San José State University
Aerospace Engineering
AE112, Aerospace Structures I, Fall 2021

Course and Contact Information

Instructor:	Maria Chierichetti
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Office Hours:	Tuesday 9:30-11:00AM via zoom By appointment via email
Class Days/Time:	10:45AM-12:25PM
Classroom:	ENG 331
Prerequisites:	Grade of "C" or better in Physics 50 and Math 32

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. You are responsible for regularly checking with the messaging system through MySJSU on Spartan App Portal http://one.sjsu.edu (or other communication system as indicated by the instructor) to learn of any updates. Announcements are regularly posted on Canvas.

Course Description

Aircraft loads, V-n diagram; spacecraft boost loads. Free-body diagrams, 2-D and 3-D force and moment equilibrium. Centroid and area moment of inertia. Shear force and bending moment diagrams; cantilevered wings & internal support structures; stress/strain relationships; Mohr's Circle. Experimental strain measurement.

Course Goals

1. To review vector algebra and develop the skills of creating a free-body diagram and performing a static equilibrium analysis.
2. To show the application of air loads, inertia loads, mass properties and materials to aircraft structural analysis and design.
3. To provide a fundamental knowledge of the principles of strength of materials.
4. To analyze aircraft and spacecraft structural members in tension, compression and torsion.
5. To calculate centroids and area (section) moments of inertia.

6. To become familiar with experimental strain measurement and its reconciliation with theoretical
   stress prediction.

Course Learning Outcomes

Upon successful completion of this course, students will be able to:
1. Estimate forces and moments applied over an aircraft's flight envelope.
2. Create free-body diagrams of aircraft internal and external structure; solve with vector algebra.
3. Solve for forces and moments applied to typical internal aircraft members.
4. Construct shear force and bending moment diagrams for a cantilevered wing under constant and triangular distributed loads.
5. Learn the principles of strain gage technology, application and use.
6. Compute area properties of two-dimensional wing and fuselage cross sections: centroid and moments/products of inertia.
7. Calculate shear stress and angle of twist along a shaft-type structure in torsion.
8. Draw Mohr's Circle and solve for the maximum principal stresses.
9. Work effectively in teams to design, carry out and analyze results from the Lab Problems.

Required Texts/Readings

Textbook

Beer and Johnston, Statics and mechanics of materials, Ed. 3

Other Readings

1. Bruhn: Analysis & Design of Flight Vehicle Structures
2. Hibbeler: Mechanics of Materials
3. Megson: Aircraft Structures for Engineering Students
4. Mitiguy: Statics & Introduction to Solid Mechanics
5. Niu: Airframe Structural Design: Practical Design Information and Data on Aircraft Structures
6. Peery: Aircraft Structures

Other technology requirements / equipment / material

Course Requirements and Assignments

The assignments for this course consist of analytical and hardware lab problems.

Be mindful of the following University Policy S16-9
"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 three hours per unit per week) for instruction, preparation/studying, or course related activities, including but not limited to internships, labs, and clinical practica. Other course structures will have equivalent workload expectations as described in the syllabus."

Final Examination or Evaluation

A comprehensive written final exam will be given during the university's final exam week.

Grading Information

Grades will be determined using a specifications grading pedagogy. Each assignment will be evaluated according to a pre-defined rubric, and will receive either a "Meets Expectations" or "Revisions Needed" grade. The final grade in the class will be determined based on the number of assignments that have been evaluated as "Meets Expectations". Students will be allowed to retake some of the assignments. The final class grade will be derived from homework problems, quizzes, lab reports, and a final exam, according to the grade bundles defined in the following sections.

Quizzes: 10 quizzes will be assigned to the students, that will take about 15 minutes to complete. Quizzes will be assigned every Wednesday at the beginning of class (10:45am – in person). Each quiz will focus on one of the topics in the table below, which are aligned with the Course Learning Outcomes. Students will be able to progress to a subsequent quiz only after having passed all the previous quizzes (i.e. students can take Q3 only after passing Q1 and Q2). Students will need to pass all quizzes related to the "Essential Topics" (Q1-Q7) to pass the class. Each quiz will be evaluated according to a pre-defined rubric provided to the students, and will receive either a "Meets Expectations" or "Revisions Needed" grade. Additional practice material may be assigned before students are able to retake a quiz.

Essential Topics	
1	Equilibrium of particles in 2D & 3D
2	Moments and couples
3	Equilibrium of rigid bodies in 2D & 3D
4	Distributed loads
5	Trusses & Frames
6	Centroids and area moment of inertia
7	Stress & strain
Supplementary topics	
8	Shear and bending moment diagrams
9	Beam in bending
10	Torsion & principal stresses + Mohr circle

Homework: homework will be assigned on a weekly basis. They will be always due on Wednesday, before the beginning of class (due at 10am); students will submit their homework online through Canvas. Each homework will receive either a "Meets Expectations" or "Revisions Needed" grade. If it is determined that a solution manual (or any other form of Academic Dishonesty) was used to solve any one of the problems in the homework, the homework assignment will be graded as "Revisions Needed" in its entirety. No late policy.

