ME 53800 / A&AE 53800
AIR BREATHING PROPULSION

Course Outcomes
1. Understand principles of operation of turbojet, turbofan, and turboprop engines.
2. Develop the ability to select a cycle and size an engine for mission requirements.
3. Develop the ability to perform fundamental component design and analysis.
4. Develop the ability to perform component matching.
5. Develop the ability to predict on and off design operating points for an engine.

Fundamental Concepts (2 wks)
1. Review of thermodynamics
2. Review of fluid mechanics
3. Review of compressible flow
4. Basics of energy transfer

Cycle Analysis (3 wks)
1. Ideal cycle analysis
2. Engine performance parameters
3. Component performance parameters
4. Real cycle analysis
5. Design point performance

Inlet and Nozzle (1 wk)
1. Inlet performance parameters
2. Subsonic inlets
3. Supersonic inlets
4. Thrust nozzle performance

Turbomachinery (4 wks)
1. Inlet design for transonic compressors
2. Mean line design
3. Full radial equilibrium
4. Blade element design
5. CFD for design systems
6. Real fluid effects

Combustor (2 wks)
1. Diffusion combustor terminology
2. Main combustor aerodynamics
3. Combustor performance parameters
4. Radial profiles and profile factor
5. Emissions
6. Operability
7. Augmentors

Operability and Durability (2 wks)
1. Spool balancing in two-shaft engines
2. Engine off design performance
3. Compressor operability issues
4. Turbine durability issues

Revision Date: 6/17/2013
1. **COURSE NUMBER AND NAME:** ME 53800 (A&AE 53800) Air Breathing Propulsion

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

3. **COURSE COORDINATOR OR INSTRUCTOR:**
   C. Merkle

4. **TEXTBOOK:**

5. **SPECIFIC COURSE INFORMATION:**
   a. **Catalog Description:** Analysis of operating characteristics of turbojet, turbofan, turboshaft, afterburning, and ramjet propulsion systems. Analysis and design of inlet, diffuser, combustor, compressor, turbine, and nozzle. Component matching and off-design performance. Inlet distortion, nozzle-afterbody, and installation losses. Mission analysis. Typically offered in the fall.
   b. **Prerequisites:**
      ME 43800 – Gas Turbine Engines or A&AE 37200 – Jet Propulsion Power Plants
   c. **Status:**
      Elective

6. **SPECIFIC GOALS FOR THE COURSE:**
   a. **Course Outcomes:**
      1. Understand principles of operation of *turbojet, turbofan* and *turboprop engines*.
      2. Develop the ability to *select a cycle and size an engine* for mission requirements.
      3. Develop the ability to perform fundamental *component design* and *analysis*.
      4. Develop the ability to perform *component matching*.
      5. Develop the ability to *predict on- and off-design operating points* for an engine.
   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.

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**PREPARED BY:** C. Merkle

**REVISION DATE:** June 17, 2013