UNIVERSITY OF WARWICK

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

Approval information	
Approval Type	☒ Revised module
Date of Introduction/Change	October 2018
If new, does this module replace another? If so, enter module code and title:	
If revised/discontinued, please outline the rationale for the changes:	Revised to take account of first year material. Changes to contact hours; assessment changed to 30% coursework and 70% 2-hour examination and associated changes to Learning Outcomes.
Confirmation that affected departments have been consulted:	Changes were made in consultations between the School of Engineering and WMG. Computer Science have been consulted via the CSE Steering Group.

Module Summary	
1. Module Code (if known)	ES2C7
2. Module Title	Engineering Mathematics and Technical Computing
3a. Lead department:	School of Engineering
3b. Teaching Split (if known):	100% Engineering
4. Name of module leader	Prof. D.G. Bates
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 credits

Module Summary	
7. Principal Module Aims	To build on the fundamental material introduced in ES193 Engineering Mathematics and ES197 Systems Modelling, Simulation and Computation thereby ensuring that students are equipped with the necessary analytical and computational tools to tackle advanced material in modules taught in later years. To present and provide skills in the application of more advanced mathematics and systems modelling concepts that underpin all areas of the Warwick Engineering Curriculum. To develop skills in the use of MATLAB for modelling and analysis of engineering systems. To introduce computer programming concepts and develop programming skills within MATLAB. To apply computational methods to the analysis and modelling of data.
8. Principal Learning Outcomes	By the end of the module the student should be able to: 1. Recognise and apply advanced mathematical tools and techniques to solve engineering based problems 2. Develop complex mathematical models of engineering systems 3. Solve complex engineering problems using MATLAB 4. Apply computer programming concepts and methods using MATLAB. 5. Apply data analytics techniques to analyse datasets produced by engineering processes and systems
9. Timetabled Teaching Activities (summary)	24 x 1hr lectures 2 x 1hr example classes (for each student in sub-groups) 2 x 1hr revision class 1 x 1hr formative on-line test: linear algebra 1 x 1hr formative on-line test: use of MATLAB 1 x 4hr laboratory: engineering mathematics in MATLAB 2 x 4hr laboratory: data analysis in MATLAB **TOTAL 42 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 (theory and examples) and past examination questions.
12. Assessment methods (summary)	Written examination 2 hours (70%) Coursework (30%) comprising laboratory assessment and group assignment (peer assessed). Computer-based Linear Algebra test (formative) Computer-based use of MATLAB test (formative)

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
H113	BEng Engineering	2		15
H114	MEng Engineering	2		15
H161	BEng Biomedical Systems Engineering	2		15
H163	MEng Biomedical Systems Engineering	2		15
H216	BEng Civil Engineering	2		15
H217	MEng Civil Engineering	2		15
H315	BEng Mechanical Engineering	2		15
H316	MEng Mechanical Engineering	2		15
H335	BEng Automotive Engineering	2		15
H336	MEng Automotive Engineering	2		15
H605	BEng Electrical and Electronic Engineering	2		15
H606	MEng Electrical and Electronic Engineering	2		15
H63W	BEng Electronic Engineering	2		15
H63X	MEng Electronic Engineering	2		15
HH35	BEng Systems Engineering	2		15
HH31	MEng Systems Engineering	2		15
HH75	BEng Manufacturing and Mechanical Engineering	2		15
HH76	MEng Manufacturing and Mechanical Engineering	2		15
HN11	BSc Engineering and Business Studies	2		15
HN15	BEng Engineering Business Management	2		15
G406	BSc/BEng Computer Systems Engineering	2		15
G408	MEng Computer Systems Engineering	2		15

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

1 (Core)