Lab Problems: students will complete three lab problems in the second half of the semester. Groups of 2-3 students will be defined by the instructor. Students will submit a lab report for each of the

lab activities. Each report will receive either a "Meets Expectations" or "Revisions Needed" grade. Students will have *one* possibility of re-submit a report graded as "Revisions Needed". No late policy. If it is determined that any form of Academic Dishonesty was committed in the preparation of lab reports, the assignment will be graded as "Revisions Needed" in its entirety.

Final Exam: students will complete a comprehensive final exam during final exams' week, as determined by SJSU calendar. Students will receive a "Meets Expectations", "Excellent" or "Revisions Needed" grade. The final exam grade will be defined as "Meets Expectations" if the student will *satisfactory* complete all the problems focusing on the essential topics defined above.

Determination of Grades – grade bundles

	F	**D**	**C**	**B**	**A**	**A+**
(E) Quizzes: "Meets Expectations" in #	<6	6	7	8	9	10
(E) Final exam	Revisions needed	Revisions needed	Meets expectations	Meets expectations	Excellent	Excellent

Plus "+" or minus "–" determination

	Lab Reports
+	3 reports "Meets Expectations"
no change	2 reports "Meets Expectations"
-	1 reports "Meets Expectations"

	Homework
+	12 Homework "Meets Expectations"
no change	10 Homework "Meets Expectations"
-	8 Homework "Meets Expectations"

A grade tracker will be provided to students to help with grade determination.

University Policies (Required)

University Policy S16-9 *(http://www.sjsu.edu/senate/docs/S16-9.pdf)*, relevant information about academic integrity, accommodations, dropping and adding, consent for recording of class, etc. is available on Office of Graduate and Undergraduate Programs' Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo/"

AE Department Policies http://www.sjsu.edu/ae/programs/policies/

AE112 – Aerospace Structures I, Fall 2021

Tentative Course Schedule

Week	Date	Deadlines	Topics	Readings
1	23-Aug		Introduction, units, vector algebra	ch. 1, 2.1:2.2
1	25-Aug		Equilibrium of forces in 2D; vector algebra in space	2:1-2:3
2	30-Aug		Equilibrium of forces in space; types of forces	2.4-2.5-3.1
2	1-Sep	due homework; quiz	Forces & moments / couples, equivalent loads	3.1:3.4
3	6-Sep		LABOR DAY - NO CLASS	
3	8-Sep	due homework	Forces & moments / couples, equivalent loads	3.1:3.4
4	13-Sep		Equivalent loads	3.1:3.4
4	15-Sep	due homework; quiz	Free body diagrams for rigid bodies	
5	20-Sep		Equilibrium of rigid bodies in 2D	4.1:4.2
5	22-Sep	due homework; quiz	Equilibrium of rigid bodies in 3D	4.3
6	27-Sep		Distributes forces – V-n diagram	5.3
6	29-Sep	due homework; quiz	Distributes forces	5.3
7	4-Oct		Analysis of trusses	6.1
7	6-Oct	due homework; quiz	Analysis of trusses	6.2
8	11-Oct		Analysis of frames & machines	6.3-6.4
8	13-Oct	due homework; quiz	Centroids; area moments of inertia	5.1-5.2-5.4-7.1-7.2
9	18-Oct		Normal stress & strain	8.1:8.4
9	20-Oct	due homework; quiz	Poisson's ratio & Hooke's law	9.1-9.4-9.5
10	25-Oct		TBD	
10	27-Oct	due homework; quiz	Shear stress & strain	9.6:9.9
11	1-Nov		Beam: shear force and bending moment diagrams	12.1

Week	Date	Deadlines	Topics	Readings
11	3-Nov	due homework; quiz	Beam: relation between bending and shear	12.2
12	8-Nov		Stresses in beams	lecture notes
12	10-Nov	due homework; quiz	Stresses in beams	lecture notes
13	15-Nov		Torsion	10.1-10.2
13	17-Nov	due homework; quiz	Torsion	10.1-10.2
14	22-Nov		Principal stresses; Mohr's circle	14.1-14.2
14	24-Nov	due homework;	NO CLASS	
15	29-Nov		Principal stresses; Mohr's circle	14.1-14.2
15	1-Dec	due homework; quiz	Review	
16	6-Dec		Review	
16	8-Dec		FINAL EXAM	