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 2018
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. Running the module across 20 weeks, removed lectures and added 14 hours of design and build seminars. Updated learning outcomes. Changed assessment to 100% coursework.
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)	ES3C2
2. Module Title	Mechanical Engineering Design
3a. Lead department:	Engineering
3b. Teaching Split (if known):	100% School of Engineering.
4. Name of module leader	Dr Richard Lillington
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	This module builds upon the fundamentals of mechanical design as taught in ES2A8 – Engineering Design. The module provides a systematic approach to the design of mechanical systems such as

Module Summary	
	engine transmissions, and explores theoretical models of common machine elements for use in making strategic decisions about their arrangement. The module will run across terms 1, 2, and 3.
8. Principal Learning Outcomes	By the end of the module the student should be able to... • Determine a suitable specification to progress a design. • Choose appropriate assemblies and configurations of machine components for purpose. • Select appropriate types of machine components for particular conditions of use. • Use theoretical models of behaviour to decide the key dimensions and material choices for machine components. • Analyse the effects of uncertainty in design. • Consider the effect of safety factors in the design. • Use modern CAD analysis and optimisation tools to develop robust designs of machine elements and assemblies. • Manage a complex design task at the product, sub-assembly and component levels of detail, giving due regard to the uncertainties of analytical and numerical models. • Make judgements of the accuracy of analytical and numerical models of machine elements. • Select analytical or numerical models of precision appropriate to the progressive stages of a machine design's evolution. • Critique a design using methods such as Failure Modes and Effects Analysis and identify workable improvements.
9. Timetabled Teaching Activities (summary)	Lectures : 10 x 1 hours Design and build Seminars : 7 x 2 hours FMEA Laboratory : 1 x 3 hours CAD Surgery (CAD lab) : 1 x 2 hrs **Total 29 hours**
10. Departmental Web-link	http://www2.warwick.ac.uk/fac/sci/eng/eso/modules/year3/es3c2
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)	100% coursework • 20% - 10-page individual design study (report equivalent to 2000 words) • 20% - 10-page individual DFMEA lab report (report equivalent to 2000 words) • 10% - Group project prototype poster • 50% - Group project design portfolio

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.

100% School of Engineering.

14. Availability of module

Degree Code	Title	Study Year	C/OC/ A/B/C	Credits
H106	**Engineering BEng**	**3**	**O**	**15**
H107	**Engineering MEng and variants**	**3**	**O**	
H109	**Engineering MEng with Intercalated Year**	**3**	**O**	
H110	**Engineering MEng with a Year in Research**	**3**	**O**	
H310	**Mechanical Engineering BEng**	**3**	**C**	
H311	**Mechanical Engineering MEng and variants**	**3**	**C**	
H312	**Mechanical Engineering MEng with Intercalated Year**	**3**	**C**	
H313	**Mechanical Engineering MEng with a Year in Research**	**3**	**C**	
NEW	**BEng Engineering with Intercalated Year**	**4**	**O**	
H319	**BEng Mechanical Engineering with Intercalated Year**	**4**	**C**	

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

1 (core)

16. Pre- and Post-Requisite Modules

Pre-Requisite : ES2A8 Engineering Design

Module Content and Teaching

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

Module duration (weeks)	**20**
Lectures	**10 x 1 hour**
Seminars	**7 x 2 hrs**
Tutorials	**-**
Project Supervision	**-**

Module Content and Teaching		
Demonstration	-	
Practical Class/Workshops	1 x 3 hour FMEA laboratory 1 x 2 hour CAD surgery (lab)	
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.*	**Guided Independent Learning 121 hours**	
18. Assessment Method (Standard)		
Type of assessment	**Length**	**% weighting**
Written Examinations	-	**-**
Practical Examinations		
Assessed essays/coursework	10-page individual design study (report equivalent to 2000 words) 10-page individual DFMEA lab report (report equivalent to 2000 words) Group project prototype poster including peer assessment Group project design portfolio including peer assessment	**20%** **20%** **10%** **50%**
18a. Final chronological assessment *(please see guidance*)	Group project design portfolio including peer assessment.	
19. Methods for providing feedback on assessment.		
Written comments on submitted work. Cohort feedback on coursework. Support through advice and feedback hours.		

