Introduction to Ae105

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Instructors

- Tony Freeman (Ae105 Instructor and JPL Innovation Foundry Manager)
- Oscar Alvarez-Salazar (Ae105 Instructor and JPL GN&C Senior Engineer)
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- Sergio Pellegrino (Professor of Aeronautics and Civil Engineering, JPL Senior Research Scientist)

Course Objectives

- To reinforce a set of core competencies in the key aerospace engineering disciplines of systems engineering; structural and thermal mechanics; and guidance, navigation, and control.
- To provide examples whenever possible illustrating the state-of-the-practice of these disciplines in aerospace engineering.
- To develop an appreciation for spacecraft design as a systems engineering problem.
- To apply the academic aerospace engineering disciplines to solving a flight-relevant aerospace engineering project using a professional, team-based approach.

Ae105 Course Description

Ae 105 abc. Aerospace Engineering. 9 units (3-0-6); first, second, third terms.
Prerequisites: APh 17 or ME 18 and ME 19 or equivalent.
Part a (1st term): Introduction to spacecraft systems and subsystems, mission design, fundamentals of orbital and rocket mechanics, launch vehicles and space environments; JPL-assisted design exercise; spacecraft mechanical, structural, and thermal design; numerical modeling, test validation.
Part b (2nd term): Introduction to guidance, navigation, and control (GNC), measurement systems, Kalman filtering, system analysis, simulation, statistical error analysis, case studies of JPL GNC applications; preliminary discussion and setup for team project leading to system requirements review.
Part c (3rd term): Team project leading to preliminary design review and critical design review.

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1st Term Outline (2016)

Lecture	Date	Lecturer	Topic
1	9/27	Freeman	Introduction/AAReST Mission Overview
2	9/29	Freeman	Mission Architecture and Systems Engineering for Nanosats
3	10/04	Freeman	Spacecraft Design: The Coresat Spacecraft Point Design
4	10/06	Freeman	Instrument/Spacecraft Interfaces; HW #1 assigned (AF)
5	10/11	Freeman	I. Working on a Project team II. The Space Environment, Reliability, Quality Assurance and Radiation Effects
6	10/13	Freeman	Requirements Traceability and Error Budgets; Attitude Determination and Control – HW #1 due; HW #2 assigned
7	10/18	Freeman	RF Communication Links; Power Subsystem.
8	10/20	Freeman	Calibration; Integration and Test. HW #2 due
9	10/25	Freeman	Spacecraft Command and Telemetry; OBC; Flight Software; Fault Protection. Mid-Term #1 assigned (AF)
10	10/27	Freeman	The Ground System and Mission Operations

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Lecture	Date	Lecturer	Topic
11	11/1	Alvarez-Salazar	Rocket Equation. Mid-term #1 due
12	11/3	Alvarez-Salazar	Launch Vehicles/Static Loads – HW #3 assigned (OA-S)
13	11/8	Alvarez-Salazar	Modal Analysis
14	11/10	Alvarez-Salazar	Modal Analysis. HW #3 due. HW #4 assigned (OA-S)
15	11/15	Alvarez-Salazar	Dynamic (Random) Loads.
16	11/17	Alvarez-Salazar	Thermal Analysis I. HW #4 due. HW #5 assigned (OA-S)
17	11/22	Alvarez-Salazar	Thermal Analysis II
18	11/24	-	Thanksgiving
19	11/29	Freeman/ Alvarez-Salazar	Class review. HW #5 due
20	12/1	All	Project Arrangement. Mid-term #2 assigned (OA-S). Due 12/08.

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- Reference Textbook: Fundamentals of Space Systems, V. L. Pisacane, Oxford University Press, 2005

- Freeman:
  - Homework 1 (20%)
  - Homework 2 (30%)
  - Mid-term 1 (50%)

- Alvarez-Salazar
  - Homework 3 (20%)
  - Homework 4 w presentation (20%)
  - Homework 5 (20%)
  - Midterm 2 (40%)