

# MAE 155A

## Aerospace Engineering Design I

**Designation:** Required Course for AE

**Catalog Data:**

MAE 155A Aerospace Engineering Design I (4)

Fundamental principles of aerospace vehicle design including the conceptual, preliminary, and detailed design phases. Aeronautical and astronautical design process and integration of a comprehensive range of technical disciplines into the design of an overall system project that integrates all appropriate engineering disciplines as well as issues associated with optimization, manufacturability, reporting, and professionalism.

**Prerequisites:**

Grade of C- or better in MAE2 [Intro to AE], MAE 104 [Aerodynamics], MAE 113 [Propulsion], MAE 130C [Vibrations], MAE 142 [Dynamics and Control], MAE 150 [Computer-Aided Design], SE 2 [Materials] and SE 160B [Structures]. Students may enroll concurrently with MAE 113, 142, and 150.

**Textbook, Required Materials:**

- \* D.P. Raymer, Aircraft Design: A Conceptual Approach, AIAA Education Series
- \* C.D. Brown, Elements of Spacecraft Design, AIAA Education Series
- \* Web reference material (see course web site)

**Class/Laboratory Schedule:** 4 lecture hours per week

**Course Topics:**

1. Engineering Design Process
2. Design Techniques, System Development
3. Aircraft Design
  - Aircraft Design Process
  - System Requirements Decomposition
  - Aircraft Sizing
  - Subsystems and Payload Integration
  - Vehicle Aerodynamics
  - Propulsion System Selection and Integration
  - Structural Layout
  - Stability and Control
  - Mass Properties
  - Performance Analysis and Estimation
  - Cost Estimation
  - Multidisciplinary Design Optimization, Operations, Certification
4. Spacecraft Design
  - Introduction to Astronautics
  - Fundamentals of Orbital Mechanics
  - Rocket Propulsion and Flight Mechanics
  - Launch Vehicle Design
  - Space Environment, Spacecraft Layout
  - Spacecraft Thermal Control Systems
  - Spacecraft Power Systems
  - Basic Spacecraft Attitude Control

**Course Objectives:**

(Numbers in parenthesis refer to MAE Program Outcomes)

Objective 1: To teach students how to solve open-ended design problems and to integrate knowledge of fundamental aeronautical and astronautical topics in the design of an aerospace system (3c, 5e, AE12, AE13, AE14).

Objective 2: To provide students with the experience of applying engineering science theory to real world design problems (1a, 3c, 5e, AE12, AE13, AE14).

2.1 Strengthen and apply knowledge of aeronautical topics including aerodynamics, aerospace materials, structures, propulsion, flight mechanics, and stability and control (AE12).

2.2 Strengthen and apply knowledge of astronautical topics including attitude determination and control, space structures, orbital mechanics, and rocket propulsion (AE13).

**Methods of Evaluation:**

1. Homework will be collected and graded.
2. Quizzes, Exams.

**Performance Criteria:**

(Numbers in parentheses refer to the methods of evaluation used to assess student performance.)

Objective I (AE Design)

1.1 Students will be given open-ended design problems to solve and apply design methods to specific design problems (1,2).

Objective 2 (Application of Engineering Science)

2.1 Analysis will be used in the conceptual and preliminary design stages to evaluate feasibility of various design concepts (1,2).

2.2 The performance of aeronautical components and system will be evaluated, and engineering analysis will be used for design and correlation of theory with practice (1,2).

2.3 The performance of astronautical components and system will be evaluated, and engineering analysis will be used for design and correlation of theory with practice (1,2).

**Prepared by:** James Lang, February 2004.

**Revised:** May 2007 (A. Drake, S. Harrington, J. Kosmatka, K. Nomura)