Course Outcomes

1. Understand the fundamentally unsteady nature of turbomachine energy transfer.
2. Understand the fundamental processes involved in forced response and flutter.
3. Understand the fundamental processes involved in discrete frequency noise.
4. Understand the fundamental processes involved in compressor surge and stall.
5. Gain the ability to analyze problems in blade row interaction to predict unsteady loading, noise, and flutter boundaries.

Fundamental Concepts (4 wks)
1. Complex Numbers
2. Energy Transfer
3. Linearized Flow Equations
4. Reduced Frequency

Linear Theory Unsteady Aerodynamics (4 wks)
1. Fundamental equations
2. Rotational & irrotational splitting
3. Plane wave solutions
4. Discrete frequency noise generation

Forced Response and Flutter (5 wks)
1. Single degree-of-freedom systems
2. Stability and flutter
3. Aerodynamic damping
4. Blade row structural dynamics
5. Bladed disk vibrations
6. Wind Turbine Blade Vibration Issues

Discrete Frequency Noise Generation (2 wks)
1. Response Modes
2. Annular Duct Acoustics
3. Turbomachine & Wind Turbine Application
4. Active Noise Control

Compressor Stability (2 wks)
1. Rotating stall
2. Surge
3. Theory of initiation
4. Small perturbation stability theory
5. Surge line management

Revision Date: 6/26/2012
1. COURSE NUMBER AND NAME: ME 53300 Turbomachinery II

2. CREDITS AND CONTACT HOURS: 3 credits
   a. Lecture – 3 days per week at 50 minutes for 16 weeks

3. COURSE COORDINATOR OR INSTRUCTOR:
   S. Fleeter

4. TEXTBOOK: None

5. SPECIFIC COURSE INFORMATION:
   b. Prerequisites:
      ME 43300 – Principles of Thermodynamics or AAE 53800/ME 53800 – Air Breathing Propulsion
   c. Status: Elective

6. SPECIFIC GOALS FOR THE COURSE
   a. Course Outcomes:
      1. Understand the fundamentally unsteady nature of turbomachine energy transfer.
      2. Understand the fundamental processes involved in forced response and flutter.
      3. Understand the fundamental processes involved in discrete frequency noise.
      4. Understand the fundamental processes involved in compressor surge and stall.
      5. Gain the ability to analyze problems in blade row interaction - to predict unsteady loading, flutter boundaries, resonant response, discrete frequency noise generation and control, and rotating stall/surge onset.
   b. Related ME Program Outcomes:
      A1. Engineering Fundamentals; B3. Prof/Ethical Responsibility;
      A3. Experimental Skills; B5. Life-Long Learning;
      A4. Modern Engr Tools; C1. Leadership,
      A5. Design Skills; C2. Global Engineering Skills;
      A6. Impact of Engr Solns; C3. Innovation;
      B1. Communication Skills; C4. Entrepreneurship
      B2. Teamwork Skills

7. LIST OF TOPICS: See following page.