ENG ME 409 Flight Vehicle Design I

2008 - 2009 Catalog Data:
ENG ME 409 Flight Vehicle Design I Prereq: ENG ME 307, ENG ME 311, and ENG ME 312; coreq: ENG ME 403 and ENG ME 423. Conceptual design of aerospace systems, including first-order design analysis and design layout. Synthesis of aerodynamics, propulsion, structures and loads, stability and control, and payload considerations for vehicle sizing and configuration layout. Use of trade studies to evaluate alternative designs for specific mission requirements. Introduction to satellite design, including propulsion, power, telecommunications, thermal control, astrodynamics, attitude control. Computer usage, and presentation and written reports. 4 cr.

Course Schedule: 4 lecture hours per week

Status in Curriculum: Required in Aerospace Program

Textbook(s):AC: Daniel Raymer, Aircraft Design: A Conceptual Approach, Prentice Hall, 2003

Coordinator: Donald Wroblewski, Associate Professor, Mechanical Engineering

Prerequisites by Topic:
1. Engineering Design I and II (CAD, Engineering Design Methodologies and Management, Engineering Economics, Safety)
2. Engineering Mechanics (Statics and Dynamics)
3. Incompressible Aerodynamics
4. Mechanics of Materials
5. Atmospheric Flight Mechanics (corequisite)

Goals:
1. To introduce aircraft conceptual design through a formal textbook approach, in sufficient detail to fully prepare students for more in-depth preliminary design project
2. To initiate group capstone design project, to be concluded during AM 410, through application of conceptual design approach

Course Learning Outcomes:
As an outcome of completing this course, students will:

i. Develop the ability to synthesize basic engineering science to accomplish a mission-driven design of an aircraft, including: preliminary and refined sizing; airfoil and wing selection; engine selection; fuselage and tailplane design; static stability; structural loading; cost analysis; takeoff and landing; and specification of thrust-to-weight (T/W) ratio and wing loading (W/S). (A, C, E, L, AE:M)
ii. Develop proficiency in and an appreciation for performing trade studies to optimize aircraft conceptual design (A, C, E, K, L, AE:M)

iii. Gain experience working on a major group design of an aerospace vehicle (capstone design) including mission definition, preparation of formal written proposal, and application of the conceptual design approach to develop a workable configuration that will be the basis for the preliminary design to be carried out in AM 410 Flight Vehicle Design II. (C, D, E, K, L, AE:M)
iv. Gain experience in preparing and delivering oral presentations through an oral presentations for the system design review. (G)
v. Gain experience and confidence in self-instruction and use of software for aircraft design, through use of software to perform design analysis as part of group design work. (I, K)
vi. Gain experience with professional aspects of engineering design including teaming skills and effective project management. (D, F)
vii. Gain an appreciation for contemporary issues related to aircraft through homework assignments and class discussions. (H, J)

Course Learning Outcomes mapped to Program Outcomes:
(For Program Outcomes, please see attached page or Department Web Site)

Program:	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Course:	i, ii		i , ii, iii	iii, vi	i, ii, iii	vi	iv	vii	v	vii	ii, iii, v	i, ii, iii		
Emphasis:	4	1	5	3	5	2	3	2	2	2	4	4	1	1

Topics (time spent in weeks):
Aircraft topics:
1. Introduction, Initial and Updated sizing (2)
2. Wing loading and wing design (2)
3. Fuselage and tailplane design (1.5)
4. Propulsion system selection (1.5)
5. Takeoff and High Lift Devices (1.5)
5. Refined weight estimate and trade studies (1)
6. Loads and V-n Diagram (0.5)
7. Stability and control (1)
8. Cost (0.5)

Professional topics:
1. Teaming skills (0.5)
2. Presentation skills (0.5)
3. In class presentations (1)

Contribution of Course to Meeting the Professional Requirement:
Engineering Topics: 100%

Status of Continuous Improvement Review of this Course:
Date: Spring 2009 **Reviewed by:** Design Subcommittee
Prepared by: Donald Wroblewski **Date:** August 29, 2007