ABET Course Syllabus

ENAE 455 Aircraft Propulsion and Power

Credits & Contact Hours: 3 credits (3 hours of lecture)

Course Status: Required

Schedule: Offered every Fall semester

Course Description: Thermodynamic cycle analysis, aerothermochemistry of fuels and propellants, operating principles of piston, turbojet, fanjet, and other variations of airbreathing aircraft power units.

Pre-Requisites: ENAE 311, ENME 232 (or ENME 320)

Co-Requisites: None

Textbooks:
(1) P. Hill and C. Peterson. Mechanics and Thermodynamics of Propulsion. Addison-Wesley Publishing, second edition, 1992 (strongly recommended)
(2) J. Mattingly. Elements of Gas Turbine Propulsion. AIAA Education Series, 2005 (recommended)
(3) W. Bathie. Fundamentals of Gas Turbines. John Wiley & Sons, second edition,1996 (recommended)
(4) J. Kerrebrock. Aircraft Engines and Gas Turbines. The MIT Press, second edition, 1992 (recommended)
(5) G. Oates. Aerothermodynamics of Gas Turbine and Rocket Propulsion. AIAA Education Series, third edition, 1998 (recommended)
(6) W. Heiser and D. Pratt. Hypersonic Airbreathing Propulsion. AIAA Education Series, 1994 (recommended)
(7) G. Sutton. Rocket Propulsion Elements. John Wiley & Sons, sixth edition, 1992 (recommended)
(8) R. Flack. Fundamentals of Jet Propulsion with Applications. Cambridge University Press, 2005 (recommended)
(9) S. Farokhi. Aircraft Propulsion. John Wiley & Sons, 2009 (recommended)

Other Required Material: Course lecture notes and handouts

Course Oversight: Aerodynamics and Propulsion Committee

Syllabus Prepared By/Date: Dr. Kenneth Yu in August 2010

Course Objectives/Student Learning Outcomes:

1. Analyze thermodynamics of an aircraft jet engine and calculate the performance measures, such as thrust and specific fuel consumption in terms of design requirement.
2. Be able to estimate the best possible engine performance as a function of principal design parameters, such as maximum engine temperature, pressure ratio, and flight speed
3. Analyze the internal mechanisms of gas turbine engine components and understand the factors that limit the practical performance of inlets, combustion chambers, and nozzles

4. Understand the operating characteristics of compressors and turbines in terms of given blade shapes, angles, and direction of rotation
5. Design a gas turbine engine using the understanding of the relationship between components, at least at the level of selecting the number of spools and stages
6. Understand the broader context of aircraft propulsion technology, including the environmental and economic issues

Topics Covered:

1. Ideal and non-ideal thermodynamic cycle analysis
2. Performance analysis for quantifying fuel consumption, specific impulse, and various efficiencies
3. Gas turbine component matching,
4. Aerothermochemistry of fuels and propellants
5. Fundamental background materials, including Reynolds transport theorem, control volume analysis, ideal gas analysis, and equilibrium chemistry
6. Other contemporary topics of interest, including environmental consideration and hypersonic engines, will be briefly addressed.

Relationship of Course Objectives to Program Outcomes

This course addresses program outcomes: 1, 2, 3, 4, 5, 7, 8, 9, 14, 15, 16