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

Instructor: Prof. Fabrizio Vergine
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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**

<table>
<thead>
<tr>
<th>Learning Outcomes</th>
<th>1</th>
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<td>1 – 6</td>
<td>++</td>
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+: 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**


**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.

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topics, Readings, Assignments, Deadlines</th>
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</table>
| 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 |