UNIVERSITY OF WARWICK

Proposal Form for New or Revised Modules (MA1 - version 7 - April 2014)

Approval information	
Approval Type	☐ New module ☒ Revised module ☐ Discontinue module
Date of Introduction/Change	October 2017
If new, does this module replace another? If so, enter module code and title:	N/A
If revised/discontinued, please outline the rationale for the changes:	Revised as part of the curriculum refresh
Confirmation that affected departments have been consulted:	Changes were made in consultations between the School of Engineering and WMG

Module Summary	
1. Module Code (if known)	ES4C8
2. Module Title	Signal and Image Processing
3a. Lead department:	School of Engineering
3b. Teaching Split (if known):	100% Engineering
4. Name of module leader	D. D. Iliescu
5. Level	UG: ☐ Level 4 (Certificate) ☐ Level 5 (Intermediate) ☐ Level 6 (Honours) PG: ☒ Level 7 (Masters) ☐ Level 8 (Doctoral) See Guidance Notes for relationship to years of study
6. Credit value(s) (CATS)	15
7. Principal Module Aims	Consolidate principles of theory and implementation of digital signal processing techniques; Introduce and consolidate concepts of image processing; Design and implement in software advanced signal and image processing applications.

Module Summary	
8. Principal Learning Outcomes	By the end of the module students will be able to: • Demonstrate an advanced understanding of the principles of digital signal and image processing; • Evaluate and compare specific filter designs, interpret filter analysis results and assess critically the merits and appropriateness of each filter for the given specifications and applications; • Critically assess the appropriateness of algorithms for image feature detection and justify trade-offs; • Design and implement in software specific solutions for voice analysis and synthesis and critically evaluate the results in an independent manner.
9. Timetabled Teaching Activities (summary)	Lectures 28 x 1 hour Examination Revision Seminars 2 x 1 hour Laboratories 6 x 2 hours Total 42 hours
10. Departmental Web-link	http://www2.warwick.ac.uk/fac/sci/eng/eso/modules/year4/es4c8
11. Other essential notes	Advice and feedback hours are available for answering questions on the lecture material (theory and examples) and past examination questions.
12. Assessment methods (summary)	40% Software Implementation and 3000 words Report (excluding bibliography and software listing) 60% Examination (2 hour paper) Students must pass the examination and pass the coursework overall.

For use by Strategic Planning and Analytics Office only - Do not fill in this section

Level	JACS3 Code	Teaching Split
		If not provided in 3b above

External Credit Level		Scheme	

Module Context

13. Please list all departments involved in the teaching of this module. If taught by more than one department, please indicate percentage split.

School of Engineering 100%

14. Availability of module

Degree Code	Title	Study Year	C/OC/ A/B/C	Credits
H635	MEng Electronic Engineering and variants	4	A/OC	
H636	MEng Electronic Engineering with Intercalated Year	5	A	
H637	MEng Electronic Engineering with Year in Research	5	A	
H107	MEng Engineering and variants	4	A/B	
H109	MEng Engineering with Intercalated Year	5	A	
H110	MEng Engineering with Year in Research	5	A	15
HH63	MEng Systems Engineering and variants	4	A	
HH64	MEng Engineering with Intercalated Year	5	A	
HH65	MEng Engineering with Year in Research	5	A	
H642	MSc Energy and Power Engineering	M1	O	
H641	MSc Communications and Information Engineering	M1	Core	

15. Minimum number of registered students required for module to run

1 (core)

16. Pre- and Post-Requisite Modules

Module Content and Teaching

17. Teaching and Learning Activities *(totals for module – please see guidance)*

Module duration (weeks)	10
Lectures	28
Seminars	Examination Revision Seminars 2 x 1 hour
Tutorials	
Project Supervision	

Module Content and Teaching		
Demonstration		
Practical Class/Workshops	6 (x 2 hours each)	
Supervised time in studio/workshop		
Fieldwork		
External visits		
Work based learning		
Placement		
Year abroad		
Other activity *(please describe): e.g. distance-learning, intensive weekend teaching etc.*	108 hrs private study	
18. Assessment Method (Standard)		
Type of assessment	**Length**	**% weighting**
Written Examinations	2 Hours	**60%**
Practical Examinations	Hours	
Assessed essays/coursework	Software Implementation and 3000 words Report (excluding bibliography and software listing)	**40%**
18a. Final chronological assessment *(please see guidance*)	Written Examination	

19. Methods for providing feedback on assessment.
Software and Report: Oral feedback and guidance during laboratories and design stage; Marks and written feedback on the assignment Written Exam: Marks and general exam feedback for resit students. Cohort level feedback on the exam.
20. Outline Syllabus
Signal Representation: Review of one-/two-dimensional discrete signals in time/space and frequency: Z-transform and Fourier representations; sampling and quantisation; stochastic signals and noise processes.

