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 Review
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)	ES4A8
2. Module Title	Design for Sustainability
3a. Lead department:	School of Engineering
3b. Teaching Split (if known):	50% School of Engineering 50% WMG
4. Name of module leader	Dr Colin Oram
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

Approval information	
7. Principal Module Aims	Ecological and 'green' constraints weigh significantly on engineering designers already and these pressures are likely to increase very significantly during the careers of today's students. This module examines the need for significant change in the design philosophy employed in industrialised manufacture and civil construction in terms of energy and resource use. It then examines responses to those pressures including legislation and standards, alternative processes and materials and design for resource economy at small and large scale.
8. Principal Learning Outcomes	By the end of the module the student should be able to... ▪ Demonstrate advanced understanding of the significance and importance of material resource and energy limitations to professional design engineers. ▪ Evaluate and criticize the primary energy and resource loads in modern industrial societies and the environmental effects of satisfying these demands on the Earth's ecological and mineral systems. ▪ Systematically apply lower energy and resource demanding materials and technologies for small scale products and large scale projects. ▪ Outline the main procedures and methods used in life cycle analysis and identify likely difficulties with the process. ▪ Critically assess the significance of environmental law and other standards for large and small businesses. ▪ Evaluate the effect of engineering decisions on global warming, acid rain, ozone generation and resource depletion. ▪ Show systematic understanding of the effect of location, orientation and form on environmental economies, adaptability and flexibility of use or reuse. ▪ Design to minimise the effects of construction and deconstruction on land take, waste and pollution.
9. Timetabled Teaching Activities (summary)	30x1 hrs lectures; 8 hours of site visit. **Total of 38 hours.**
10. Departmental Web-link	www2.warwick.ac.uk/fac/sci/eng/eso/modules/year4/es4a8/
11. Other essential notes	Advice and feedback hours are available for answering questions on the lecture material (theory and examples).
12. Assessment methods (summary)	70% examination (2 hrs); 20% group report, including peer assessment (5000 words); 10% a group case study presentation.

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 (100%).

14. Availability of module

Degree Code	Title	Study Year	C/OC/ A/B/C	Credits
H107	MEng Engineering (and variants)	4	A/B	
H109	MEng Engineering with Intercalated Year	5	A	
H110	MEng Engineering with a Year in Research	5	A	
H311	MEng Mechanical Engineering	4	B/C	
H312	MEng Mechanical Engineering with Intercalated Year	5	B	
H313	MEng Mechanical Engineering with a Year in Research	5	B	
HH63	MEng Systems Engineering	4	B/OC	
HH64	MEng Systems Engineering with Intercalated Year	5	B	15
HH65	MEng Systems Engineering with a Year in Research	5	B	
H331	MEng Automotive Engineering (and variants)	4	B/C	
H333	MEng Automotive Engineering with a Year in Research	5	B	
H332	MEng Automotive Engineering with Intercalated Year	5	B	
HH37	MEng Manufacturing and Mechanical Engineering (and variants)	4	A/B	
HH39	MEng Manufacturing and Mechanical Engineering with a Year in Research	5	A	
HH38	MEng Manufacturing and Mechanical Engineering with Intercalated Year	5	A	
H211	Civil Engineering (and variants)	4	A/Core	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

1 (Core)

16. Pre- and Post-Requisite Modules

Module Content and Teaching

17. Teaching and Learning Activities *(totals for module – please see guidance)*	
Module duration (weeks)	10
Lectures	30x1 hours
Seminars	None
Tutorials	None
Project Supervision	None
Demonstration	None
Practical Class/Workshops	None
Supervised time in studio/workshop	None
Fieldwork	None
External visits	8 hours site visit
Work based learning	None
Placement	None
Year abroad	None
Other activity *(please describe): e.g. distance-learning, intensive weekend teaching etc.*	112 hours of guided independent learning

18. Assessment Method (Standard)		
Type of assessment	**Length**	**% weighting**
Written Examinations	2 Hours	70
Practical Examinations		
Assessed essays/coursework	Group report, including peer assessment (5000 words) Group case study presentation, including peer assessment	20 10
18a. Final chronological assessment *(please see guidance*)	Written Examination.	

19. Methods for providing feedback on assessment.
Written individual feedback on essay submissions and cohort level feedback on the oral presentation and written exam.
20. Outline Syllabus
Energy and the environment: global warming and pollutions, present energy use patterns, trends over period of industrial development.

