EXPERIMENTAL METHODS IN THERMAL ENGINEERING

Course Code: 15ME2310

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Course Outcomes: At the end of the course, student will be able to

CO1: Identify the suitable instrument for measuring transport parameters and estimate error

CO2: Detect suitable range of pressure gauge and compute its dynamic response

CO3: Distinguish different flow visualization methods and temperature measurements.

CO4: Determine thermal conductivity in solids, liquids and gases and radiation measurements

CO5: Develop transfer function of given mechanical system by using concept of control system.

UNIT-I (10-Lectures)

Instrument classification, static and dynamic characteristics of instruments, experimental error analysis, systematic and random errors, statistical analysis, uncertainty, reliability of instruments,

Variable resistance transducers, capacitive transducers, piezoelectric transducers, photoconductive transducers, photovoltaic cells, ionization transducers, Hall effect transducers.

UNIT-II (10-Lectures)

Dynamic response considerations, Bridgman gauge, McLeod gauge, Pirani thermal conductivity gauge, Knudsen gauge, Alphatron.

UNIT-III (10-Lectures)

Flow measurement by drag effects; hot-wire anemometers, magnetic flow meters, flow visualization methods, interferometer, Laser Doppler anemometer.

Temperature measurement by mechanical effect, temperature measurement by radiation, transient response of thermal systems,

thermocouple compensation, temperature measurements in high- speed flow.

UNIT-IV (10-Lectures)

Thermal conductivity measurement of solids, liquids, and gases, measurement of gas diffusion, convection heat transfer measurements, humidity measurements, heat-flux meters.

Detection of thermal radiation, measurement of emissivity, reflectivity and transmissivity, solar radiation measurement.

UNIT-V (10-Lectures)

Review of open and closed loop control systems and servo mechanisms, Transfer functions of Mechanical Systems, input and output systems.

TEXT BOOK:

Holman, J.P., "*Experimental methods for engineers"*, Tata McGraw-Hill, 7th Edition, 2007.

REFERENCES:

1. Prebrashensky V., "*Measurement and Instrumentation in Heat Engineering"*, Vol.1, MIR Publishers, 1980.
2. Raman C.S. Sharma G.R., Mani V.S.V., "*Instrumentation Devices and Systems*", 2nd Edition, Tata McGraw-Hill., 2001.
3. Morris A.S, "*Principles of Measurements and Instrumentation"*, 3rd Edition, Butterworth-Heinemann, 2001.