

Module Details	
Module Title	Earth Observation Satellite Systems
Module Code	ELE7036-B
Academic Year	2023/4
Credits	20
School	Department of Biomedical and Electronics Engineering
FHEQ Level	FHEQ Level 7

Contact Hours	
Type	Hours
Project Supervision	6
Seminars	6
Lectures	22
Tutorials	6
Directed Study	160

Availability	
Occurrence	Location / Period
BDA	University of Bradford / Semester 2

Module Aims
<p>End-to-end (E2E) Systems for earth observation (EO) is a key element within ?Space Systems? to assess climate change and to provide the information necessary to governments to take corrective actions. This module will provide several examples of applications (through data processing) of the scientific/measurement data output of the typical sensors embarked on EO Satellites for land, sea, water, atmosphere control and meteorology.</p> <p>During the module, students will gain key system engineering knowledge of E2E systems for earth observation, encompassing the satellite and main specific EO elements of the ground segment, the key design driver and technical parameters determining the system performances.</p>

Outline Syllabus

- 1) Introduction to E2E System for Earth Observation from User and from Application point of view; flow down at Mission design level.
- 2) Mission main driving and dimensioning parameter and flow down at Satellite and Ground Segment level.
- 3) Overall "typical" E2E System architecture and constituting main building blocks.
- 4) Satellite Architecture and main dimensioning parameter, constituting elements of the Architecture, dimensioning parameter and performance data.
- 5) Radar and Optical Observation Microwave Payload: Microwave Payload (SAR, Radar Altimeter) main functional principles, architecture and main building blocks; design dimensioning parameter and performance data.
- 6) Radar and Optical Observation Optical Payload: working principles, architecture and main building blocks; design dimensioning parameter and performance data.
- 7) Ground Segment Architecture and E2E System Operations: Ground Segment Architecture and main functional blocks, focusing on the element which are specific for an Earth Observation Mission; design dimensioning parameter and performance data; typical E2E System operations.
- 8) Typical Design and Development Plan of E2E System, including On Ground Testing, Launch Campaign, Launch and LEOP, Commissioning and Operations.

Learning Outcomes

Outcome Number	Description
LO1	Analyse the application of earth observation satellite systems.
LO2	Critically evaluate the configuration of EO satellite systems, of Payload selection, versus the identified User Applications and related Mission Requirements.
LO3	Critically review the architecture of E2E EO satellite systems and to select the proper E2E architecture taking into account system constraints and requirements.
LO4	Evaluate the key dimensioning parameter of an EO satellite systems versus user needs and mission requirements.
LO5	Demonstrate a comprehensive understanding, through the group project, on collaborative working, proposal writing, project management, and their ability to present their 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, workshops 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 require extra support.

The module will be delivered and assessed over one Semester, with lectures, laboratory, project supervision, tutorials, and seminars delivered within the first 11 weeks. Students start their assessed group project from the third week. Extra tutorials or support sessions can be arranged upon request by students to ensure that every student understands the theory and knows how to use the software tools.

Lectures and workshops 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 delivery of the module will consist of lectures and a workshop where study cases are presented and solved. The lectures will be face to face and will combine with workshops to provide the students with the knowledge and skills to define the architecture in End-to-End (E2E) Earth Observation System.

Summative assessment will be composed of open book written examination and a group project. The examination will allow the students to demonstrate the acquisition of knowledge and competences provided by the module course.

The group project enables the students to work in team on a case study to develop their design knowledge and skills. The case study will allow the students to progress from the 'User Application and Requirements' to the 'Architecture Definition and Dimensioning' of the main elements constituting the E2E system. During the group project development, the students will have the opportunity to exercise and to develop project management and teamwork skills. Students must plan (implementing a work plan structure) and share the workload (define work packages; each student shall be responsible for at least one work package). The group project will be assessed through individual student report of a minimum of 1500 words for their own tasks as an integral part of a group project report followed by a group presentation to evaluate project management, teamwork, and presentation skills.

Formative assessment will be through informal feedback to the technical and project management aspects of the group project work and during workshop sessions.

Supplementary assessment for the group coursework will involve an individual submission of a minimum 1500 words report and an individual presentation of the associated work package.

Project Report - A 1500-word (min) project report detailing allocated task conducted by the student towards the group project work, including analysis of and reflection upon practical research carried out in the group project work.

Presentation - In-person group oral presentation by each project group.

For supplementary assessment, group oral presentation will be replaced by individual presentation.

Examination open book or seen paper - A timed examination that takes place on-campus, with all students sitting the exam in the same place and at the same time. Students may bring specified books/other resources into the exam.

Mode of Assessment

Type	Method	Description	Weighting
Summative	Dissertation or Project Report	Including analysis of and reflection upon practical research carried out in the group project work. 1500-word.	30%
Summative	Presentation	In-person group oral presentation by each project group. Group oral individual presentation - Supplementary assessment.	20%
Summative	Examination - Open Book	Open book examination (2 hours). Students may bring specified books/other resources into the exam.	50%

Reading List

To access the reading list for this module, please visit <https://bradford.rl.talis.com/index.html>

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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