

Module specification

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Module Code	ENG6D2
Module Title	Digital Communication Techniques
Level	6
Credit value	20
Faculty	FACE
HECoS Code	100188
Cost Code	GAME
Pre-requisite module	N/A

Programmes in which module to be offered

Programme title	Core/Optional/Standalone
BEng (Hons) Industrial Engineering (Electrical)	Core
BEng (Hons) Industrial Engineering (Mechatronics)	
BEng (Hons) Electrical Engineering with Manufacture	
BEng (Hons) Electrical Engineering	

Breakdown of module hours

Learning and teaching hours	18 hrs
Placement tutor support hours	0 hrs
Supervised learning hours e.g. practical classes, workshops	18 hrs
Project supervision hours	0 hrs
Active learning and teaching hours total	36 hrs
Placement hours	0 hrs
Guided independent study hours	164 hrs
Module duration (Total hours)	200 hrs

Module aims

This module integrates advanced theoretical study with applied laboratory investigation. Students critically evaluate techniques, interpret data, and justify design or methodological decisions within a professional context. The combination of theory and practice cultivates independent learning, innovation, and readiness for individual project or dissertation work.

This module aims to develop students' advanced understanding of digital communication systems, equipping them with the analytical, design, and simulation skills required to evaluate, design, and implement effective solutions to real-world engineering challenges.

Module Learning Outcomes

At the end of this module, students will be able to:

1	Critically analyse complex digital communication scenarios using first principles of mathematics and engineering to generate well-reasoned conclusions (AHEP-4 C2, C6).
2	Integrate analytical findings into a systems-based approach to design and evaluate effective digital communication solutions (AHEP-4 C2, C6).
3	Apply laboratory/simulation techniques to investigate, statistically validate, and justify the performance of digital communication systems (AHEP-4 C2, C12).

Assessment

Indicative Assessment Tasks:

This section outlines the type of assessment task the student will be expected to complete as part of the module. More details will be made available in the relevant academic year module handbook.

Assessment 1: Coursework

Students will complete a technical report in which they analyse, design, and evaluate a digital communication system. This assessment is designed to address all learning outcomes and requires the development of justified solutions supported by appropriate technical evidence.

Assessment number	Learning Outcomes to be met	Type of assessment	Duration/Word Count	Weighting (%)	Alternative assessment, if applicable
1	1-3	Coursework	3000	100	N/A

Derogations

Credits shall be awarded by an Assessment Board for those modules in which a pass mark 40% has been achieved, with a minimum mark of 30% in each assessment element.

Learning and Teaching Strategies

Learning combines theoretical exploration with applied laboratory investigation to bridge conceptual understanding and professional competence. Students critically analyse data, test approaches, and evaluate outcomes in practical settings. Blended delivery through the Virtual

Learning Environment supports flexibility and reflection. Tutorials focus on independent enquiry, innovation, and readiness for project or dissertation work.

Welsh Elements

This module will be delivered through the medium of English; however, students have the option to submit their assessments in the medium of Welsh. While this module is not currently offered fully through Welsh, Welsh language support and guidance are available, and some learning materials or tutorial discussions may incorporate Welsh elements where appropriate. To further promote bilingual learning, all students have the opportunity to take the 20-credit *Welsh for STEM* short course, designed to develop confidence and subject-specific language skills in both English and Welsh.

Indicative Syllabus Outline

Fundamentals of Digital Communication: Analysis of signal representation, spectral efficiency, and the effects of noise on digital signals, applying first principles reasoning to evaluate bandwidth, power, and data rate relationships.

Digital Transmission and Channel Behaviour: Modelling and analysis of transmission over AWGN and fading channels, evaluating the impact of noise, interference, and multipath effects on system performance and bit error rates.

Modulation and Demodulation Techniques: Comparative evaluation of digital modulation schemes, including QPSK, QAM, FSK, and OFDM, considering symbol decision processes, constellation behaviour, and performance trade-offs in realistic systems.

Multiplexing and Multiple Access: Application of time, frequency, and code division multiplexing techniques, integrating these strategies into complete communication system architectures for multiuser environments.

Error Control and Coding Techniques: Design and assessment of coding methods, including block codes, convolutional codes, and interleaving, to improve system reliability and performance through redundancy and coding gain.

Synchronization and System Validation: Investigation of timing and carrier synchronisation, including symbol timing and clock recovery, using simulation or laboratory methods to evaluate system performance and justify design decisions.

Indicative Bibliography

Please note the essential reads and other indicative reading are subject to annual review and update.

Essential Reads:

J. G. Proakis and M. Salehi, *Digital Communications*, 5th ed. New York, NY, USA: McGraw-Hill, 2008. [Online]. Available: <https://daskalakispiros.com/files/Ebooks/digital-communication-proakis-salehi-5th-edition.pdf>. Accessed: Apr. 27, 2026.

Other indicative reading:

Massachusetts Institute of Technology (MIT), “Principles of digital communications I – lecture notes,” MIT OpenCourseWare, 2006. [Online]. Available: <https://ocw.mit.edu/courses/6-450-principles-of-digital-communications-i-fall-2006/pages/lecture-notes/>.

Plus, various others to be signposted on Moodle.

Administrative Information

For office use only	
Initial approval date	June 2026
With effect from date	September 2026
Date and details of revision	
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