

## MODULE SPECIFICATION

Please contact your College Learning and Teaching Team for guidance completing this form:  
 Colleges of Arts & Social Sciences and of Business & Law – [cass-tandlteam@salford.ac.uk](mailto:cass-tandlteam@salford.ac.uk)  
 College of Health and Social Care – [chsc-teaching@salford.ac.uk](mailto:chsc-teaching@salford.ac.uk)  
 College of Science and Technology – [cst-tl@salford.ac.uk](mailto:cst-tl@salford.ac.uk)

This form is available to download from [http://www.governance.salford.ac.uk/page/aqa\\_forms](http://www.governance.salford.ac.uk/page/aqa_forms)).

Date of completion of this version of Module Specification: 12/01/2016				
Date of approval by the USP: 26/01/2016				
1. Module Title: (Full title and short title no more than 30 characters) Speech and Signal Processing			2.CRN: 35527	
3.University module code: H341 30001		4.HESA/JACS subject area code <sup>1</sup> : H341		
5.Level: Level 6	6.Credit Value: 20	7.ECTS Value <sup>ii</sup> : 10	8.Length of module in semesters: 2	9.Month(s) in which to be offered <sup>iii</sup> : September
10.Module Status <sup>iv</sup> Existing	11.Title of Module being replaced (if any):		12.With effect from <sup>v</sup> (academic year): September 2016	
13.Originating School: School of Computing, Science & Engineering		14.Module Leader(s) Trevor Cox		
15.Programme(s) in which to be offered <sup>vi</sup> : BEng (Hons) Audio Acoustics: Acoustic Engineering BEng (Hons) Audio Acoustics: Audio Engineering BEng (Hons) Electronic Engineering BSc (Hons) Physics with Acoustics BSc (Hons) Physics with Acoustics with Professional Experience MPhys (Hons) Physics with Acoustics MPhys (Hons) Physics with Acoustics with Professional Experience				
16.Pre-requisites (between levels): None		17.Co-requisites (within a level): None		
18.Indicative learning hours (breakdown of hours required) <sup>vii</sup> 200				
Lecture	36	Fieldwork		
Seminar		External visits		
Tutorial		Work based learning		
Project supervision		Guided independent study		146
Demonstration Practical classes and workshops	18	Placement		
Supervised time in studio/workshop		Year abroad		
Other – please specify <sup>viii</sup>				
19.Percentage of module taught by School(s) other than originating School: 0%				
20.Aims of Module <sup>ix</sup> : (maximum of 5)				
1. To develop knowledge and skills in digital signal processing.				

2. To critically evaluate techniques for digital filter design and system measurement
3. To develop a detailed understanding of systems for modelling and analysing speech signals.
4. To critically evaluate current audio coding methods

21. Intended Learning Outcomes<sup>x</sup>

Knowledge and Understanding (maximum of 5)<sup>xi</sup>

On successful completion the student will be able to:

1. Explain the mechanisms of speech production and procedures for modelling, at the forefront of the discipline.
2. Apply a detailed knowledge of speech perception to speech synthesis, recognition and hearing aid design.
3. Apply statistical methods in the analysis of audio signals and systems.
4. Use a detailed knowledge of mathematical techniques to design digital filters.
5. Explain the limits of digital processing and audio coding with respect to system requirements and psychoacoustic constraints.

Transferable/Key Skills and other attributes (maximum of 5)

On completion the student will have had the opportunity to:

6. Numeracy: Engineering mathematics for analysis and design.
7. Managing Learning: Assignment and tutorial in own time.
8. Information Technology: Computer based signal processing assignment.
9. Problem solving in the assignment.

All learning outcomes will be tested in both assessments.

22. Module mark calculation: Method A

23. Assessment components (in chronological order of submission/examination date)

Denote final assessment component in box marked **final assessment component (99)**

Type of assessment	Identify which ILO is met by number <sup>xii</sup>	Weighting %	Duration	Word count	Component pass required <sup>xiii</sup>	E Submission	Assessment organised by
Assessment of practical DSP skills	4,5	50		10 pages including graphs	No	No	School
					Choose an item.	Choose an item.	Choose an item.
<b>Final assessment component (99)</b> Exam end of semester 2	1,2,3,4,5	50	2 hours	n/a	No	No	SID

24. Is ethical approval for the module required?	No	25. Is ethical approval for an assessment component required? <sup>xiv</sup>	No
--	----	--	----

26. Learning, teaching and assessment strategies:

The module will be delivered via a combination of lectures and Computer lab workshops.

The lectures will cover the essential theoretical material and mathematical concepts underpinning current Digital Signal Processing and speech technology. lectures will be delivered by full-time teaching staff. The Computer lab Workshops will involve a series of Matlab exercises to support the coursework assignment which involves the implementation of practical DSP for audio signal processing using the concepts covered by the lecture course.

