AE 415 - INTRODUCTION TO SPACE DYNAMICS
Fall 2000 - TuTh at 11-12:15 in Wallace Hall 210

Instructor: Dr. Roy Myose   Office: Wallace Hall 204   Phone: 978-5935

Office hours are by appointment; please call ahead; note that mornings (every day) are extremely busy

Text: Fundamentals of Astronautical Engineering by R. Myose (pre-publication version 0.5)

Prerequisite: AE 373 (Dynamics), AE 227 (Programing)   Co-requisite: Math 555 (Differential Equations)

Course Objective and Content

Goal: provide an introduction to astronautical engineering. Topics to be covered include:

1. Two-Body Orbital Mechanics and Simple Orbital Maneuvers (5 weeks)
2. Inclined Orbits and Orbit Determination (5 weeks)
3. Rigid Body Kinematics and Kinetics (5 weeks)

Grades

23% = Team Assignments (16% design project+7% homework) modified by Peer/Instructor Evaluation

48% = Semester-wide Exams (three exams spread throughout the semester, each worth 16% of grade)

29% = Comprehensive Final Exam

Team Assignments and Peer/Instructor Evaluation

The homework assignments and the design project will be solved in a team setting. Most of the details about the design project are given at a future date while homework requirements are discussed below.

During the first week, you will be given the opportunity to form teams (optimum size is four). If you have tight scheduling problems, it is your responsibility to find teammates with compatible schedules during the first week. Any remaining individuals will be assigned to teams of three or four. Note that these teams are typically permanent, but I reserve the right to change a team's composition for valid reasons.

Each person who contributes (via solution or discussion) on a homework problem will receive the same grade. For the design project, half of the person's project grade is based on that person's chapter write-up and calculations while the other half is based on the overall team score. Each person's project grade is then modified by a multiplying factor which is based on evaluations by your peers and by the instructor. My evaluation will be based on interactions with you both in and out of class.

Homework

Each team may decide how to complete a homework assignment. One approach may be to evenly distribute problems and discuss solutions at a team meeting. Another approach may be to have everyone do every problem, and then compare solutions at a team meeting. Irrespective of the approach, each team must turn-in only *one* solution set. Note: everyone **MUST** participate (in some manner) in the solution of **EACH** homework problem.

Homework is due at the start of class. A few problems will be selected for thorough grading while others will only be checked for final answers. There will be **BIG** deductions unless you adhere to the following rules:

1. Write on one side of page only. Spiral notebook paper is **NOT** acceptable nor are torn sheets of paper.
2. Start each problem on a new page. If the problem takes more than one page, **DO NOT** start the next problem from the middle of this second page.
3. Put a box around **EACH** answer.
4. Team must turn-in one set of papers (i.e. solutions), stapled together with the proper **COVER** page*.

Graded homework is returned to one person on the team. It is the team's responsibility to make copies for each person. Homework solution is **NOT** given out, but instead will be posted so you can check your answers against returned homework.

Class Policies

Working problems are graded primarily on the correct **SOLUTION METHOD**. The final answer (i.e. correct numbers) is of little value if your solution method is incorrect or not properly justified. The amount of partial credit given is **NON-NEGOTIABLE**.

Late make-up exams are not given except for **DOCUMENTED** cases of illness or personal emergency. No matter which exam you miss, there is **ONLY ONE** make-up. It is **COMPREHENSIVE** covering the entire semester and it will only be given at one particular time. If you miss two exams, you will be given a zero even if both are valid and documented excuses. All exam and assignment due dates are announced in class; **you are responsible** for being informed about these dates.

Lectures Material

½ Class Policy

6 **Introduction, Two-Body Orbital Mechanics, Simple Orbital Maneuvers**
Read: chapter 1; chapter 2 sections 1-4 & 6-11; chapter 3 sections 1-2 & 10
Conic Sections, Two-body Problem, Conservation of Angular Momentum, Conservation of Energy, Orbit Equation, Conic Section Relationship, Time of Flight, and Hohmann Transfer

2½ Review, Exam, and Solution

7 **Inclined Orbits and Orbit Determination**
Read: chapter 3 sections 4-5 & 7-10; chapter 5 sections 3-10
Launch Lattitude, Inclined Orbits, Inclination Change Maneuvers, Combined Hohmann Transfer and Inclination Change Maneuver, Orbital Elements, Ground Tracks, Orbital Rendezvous and Orbit Determination

2½ Review, Exam, and Solution

Last day to officially drop a course with a "W" is Friday October 27th

8 **Rigid Body Kinematics and Kinetics**
Read: chapter 9; chapter 10
Kinematics (Motion): Transformation of Coordinate Systems, Inertial Derivative, Generalized Motion Analysis
Kinetics (Forces): Moments of Inertia, Angular Momentum, Kinetic Energy, Principal Axes, Coordinate Transformation of Moment of Inertia Matrix, Euler's Equations of Motion, Torque-Free Motion, Attitude Control Techniques

2½ Review, Exam, and Solution

1 Semester Review

Final Exam is 10AM (note the time difference) on Tuesday December 12th