COURSE CONTENT

INSTRUMENTATION AND CONTROL SYSTEMS								
IV Semester: ME								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
2540323	**Foundation**	3	0	0	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisites: **There are no prerequisites to take this course.**								

Course Objectives:

- Understanding the basic characteristics of a typical instrument. Identifying errors and their Types that would occur instrument.
- Identifying properties used for evaluating the thermal systems.
- The concept of transducer and Various types and their characters of Engineering metrology and its practice which is having increasing importance in industry

Course Outcomes: After completion of the course the student is able to

- To identify and analyse various errors that would occur in instruments (L3).
- Identify the different displacement measurement techniques and temperature measurement techniques, used in industries (L4).
- To know the working principles of various instruments to measure level (L2).
- Students will be able differentiate between mechanical electrical tachometers.(L3)
- Student will be able select appropriate device for the measurement of parameters like humidity, strain, force and torque(L4)
- Suggest control systems for speed, position and control in practical applications(L4)

UNIT – 1 **[9]**

Definition – Basic principles of measurement – Measurement systems, generalized configuration and functional description of measuring instruments – examples. Static and Dynamic performance characteristics – sources of errors, Classification and elimination of errors.

Measurement of Displacement: Theory and construction of various transducers to measure displacement – Piezo electric, Inductive, capacitance.

UNIT – 2 **[10]**

Measurement of Temperature: Various Principles of measurement- Classification: Expansion Type: Bimetallic Strip- Liquid in glass Thermometer; Electrical Resistance Type: Thermistor, Thermocouple, RTD; Radiation Pyrometry: Optical Pyrometer; Measurement of Pressure: Different principles used- Classification: Manometers, Dead weight pressure gauge. Tester (Piston gauge), Bourdon pressure gauges, Bulkmodulus pressure gauges; Bellows – Diaphragm gauges. Low pressure measurement – Thermal conductivity gauges, ionization pressure gauges, Mcleod pressure gauge.

UNIT – 3 **[9]**

Measurement of Level: Direct methods – Indirect methods – Capacitive, Radioactive, Ultrasonic, Magnetic, Cryogenic Fuel level indicators – Bubbler level indicators.

Flow measurement: Rotameter, magnetic, Ultrasonic, Turbine flow meter, Hot – wire anemometer. Measurement of Speed: Mechanical Tachometers, Electrical tachometers, Non- contact type-Stroboscope Measurement of Acceleration and Vibration: Different simple instruments – Principles of Seismic instruments – Vibrometer and accelerometer using this principle- Piezo electric accelerometer.

UNIT – 4 **[10]**

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 – Use of strain gauges for measuring torque, Strain gauge Rosettes.

Measurement of Humidity: Moisture content of gases, Sling Psychomotor, Absorption Psychomotor, Dew point meter.

Measurement of Force, Torque and Power- Elastic force meters, load cells, Torsion meters, Dynamometers.

UNIT – 5 **[10]**

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

TEXT BOOK:

- Instrumentation mechanical measurements and control by A.k.tayal, Galogtia publications/2nd Edition
- Mechanical measurements & control by Dr D.S.Kumar, metropolitan book co pvt ltd/1st Edition

REFERENCE BOOK:

- Control systems by A.nagoorkani, RBA Publications/1st Edition
- Instrumentation Measurements and Analysis by B.C. Nakra, Tata mc grawhill Publishers/3rd Edition
- Electric Measurements & Instrumentation by K. Lalkishore,Pearson publications/1st Edition

Electronic Resources:

1. https://instrumentationtools.com/free-pdf-downloads/
2. https://www.cedengineering.com/userfiles/Introduction%20to%20Control%20and%20%20Instrumentation-R1.pdf
3. https://www.scribd.com/document/884030601/Control-and-Instrumentation-Systems-Notes

Materials Online:

1. Course template
2. Tutorial question bank
3. Tech talk and Concept Video topics
4. Open-ended experiments
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper – II
9. Lecture notes
10. E-Learning Readiness Videos (ELRV)