

**OBJECTIVE:**

- To provide extensive treatment of the operating principles and limitations of pressure and temperature measurements. To cover both operating and application procedures of hot wire anemometer. To describe flow visualization techniques and to highlight in depth discussion of analog methods.

**UNIT I BASIC MEASUREMENTS IN FLUID MECHANICS**

Objective of experimental studies – Fluid mechanics measurements – Properties of fluids – Measuring instruments – Performance terms associated with measurement systems – Direct measurements - Analogue methods – Flow visualization – Components of measuring systems – Importance of model studies.

**UNIT II WIND TUNNEL MEASUREMENTS**

Characteristic features, operation and performance of low speed, transonic, supersonic and special tunnels - Power losses in a wind tunnel – Instrumentation and calibration of wind tunnels – Turbulence- Wind tunnel balance – Wire balance – Strut-type – Platform-type – Yoke-type – Pyramid type – Strain gauge balance – Balance calibration.

**UNIT III FLOW VISUALIZATION AND ANALOGUE METHODS**

Visualization techniques – Smoke tunnel – Hele-Shaw apparatus - Interferometer – Fringe-Displacement method – Schlieren system – Shadowgraph - Hydraulic analogy – Hydraulic jumps – Electrolytic tank.

**UNIT IV PRESSURE, VELOCITY AND TEMPERATURE MEASUREMENTS**

Pitot - static tube characteristics - Velocity measurements - Hot-wire anemometry – Constant current and Constant temperature Hot-Wire anemometer – Pressure measurement techniques - Pressure transducers – Temperature measurements.

**UNIT V SPECIAL FLOWS AND UNCERTAINTY ANALYSIS**

Experiments on Taylor-Proudman theorem and Ekman layer – Measurements in boundary layers - Data acquisition and processing – Signal conditioning – Uncertainty analysis – Estimation of measurement errors – External estimate of the error – Internal estimate of the error – Uncertainty calculation - Uses of uncertainty analysis.

**TEXT BOOKS:**

1. Rathakrishnan, E., "Instrumentation, Measurements, and Experiments in Fluids," CRC Press – Taylor & Francis, 2007.
2. Robert B Northrop, "Introduction to Instrumentation and Measurements", Second Edition, CRC Press, Taylor & Francis, 2006.

**REFERENCES:**

1. Bradsaw "Experimental Fluid Mechanics", Elsevier, 2nd edition, 1970.
2. Pope, A., and Goin, L., "High Speed Wind Tunnel Testing", John Wiley, 1985.