AE 6361 - Syllabus

Air Breathing Propulsion System Design I - 3 Credits

General Information

Description

Introduction to propulsion system cycle analysis and design at the conceptual and preliminary levels, with emphasis on gas turbine engines. Develop a working understanding of engine cycle analysis, basic component performance, and engine installation effects for aircraft gas turbine propulsion systems. Learn the basics of the conceptual and preliminary design process for the commercial engine markets. Explore emerging and proposed propulsion system concepts intended to address the ever-increasing needs for improved fuel efficiency, reduced noise, and increased aircraft performance.

Pre- &/or Co-Requisites

AE 2010 minimum grade of C and CS 1331 minimum grade of D

Course Format, Goals, and Learning Outcomes

The course will be structured in a traditional lecture format with PowerPoint slides as well as mathematical derivations on the smart pad. Later lectures covering the design process and emerging engine concepts will be covered in a more interactive format with significant class participation. Vignettes and case studies from historical propulsion system development programs will be interspersed during the lectures.

Upon successful completion of this course, you should be able to:

- Reinforce basic on-design thermodynamic cycle analyses and extending it to include to turbine cooling and power extraction
- Gain modeling knowledge on Numerical Propulsion System Simulation (NPSS) software, industry standard for engine thermodynamic cycle analysis
- Gain working knowledge on modeling on-design and off-design cycle performance for commercial engine applications using NPSS
- Applied course learnings to optimize an engine cycle for a commercial transport for range

Course Requirements & Grading

The course grades will be based on two tests, a final exam, and three projects. The projects will require a combination of computer programming, literature research, and design knowledge acquired. The programming language used in this class will be NPSS. The projects will require approximately 20 hours of effort for experienced programmers. Beginning work early upon receipt of project assignments will be crucial. Grading percentages are as follows:

Graded Components

Test #1	15%		Project 1	15%
Test #2	15%		Project 2	15%
Final Exam	25%		Project 3	15%

Grading Scale

Your final grade will be assigned as a letter grade according to the following scale:

A	90 – 100%
B	80 – 89%
C	70 – 79%
D	60 – 69%
F	0 – 59%

Grades may be curved at the discretion of the instructor.

"The final assignment in this course will be due during the 'Final Instructional Class Days' unless otherwise announced by the instructor."

Course Materials

Suggested Textbook

Nicholas, Cumpsty, Jet Propulsion, ISBN: 0 521 59674 2

Course notes

Lecture slides and other course materials will be posted at http://canvas.gatech.edu. Important emails to the class will also be sent through the Canvas system; please be alert to these messages.

Honor Code

Students should adhere to the Georgia Tech Academic Honor Code (https://policylibrary.gatech.edu/student-life/academic-honor-code). Please note the following specific policies:

- Projects are intended to facilitate the learning of course material, so group collaboration is allowed for discussing methods, procedures, and derivations; however, students may not directly copy the work, code, data, graphics, or reports of other current and/or former students. Plagiarism of other works in the literature is also disallowed.
- Exams are intended to measure the learning of each individual student; copying from others' exams is not allowed.
- Equation sheets may be allowed for particular exams at the discretion of the instructor. Students will be informed of the number of pages permitted for each exam, and no notes beyond the allowed sheets may be used.
- Suspected violations of these policies will be reported to the Office of Student Integrity for investigation.

Attendance

Lecture attendance is highly encouraged but not required. Although most lecture notes will be uploaded to Canvas, content presented during "chalk talk" portions of the lectures may or may not be uploaded. Students will be responsible for learning this lecture material in addition to the posted notes.

Topics Covered

Note: The exact topics covered in a course may vary with each offering. The example below is typical but subject to change.

