UNIVERSITY OF WARWICK

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

Approval information	
Approval Type	☒ New module ☒ Revised module ☐ Discontinue module
Date of Introduction/Change	01/10/2017
If new, does this module replace another? If so, enter module code and title:	
If revised/discontinued, please outline the rationale for the changes:	Minor revisions as part of harmonisation within Mechanical Engineering degree stream.
Confirmation that affected departments have been consulted:	Changes have been made in consultations between the School of Engineering and WMG

Module Summary	
1. Module Code (if known)	ES4E0
2. Module Title	Renewable Energy
3a. Lead department:	School of Engineering
3b. Teaching Split (if known):	100% Engineering
4. Name of module leader	Dr G.S.F. Shire
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
7. Principal Module Aims	The module is intended to present and assess some of the important renewable energy technologies and give some sense of the engineering design and development of some of these technologies. Starting with a brief outline of existing and proposed renewable energy systems, the course adopts an active solution-seeking approach, assessing these technologies against economic, engineering and other criteria.

Module Summary	
	Two of the most promising technologies, wind power, and solar energy are treated in some depth as an example of optimisation in mechanical and electrical engineering design. Other technologies studied include geothermal, biomass, ocean and hydro power.
8. Principal Learning Outcomes	By the end of the module students should be able to… • Interpret, apply and resolve the scientific concepts and principles underpinning renewable energy technologies. • Evaluate design processes and methodologies for renewable energy systems and apply them to new situations. • Apply concepts from a range of areas such as business, economics, legislation (H&S, environmental and social impacts) for assessment of renewable energy technologies and systems in order to evaluate their suitability and efficacy. • autonomously apply mathematical and computer based models for solving problems in renewable energy systems, critique these methods and advance independent hypotheses for the scope of their applicability and the limitations of these models for practical application. • discuss current practice and its limitations as well as likely new and advanced developments at the forefront of renewable energy technology
9. Timetabled Teaching Activities (summary)	30 hours of Lectures, 2 x 1hr Seminars, 2 x1hr Examples classes and 2 x 1hr Feedback sessions**.** Site visit 6 hrs **Total 42 hours**
10. Departmental Web-link	http://www2.warwick.ac.uk/fac/sci/eng/eso/modules/year4
11. Other essential notes	Advice and feedback hours are available for answering questions on the lecture material and past examination questions
12. Assessment methods (summary)	3 hour written Examination (70%) 2 pieces of assessed coursework 15 pages 15% each (30%)

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
H340	MSc Advanced Mechanical Engineering	M1	A	15
H650	MSc Energy and Power Engineering	M1	C	
H1A0	MSc Sustainable Energy Technologies	M1	C	
H331	MEng Automotive Engineering (and variants)	4	B/OptionC	
H332	MEng Automotive Engineering with Intercalated Year	5	B	
H333	MEng Automotive Engineering with a Year in Research	5	B	
H211	MEng Civil Engineering (and variants)	4	C/B	
H212	MEng Civil Engineering with Intercalated Year	5	B	
H213	MEng Civil Engineering with a Year in Research	5	B	
H107	MEng Engineering (and variants)	4	A/B	
H109	MEng Engineering with Intercalated Year	5	B	
H110	MEng Engineering with a Year in Research	5	B	
HH37	MEng Manufacturing and Mechanical Engineering (and variants)	4	A/B	
HH38	MEng Manufacturing and Mechanical Engineering with Intercalated Year	5	A	
HH39	MEng Manufacturing and Mechanical Engineering with a Year in Research	5	A	
H311	MEng Mechanical Engineering (and variants)	4	B/Option 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 (and variants)	4	A/OC	

Module Context				
HH64 **HH65**	**MEng Systems Engineering with an Intercalated Year** **MEng Systems Engineering with a Year in Research**	**5** **5**	**A** **A**	
15. Minimum number of registered students required for module to run				
1 (core)				
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	**30 x 1 hour**	
Seminars	**2 x 1 hour**	
Tutorials	**-**	
Project Supervision		
Demonstration		
Practical Class/Workshops		
Supervised time in studio/workshop		
Fieldwork		
External visits	Site visit to small-scale and community renewable energy project (eg.Hockerton Housing Association/ SHOCK) **6 hours.**	
Work based learning		
Placement		
Year abroad		
Other activity *(please describe): e.g. distance-learning, intensive weekend teaching etc.*	**Coursework Feedback Classes 2 x 1 hrs,** **Examples Classes 2 x 1 hrs,** **Guided Independent Learning 108 hrs.**	
18. Assessment Method (Standard)		
Type of assessment	**Length**	**% weighting**
Written Examinations	3 Hours	**70**
Practical Examinations	Hours	

