 4, 8, 9 respectively to the subject code. 																	

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.

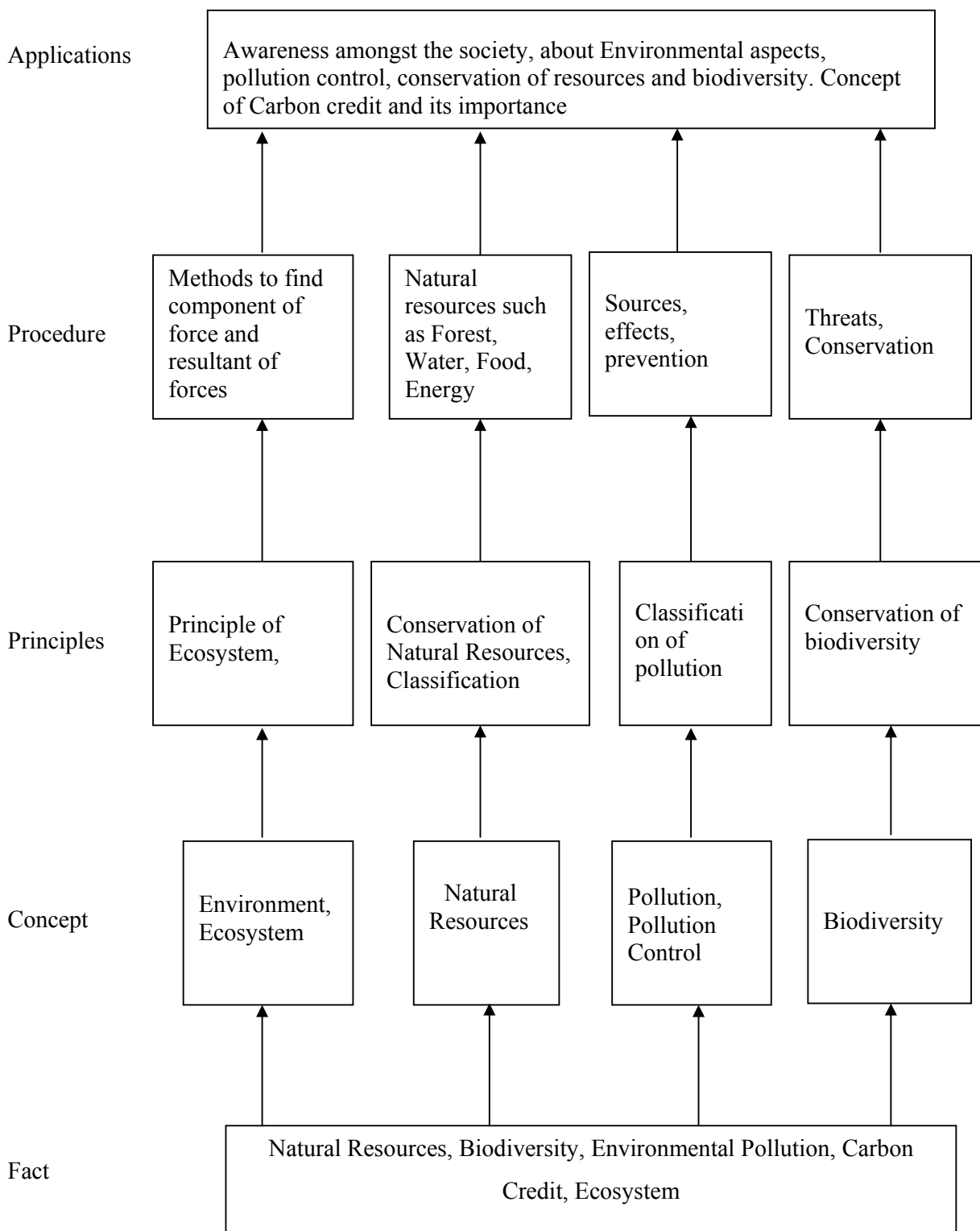
It is therefore necessary to study environmental issues to realize how human activities affect the environment and what could be possible remedies or precautions which need to be taken to protect the environment.

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:

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

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

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:**

Sr. No.	Author	Title	Publisher
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.

