

Course Name: Principles of Orbital Mechanics
Course #: 22851
Composition: Lecture: 3hrs; PA: 1hr
Credits: 3.5
Prerequisites: 22511 Dynamics of Particles
Teacher: Dr. Avi Weiss, EF-508, Wed. 12:30-14:20, avi@braude.ac.il

Course Objectives:

The goal of the course is to introduce the student to the principles of space flight and orbital mechanics. The course gives a background and introduction to orbital mechanics and utilizes principles acquired in the basic dynamics courses to present complex mechanical applications such as satellites and spacecraft.

Course procedure:

The course is comprised of lectures and problem assignment sessions, in addition to homework.

Website:

<http://moodle24.braude.ac.il>

Grading:

Homework and active learning (compulsory) 40%, Midterm – 60%.

Course content:

- 1 Brief review of space research history.
- 2 Space environment: gravity, vacuum, micrometeorites and space-junk, radiation, charged particles, physiological effects.
- 3 Orbital mechanics:
 - 3.1 The two-body problem and equations of motion.
 - 3.2 Orbit geometry and orbit constants: mechanical energy and angular momentum.
 - 3.3 Orbit description: classical orbit parameters, other parameters; orbit traces.
 - 3.4 Maneuvers in space: Hohmann transfers, plane change, rendezvous.
 - 3.5 Interplanetary travel: planning, equations of motion, the patched-conic approximation, gravity-assist.
 - 3.6 Predicting orbits: Kepler's problem, time of flight, orbit perturbations due to atmospheric drag and earth's oblateness.
- 4 Getting to orbit: Launch window, launch velocity.

Textbooks:

1. J.J. Sellers, W.J. Astore, R.B. Giffen, W.J. Larson – Understanding Space: an Introduction to Astronautics, McGraw Hill, 3rd Ed. 2005.
2. H.D. Curtis – Orbital Mechanics for Engineering Students, Butterworth-Heinemann, 4th Ed. 2019.

Learning outcomes:

After studying Principles of Orbital Mechanics , the student should be able to:

1. Apply Dynamics principles to derive equations of motion for spaceflight.
2. Determine the orbit of a spacecraft.
3. Analyze orbits of spacecraft.
4. Design orbital maneuvers.
5. Understand basic interplanetary travel principles.
6. Understand the foundations of space mission.

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