AE 3610 – Experiments in Fluid and Solid Mechanics

HOURS: 1-3-2

CATALOG DESCRIPTION: Experimental laboratory in solid and fluid mechanics, aerodynamics, propulsion. Emphasis on measurement techniques, analysis and interpretation of data, comparison to analytical predictions, and reporting.

PREREQUISITES:
AE 2010 Thermodynamics and Fluids Fundamentals
AE 2610 Introduction to Experimental Methods in Aerospace
COE 3001 Deformable Bodies

COURSE OBJECTIVES:

1) Hands-on experience in the areas of fluid and solid mechanics in order to investigate and validate theoretical concepts from foundation courses.
2) Use of laboratory instrumentation, and measurement techniques commonly used in aerospace engineering.
3) Familiarity with aspects of data reduction such as sampling, filtering, frequency analysis, uncertainty analysis, and proper data fitting methods.
4) Reporting of technical information through effective graphics, formal reports, data reports, and technical presentations.
5) design of experiments including scaling and similarity parameters.

LEARNING OUTCOMES:

Students will:

- gain basic laboratory skills through hands-on learning and analysis of data
- have an operating knowledge of laboratory instrumentation, sensors, transducers, and experimental techniques used in aerospace engineering
- reinforce their understanding of fundamental of solid and fluid mechanics principles and develop intuition through experimental experience
- increase their critical reasoning, strategic thinking, and decision making skills through student-led experiments
- have the ability to work effectively in teams

TOPICAL OUTLINE:

Topics	Weeks
1. Course overview and introduction	1
2. Pressure measurements in a low speed wind tunnel	1
• Pressure tabs, pitot probes, piezoresistive and capacitive pressure transducers	
• Pressure coefficients, boundary layers, wakes	2
3. Velocity measurements in a jet flow field	
• Hot-wire anemometry and LDV	
• Shear layers, jets and turbulence	1
4. Jet engine testing	
• Thermocouples	
• Thermodynamic component analysis, heat transfer	1
5. Supersonic nozzle and wind tunnel flow	
• Schlieren imaging, pressure measurements	
• Isentropic flow, shocks	

6. Stress-strain characterization of metallic alloys	1
7. Orthotropic properties of composite materials	1
8. Material behavior under combined tension/torsion loading	1
9. Stress and strain response of a thin-walled pressure vessel	1
10. Column and shell buckling	1
11. Experimental planning	2