

**San José State University**  
**Aerospace Engineering Department**  
**AE114, Aerospace Structural Analysis II, Spring 2018**

**Course and Contact Information**

<b>Instructor:</b>	J. M. Hunter
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<b>Office Hours:</b>	Monday & Wednesday 10:30 – 2:30pm
<b>Class Days/Time:</b>	Monday & Wednesday 3:00 – 4:15pm
<b>Classroom:</b>	Sweeney Hall 100

**Course Format**

**Course Description**

Aircraft and spacecraft structural analysis and design. Conventional and introductory finite element methods. Bending and shear stress analysis as well as shear flow analysis. Aircraft wing and fuselage design considerations for simplified models and actual structures. Matrix structural analysis of joint displacement and axial bar stress as well as design of spacecraft truss structures.

**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 the 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)**

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 a (closed) multiple-cell wing section under torsion.

7. For a wing section subjected to multiple bending moments, find the bending stress in the wing stringers.
8. 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.
9. Determine the shear flow distribution and shear center location for a (closed) thin-walled section with stringers.
10. Iterate to a successful aircraft stringer-skin-type wing design using actual material properties – beginning with a baseline configuration.
11. Using Finite Element Method, assemble the stiffness matrix for a spacecraft truss structure.
12. Analyze a spacecraft truss structure to determine axial force and joint displacement.
13. Design and carry out experiments to define material or geometric properties of the cantilever beam, torsional beam and Beechcraft tail section.

**Textbook** Bruhn: [Analysis and Design of Aircraft Structures](#)

**References** 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

This course consists of 8 - 10 homework assignments, 3 lab problems, several quizzes, a midterm exam and a final exam. The homework assignments and lab problems are designed to directly support the Course Learning Objectives. More details can be found from [University Syllabus Policy S16-9](http://www.sjsu.edu/senate/docs/S16-9) at <http://www.sjsu.edu/senate/docs/S16-9.pdf>.

### Final Examination

A comprehensive written final exam will be given on Thursday May 17, 12:15 – 2:30pm

### Grading Information

Grades are derived from homework, exams and the project. Each homework problem is worth 10 points. Partial credit is assigned based on the demonstrated understanding of concepts and analytical/numerical results. More guidelines on grading information and class attendance can be found from the following two university policies:

- [University Syllabus Policy S16-9](http://www.sjsu.edu/senate/docs/S16-9.pdf) (<http://www.sjsu.edu/senate/docs/S16-9.pdf>)
- [University policy F15-12](http://www.sjsu.edu/senate/docs/F15-12.pdf) (<http://www.sjsu.edu/senate/docs/F15-12.pdf>)

### Determination of Grades

Homework	20%
Lab Problems	10%
Quizzes (top 6 grades)	30%
Midterm Exam	20%
Final Exam	20%

Grading Scale: 100 – 97% A+; 96.9 – 93% A; 92.9 – 90% A-; 89.9 – 87% B+; 86.9 – 83% B; 82.9 – 80% B-;

79.9 – 77% C+; 76.9 – 73% C; 72.9 – 70% C-; 69.9 – 67% D+; 66.9 – 63% D; 62.9 – 60% D-; < 59.9% F  
 All exams must be taken to receive a passing grade.

### 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 Policies** <http://www.sjsu.edu/ae/programs/policies/>

## AE114 / Aerospace Structural Analysis II, Spring 2018, Course Schedule

Week	Date	Topics
1	1/24/2018	Two-Dimensional Inertia Properties of Wing Sections
2	1/29/2018	History of Aircraft Structures
3	2/5/2018	Bending Moments on Beam Columns
4	2/12/2018	Non-Symmetrical Bending Stresses; Shear Center
5	2/19/2018	Structural Design Considerations for Contemporary Aircraft
6	2/26/2018	Shear Flow and Shear Center in an Open Section
7	3/5/2018	Shear Flow in a Section with Stringers
8	3/12/2018	Analysis of Wing Structures
9	3/19/2018	Midterm
10	4/2/2018	Loads and Stresses on Ribs and Frames
11	4/9/2018	Analysis of a Whole Wing
12	4/16/2018	History of Spacecraft Structures
13	4/23/2018	Introduction to Finite Element Analysis
14	4/30/2018	Booms and Truss Structures
15	5/7/2018	Axial Force and Joint Displacement
16	5/14/2018	Final Exam Review
Final Exam		Thursday 5/17, 12:15 – 2:30pm