

**Fall 2007**      **EAS4700**      **Aerospace Design I**  
**EML4501**      **Mechanical Engineering Design I**  
**EGN4412C**      **Interdisciplinary Design I**

**Description:**

Application of the design process in the team solution of a state-of-the-art problem. Aerospace, mechanical, thermo-fluid, material, electrical, electronic, and software problems are considered.

**Objectives:**

To introduce students to engineering design and the design process through applied engineering related design projects. Emphasis shall be placed on professionalism, creativity, engineering, design logic and communication. Particular objectives are:

1. To present topics needed by a designer but not covered elsewhere
  - Robust design, decision theory, optimization.
  - Manufacturing processes, reliability.
  - Codes/standards, patents, litigation.
2. To foster awareness about different requirements during a design process
  - Requirement for role of creativity.
  - Requirement for continuing study.
  - Role of ethics.
3. To provide experience in writing/speaking/communication

**Overview:**

Subject material in this course will include the design process, as well as design projects of varying scales. In addition, the course will include material on selected subjects chosen to help round out and bring together the students knowledge. The course will place emphasis on initiative to develop definitions and formulate solution approaches. The course will rely on self-learning in manner which is expected in the work force. A large and long-term project (fall through spring) will be assigned to facilitate practical implementation of engineering design and the design process.

This course is intended to complete the students engineering education. Thus, upon completion of this course, the student must demonstrate:

- an ability to apply knowledge of mathematics, science and engineering;
- an ability to design systems, components and processes to meet desired needs;
- an ability to function in multi-disciplinary teams;
- an ability to identify, formulate and solve engineering problems;
- an understanding of professional and ethical responsibility;
- an ability to communicate effectively
- an ability to use the techniques, skill and modern engineering tools necessary for engineering practice;
- the ability to understand the impact of engineering solutions in a global and societal context; and
- a knowledge of contemporary issues.

**Prerequisites:**

ME Major: EML 3500 (Machine Design & Analysis)  
EML 3701 (Fluid Mechanics I)  
EML 3303 (Mechanical Engineering Measurements)

AE Major: EAS 3101 (Fundamental of Aerodynamics)  
EAS 3800 (Aerospace Engineering Measurements)  
EAS 4200 (Flight Structures)

EE/CS Major: EEL 3307, EEL 3657, EEL 3252 / EEL 3307, EEL 3657, EEL 4767

**Instructors:**

Dr. Hyoung Jin “Joe” Cho                      Office: ENG1-215                      Phone: 407-824-6630  
email: [joecho@mail.ucf.edu](mailto:joecho@mail.ucf.edu)                      Office Hours: M, W 9:00-11:00 am

Dr. Jihua “Jan” Gou                              Office: ENG1-217                      Phone: 407-823-2155  
email: [jgou@mail.ucf.edu](mailto:jgou@mail.ucf.edu)                      Office Hours: M, W 2:00-4:00 pm

**Text:**

Engineering Design by R. Eggert, Prentice Hall

**Projects:**

In the beginning of the semester, candidate design projects will be presented. Based upon your expression of interest, you will be assigned to a project and a team. The design must be carried through the conceptual and embodiment phases. This is the first of a two-semester sequence. In Design II, you will be required to complete the detail design phase and build and test a prototype according to the design specifications selected.

At the end of each term, a single overall report will be required from each group that details the team’s work and integrates the various components into the complete design. The entire group will be responsible for ensuring its completeness and organization. *Submission of the design projects is mandatory. Completion of the prototype is a requirement of this course and completion is defined as the building, testing, and evaluation of the prototype. Failure for any group (or any group member to actively participate) to complete the prototype will result in an incomplete grade.*

Additionally, each student will be required to maintain an engineering logbook of the efforts on the project, keeping track of the time spent, the tasks being worked on, etc. The logbook shall be submitted to the instructor at the time of the Final Examination.

**Presentations:**

One member from each team will be expected to give an oral progress report each week, beginning the third week of the semester. Formal design reviews will be conducted as scheduled below. During formal reviews, each team will be limited to about 30 minutes, and each team member must participate.

**Reports:**

Formal written reports must be presented at the end of the conceptual and embodiment phases, as noted below. The format to be followed will be provided later in class.

