**AE 5326 AIR-BREATHING PROPULSION**

**SPRING SEMESTER, 2013**

**TTh 11:00 am – 12:20 pm, 112 NH**

1. Instructor: Dr. Donald R. Wilson
2. Office: 206B, Woolf Hall
3. Office Hours: MWF 9:00 a.m.–12 Noon, Afternoons by appointment.
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6. Course Prerequisites: Undergraduate degree in ME or AE, or consent of instructor
7. Required Software: NPSS (<http://wolverine-ventures.com/>);

Notepad++(http://notepad-plus-plus.org/download/v5.9.6.2.html)

1. Reference Textbook: *Elements of Propulsion - Gas Turbines and Rockets*, Jack D.

Mattingly*,* AIAA Education Series, 2006

Course Description:

Development of thrust and efficiency equations, thermodynamic cycle analysis, cycle design methods of aerospace propulsion systems, component performance analysis methods, component matching and dynamic interactions, and vehicle/propulsion‑system integration.

Course Goals/ Objectives:

Introduce students to gas turbine component and system design and performance analysis methods, using combination of classical and NPSS models.

Specific Course Requirements/ Grade Determination

Quizes (2) 60%

Homework assignments 10%

Design Project 30%

100%

Policy on Late Homework: 25% penalty per period

Course Web Site: BlackBoard (https://elearn.uta.edu)

**Course Outline**

|  |  |  |
| --- | --- | --- |
| **Introduction** | | |
|  | Aerospace propulsion systems | |
|  | Introduction to NPSS | |
| **Thrust/Efficiency Equations** | | |
|  | Ideal thrust equation | |
|  | Efficiency relations | |
| **Cycle Analysis** | | |
|  | Brayton cycle/thermal efficiency | |
|  | Ideal cycle performance analysis | |
|  | Design point vs. Off-design performance | |
|  | Non-ideal cycle analysis-AB Turbojet | |
|  | Hi-Bypass TF | |
|  | Mixed-flow TF | |
| **Gas Turbine Simulation with NPSS** | | |
|  | NPSS: Object oriented programming | |
|  | Creating and running NPSS | |
|  | Component modeling (burner) | |
|  | System modeling (turbojet) | |
| ***Quiz # 1*** | |  |
| **Combustion Chambers & Afterburners** | | |
|  | Intro/Fundamental concepts | |
|  | Combustion chamber design | |
|  | Burner efficiency | |
|  | Burner pressure ratio | |
|  | Main burner-design considerations | |
|  | Afterburners | |
|  | NPSS combustor model | |
| **Turbomachinery** | | |
|  | Intro/Fundamental concepts | |
|  | Axial flow compressors | |
|  | Axial flow turbines | |
|  | NPSS turbomachinery model | |
| **Propulsion/Airframe Integration** | | |
|  | Installed thrust | |
|  | Inlets | |
|  | Nozzles | |
|  | NPSS inlet & nozzle models | |
| ***Quiz # 2*** | |  |
| **Component Matching - Operating Line Performance** | | |
|  | Corrected parameters | |
|  | Component matching | |
|  | Determination of compressor operating line | |
|  | Operating line performance | |
| **Off-Design Performance Analysis** | | |
|  | Off-design scaling relations | |
|  | Off-design performance - turbojet | |
|  | Off-design performance - turbofan | |
| **Gas Turbine Simulation with NPSS** | | |
|  | Turbojet; design vs. off-design | |
|  | Afterburning turbojet | |
|  | Hi-bypass, unmixed-flow turbofan | |
|  | Lo-bypass, mixed flow turbofan | |
| **Propulsion System Dynamics** | | |
|  | Starting | |
|  | Accel/decel transients | |
|  | Dynamic system modeling | |
|  | Compressor instabilities - stall/surge | |
| ***Final Design Project*** | | |

**Americans with Disabilities Act**

The University of Texas at Arlington is on record as being committed to both the spirit and letter of federal equal opportunity legislation; reference Public Law 93112-The Rehabilitation Act of 1973 as amended. With the passage of new federal legislation entitled Americans with Disabilities Act – (ADA), pursuant to section 504 of The Rehabilitation Act, here is renewed focus on providing this population with the same opportunities enjoyed by all citizens.

As a faculty member, I am required by law to provide **“reasonable accommodation”** to students with disabilities, so as not to discriminate on the basis of that disability. Student responsibility primarily rests with **informing faculty at the beginning of the semester and in providing *authorized* documentation through designated administrative channels. If you require an accommodation based on disability, I would like to meet with you in the privacy of my office during the first week of the semester to make sure that you are properly accommodated.**

**Academic Dishonesty**

It is the philosophy of The University of Texas at Arlington that academic dishonesty is a completely unacceptable mode of conduct and will not be tolerated in any form. All persons involved in academic dishonesty will be disciplined in accordance with University regulations and procedures. Discipline may include suspensions or expulsion from the University.

“Scholastic dishonesty includes but is not limited to cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts.” (Regents’ Rules and Regulations, Part One, Chapter VI, Section 3, Subsection 3.2, Subdivision 3.22)