

San José State University
Aerospace Engineering
AE167, Aerospace Propulsion, Spring 2021

Course and Contact Information

Instructor:	Prof. Fabrizio Vergine
Office Location:	E272B
Telephone:	(408) 924-3958
Email:	fabrizio.vergine@sjsu.edu
Office Hours:	Monday, from 3:00pm to 4:00pm Tuesday, from 2:00pm to 3:00pm <i>Please follow the ZOOM link below to access office hours:</i> https://sjsu.zoom.us/j/82345024070
Class Days/Time:	Monday, Wednesday, 1:30pm – 2:45pm
Classroom:	Online. <i>Please follow the link below to register to the ZOOM meetings:</i> https://sjsu.zoom.us/meeting/register/tZwkcOCgrzMiGt1jvVcCVMe6IMXWtGIIdUi7j Passcode: 421133
Prerequisites:	Grade of “C” or better in AE160 and AE164

Course Format

Faculty Web Page and MYSJSU Messaging

Course materials such as syllabus, handouts, notes, assignment instructions, etc. can be found on [Canvas Learning Management System course login website](#) at <http://sjsu.instructure.com>. You are responsible for regularly checking the email address listed in your [MySJSU](#) at <http://my.sjsu.edu> profile and the [Canvas Inbox](#) to learn of any updates.

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
<i>Learning Outcomes</i>							
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

Individual assignments. Note that homework will be assigned to allow students to prepare for in-class workouts. The assignments will not be graded, however they must be turned in and show enough effort in order to receive a grade in the related workout. Homework assignments will be due at the beginning of the lecture of a workout day.

Workouts

Workout days will follow the typical approach of a “flipped” classroom, for which students are required to come to lecture prepared on the topics and problems that the professor instructed them to study/deepen/solve at the time of assignment of the homework.

Workouts are group efforts which will typically be held on Wednesdays (exact dates and times of the workouts will be communicated during lecture), for approximately 5-6 assignments during the semester. Assigned problems will be solved during class time by groups of 4 students and must be turned-in at the end of the meeting unless differently specified by the instructor. If not typed, the assignment should be clearly hand-written and in any case, it must include all the pertinent information (assumptions, explanation of steps, equations, etc.). Each individual in a group will receive the same grade as the group as a whole provided that he or she submitted the homework assignment related to the workout.

Policies:

- *Attendance will be taken on the day of the workout. Students who are absent will receive a zero in the assignment regardless of the homework's submission if they do not provide their contribution to the group ahead of time.*
- *Each member of the group must provide a short paragraph describing the work accomplished by him/her. Failure to do so will result in a zero in the assignment to that member.*
- *No late assignments will be accepted and no remedial work will be given unless documentation of a compelling reason for not being able to complete the work in time or not being in class during the workout is provided.*

During workout days, students will be divided into “breakout rooms” of 4 members (i.e., the same members of a group). The instructor and the TA will enter each room regularly to provide answers to questions and help. The instructor may temporarily “break” the rooms to provide explanations to the whole class, if needed.

Quizzes

Individual effort. Approximately 3-4 quizzes will be given during the course. The dates of the quizzes will be communicated in class a few days in advance.

Policies:

- *Specific rules for the quizzes will be communicated in class and posted on Canvas on the day of the announcement.*
- *In case of absence, a make-up exam may be granted at the instructor's discretion only in these cases:*
 - *the absence is justified by a letter signed by a medical doctor in case of illness;*
 - *the absence is justified by a signed supervisor's statement, in case of work duties.*

Design Project

Group effort. Student groups will solve an assigned open-ended design problem and will present their work at the end of the semester.

The final report, which will be due on the last day of class, must include:

- *Description of the rationale.* Must include a clear and thorough description of all the steps taken toward the solution of the whole assignment. Every design choice must be justified through explanations with solid theoretical foundations.
- *Results.* Plots and graphs must be commented and professionally presented. Missing units, labels and illegible images will not be granted full points.
- *Conclusions.*

“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

-	<i>Workout Assignments</i>	<i>20%</i>
-	<i>Quizzes</i>	<i>60%</i>
-	<i>Final Project</i>	<i>20%</i>

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%

Recording Zoom Classes

This course or portions of this course (i.e., lectures, discussions, student presentations) will be recorded for instructional or educational purposes. The recordings will only be shared with students enrolled in the class through Canvas. The recordings will be deleted at the end of the semester. If, however, you would prefer to remain anonymous during these recordings, then please speak with the instructor about possible accommodations (e.g., temporarily turning off identifying information from the Zoom session, including student name and picture, prior to recording).

Students are not allowed to record without instructor permission

Students are prohibited from recording class activities (including class lectures, office hours, advising sessions, etc.), distributing class recordings, or posting class recordings. Materials created by the instructor for the course (syllabi, lectures and lecture notes, presentations etc.) are copyrighted by the instructor. This university policy (S12-7, <https://www.sjsu.edu/senate/docs/S12-7.pdf>) is in place to protect the privacy of students in the course, as well as to maintain academic integrity through reducing the instances of cheating. Students who record, distribute, or post these materials will be referred to the Student Conduct and Ethical Development office. Unauthorized recording may violate university and state law. It is the responsibility of students that require special accommodations or assistive technology due to a disability to notify the instructor.

