

AEROSPACE VEHICLE DESIGN I-II

MAE 4350/4351

(2-3) 3 HOURS CREDIT

FALL 2009/SPRING 2010

SYLLABUS

CONTENT Analysis and design of an aerospace system such as a complete flight vehicle, a propulsion system, a structural system, or a control system; market analysis, operating studies, mission specification, civil and military certification requirements; design process, methods and tools; configuration concept selection, harmonization of individual design disciplines (aerodynamics, performance, flight mechanics, structures, cost, systems, etc.).

TOPICS COVERED 1) Flight Vehicle Classes and Characterization, 2) Overview and Assessment of Aerospace Product Development Texts, 3) Product Development Life-Cycle, 4) Generic Product Development Process, 5) Disciplinary Analysis of Hardware

COURSE OBJECTIVES This two-semester aerospace design course is developed to integrate the fundamental courses taken earlier throughout the curriculum by the aerospace or mechanical engineering student. The student is required to exercise the knowledge obtained in the prerequisite courses in the determination of a well-balanced multi-disciplinary flight vehicle system and develop an understanding of the design methodology through a highly structured lecture program, laboratory program, and a capstone design project to develop an overall understanding for aerospace systems.

LECTURE PROGRAM: A unique lecture series has been developed presenting the three key elements in aerospace product development: a) management domain, b) engineering domain, and c) operation domain. Emphasis has been placed on a generic presentation of the material being applicable to subsonic to hypersonic designs. Although the student is asked to familiarize and utilize classical design texts, the presentation material aims to assemble a unique flight vehicle design compendium ultimately guiding the engineering apprentice towards the state-of-the-art of product synthesis. The lecture program is exclusively reserved for the Fall semester.

LABORATORY PROGRAM: One important feature of this course is the inclusion of a reverse-engineering example problem (Cessna Citation X). Throughout the semester the students successively quantify the Citation X by applying their theoretical, physical, and technical understanding. Emphasis has been placed on emulating an industry-typical disciplinary and

multi-disciplinary design decision processes. Problem solving techniques range from by-hand calculations, the development of custom spreadsheet applications to specialist software execution. This laboratory program will enable the student engineer to build design proficiency for the range of design disciplines concerned. The laboratory (training) program is exclusively reserved for the Fall semester, thereby exposing the student body to the overall design process, methods library, and a variety of software applications before the Spring capstone design project is started.

CAPSTONE DESIGN PROJECT: The capstone project serves as the primary vehicle throughout the Spring semesters to systematically apply problem solving skills leading to a final deliverable to the individual student, the student design team, and possibly the industry sponsor. The students will respond to a given RFP (request of proposal) usually provided by a major aerospace company. A significant portion of the theoretical design work has to be accomplished ‘by hand’, but specialized disciplinary software tools will also be used to support certain aspects of the design process. Hands-on experience can be included in case the project requires the design-built-test sequence of a test specimen like a wind-tunnel model or of a small-scale R/C flight test demonstrator. Students will continually document individual and overall project progress by writing professional quality, regularly scheduled reports.

COMPUTER USE	The computer is used extensively for design computations (disciplinary analysis, vehicle synthesis), for utilizing and building technical databases, for configuration development and geometry visualization using a CAD system, for visuals for class presentations, and for producing weekly reports and the final report. Students are urged to utilize computer facilities provided by MAE to develop their own programs based on course text and lectures.
PREREQUISITES	MAE 4350 for MAE 4351 or MAE 4287 and MAE 4188; permission of the instructor.
CLASS SCHEDULE	Lectures and design exercises during the Fall 2009 semester, and capstone design project discussions during the Spring 2010 semester totaling 270 minutes per week, for the Fall 2009 semester Monday and Wednesday 01:00 p.m. – 01:50 p.m., and Friday 01:00 p.m. – 03:50 p.m.
CLASS ATTENDANCE	It is part of the students’ obligation to attend lectures, training exercises, and scheduled project meetings; lack of attendance results in penalty points.
LABORATORY	Utilization of the MAE Capstone Laboratory in WH 306; possible utilization of the machine shop, wind tunnel, and CAD Laboratory.
INSTRUCTOR	Bernd Chudoba, Assistant Professor, UTA MAE 500 W. First St., Phone: 817 272 1436 E-Mail: chudoba@uta.edu <i>Office Hours: TBD</i>

