

Module Details	
Module Title	RF and Wireless Systems
Module Code	ELE7039-B
Academic Year	2024/5
Credits	20
School	School of Computer Science, AI and Electronics
FHEQ Level	FHEQ Level 7

Contact Hours	
Type	Hours
Lectures	22
Lectures	To provide a thorough grounding in radio frequency (RF) engineering and wireless communications with a special emphasis on design considerations and tools, mastery of underlying theoretical concepts, and knowledge of current industry standards and future trends.
Lectures	- RF Circuits Design: Introduction to RF circuits for wireless communication systems; system components; impedance matching; RF amplifier design; RF front-end design; RF design tools; modern communication receiver. - Antennas: Single-element and array antennas; antennas for cellular networks; use of diversity at receiver; adaptive base station antennas; use of software tool for analysis of antennas and waveguide structures. - Mobile Communication Systems: Radiowave propagation effects and factors; the cellular radio concept; macrocells, microcells and picocells; implementation and evolution to present day 5G system; network planning; planning models and link analyses; modulation and multiple access issues; overview of wireless LAN standards; ad-hoc networks.
Lectures	Learning and teaching will be directed, supported, and reinforced through a combination of face-to-face or online lectures, seminars, laboratory sessions, tutorials, and project supervision sessions as well as through directed and self-directed study supported by learning materials available in CANVAS. 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 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 in person due to extenuating 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 to watch the videos at their own time. Lectures are intended to give the students a systematic understanding of the component systems and techniques employed in RF engineering and wireless communications as well as the ability to engage in the analysis, design, and application of state-of-the-art RF and wireless systems. This learning will be further reinforced by laboratory work and seminars, one of which will be delivered by an industry expert. Active participation is encouraged during the lectures. There will be an open book exam to assess 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 to 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 with collaboration and project management as integral parts. 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.
Directed Study	160
Project Supervision	6

Type	Hours
Seminars	4
Tutorials	2

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

Module Aims
To provide a thorough grounding in radio frequency (RF) engineering and wireless communications with a special emphasis on design considerations and tools, mastery of underlying theoretical concepts, and knowledge of current industry standards and future trends.

Outline Syllabus
<ul style="list-style-type: none"> - RF Circuits Design: Introduction to RF circuits for wireless communication systems; system components; impedance matching; RF amplifier design; RF front-end design; RF design tools; modern communication receiver. - Antennas: Single-element and array antennas; antennas for cellular networks; use of diversity at receiver; adaptive base station antennas; use of software tool for analysis of antennas and waveguide structures. - Mobile Communication Systems: Radiowave propagation effects and factors; the cellular radio concept; macrocells, microcells and picocells; implementation and evolution to present day 5G system; network planning; planning models and link analyses; modulation and multiple access issues; overview of wireless LAN standards; ad-hoc networks.

Learning Outcomes	
Outcome Number	Description
01	Demonstrate a systematic understanding of the component systems and techniques employed in RF engineering and wireless communications.
02	Engage in the analysis, design, and application of state-of-the-art RF and wireless systems, and presentation of solutions to practical problems.
03	Demonstrate good understanding of collaborative working, proposal writing, project management, and presentation of 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, laboratory sessions, tutorials, and project supervision sessions as well as through directed and self-directed study supported by learning materials available in CANVAS.

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 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 in person due to extenuating 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 to watch the videos at their own time.

Lectures are intended to give the students a systematic understanding of the component systems and techniques employed in RF engineering and wireless communications as well as the ability to engage in the analysis, design, and application of state-of-the-art RF and wireless systems. This learning will be further reinforced by laboratory work and seminars, one of which will be delivered by an industry expert. Active participation is encouraged during the lectures. There will be an open book exam to assess 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 to 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 with collaboration and project management as integral parts.

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.

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 words.	30%
Summative	Presentation	In-person group oral presentation by each project group. Individual Presentation - Supplementary.	20%
Summative	Examination - Open Book	A timed examination on-campus. 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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