ENAE 601: Astrodynamics
Syllabus – Fall 2016

Class Times: Mondays and Wednesdays, 2-3:15pm EGR 1102
Instructor: Dr. Christine Hartzell
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Office Hours: Mondays 3:30-4:30, or by appointment

Prerequisites: ENAE 404, ENAE 441, or equivalent. Knowledge of a programming language (Matlab or C, preferably) is highly recommended.

Required Texts: There are no required texts for this course, however students will likely find a textbook helpful. The following textbooks are good references, and are held in the library reserves:
Fundamentals of Astrodynamics and Applications,
D.A. Vallado, ISBN: 978-1-881883-14-2
Fundamentals of Astrodynamics, Bate, Mueller and White, ISBN: 0486600610
(Dover book, new edition out soon)
Orbital Motion, A.E. Roy, ISBN: 0-7503-1015-4
Fundamentals of Celestial Mechanics, J.M.A. Danby, ISBN: 0-943396-20-4
An Introduction to the Mathematics and Methods of Astrodynamics, Battin, ISBN: 978-1-56347-342-5

General Description of the Course:
Mathematics and applications of orbit theory, building upon the foundations developed in ENAE 404 and ENAE 441. Topics include two body orbits, solutions of Kepler's equation, the two-point boundary value problem, rendezvous techniques, and Encke's method.

Course Goals:
The goal of this course is to prepare students for subsequent research or work in the area of astrodynamics. By the end of the course, students should be fluent in the fundamentals of the two body problem and have solid working knowledge of perturbations, maneuvers, and the circular restricted three body problem. Through the course, students will produce a toolbox of computer programs useful for future studies in astrodynamics. Students will also gain experience selecting and pursuing a scientific research topic of their interest, produce a professional-quality written report, and present a the results of their research.

Course Schedule:
See Course Schedule attachment.

Grading Procedures:
Midterm: 30%

Homework: 30%
Journal Review: 5%
Final Project: 35%

There will be an in-class **midterm exam** on **Oct 26th**.

Homework will be assigned approximately every 2 weeks and will include a combination of derivations and programming assignments. Homework assignments are due at the beginning of a class period, as a hard copy. Late homework (or digital homework) will not be accepted unless prior arrangements are made with the instructor. Homework assignments will be designed to allow students to check their own answers. Students are expected to turn in plots that are legible and **have axes labeled with the correct units**. Students are also expected to think about whether or not their answers make sense.

In order to expose students to current research related to astrodynamics, students will be required to review one journal article related to astrodynamics or celestial mechanics. Students may choose any article in the journal Celestial Mechanics and Dynamical Astronomy. Students may also choose relevant articles from the AIAA Journal of Guidance, Control and Dynamics. Articles from other journals must be pre-approved by the instructor. Students may not choose articles which they authored or co-authored. The journal review should be 2-3 pages and include a discussion of: 1. the state of the art in the field of the paper, 2. the major contribution(s) of the paper to the state of the art, 3. one of the major plots in the paper, 4. the significance/implications/real-word applications of the paper's contributions, and 5. any major weaknesses of the paper (e.g. omissions that would prevent reproduction/implementation). The journal review may include a list of references. The journal review will also engage the student's writing skills.

There will be a final project instead of a final exam. The goal of the final project is for students to take material learned in this course and apply it to either an on-going research project or a research project of their choosing. Additionally, the final project will also facilitate the development of report writing and public speaking skills. Deliverables for the final project include a 1 page project proposal, a final report and a final presentation. The **final report proposal** is due **Nov 9**. The **final report** is due **Dec 5**. The final presentations will be given during the class periods the week of Dec 5 and during the final exam period, as required. Final reports submitted late (i.e. after class on Dec 5) will be penalized by 1% per hour late. More details concerning the final project will be provided later in the semester.

Due Dates of Major Grading Events:
Oct 26: Midterm Exam
Nov 9: Final Report Proposal Due
Dec 5: Final Report Due

Communication Outside the Classroom and Emergency Protocol:
Email will be the primary means of communication outside of the classroom. Any and all homework assignments or other handouts will be posted on ELMS. If classes need to be cancelled, reschedule or otherwise adjusted, the announcement will be made via email. Additionally, in the case that the University is closed for an extended period of time, contingency plans regarding the course will be announced via email.

Religious Observances:
If a student will be participating in a religious holiday that conflicts with an exam or other major event in this course, it is the student's responsibility to inform the instructor of this conflict within the first two weeks of the course so that accommodations can be made.

Attendance:
In-class attendance is important to students' success in this class. If a student has a non-medical and non-religious conflict (e.g. travel to a conference) with a class session or homework due date, the student must inform the instructor prior to the missed class or due date so that accommodations can be made. Students will be required to know the material covered in the classes missed and should plan to get notes from their friends. In the event of a prolonged medically-necessary absence from class, the student should contact the instructor as soon as possible and provide documentation of the illness signed by a medical professional.

Academic Integrity:
Academic integrity is important for two main reasons: 1. It ensures that all students learn the material and 2. It allows the instructor to accurately assess students' understanding of the course material.

Students are allowed to discuss homework problems and solution methods in order to promote better understanding of the material. Students are not allowed to copy solutions.

Students are not allowed to collaborate on exams or projects. Exams and projects serve as summative assessments and thus should be representations of a single student's mastery of the course material. Specifically during the course project, **plagiarism will not be tolerated**. Appropriate citations are required. The following statement must be included and signed **at the top** of the student's exam and project: *I pledge on my honor that I have not given or received any unauthorized assistance on this examination (or project).*

All incidents of academic dishonesty will be reported to the Student Honor Council.

Students with Disabilities:
Students with disabilities should contact the instructor so that accommodations can be made in accordance with the University's policy.

Lecture Number	Date	Topic	
1	29-Aug	Syllabus overview, 2BP	
2	31-Aug	2BP	
3	5-Sep	No Class - Labor Day	
4	7-Sep	2BP - Cart2OE	
5	12-Sep	2BP - Kepler's Prob	HW 1 DUE
6	14-Sep	2BP - Kepler's Prob	
7	19-Sep	NBP	
8	21-Sep	NBP	
9	26-Sep	Manuevers	HW2 DUE
10	28-Sep	Manuevers	
11	3-Oct	Manuevers	
12	5-Oct	CR3BP	HW3 Due
13	10-Oct	CR3BP	
14	12-Oct	Exam Review	Journal Review Due
15	17-Oct	**MidTerm Exam**	
16	19-Oct	Cancelled - AT DPS	
17	24-Oct	CR3BP	email final report topic
18	26-Oct	Perturbations	
19	31-Oct	Perturbations	HW4 Due
20	2-Nov	Perturbations	
21	7-Nov	Exam Solution Review	Final Report Proposal Due
22	9-Nov	Perturbations	
23	14-Nov	Rendezvous	HW5 Due
24	16-Nov	Rendezvous	
25	21-Nov	Rendezvous	
26	23-Nov	No Class - Thanksgiving	HW6 Due
27	28-Nov	Special Topics -Rendezvous	
28	30-Nov	Special Topics	HW7 Due
29	5-Dec	Final Presentation	Final Report Due
30	7-Dec	Final Presentation	
31	12-Dec	Final Presentation	
Exam Period	17-Dec	1:30-3:30	