Module Content and Teaching

20. Outline Syllabus

1. Design project control and specification.
2. Design analysis - PFMEA
3. Power matching: torque and speed characteristics of prime movers, torque and speed characteristics of load.
4. Corner power, and corner work as design tools.
5. Epicyclic gearing: relative velocity method for velocity, acceleration and displacement, applications.
6. Belt transmissions: slip limitation for flat and vee belts, initial tension, applications.
7. Kinematics of toothed gearing: conjugate action, fundamental law of gearing, involute tooth profiles, interference and addendum modification.
8. Gearing performance: mean tooth sliding velocity and estimating power losses, root and surface failure.
9. Bearing selection: boundary lubrication, hydrodynamic, hydrostatic and rolling element bearing behaviour and limitations.
10. Disk clutches: uniform pressure and uniform wear relationships.

21. Illustrative Bibliography

- Shigley's Mechanical Engineering Design 10th edition, Budynas and Nisbett, McGraw-Hill higher Education, 2014.
- Shigley, J.E. Uicker, J.J. Theory of machines and mechanisms, McGraw-Hill Education, 2016.
- Pahl, G., Beitz, W. Engineering Design, a systematic approach, 3rd Ed. Springer-Verlag, 2006.
- Design of Machinery: an Introduction to the Synthesis and Analysis of Mechanisms and Machines, Norton, RL, 5th edition (McGraw Hill 2012).
- French, M.J. Form, Structure and Mechanism, Palgrave Macmillan, 1992
- French, M.J. Conceptual Design for Engineers, Springer-Verlag UK, 1998

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.

This module is to be run across terms 1 and 2.

Approval	
24. Module leader's signature	Dr Richard Lillington
25. Date of approval	25 April 2018
26. Name of Approving Committee (include minute reference if applicable)	School of Engineering and WMG Course and Module Approval Committee (CMAC), Minute 251-17/18
27. Chair of Committee's signature	Professor Gill Cooke
28. Head of Department(s) signature	Professor David Towers

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**
0	**100** • 20% - 10-page individual design study (report equivalent to 2000 words) • 20% - 10-page individual DFMEA lab report (report equivalent to 2000 words) • 10% - Group project prototype poster including peer assessment • 50% - Group project design portfolio including peer assessment	**n/a**
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?	-	
A5. When would you wish the exam take place (e.g. Jan, April, Summer)?	**-**	
A6. Is reading time required?	-	
A7. Please specify any special exam timetable arrangements.		
A8. Stationery requirements		
No. of Answer books?	**-**	
Graph paper?	**-**	
Calculator?	**-**	
Any other special stationery requirements (e.g. Data books, tables etc)?	**-**	
A9. Type of examination paper		
Seen?	-	
Open Book?	-	
Restricted?	-	
If restricted, please provide a list	-	

Examination Information	
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 15)**	**Which summative assessment method(s) will measure the achievement of this learning outcome? (reference activities in section 16)**
Determine a suitable specification to progress a design.	Lectures, seminars, design case studies.	Group project design portfolio
Choose appropriate assemblies and configurations of machine components for purpose.	Lectures, seminars, design case studies CAD surgery.	10-page individual design study (report equivalent to 2000 words)
Select appropriate types of machine components for particular conditions of use.	Lectures, seminars, design case studies.	Group project design portfolio
Use theoretical models of behaviour to decide the key dimensions and material choices for machine components.	Lectures, seminars, design case studies.	10-page individual design study (report equivalent to 2000 words) Group project design portfolio
Analyse the effects of uncertainty in design.	Lectures, seminars, design case studies.	10-page individual design study (report equivalent to 2000 words)
Consider the effect of safety factors in the design.	FMEA lab. Lectures and seminars.	10-page individual DFMEA lab report (report equivalent to 2000 words) Group project design portfolio
Use modern CAD analysis and optimisation tools to develop robust designs of machine elements and assemblies.	Lectures, seminars, design case studies CAD surgery.	10-page individual design study (report equivalent to 2000 words)

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)**
		Group project prototype poster
Manage a complex design task at the product, sub-assembly and component levels of detail, giving due regard to the uncertainties of analytical and numerical models.	Lectures, seminars, design case studies.	Group project design portfolio
Make judgements of the accuracy of analytical and numerical models of machine elements.	Lectures, seminars, design case studies CAD surgery.	10-page individual design study (report equivalent to 2000 words)
Select analytical or numerical models of precision appropriate to the progressive stages of a machine design's evolution.	Lectures, seminars, design case studies CAD surgery.	10-page individual design study (report equivalent to 2000 words) Group project design portfolio
Critique a design using methods such as Failure Modes and Effects Analysis and identify workable improvements.	FMEA Lab.	10-page individual DFMEA lab report (report equivalent to 2000 words) Group project prototype poster