

Course name : Electrical Engineering Group

Course Code: EE/EP

Semester : Third

Subject Title : Electrical Measurements

Subject Code: 9032

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme						
TH	TU	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
03	-	02	03	80	20	50#	--	25@	175

Rationale:

This subject is classified under core technology. The Diploma holder has to work as Technical supervisor, maintenance engineer, production engineer in industries, electrical power generation, transmission and distribution system, traction installation system, machine operation etc.

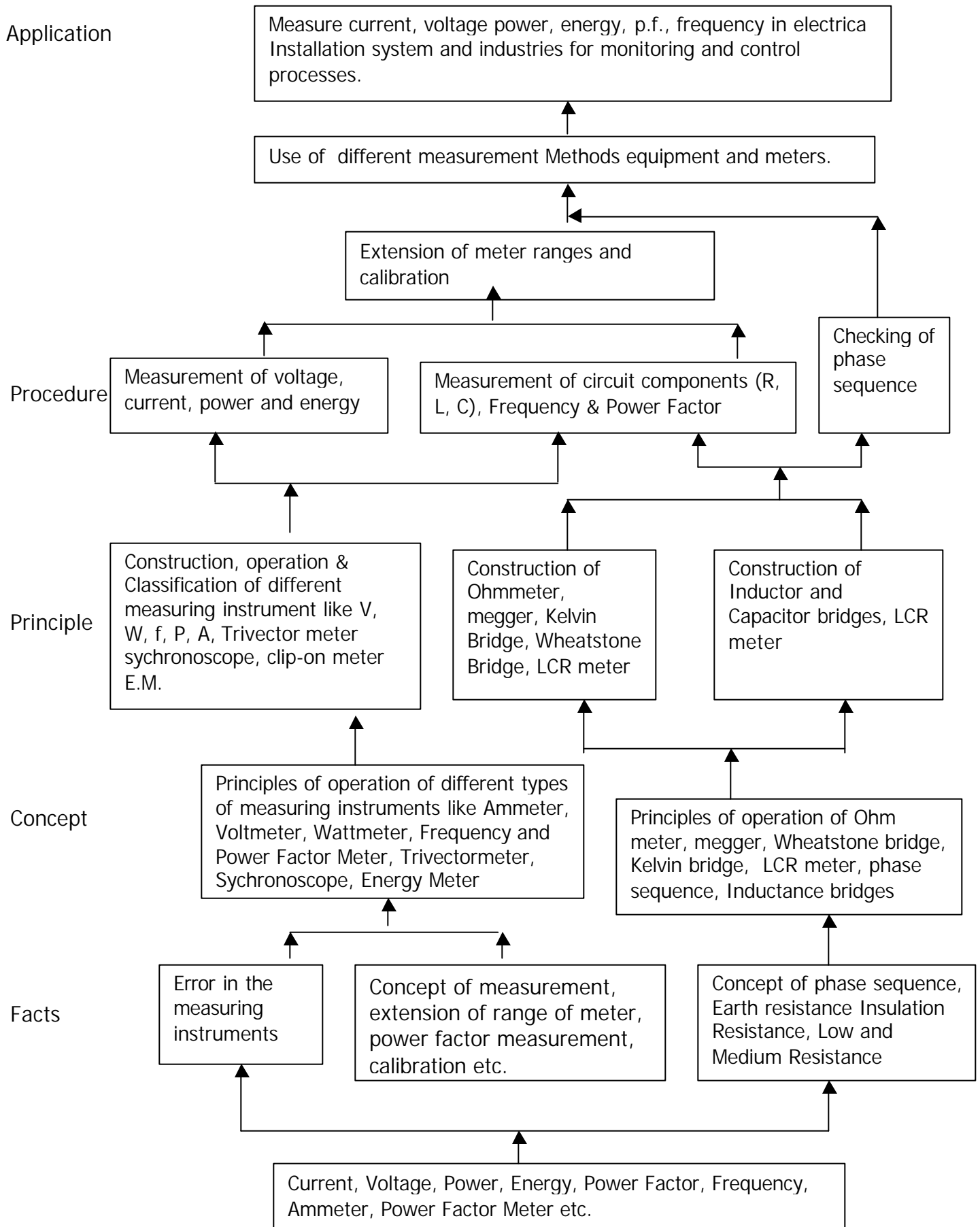
For above job responsibilities he has to take the measurements of various electrical quantities power & energy for testing, monitoring, maintenance, and controlling the process. In addition to this he must know the calibration techniques and extension of meter ranges. Therefore Electrical Measurement skills are very important. Accuracy of measurement is one of the main parameters in industrial processes as ability of control depends upon ability to measure.

Objectives:

The Students will be able to:

1. identify the measuring instruments used for measuring electrical quantities.
2. select appropriate measuring instrument with range for measurement of various electrical quantities. select and use range multiplier if required.
3. select appropriate instrument for measurement of power, energy.
4. classify measuring instruments based on construction, principle of operation and quantity to be measured, types of errors.
5. calibrate various types of instruments as per is.

