Experiments in Aerospace Engineering I (AE 251)
2L-0T-2P-0A (8 credits) **Prereq.:**

Objectives of the course: Introduction to principles of measurement, sensors and data acquisition, and the issue of experimental accuracy.

Course content: Principles of Measurement, Dimensional Analysis, Error analysis and data reduction, Sensors, Data acquisition, Virtual Instrumentation, Virtual instrumentation Lab, Demo experiments with sensors and data acquisition.

Lecture Component of the course

Content	Number of Lectures
Principles of measurement • Introduction • Description of Measuring Instruments • Performance Characteristics of Instruments, Calibration, Accuracy, Precision, Bias, Dynamic response	4
Virtual Instrumentation and Data acquisition • Introduction to VI • Graphical programming using LABView: Vis and sub Vis, loops, arrays, clusters, file I/O • Data acquisition: ADC, DAC, DIO, serial and GPIB communication • Motion control system	10
Sensors • Strain Gage • Motion • Force, Torque, Power • Pressure and Sound • Temperature and Heat Flux • Flow	8
Error analysis and data reduction • Uncertainties in measurements • Probability distributions • Propagation of errors • Estimates of Mean and Errors • Curve fits	4
Advanced Optical Measurements (PIV, LDV,etc.)	2
Total	**28**

Laboratory Component of the course

Content	No. of Lab. Hours
Virtual Instrumentation Lab • Data acquisition • Signal conditioning • Data reduction	12
Experiments with motion sensors (LVDT, accelerometer, displacement sensor)	4
Experiments with pressure sensors (manometer, strain gage, piezo-electric)	4
Experiments with load cells	2
Experiments with Thermocouples	2
Laser based flow measurements (PIV, LDV)	4
Total	**28**

Suggested Text/ Reference books:

1. Measurement Systems Application and Design, E. O. Doebelin
2. Data Reduction and Error Analysis for Physical Sciences, P. R. Bevington and D. K. Robinson.
3. Experimental Stress Analysis, James W. Dally, William F. Riley
4. Mechanical Behavior of Materials, Norman E. Dowling