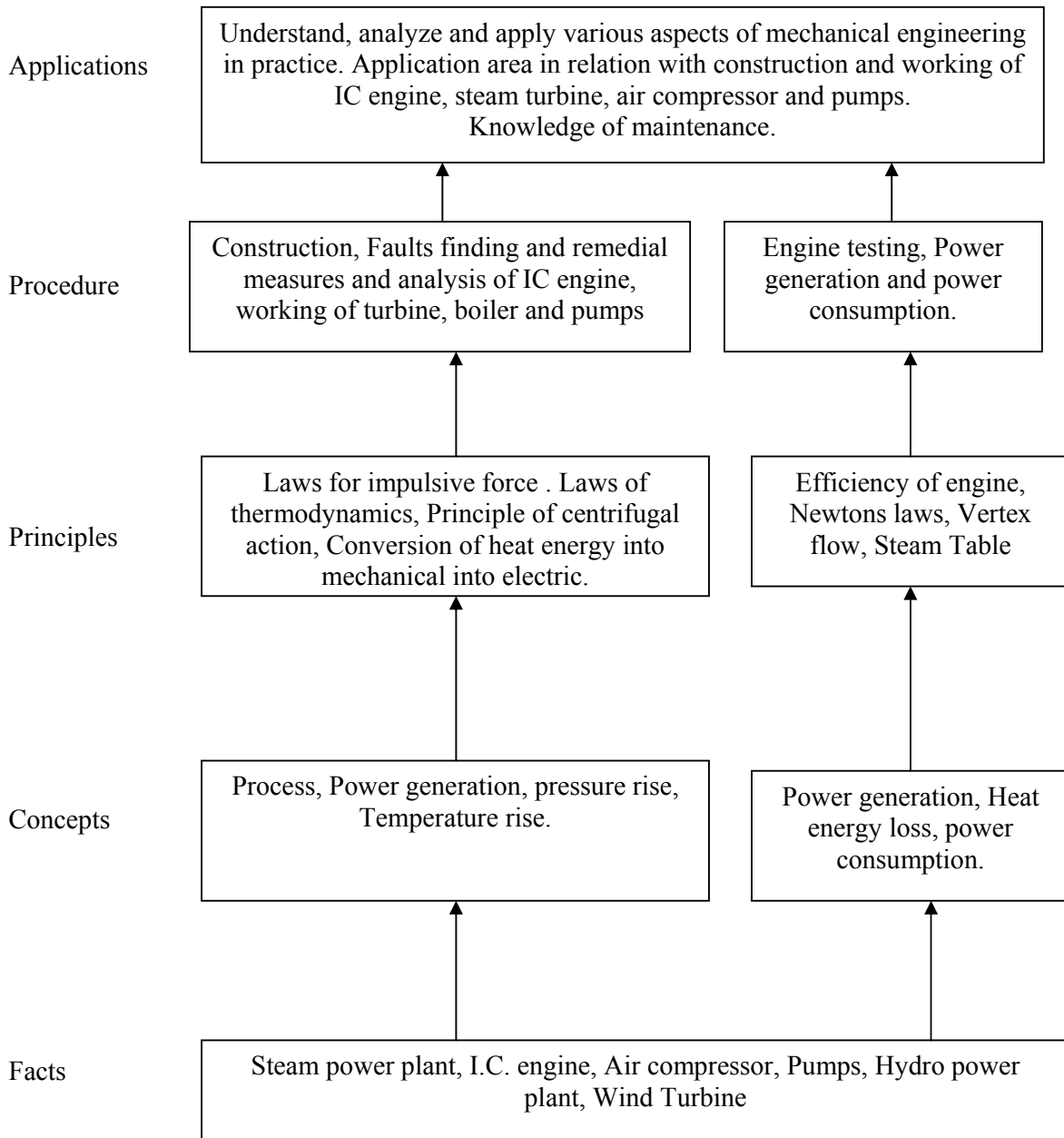
Topics on air compressors and pumps, turbine also provide necessary guide line in respect of electrical engineer. For trouble free working of these equipment with saving ion energy consumption.

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:

Topic and Contents	Hours	Marks
Topic 1: Boilers, Steam turbines, Steam engine Specific Objectives: <ul style="list-style-type: none"> ➤ Calculate the properties of two phase system by using steam table ➤ Explain construction & working of boilers ➤ Identify the heat losses & malfunctioning of boilers Contents: <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
Topics 2: I.C. Engines Specific Objectives: <ul style="list-style-type: none"> ➤ Calculate performance of engine ➤ Identify the malfunctioning Causes Contents: <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"> ➤ Break power ➤ Indicated power ➤ Frictional power <p>2.3 Fault finding and remedial action.</p> <p>2.4 Starting motor of I.C. engine.</p>	06	10
Topic 3: Air Compressor Specific Objectives: <ul style="list-style-type: none"> ➤ Know the working principles of air compressor ➤ Identify Methods of energy saving ➤ Identify the fault & suggest remedies Contents: <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
Topic 4: Pumps Specific Objectives: <ul style="list-style-type: none"> ➤ Selection of pumps for various applications ➤ Know the construction & working of pumps ➤ Identify the trouble shooting of IC engines Contents: <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
Total	32	50

