DEPARTMENT OF ELECTRICAL ENGINEERING

GOVERNMENT POLYTECHNIC, BARGARH

LESSON PLAN

ELECTRICAL MEASUREMENT & INSTRUMENTATION (TH 3)

4TH SEMESTER

ELECTRICAL ENGINEERING

DEPARTMENT OF ELECTRICAL ENGINEERING

VISION:

To produce Electrical Engineer professionals who can contribute for socio-economic and technological development to meet global needs.

MISSION:

M1 - To strengthen academic infrastructure leading to quality professional by using modern technical tools and technologies.

M2 - To impart innovative knowledge among the students and make more industry-institution programs to make them successful professionals for serving the society.

M3 - To provide a learning environment to improve problem solving abilities, leadership abilities, ethical responsibilities and lifelong learning.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

PEO1: Apply electrical engineering knowledge and practical skills to solve well-defined engineering problems using modern tools and techniques.

PEO2: Perform effectively in industry and society as competent junior engineer, supervisors, or entrepreneurs with ethical and sustainable engineering practices.

PEO3: Demonstrate teamwork, communication, leadership, and project management skills in professional engineering activities.

PEO4: Engage in lifelong learning and adapt to emerging technologies for career growth and higher education.

PROGRAM SPECIFIC OUTCOMES

The electrical diploma engineers will be able to:

PSO1:-Apply the fundamentals of mathematics, science and engineering knowledge to identify, formulate, design and investigate engineering problems of electric circuits, analog and digital electronics, control system, electrical machines and power system.

PSO2:- Apply the appropriate techniques and modern engineering hardware and software tools in electrical engineering to engage in life-long learning and to successfully adapt in multidisciplinary environments.

PSO3:-Work professionally in power systems engineering, Electrical machinery and electrical circuit.

Week	Class No.	Topic / Specific Objective Covered
1	1	Introduction to Measurement; Define Accuracy and Precision
	2	Define Errors (Types of Errors) and Resolutions
	3	Define Sensitivity and Tolerance
	4	Classification of measuring instruments (Absolute, Secondary, Indicating, Recording, Integrating)
	5	Introduction to Indicating Type Instruments & Deflecting arrangements
2	6	Controlling arrangements (Spring control and Gravity control)
	7	Damping arrangements (Air friction, Fluid friction, Eddy current damping)
	8	Calibration of instruments: Principles and Importance
	9	Methods and setup for Calibration of basic instruments
	10	Moving iron (MI) instruments: Construction and Operating principle
3	11	MI instruments: Torque equation, Errors, Ranges, Merits, and Demerits
	12	Permanent Magnet Moving Coil (PMMC) instruments: Construction and Principle
	13	PMMC instruments: Torque equation, Ranges, Merits, and Demerits
	14	Dynamometer type Ammeters and Voltmeters: Construction and Working
4	15	Dynamometer type instruments: Errors, Merits, and Demerits
	16	Rectifier type instruments: Construction and Operating Principle
	17	Rectifier type instruments: Waveform effects, Merits, and Demerits
	18	Induction type instruments: Principle of operation and Construction
	19	Induction type instruments: Torque development, Merits, and Demerits
	20	Extension of instrument ranges: Theory of Shunts for Ammeters
5	21	Extension of instrument ranges: Theory of Multipliers for Voltmeters
	22	Numerical Problems: Designing Shunts for Ammeter range extension
	23	Numerical Problems: Designing Multipliers for Voltmeter range extension
	24	Numerical Problems: Error analysis in MI and PMMC instruments

	25	Dynamometer type wattmeter: Construction and Principle of working
6	26	Types of Wattmeters: Low Power Factor (LPF) type wattmeters
	27	Types of Wattmeters: Up Power Factor (UPF) type wattmeters
	28	Errors in Dynamometer type wattmeters (Pressure coil inductance & capacitance)
	29	Methods of error correction and compensation in Dynamometer wattmeters
	30	Induction type wattmeters: Construction and Principle of operation
7	31	Induction type wattmeters: Torque equation, advantages, and limitations
	32	Introduction to Energy meters and Measurement of Energy
	33	Single Phase Induction type Energy meters: Detailed Construction
	34	Single Phase Induction type Energy meters: Working principle & Torque equation
	35	Compensations in Energy meters: Lag adjustment and Friction compensation
8	36	Adjustments in Energy meters: Creep compensation and Voltage/Temperature errors
	37	Testing of Energy Meters: Phantom loading and Direct loading methods
	38	Testing of Energy Meters: Creep test, Speed test, and percentage error calculation
	39	Tachometers: Introduction and Mechanical type tachometers
	40	Electrical tachometers: AC & DC types and working principles
9	41	Frequency meters: Principle of operation of Mechanical resonance type
	42	Frequency meters: Construction of Electrical resonance type
	43	Power factor meters: Principle of operation of Dynamometer type 1-Phase P.F. meter
	44	Power factor meters: Construction and working of Dynamometer type 3-Phase P.F. meter
	45	Classification of resistance: Low, Medium, and High resistance thresholds
10	46	Measurement of low resistance: Potentiometer method setup and calculation
	47	Measurement of medium resistance: Wheatstone Bridge method derivation

	48	Wheatstone Bridge: Sensitivity, errors, and numerical problems
	49	Measurement of high resistance: Loss of charge method theory
	50	Loss of charge method: Mathematical derivation and numerical problems
11	51	Megger: Construction and principle of operation for insulation resistance
	52	Earth tester: Construction and principle of operation for earth resistance
	53	Analog Multimeter: Internal construction, working, and application
	54	Digital Multimeter: Operating principle, block diagram, and advantages
	55	Measurement of inductance: Maxwell's Bridge circuit and phasor diagram
12	56	Maxwell's Bridge: Derivation of balance equations and limitations
	57	Measurement of capacitance: Schering Bridge circuit and phasor diagram
	58	Schering Bridge: Derivation of balance equations and dissipation factor
	59	Introduction to Sensors and Transducers: Definitions and basic concepts
	60	Define Sensing element / detector element and Transduction elements
13	61	Classification of Transducers: Active, Passive, Primary, Secondary, Analog, Digital
	62	Examples of various classes of transducers and selection criteria
	63	Resistive transducer: Linear and angular motion potentiometers
	64	Resistive transducer: Thermistor (Characteristics and working)
	65	Resistive transducer: Resistance thermometers (RTD configuration)
14	66	Resistive transducer: Wire Resistance Strain Gauges (Gauge factor expression)
	67	Inductive Transducer: Principle of Linear Variable Differential Transformer (LVDT)
	68	Uses, advantages, and disadvantages of LVDT
	69	Capacitive Transducers: General operating principle and governing equations
	70	Variable area type and Change in distance between plates type capacitive transducers
15	71	Piezoelectric Transducers: Principle, materials, and industrial applications
	72	Hall Effect Transducers: Principle, working, and applications

	73	Oscilloscope: Principle of operation and internal structure of Cathode Ray Tube (CRT)
	74	Block diagram and detailed principle of operation of a general Oscilloscope
	75	Measurement procedures for DC/AC Voltage, Current, Phase, and Frequency via CRO