MODULE SPECIFICATION

DIGITAL SIGNAL PROCESSING

This version of the specification was approved for its first delivery in the academic year 2021/22

Short Module Title:

Module Description:

This module demonstrates the basic principles of AD conversion (sampling, aliaising, quantisation and dither), the principles and application fo signal processing (impulse response, frequency response, and convolution), filtering, and the various time-frequency-phase transforms (Laplace, Fourier, Wavelet), as well as gives a general introduction to big data analysis, machine learning, and the application of specific acoustic signal processing (reverberation, application of windowing).

STANDALONE MODULE

Will this module be marketed as a standalone module? No, this module will not be marketed as a stand alone module

Entry Requirements:

Module Level	Level 5	Module Code	J930 20033
Module Credit Value	20	HECoS Code	
Owning School	School of Science, Engineering and En...		
Contributing School		Percentage delivered by another school	0

Is this module available to International Students? Yes

DELIVERY DETAILS

CRN	*Semester Part Code*	Campus
39014	*S4 - September Start, Trimesters 1&2 (Long Thin)*	University of Salfo...
	S1 - September Start, Trimester 1 (Short Fat)	
	S1 - September Start, Trimester 1 (Short Fat)	

	S1 - September Start, Trimester 1 (Short Fat)	
	S1 - September Start, Trimester 1 (Short Fat)	
	S1 - September Start, Trimester 1 (Short Fat)	
	S3 - September Start, Trimester 3 (Short Fat)	
	J2 - June Start, Trimester 2 (Short Fat)	

For a full set of module CRNs, please go to PaMIS or contact the Quality and Enhancement Office on QEO@salford.ac.uk

INDICATIVE LEARNING HOURS

Lecture:	44	Practical Classes and Workshops:	44
Seminar:		Supervised studio/workshop time:	
Tutorial:		Fieldwork:	
Project supervision:		External Visits:	
Demonstration:		Work Based Learning:	
Placement:		Year Abroad:	
Guided Independent Study	112	Total:	200
		Other (including additional placement hours):	

INDICATIVE LEARNING OUTCOMES

Aims:

1. To introduce the concepts and principles of analogue and digital signals including conversion.
2. To introduce and develop the knowledge and skills needed to design, program and implement DSP applications.
3. To develop project management, research and written communication skills.

Intended Learning Outcomes: Knowledge and Understanding:

1. Demonstrate the basic principles behind AD conversion e.g. Sampling, Aliasing, Quantisation and Dither.

2. Demonstrate the underlying principles behind signal processing e.g. impulse response, frequency response and convolution.

3. Demonstrate knowledge of transforming between time and frequency via the Fourier Transform.

4. Design and implement a Window based Low-Pass FIR filter.

5. Describe and explain the difference between IIR and FIR filters.

Intended Learning Outcomes: Key Subject Specific Skills:

MODULE REQUIREMENTS

Pre-Requisites:

Co-requisites:

ETHICS

Does this module require ethical approval? Ethical approval is required for the module

Will students require individual ethical approval for an assessment task? No ethical approval is required.

ASSESSMENT TASKS

Is this module eligible for compensation? Yes

Mark Calculation Method Method A

KIS Type	*Description*	*Pass/ Fail?*	*ILO of this task*	*Weight*	*Duration/ Word Count*	*Component Pass Req'd?*	*eSubmission*	*Organiser?*
Coursework	*Reverb algorithm and accompanying conference paper*	☐	*1,2,3*	*50*		*No*	*Yes*	*School*
Coursework	*Room equalisation algorithm design and accompanying conference paper*	☐	*3,4,5*	*50*		*No*	*Yes*	*School*
		☐				*No*	*Yes*	
There is no Programme Specific Regulation for additional assessments								
		☐					*Yes*	
		☐					*Yes*	
		☐					*Yes*	

Learning Teaching and Assessment Strategies:

Lectures: board-work, discussion, supplementary material with directed weekly reading will be used to introduce topics, develop theory and discuss example of applications.

Formative assessment via Tutorials in which numerical example sheets and computer simulations will be used to further explore the concepts and apply the learnt theory to numerical examples.

Computer and practical labs: Prepared exercises will build on the theoretical understanding developed in the lecture and tutorial sessions.

Summative assessment through computer labs resulting in two formative MATLAB projects with accompanying conference paper

style reports.

You will be encouraged to engage with UniSkills E Learning resources in order to develop study skills and understanding specific to the module content. https://www.salford.ac.uk/library/skills-for-learning/uniskills.

Reassessment Strategies:

Students requiring reassessment should submit either of the formative assessments – either should be sufficient to achieve a pass in the module and both offer similar assessment opportunities for students who are proficient in code, or technical writing.

Syllabus Outline:

- Introduction to digital signals in acoustics and audio: Sampling, Aliasing, Quantisation, and Dither
- Noise shaping and Oversampling, Application to AD Conversion
- The continuous Fourier Transform Pair, Discrete and Fast Fourier Transforms
- Filters: Impulse responses, Frequency responses, and the Convolution Theorem
- Digital filters: Discrete convolution, and the FIR filter
- Sample rate conversion using FIR filters, with application to Audio conversion
- FIR Filter design, Windowing, Fast Convolution, IIR Filter principles
- Applications of FIR and IIR digital filters, e.g. reverberators and audio equalisers
- Machine learning in principle
- Large scale feature evaluation from audio signals (spectrotemporal feature analysis)

Indicative texts:

Li, Francis F., and Trevor J. Cox. *Digital signal processing in audio and acoustical engineering*. CRC Press, 2019.
Howard, David M., and Jamie Angus. *Acoustics and psychoacoustics*. Taylor & Francis, 2017.

Tarr, Eric. *Hack Audio: An Introduction to Computer Programming and Digital Signal Processing in MATLAB*. Routledge, 2018.
Hill, Paul. *Audio and speech processing with MATLAB*. CRC Press, 2018.

Up to date lists should be accessed at www.salford.ac.uk/readinglists

IMPLEMENTATION

Module Leader:	***Display Name***
	Duncan Williams,#,#School of Science,, Engineering & Environ...
Approval Date:	22/06/2021

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