**Schedule:**

Class T 9:00-10:20am

Laboratory T 7:30-9:00am, Th 7:30-10:20am (unless the technical advisor schedules otherwise)

Laboratory periods will be used for team meetings, work sessions, design reviews and presentations.

**Deadlines (to be updated):**

Written Design Requirements report	due Sep 21
Oral presentation of Design Reqs	Sep 18, 20
Written conceptual design report	due Oct 20
Oral presentation of conceptual design	Oct 16, 18
Written parametric design report	due Nov 30
Oral presentation of parametric design	Nov 27, 29
Logbook	(with each report)
Final Exam	December 4 (7:00 - 9:50 am)

**Grades:**

Each of the following items will contribute to your final overall grade:

Written Design Requirements report	10%
Design Requirements Presentation	10%
Written conceptual design report	10%
Conceptual design presentation	10%
Written parametric design report	10%
Parametric design presentation	10%
Homeworks and participation	10%
Logbook	10%
Peer Evaluation	10%
Final examination	10%

## Rubric Matrix Grading Policy

### What is a Rubric Matrix?

A rubric matrix is a rank-ordered set of descriptive characteristics for a list of criteria upon which an instructor wishes to evaluate a student. The matrix is 2-dimensional, composed of rows and columns. Each row in the matrix is a criterion. Each column in the matrix is a short list of features which are typical at, or expected of, a certain level of student performance (the rubric). The columns are arranged left to right in decreasing order of performance (*i.e.*, the leftmost column is the best; the rightmost column is the worst).

To assign grades, the instructor goes row by row through the matrix and, for each row criterion, selects the column whose description best matches his evaluation of the student's work. When the matrix is completed, some kind of quantitative mapping is performed to combine the individual rank grades into an overall rank grade (typically the University A-F letter grade system).

Here is a sample rubric matrix (perhaps for a handwritten in-class essay). Note that one of the criteria has a qualitative evaluation, and the other is quantitative:

SAMPLE ONLY	A	C	F
<b>Handwriting</b>	<p>Writing is very legible and neat. All letters are well-formed. Adequate space is left between words. Writing stays within the lines.</p> <p>There are no ambiguities.</p>	<p>I can read it, but it's cramped and uneven. Some letters are not clearly distinguished ("a" looks like "o", "e" looks like "i").</p> <p>You can do better if you are more meticulous and write more slowly.</p>	<p>Illegible scrawls. Very hasty writing, many malformed or smeary letters that are not written with adequate definition.</p> <p>This is like stereotypical physician's handwriting. Some of what you say is lost because it can't be deciphered.</p>
<b>Spelling (number of misspelled words)</b>	0-1	2-3	4+

Also note that it is possible for some of the criteria to interact. In the example above, someone with F-level handwriting might also receive a C in spelling, because the instructor misread "correct" spellings that were illegibly written. In general, however, the criteria for a well-designed rubric matrix will be as independent as possible.

## Why Rubric Matrix Grading?

Traditional grading schemes often attempt to assign very quantitative values to inherently subjective judgments of performance. Frequently, the resolution of a single grading point cannot be translated into any concrete differences that a conscientious student, seeking to improve, can actually recognize and strive for. Especially in borderline cases, the exact numbers can be massaged to give any grade that the instructor desires. This is a headache for both student and instructor.

A rubric matrix forces the instructor to articulate clear examples of what he judges as certain levels of acceptable and unacceptable performance. Moreover, the student himself can evaluate his own work using the very criteria that the instructor uses, and so be better able to adjust his own work to match the instructor's expectations.

For many well established courses (*i.e.*, once the course is invented and stabilized), a very detailed, quantitative grading scheme is employed. Different criteria are worth different values of points, weighted according to importance; but aside from occasional notes made directly in the notebook at the time of grading, or as comments on the grade sheets, the only feedback a student got was some numbers. While we listed in great detail what we expected from perfect students, it was difficult for students to determine how far from perfect they might be.

The current rubric matrix grading system has been formulated to reflect the instructors' grading practice. What was A-level work under the previous quantitative scheme will still grade out to A-level work. The instructors' thought processes and grading criteria, however, should be far more obvious to the student; it should be easier for students to assess their own progress; and it should be easier for the instructors to assign final grades.

## Rubric Matrices

These are the actual evaluation criteria that the instructors will use when assigning grades to your work.

