

**Course ID and Title**

AME 499 – Analysis and Design of Flight Vehicle Structures  
Fall 2016

**Location: VHE 214**

**430p-715pm**

**Instructor:** Vinay Goyal

**Office:**

**Office Hours:**

**Contact Info:** vinay.k.goyal@gmail.com

**Teaching Assistant:** Requested

**Office:**

**Office Hours:**

**Contact Info:**

**IT Help:** None

**Hours of Service:**

**Contact Info:**

**Course Description**

Modeling and analysis of aerospace structures -- aircraft and launch vehicles. The course will discuss sizing of wing box and fuselage, and topics such as bending, torsion, buckling, and damage tolerance. Discussions on aircraft configurations and load paths, design philosophy and criteria, external and internal loads, materials, failure theories, tension structures, and how to analyze joints, lugs, fittings, shear resistant beams, and diagonal tension beams. FAA Regulations, AIAA standards, and NASA Standards.

## **Learning Objectives**

The fundamental concepts in the analysis and design of aircraft structures including the assessment of:

- (1) Aircraft and launch vehicle hardware
- (2) Strength of joints, wings, frames, bolts
- (3) Stress Concentrations
- (4) Welded Connections
- (5) Thin Walled Structures
- (6) Buckling and crippling
- (7) Design factors of safety, certification, and practical considerations

**Prerequisite(s):** None, But AME 201, AME 204, Recommended

**Co-Requisite (s):** None

**Concurrent Enrollment:** None

**Recommended Preparation:** None

## **Course Notes**

Copies of lecture slides and other class information will be posted online.

## **Technological Proficiency and Hardware/Software Required**

Mathematica, Matlab Not Required, but may be needed.

## **Required Readings and Supplementary Materials**

Primary Textbook: "Aircraft Structures for Engineers," V. K. Goyal, provided complimentary.

1. Aircraft Structures, Peery, David J., Dover Publications, 1950
2. Airframe Structural Design: Practical Design Information and Data on Aircraft Structures, Niu, Michael Chun-Yung, Adaso/Adastra Engineering Center 1999
3. Airframe Stress Analysis and Sizing , Niu, Michael Chun-Yung, Adaso/Adastra Engineering Center, 1999
4. Composite Materials for Aircraft Structures (2nd Edition), Baker, Alan; Publisher American Institute of Aeronautics and Astronautics, 2004
5. Aircraft Structures for Engineering Students (3<sup>rd</sup> Edition), T H.G. Megson, 1999.

## **Description and Assessment of Assignments**

Homework will be assigned approximately weekly and will generally be due at the beginning of class one week after the date assigned.

## **Grading Breakdown**

10 Problem Sets – 80%; 1 Final Exam 20%

### Assignment and Exams Submission Policy

Homework will be submitted to professor. Late assignments will not be accepted. Exams will be take-home.

### Course Schedule: Weekly Breakdown

	Topics/Daily Activities	Homework
<b>Week 1</b> Aug 24 <sup>th</sup>	Introductory Remarks  Stress, Strain, Constitutive Law & Strength Failure Criteria for Metals and Composites	
<b>Week 2</b> August 31st	Composite and Structural Assessment Process of Aircraft/Launch Vehicles	Problem Set 1
<b>Week 3</b> September 7	Aircraft and Launch Vehicle Failures; Launch Vehicles	
<b>Week 4</b> September 14	Aircraft Launch Vehicles Loads and Sizing and Design Process	Problem Set 2
<b>Week 5</b> September 21	FAA Regulations, AIAA Standard, and NASA Standard for Unmanned and Manned Spaceflight	
<b>Week 6</b> September 28	Buckling Plates and Shells, I	Problem Set 3
<b>Week 7</b> October 5	Buckling Plates and Shells, II	
<b>Week 8</b> October 12	Three Hour Seminar on Launch Vehicle Issues	Problem Set 4
<b>Week 9</b> October 19	Stress Concentrations	Problem Set 5
<b>Week 10</b> October 26	Bolted/Rivet Connections, Seals, I	Problem Set 6
<b>Week 11</b> November 2	Bolted/Rivet Connections, Seals, II	
<b>Week 12</b> November 9	Welded Connections	Problem Set 7
<b>Week 13</b> November 16	Thin Walled Shear Stresses	8
<b>Week 14</b> November 23	Thanksgiving	Problem Set 9
<b>Week 15</b> November 30	Applications to Launch Vehicles and Aircraft	Problem Set 10

### **Statement for Students with Disabilities**

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. Website and contact information for DSP: [http://sait.usc.edu/academicsupport/centerprograms/dsp/home\\_index.html](http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html), (213) 740-0776 (Phone), (213) 740-6948 (TDD only), (213) 740-8216 (FAX) [ability@usc.edu](mailto:ability@usc.edu).

### **Statement on Academic Integrity**

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. *SCampus*, the Student Guidebook, ([www.usc.edu/scampus](http://www.usc.edu/scampus) or <http://scampus.usc.edu>) contains the University Student Conduct Code (see University Governance, Section 11.00), while the recommended sanctions are located in Appendix A.

### **Emergency Preparedness/Course Continuity in a Crisis**

In case of a declared emergency if travel to campus is not feasible, USC executive leadership will announce an electronic way for instructors to teach students in their residence halls or homes using a combination of Blackboard, teleconferencing, and other technologies.