PLACE OF CLASS Room 208, WH

TEXT Lecture Notes

REFERENCES Torenbeek, E., “*Synthesis of Subsonic Airplane Design*”, Delft University Press, 1982
Roskam, J., “*Airplane Design – Parts I-VIII*”, First Edition, Second Printing, 1997
Schaufele, R.D., “*The Elements of Aircraft Preliminary Design*,” First Edition, Aries Publications, 2000

COURSE WEBSITE <http://www-woolf.uta.edu>
Login: 4350chudoba
Password: 17vehing48

GRADING LECTURE (Fall 2008)	Homework (ABET, Misc.)	30%
	Homework (Lab Section)	40%
	Pop-Quizzes	30%

GRADING PROJECT (Spring 2009)	Individual Weekly Progress Reports	15%
	Mid-Term Presentation	10%
	Mid-Term Report	25%
	End-of-Semester Presentation	15%
	End-of-Semester Report	35%

GRADE ALLOCATION Course grades will be earned based on the following criteria:

- A = 90% - 100%
- B = 80% - 89%
- C = 70% - 79%
- D = 60% - 69%
- F = 0% - 59%

This criteria is ABSOLUTE and there is no intention to deviate from it.

PROGRAM EDUCATIONAL OBJECTIVES (MAE Outcomes; ABET A-K)

The MAE 4350/4351 capstone course relates to the following MAE/ABET outcomes: A, B, C, D, E, F, G, H, I, J, K. The A-K statements describe what students are expected to know and be able to do by the time of graduation.

The students shall have:

- A. an ability to apply knowledge of mathematics, science and engineering;
- B. an ability to design and construct experiments, as well as to analyze and interpret data;
- C. an ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability;
- D. an ability to function on multidisciplinary teams;
- E. an ability to identify, formulate and solve engineering problems;
- F. an understanding of professional and ethical responsibility;
- G. an ability to communicate effectively;

- H. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context;
- I. a recognition of the need for, and the ability to engage in, lifelong learning;
- J. a knowledge of contemporary issues;
- K. an ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

KEY A-K ASSIGNMENTS FOR PERFORMANCE TRACKING

Although this course naturally addresses all the above educational objectives A-K, the following key assignments have been selected by the MAE department to formally assess your ability **(1)** to design a system, component or process taking real-life constraints into account (*Outcome C*), **(2)** to function in a multidisciplinary team (*Outcome D*), **(3)** to develop an understanding for professional and ethical responsibility (*Outcome F*), **(4)** to develop an ability to communicate effectively (*Outcome G*), and **(5)** to develop the recognition and ability to engage in lifelong learning (*Outcome I*).

Therefore, the above five key assignments consisting of either homework and/or project related tasks throughout both individual capstone semesters must be passed in each semester in order to pass the course. During the semester these assignments will be designated as key assignments. **Caution: in order to pass this class you must pass all five key assignments each semester.** If any key assignment is not passed in either semester, you will not pass the class even if you score perfectly on all the other exams and assignments. Assignments that are selected to be those key assignments are explained below.

Key Assignment for Outcome C - *“an ability to design a system, component or process to meet desired needs within realistic constraints ...”*

Successful a) individual semester task planning (design a process) and b) successful execution of the plan leading to a system or component, is a key assignment. First, this assignment requires the student to understand his/her responsibilities in the team, leading to the definition of the process enabling to meet two semester milestones for each semester. Second, realistic constraints of relevance for the task/process at hand have to be identified, combined with an overall time plan, and a description of the quality of the deliverable to be expected. Third, the students are required to compare the initial (theoretical) semester task plan with the final (actual) deliverable, being a system or component. Students will be required to write a chapter dedicated to this key assignment in his/her individual report which will be graded individually. Regardless of his/her performance in other parts of the class, *students must pass this assignment as any other key assignment in order to receive a passing grade in the course.*

