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	01/10/2018
If new, does this module replace another? If so, enter module code and title:	No
If revised/discontinued, please outline the rationale for the changes:	n/a
Confirmation that affected departments have been consulted:	School of Engineering and WMG have been consulted via CMAC.

Module Summary	
1. Module Code (if known)	ES1A0
2. Module Title	Computational Modelling
3a. Lead department:	School of Engineering
3b. Teaching Split (if known):	100% School of Engineering
4. Name of module leader	Dr Mohammad Rezania
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

Module Summary	
7. Principal Module Aims	The use of models aims to provide information necessary to make decisions in the design and development of Civil Engineering solutions or to investigate solutions which are too costly, difficult or unethical to investigate physically. Vast numbers of bespoke software solutions are available to Civil Engineers working in industry but this module will focus on designing and programming models from first principles showing the application of mathematical techniques and avoidance of modelling errors. There are design principles associated with models which ensure robust development and these will also be covered along with verification and validation techniques and applications to data modelling. These methods are inherited from software design processes and the synthesis will be exploited.
8. Principal Learning Outcomes	By the end of the module students should be able to: • Simplify real civil engineering problems and approximate via a mathematical model. • Represent multi-domain systems in a graphical programming environment. • Derive models and relationships from data. • Construct a model to predict system response to inputs using simulation methods. • Demonstrate understanding that models are a tool developed with a user and purpose in mind. • Describe the role of modelling and simulation in Engineering design and development.
9. Timetabled Teaching Activities (summary)	Learning activity is scheduled as 24 weeks, comprising of formally timetabled sessions and student-led activities. Intensive timetabled activity comprising of: 14 hours of lectures, 2 hours of revision lectures, 12 hours of computer based exercises, Student-led learning comprising of: 5 hours of online exercises (Moodle Quizzes) 8 hours of work-based project presentation and verification. **Total of 41 hours.**

Module Summary	
10. Departmental Web-link	http://moodle.warwick.ac.uk/course/
11. Other essential notes	Advice and feedback are available on the lecture material, via online web-forum based in module support Moodle pages.
12. Assessment methods (summary)	30% assessment of online computer-based exercises (Moodle Quizzes)(2 hours) 70% work-based project.

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.

100% Engineering

14. Availability of module

Degree Code	Title	Study Year	C/OC/ A/B/C	Credits
TBC	BEng Civil and Infrastructure Engineering	1	CORE	15

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

1 (core module)

16. Pre- and Post-Requisite Modules

None

Module Content and Teaching

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

Module duration (weeks)	24
Lectures	14 hours
Seminars	None
Tutorials	None
Project Supervision	
Demonstration	None
Practical Class/Workshops	12 hours of computer-based exercises; 5 hours of online exercises (Moodle Quizzes)
Supervised time in studio/workshop	None
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.*	2 hours of revision lectures 8 hours of work-based project presentation and verification. 109 hours of guided independent learning (including VLE use and support from Employer)

18. Assessment Method (Standard)

Type of assessment	Length	% weighting

Module Content and Teaching		
Written Examinations		
Practical Examinations		
Assessed essays/coursework	Assessment of online computer-based exercises (Moodle quizzes) (2 hours) Work-based Project	**30%** **70%**
18a. Final chronological assessment *(please see guidance*)		

19. Methods for providing feedback on assessment.

- Written feedback on work-based project.
- Cohort-level written feedback on online computer-based exercises.
- Support through advice and feedback hours.

20. Outline Syllabus

Context: What is modelling and how is it used?

- Model types, models as a tool, model design process akin to physical design process

Systems Modelling: how are mathematical models developed, simulated and validated? Model in the loop

- First/second order, block diagrams, Simulink, boundary conditions
- Modelling of translational, rotational, thermal systems
- First order systems, input-output and transfer function representation, step and frequency response
- Second order systems, input-output and transfer function representation, step and frequency response
- Deriving relationships from data: linear, quadratic, polynomial, exponential, logical, logarithmic, logistic

Programming and implementation of models, verification of code representation and testing, software in the loop

- Data representation
- Computational thinking

Code architecture, verification, testing and implementation

21. Illustrative Bibliography

Close, C.M., Newell, J.C. and Frederick, D.K., 2002. *Modeling and analysis of dynamic systems*. Wiley.

Ceder, V., 2010. *The quick python book*. Manning Publications Co.

Karris, Steven T. *Introduction to Simulink with engineering applications*. Orchard Publications, 2006.

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.

Approval

24. Module leader's signature	Dr Mohammad Rezania
25. Date of approval	21 March 2018
26. Name of Approving Committee (include minute reference if applicable)	School of Engineering and WMG Course and Module Approval Committee (CMAC) Minute 173-17/18
27. Chair of Committee's signature	Professor Gillian Cooke
28. Head of Department(s) signature	Professor David Towers

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**
	30% Assessment of online computer-based exercises (Moodle quizzes) (2 hours) 70% Work-based Project	
A3. Will this module be examined together with any other module (sectioned paper)? If so, please give details below.		
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)?	n/a	
A6. Is reading time required?	☐ Yes	☐ No
A7. Please specify any special exam timetable arrangements.		
A8. Stationery requirements		
No. of Answer books?	n/a	
Graph paper?	n/a	
Calculator?	n/a	
Any other special stationery requirements (e.g. Data books, tables etc)?	n/a	
A9. Type of examination paper		
Seen?	☐ Yes	☐ No
Open Book?	☐ Yes	☐ No

Examination Information		
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 17)**	**Which summative assessment method(s) will measure the achievement of this learning outcome? (reference activities in section 18)**
Simplify real civil engineering problems and approximate via a mathematical model.	Lectures, computer-based exercises.	Work-based project.
Represent multi-domain systems in graphical programming environment.	Lectures, computer-based exercises.	Online computer-based exercises.
Derive models and relationships from data.	Lectures, computer-based exercises.	Work-based project, online computer-based exercises.
Construct a model to predict system response to inputs using simulation methods.	Lectures, computer-based exercises.	Work-based project, online computer-based exercises, work-based project.
Demonstrate understanding that models are a tool developed with a user and purpose in mind.	Lectures, computer-based exercises.	Work-based project.
Describe the role of modelling and simulation in Engineering design and development.	Lectures	Work-based project.