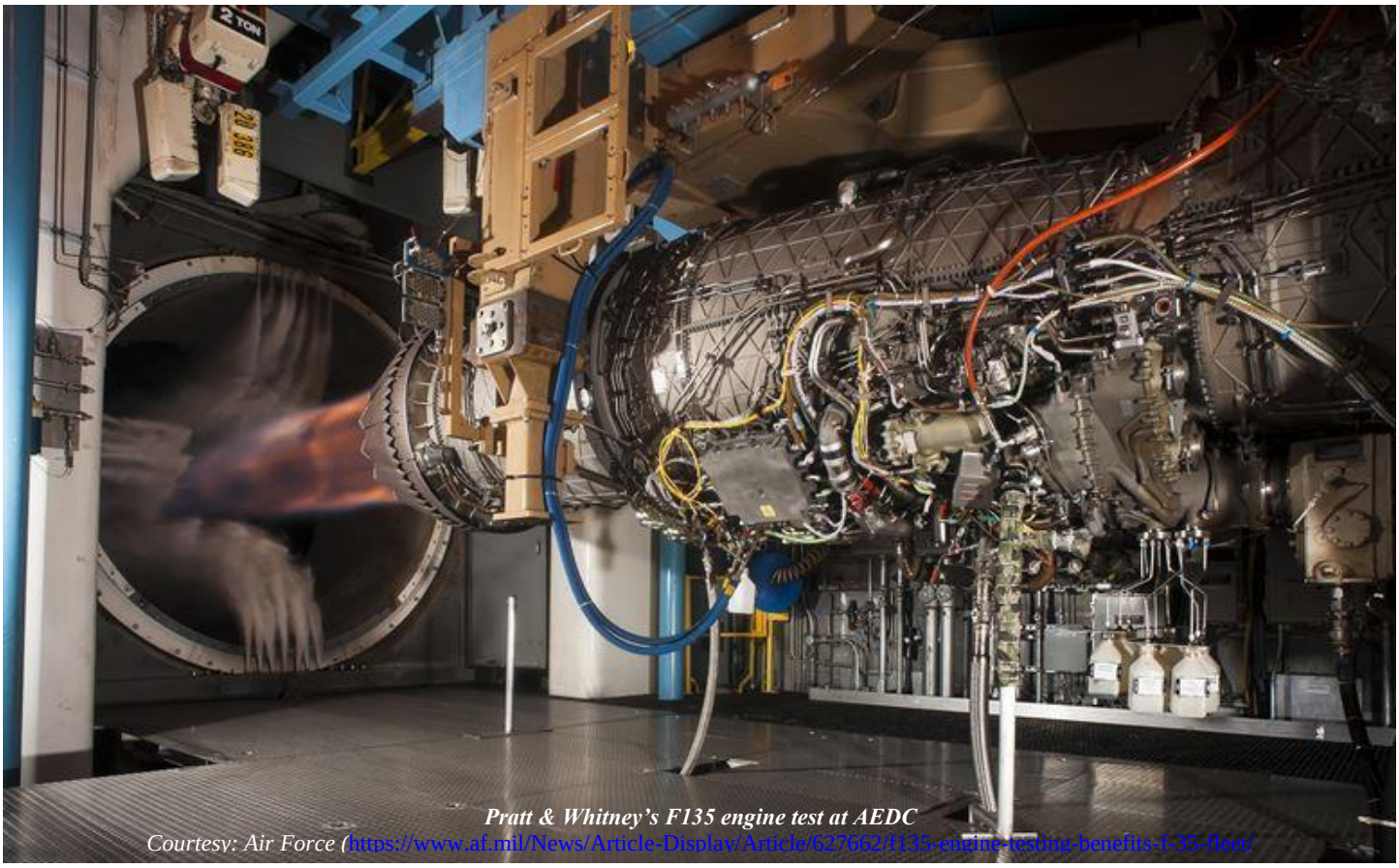
San José State University
Aerospace Engineering
AE167 – Aerospace Propulsion – Spring 2020



Pratt & Whitney's F135 engine test at AEDC
Courtesy: Air Force (https://www.af.mil/News/Article-Display/Article/627662/f135-engine-testing-benefits-f-35-fleet/

Instructor:	Prof. Fabrizio Vergine
Office Location:	E272B
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Email:	fabrizio.vergine@sjsu.edu
Office Hours:	Wednesday: 1:00pm – 3:00pm Thursday: 2:30pm – 3:30pm
Class Days/Time:	Tuesday and Thursday / 12:00pm – 1:15pm
Classroom:	Boccardo Business Center 202
Prerequisites:	"C" or better in AE160 and AE164

Faculty Web Page and MYSJSU Messaging

Course materials such as syllabus, handouts, notes, assignment instructions, etc. can be found on the Canvas Leaning Management System course login website at http://sjsu.instructure.com. You are responsible for regularly checking with the messaging system through MySJSU at http://my.sjsu.edu.

