Module Code	EEP55C05/EEU44C05
Module Name	DIGITAL SIGNAL PROCESSING
ECTS Weighting[1]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Professor Naomi Harte
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module, students should be able to: LO1. Outline and use a variety of approaches to sampling and reconstruction of signals. LO2. Describe, appraise and implement filter design methods for IIR and FIR filters, identifying trade-offs and evaluating outcomes. LO3. Appreciate and illustrate the role of linear phase. LO4. Elaborate on the relationship between the Continuous Time Fourier Transform and the Discrete Fourier Transform. LO5. Discuss the importance and relevance of properties of the DFT. LO6. Illustrate fast algorithms for implementation of the DFT and their practical use and advantages. LO7. Interpret and analyse signals using spectral analysis techniques derived from the DFT. LO8. Appreciate the role of signal processing in current approaches to system design. LO9. Exploit assigned reading and lab exercises to deepen insights into module content. **Graduate Attributes: levels of attainment** To act responsibly - Enhanced To think independently - Attained To develop continuously - Attained To communicate effectively - Attained

[1] TEP Glossary

Module Content	Signal Processing is concerned with the representation, transformation and manipulation of signals and the information they contain. Typical signals include speech, video, measurements of physical phenomena such as pressure, speed, or information of all kinds from stock market prices to mobile phone text messages. This module deals specifically with the treatment of signals that are digital. This means that they are discrete in time, i.e. sampled, often from a signal that was originally continuous or analog, and they are also quantised, taking on one of a fixed set of values, and often represented in binary form in implementation. Hence the module title – Digital Signal Processing. The module includes the following content: • Signals and Properties, LTI systems – a review (3C1 or equivalent background) • Sampling and reconstruction, Decimation, interpolation, quantisation • Digital Filters, Linear Phase systems • Filter design methods – IIR, FIR • Optimum FIR Filter Design • Practical Filter Design in Matlab • Discrete Fourier Series, Discrete Fourier Transform, Discrete Fourier Transform Properties • Computation of FFT • Random Processes • Spectral analysis of signals with DFT • Filter realisations • DSP in an era of Deep Learning DSP is essential for engineers to work with and transform real-world signals into meaningful, usable data. Applications that need the fundamentals delivered in this module span areas including speech, audio and video, data communications, control engineering, medical devices and sensing. DSP is particularly powerful when combined with expertise in machine learning and AI.
Teaching and Learning Methods	The module is delivered with: • 3 lectures weekly • 1-hour Office Hour • 4 Laboratories (mostly self-directed, done in Matlab, with a 1-hour clinic provided per student per lab)

- The delivery will include a number of guest lectures to allow students hear about DSP in action in real-world applications.

A problem set aligned with module content is assigned weekly from Week 2, with solutions provided via Blackboard one week later. The fixed weekly Office Hour session allows students to drop in (no appointment required) to ask the lecturer for help with either those questions or any other material delivered in lectures.

Students are expected to engage fully with the module through self-directed study of the supporting module text or other suggested reading. This is essential to aid their understanding of the content. The labs will be used to reinforce concepts delivered through the lecture program.

Assessment Details[2]
Please include the following:

- **Assessment Component**
- **Assessment description**
- **Learning Outcome(s) addressed**
- **% of total**
- **Assessment due date**

Assessment Component	Assessment Description	LO Addressed	% of total	Week due
Annual Exam	End of year written in-person exam	All	85	End of Semester
CA	4 labs	1,2,3,7,9	15	Date depends on group. 2 labs from Week 3-7, 2 Labs from Week 8-11

Reassessment Requirements

Contact Hours and Indicative Student Workload[2]

Contact hours: 46
Independent Study (preparation for course and review of materials): 42
Independent Study (preparation for assessment, incl. completion of assessment): 20

Recommended Reading List

Discrete-Time Signal Processing, Alan V. Oppenheim, Ronald W. Schafer (3rd edition) Available electronically to students via TCD Library, including off-campus access.
Other reading will be assigned in lectures.

Module Pre-requisite

EE3C1 Signals & Systems or equivalent

[2] TEP Guidelines on Workload and Assessment

Module Co-requisite	
Module Website	Blackboard
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	
Module Approval Date	
Approved by	Prof. Naomi Harte
Academic Start Year	September 2025
Academic Year of Date	2025/2026