UNIVERSITY OF WARWICK

Proposal Form for New or Revised Modules (MA1 - version 7 - November 2016)

Approval information	
Approval Type	☒ New module ☐ Revised module ☐ Discontinue module
Date of Introduction/Change	02/10/2018
If new, does this module replace another? If so, enter module code and title:	It will replace part of the following modules: ES2A8 Engineering Design, ES2B1 Energy Conversion and Power Systems and ES3A3 Analogue System Design.
If revised/discontinued, please outline the rationale for the changes:	
Confirmation that affected departments have been consulted:	Changes have been made in consultations between the School of Engineering, WMG and the Computer Systems Engineering Steering Group.

Module Summary	
1. Module Code (if known)	ES2C0
2. Module Title	Analogue Electronic Design
3a. Lead department:	School of Engineering
3b. Teaching Split (if known)	100% School of Engineering
4. Name of module leader	Dr James A. Covington
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	Analogue electronics is one of the core requirements for any electronics and electrical engineer. The module is designed to provide learning on the practical applications of different analogue electronic circuits and devices that are commonly used in modern electronics.

Module Summary	
	There four fundamental categories of components that are critical for any electronics or electrical engineer to understand. These are: • Linear devices; • Active/passive filters; • Voltage Regulation/reference; • Signal conversion. This module will present tools and techniques of used combinations of these components to create a useful analogue electronic system. Professional Engineers must appreciate the concept of electronic analogue systems and how they interact with digital systems.
8. Principal Learning Outcomes	By the end of the module the student will be able to: • Understand a range of different analogue electronics systems • Combine different analogue electronic components to create a system • Appreciate specifications and design limitations and be able to design analogue electronic systems to fulfil these. • Reverse engineer and understand the operation of an existing analogue system
9. Timetabled Teaching Activities (summary)	20 x 1 hours of lectures, 2x 1 hours of industrial lectures, 2x 1 hours of revision classes, 5 x 3 hours of laboratories **Total 39 hours**
10. Departmental Web-link	http://www2.warwick.ac.uk/fac/sci/eng/eso/modules/year2/
11. Other essential notes	Advice and feedback hours are available for answering questions on the lecture material and past examination questions.
12. Assessment methods (summary)	60% written examination (2 hrs); 10% circuit simulation (5 pages), 10% Circuit Design Exercise (5 pages), 20% Circuit Design Report (10 pages length). Students must achieve a cumulative coursework mark ≥40% and a mark ≥40% in the examination.

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
H113	BEng Engineering	2	A	15
H114	MEng Engineering	2	A	15
H605	BEng Electrical and Electronic Engineering	2	C	15
H606	MEng Electrical and Electronic Engineering	2	C	15
H63W	BEng Electronic Engineering	2	C	15
H63X	MEng Electronic Engineering	2	C	15
HH35	BEng Systems Engineering	2	C	15
HH31	MEng Systems Engineering	2	C	15
HN11	BSc Engineering and Business Studies	2	A	15
G406	BSc/BEng Computer Systems Engineering	2	C	15
G408	MEng Computer Systems Engineering	2	C	15

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

1 (core module).

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	20 x 1 hours
Seminars	2 x 1 hour industrial talks
Tutorials	None
Project Supervision	None
Demonstration	2 x 1 hour examples classes
Practical Class/Workshops	5 electronics laboratories (5 x 3 hours = 15 hrs)
Supervised time in studio/workshop	None

Module Content and Teaching		
Fieldwork	None	
External visits	None	
Work based learning	None	
Placement	None	
Year abroad	None	
Other activity *(please describe): e.g. distance-learning, intensive weekend teaching etc.*	111 hours of guided independent learning	
18. Assessment Method (Standard)		
Type of assessment	**Length**	**% weighting**
Written Examinations	2 Hours	60
Practical Examinations		
Assessed essays/coursework	A1 Circuit simulation (5 pages) A2 Circuit design exercise (5 pages) A3 Circuit design report (10 pages)	10 10 20
18a. Final chronological assessment *(please see guidance*)	Written examination	

19. Methods for providing feedback on assessment.

- Support through advice and feedback hours.
- Written feedback on marked laboratory reports.
- Cohort-level feedback on final exam.

20. Outline Syllabus

Lecture Topics include:

- Diodes, BJTs and FETs transistors as individual devices and in use as simple linear amplifiers. In addition, use of transistors as high/low sided switches and level shifters.
- Analogue Circuit Modelling and Simulation: Schematic capture and simulation of analogue electronic components.
- Voltage regulators (including LDOs), voltage references and current sources. How to construct and deploy these components.
- Digital to Analogue and Analogue to Digital Converters, including SAR, Sigma-delta and flash

- Operational Amplifiers (including internal topology), covering different circuit configuration with focus on single supply (5V, 3.3V and 1.8V) operation. This will include instrumentation amplifiers and comparators
- Sources of electrical noise, passive and active filters, covering operation and design methods
- Signal Selection, processing and conversion (including multiplexing, ADC and DAC converters)
- Analogue oscillators, waveform generation and timers
- Non-linear circuits, including log amplifiers

21. Illustrative Bibliography

- Paul Horowitz and Winfield Hill, "The art of Electronics", third edition, Cambridge Publishing, 2015.
- Adel Sedra and Kenneth Smith, "Microelectronic Circuits", Oxford, 2015
- Neil Storey, "Electronics and System Approach", Pearson, 2015

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.

N/A

Approval

24. Module leader's signature	Dr James Covington
25. Date of approval	Teaching Policy Committee Meeting of 22 March 2017 308-16/17
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

Approval	
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	10% A1 Circuit simulation (5 pages) 10% A2 Circuit design exercise (5 pages) 20% A3 Circuit design report (10 pages)	**2 hours**
A3. Will this module be examined together with any other module (sectioned paper)? If so, please give details below.		
N		
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?	**Y**	
Calculator?	**Y**	
Any other special stationery requirements (e.g. Data books, tables etc)?	**Engineering Data Book**	
A9. Type of examination paper		
Seen?	☐ Yes	☒ No

Examination Information		
Open Book?	☐ Yes	☒ No
Restricted?	☐ Yes	☒ No
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 15)**	**Which summative assessment method(s) will measure the achievement of this learning outcome? (reference activities in section 16)**
Understand a range of different analogue electronics systems	Lectures and Electronics Labs	Examination, circuit simulation, circuit design exercise, circuit design report.
Combine different analogue electronic components to create a system	Lectures and Electronics Labs	Examination, circuit simulation, circuit design exercise, circuit design report.
Appreciate specifications and design limitations and be able to design analogue electronic systems to fulfil these.	Electronics Labs	Examination and circuit simulation, circuit design exercise and circuit design report.
Reverse engineer and understand the operation of an existing analogue system	Lectures and Electronics Labs	Examination, circuit simulation, circuit design exercise and circuit design report.