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:	Revised as part of the curriculum refresh.
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)	ES3D2
2. Module Title	Steel Structures
3a. Lead department:	School of Engineering
3b. Teaching Split (if known):	100% Engineering
4. Name of module leader	Dr Irwanda Laory
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 appraisal and design of structures is the main activity of many professional civil engineers. (Study of the structural behaviour, analysis and design is therefore a principal part of civil engineering teaching and is essential for professional accreditation.) Structural engineering is a substantial economic activity.

Module Summary	
	The study of the design of steel structures is therefore core within an integrated programme leading to a degree in Civil Engineering The ES3D2 module aims to learn the design process according to Eurocode 3. It includes an educational and comprehensive experience in the design of simple steel structures.
8. Principal Learning Outcomes	By the end of the module the students will be able to: • Understand function of structures as load-bearers and the response of members, joints and frames. • Propose concepts for common civil engineering structures of steel, particularly those related to buildings. • Analyse common building structures to determine response to load. • Determine form and size of structural elements. • Sketch structural solutions. • Prepare structural calculations. • Appraise alternative structural solutions and examine critically the results of structural analysis. • Appreciate the needs of clients and relationship between design and safety.
9. Timetabled Teaching Activities (summary)	28 hrs lectures, 12 hrs of examples classes, 3 hr laboratory, 1 hr Site Visit. **Total 44 hrs**
10. Departmental Web-link	http://www2.warwick.ac.uk/fac/sci/eng/eso/modules/year3/es3d2
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 70% and coursework 30% (Laboratory Report 1000 words 10%, Steel Design Exercise 6 pages 20%)

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)	14
Lectures	28x1 hr lectures
Seminars	
Tutorials	
Project Supervision	
Demonstration	
Practical Class/Workshops	3x1 hr
Supervised time in studio/workshop	
Fieldwork	1x 1 hr
External visits	

Module Content and Teaching

Work based learning	
Placement	
Year abroad	
Other activity *(please describe): e.g. distance-learning, intensive weekend teaching etc.*	106 hours of guided independent learning 12x1 hr Examples Class

18. Assessment Method (Standard)

Type of assessment	Length	% weighting
Written Examinations	3 hrs	70%
Practical Examinations	Hours	
Assessed essays/coursework	Laboratory Report (1000 words) Steel Design Exercise (six pages)	10% 20%
18a. Final chronological assessment *(please see guidance*)	Examination	

19. Methods for providing feedback on assessment.

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

20. Outline Syllabus

Introduction to steel structures: Structures for buildings and bridges and the design process: types and forms of structure; load paths; choice of structural materials (steel grades); design of individual members and connections; influence of imperfections, design for construction methods; H&S issues (e.g. CDM 2014); sustainable construction and the client's view. Eurocode system for limit state design: loads and load combinations and arrangements; ULS (resistance) and SLS; (deflections and vibration), robustness (Building Regulations), frame stability, fire design and durability.

Plastic collapse analysis: ULS for members and frames, to limit analysis, mention of shakedown; interpretation of results for the design process.
Geometric properties of steel sections.

Design process: Tension struts, Local buckling and classification, Laterally-restrained beams; (bending moment and shear), Uniform and non-uniform torsion: Unrestrained and restrained warping, Laterally-unrestrained beams - lateral-torsional buckling, Column members; buckling curves; interaction of bending and axial compression.

Introduction to Connections and Joints, and flooring systems.

Overall stability of frames: Second-order P-Δ effects; elastic critical buckling loads and beam-column members. Design process: α_{cr} and Merchant-Rankine formula modification.

Module Content and Teaching

21. Illustrative Bibliography

Martin, L. and Purkiss, J., Structural Design of Steelwork - To EN 1993 and EN 1994, 3rd Ed., Butterworth-Heinemann, Oxford, 2008.
Davison, B. and Owens, G.W. (Eds.) Steel Designer's Manual, Wiley-Blackwell, 7th edition, 2012.
Roberts, J., Structural Eurocodes - Extracts from the Structural Eurocodes for Students of Structural Design (3rd Edition): (PP 1990:2010), BSI Standards Ltd, 2010.

AccessSteel http://www.steelbiz.org/ (for Eurocode 3)

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 Irwanda Laory
25. Date of approval	Teaching Policy Committee Chair's Action 17 August 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 Gill 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 function of structures as load-bearers and the response of members, joints and frames.	Laboratory, visit, lectures, examples classes, coursework exercise and private study.	Laboratory report, steel design exercise and written examination.
Propose concepts for common civil engineering structures of steel, particularly those related to buildings.	Laboratory, visit, lectures, examples classes, coursework exercise and private study.	Laboratory report, steel design exercise and written examination.
Analyse common building structures to determine response to load.	Laboratory, visit, lectures, examples classes, coursework exercise and private study.	Laboratory report, steel design exercise and written examination.
Determine form and size of structural elements.	Laboratory, visit, lectures, examples classes, coursework exercise and private study.	Laboratory report, steel design exercise and written examination.
Sketch structural solutions.	Laboratory, visit, lectures, examples classes, coursework exercise and private study.	Laboratory report, steel design exercise and written examination.
Prepare structural calculations.	Laboratory, visit, lectures, examples classes, coursework exercise and private study.	Laboratory report, steel design exercise and written examination.
Appraise alternative structural solutions and examine critically the results of structural analysis.	Laboratory, visit, lectures, examples classes, coursework exercise and private study.	Written examination.
Appreciate the needs of clients and relationship between design and safety.	Laboratory, visit, lectures, coursework exercise and private study.	Written examination.