

Module Details	
Module Title	Space Dynamics and Systems Design
Module Code	ELE7033-B
Academic Year	2022/3
Credits	20
School	Department of Biomedical and Electronics Engineering
FHEQ Level	FHEQ Level 7

Contact Hours	
Type	Hours
Lectures	26
Project Supervision	4
Seminars	4
Supervised time in studio/workshop	6
Directed Study	160

Availability	
Occurrence	Location / Period
BDA	University of Bradford / Semester 1

Module Aims
<p>The module aims to provide a basic tools and professional knowledge of satellites engineering based on consolidated industrial experience. This will allow students to gain an insight which will both support the learning of the other modules of the master and, ultimately, empower their professional skills and knowledge.</p> <p>The lectures will first tackle the principles of satellites motions and manoeuvres in order to provide the students a fundamental background to understand spacecraft capabilities and behaviour. Then a comprehensive overview of how space projects are conceived and developed will be illustrated. In particular, how these space projects have helped improve the quality of lives in a global context, especially in developing countries, will be emphasized and discussed. This will allow to drive the lectures into more technical engineering discussions where students will gain both key elements of satellite systems architectures and an understanding of satellite systems design drivers and criticalities.</p> <p>A number of use cases for LEO and GEO systems will be illustrated in order to ease the understanding of the concepts and to provide the students an industrial return of experience. Specific knowledge about spacecraft avionics will be offered maintaining a particular focus on system engineering and technological issues.</p>

## Outline Syllabus

- Spacecraft dynamics and space environment: Concepts of orbital and attitude dynamics, including multibody dynamics and earth space environment effects.
- Space missions: typical life-cycle processes for space projects and a few highlights on applicable space standards.
- Spacecraft systems architectures: typical GEO/MEO/LEO satellite systems architecture definitions including an overview on main subsystems (Avionics, data-handling, thermal, mechanical, electrical, propulsion...).
- Spacecraft systems design: typical design drivers and trade-offs.
- Spacecraft avionics: main functions and design drivers, typical solutions.
- Space technologies: overview of state of the art technologies mainly on AOCS sensor and actuators.

## Learning Outcomes

Outcome Number	Description
LO1	Demonstrate a comprehensive understanding of and apply the principles of spacecraft orbit and attitude dynamics.
LO2	Demonstrate a critical awareness of and apply the life cycle of a satellite system including which phases, which processes and which standards shall be referenced.
LO3	Critically apply key principles and concepts of satellite system engineering.
LO4	Critically evaluate the main design drivers of spacecraft architectures for typical Low Earth Orbit, Medium Earth Orbit and Geostationary Earth Orbit missions.
LO5	Critically evaluate current space technologies for avionics.
LO6	Demonstrate a comprehensive understanding, through the group project, on collaborative working, proposal writing, project management and the ability to present findings in a commercial context.

## Learning, Teaching and Assessment Strategy

Learning and Teaching will be directed, supported and reinforced through a combination of face-to-face or online lectures and tutorials as well as through directed and self-directed study supported by learning materials available in CANVAS. Face-to-face or online drop-in sessions will be scheduled to assist students who required extra support.

The module will be delivered and assessed over four consecutive weeks, with lectures and tutorials delivered within the first two weeks. Students can kick start their assessed group project in the second half of the 2nd week and complete this by the end of the 3rd week. Students will use the 4th week to prepare for the examination, which will be scheduled on Friday of the 4th week. Extra tutorials or laboratory sessions can be arranged upon request by students to ensure that every student understands the theory. Lectures and tutorials will be recorded live to cater for students who may not be able to attend face-to-face lectures due to extenuation circumstances. In the event of face-to-face delivery not being possible, recorded synchronous online or pre-recorded lectures and laboratories will be delivered and uploaded to CANVAS to enable students watch the presentations, videos at their own time.

The group project aiming at a feasibility study for a specific use-case will be conducted by working groups of 4 or 5 students at most. This activity is addressed to strengthen the knowledge base acquired in the previous days, encourage team work and empower their technical and soft skills.

This team work will be assessed through a presentation of the results developed, where each member of the team shall illustrate its individual contribution, and integrated with tutor feedback. Finally, an open book written examination will be used to assess students' technical understanding of the module.

Mode of Assessment			
Type	Method	Description	Weighting
Summative	Presentation	Oral group presentation (up to 30 minutes presenting with up to 30 minutes of questions and answers).	30%
Summative	Examination - Open Book	Open book examination (2 hours)	70%
Summative	Examination - Open Book	Supplementary open book final examination (2 hours)	100%

Reading List
To access the reading list for this module, please visit <a href="https://bradford.rl.talis.com/index.html">https://bradford.rl.talis.com/index.html</a>

*Please note:*

*This module descriptor has been published in advance of the academic year to which it applies. Every effort has been made to ensure that the information is accurate at the time of publication, but minor changes may occur given the interval between publishing and commencement of teaching. Upon commencement of the module, students will receive a handbook with further detail about the module and any changes will be discussed and/or communicated at this point.*

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