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	02/10/2017
If new, does this module replace another? If so, enter module code and title:	
If revised/discontinued, please outline the rationale for the changes:	
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)	ES3D1
2. Module Title	Concrete Structures
3a. Lead department:	School of Engineering (100%)
3b. Teaching Split (if known):	100% Engineering
4. Name of module leader	Dr Sean Carroll
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 analysis and design of concrete structures is a main stream activity of professional civil engineers. The subject, therefore, forms a principal part of civil engineering courses and is essential for professional accreditation. Structural engineering is a substantial economic activity; many concrete structures are of such a scale and complexity that they require extensive management for their procurement, maintenance and later reuse, or demolition.

Module Summary	
8. Principal Learning Outcomes	• Understand the background theory of structural analysis and design concrete structures, knowledge of principles of Limit State Design, and margins of uncertainty associated with loading, material properties and type of structural action. • Analyse the response of main structural elements to a variety of load and boundary conditions and determine the size of structural elements. • Critically examine the results of structural analysis and design of concrete sections. • Compare the relationship between design, durability and cost, ease of construction.
9. Timetabled Teaching Activities (summary)	30 hrs lectures, 10 hours of examples classes, 3 hr laboratory **Total 43 hours**
10. Departmental Web-link	http://www2.warwick.ac.uk/fac/sci/eng/eso/modules/year3/es3d1
11. Other essential notes	Advice and feedback hours are available for answering questions on the lecture material (theory and examples).
12. Assessment methods (summary)	Unseen examination 90% and laboratory report 1000 words 10%

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

14. Availability of module

Degree Code	Title	Study Year	C/OC/ A/B/C	Credits
H211	MEng Civil Engineering	3	C	15
H212	MEng Civil Engineering with Intercalated year	3	C	15
H213	MEng Civil Engineering with a Year in Research	3	C	15
H210	BEng Civil Engineering	3	C	15
H106	BEng Engineering	3	O	15
H107	MEng Engineering	3	O	15
H109	MEng Engineering with Intercalated Year	3	O	15
H110	MEng Engineering with a Year in Research	3	O	15

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

1 (core module)

16. Pre- and Post-Requisite Modules

Pre-requisites:
ES3D3 Civil Engineering Materials and Structural Analysis.

Module Content and Teaching

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

Module duration (weeks)	17
Lectures	30x1 hours lectures
Seminars	
Tutorials	
Project Supervision	
Demonstration	
Practical Class/Workshops	3 hours
Supervised time in studio/workshop	
Fieldwork	
External visits	
Work based learning	

Module Content and Teaching	
Placement	
Year abroad	
Other activity *(please describe): e.g. distance-learning, intensive weekend teaching etc.*	107 hours Guided independent learning 10 hours Examples Class

18. Assessment Method (Standard)

Type of assessment	Length	% weighting
Written Examinations	3 hrs	90
Practical Examinations	Hours	
Assessed essays/coursework	Laboratory Report 1000 words	10%
18a. Final chronological assessment *(please see guidance*)	Examination	

19. Methods for providing feedback on assessment.

Coursework: feedback returned.
Feedback in examples class.
Model solutions to recent past papers.
Cohort level feedback on examinations.

20. Outline Syllabus

Design process; structural form and action; choice of material; uncertainties in design: partial safety factors. Limit States.
Revision of Slope Deflection and Moment Distribution method.
Re-distribution of elastic moments
Design of reinforced concrete beams to ULS: design assumptions; resistance to bending; stress and strain blocks; design formulae for singly and doubly reinforced rectangular sections; examples.
Design of T- and L-beam sections in bending; examples
Design for shear; truss analogy; examples
Serviceability limit state (SLS): elastic theory; deflections, cracking; bond and anchorage; calculation and control of crack widths; examples
Design of reinforced concrete columns; axially loaded short columns; eccentric load; principles of column interaction diagrams; slender columns; biaxial bending; examples.
Reinforced concrete slabs; one-way and two-way spanning elements, flat slabs. Shear in slabs: punching shear; examples
Torsion in reinforced concrete; prismatic members; St.Venant torsional constant; Poisson's equation; membrane analogy; sand heap analogy; design of reinforcement; examples.

21. Illustrative Bibliography

Millais, M., 'Building Structures: from Concepts to Design,' 2nd Ed., Taylor & Francis, 2005.

Arya, C., Design of Structural elements, Spon Press, 2009. Mosley, W.H., Hulse, R., Bungey, J.H. Reinforced Concrete Design: to Eurocode 2, 7th ed. Palgrave Macmillan, 2012.
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 Sean Carroll
25. Date of approval	Teaching Policy Committee Chair's Action 30 March 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

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)**
Understand the background theory of structural analysis and design concrete structures, knowledge of principles of Limit State Design, and margins of uncertainty associated with loading, material properties and type of structural action.	Laboratory, lectures, examples classes, and private study.	Laboratory report and written examination
Analyse the response of main structural elements to a variety of load and boundary conditions and determine the size of structural elements.	Laboratory, lectures, examples classes, and private study.	Laboratory report and written examination
Critically examine the results of structural analysis and design of concrete sections.	Laboratory, lectures, examples classes, and private study.	Laboratory report and written examination
Compare the relationship between design, durability and cost, ease of construction.	Laboratory, lectures, and private study.	Laboratory report and written examination