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LESSON PLAN **SESSION** January-June 2024

SUBJECT: **Industrial Measurements & Control** SEM: **4TH** BRANCH: - **MECHANICAL ENGINEERING**

UNIT NUMBER	NAME OF THE TOPIC	NO OF CLASS REQUIRED	REMARK
Unit 01: Measurement System.	**1.1** Measurement and measuring instruments, Classification of Measuring Instruments, Characteristics sensitivity, accuracy, linearity, threshold, resolution, etc.	02	
	1.2 Measuring system, Block diagram with example, stages of measuring system with examples – Stage I input signal (detector transducers), Stage II (Intermediate modifying), and Stage III (terminating), Types of input signals.	02	
	1.3 Measurement standards :- Time, frequency, Voltage, Current, 3-15 psi etc., ANSI, ASME, ADA, BS, DIN, CSMR, FCI, API, ISI, and introduction Reliability and safety.	02	
	1.4 Transducers –Primary and secondary transducers, classification, working Principle of Resistance, inductance, capacitance and piezoelectric transducers with their line sketches, applications of each, sensors, types and applications, difference between transducer and sensor.	01	
Unit 02 Introduction to Control system	**2.1** Definition , Terminology, Objective of control system, Types of Control Systems, Effect of Feedback Systems,	01	
	2.2 Basic elements of open and closed loop system, concept of open loop and closed loop systems, Block diagram of Open loop and closed loop control systems, Effect of feedback, Multivariable control systems comparison, Applications and advantage	03	
	2.3 Time Response of feedback control systems: Standard test signals -unit step, ramp, impulse and Parabolic **2.4** Process Control and its benefits, Basic control actions, Two position or On/Off control, Introduction to **PI**, **PD** and **PID** Controllers.	03	
	2.5 Control System Components, construction and working, Ac servomotor, synchronous and stepper motor.	01	
Unit 03: Displacement and speed measurement	**3.1** Working principle & use of Potentiometer, Differential transformer (LVDT & RVDT), capacitive element & Optical encoders.	01	
	3.2 Mechanical tachometer, Electrical Tachometer, incremental optical Encoder, Eddy current drag cup tachometer.	02	
	3.3 Magnetic pickup tachometer, Stroboscopic tachometer, Photoelectric tachometer, non-contacting electrical tachometer (inductive pick up & capacitive pick up)	03	
Unit 04: Temperature measurement	**4.1** Principles of Temperature measuring devices – change in physical state, expansion, electrical resistance, thermoelectric Emf, intensity of radiation, Change in chemical state.	02	
	4.2 Construction, working, measuring range, accuracy, applications, limitations of (Bimetal thermometer, pressure spring thermometer, Electrical resistance thermometer, Thermistor, Thermocouple, Pyrometer).	02	
	4.3 Errors in Temperature measurement (i) Instrument error – calibration error, ambient temperature error, hysteresis error. (ii) Thermal probe error – Time lay error, conduction error, radiation error, velocity of error	02	

	4.4 Calibration of temperature measuring instruments- Direct comparison method, fixed point method.	02	
Unit 05: Flow and Pressure measurement	**5.1** Classification of Flow measurement device (1) Volumetric or primary and (2)rate of flow or secondary meters, their function and Ex.	01	
	5.2 Volumetric or Primary meters - Bellow type meter, Rotating impeller type meter, Positive displacement meter, Rotating lobe meter, Nutating disc Meter, Their function, working principle, sketches, applications and limitations	02	
	5.3 Rate of flow or Secondary meters – Obstruction meters • Orifice, Venturimeter, Flow nozzles, Variable area meter, Pitot tube • **Velocity probes** Total pressure probes, Static pressure probes, Direction sensing probes • **Special meters** Turbine meter, Hot wire anemometer, Magnetic flow meter Their function, working principle, sketches, applications and limitations.	02	
	5.4 Classification of Pressure measuring devices – Manometer, Elastic gauges Diaphragm, Pressure capsules, Bellows, Pressure springs Electronic pressure sensors/Transducers - Resistance, Inductance and Capacitive type. principle, working, sketches, applications and limitations of above pressure measuring devices	03	
	5.6 Low pressure gauges- McLeod Gauge, Pirani gauge. **5.7** Calibration of pressure gauges using Dead weight Pressure tester.	02	
Unit 06: Strain measurements	**6.1** Strain Measurement- Stress- strain relation, types of strain gauges, Strain gauge materials.	02	
	6.2 Resistance strain gauge- Bonded and unbounded, types (foil, semiconductor, wire wound gauges)	02	
	6.3 Selection and installation of strain gauges, Load cells, Strain rosettes.	01	
	Total Class Required	44	

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