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@	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:

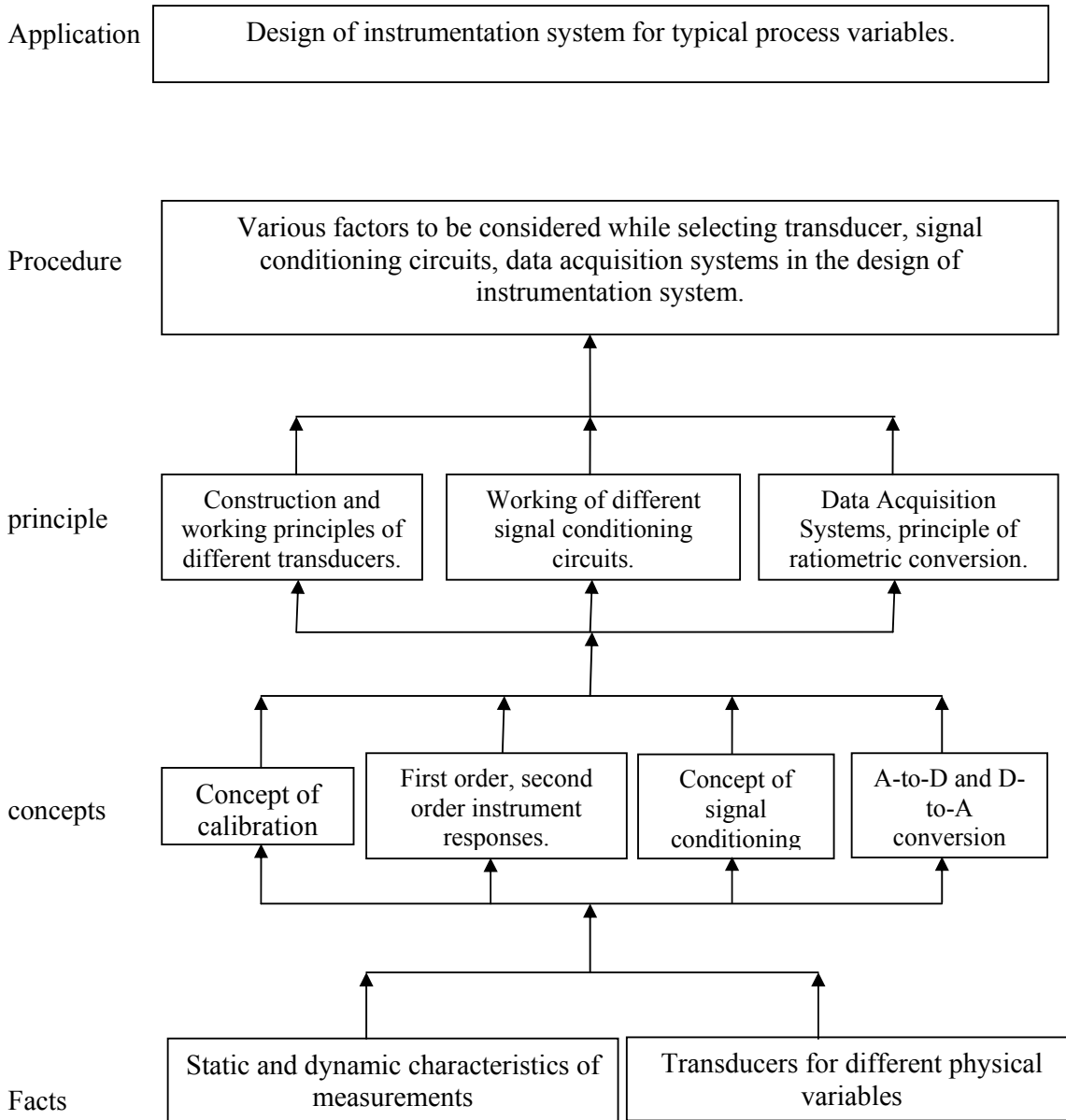
A diploma engineer is required to work in various capacities such as development, innovation & maintenance engineer, in today's highly automated industrial environment. Therefore the basic knowledge of industrial instrumentation and control is a necessary prerequisite.