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	Fundamentals of Measurement 1.1 Purpose of measurement and significance of measurement 1.2 Various effects of electricity employed in measuring instruments. 1.3 Desirable qualities of measuring instruments. 1.4 Classification of Instruments. 1.5 Types of errors 1.6 Different types of torque in Analog Instruments.	05	08
02	Measurement of Current and Voltage 2.1 Construction and principle of PMMC, MI & Dynamometer type Instrument. 2.2 Production of torque :methods. 2.3 Principles of Voltage and Current measurement. 2.4 Range Extension of Ammeter and Voltmeter 2.5 Different Methods of range extension of Ammeter and Voltmeter. 2.6 Calibration of Ammeter and Voltmeter. 2.7 Instrument transformers (CT & PT)	10	16
03	Measurement of Power 3.1 Concept of power in A.C. Circuit 3.2 Principle and Construction of dynamometer type wattmeter. 3.3 Errors and their compensation. 3.4 Polyphase wattmeter. 3.5 Multiplying factor of wattmeter. 3.6 Measurements of power in 3 phase circuit for balanced and unbalanced load by one wattmeter method, two wattmeter method. 3.7 Effect of power factor variation on wattmeter readings in two wattmeter method. 3.8 Measurement of reactive power in three phase balance load by one wattmeter method and two wattmeter method. 3.9 Digital Wattmeter.	10	16
04	Measurement of Electrical Energy 4.1 Concept of electrical energy. 4.2 Constructional feature & principle of working of single phase and three-phase induction type energy meter. 4.3 Different types of errors and their compensation. 4.4 Calibration of energy meter. 4.5 Electronic energy meter.	07	12

05	Constructional features and working principles of other Meters 5.1 Single phase and three phase Power Factor Meter(only dynamometer type). 5.2 Frequency meter (Weston and Ferro dynamic type). 5.3 Sychronoscope. 5.4 Phase sequence Indicator.(Rotating type only) 5.5 Clip-on-ammeter. 5.6 Q-meter.	08	12
06	Measurement of Circuit Parameters 6.1 Classification of Resistance, Low, Medium and High. 6.2 Methods of Measurements of Low, Medium and High. Resistance (Kelvin Double bridge, wheatstone bridge and Megger) 6.3 Measurement of Earth resistance- Earth tester (Analog & Digital) 6.4 Digital Multimeter. 6.5 Introduction to A.C. Bridges. 6.6 L.C.R. Meter.	08	16
Total		48	80

Practical:

Skills to be developed:

Intellectual Skills:

1. Identification of instruments
2. Selection of instruments and equipment for measurement

Motor Skills:

1. Accuracy in measurement
2. Making proper connections

List of Practicals:

1. Measurement of Current and Voltages by Low range ammeter and voltmeter respectively with shunt and multiplier.
2. Measurement of Current and Voltages by Low range ammeter and voltmeter respectively by Using Current Transformer and potential Transformer.
3. Measurement of active and reactive power in three phase balanced load by single wattmeter method.
4. Measurement of active and reactive power in three phase balanced load by two wattmeter method and observe the effect of Power Factor variation on Wattmeter reading.

5. Calibration of Energy meter at various power factor by standard energy meter.
6. Measurement of energy in single phase & three phase balanced load using Electronic Energy Meter.
7. Measurement of Low resistance by Kelvin's Double Bridge.
8. Measurement of Medium resistance by Wheatstone bridge.
9. Measurement of Insulation Resistance by Megger.
10. a) Measurement of Resistance, Voltage, Current , Voltage, Current in A.C & D. C. Circuit by using digital multimeter.
b) Measurement of A.C. Current by Clip-on ammeter
11. Measurement of Earth Resistance by Earth Tester.
12. Measurement of Circuit Parameters by LCR meter.
13. Measurement of power factor of single phase and three phase load by PF meter and verifying through I, V and P measurement.
14. Observe the phase sequence of three phase circuit Using Rotating type phase sequence Indicator.
15. Measurement of Frequency of A.C. Supply Using Weston or Ferro dynamic type Frequency meter.

Learning Resources:

Books:

Sr. No.	Author	Title	Publisher
1	A.K. Sawhney	Electric & Electronic Measurement and Instrumentation	Dhanpatrai & Sons
2	Copper & Heltrick	Electronic Instrumentation & measurement Techniques	Prentice Hall of India
3	Rangan Mani & Sarma	Instrumentation Devices and System	Tata McGraw Hill
4	Kalsi	Electronic Instrumentation	Tata McGraw Hill
5	S.K.Singh	Industrial Instrumentation & control	Tata McGraw Hill
6	Golding	Electrical Measurement & measuring Instrument	Wheeler
7	N.V.Suryanaryan	Electrical Measurement & measuring Instrument, Delhi.	S. Chand & Co.
8	C.T. Baldwin	Fundamental of Electrical measurement	-

- IS/International Codes :IS 1248, 1765, 6236, 9223, 8945, 2442