

# ES3C2-15 Advanced Mechanical Engineering Design

**23/24**

**Department**

School of Engineering

**Level**

Undergraduate Level 3

**Module leader**

Javier Munguia

**Credit value**

15

**Module duration**

20 weeks

**Assessment**

100% coursework

**Study location**

University of Warwick main campus, Coventry

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## Description

### Introductory description

ES3C2-15 Advanced Mechanical Engineering Design

[Module web page](#)

### Module aims

The module examines the systematic approach to the complete design of optimal mechanical systems. Working at the convergence of fundamental mechanical engineering concepts and engineering design, the module approaches the design of mechanical systems by drawing on aspects such as theoretical calculations, computer-based simulation and design for manufacture to come up with a design that fulfils a design brief. The module will run across terms 1 and 2.

### Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

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1. Design project process: requirements, specifications, assumptions and delivery.
2. Design analysis - FMEA.
3. Detailed component design – including fixings and fits and tolerances
4. Effective use of computer-based simulation for design optimisation
5. Design for manufacture - including material choice and manufacturing method selection
6. Machining processes
7. Prime movers
8. Mechanisms - including gearing and transmissions
9. Coupling mechanical and electronic/electrical systems
10. Justification of design decisions
11. Clear and concise technical communication
12. Evaluation of success and understanding basic types of risk associated with mechanical design and manufacturing.

## **Learning outcomes**

By the end of the module, students should be able to:

- Evaluate and apply suitable constraints to systematically manage and progress a complex design task, with due regard to technical uncertainty and the need to proceed with incomplete information. [C1, C3, C4, M1, M3, M4]
- Choose appropriate components, assemblies, and configurations, and apply suitable design and analysis techniques to make judgements on key dimension and material choices and model solutions. [C3, C12, C13, M3, M12, M13]
- Make judgements on the accuracy of analytical and numerical models, and use these to inform design choices. [C3, C6, M3, M6]
- Critique a design using methods such as Failure Modes and Effects Analysis, analysing the effects of uncertainty in design, and considering the effect of safety factors to identify workable improvements. [C5, C9, M5, M9]
- Design solutions for broadly-defined problems that meet a combination of user, business and customer needs as appropriate. This will involve consideration of applicable health & safety, mitigating security risk, diversity, inclusion, cultural, societal and environmental matters, codes of practice and industry standards. [C5, C10, C11, M5, M10, M11]
- Balance the needs of all stakeholders whilst acknowledging the need for inclusivity and ethical design principles. [C8, M8]
- Work efficiently within a small team to manage and plan a sequence of work both on an individual and team level. [C16, C17, M16, M17]

## **Indicative reading list**

- 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

### **Subject specific skills**

1. Plan and manage the design process, including cost drivers, evaluating outcomes, and working with technical uncertainty.
2. Ability to apply relevant practical and laboratory skills.

### **Transferable skills**

1. Numeracy: apply mathematical and computational methods to communicate parameters, model and optimise solutions
  2. Apply problem solving skills, information retrieval, and the effective use of general IT facilities
  3. Communicate (written and oral; to technical and non-technical audiences) and work with others
  4. Exercise initiative and personal responsibility, including time management, which may be as a team member or leader
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## **Study**

### **Study time**

<b>Type</b>	<b>Required</b>
Lectures	15 sessions of 1 hour (30%)
Seminars	10 sessions of 2 hours (40%)
Practical classes	1 session of 3 hours (6%)
Private study	12 hours (24%)
Total	50 hours

### **Private study description**

Guided Independent Learning. / Support of group portfolio submission.

### **Costs**

No further costs have been identified for this module.

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## Assessment

You must pass all assessment components to pass the module.

Students can register for this module without taking any assessment.

### Assessment group A6

	Weighting	Study time
Individual design Study/Portfolio	50%	
Individual design Study/Portfolio – maximum 15 A4 pages		
Group Design Project -Final Portfolio	50%	
A final design portfolio submission for the group project comprising of a i) portfolio document and ii) a video assignment - Report of 20 pages, 5 minute video. Including Peer Assessment.		

### Feedback on assessment

Individualised written comments on submitted work.

Written cohort feedback.

Cohort feedback

Team feedback in design seminars.

Support through advice and support hours.

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## Availability

### Pre-requisites

To take this module, you must have passed:

- All of
  - [ES2D2-15 Mechanical Engineering Design](#)

### Courses

This module is Core for:

- Year 3 of UESA-H310 BEng Mechanical Engineering
- Year 3 of UESA-H315 BEng Mechanical Engineering
- Year 4 of UESA-H314 BEng Mechanical Engineering with Intercalated Year
- Year 3 of UESA-H311 MEng Mechanical Engineering
- Year 3 of UESA-H316 MEng Mechanical Engineering
- Year 4 of UESA-H317 MEng Mechanical Engineering with Intercalated Year

This module is Core optional for:

- Year 3 of UESA-H115 MEng Engineering with Intercolated Year
- UESA-H317 MEng Mechanical Engineering with Intercolated Year
  - Year 3 of H317 Mechanical Engineering with Intercolated Year
  - Year 4 of H317 Mechanical Engineering with Intercolated Year
- Year 3 of UESA-H11L Undergraduate Engineering (with Intercolated Year)

This module is Optional for:

- Year 3 of UESA-H113 BEng Engineering
- Year 3 of UESA-H114 MEng Engineering
- Year 4 of UESA-H115 MEng Engineering with Intercolated Year
- UESA-H11L Undergraduate Engineering (with Intercolated Year)
  - Year 3 of H11L Engineering (with Intercolated Year)
  - Year 4 of H11L Engineering (with Intercolated Year)

This module is Option list A for:

- Year 4 of UESA-H111 BEng Engineering with Intercolated Year
- UESA-H112 BSc Engineering
  - Year 3 of H112 Engineering
  - Year 3 of H112 Engineering