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>Topic 1: Introduction to Instrumentation System</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ State basic block diagram of instrumentation system. ➤ Identify static and dynamic characteristics of instruments <p>Contents:</p> <p>1.1 Basic instrumentation system</p> <ul style="list-style-type: none"> • Basic block diagram of generalized Instrumentation system • Need of each block. <p>1.2 Static characteristics of instruments</p> <ul style="list-style-type: none"> • Accuracy and measurement uncertainty • Precision, repeatability and reproducibility • Tolerance • Range and span • Linearity • Sensitivity, resolution • Zero drift ,sensitivity drift • Hysteresis effect • Dead zone <p>1.3 Dynamic characteristics of instruments</p> <ul style="list-style-type: none"> • 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 <p>1.4 Calibration</p> <ul style="list-style-type: none"> • Principles of calibration • Calibration chain and traceability 	08	16
<p>Topics 2: Transducers</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Classify the transducers on the basis their application ➤ Select appropriate transducer as per application ➤ <p>Contents:</p> <p>2.1: Transducers</p> <ul style="list-style-type: none"> • Transducers: Definition, classification of electrical transducers. <p>2.2: Measurement of strain</p> <ul style="list-style-type: none"> • 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 <p>2.3 Measurement of Force and Torque</p> <ul style="list-style-type: none"> • Force measurement using load cell • Types of load cells: column type and beam type <p>2.4 Measurement of torque using torque cell</p> <p>2.5 Temperature Measurement</p> <ul style="list-style-type: none"> • Thermistor-working principle, characteristics, sources of error 	20	32

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

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

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 th 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 th 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.

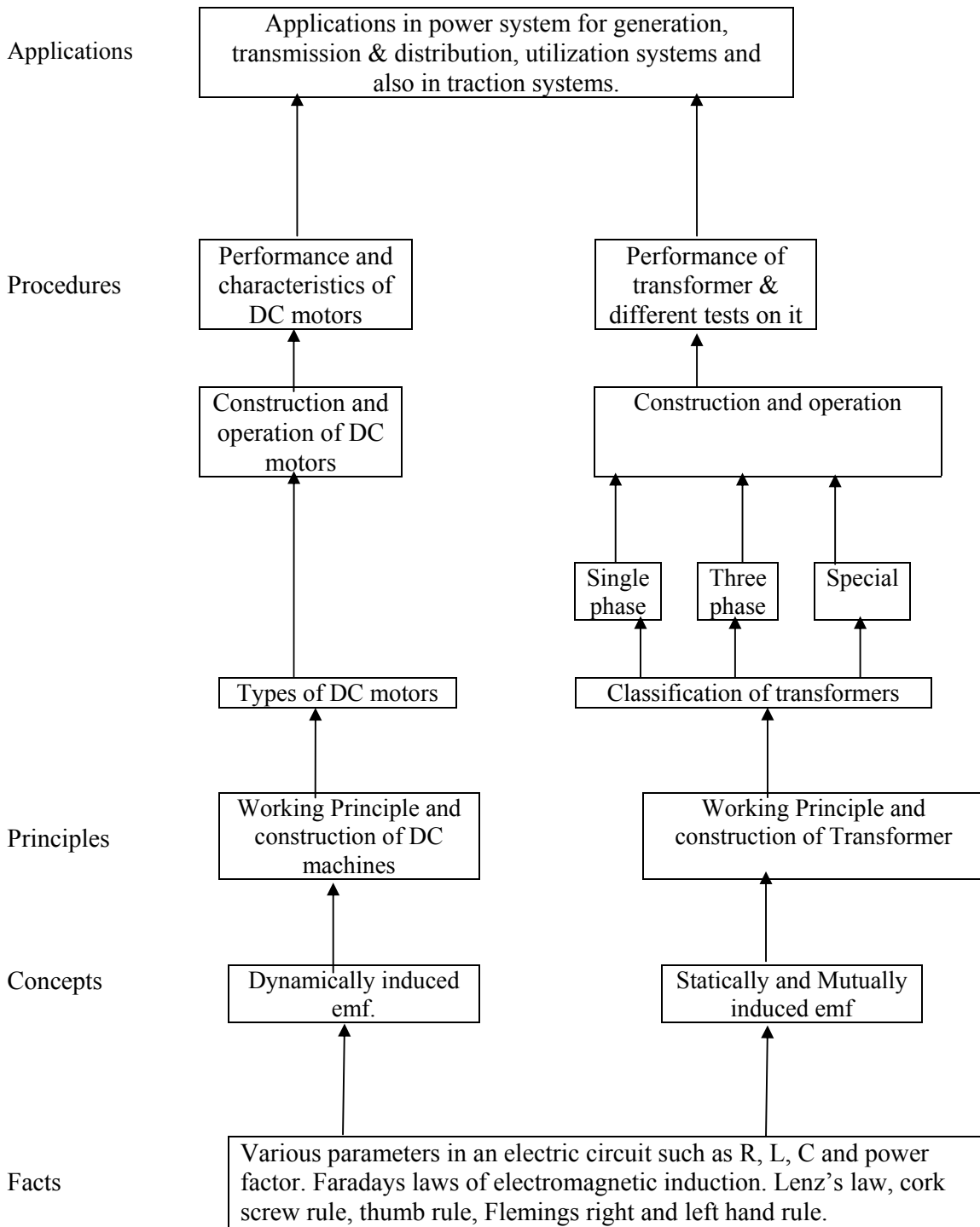
These machines are used in power system for generation, transmission & distribution, utilization systems and also in traction systems. Knowledge gained by the students will be used in the study of technological subjects such as power system operation & control, utilization system, switchgear & protection,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

