

Module Details	
Module Title	Communication Satellite Systems
Module Code	ELE7035-B
Academic Year	2023/4
Credits	20
School	Department of Biomedical and Electronics Engineering
FHEQ Level	FHEQ Level 7

Contact Hours	
Type	Hours
Tutorials	Satellite communications is a major commercial application of space so that it complements the other modules of satellite engineering to give the broader picture. This module provides students with understanding on the principles concepts of Communication Satellite Systems and their applications, the key elements that determine their performance. It builds on satellite engineering skills to apply them to this field. Students also learn to work together by dividing a project into smaller tasks.
Directed Study	160
Project Supervision	6
Seminars	6
Lectures	22
Tutorials	6
Tutorials	- Overview of Satellite Communications: advantages, history, orbits, services, frequency bands and the regulatory environment, organisations, satellite system segments. - Satellite Orbits: orbital mechanics, GEO, LEO, MEO, HEO, satellite constellation design, space environment, reliability. - Satellite Links: propagation effects and impairments, antennas used for satellite communications, link analysis, link quality, link availability, link power budgets. - Satellite Signal Processing: modulation (FM, BPSK, QPSK, 8PSK, 16APSK, ?, 512APSK), multiplexing (FDM, TDM, CDM), multiple access (FDMA, TDMA, CDMA, RAMA, multibeam), error control coding. - Satellite Communication System Network Architectures and Payloads: satellite networks (mesh, star, ISL, gateways, broadcast, broadband), payloads (classical, digital, building blocks, dimensioning (air interface, DC power, thermal)). - Satellite Communication System Applications: high throughput satellite (HTS) systems, digital video broadcasting (DVB) systems, very small aperture terminal (VSAT) systems.
Tutorials	Learning and teaching will be directed, supported, and reinforced through a combination of face-to-face or online lectures and seminars, 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, project supervision, tutorials, and seminars delivered within the first 11 weeks. Students start their assessed group project from the third week. Extra tutorials can be arranged upon request by students to ensure that every student understands the lecture materials. 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 seminars will be delivered and uploaded to CANVAS to enable students watch the presentations, videos at their own time. Lectures are intended to expose the students to the applications of satellite communications and the concepts of the implementation together with the regulatory context. This will be further reinforced by lecturers from industry. Active participation is encouraged during the lectures. There will be an open book exam to evaluate the student's ability to apply the acquired knowledge. A group project allows the students to work together on a system design project that encourages the students to apply the acquired knowledge. Students will exercise project management and teamwork skills due to the limited resources (number of students) and short schedule (e.g. a week) such that students must plan (work plan structure) and share the workload. Students will be assessed by a group project and an open book examination. For the group project, each student must take the lead for at least one work package and contribute a minimum of 1500 word to explain the logic of the work package breakdown and to detail the work associated with their specific work package. Each student will also give a presentation of his/her work as part of the final presentation. The final report will be the compilation of the work package reports. This is intended to mimic a real-life industry project and therefore collaboration, project management are integral parts throughout the project. Formative assessment will be through informal feedback to the technical and project management aspects

Type	Hours
	of the group project work. 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/unseen 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.

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

Module Aims
<p>Satellite communications is a major commercial application of space so that it complements the other modules of satellite engineering to give the broader picture.</p> <p>This module provides students with understanding on the principles concepts of Communication Satellite Systems and their applications, the key elements that determine their performance. It builds on satellite engineering skills to apply them to this field.</p> <p>Students also learn to work together by dividing a project into smaller tasks.</p>

Outline Syllabus
<ul style="list-style-type: none"> <li>- Overview of Satellite Communications: advantages, history, orbits, services, frequency bands and the regulatory environment, organisations, satellite system segments.</li> <li>- Satellite Orbits: orbital mechanics, GEO, LEO, MEO, HEO, satellite constellation design, space environment, reliability.</li> <li>- Satellite Links: propagation effects and impairments, antennas used for satellite communications, link analysis, link quality, link availability, link power budgets.</li> <li>- Satellite Signal Processing: modulation (FM, BPSK, QPSK, 8PSK, 16APSK, ?, 512APSK), multiplexing (FDM, TDM, CDM), multiple access (FDMA, TDMA, CDMA, RAMA, multibeam), error control coding.</li> <li>- Satellite Communication System Network Architectures and Payloads: satellite networks (mesh, star, ISL, gateways, broadcast, broadband), payloads (classical, digital, building blocks, dimensioning (air interface, DC power, thermal)).</li> <li>- Satellite Communication System Applications: high throughput satellite (HTS) systems, digital video broadcasting (DVB) systems, very small aperture terminal (VSAT) systems.</li> </ul>

Learning Outcomes	
Outcome Number	Description
LO1	Demonstrate a systematic understanding of the fundamentals and advanced concepts in satellite communication systems as well as its regulatory environment.
LO2	Demonstrate ability to engage in the design, and application, and implementation of state-of-the-art satellite systems, and presentation of solutions to practical problems.
LO3	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
<p>Learning and teaching will be directed, supported, and reinforced through a combination of face-to-face or online lectures and seminars, 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.</p> <p>The module will be delivered and assessed over one Semester, with lectures, project supervision, tutorials, and seminars delivered within the first 11 weeks. Students start their assessed group project from the third week. Extra tutorials can be arranged upon request by students to ensure that every student understands the lecture materials.</p> <p>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 seminars will be delivered and uploaded to CANVAS to enable students watch the presentations, videos at their own time.</p> <p>Lectures are intended to expose the students to the applications of satellite communications and the concepts of the implementation together with the regulatory context. This will be further reinforced by lecturers from industry. Active participation is encouraged during the lectures. There will be an open book exam to evaluate the student's ability to apply the acquired knowledge. A group project allows the students to work together on a system design project that encourages the students to apply the acquired knowledge. Students will exercise project management and teamwork skills due to the limited resources (number of students) and short schedule (e.g. a week) such that students must plan (work plan structure) and share the workload.</p> <p>Students will be assessed by a group project and an open book examination. For the group project, each student must take the lead for at least one work package and contribute a minimum of 1500 word to explain the logic of the work package breakdown and to detail the work associated with their specific work package. Each student will also give a presentation of his/her work as part of the final presentation. The final report will be the compilation of the work package reports. This is intended to mimic a real-life industry project and therefore collaboration, project management are integral parts throughout the project.</p> <p>Formative assessment will be through informal feedback to the technical and project management aspects of the group project work.</p> <p>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.</p> <p>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.</p> <p>Presentation- In-person group oral presentation by each project group. For supplementary assessment, group oral presentation will be replaced by individual presentation.</p> <p>Examination open book/unseen 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.</p>

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. For supplementary assessment - Individual presentation.	20%
Summative	Examination - Open Book	A timed examination - Students may bring specified books/other resources into the exam.	50%

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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