



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

INSTRUMENTATION AND CONTROL SYSTEMS								
VII Semester: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AMEC39	Core	3	0	0	3	30	70	100
Contact Classes: 45		Tutorial Classes: Nil		Practical Classes: Nil		Total Classes: 45		
Prerequisite: Machnie Tools and Metrology								
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 COURSE OBJECTIVES:								
The students will try to learn:								
<ol style="list-style-type: none"> I. The fundamental knowledge of measuring principles, configuration and functional description of instruments with static, dynamic inputs and error control. II. The concepts and working of instrumentation devices for displacement, flow, dynamic and other mechanical measurement applications. III. Instrumentation practices and automatic control system for monitoring industrial real time processes within limits of parameter specifications. 								
III.COURSE SYLLABUS:								
MODULE-I: PRINCIPLES OF MEASUREMENT (09)								
<p>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.</p>								
MODULE –II: MEASUREMENT OF DISPLACEMENT, TEMPERATURE, PRESSURE (09)								
<p>Measurement of Displacement: Theory and construction of various transducers to measuredisplacement – 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: 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>								
MODULE –III: MEASUREMENT OF LEVEL, FLOW, SPEED, ACCELERATION AND VIBRATION (09)								
<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>								

MODULE –IV: MEASUREMENT OF STRESS–STRAIN, HUMIDITY, FORCE, TORQUE AND POWER (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 Rosettes. 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 (09)

Elements of Control Systems: Introduction, Importance – Classification – Open and closed systems Servomechanisms – Examples with block diagrams–Temperature, speed & position control systems

V. TEXT BOOKS:

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.

VI. REFERENCE BOOKS:

1. D.S Kumar, “ Measurement Systems, Applications & Design ”, Anuradha agencies , 4th Edition, 2016
2. B.C Nakra, K.K Choudary, ”Instrumentation , measurement & analysis , McGraw Hill Education 3rd Edition, 2010

VII. WEB REFERENCES:

1. <https://nptel.ac.in/courses/112/103/112103261/>
2. <https://nptel.ac.in/courses/108/105/108105064/>