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

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

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

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
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

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/
- www.bis.org.in/
- www.youtube.com/watch
- 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: -**

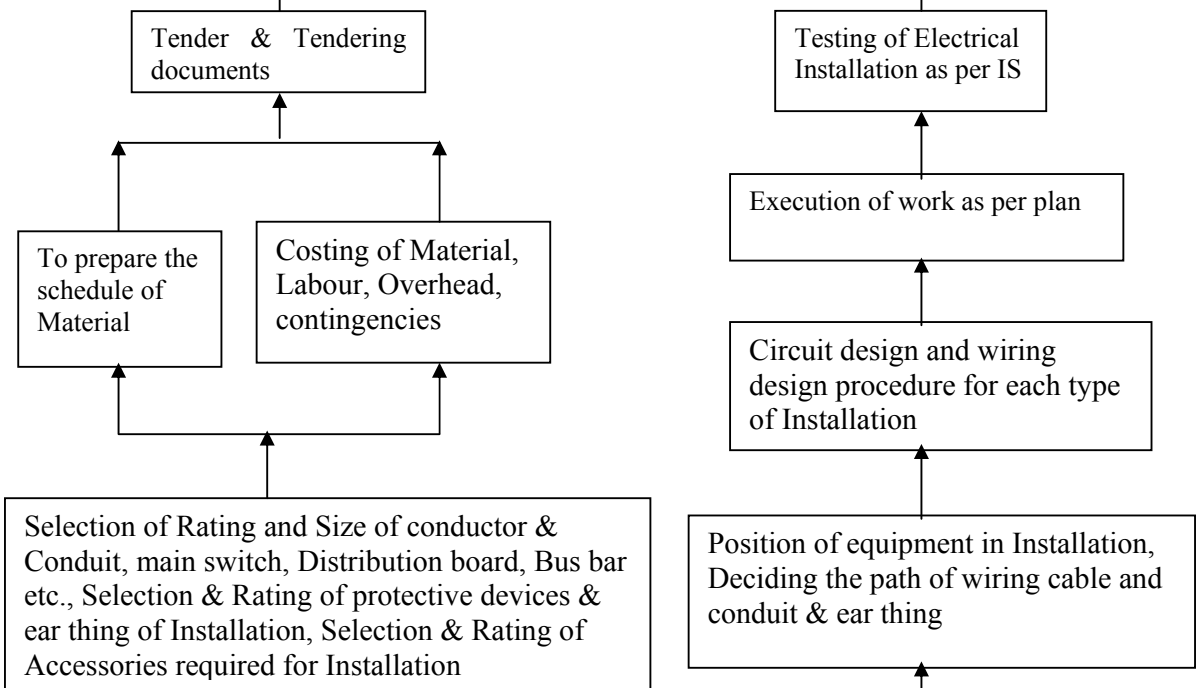
1. Read & interprets Electrical Installation drawings.
2. Understand & apply IE rules.
3. Make use of data tables & specification of wire, cables, LT lines & Distribution Transformer, MCCB, ELCB.
4. Understand principles & procedures of earthing.
5. Know basic terms to prepare design & estimate of installation.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