Lecture	Date	Week Day	Topic	Lecturer	Projects
1	01/12/2026	Mon	Engine Architectures and Applications for Aerospace	Mr. Denney	
2	01/14/2026	Wed	Station Numbers, Component Names & Corrected Parameters	Mr. Denney	
3	01/16/2026	Fri	Net Thrust Equation	Dr. Gladin	
	01/19/2026	Mon	MLK Holiday		
4	01/21/2026	Wed	Standards & Atmospheric Properties	Dr. Gladin	
5	01/23/2026	Fri	Thermodynamic Cycle - 1	Dr. Tai	
6	01/26/2026	Mon	Thermodynamic Cycle - 2	Dr. Tai	
7	01/28/2026	Wed	Inlet & Nozzles - 1	Mr. Kenny	
8	01/30/2026	Fri	Inlet & Nozzles - 2	Mr. Kenny	
9	02/02/2026	Mon	On-Design Component Equations - 1	Dr. Tai	
10	02/04/2026	Wed	On-Design Component Equations - 2	Dr. Tai	Project #1 Assigned
11	02/06/2026	Fri	On-Design Component Equations - 3	Dr. Tai	
12	02/09/2026	Mon	On-Design Cycle Analysis - Numerical Example 1	Dr. Tai	
13	02/11/2026	Wed	On-Design Cycle Analysis - Numerical Example 2	Dr. Tai	
14	02/13/2026	Fri	Review for Test #1	Dr. Tai	
	02/16/2026	Mon	**Test #1**		
15	02/18/2026	Wed	Access To NPSS	Dr. Tai	
16	02/20/2026	Fri	Introduction to NPSS	Mr. Baltman	
17	02/23/2026	Mon	On-Design NPSS Model Development 1-2	Dr. Tai	
18	02/25/2026	Wed	On-Design NPSS Model Development 3-4	Dr. Tai	Project#1 due
19	02/27/2026	Fri	Project 2 Introduction	Dr. Tai	Project #2 Assigned
20	03/02/2026	Mon	Off-Design Introduction	Dr. Gladin	
21	03/04/2026	Wed	Off-Design Map Scaling	Dr. Gladin	
22	03/06/2026	Fri	Off-Design GT Matching	Dr. Gladin	
23	03/09/2026	Mon	Off-Design Turbomachinery Matching Numeric Example	Dr. Gladin	
24	03/11/2026	Wed	Off-Design Solver Theory	Dr. Gladin	
25	03/13/2026	Fri	NPSS Solver Introduction	Dr. Gladin	
26	03/16/2026	Mon	Power Management	Dr. Gladin	
27	03/18/2026	Wed	Test 2 Review	Dr. Tai	Withdraw Deadline
	03/20/2026	Fri	**Test #2**		
	03/23/2026	Mon	Spring Break		
	03/25/2026	Wed	Spring Break		
	03/27/2026	Fri	Spring Break		
28	03/30/2026	Mon	Propulsion Design Process Overview	Dr. Tai	
29	04/01/2026	Wed	Propulsion System Design Example	Dr. Tai	Project #2 Due
30	04/03/2026	Fri	Project 3 Overview	Dr. Tai	Project #3 Assigned
31	04/06/2026	Mon	Propulsion Systems Design Demo	Dr. Tai	
32	04/08/2026	Wed	Flowpath Design Introduction	Dr. Gladin	
33	04/10/2026	Fri	Turbomachinery Introduction I (Compressors)	Dr. Gladin	
34	04/13/2026	Mon	Turbomachinery Introduction II (Turbines)	Dr. Gladin	
35	04/15/2026	Wed	Engine Transient Analysis	Dr. Gladin	
36	04/17/2026	Fri	Materials and Mechanical Design	Dr. Gladin	
37	04/20/2026	Mon	Engine Subsystems and Components	Dr. Gladin	
38	04/22/2026	Wed	Engine Accessories	Dr. Gladin	
39	04/24/2026	Fri	Turboshaft/Turboprop Engines	Dr. Gladin	Project #3 Due
40	04/27/2026	Mon	Final Exam Review	Dr. Tai	
	04/29/2026	Wed	Reading Period - No Class		
	TBD	TBD	Final Exam	Dr. Tai	