

## **10 ME 414 MECHANICAL MEASUREMENTS AND CONTROL**

### **IV B.Tech I Semester**

*(with effect from the academic year 2013-2014)*

*Credits: 4*

*Lectures/week: 4Hrs.*

*Sessional Marks: 40*

*University Exam: 3 Hrs*

*End Examination Marks: 60*

#### **UNIT-I**

Basic concepts: Introduction, Definition of terms – Span and Range, Readability, Sensitivity, accuracy, Precision, Threshold, Resolution and Hysteresis – Calibration standards. The generalized measurement system. Basic concepts in dynamic measurement – amplitude response, frequency response, phase response, delay time and time constant.

Analysis of experimental data and types of experimental errors. Combination of component errors in overall system accuracy. Method of least squares, Graphical analysis and curve fitting.

#### **UNIT-II**

Transducers – Introduction, Loading of the Signal Source, Impedance matching, Electric transducer elements – advantages Variable resistance, Differential transformer, Capacitance, Piezoelectric and Ionization transducer.

Measurement of Pressure and Vacuum: Pressure measurement – liquid column elements, elastic elements, very high pressure measurement. High vacuum measurement – McLeod gauge, Pirani gauge and Thermocouple vacuum gauge.

#### **UNIT-III**

Measurement of Flow: Positive displacement meters, rotameters, turbine meter and magnetic flow meter, Measurement of fluid velocities – Pitot tubes, Yaw tubes, hot wire and hot film anemometer flow visualization methods.

Expansion Thermometers, Thermocouples, Resistance thermometers and Pyrometers.

Measurement of Force and Torque: Basic force measurement methods. Mass balance methods, hydraulic and pneumatic load cells and elastic elements for force measurement.

#### **UNIT-IV**

Strain Measurement: Strain measurement by Electrical Resistance Strain gauge – Principle, Method of fixing, Measurement of output, Temperature compensation.

Vibration and acceleration measurement: Seismic instruments – Principle, application in the measurement of vibration and acceleration.

#### **UNIT-V**

Control Systems: Classification of control systems – Open loop, Closed loop and automatic control systems, Concepts of servomechanism, process control and regulator.

Transfer function, block diagrams, signal flow graphs and stability criterion.

Hydraulic and pneumatic control systems.

#### **TEXT BOOKS:**

1. Mechanical measurements and Control Engg. : Kumar D.S.
2. Mechanical measurements : Beckwith T.G. & Lewis Buck N.

#### **REFERENCES:**

1. Mechanical measurements : Sirohi R.S. & Radha Krishna H.C.
2. Experimental methods for Engineers : Holmen J.P.
3. Basic Instrumentation : Higgins O