representation.		
<p>4. Electrification of Commercial Installation</p> <p>Specific Objectives</p> <ul style="list-style-type: none"> ➤ Difference between residential and commercial installation ➤ Prepare comparative chart for different ratings, size & other technical specifications from manufactures/ dealers. ➤ Use given guideline for commercial installation ➤ Collect various specifications of wiring material <hr/> <ul style="list-style-type: none"> • Concept of commercial installation • Difference between residential and commercial installation • Difference between wires and cables • Types of cables required for commercial installations according to size and core • General requirements and selection factors for commercial installation • Load calculation and selection of size of service connection and nature of supply • Decide number of lighting and power sub circuits as per the IE rule • Decide size of wire/cable required for every sub circuit • Decide length of wire required for every sub circuit • Draw the single line diagram • Decide ratings of wiring accessories, main switch, bus bar MCB, ELCB etc. • Decide proper method of earthing for commercial installation • Prepare list of material for commercial installation with their costing • Draw the single line diagram • Find out the estimation chart with proper cost of material, cost of labour, contingencies charges and profit margin • Draw the circuit diagram 	12	20
<p>5. Electrification of Industrial Installation</p> <p>Specific Objectives</p> <ul style="list-style-type: none"> ➤ Based on criteria for selection decide if the installation is industrial installation ➤ State difference between power wiring and actual industrial wiring ➤ Guideline for industrial installation ➤ Calculate detail estimate and costing of industrial installation <hr/> <ul style="list-style-type: none"> • Concept of industrial load • Concept of motor wiring circuit and single line diagram • Guidelines about power wiring and motor wiring • Design considerations of electrical installation in small industry/factory/workshop • Machine current calculations • selection of size for wires, cables required for the machines and its controlling unit • Decide length and size of cable required for the every industrial load • Decide ratings of wiring accessories, main switch, bus bar MCB, ELCB etc. for every industrial load. • Decide proper method of earthing for industrial installation • Prepare list of material for industrial installation with their costing • Find out the estimation chart with proper cost of material, cost of labour, 	12	24

contingencies charges and profit margin • Draw the circuit diagram		
6. Contracts, Tenders and Execution 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
Total	48	100

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://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:

