

## Module specification

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Module Code	ENG6C1
Module Title	Wireless Communication and Antennas
Level	6
Credit value	20
Faculty	FAST
HECoS Code	10-01-59
Cost Code	GAME

## Programmes in which module to be offered

Programme title	Is the module core or option for this programme
BEng (Hons) Electrical and Electronic Engineering	Optional
MEng Electrical and Electronic Engineering	Optional

## Pre-requisites

None

## Breakdown of module hours

Learning and teaching hours	24 hrs
Supervised learning e.g., practical classes, workshops	0 hrs
<b>Total active learning and teaching hours</b>	24 hrs
Guided independent study	176 hrs
<b>Module duration (total hours)</b>	200 hrs

<b>For office use only</b>	
Initial approval date	22 <sup>nd</sup> Aug 2022
With effect from date	Sept 2022
Date and details of revision	
Version number	1

## Module aims

- To understand basics of radio wave propagation in different media, modes of propagation, wave equations and the reflection coefficient.
- To provide knowledge of the fundamental parameters of antennas, types of antennas and impedance matching.
- To develop skills of designing basic antenna types such as Dipole antenna and Patch Antenna etc.

## Module Learning Outcomes - at the end of this module, students will be able to:

1	Analyse different parameters and phenomena of radio wave propagation in electromagnetic domain.
2	Investigate and calculate various design and radiation parameters of antennas.
3	Discuss the applications of different types of antennas and wireless communication technologies according to the practical requirements.

In addition to the module learning outcomes, students will also cover the following accreditation of higher education programme (AHEP) fourth edition learning outcomes: C1, C2, C3, C4, M1, M2, M3, M4

## Assessment

Indicative Assessment Tasks:

This module will be assessed by means of an examination and a coursework. The examination will be a written exam based on the syllabus taught during the course. The coursework assessment will be in the form of a research report based on the latest trends in antennas and wireless communication. Indicative exam 2 hours, coursework word count 2000 words.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)
1	1, 2	Examination	50%
2	3	Coursework	50%

## Derogations

A derogation from regulations has been approved for this programme which means that whilst the pass mark is 40% overall, each element of assessment (where there is more than one assessment) requires a minimum mark of 30%

## Learning and Teaching Strategies

This module will be presented to the students through a series of lectures and tutorials. Learning materials will include in-class and on-line lecture notes, exercises and tutorials. Access to practical Laboratory facilities and software packages will be available to students. Extensive use will be made of VLE (Moodle) to supplement learning materials

## Indicative Syllabus Outline

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**Wireless Communication:** Wave fundamentals, Classification of waves, EM waves, Classification of EM waves Maxwell's equations, Wave equation and propagation constant, E-field and H-field, permittivity, permeability, loss tangent intrinsic impedance, Plane waves, Propagation modes - Ground wave propagation, ground reflection coefficient, Sky-wave propagation, Line of sight (LOS) propagation, Attenuation, Free space path loss, Distortion, Dispersion, Noise, Effects of ground and atmosphere on propagation, Multipath propagation, Fading. Wireless Technologies: Bluetooth, WiFi, ZigBee, 4G, 5G, NFC etc.

**Antennas:** Introduction to Antennas, Radiation mechanism, Thevenin equivalent model of antennas, Types of antennas, Various antenna parameters, Friis Transmission Equation, Reciprocity, Losses in antennas, Antennas Designing - Dipole antenna, Microstrip Patch antenna, Yagi Antenna etc, Smith Chart and Impedance - Determination of SW parameters, Determination of line impedance and admittance, Determination of Line Impedance and Admittance. Impedance matching, Quarter wave transformer.

## Indicative Bibliography:

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### Essential Reads

[1] John D. Kraus, et.al., *Antennas and Wave propagation*, 5<sup>th</sup> Edition. India: McGraw Hill, 2017.

[2] Constantine A. Balanis, *Antenna Theory: Analysis and Design*, 4<sup>th</sup> Edition. New Jersey, USA: Wiley, 2016.

### Other indicative reading

[3] Mathew N. Sadiku, *Elements of Electromagnetics*, 7<sup>th</sup> Edition. Oxford, UK: Oxford University Press, 2018.

## Employability skills – the Glyndŵr Graduate

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Each module and programme is designed to cover core Glyndŵr Graduate Attributes with the aim that each Graduate will leave Glyndŵr having achieved key employability skills as part of their study. The following attributes will be covered within this module either through the content or as part of the assessment. The programme is designed to cover all attributes and each module may cover different areas.

### Core Attributes

- Engaged
- Creative
- Ethical

### Key Attitudes

- Commitment
- Confidence

### Practical Skillsets

- Digital Fluency
- Organisation
- Critical Thinking

- Communication