

ASEN 6008 Interplanetary Mission Design

Lectures: Monday 5:30 – 6:45 pm, AERO N250
Lab: Wednesday 6:00 - 7:15 pm, AERO N100
Office Hours: See Canvas website for details

Zoom Information:

Passcode:
This link will be used for lectures, labs, and office hours.

Interplanetary Mission Design covers many topics in the field of astrodynamics that are useful when constructing conventional interplanetary mission designs. The course focuses on simple ballistic mission designs, such as the interplanetary trajectories of Galileo, Cassini, New Horizons, and the various missions to Venus and Mars. Other types of interplanetary missions will also be briefly explored, such as SOHO's libration point trajectory design. Students will learn techniques to design interplanetary trajectories theoretically using simplified models and to take these theoretical trajectories and transition them into more robust trajectories in the ephemeris. Students will also gain experience using mission design software.

Course Logistics: In Campus section:

The course has a lecture component and a lab component. Lectures will be held on Mondays from 5:30-6:45 pm in AERO N250. The majority of course content will be presented during lecture sessions. We will engage in small group discussions, exercises, and examples. The lectures will be recorded and posted to the Canvas website. Lab sessions will be conducted Wednesdays from 5:30-6:45 pm in AERO N100. There may be a few cases where a lecture will be given on Wednesday in place of the lab session and will be conducted in a classroom. The information for the lecture location will be clearly communicated to students via email and an announcement on the Canvas website.

Course Logistics: Distance Students:

Students enrolled in the distance section (ASEN 6008-001B) are encouraged to attend lecture synchronously via Zoom if your schedule allows. This will enable you to ask questions and participate in breakout discussions. If you cannot attend a lecture synchronously, it is fine to watch the recordings afterwards. Zoom sessions will be run concurrently during lab so distance students who wish to participate remotely can do so. If new material is presented during lab, that portion of the lab session will be recorded and posted to Canvas. In general, the entirety of lab sessions will NOT be recorded.

Pre-requisites:

Courses: ASEN 50500/ASEN 5052 or equivalent, or the instructor's consent.

Material: We expect you to know the following (or to learn about these very quickly): Particle dynamics and orbital mechanics, Keplerian orbital elements, Conic orbits.

Access to GMAT software: This can be through a lab on campus, or GMAT can be downloaded to personal computers.

There are no required textbooks for this class. However, these are some suggested texts that are good additions to an astrodynamist's library:

Vallado, *Fundamentals of Astrodynamics and Applications*. This book is referenced frequently.

Topics:

- I. Review
 - a. History of Interplanetary Missions
 - b. The Two-body problem
 - c. The N-body problem
 - d. Perturbations
 - e. Patched conics
 - f. Reference frames
 - g. Sphere of Influence
 - h. Hohmann transfers
- II. Lambert's Problem
 - a. Lambert's general theorem
 - b. Type I vs Type 2 orbits
 - c. Discussion of Geometry of Lambert's problem
 - d. Universal Variables Algorithm
 - e. Revisit f and g functions
 - f. TOF equations for elliptical, parabolic, and hyperbolic transfers
 - g. Multi-Revolution solutions (Type 3, Type 4, etc)
 - h. Algorithm for multi-rev solutions
- III. Ephemeris
 - a. Meeus Coefficients
 - b. Discussion of JPL Ephemerides
- IV. Pork Chop Plots
 - a. Construction and Analysis
- V. Gravity Assists
 - a. History
 - b. Vector Diagrams
 - c.
 - a.
 - LTd (nomion Bor multi)TjPf Inc 1uns foJP problem
 - d. c.

and staff must upload proof of vaccination and boosters or file for an exemption based on medical, ethical or moral grounds through the MyCUHealth portal.

The CU Boulder campus is currently mask-optional. However, if public health conditions change and masks are again required in classrooms, students who fail to adhere to masking requirements will be asked to leave class, and students who do not leave class when asked or who refuse to comply with these requirements will be referred to Student Conduct and Conflict Resolution. For more information, see the policy on classroom behavior and the Student Code of Conduct. If you require accommodation because a disability prevents you from fulfilling these safety measures, please follow the steps in the “Accommodation for Disabilities” statement on this syllabus. If you feel ill and think you might have COVID-19, if you have tested positive for COVID-19, or if you are unvaccinated or partially vaccinated and have been in close contact with someone who has COVID-19, you should stay home and follow the further guidance of the Public Health Office (contacttracing@colorado.edu). If you are fully vaccinated and have been in close contact with someone who has COVID-19, you do not need to stay home; rather, you should self-monitor for symptoms and follow the further guidance of the Public Health Office (contacttracing@colorado.edu). {Faculty: insert your procedure here for students to alert you about absence due to illness or quarantine. Because of FERPA student privacy laws, do not require students to state the nature of their illness when alerting you. Do not require "doctor's notes" for classes missed due to illness; campus health services no longer provide "doctor's notes" or appointment verifications. }

If you will miss class due to a medical reason, email Professor Davis: Kate.Davis@colorado.edu. Assignment due dates can be modified as necessary.

Accommodation for Disabilities

permission from all course instructors involved, and aiding academic dishonesty. All incidents of academic misconduct will be reported to Student Conduct & Conflict Resolution (honor@colorado.edu); 303-492-5550). Students found responsible for violating the [Honor Code](#) will be assigned resolution outcomes from the Student Conduct & Conflict Resolution as well as be subject to academic sanctions from the faculty member. Additional information regarding the Honor Code academic integrity policy can be found on the [Honor Code website](#).

Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation

CU Boulder is committed to fostering an inclusive and welcoming learning, working, and living environment. University policy prohibits sexual misconduct (harassment, exploitation, and