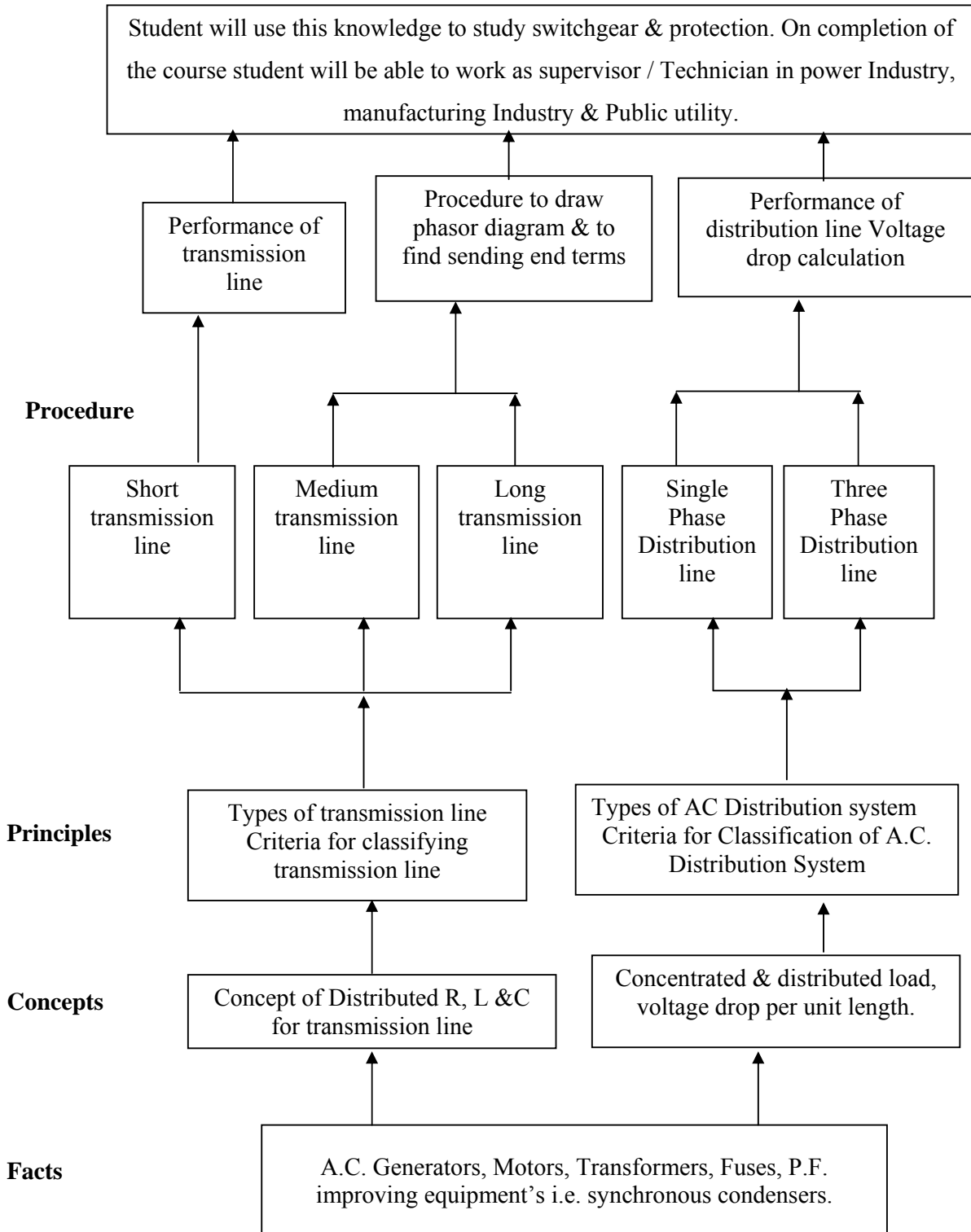
Electrical Diploma Engineers should know Transmission Voltages, Distribution Voltage. They should be able to identify various components & their functions. They will be able to measure system performance. They will use this knowledge in studying Switchgear & Protection on completing the study of Generation, 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>Topic 1: Basic Transmission Specific Objectives: ➤ Draw single line diagram of a given transmission network ➤ Classify the lines based on their length, voltage rating</p> <p>Contents:</p> <ul style="list-style-type: none"> • Single Line Diagram of Transmission & Distribution of Electric supply system. • Meaning of Primary & Secondary Transmission and its Standard Voltage level used in India. • Classification of Transmission Lines according to voltage level, Length of Transmission line, Type of Supply Voltage & Method of Construction. • Advantage of High Voltage for power transmission 	04	08
<p>Topics 2: Transmission Line Components Specific Objectives: ➤ Identify the main Components of Transmission & Distribution Line. ➤ Select size and type of conductor for transmission line based on its rating ➤ Calculate string efficiency</p> <p>Contents: Overhead Conductors: ----- 04 marks</p> <ul style="list-style-type: none"> • Properties of Conducting Material. • Comparison of Copper & Aluminum as a Conducting Material. • 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. • Trade Names of various types of conductors. • Stranded Conductor: Advantages & Disadvantages. <p>Underground Cables: ----- 04 Marks</p> <ul style="list-style-type: none"> • Introduction & requirements. • Classification of cables. • Cable conductors. • Cable construction. • Cable insulation, Metallic sheathing & mechanical protection. • Comparison with overhead lines • Cable laying and Cable Joining <p>Line supports: ----- 06 marks</p> <ul style="list-style-type: none"> • Requirements of Supporting Structures • Types of Supporting Structure: • 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. • Steel Tower: Specifications, Material used, single circuit, double 	14	24

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

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

<ul style="list-style-type: none"> • Single Line diagram (layout of) 33/11KV Sub-Station. • Single Line diagram (layout of) 11KV/400V Distribution Transformer. • Symbols & 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 & PT), Control Panel, Control Room and Outgoing Line, • Symbols & 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. 		
Total	64	100

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
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.

