AE 4220 - Structural Dynamics and Aeroelasticity

Hours: 3-0-3

CATALOG DESCRIPTION (25 words or fewer):
Structural dynamics of one-dimensional systems. Analysis of static aeroelastic phenomena, unsteady aerodynamics and flutter. Equations of motion for complete aeroelastic systems; solution techniques.

PREREQUISITES:
AE3140 Structural Analysis or AE3125 Aerospace Structural Analysis
AE3530 System Dynamics and Vibrations or AE3515 System Dynamics and Controls

COURSE OBJECTIVES: Students will learn the concept of modal analysis, various methods of structural dynamics analysis of simple beam structures and simplified analysis of such aeroelastic phenomena as divergence, control-surface reversal, and flutter. Students will learn the importance of incorporating aeroelastic phenomena in aircraft design and some elementary methods for doing so.

LEARNING OUTCOMES:
Students will:

1) be familiar with modal representation and to be able to solve elementary structural dynamics problems for beams;
2) be able to formulate and solve static aeroelasticity problems such as typical section and wing divergence problems;
3) be able to use simplified unsteady aerodynamic theories to formulate and solve typical section flutter problems with one and two degrees of freedom
4) have developed a qualitative understanding of the role of aeroelastic phenomena, such as divergence, control-surface reversal, and flutter, in aircraft design and performance.

TOPICAL OUTLINE:

I.	Structural Dynamics	7 weeks
	a. Strings	
	b. Beams in torsion	
	c. Beams in bending	
II.	Static Aeroelasticity	3.5 weeks
	a. Divergence of spring-restrained, lifting surfaces	
	b. Aileron reversal	
	c. Torsional divergence	
	d. Airload distribution	
	e. Sweep effects	
III.	Dynamic Aeroelasticity	3.5 weeks
	a. Stability analysis	
	b. The typical section	
	c. Classical flutter analysis	
	d. Unsteady aerodynamics	
	e. Flutter characteristics	
Quizzes and exams		1 week