Key Assignment for Outcome D - *“an ability to function on multidisciplinary teams.”*

Successful completion of the semester milestones for both semesters by working in a team is a key assignment. The individual teams will not be organized by the instructor. Instead, every student will assign an individual responsibility in a particular team. First, every student is required to define, organize, and finally document his/her tasks and interface function with the other team members upfront. This leads to a ‘responsibility’ chapter in the individual student report documenting individual roles, responsibilities and as well dependencies. Second, at the completion of a milestone, every student will need to fill a ‘peer evaluation form’ for every team colleague in his/her team. In this evaluation form, there are several questions to quantify,

with a rating scale of 1 to 5, a student's ability to function on a multidisciplinary team. The average of the scales given for a student by his/her teammates will affect his project grade. The first and second semester each have two major milestones to pass. Regardless of his/her performance in other parts of the class, *students must pass this assignment as any other key assignment in order to receive a passing grade in the course.*

Key Assignment for Outcome F - *“an understanding of professional & ethical responsibility”.*

Successful identification, discussion, and comprehension of professional and ethical responsibility examples relevant to his/her team focus for both semesters are a key assignment. First, two of the lectures per semester are explicitly devoted to presenting information on engineering ethics. The final semester exams will specifically test the understanding of engineering ethics. Second, there will be two homework assignments each semester to identify and discuss one professional and one educational ethics case studies. During a project session there will then be discussion led by the faculty member on each of the case studies. Third, the citing of citing reference material will be stressed throughout the semester. Students will learn the correct format of citations and the situations in which citations are necessary. The individual reports have to demonstrate such technique beginning from the literature search. The primary literature search will be a graded assignment. Fourth, students will be presented with the concept of logbooks. They will be instructed on logbook use and the ethical and professional responsibilities associated with a logbook. Logbooks will be required of each student and the organization and usefulness of its contents will be graded at the end of the semester. The logbook will be given a score of 1 to 10 and students must get at least four points out of ten to pass this key assignment. Regardless of his/her performance in other parts of the class, *students must pass this assignment as any other key assignment in order to receive a passing grade in the course.*

Key Assignment for Outcome G - *“an ability to communicate effectively.”*

Successful planning, preparation, and presentation of project information via an oral presentation and weekly written reports throughout the second semester are a key assignment. First, one of the class periods will be devoted to technical writing. Students will be presented with information about the format of technical reports, professional letters, memos and emails. Every student is asked to submit a 'cumulative' weekly research report which will be graded. Second, one class period will be devoted to oral presentations. Students will be presented with tips on preparing MS PPT presentations and how to give a good presentation. The mid-term and end-of-semester project presentations for each semester will be graded individually. Exams will include questions related to oral and written communication techniques. Regardless of his/her performance in other parts of the class, *students must pass this assignment as any other key assignment in order to receive a passing grade in the course.*

Key Assignment for Outcome I - *“a recognition of the need for, and the ability to engage in, lifelong learning.”*

Every student will be asked to (i) identify a subject of major relevant to his/her project responsibility, (ii) conduct a library search to find at least one conference/journal article on the subject, (iii) read the article and summarize, in a two-page chapter in the individual report, what he/she has learned by reading the article and, in addition to the knowledge, what he/she has gained by working on this assignment. The instructor will ask the AE subject librarian to give a

half-hour presentation for students to understand how they can utilize library resources to complete this assignment. Based on the two-page assignment, students will get a pass/fail grade. Regardless of his/her performance in other parts of the class, *students must pass this assignment as any other key assignment in order to receive a passing grade in the course.*

COURSE POLICIES

COURSE DELIVERABLES

Failure to turn in *any* course-related assignment (weekly homework, weekly report, etc.) *on its assigned date, and at the assigned time*, will result in a grade of a 0% being assigned for that course-related assignment. No late deliverables will be accepted for any reason; no grades of incomplete will be assigned. Each weekly homework assignment is due at the beginning of the Monday lecture a week after being assigned (Fall 2008 semester). Only conceptual discussion among students is allowed; sharing of results is not permitted. The weekly capstone reports are due at the beginning of the TBD project meeting documenting one week worth project work (Spring 2009 semester). The new entries into the project reports are indicated in red. The reports are collected by a TBD student who provides the collected reports to the instructor. Responsibility rests with the individual student to turn their report in.

