UNIVERSITY of BRADFORD

Module Descriptor

Module Details	
Module Title	Ground Satellite Systems
Module Code	ELE7037-B
Academic Year	2022/3
Credits	20
School	Department of Biomedical and Electronics Engineering
FHEQ Level	FHEQ Level 7

Contact Hours	
Type	Hours
Lectures	24
Project Supervision	6
Supervised time in studio/workshop	10
Directed Study	160

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

Module Aims

This module aims to illustrate the role, concept and main constituents of ground segment used in space missions, either earth observation, navigation or space exploration. Ground segment is a fully transverse item within space mission domains, being the bridge between space segment and mission users, and its definition, characteristics and performances are directly derived from mission concepts.

The module is intended to provide the student with a clear understanding of requirements and functions of the ground segment, together with an overview of the engineering principles involved in the management, design, development, testing and implementation of the ground segment of a space mission, including integrated Logistic support and Operations.

Outline Syllabus
- Introduction to ground segment architectures and key constituents, starting from user and application needs. Examples, commonalities and differences between telecom, observation, navigation and space exploration domains. - Spacecraft Control Elements: flight dynamics and satellite command and control. - Ground Stations: TT&C, Data Reception. - User request management, mission chronology and Mission Planning. - Data Processing, Archiving and dissemination. - User Data Exploitation. - Physical Ground Segment Architecture: centralization, distribution, and cybersecurity. - Ground Segment Engineering, Design and Development: main standards, lifecycles, and role of Specialty Engineering tasks in Ground Segment and Operations. - Ground Segment AIV, qualification and set-up to operations. - Operations, Integrated Logistic Support and Maintenance Engineering.

Learning Outcomes	
Outcome Number	Description
LO1	Demonstrate a comprehensive understanding of the overall architecture and key constituents of a Ground Segment System.
LO2	Evaluate how GSS relate to the overall architecture of a space mission, in terms of functions and performance(s).
LO3	Demonstrate practical understanding of the key functions, performances and technologies of the ground segment constituents.
LO4	Critically evaluate the Ground Segment and Operations System Engineering cycle and standards, describing the various phases and peculiarities.
LO5	Demonstrate the ability of dimensioning the main technical parameters characterizing a ground segment, focusing on an observation mission.
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, seminars and 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 required extra support.

The module will be delivered and assessed over four consecutive weeks, with lectures and seminars delivered within the first two weeks. Students can kick start their assessed group project from the second half of the 2nd week. Students will spend the 4th week revising for their closed-book examination. Extra tutorials or laboratory 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 seminars 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 directed reading, lectures and seminars to expand upon key points in the reading and a workshop where example study cases are discussed and solved; and a group project (design and dimensioning of a ground segment) is assigned to students to apply the acquired knowledge.
Lectures and seminars are intended to familiarize the students with the different ground segment engineering topics addressed in the course, to be deepened by the independent study of reading list items.
The workshop is intended to practically illustrate and discuss a sample project with the students, and to assign them the group project needed to apply the acquired knowledge. Due to the limited resources (number of students) and short schedule (e.g. a week) within the workshop, students will be required to plan (work plan structure) and share the workload (define work packages, at least each one led by one student), clearly identifying per each student an assigned role in the group project.

Formative assessment will be undertaken through feedback at unassessed workshop exercises, and also in feedback on draft outlines of assessed coursework. Summative assessment will be composed by an open book examination (LOs 1, 2, 3, 4) which allows the student to revise, apply and demonstrate specific knowledge and competences relating to course contents, and by a written coursework for the group project (LO 5).

The coursework will assess the students' understanding of the theoretical concepts, technical and practical skills required by the module, and evaluate their ability to apply these technical skills to the design, development and testing cycle of ground segment. Each student shall contribute, as coursework, for 1500 word to the group report associate to each work package. The final report will be the compilation of the work package reports. Students' teamwork, presentation and entrepreneur skills will be assessed by a group oral presentation in front of an industrial panel with a 'Dragons Den' approach during which students have to pitch their project objectives and outcomes

Mode of Assessment

Type	Method	Description	Weighting
Summative	Coursework - Written	Project report (min. 1500 words) detailing individual contribution to group project inc. research analysis & reflection	30%
Summative	Presentation	Oral group presentation (nswers). SUPPLEMENTARY: Individual or group presentation	20%
Summative	Examination - Open Book	Open book examination (2 hours)	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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