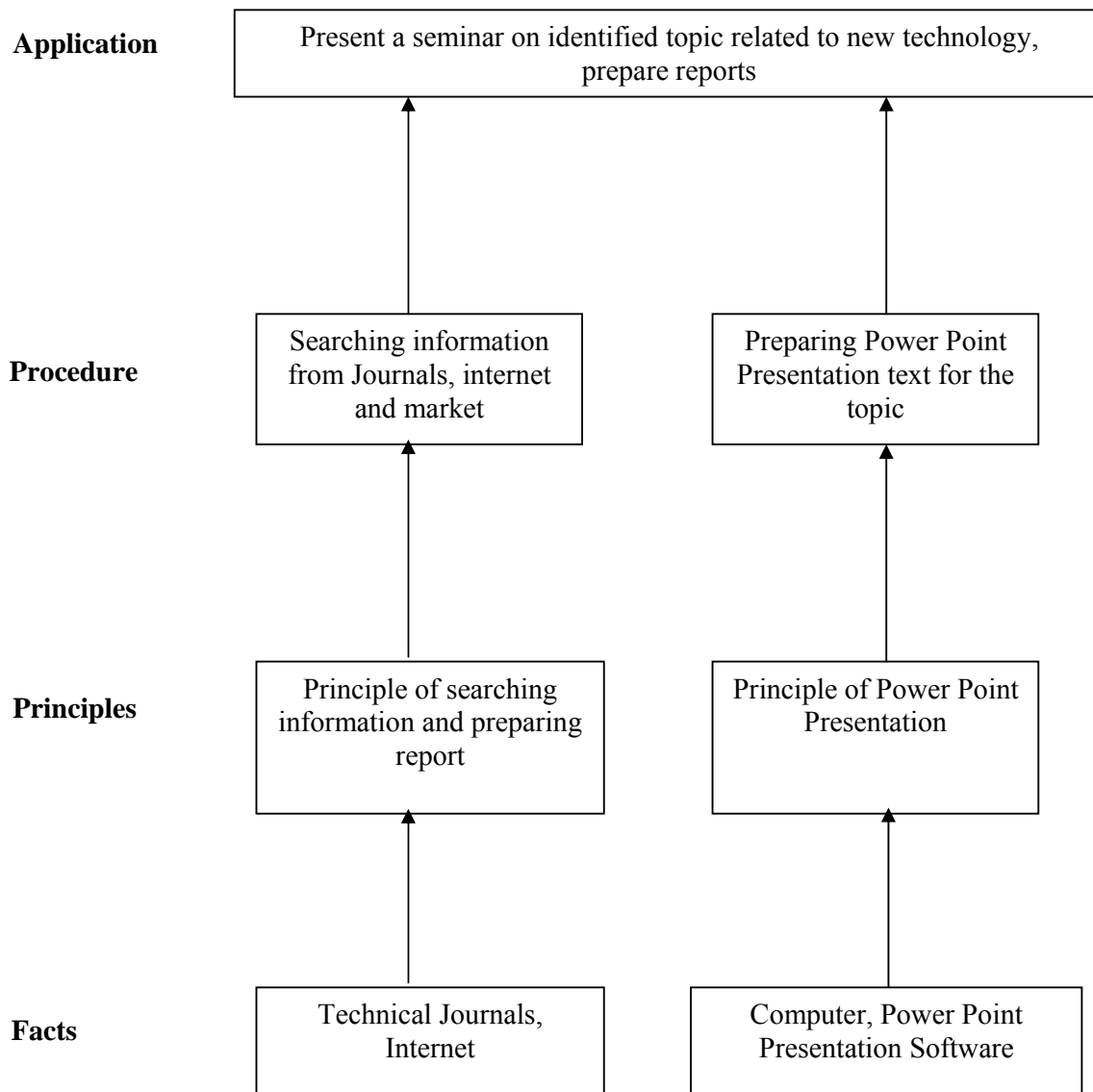
The purpose of introducing professional practices is to provide opportunity to students to undergo activities which will enable them to develop confidence. Industrial visits, expert lectures, seminars on technical topics and group discussion are planned in a semester so that there will be increased participation 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>Industrial Visits 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"> i) Visit to HT Sub Station (Compulsory) ii) Visit to Transformer Manufacturing Industry iii) Visit to Electronics Industry iv) Visit to Design Office of MSEDCL, MSEGENCEL v) Visit to Industry to observe:- <ul style="list-style-type: none"> a) Function of DAS and Data logger b) Electrical quantities, non-electrical quantities by recorder. vi) Adarsh Gram 	16
02	<p>Lectures by Professional / Industrial Expert / Student Seminars based on information search, expert lectures to be organized from any of the following areas:</p> <ul style="list-style-type: none"> i) Interview Techniques. ii) Effect of Transmission and Distribution Losses on cost of Energy Generation iii) Recent Trends in Transformer Manufacturing iv) Electrical Safety in Industry v) Applications of D. C. Motors : Present and Future Trends vi) Any other suitable topic 	08
03	<p>Information Search: 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"> i) Recent Trends in Insulation Material and Insulators ii) Electrical Wiring Accessories iii) Non Conventional Energy Sources with focus on solar energy iv) Elevators installation and maintenance v) Any other suitable areas 	08
04	<p>Seminar: 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>Mini Projects: A group of 6to8 students be formed for group discussion;</p> <ol style="list-style-type: none"> 1. Prepare a report on Electrification of multi storied building 2. Market Survey of Power Converters on the basis of Rating, Cost, Efficiency, Battery quality 	08
Total		48

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 4th semester examination.

Note:- Examination in Professional Practices of 5th 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.
- Their 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.