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)	**10**	
Lectures	**24 hr**	
Seminars	**0**	
Tutorials	**0**	
Project Supervision	0	
Demonstration	0	
Practical Class/Workshops	3 x 4 hr laboratory sessions	
Supervised time in studio/workshop	0	
Fieldwork	0	
External visits	0	
Work based learning	0	
Placement	**0**	
Year abroad	**0**	
Other activity *(please describe): e.g. distance-learning, intensive weekend teaching etc.*	2 x 1hr examples class 2 x 1hr revision class 2 x 1hr formative on-line test 108 hours guided independent study	
18. Assessment Method (Standard)		
Type of assessment	**Length**	**% weighting**
Written Examinations	2 Hours	70
Practical Examinations		
Assessed essays/coursework	Comprising laboratory assessment and group assignment (peer assessed).	30
18a. Final chronological assessment *(please see guidance*)	Assignment (but depends timetable / student workload balancing)	

19. Methods for providing feedback on assessment.

- Model solutions to past papers.
- Support through advice and feedback hours.
- Written feedback on marked laboratory report.
- Online feedback on computer-based formative test.
- Cohort-level feedback on final exam.

20. Outline Syllabus

Sequences, series, limits and Taylor series.
Fourier series.
Multi-variable vector calculus
Applied linear algebra: linear matrix/vector equations and their solution (applications such as linear regression analysis, electrical circuits and fluid networks); eigenvalue/eigenvector analysis (applications such as oscillation in circuits, structural dynamics, solution of state variable models and stability analysis); multidimensional Taylor series, linearization and extrema of functions.
Fourier transforms, z-transforms.
Partial differential equations and their solution (examples to include: wave equation, diffusion equation and Laplace equation).
Data manipulation in MATLAB
Data analysis techniques: Classification, Regression, PCA and Clustering.
MATLAB as a system modelling and analysis tool.
Elementary computer programming concepts and constructs, illustrated using MATLAB as a prototype programming tool

21. Illustrative Bibliography

Croft, A. and Davison, R., "Mathematics for Engineers: and MyMathLab: A Modern Interactive Approach", 3rd Ed., Pearson, ISBN-10: 1408263238, 2010.
James, G., "Modern Engineering Mathematics : 4th edition with MyMathLab", Pearson, ISBN-10: 027373413X, 2010.
Magrab, E.B. et al., "An Engineer's Guide to MATLAB: International Edition", 3rd Ed. Pearson, ISBN-10: 0137039549, 2010.
Cho, MoonJung, and Wendy L. Martinez. "Statistics in Matlab: A Primer". Vol. 22. CRC Press, 2014.
Lei, B., Xu, G., Feng, M., van der Heijden, F., Zou, Y., de Ridder, D. and Tax, D.M., 2017. "Classification, parameter estimation and state estimation: an engineering approach using MATLAB". John Wiley & Sons.

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	Professor Declan Bates
25. Date of approval	CMAC Chair's Action 17 May 2018
26. Name of Approving Committee (include minute reference if applicable)	School of Engineering and WMG Course and Module Approval Committee
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**
70	**30 (Assignment comprising laboratory assessment and group assignment (peer assessed)**	**2 hours**
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)?	**January**	
A6. Is reading time required?	☐ Yes	☒ No
A7. Please specify any special exam timetable arrangements.		
A8. Stationery requirements		
No. of Answer books?	**2**	
Graph paper?	**Y**	
Calculator?	**Student approved**	
Any other special stationery requirements (e.g. Data books, tables etc)?	**Engineering Databook**	
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)**
Recognise and apply advanced mathematical tools and techniques to solve engineering based problems.	Lectures, examples sheets, examples classes, formative on-line tests and laboratories	Examination
Develop complex mathematical models of engineering systems.	Lectures, examples sheets, formative on-line tests, examples classes and laboratories	Examination
Solve complex engineering problems using MATLAB.	Lectures and laboratories	Coursework
Apply computer programming concepts and methods using MATLAB.	Lectures and laboratories	Coursework
Apply data analytics techniques to analyse datasets produced by engineering processes and systems	Lectures and laboratories	Coursework