ATTENDANCE, PERFORMANCE EVALUATION

Attendance is mandatory during lectures, training exercises, project group meetings, class meetings, and presentations (mid-term, final, or by guest speakers). Subjective evaluation of individual students' performance is based on faculty impression, input from sponsors (customer satisfaction), team members (peer review), technical staff, and external judges.

UNIVERSITY POLICIES

STUDENT EVALUATION OF TEACHING

The students will be asked to complete feedback forms at the end of the semester.

ABSENCES BASED ON RELIGIOUS BELIEFS

A student who misses an examination, work assignment, or other project due to the observance of a religious holy day will be given the opportunity to complete the work missed. To be eligible for such a make-up, the students must notify his/her instructor in writing within the first 15 days of class. Failure to follow the rules provided above within the time frames listed will result in the absence being considered unexcused.

AMERICANS WITH DISABILITY ACT

The University of Texas at Arlington is on record as being committed to both the spirit and letter of federal equal opportunity legislation; reference Public Law 93112 – The Rehabilitation Act of 1973 as amended. With the passage of new federal legislation entitled Americans With Disabilities Act (ADA), pursuant to section 504 of The Rehabilitation Act, there is renewed focus on providing this population with the same opportunities enjoyed by all citizens. As faculty members, we are required by law to provide '*reasonable accommodation*' to students with disabilities, so as not to discriminate on the basis of that disability. Student responsibility primarily rests with *informing faculty at the beginning of the semester and in providing authorized documentation through designated administrative channels*. For more information contact the Office for Students with Disabilities.

ACADEMIC DISHONESTY

It is the philosophy of The University of Texas at Arlington that academic dishonesty is a completely unacceptable mode of conduct and will not be tolerated in any form. Any person involved in academic dishonesty will be disciplined in accordance with University regulations and procedures. Discipline may include suspension or expulsion from the university. It is the student's responsibility to know University policies on these matters. *"Scholastic dishonesty includes but is not limited to cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts."* (Regents' Rules and Regulations, Part One, Chapter VI, Section 3, Subsection 3.2, Subdivision 3.22)

INCLEMENT WEATHER POLICY

In the event that weather or other conditions are such that normal campus operations could be impeded, the following policy will apply for this class. If the University is closed, this class will not meet. Any assignments due or examinations scheduled will be due or rescheduled to the very next class period that the class meets. Local media should announce any closings.

STUDENT SUCCESS

UTA supports a variety of student success programs to help you connect with the university and achieve academic success. They include learning assistance, developmental education, advising and mentoring, admission and transition, and federally funded programs. Students requiring assistance academically, personally, or socially should contact the Office of Student Success Programs for more information and appropriate referrals.

EMAIL TO FACULTY

To contact a faculty member, use the email address shown on the top of the syllabus. Use as the 'subject line' MAE 4350/4351, put your name inside the email message, start with the main point/question of the message. Emails from outside the UTA domain are subject to being treated as spam by the server and are possibly deleted.

NOTICE

The instructors reserve the right to make changes to the course syllabus as necessary. It is the student's responsibility to keep up with changes to the syllabus as posted on the class website.

COPYRIGHT

Copyright 2008 UTA COE as to this syllabus, all lectures, and all materials. Students are prohibited from selling notes taken during this course (or being paid for taking by) any person or commercial firm without the express written permission of the professor teaching this course.

By signing this syllabus, the student acknowledges that he/she has read and understood this document.

Signature: _____ Date: _____

Prepared by: Bernd Chudoba
Date: 24 August 2009

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