

Fundamental Astronautics

AEROENG 3522

Credit Hours:

3.00 - 3.00

Course Levels:

Undergraduate (1000-5000 level)

Course Components:

Lecture

Course Description:

This course will present a conceptual understanding of different types of orbits in space that arise under the laws of gravitational motion, basics of preliminary orbit determination, design of maneuvers among orbits of different types, a preliminary understanding of perturbations in space, preliminary space propulsion and the patched conics approach for interplanetary mission design.

Prerequisites and Co-requisites:

Prereq: 3520. Concur: 2405.

Course Goals / Objectives:

- Conceptually understand and distinguish between different types of orbits in space that arise under the laws of gravitational motion.
- Design maneuvers for transfering spacecraft from one orbit to another
- Perform preliminary orbit determination
- Understand the causes and consequences of perturbations in space
- Perform preliminary design of interplanetary missions
- Understand principles of propulsion in the space environment and integration of the propulsive system into mission and vehicle design

Course Topics:

- Newtonian particle mechanics, law of gravitation
- Keplerian motion (two body problem), geometry of conics, integrals of motion, Kepler's laws
- Orbital elements
- r v/s t, Kepler's equation
- Numerical solution for two body problem
- F-G solution, Universal variables for the two body problem
- Orbit in 3 dimensions
- Orbital maneuvers: Hohmann/bielliptic maneuvers, phase/apse/plane change
- Orbital perturbations: oblateness, drag, third-body effects, solar radiation pressure
- Preliminary orbit determination, Gibbs method and the Lambert's problem
- Interplanetary trajectories: spheres of influence, patched conics
- Thrusters for various missions
- Low thrust maneuvers: climbs and plane change

Designation:

Required