III B.TECH- II SEMESTER
MECHANICAL MEASUREMENTS

Course Code: ME6T1 **Credits: 3**
Lecture: 3 Periods/week **Internal assessment: 30 marks**
Tutorial: 1 Period /week **Semester end examination: 70 marks**

COURSE OBJECTIVES:

- Demonstrate fundamentals, basic procedures for operating, testing, calibration and the characteristics of an instrument.
- 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.
- Know the construction details, working principle and mounting of strain gauges for measurement of bending, compressive and tensile forces.
- Interpret working principle of various instruments used for measurement of humidity, torque and power.
- Illustrate various basic reasons for pollution, methods used for controlling pollution.

COURSE OUTCOMES:

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

1. Identify the basic elements, configuration, errors and characteristics of an instrument.
2. Describe the instruments for the measurement of displacement, temperature, pressure, fluid flow, level.
3. Explain the instruments used for the measurement of speed, acceleration and vibration.
4. Discuss the measurement of force, torque, power & applications of strain gauges.
5. Discuss about the humidity measurement equipment, Air pollution sampling & control.

Pre Requisites: Basic Electrical and Electronics.

UNIT I

DEFINITION:

Basic principles of measurement, measurement systems, generalized configuration and functional descriptions of measuring instruments- examples, static and dynamic performance characteristics, sources of error, classification and elimination of error, calibration procedure.

MEASUREMENT OF DISPLACEMENT:

Theory and construction of various transducers to measure displacement, piezoelectric, inductive, capacitance, resistance, ionization and photo electric transducers,

MEASUREMENT OF TEMPERATURE: Classification, ranges, various principles of measurement- expansion, electrical resistance, thermistor, thermocouple, pyrometers temperature indicators.

UNIT II

MEASUREMENT OF PRESSURE:

Units- classification- different principles used, manometers, piston, bourdon the pressure gauges, bellows- diaphragm gauges, low pressure measurement- thermal conductivity gauges, ionization pressure gauges, Mcleod pressure gauge.

MEASUREMENT OF LEVEL:
Direct method- Indirect methods- capacitive, ultrasonic, magnetic, cryogenic fuel level indicators-bubbler level indicators
FLOW MEASUREMENT: Rota meter, magnetic, ultrasonic, turbine flow meter, hot-wire anemometer, Laser Doppler Anemometer (LDA).

UNIT III
MEASUREMENT OF SPEED:
Mechanical tachometers, electrical tachometers, stroboscope, noncontact type of tachometer
MEASUREMENT OF ACCELERATION AND VIBRATION: Different simple instruments, principles of seismic instruments- vibro meter and accelerometer using this principle.

UNIT IV
MEASUREMENT OF FORCE,TORQUE AND POWER: Elastic force meters, load cells ,torsion meters, dynamometers
STRESS STRAIN MEASUREMENTS:
Various types of stress and strain measurements- electrical strain gauge-gauge factor, method of usage of resistance strain gauge for determining bending, compressive and tensile strains-usage for measuring torque, strain gauge rosettes.

UNIT V
MEASUREMENT OF HUMIDITY:
Moisture content of gases, sling psychomotor, absorption psychomotor, Dew point meter.
MEASUREMENT OF POLLUTION CONTROL: Introduction- Air pollution, Metrological aspects, air pollution sampling and measurement -Air pollution control methods and equipment, control of specific gaseous pollutants.

Learning Resources

Text books:
1. Mechanical measurements, by Thomas G. Beckwith, Nelson Lewis Buck, Roy D. Marangoni, Addison-Wesley Pub. Co
2. Mechanical Measurements, by Beckwith, Marangoni, Linehard, PHI, PE
3. Environmental pollution control Engineering, by Rao. C.S, New Age International Pvt. Ltd., 2nd Edition, 2006.
Reference books:
1. Measurement systems: Application and design, by Doeblin Earnest. O.Manik and Dhanesh TMH
2. Experimental Methods for Engineers by Holman, McGraw Hill
3. Mechanical Measurements and control, by Dr. D.S.Kumar, Metropolitan Book Co. Pvt. Ltd.
4. Instrumentation Measurement and Analysis, by B.C.Nakra and K.K.Chaudhry, Mc Graw Hill Education (India) Private Limited.