Note that there are blank spaces (grayed out) in some of the matrices. These indicate a major jump in quality, and that, in the instructors' experience, there really isn't a smooth transition at this point. Sometimes, it really *is* just good, fair, or bad.

## Attendance to Main Events

	A	B	C	D	F
Lates	0	1	2	3	4+
Unexcused Absences	0			1	2+

## Class Participation

	A	B	C	D	F
Group Dynamics	<p>All members work productively together. Cordial resolution of any differences. All opinions are respected.</p>	<p>Group is productive, but one member is somewhat less effective (or perhaps less respected) than the others.</p> <p>Can be improved with instructor intervention/counseling, since oftentimes it's subtle and unintentional.</p>	<p>Group is still productive, but there is noticeable internal friction. Some backbiting, rude comments.</p> <p>Instructor intervention is usually not successful, except to reduce the more overt displays of discontent.</p>	<p>Group has significantly reduced productivity compared to their potential. Frequent bickering and disrespect. Members undo each others' work at extra sessions, when the originators aren't around.</p> <p>Often occurs if a co-worker relationship breaks up during the semester.</p>	<p>Dysfunctional, pathological group. Open hostilities, ganging up, shunning, "recorders" who just take notes, people who stare off into space, read E-mail, or work on other coursework. No tangible progress.</p> <p>Extremely rare.</p>
Personal Contribution (peer assessment)	<p>Equally conversant with all aspects of the project, even if specializing in one or the other. Readily communicates knowledge to the rest of the group. Can accept ideas from others, as well as constructive criticism.</p>	<p>Knows all aspects of the project, but less able to share specialized knowledge. Still open to input from others, and not too critical of failures.</p>	<p>Knows a specialty adequately, but has little concern about what others are doing. Begins to blame others for failures.</p> <p>Mantras: "Hey, I'm just the mechanical guy" or "Hey, I'm just the code monkey."</p>	<p>Supposedly has specialized or accepted responsibility for a given task, but actually is clueless about how to do the job -- and won't give it up to someone else who <i>can</i> do it! Knows nothing about what others are doing. Mismatch between perceived and actual abilities.</p>	<p>Is just "there" occupying space-time and consuming oxygen. Might be writing very diligently in his design notebook, perhaps even making an excellent one, but is not helping the others in any tangible way.</p> <p>A tragic waste.</p>

## Project Quality

	A	B	C	D	F
Design Report	<p>Clearly organized and well-commented. No or very very very few "magic numbers".</p> <p>Elegant, no more complicated than necessary, and is easily understandable by someone who did not write it.</p>	<p>It works, but it's not particularly elegant. It might be overly complicated, split into a zillion tiny steps; or it might be a bit under-commented. Has some "magic numbers" in it.</p> <p>Might be hard to understand by someone who didn't write it, but the author can tell you what it does without too much trouble.</p>	<p>Definitely under-commented, many "magic numbers".</p> <p>Almost impossible for an outsider to understand, and probably very difficult for the author himself to understand after not looking at it for a weekend.</p>		<p>Pure spaghetti, uncommented, impenetrable, and unmaintainable. May contain incomplete or under-design parts. Misleading or incorrect steps.</p>
Prototype Construction	<p>Sturdy and robust. High degree of craftsmanship. Uses modular design when appropriate, or is otherwise easy to maintain.</p> <p>Well-built <i>and</i> elegant.</p>	<p>Everything works (even 50% of the time), but it has some kludgy hacks that you might be ashamed to admit to publicly. There is still excellent craftsmanship.</p> <p>Well-built but somewhat inelegant.</p>	<p>Good and bad cancel each other out. Some parts are good, even excellent; others are poor or downright bad. It may survive a drop from a height of 2 feet, but fall apart when it snags the edge of the nest.</p> <p>Sometimes a victim of creeping featurism, or a last-minute major redesign with tragic, unanticipated consequences.</p> <p>Either elegant ideas poorly executed, or else a slick-looking doorstop.</p>		<p>A total piece of junk.</p> <p>No evidence of improvement or learning from past mistakes. It's awful and revels in its own awfulness. Hack after hack after hack. Your colleagues would throw it away and start over during some extra session when you weren't there, were such behavior not specifically prohibited by course policy.</p> <p>An embarrassment to all. Fortunately, projects this bad are rare, occurring only at intervals of several years.</p>