Assessment will be in two parts:

The coursework assessment will involve a series of DSP exercises implemented using Matlab to demonstrate the students understanding of DSP concepts and coding skills.

The end exam will assess the student's understanding of the DSP and mathematical concepts and material covered by the module

Learning outcomes map

	1	2	3	4	5
--	---	---	---	---	---

Courswork Assessment				X	X
End Exam	X	X	X	X	X

27.Syllabus outline:

- Speech production and phonetics.
- Physiology of the vocal tract and vocal folds. Acoustic output of the vocal folds. Modelling of the vocal folds and tract. Speech measurement.
- Single and double resonator models of the vocal tract using electrical analogues for pure vowels.
- Analysis, synthesis and speech recognition. Pattern recognition
- The vowel quadrilateral for acoustic labelling of phonemes. Speech analysis using modern digital methods with applications in recognition and synthesis.
- Signal analysis: Auto/cross covariance, Power spectral density.
- Measurement of transfer function of LTI.
- Digital filters 1: Pole zero map, Frequency response, z as an advance operator, Difference equations/impulse response.
- Digital filters 2:IIR filters e.g. equalisers, Bilin/Biquad section implementation, Bilinear transform, impulse invariance.
- Audio coding e.g. perceptual codes such as mp3
- Loudspeaker and microphone array processing
- Signal processing for hearing aids

28.Indicative texts and/or other learning materials/resources<sup>xv</sup>:

- HOLMES, W. & HOLMES, J., Speech Synthesis and Recognition, 2001, Taylor & Francis
- OWENS, F.J., Signal Processing of Speech, 1993, Macmillan
- R.B. Randal, Frequency Analysis -3rd Edition, Naerum:Bruel and Kjaer, 1987
- P.A.Lynn and W.Fuerst, Digital Signal Processing, J. Wiley, 2009
- Smith M.T., Introduction to Digital Signal Processing: A computer laboratory textbook, Wiley. 1991
- J Watkinson, Art of Digital Audio, Focal Press, ISBN-13: 978-0240515878, 2000

A comprehensive reading list can be accessed at <http://lasu.salford.ac.uk>

For Office Use only:

Teaching and Learning Team Comments:	Module spec brought as part of Physics PPRR on 26 Jan 2016.
--------------------------------------	---

- i See UoS guidance notes on selecting JACS codes ([http://www.planning.salford.ac.uk/jacs\\_codes/](http://www.planning.salford.ac.uk/jacs_codes/)) see HESA JACS Codes webpage <http://www.hesa.ac.uk/index.php/content/view/356/233/>
- ii The ECTS value is half of the module credit value
- iii Please indicate the month (s) in which delivery of the module will commence.
- iv Amendments to the title or credit value constitute a new module.
- v If the delivery month of the module is to be available for different intakes of a programme, please indicate this here. E.g. Module effective from Sept 2014 – to state the module is to be available for Sept 2014 intake & Feb 2014 intake.
- vi The module will only be attached to programmes specified in this section. Any approved module can be available as a stand alone module.
- vii These categories are used for the Key Information Set which currently applies only to full time undergraduate students only but please include for all students – for more information including definitions see [http://www.qaa.ac.uk/Publications/InformationAndGuidance/Documents/contact\\_hours.pdf](http://www.qaa.ac.uk/Publications/InformationAndGuidance/Documents/contact_hours.pdf) and [http://www.hesa.ac.uk/component/option,com\\_studrec/task,show\\_file/Itemid,233/mnl,13061/href,Calculations\\_methods.html/#LearningandTeaching](http://www.hesa.ac.uk/component/option,com_studrec/task,show_file/Itemid,233/mnl,13061/href,Calculations_methods.html/#LearningandTeaching)
- viii The 'other' category should not be used for learning undertaken by full undergraduate students as 'other' is not used in KIS categories
- ix The aims should express the purpose of the module.
- x The intended learning outcomes should detail the knowledge, understanding and skills that students will be able to demonstrate on successful completion.
- xi In some circumstances it may be necessary to have more than 5 intended learning outcomes. You will be asked to provide your rationale for this in discussion at the USP.
- xii For example, if the assessment is an essay and the essay meets ILOs number 1-4 and 6-7, state 1-4,6-7
- xiii If Method B is used for module mark calculation, indicate Yes to specify the assessment component(s) to be passed in order to pass the module
- xiv Please specify component(s) for which ethical approval is required.
- xv The "Indicative texts and/or learning materials/resources" box should include a maximum of 5 items for new modules; for existing modules the box should just include a link for USP reviewers and readers to the comprehensive reading list at <http://lasu.salford.ac.uk>