San José State University
Aerospace Engineering
AE167 – Aerospace Propulsion – Spring 2018

J85-GE-17A Engine
Courtesy: https://airandspace.si.edu/collection-objects/general-electric-j85-ge-17a-turbojet-engine-cutaway
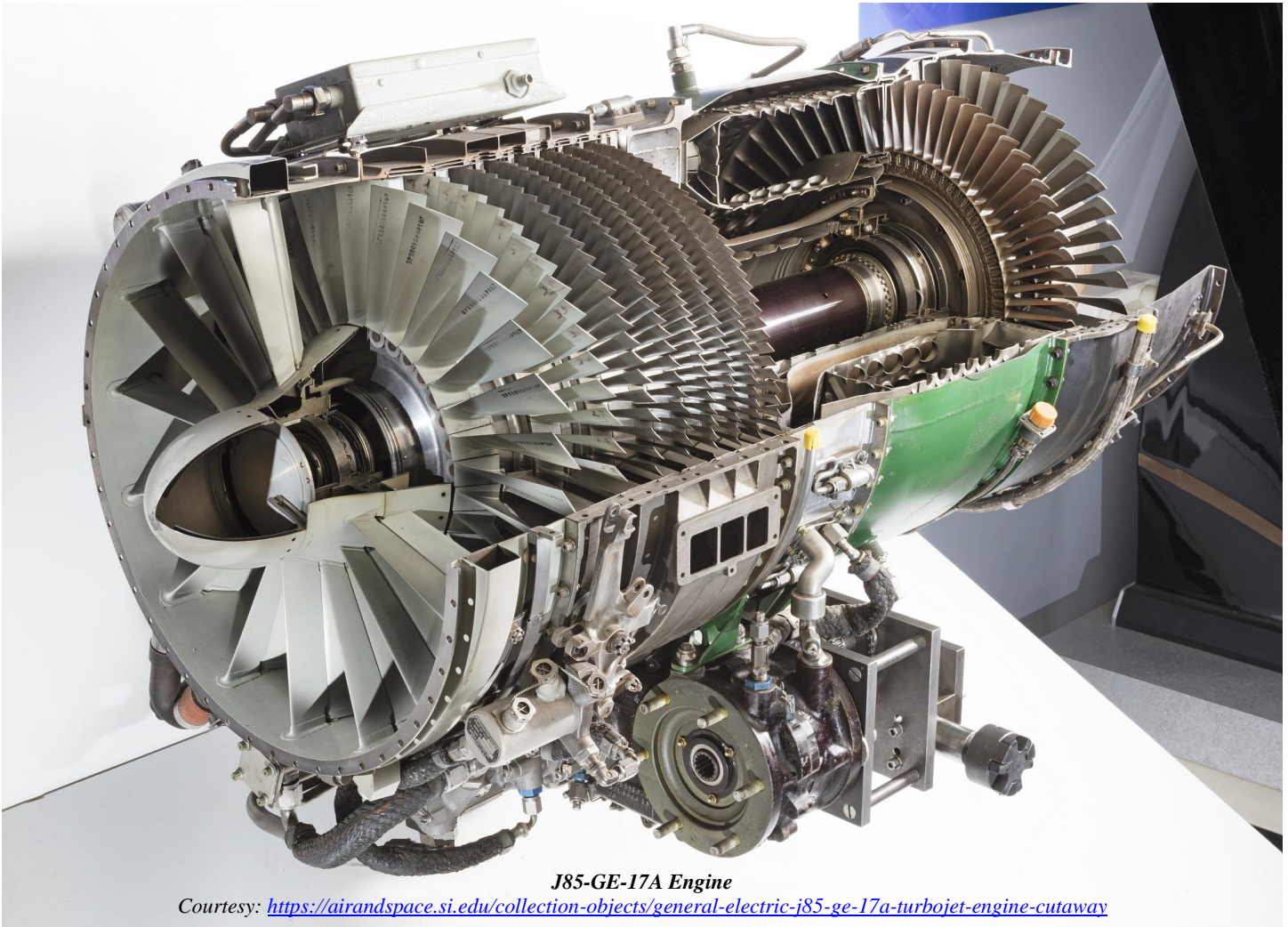
Instructor:	Prof. Fabrizio Vergine
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Email:	fabrizio.vergine@sjsu.edu
Office Hours:	Tuesday and Thursday: 3:00pm – 4:15pm or by appointment
Class Days/Time:	Tuesday and Thursday / 12:00pm – 1:15pm
Classroom:	ENG341
Prerequisites:	"C-" or better in AE160 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

	A	B	C	D	E	F	G	H	I
Learning Outcomes									
1 – 6	++	O	+++	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 will 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. I reserve the right to periodically and randomly call students to explain the solution of the problems provided by the group.

Bi-weekly Quizzes

Individual bi-weekly quizzes. The exact dates of each quiz will be confirmed in class.

Experiment Design

Group effort. Teams of four students will design and perform an experiment with the available jet engine facility. The final report is due on the last day of class. The groups will present the work on the day of the final exam. The grade will be assigned to the group as a whole.

"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

-	***Bi-weekly Quizzes***	*45%*
-	***Homework Assignments***	*40%*
-	***Experiment Design***	*15%*

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

Classroom Protocol

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

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

Week	Date	Topics, Readings, Assignments, Deadlines
1	01/25	**Introduction** - Brief historical background. - Classification of aerospace engines.
2	01/30 – 02/01	**Review of aerothermodynamics for engine analysis** - I and II law of thermodynamics. - Thermodynamic cycles. - Control volume analysis.
3	02/06 - 02/08	**Aircraft gas turbine engine** - Uninstalled and installed thrust. - Gas turbine engine components. - Joule-Brayton cycle.
4	02/13 - 02/15	**Parametric cycle analysis of ideal engines** - Turbojet. - Turbojet with afterburner.
5	02/20 - 02/22	**Parametric cycle analysis of ideal engines** - Turbofan.
6	02/27 - 03/01	**Parametric cycle analysis of ideal engines** - Ramjet.
7	03/06 - 03/08	**Component Performance Analysis** - Subsonic inlets.
8	03/13 - 03/15	**Component Performance Analysis** - Supersonic inlets.
9	03/20 - 03/22	**Component Performance Analysis** - Compressors.
10	04/03 - 04/05	**Component Performance Analysis** - Turbines.
11	04/10 - 04/12	**Component Performance Analysis** - Combustors and Nozzles.
12	04/17 - 04/19	**Parametric cycle analysis of real engines** - Turbojet. - Turbojet with Afterburner.
13	04/24 - 04/26	**Rocket Propulsion** - Thrust equation. - Equation of motion for an accelerating rocket.
14	05/01 - 05/03	**Rocket Propulsion** - Multi-stage rockets.
15	05/03 - 05/05	**Rocket Propulsion** - Liquid propellant rocket engines.
16	05/08 - 05/10	**Rocket Propulsion** - Solid propellant rocket engines.
Final Exam	Thursday, May 17	ENG341, from 09:45pm to 12:00pm