

INSTRUMENTATION AND CONTROL SYSTEMS

VII Semester: ME									
Course Code	Category	Hours / Week			Credits	Maximum Marks			
AMEB27	Core	L	T	P	C	CIA	SEE	Total	
		3	-	-	3	30	70	100	
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45				
I. COURSE OVERVIEW:									
<p>The Present course concentrates on developing basic understanding about various instruments that are involved in measuring. This course enables the student to understand the working of various measuring instruments. The course focuses on all principles, working, advantages, disadvantages and applications of various measuring instruments. In this course; students also will gain a broad understanding of the control systems. Student can learn in detail about how to measure displacement, temperature, pressure, level, flow, acceleration, vibration, strain, humidity, force, torque and power and their appropriate application.</p>									
II. OBJECTIVES:									
The course should enable the students to:									
<ol style="list-style-type: none"> I. Visualize the concepts of measurement and dynamic performance characteristics of measuring instruments. II. Understand the measurement of typical physical quantities like displacement, temperature, pressure, discharge, and speed. III. Comprehend for machine condition monitoring systems by using seismic instruments. IV. Develop electronic servo and interfacing systems for analogue to digital measurement. 									
COURSE OUTCOMES:									
After successful completion of the course, students should be able to:									
CO 1	Recognize the importance of basic principles, configuration and functional description of measuring instruments.						Remember		
CO 2	Describe performance characteristics of an instrument when the device is exposed to measure dynamic inputs and error control.						Understand		
CO 3	Categorize the measuring instruments based on the principle of working with the physical parameters such as displacement, temperature and pressure.						Understand		
CO 4	Explain calibration of instruments for measurement of all types of mechanical parameters.						Understand		
CO 5	Demonstrate working principle of level measuring devices for ascertaining liquid level and choose appropriate device for controlling fluid level in industrial applications.						Understand		
CO 6	Discuss the theory, phenomena and working principle of flow measuring instruments and calibration.						Understand		
CO 7	Make use of appropriate instrument for measuring Speed, Acceleration and Vibration by considering different aspects.						Apply		
CO 8	Demonstrate the concepts for measurement of Stress, Strain, Humidity and their application for finding stress, strain, and humidity.						Understand		
CO 9	Describe the principles of measurement of force, torque and power and their application in industries, for finding force, torque and power.						Understand		

CO 10 Apply relevant control systems for speed, position and control processes in practical applications.		Apply
IV. SYLLABUS:		
MODULE-I	PRINCIPLES OF MEASUREMENT	Classes : 09
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.		
MODULE-II	MEASUREMENT OF DISPLACEMENT, TEMPERATURE, PRESSURE	Classes : 09
Measurement of Displacement: Theory and construction of various transducers to measure displacement, piezo electric, inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures; Measurement of temperature: Classification ranges, various principles of measurement, expansion, electrical resistance, thermistor, thermocouple, pyrometers, temperature indicators; Measurement of pressure: MODULEs, classification, different principles used, manometers, piston, bourdon pressure gauges, Bellow, diaphragme gauges. low pressure measurement, thermal conductivity gauges, ionization pressure gauges, Mcleod pressure gauge.		
MODULE-III	MEASUREMENT OF LEVEL, FLOW, SPEED, ACCELERATION AND VIBRATION	Classes: 09
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); 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.		
MODULE-IV	MEASUREMENT OF STRESS – STRAIN, HUMIDITY, FORCE, TORQUE AND POWER	Classes: 09
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 rosette; Measurement of Humidity: Moisture content of gases, sling psychrometer, Absorption psychrometer, Dew point meter; Measurement of Force, Torque and Power: Elastic force meters, load cells, torsion meters, dynamometers.		
MODULE-V	ELEMENTS OF CONTROL SYSTEMS	Classes : 09
Elements of Control Systems: Introduction, importance, classification, open and closed systems, servomechanisms examples with block diagrams, temperature, speed and position control systems.		
V. Text Books:		
1. D. S. Kumar, “Measurement Systems: Applications & Design”, Anuradha Agencies. 2. C. Nakra, K. K. Choudhary, “Instrumentation, Measurement & Analysis”, TMH.		

VI. Reference Books:

1. Chennakesava R Alavala, “Principles of Industrial Instrumentation and Control Systems”, Cengage Learning.
2. S. Bhaskar, “Instrumentation and Control systems”, Anuradha Agencies.
3. Holman, “Experimental Methods for Engineers”, McGraw Hill.
4. R. K. Jain, “Mechanical and Industrial Measurements”, Khanna Publishers.
5. Sirohi, Radhakrishna, “Mechanical Measurements”, New Age
6. A. K. Tayal, “Instrumentation & Mech. Measurements”, Galgotia Publications.

VII. Web References:

1. <http://nptel.ac.in/courses/112106138/>

VIII. E-Text Book:

1. <http://elearning.vtu.ac.in/newvtuelc/courses/10ME42B.html>