

Module code: MOD011141	Version: 1 Date Amended: 10/Jul/2025
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1. Module Title
Solid Mechanics and Machine Elements Design Project

2a. Module Leader
Hossein Bisheh

2b. School
School of Engineering and the Built Environment

2c. Faculty
Faculty of Science and Engineering

3a. Level
5

3b. Module Type
Standard (fine graded)

4a. Credits
30

4b. Study Hours
300

5. Restrictions			
Type	Module Code	Module Name	Condition
Pre-requisite:	MOD009156	Engineering Dynamics	Compulsory
Pre-requisite:	MOD009161	Structural Mechanics	Compulsory
Pre-requisite:	MOD007035	Applied Engineering Mathematics	Compulsory
Co-requisites:	None		
Exclusions:	None		
Courses to which this module is restricted:	None		

LEARNING, TEACHING AND ASSESSMENT INFORMATION

6a. Module Description
In this hands-on, project-based module, you'll work in teams to enhance the design of an existing mechanical appliance/product using the design and analysis concepts for enhanced performance metrics. You'll use specialised engineering software packages, such as Autodesk Inventor, to design, analyse and optimise a product and/or its components. You'll be introduced to the principles of mechanical design, materials in mechanical design, solid mechanics, stress and deformation analysis, failure analysis of mechanical and structural components, mechanical integrity, and their importance while designing a product. This will help you understand and apply theoretical concepts related to mechanical design and mechanics of materials in design, analysis and development of products. You'll also learn how to design machine elements based on the knowledge attained from the principles of mechanical design, materials science and solid mechanics and will develop a further appreciation for: • the range of readily available mechanical components for use in design. • the limitations of purely analytical models in capturing the behaviour of complex mechanical systems, and the importance of empirical models (codes, manufacturer's guidelines, etc.) derived from generations of design experience. • the iterative nature of the design process. • the importance of the teamwork and collaboration. • the critical analysis of results of group design project and preparing the final group oral presentation.

6b. Outline Content
• Computer-Aided Design and Engineering (CAD/CAE): designing and modelling mechanical components and complex products and analysing/optimising them under various loading and boundary conditions. • Engineering Materials: properties of materials, classification of materials (metals and alloys, plastics, and composites), materials selection, and characterizing mechanical properties of specimens created from various materials through a tensile loading test. • Solid Mechanics: stress and deformation analysis, combined stresses and transformation of stresses, principal stresses, design for different types of loading, failure analysis, etc. • Machine Elements Design: transmission components (flexible drives and gear elements), connecting elements (bushing, bearings, shafts, shaft accessories, springs, and threaded fasteners).

6c. Key Texts/Literature

The reading list to support this module is available at: <https://readinglists.aru.ac.uk/>

6d. Specialist Learning Resources

Computer Room and Mechanical Engineering Laboratory

7. Learning Outcomes (threshold standards)

No.	Type	On successful completion of this module the student will be expected to be able to:
1	Knowledge and Understanding	Demonstrate the capacity to apply appropriate 3D computer-aided design (CAD) skills and analytical techniques and select appropriate mechanical elements to model, analysis, and optimise complex products, recognizing its scope, constraints, and limitations.
2	Knowledge and Understanding	Understand and apply the principles of mechanical design, materials science, structural analysis, solid mechanics, and design of machine elements while designing a specific product and formulate their impact on the product performance and integrity.
3	Intellectual, practical, affective and transferrable skills	Demonstrate the ability to independently design and analyse mechanical systems in the areas of mechanics of materials, solid mechanics, and machine elements design, with a critical understanding of input data, interpretation of results, and awareness of scope and limitations of engineering design and analysis.
4	Intellectual, practical, affective and transferrable skills	Effectively function as an individual and as a member of a team; establish the proficiency to communicate effectively on complex engineering subjects with technical and non-technical audiences.

8a. Module Occurrence to which this MDF Refers

Year	Occurrence	Period	Location	Mode of Delivery
2026/7	ZZF	Template For Face To Face Learning Delivery		Face to Face

8b. Learning Activities for the above Module Occurrence			
Learning Activities	Hours	Learning Outcomes	Details of Duration, frequency and other comments
Lectures	72	1-4	6 hours lecture per week
Other teacher managed learning	24	1-4	3-hour weekly (for 8 weeks) tutorial, practice, and supervised activity in the computer room and laboratory
Student managed learning	204	1-4	Self-directed activity and learning
TOTAL:	300		

9. Assessment for the above Module Occurrence					
Assessment No.	Assessment Method	Learning Outcomes	Weighting (%)	Fine Grade or Pass/Fail	Qualifying Mark (%)
010	Practical	1-4	50 (%)	Fine Grade	30 (%)
2 Components (3500 words equivalent) Component 1 - 010/1 20-min group oral presentation of the group design project followed by 5 minutes of Q&A, associated with the requirements of Engineering Council Learning Outcome C3 (Equivalent to maximum 2000 words) Component 2 - Individual laboratory report, maps to Engineering Council Learning Outcome C12 (Equivalent to maximum 1500 words)					

Assessment components for Element 010				
Component No.	Assessment Title	Submission Method	Weighting (%)	Components needed for Mark Calculation?
010/1	20 Minutes Group Presentation (equivalent to 2000 words)	Canvas	70 (%)	All
010/2	Individual Laboratory Report (1500 words)	Canvas	30 (%)	

Assessment No.	Assessment Method	Learning Outcomes	Weighting (%)	Fine Grade or Pass/Fail	Qualifying Mark (%)
011	Coursework	1-3	50 (%)	Fine Grade	30 (%)
In-Class Test (2.5 hours) (Equivalent to maximum 2500 words), maps to Engineering Council Learning Outcome C13					

In order to pass this module, students are required to achieve an overall mark of 40% (for modules at levels 3, 4, 5 and 6) or 50% (for modules at level 7*).

In addition, students are required to:

- (a) achieve the qualifying mark for each element of fine graded assessment as specified above
- (b) pass any pass/fail elements

[* the pass mark of 50% applies for all module occurrences from the academic year 2024/25 – see Section 3a of this MDF to check the level of the module and Section 8a of this MDF to check the academic year]