3/4 B.Tech. SIXTH SEMESTER

ME6T1 MECHANICAL MEASUREMENTS Credits: 3

Lecture:- 3 periods/week **Internal assessment: 20marks**
Practice: - - **Semester end examination: 70 marks**

Objectives:

1. Demonstrate fundamentals, basic procedures for operating, testing, calibration and the characteristics of an instrument.
2. Select different types of instruments their construction details, working principle which are used to measure different parameters like displacement, pressure, temperature, level, flow, speed, vibration etc.
3. Know the construction details, working principle and mounting of strain gauges for measurement of bending, compressive and tensile forces.
4. Interpret working principle of various instruments used for measurement of humidity, torque and power.
5. Illustrate various basic reasons for pollution, methods used for controlling pollution.

Learning outcomes:

At the end of course the students will be able to:

1. Analyze the basic elements, characteristics and errors of an instrument.
2. Select the instrument for measurement of displacement, temperature, pressure, fluid flow and level.
3. Explain how to measure speed, vibration using various instruments.
4. Describe the working principle of strain gauges, mounting procedures for measurement of bending, compressive, tensile forces.
5. Express how to measure humidity, force, torque and power.
6. Chose a system for measurement and control of pollution.

Pre Requisites:

Basic electrical and electronics.

UNIT-I

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:

Theory and construction of various transducers to measure displacement- piezoelectric, 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.

UNIT-III

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.

UNIT-IV

MEASUREMENT OF LEVEL:

Direct method- Indirect methods- capacitative, ultrasonic, magnetic, cryogenic fuel level indicators-bubbler level indicators

FLOW MEASUREMENT:Rotameter, magnetic, ultrasonic, turbine flow meter, hot-wire anemometer, laser doppleranemometer(LDA).

UNIT-V

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.

UNIT-VI

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.

UNIT-VII

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

UNIT-VIII

MEASUREMENT OF POLLUTION CONTROL:

Introduction- Air pollution, Metrological aspects of air polluting sampling and measurement -Air pollution control methods and equipment control of specific gaseous pollutants.

Learning resources

Text books:

1. Measurement Systems: Applications and design, by D.S.Kumar “” McGraw Hill, 2004
2. Mechanical Measurements, by Beck With, Marangoni, Linehard, PHI,PE
3. Environmental pollution control Engineering, by Rac. C.S, Wiley Estran Limited, 2006.

Reference books:

1. Measurement systems: Application and design, by Doeblin Earnest. O. Adaptation, Manik and Dhanesh “” , TMH
2. Experimental Methods for Engineers by Holman, McGraw Hill
3. Mechanical and Industrial Measurements, by R.K.Jain, Khanna Publishers
4. Instrumentation Measurement and Analysis, by B.C.Nakkra and K.K.Chowdary, TMH