AE 6251: SMART STRUCTURES AND STRUCTURAL CONTROL

1. Introduction and Objectives of Smart Structures and Structural Control — 2 hours

2. Actuators — 12 hours

Actuator materials including piezoelectric actuators
SMA actuators and terfenol actuator
Constitutive equations for actuator materials
Modeling structures with actuators and actuator subassemblies in structures like beams and plate lumped parameters
Distributed parameter and finite element models

3. Sensors for Structural Control — 5 hours

Accelerometer
PVDF
Strain gage
Fiberoptics and laser sensors
Models for sensors on structural systems like beams with detection circuits

4. Closed Loop Models to Integrate Smart Sensors, Smart Actuators, Structures and Compensators — 8 hours

5. Controller Design — 10 hours

Methods of improving control authority
Sensor actuator locations
Principles of feedback control techniques based on state space model including LQR, LQG, LTR, H-2, H-infinity and μ synthesis
Second and controllers including ppf, svf and aef
Design of controllers

6. Controller Validation Techniques — 5 hours

Vibration controller validation on beams by using piezoactuators
Appropriate sensors
PC based Simulink and DSP boards

7. Introduction to Other Applications: Aeroelastic Control and Adaptive Aircraft Wings — 3 hours

Midterm Exam — 1 hour

Semester Project: A term project to design and validate a Smart Structure based vibration controller or structural system.