

INSTRUMENTATION AND CONTROL SYSTEMS

VII Semester: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME019	CORE	L	T	P	C	CIA	SEE	Total
		3	1	2	4	30	70	100
Contact Classes: 45		Tutorial Classes: 15		Practical Classes: 12			Total Classes: 60	
<p>COURSE OBJECTIVES: The students will try to learn:</p> <p>I The fundamental knowledge of measuring principles, configuration and functional description of instruments with static, dynamic inputs and error control.</p> <p>II The concepts and working of instrumentation devices for displacement, flow, dynamic and other mechanical measurement applications.</p> <p>III Instrumentation practices and automatic control system for monitoring industrial real time processes within limits of parameter specifications.</p>								
<p>COURSE OUTCOMES:</p> <p>CO 1 Recognize the importance of basic principles, configuration and functional description of measuring instruments.</p> <p>CO 2 Describe performance characteristics of an instrument when the device is exposed to measure dynamic inputs and error control.</p> <p>CO 3 Categorize the measuring instruments based on the principle of working with the physical parameters such as displacement, temperature and pressure.</p> <p>CO 4 Explain calibration of instruments for measurement of all types of mechanical parameters.</p> <p>CO 5 Demonstrate working principle of level measuring devices for ascertaining liquid level and choose appropriate device for controlling fluid level in industrial applications.</p> <p>CO 6 Discuss the theory, phenomena and working principle of flow measuring instruments and calibration.</p> <p>CO 7 Make use of appropriate instrument for measuring Speed, Acceleration and Vibration by considering different aspects.</p> <p>CO 8 Demonstrate the concepts for measurement of Stress, Strain, Humidity and their application for finding stress, strain, and humidity.</p> <p>CO 9 Describe the principles of measurement of force, torque and power and their application in industries for finding force, torque and power.</p> <p>CO 10 Apply relevant control systems for speed, position and control processes in practical applications.</p>								
UNIT-1	PRINCIPLES OF MEASUREMENT							
Definition – Basic principles of measurement – Measurement systems, generalized configuration and functional descriptions of measuring instruments – examples. Dynamic performance characteristics – sources of error, Classification and elimination of error.								
UNIT-II	MEASUREMENT OF DISPLACEMENT, TEMPERATURE, PRESSURE							
Measurement of Displacement: Theory and construction of various transducers to measure displacement – Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures.								

<p>Measurement of Temperature: Classification – Ranges – Various Principles of measurement – Expansion, Electrical Resistance – Thermistor – Thermocouple – Pyrometers – Temperature Indicators.</p> <p>Measurement of Pressure: Units – classification – different principles used. Manometers, Piston, Bourdon pressure gauges, Bellows – Diaphragm gauges. Low pressure measurement – Thermal conductivity gauges – ionization pressure gauges, McLeod pressure gauge.</p>	
UNIT-III	MEASUREMENT OF LEVEL, FLOW, SPEED, ACCELERATION AND VIBRATION
<p>Measurement of Level: Direct method – Indirect methods capacitive, ultrasonic, magnetic, cryogenic fuel level indicators – Bubbler level indicators. Flow Measurement: Rotameter, magnetic, Ultrasonic, Turbine flow meter, Hot – wire anemometer, Laser Doppler Anemometer (LDA).</p> <p>Measurement of Speed: Mechanical Tachometers – Electrical tachometers – Stroboscope, Noncontact type of tachometer. Measurement of Acceleration and Vibration: Different simple instruments – Principles of Seismic instruments – Vibrometer and accelerometer using this principle.</p>	
UNIT-IV	MEASUREMENT OF STRESS–STRAIN, HUMIDITY, FORCE, TORQUE AND POWER
<p>Stress Strain Measurements: Various types of stress and strain measurements – electrical strain gauge gauge factor – method of usage of resistance strain gauge for bending compressive and tensile strains usage for measuring torque, Strain gauge Rosettes.</p> <p>Measurement of Humidity: Moisture content of gases, sling psychrometer, Absorption psychrometer, Dew point meter.</p> <p>Measurement of Force, Torque and Power: Elastic force meters, load cells, Torsion meters, Dynamometers.</p>	
UNIT-V	ELEMENTS OF CONTROL SYSTEMS
<p>Elements of Control Systems: Introduction, Importance – Classification – Open and closed systems Servomechanisms–Examples with block diagrams–Temperature, speed & position control systems.</p>	
Textbooks :	
<ol style="list-style-type: none"> 1. K Padma Raju, Y J Reddy, “Instrumentation and Control Systems”, McGraw Hill Education 1st Edition, 2016. 2. S W. Bolton, “Instrumentation and Control Systems”, Newness Publisher, 1st Edition, 2004. 3. K Singh, “Industrial Instrumentation and Control”, McGraw Hill Education, 3rd Edition, 2015. 	
Reference Books :	
<ol style="list-style-type: none"> 1. Schmidt, L.V., “Introduction to Aircraft Flight Dynamics”, AIAA Education Series, 1st Edition, 1998, ISBN A-56347-226-0.G. 2. McCormick, B.W., “Aerodynamics, Aeronautics, and Flight Mechanics”, Wiley India, 2nd Edition, 1995, ISBN 97. 	
Web References :	
<ol style="list-style-type: none"> 1. https://auceipi.files.wordpress.com/2010/04/measurement-of-control-basics.pdf 	
E-Text Books:	
<ol style="list-style-type: none"> 1. https://instrumentationtools.com/category/books/ 2. https://instrumentationtools.com/what-is-instrumentation-and-control-engineering/ 	