Proctoring Exams/Quizzes

Exams will be proctored in this course by the instructor and the teaching associate/s. Exam sessions will require use of a webcam and will be recorded. The recordings of the exam sessions will not be made available to students. Please note it is the instructor's discretion to determine the method of proctoring. If cheating is suspected the proctored videos may be used for further inspection and may become part of the student's disciplinary record. Students are encouraged to contact the instructor if unexpected interruptions (from a parent or roommate, for example) occur during an exam.

Online Exams Testing Environment

- No phones.
- No earbuds, headphones, or headsets visible.
- The environment should free of other people besides the student taking the test.
- If students need scratch paper for the test, they should present the front and back of a blank scratch paper to the camera before the test.
- Well-lit environment. Proctors should be able to see the students' eyes and their whole face. Avoid having backlight from a window or other light source opposite the camera.

- The work must be hand-written on white paper only and scans must be submitted on Canvas at the end of the test.

Classroom Protocol

- **Students will be muted upon entry in the Zoom meeting of each lecture:** but they can raise their hand electronically or unmute themselves at any time to ask questions, reply to questions and make comments.
- **Be mindful of background noise and distractions:** find a quiet place to “attend” class, to the greatest extent possible. Avoid video setups where people may be walking behind you, people talking/making noise etc. Avoid activities that could create additional noise, such as shuffling paper, listening to music in the background, etc.
- **Position your camera properly:** be sure your webcam is in a stable position and focused at eye level.
- **Limit your distractions/avoid multitasking:** you can make it easier to focus on the meeting by turning off notifications, closing or minimizing running apps, and putting your smartphone away (unless you are using it to access Zoom).
- **Use appropriate virtual backgrounds:** if using a virtual background, it should be appropriate and professional and should NOT suggest or include content that is objectively offensive or demeaning.

Technical difficulties

Internet connection issues:

Canvas automatically saves responses a few times per minute as long as there is an internet connection. If your internet connection is lost, Canvas will warn you but allow you to continue working on your exam. A brief loss of internet connection is unlikely to cause you to lose your work. However, a longer loss of connectivity or weak/unstable connection may jeopardize your exam.

Other technical difficulties:

Immediately email the instructor a current copy of the state of your exam and explain the problem you are facing. Your instructor may not be able to respond immediately or provide technical support. However, the copy of your exam and email will provide a record of the situation.

Contact the SJSU technical support for Canvas:

Technical Support for Canvas
Email: ecampus@sjsu.edu
Phone: (408) 924---2337
<https://www.sjsu.edu/ecampus/support/>

If possible, complete your exam in the remaining allotted time, offline if necessary. Email your exam to your instructor within the allotted time or soon after.

Academic Integrity

Students who are suspected of cheating during an exam will be referred to the Student Conduct and Ethical Development office and depending on the severity of the conduct, will receive a zero on the assignment or a grade of F in the course. Grade Forgiveness does not apply to courses for which the original grade was the result of a finding of academic dishonesty.

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](http://www.sjsu.edu/gup/syllabusinfo/) at <http://www.sjsu.edu/gup/syllabusinfo/>.

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

AE 167 / Aerospace Propulsion, Spring 2021, 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.

Course Schedule

Week	Date	Topics, Readings, Assignments, Deadlines
1		Introduction <ul style="list-style-type: none"> - Brief historical background. - Classification of aerospace engines.
2		Review of aerothermodynamics for engine analysis <ul style="list-style-type: none"> - I and II law of thermodynamics. - Thermodynamic cycles. - Control volume analysis.
3		Aircraft gas turbine engine <ul style="list-style-type: none"> - Uninstalled and installed thrust. - Gas turbine engine components. - Joule-Brayton cycle.
4		Parametric cycle analysis of ideal engines <ul style="list-style-type: none"> - Turbojet. - Turbojet with afterburner.
5		Parametric cycle analysis of ideal engines <ul style="list-style-type: none"> - Turbofan.
6		Parametric cycle analysis of ideal engines <ul style="list-style-type: none"> - Ramjet.
7		Component Performance Analysis <ul style="list-style-type: none"> - Subsonic inlets.
8		Component Performance Analysis <ul style="list-style-type: none"> - Supersonic inlets.
9		Component Performance Analysis <ul style="list-style-type: none"> - Compressors.
10		Component Performance Analysis <ul style="list-style-type: none"> - Turbines.
11		Component Performance Analysis <ul style="list-style-type: none"> - Combustors and Nozzles.
12		Parametric cycle analysis of real engines <ul style="list-style-type: none"> - Turbojet. - Turbojet with Afterburner.
13		Rocket Propulsion <ul style="list-style-type: none"> - Thrust equation. - Equation of motion for an accelerating rocket.
14		Rocket Propulsion <ul style="list-style-type: none"> - Multi-stage rockets.
15		Rocket Propulsion <ul style="list-style-type: none"> - Liquid propellant rocket engines.

Week	Date	Topics, Readings, Assignments, Deadlines
Final Exam	Wednesday, May 19, 2021	