Module Content and Teaching		
Assessed essays/coursework	2 x 15 page (maximum) (2250 words equivalent). • Report on wind turbine modelling (15%). • Mathematical analysis of solar collector performance (15%).	**2 x 15%**
18a. Final chronological assessment *(please see guidance*)	Examination	

19. Methods for providing feedback on assessment.

For each of the two pieces of assessed coursework, feedback will be provided using the following methods:

- Demonstration of a suitable approach to the assignment set for assessment during a time-tabled one hour class-based feedback session.
- Verbally answering questions that arise in the time-tabled feedback session.
- Written comments on each individual student's work submitted for assessment.
- Numerical scoring for each individual student's work submitted for assessment.

Model solutions to past examination papers will be published
Cohort level feedback on examinations.

20. Outline Syllabus

Overview of renewable energy:
Resource scale and availability.
Available technologies and challenges.
Technical and economical assessment of renewable technologies.

Detailed technical study of two major renewable energy technologies:
Solar energy: solar thermal & solar PV, current technology and future potential.
Wind energy: wind turbine configurations and power generating technologies.

Broad study of technologies with less potential:
Hydro power energy: Principles of hydro power technology.
Ocean current, tidal & wave energy: technology, economics, challenges and R&D.
Ground source and geothermal energy: principles, operation, future scope.
Biomass and Bioenergy: resources, sustainability, processing, combustion, scope.

21. Illustrative Bibliography

1. Solar Engineering of Thermal Processes, Duffie JA and Beckman WA, John Wiley & Sons. 2013. ISBN: 978-0-470-87366-3
2. Understanding renewable Energy Systems. Quashning V. Earthcan. 2005. ISBN 978-1-84407-128-9
3. Renewable Electricity and the Grid. Boyle G (ed). Earthscan. 2007. ISBN 978-1-84407-418-1.

4. Freris L, Principles of Wind Energy Conversion, Prentice Hall, 1990. ISBN: 9780139605277.
5. The Design and Sizing of Active Solar Thermal Systems. Reddy TA. Oxford University Press. 1987. ISBN 978-0198590163
6. Wind Turbine Technology. Spera A (ed). ASME Press. 2009. ISBN: 0-7918-0260-4

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.

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Approval

24. Module leader's signature	Stan Shire
25. Date of approval	Teaching Policy Committee Chair's Action 24 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	**30**	**3 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)?	**Summer**	
A6. Is reading time required?	☐ Yes	☒ No
A7. Please specify any special exam timetable arrangements.		
A8. Stationery requirements		
No. of Answer books?	**1**	
Graph paper?	**Y**	
Calculator?	**Y**	
Any other special stationery requirements (e.g. Data books, tables etc)?	**Engineering Data Book**	
A9. Type of examination paper		
Seen?	☐ Yes	☒ No
Open Book?	☐ Yes	☒ No
Restricted?	☐ Yes	☒ No
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)**
Interpret, apply and resolve the scientific concepts and principles underpinning renewable energy technologies.	Lecture	Exam
Evaluate design processes and methodologies for renewable energy systems and apply them to new situations.	Lecture, seminar	Exam
Apply concepts from a range of areas such as business, economics, legislation (H&S, environmental and social impacts) for assessment of renewable energy technologies and systems in order to evaluate their suitability and efficacy.	Lecture, reading, site visit to small scale renewable energy project (eg. Hockerton Housing Project or similar)	Exam
Autonomously apply mathematical and computer based models for solving problems in renewable energy systems, critique these methods and advance independent hypotheses for the scope of their applicability and the limitations of these models for practical application.	Lecture, reading, coursework	Coursework
Discuss current practice and its limitations as well as likely new and advanced developments at the forefront of renewable energy technology.	Lecture, site visit to small scale renewable energy project (eg. Hockerton Housing Project or similar)	Exam