Course Description

Overall performance characteristics of propellers, ramjets, turbojets, turbofans, rockets. Performance analysis of inlets, exhaust nozzles, compressors, burners, and turbines. Rocket flight performance, single-/multi-stage chemical rockets, liquid/solid propellants and design problems.

Course Goals

Introduce students to the basic principles and design of:

- *Air-breathing propulsion systems.*
- *Space propulsion systems.*

Course Learning Outcomes (CLO)

Upon successful completion of this course, students will be able to:

1) *Perform a thermodynamic analysis of turboprop, turbojet and turbofan engines.*
2) *Analyze the performance of subsonic and supersonic inlets.*
3) *Analyze the performance of combustors, afterburners and exhaust nozzles.*
4) *Analyze the performance of axial flow compressors and turbines.*
5) *Carry out flight performance calculations for rockets.*
6) *Analyze the performance of solid and liquid rockets.*

Course Relationship to BSAE Program Outcomes

	1	2	3	4	5	6	7
Learning Outcomes							
1 – 6	++	+++	O	O	+++	O	O

+: Skill level 1 or 2 in Bloom's Taxonomy
++: Skill level 3 or 4 in Bloom's Taxonomy
+++: Skill level 5 or 6 in Bloom's Taxonomy
O: Skill addressed but not assessed

Required Texts/Readings

Textbook

Mattingly, J.D., Elements of Propulsion Gas Turbines and Rockets, AIAA Education Series, ISBN 1563477793

Other Readings

Instructor's notes posted on Canvas. Additional research material may be required for the completion of various assignments.

Course Requirements and Assignments

Homework Assignments

Individual/group effort. Some of the homework assignments may have to be solved by groups of 4 students, in which case each individual in a group will receive the same grade as the group as a whole. The earned grade on assignments turned in within 24 hours from the due date/time will be penalized by 20%. Assignments turned in 24 or more hours late will not be accepted.

Workout Assignments

These assignments will be solved by groups of 4 students. Group workouts will take place under the supervision of the instructor.
Rules:

- *All the students in a group must be present in class and contribute to the work; members of the group that are not present will not receive a grade in the group part of the workout.*
- *In general, no make-up workouts will be granted. Exceptions may be made if it is provided a written and signed justification from a third party (i.e., work supervisor, doctor, etc.).*

Quizzes

Individual effort. Approximately 4 or 5 quizzes will be given during the course. The dates of the quizzes will be communicated in class a few days in advance.
Rules:

- *No make-up quizzes will be granted. Exceptions may be made if it is provided a written and signed justification from a third party (i.e., work supervisor, doctor, etc.).*

"Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally 3 hours per unit per week with 1 of the hours used for lecture) for instruction or preparation/studying or course related activities including but not limited to internships, labs, clinical practica. Other course structures will have equivalent workload expectations as described in the syllabus."

Grading Information

- ***Homework Assignments*** *30%*
- ***Workout Assignments*** *20%*
- ***Quizzes*** *50%*

A plus	> 97%
A	93% - 97%
A minus	90% - 92%
B plus	88% or 89%
B	83% - 87%
B minus	80% - 82%
C plus	78% or 79%
C	73% - 77%
C minus	70% - 72%
D	60% - 69%
F	< 60%

Classroom Protocol

No cellphone use is permitted in class. Respect for others is required and expected.

Academic Integrity

A student found guilty of academic dishonesty in any form (cheating, fabrication, plagiarism etc.) will automatically fail the course and will be reported to the Office of Student Conduct and Ethical Development.

University Policies

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs' Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo/.

AE Department and SJSU policies are also posted at http://www.sjsu.edu/ae/programs/policies/

Course Schedule

The schedule may be subject to change. Any changes will be notified with fair notice through official announcements both in class and on Canvas.

Week	Date	Topics, Readings, Assignments, Deadlines
1		**Introduction** - Brief historical background. - Classification of aerospace engines.
2		**Review of aerothermodynamics for engine analysis** - I and II law of thermodynamics. - Thermodynamic cycles. - Control volume analysis.
3		**Aircraft gas turbine engine** - Uninstalled and installed thrust. - Gas turbine engine components. - Joule-Brayton cycle.
4		**Parametric cycle analysis of ideal engines** - Turbojet. - Turbojet with afterburner.
5		**Parametric cycle analysis of ideal engines** - Turbofan.
6		**Parametric cycle analysis of ideal engines** - Ramjet.
7		**Component Performance Analysis** - Subsonic inlets.
8		**Component Performance Analysis** - Supersonic inlets.
9		**Component Performance Analysis** - Compressors.
10		**Component Performance Analysis** - Turbines.
11		**Component Performance Analysis** - Combustors and Nozzles.
12		**Parametric cycle analysis of real engines** - Turbojet. - Turbojet with Afterburner.
13		**Rocket Propulsion** - Thrust equation. - Equation of motion for an accelerating rocket.
14		**Rocket Propulsion** - Multi-stage rockets.
15		**Rocket Propulsion** - Liquid propellant rocket engines.
Final Exam	May 13	Boccardo Business Center 202, from 09:45am to 12:00pm