San José State University
Aerospace Engineering Department
AE 114, Aerospace Structural Analysis II, Spring 2020

Course and Contact Information

Instructor(s):	Maria Chierichetti
Office Location:	ENG 272-C
Telephone:	408-924-4329
Email:	Maria.chierichetti@sjsu.edu
Office Hours:	Monday 3:00-4:00 PM; Thursday 10:30 AM-12 PM
Class Days/Time:	MW 10:30-11:45AM
Classroom:	ENG 331
Prerequisites:	AE 112 or Graduate Standing; Corequisite: ENGR 100W

Course Description

Aircraft, missile, spacecraft structural design and analysis. Static, elastic and stress analysis of structures. Structural materials. Deflection analysis of structural systems. Conventional, stiffened, sandwich and composite structures. Structural dynamics. Thermal effects.

Course Format

AE 114 adopts a flipped classroom approach, and as such Internet connectivity and access to a laptop during class will often be required during classroom activities.

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 with the messaging system through MySJSU on Spartan App Portal http://one.sjsu.edu to learn of any updates. Announcements are regularly posted on Canvas.

Course Goals

1. To demonstrate the iterative design/analysis process of aerospace structures.
2. To provide a review of strength of materials.
3. To delineate the trade-offs present in structural design of aerospace vehicles.
4. To examine actual aircraft design successes and failures via case studies.
5. To show the application of air loads, mass properties and materials in the consideration of aircraft structural design.

Course Learning Outcomes (CLO)

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

1. Compute area properties of two-dimensional wing and fuselage cross sections: centroid and moments/products of inertia.
2. Find the orientation of the centroidal principal axes and calculate the centroidal principal moments of inertia.
3. Construct the axial force, shear force and bending moment diagrams for aircraft beam structures.
4. Perform a buckling analysis for beam-column-type wing and fuselage structures.
5. Calculate shearing stress and angle of twist along a shaft-type structure in torsion.
6. Determine the shear flow distribution for an open section under torsion.
7. Determine the shear flow distribution for a (closed) multiple-cell wing section under torsion.
8. For a wing section subjected to multiple bending moments, find the bending stress in the wing stringers.
9. Plot the shear flow distribution and find the location of the shear center for an (open) thin-walled wing cross section under a shear load.
10. Determine the shear flow distribution and shear center location for a (closed) thin-walled section with stringers.
11. Iterate to a successful aircraft stringer-skin-type wing design using actual material properties – beginning with a baseline configuration.
12. Using Finite Element Method, assemble the stiffness matrix for a spacecraft truss structure.
13. Using Finite Element Method, compute the stress distribution over a wing.
14. Design and carry out experiments to define material or geometric properties of the cantilever beam, torsional beam and Beechcraft tail section.

Required Texts/Readings

Textbook

Bruhn: Analysis and Design of Aircraft Structures

Other Readings

Sheppard: Statics
Niu: Airframe Structural Design: Practical Design Information and Data on Aircraft Structures
Megson: Aircraft Structures for Engineering Students
Yang: Finite Element Structural Analysis
Hibbeler: Mechanics of Materials Meirovitch: Fundamentals of Vibrations

Course Requirements and Assignments

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

"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 are derived from homework problems, lab reports, two midterms, in-class group work (collected at end of class) and a final exam. Partial credit is assigned based on the demonstrated understanding of concepts and analytical/numerical results. In-class group work will be graded on completion and accuracy, and will be collected at the end of class (I will not accept individual submissions). One in-class group work grade will be dropped in determining the final grade.

Determination of Grades

In-class group work	15 %	
Homework	15 %	Biweekly, due on Wednesday
Lab Problems	20 %	Three lab problems
Midterm I	15 %	Tentative: March 4th, 2020
Midterm II	15 %	Tentative: April 8th, 2020
Final Exam	20 %	Friday May 15th, 2020 @ 9:45am

All exams must be taken to receive a passing grade

Grade	*Points*	*Percentage*
A plus	*960 to 1000*	*96 to 100%*
A	*930 to 959*	*93 to 95%*
A minus	*900 to 929*	*90 to 92%*
B plus	*860 to 899*	*86 to 89 %*
B	*830 to 859*	*83 to 85%*
B minus	*800 to 829*	*80 to 82%*
C plus	*760 to 799*	*76 to 79%*
C	*730 to 759*	*73 to 75%*
C minus	*700 to 729*	*70 to 72%*
D plus	*660 to 699*	*66 to 69%*
D	*630 to 659*	*63 to 65%*
D minus	*600 to 629*	*60 to 62%*

University Policies

Per University Policy S16-9 *(http://www.sjsu.edu/senate/docs/S16-9.pdf)*, relevant university policy concerning all courses, such as student responsibilities, academic integrity, accommodations, dropping and adding, consent for recording of class, etc. and available student services (e.g. learning assistance, counseling, and other resources) are listed on Syllabus Information web page (http://www.sjsu.edu/gup/syllabusinfo), which is hosted by the Office of Undergraduate Education. Make sure to visit this page to review and be aware of these university policies and resources.

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

AE 114, Spring 2020, Course Schedule

Week	Date	Topics, Readings, Assignments, Deadlines	Chapter
1	01/27	Class introduction; review of statics and strength of materials	
1	01/29	Two-dimensional inertia properties of wing sections	A3
2	02/03	Two-dimensional inertia properties of wing sections	A3
2	02/05	Analysis of structural design configurations	
3	02/10	Computing internal forces on wings and airplane body	A5
3	02/12	Computing internal forces on wings and airplane body	A5
4	02/17	Buckling of columns	A5
4	02/19	Combined bending and buckling of wings	A5
5	02/24	Stresses due to torsion in wing & fuselage cross-sections	A6
5	02/26	Stresses due to torsion in wing & fuselage cross-sections	A6
6	03/02	Review	
6	03/04	MIDTERM 1	
7	03/09	Axial stresses due to multiple bending in wings	A13
7	03/11	Axial stresses due to multiple bending in wings	A13
8	03/16	Flexural shear flow in open cross-sections	A14
8	03/18	Flexural shear flow in open cross-sections	A14
9	03/23	Flexural shear flow in closed cross-sections	A14
9	03/25	Flexural shear flow in closed cross-sections	A14
10	03/30	No class - spring break	
10	04/01	No class - spring break	
11	04/06	Review	
11	04/08	MIDTERM 2	
12	04/13	Shear flow due to bending and torsion in thin-walled wings	A15
12	04/15	Shear flow due to bending and torsion in thin-walled wings	A15
13	04/20	Intro to Finite Element Method	
13	04/22	Intro to Finite Element Method	
14	04/27	Intro to Finite Element Method	
14	04/29	Intro to Finite Element Method	

Week	Date	Topics, Readings, Assignments, Deadlines	Chapter
15	05/04	Intro to Finite Element Method	
15	05/06	Intro to Finite Element Method	
16	05/11	Review	
Final Exam		Friday May 15th, 2020 @ 9:45AM – 12:00 PM	