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 2016
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:	Changes to assessment strategy: 30% examined via a 1.5 hour paper (all compulsory questions). This change is made to reflect the practical nature of the module and the intensity of the coursework assessment.
Confirmation that affected departments have been consulted:	Other Streams and WMG have been consulted as part of the TPC ratification of the changes to this module.

Module Summary	
1. Module Code (if known)	ES4B5
2. Module Title	Finite Element Methods
3a. Lead department:	School of Engineering
3b. Teaching Split (if known):	100% School of Engineering
4. Name of module leader	Ken Mao
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	The main objective of the module is to provide a practical training in Engineering design using finite element methods. Design is at the heart of what professional engineers do. When components have complex construction, shape, and general boundary conditions (loading and restraint) the designer will often use finite element methods to determine their structural integrity. The first

Module Summary	
	half of the module aims at introducing the fundamental principles of the modelling for statics and dynamics analyses. In the second half of the module the students will be taught how to use the method in practice and to critically assess and evaluate the results. The module aims to provide an introduction to this important stress analysis technique, and by way of case studies shows how it may be used to design components.
8. Principal Learning Outcomes	By the end of the module the students should be able to... • recognise the significance and importance of finite element methods to the professional design engineer. • have a theoretical understanding on the fundamentals of finite element methods for small displacement linear elastic analysis (statics). • Start understanding non-linear finite element method. • have experience in analysing problems by commercial FE software (Abaqus). • have experience on how to develop good models and how to interpret the numerical results in design.
9. Timetabled Teaching Activities (summary)	This module includes 16 hours of lectures and 20 hours of computer labs. Required self-study: 114 hours
10. Departmental Web-link	http://www2.warwick.ac.uk/fac/sci/eng/eso/modules/year4/es4b5
11. Other essential notes	N/A
12. Assessment methods (summary)	30% examined via a 1.5 hour paper 70% assessed consisting of individual project assignment (15 pages).

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.

Engineering

14. Availability of module

Degree Code	Title	Study Year	C/OC/ A/B/C	Credits
H107	**MEng Engineering (and variants)**	**4**	**A**	**15**
H109	**MEng Engineering with Intercalated Year**	**5**	**A**	
H110	**MEng Engineering with a Year in Research**	**5**	**A**	
H311	**MEng Mechanical Engineering (and variants)**	**4**	**A**	
H312	**MEng Mechanical Engineering with Intercalated Year**	**5**	**A**	
H313	**MEng Mechanical Engineering with a Year in Research**	**5**	**A**	
H341	**MSc Advanced Mechanical Engineering**	**1**	**C**	
H1A0	**MSc Sustainable Energy Technologies**	**1**	**O**	
H211	**Civil Engineering (and variants)**	**4**	**A/B**	**15**
H212	**Civil Engineering with Intercalated Year**	**5**	**A**	
H213	**Civil Engineering with a Year in research**	**5**	**A**	

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

Core so 1

16. Pre- and Post-Requisite Modules

N/A

Module Content and Teaching

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

Module duration (weeks)	10
Lectures	16 hours
Seminars	
Tutorials	
Project Supervision	
Demonstration	
Practical Class/Workshops	20 hours computer labs

Module Content and Teaching	
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.*	**Emails and weekly office hour support for students' questions** **Self-study 114 hours**

18. Assessment Method (Standard): 30% exam and 70% assignment		
Type of assessment	**Length**	**% weighting**
Written Examinations	1.5 hours	30%
Practical Examinations	n/a	
Assessed essays/coursework	15 page maximum report	70%
18a. Final chronological assessment *(please see guidance*)	Written examination	

19. Methods for providing feedback on assessment.

- Class summary of typical strengths/weaknesses (individually annotated);
- Annotations onto submitted script;
- Worked examples in examples classes;
- Nominal mark *via* Tabula and feedback (or link to feedback on returned script);
- Student support through advertised Office Hours.

20. Outline Syllabus

Design is at the heart of what professional engineers do. When components have complex construction, shape, and general boundary conditions (loading and restraint) the designer will often use finite element methods to determine their structural integrity. The first half of the module aims at introducing the fundamental principles of the mathematical modelling for statics and dynamics analyses. In the second half of the module the students will be taught how to use the method in practice and to critically assess and evaluate the results. The module aims to provide an introduction to this important stress analysis technique, and by way of case studies shows how it may be used to design components.

21. Illustrative Bibliography

J T Mottram, and C T Shaw, *Using finite elements in mechanical design*, McGraw-Hill, Maidenhead, 1996 .
R D Cook, D S Malkus, M E Plesha and R J Witt, *Concepts and applications of finite element analysis*, Wiley, 2002.
R D Cook, *Finite element modelling for stress analysis*, Wiley, New York, 1995.
V Adams and A Askenazi, *Building better products with Finite element analysis*, On Word Press, Santa Fe, (1999).

22. Learning outcomes

By the end of the module the students should be able to...

- *recognise the significance and importance of finite element methods to the professional design engineer.*
- *have a theoretical understanding on the fundamentals of finite element methods for small displacement linear elastic analysis (statics).*
- *Start understanding non-linear finite element method.*
- *have experience in analysing problems by commercial FE software (Abaqus).*
- *have experience on how to develop good models and how to interpret the numerical results in design.*

Please see table at end of 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 Ken Mao
25. Date of approval	14 April 2016
26. Name of Approving Committee (include minute reference if applicable)	School of Engineering Teaching Policy Committee Meeting of 14 April 2016
27. Chair of Committee's signature	Dr David Dyer
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**
30 (For MSc Students) **30 (For MEng Students)**	**70 (For MSc Students)** **70 (For MEng Students)**	**1.5 hours** **1.5 hours**
A3. Will this module be examined together with any other module (sectioned paper)? If so, please give details below.		
No		
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.		
Papers for MSc and MEng students should be scheduled together.		
A8. Stationery requirements		
No. of Answer books?	1	
Graph paper?	No	
Calculator?	Yes	
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
If restricted, please provide a list of permitted texts:	N/A	

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)**
Distinguish the significance and importance of FEM to the professional design engineer.	Lectures, self-study, computer laboratory	Unseen examination, assignment
Communicate a theoretical understanding on the fundamentals of FEM for small displacement linear elastic analysis (statics).	Lectures, self-study, computer laboratory	Unseen examination, assignment
Autonomously develop models using non-linear finite element methods of analysis.	Lectures, self-study, example sheets	Unseen examination, assignment
Demonstrate experience in evaluating problems using current commercial FE software (Abaqus).	Assignment, computer laboratory	Assignment
Work independently to develop suitable models and interpret the numerical results	Lectures, assignment, computer laboratory	Unseen examination, assignment
Demonstrate written and graphical communication skills, and show initiative in designing model constraints that enable the development of practical models.	Assignment, example sheets	Unseen examination, assignment