Filtering: Analysis and synthesis of discrete time filters: finite impulse response (FIR) and infinite impulse response (IIR) filters; frequency response of digital filters: poles and zeros; filters for correlation and detection: matched filters. Wavelet transform and multiscale analysis. General applications of filters. Speech analysis and synthesis: human speech production; parameters estimation; digital models. MATLAB implementation of filters.

Image analysis: Statistical models of images; Image filtering in spatial and frequency domains: smoothing, contrast enhancement, edge detection and segmentation; Binary morphology and shape analysis. General applications of image processing. MATLAB implementation of image processing algorithms.

21. Illustrative Bibliography

1. Leis J.W. *Digital Signal processing using MATLAB for Students and Researchers*, Wiley 2011, Library E-Book
2. Gonzalez R.C., , Woods R.E., Eddins S.L. *Digital image processing using MATLAB*, McGraw Hill Education, 2010
3. Shenoi B.A., Introduction to digital signal processing and filter design, Wiley 2005, Library E-Book.
4. Proakis J.G., Manolakis D.G., Digital Signal Processing, Pearson Prentice Hall, 2007.

22. Learning outcomes

Successful completion of the module leads to the learning outcomes. The learning outcomes identify the knowledge, skills and attributes developed by the module.

Learning Outcomes should be presented in the format "By the end of the module students should be able to..." using the table at the end of the module approval form:

Resources

23. List any additional requirements and indicate the outcome of any discussions about these.

Laboratories require computer room with MATLAB installed

Approval

24. Module leader's signature	Dr. Daciana Iliescu
25. Date of approval	Teaching Policy Committee Chair's Action 6 April 2017
26. Name of Approving Committee (include minute reference if applicable)	School of Engineering and WMG Teaching Policy Committee
27. Chair of Committee's signature	Professor Gillian Cooke
28. Head of Department(s) signature	Professor Nigel Stocks

Examination Information		
A1. Name of examiner (if different from module leader)		
A2. Indicate all available methods of assessment in the table below		
% Examined	**% Assessed by other methods**	**Length of examination paper**
60%	40% Assignment (Software implementation and 3000 words Report)	2 hours
A3. Will this module be examined together with any other module (sectioned paper)? If so, please give details below.		
N/A		
A4. How many papers will the module be examined by?	☒ 1 paper	☐ 2 papers
A5. When would you wish the exam take place (e.g. Jan, April, Summer)?	Summer	
A6. Is reading time required?	☐ Yes	☒ No
A7. Please specify any special exam timetable arrangements.		
A8. Stationery requirements		
No. of Answer books?	1	
Graph paper?	Yes	
Calculator?	Yes (non-programmable)	
Any other special stationery requirements (e.g. Data books, tables etc)?	Engineering Data Book	
A9. Type of examination paper		
Seen?	☐ Yes	☒ No
Open Book?	☐ Yes	☒ No
Restricted?	☐ Yes	☒ No

Examination Information	
If restricted, please provide a list of permitted texts:	

LEARNING OUTCOMES		
(By the end of the module the student should be able to....)	**Which teaching and learning methods enable students to achieve this learning outcome? (reference activities in section 17)**	**Which summative assessment method(s) will measure the achievement of this learning outcome? (reference activities in section 18)**
Demonstrate an advanced understanding of the principles of digital signal and image processing;	Lectures Worked Examples in Lectures Laboratories Self-study	Coursework Unseen examination
Evaluate and compare specific filter designs, interpret filter analysis results and assess critically the merits and appropriateness of each filter for the given specifications and applications;	Lectures Worked Examples in Lectures Laboratories Self-study	Coursework Unseen examination
Critically assess the appropriateness of algorithms for image feature detection and justify trade-offs;	Lectures Worked Examples in Lectures Laboratories Self-study	Coursework Unseen examination
Design and implement in software specific solutions for voice analysis and synthesis and critically evaluate the results in an independent manner.	Lectures Worked Examples in Lectures Laboratories Self-study	Coursework Unseen examination