Resources and the environment: embodied energy, reserves and resources, trade off between energy and material resources, environmental damage from materials extraction, materials substitution. Water wars. Industrial, commercial and domestic water economy.
Responses – energy: alternative fuels and fuel burning technologies, renewable energies.
Responses – law/ standards, life cycle analysis: ISO 14001, EU Directives – packaging, buy-back, electrical and electronic goods, automotive products.
Materials – embodied energy and alternatives: small product materials recycling/ re-use, waste disposal – materials hierarchy. Building and civil scale materials alternatives.
Holistic approach to design and construction. Sustainable development policies.
Design for the environment – small scale: corporate v consumer product lives, design for recycling, design for disassembly (fishbones/ recyclability maps), design for re-use, design for repair.
Design for the environment – large scale: building energy use (space heating and air-conditioning and refrigeration), passive and active solar heating, vernacular buildings. Building design for re-use/ conversion.
Design for occupancy – occupational energy, comfort, insulation and infiltration, facades as climate moderators, cooling and air conditioning, ventilation and passive design.
Contaminated land use and issues.

21. Illustrative Bibliography

Sustainability in Engineering Design. Johnson A, Gibson A. Elsevier 2014. ISBN 9780080993690.
Engineering for Sustainability: A Practical Guide for Sustainable Design. Jonker G, Harmsen J. Elsevier 2012. ISBN 9780444538475.
Sustainability in Engineering Design and Construction. Yates JK, Castro-Lacouture D. CRC Press 2015. ISBN 9781498733915.
Green Building with Concrete: Sustainable Design and Construction. Sabnis GM. CRC Press 2015. ISBN 9781498704106.
Sustainability Engineering: A Design Guide for the Chemical Process Industry. Perl J. Springer 2016. ISBN 978-3-319-32495-1.
Design for Sustainability: a practical approach for Developing Economies. Crul MRM, Diehl JC (eds). CPC 2006. Free download: http://www.d4s-de.org/manual/d4stotalmanual.pdf
EcoDesign. Barbero S, Cozzo B, Tamborrini P. H.F.Ullmann 2012. ISBN: 9783833163081.
Design and Environment - a global guide to designing greener goods. Lewis H, Gertsakis J. Greenleaf. 2001.
ISO 14001 - case studies and practical experiences. Hillary R (ed). Greenleaf 2001.
Green Biorenewable Biocomposites: From Knowledge to Industrial Application. Thakur VK, Kessler M. CRC Press 2015. ISBN 9781771880329.
Bio-Based Plastics: Materials and Applications. Kabasci S (ed). Wiley 2013. ISBN 9781119994008.
Introduction to Peak Oil. Bentley R.W. Springer 2016. ISBN 978-3-319-26372-4.
Sustainable Energy – without the hot air. MacKay D. UIT Cambridge 2009. ISBN-10: 0954452933. ISBN-13: 978-0954452933. Free download: https://www.withouthotair.com/
Our renewable future; Laying the path for one hundred percent clean energy. Heinberg R, Fridley D. Island Press 2016. ISBN 978-1610917797.
Energy Beyond Oil. Mobbs P. Matador 2005. ISBN 1905237006.

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 Colin Oram
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

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%	20% group report, including peer assessment (5000 words) 10% group case study presentation, including peer assessment	2 hours
A3. Will this module be examined together with any other module (sectioned paper)? If so, please give details below.		
N/A		
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.		
N/A		
A8. Stationery requirements		
No. of Answer books?	1	
Graph paper?	Yes	
Calculator?	Yes	
Any other special stationery requirements (e.g. Data books, tables etc)?		
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 17)**	**Which summative assessment method(s) will measure the achievement of this learning outcome? (reference activities in section 18)**
Demonstrate advanced understanding of the significance and importance of material resource and energy limitations to professional design engineers.	Lectures, site visit.	Examination, report, presentation
Evaluate and criticize the primary energy and resource loads in modern industrial societies and the environmental effects of satisfying these demands on the Earth's ecological and mineral systems.	Lectures, site visit.	Examination, report, presentation
Systematically apply lower energy and resource demanding materials and technologies for small scale products and large scale projects.	Lectures.	Examination, report, presentation
Outline the main procedures and methods used in life cycle analysis and identify likely difficulties with the process.	Lectures, site visit.	Examination, report, presentation
Critically assess the significance of environmental law and other standards for large and small businesses.	Lectures.	Examination
Evaluate the effect of engineering decisions on global warming, acid rain, ozone generation and resource depletion.	Lectures.	Examination, report, presentation
Show systematic understanding of the effect of location, orientation and form on environmental economies, adaptability and flexibility of use or reuse.	Lectures.	Examination, report, presentation

Design to minimise the effects of construction and deconstruction on land take, waste and pollution.	Lectures.	Examination, report, presentation