32081- MECHANICAL INSTRUMENTATION

DETAILED SYLLABUS

UNIT- I TYPES OF MEASUREMENT

Classification of instruments - Static terms and characteristics - Range and Span, Accuracy and Precision, Reliability, Calibration, Hysteresis and Dead zone, Drift, Sensitivity, Threshold and Resolution, Repeatability and Reproducibility, Linearity. Dynamic characteristics - Speed of response, Fidelity and Dynamic errors, overshoot. Measurement of error - Classification of errors, environmental errors, signal transmission errors, observation errors, operational errors Transducers: Classification of transducers, active and passive, resistive, inductive, capacitive, piezo-resistive, thermo resistive.

UNIT- II DISPLACEMENT MEASUREMENT

Capacitive transducer, Potentiometer, LVDT, RVDT, Specification, Selection & application of displacement transducer. Optical measurement scale anden coders Pressure Measurement: Low pressure gauges- McLeod Gauge, Thermal conductivity gauge, Ionization gauge, Thermocouple vacuum gauge, Pirani gauge. High Pressure gauge- Diaphragm, Bellows, Bourdon tube, Electrical resistance type, Photoelectric pressure transducers, piezoelectric type, Variable capacitor type

UNIT- III TEMPERATURE MEASUREMENT

Non-electrical methods - Bimetal, Liquid in glass thermometer and Pressure thermometer. Electrical methods - RTD, Platinum resistance thermometer, Thermistor, Thermoelectric methods - elements of thermocouple, Seebek series, law of Intermediate metals, thermo emf measurement. Flow Measurements: Variable area meter - Rota meter, Variable velocity meter – Anemometer, Special flow meter - Hot wire anemometer, Electromagnetic flow meter, Ultrasonic flow meter, Turbine meter, Vortex shedding flow meter

UNIT- IV MISCELLANEOUS MEASUREMENT

Introduction to sound measurement and study of Electro dynamic microphone and Carbon microphone. Humidity measurement –Hair hygrometer, Sling psychrometer, Liquid level measurement – direct and indirect methods. Force & Shaft power measurement - Tool Dynamometer (Mechanical Type), Eddy Current Dynamometer, Strain Gauge Transmission Dynamometer. Speed measurement -Eddy current generation type tachometer, incremental and absolute type, Mechanical Tachometers, Revolution counter & timer, Slipping Clutch

Tachometer, Electrical Tachometers, Contact less Electrical tachometer, Inductive Pick Up, Capacitive Pick Up, Stroboscope, Strain Measurement - Stress-strain relation, types of strain gauges, strain gauge materials, resistance strain gauge- bonded and unbounded, types (foil, semiconductor, wire wound gauges), selection and installation of strain gauges load cells, rosettes.

UNIT- V CONTROL SYSTEMS

Block diagram of automatic control system, closed loop system, open loop system, feedback control system, feed forward control system, servomotor mechanism. Comparison of hydraulic, pneumatic, electronic control systems, Control action: Proportional, Integral, derivative, PI, PD, PID. Applications of measurements and control for setup for boilers, air conditioners, motor speed control.

TEXT BOOKS

1) Mechanical Measurements &Control-D.S.Kumar-Metropolitan Publications, New Delhi.
2) Mechanical & Industrial Measurements-R.K.Jain-Khanna Publications, NewDelhi,
3) Mechanical Measurements &Instrumentation-A.K. Sawhney- Dhanpat Rai & Sons, New Delhi.
4) Measurement Systems-E. O. Doebelin-Tata McGraw Hill Publications.
5) Mechanical Measurement &Control-R.V. Jalgaonkar-Everest Publishing House, Pune