Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
M. Tech. in Thermal Engg.	Measurement and Process Control	MET 506	SM+MT+ET 25+25+50
Semester	**Credits**	**L-T-P**	**Exam.**
II	4	3-1-0	3 **Hours**

Unit – I

Need and Objective of Experimental Study: Introduction; Measurement Systems; Performance Terms; Wind Tunnels: Introduction; Classification; Low-speed Wind Tunnels; Power Losses in Wind Tunnel; Instrumentation and Calibration of Wind Tunnels; Wind Tunnel Balance; Data Acquisition system; Static and Dynamics characteristic of instruments. **(08 Hours)**

Unit – II

Flow Visualization: Introduction; Classification of Visualization Techniques; Interferometer; Schlieren and Shadowgraph; Hot-Wire Anemometry: Introduction; Operating Principle; Hot-Wire Filaments; Constant Current Hot-Wire Anemometer (CCA); Constant Temperature Hot-Wire Anemometer; Hot-Wire Probes; Limitations of Hot-Wire Anemometer. **(07 Hours)**

Unit – III

Analog Methods: Introduction; Hale-Shaw Apparatus; Electrolytic Tank; Hydraulic Analogy; Hydraulic Jumps; Pressure Measurement Techniques: Introduction; Barometers; Manometers; Dial type pressure gauge; Pressure Transducers; Pitot; Static; and Pitot-Static Tube and Its characteristics; Flow direction measurement probes and Low Pressure Measurement Gauges.

(06 Hours)

Unit – IV

Velocity Measurement: Introduction; Velocity & Mach number from pressure measurements; Laser droplet anemometer- LDA Principle; Doppler shift equation; Reference beam system; Fringe system. Measurement of velocity by Hot-Wire Anemometer; Measurement of velocity using vortex shedding Technique; Fluid Jet Anemometer; Mass & volume flow measurement.

(09 Hours)

Unit – V

Temperature Measurement: Introduction; Types of thermometers; Thermocouples; RTD; Thermistors; Pyrometers; Temperature measurement in fluid flow. **(06 Hours)**

Unit – VI

Uncertainty Analysis: Introduction; Estimation of measurement errors; External estimation of errors; Internal estimate of the error; Uncertainty Analysis- Uses of uncertainty analysis; Uncertainty estimation; General procedure- Uncertainty in flow Mach number; Uncertainty calculation.

(09 Hours)

Recommended Books:

1. Instrumentation; Measurements and Experiments in Fluids; E. Rathakrishnan; CRC press; 2007.
2. Experimental methods for Engineers; Jack Philip Holman; Walter J. Gajda; McGraw-Hill; 4th Edition; 1984.
3. Measurement Systems; Ernest Doebelin; McGraw Hill Professional; 2003.
4. Mechanical Measurements; Thomas G. Beckwith; Nelson Lewis Buck; Addison-Wesley Pub. Co.; 5th Edition; 1961.
5. Instrumentation for Process Measurement and Control; Norman A. Anderson; CRC Press; 3rd Edition; 1997.