UNIVERSITY of NICOSIA

Course Syllabus

Course Code	Course Title	ECTS Credits
MENG-324	Introduction to Space Environment and Spacecraft Engineering	6
Prerequisites	**Department**	**Semester**
MATH-330	Engineering	Spring
Type of Course	**Field**	**Language of Instruction**
Elective	Engineering	English
Level of Course	**Lecturer(s)**	**Year of Study**
1st Cycle	Dr Harry Nicos Iordanou	3rd
Mode of Delivery	**Work Placement**	**Corequisites**
Face-to-face	N/A	None

Course Objectives:

The main objectives of the course are to:

- Present the different environments that a spacecraft operates during its life, and their effect on the spacecraft design and operational use.
- Provide an understanding of the trajectory and general attitude dynamics, oscillatory modes and attitude motion of different spacecraft.
- Introduce celestial mechanics for orbits and their perturbations
- Provide understanding on Keplerian orbit transfers and different mission types such as Polar, Low Earth Orbit, Highly Elliptic Orbit and Geostationary Earth Orbit.
- Familiarize with spacecraft propulsion systems including chemical, electric and hybrid.
- Introduce the design requirements and materials selection for spacecraft structures.
- Familiarize with attitude control computations and systems including relevant sensors and actuators, such as infrared and star sensors, gyros, momentum wheels.
- Introduce the principles for electrical power generation, regulation, management, storage and control, and design considerations for power budget.
- Familiarize with the telemetry, telecommand and data handling and processing techniques and protocols
- Develop ability to use software tools for design and analysis of spacecraft mission, budgets.

Learning Outcomes:

After completion of the course students are expected to be able to: • Describe the key spacecraft design considerations for ground and in-orbit operations. • Demonstrate ability of setting up the dynamic analysis for trajectories and orbits using analysis computations and software. • Interpret dynamic spacecraft response and effects in mission trajectory and attitude. • Illustrate the fundamental characteristics, design considerations and control of spacecraft subsystems including thermal, propulsion, power and attitude. • Recall the design principles and budgets for spacecraft structures and communications, including telemetry, telecommand, ranging, and on-board software. • Show how computer software can be used for the analysis and design of spacecraft.

Course Content:

• Overview of space environment and history of space travel. • Mission objectives and requirements including performance, coverage, lifetime etc. • Spacecraft system requirements for orbit configuration and operations, power and mass. • Spacecraft subsystem requirements for Thermal, Structure, Propulsion, Power, OBSW (electronics), Communications and Attitude Control. • Modeling of mechanical, electrical, and other dynamic spacecraft systems such as mechanisms for deployable solar arrays and reflectors.

Learning Activities and Teaching Methods:

Lectures, in-class examples, exercises.

Assessment:

Homework, in-class assignments, mid-term exam, final exam.

Required Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN
Space Mission Engineering - The New SMAD / 4th Edition	Editors: James Wertz, David Everett, Jeffery Puschell	Space Technology Library	2014	978-1-881-883-15-9
Spacecraft Systems Engineering / 4th Edition	Editors: Peter Fortescue, Graham Swinerd, John Stark	Wiley&Sons	2011	978-04-470-750-124

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Recommended Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN / site
European Cooperation for Space Standardization (ECSS)	------------	ESA-ECSS	2023	www.ecss.nl
Orbital Mechanics for Engineering Students	Author: Howard D. Curtis	BH-Elsevier	2014	978-0-08-097747-8