

WM113-15 Engineering Mechanics I

Mechanics and Structures

20/21

Department

WMG

Level

Undergraduate Level 1

Module leader

Mohammad Al-Amin

Credit value

15

Module duration

14 weeks

Assessment

40% coursework, 60% exam

Study location

University of Warwick main campus, Coventry

Description

Introductory description

This module is about the fundamental concepts of mechanics, structures and dynamic mechanics that underpin many branches of engineering science.

[Module web page](#)

Module aims

The aims are to introduce the fundamental principles of statics as applied in an engineering context and to develop skills in system description and modelling. In general, engineers work to design and analyse systems. Understanding and employing physical laws and formulating them mathematically is an inevitable step towards any analysis in engineering. By applying the mechanical science principles such as forces and moments, Newton's laws and mechanics of materials, an engineer can simulate an engineering problem that underpins many branches of engineering science towards designing new products and/or optimising existing products that are safe, efficient, reliable and cost-effective.

This module provides an overview of fundamental mechanical principles of solids and structures

which will be required not only for technical mechanical design but also for the systematic evaluation and analysis of various engineering problems.

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.

- Intro to vector mechanics
- Force and Moment; Equivalent Forces
- Degrees of Freedom (DoF)
- Free Body Diagrams (FBD)
- Simplifications and assumptions to solve structural problems
- Pin-jointed frames
- Introduction to Mechanics of Materials
- Mechanical Properties of Materials
- Normal Stress and Shear Stress
- Stress-Strain Relationship
- Structural components – Beam analysis
- Bending and deflection of beam structures
- Bending Stress
- Motions in dynamic mechanics
- Kinetics of a particle
- Work and energy of a particle
- Power and efficiency
- Linear and angular impulse and momentum

Learning outcomes

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

- Understand, model, analyse and simulate a mechanical system by using the laws of physics and appropriate mathematical formulation strategies;
- Simplify, analytically solve and simulate mechanical systems using a step-by-step approach and justify simplifications and assumptions;
- Apply force vectors and couples in free body diagrams and construct the static equilibrium equations in order to determine boundary reactions;
- Understand and apply the general bending formula for beam and calculate the bending stress
- Comprehend the material properties such as Young's modulus, Poisson's ratio and shear modulus and the relationship between them in order to employ the best material and structural options, considering the appropriate safety factors
- Calculate the internal stress resultants acting at positions within a component to calculate normal and shear stresses
- Set up a beam/structural model and analyse internal shear forces and bending moments;
- Demonstrate knowledge and understanding of the kinematics and kinetics of particles
- Able to solve problems related to work, power and efficiency in a machine

- Understand the Kinetic/Potential energy and impulse/momentum for particles and rigid bodies in 2D
- Comprehend and apply the conservation of energy and momentum for particles and rigid bodies in 2D

Indicative reading list

[Reading lists can be found in Talis](#)

[Specific reading list for the module](#)

Subject specific skills

Solve engineering problems, able to build trusses, understand the effect of materials in engineering mechanics, analyse of engineering experiment, able to think critically in solving mechanics problems.

Transferable skills

Teamwork, adaptability, technology literacy, presentation skills.

Study

Study time

Type	Required
Lectures	22 sessions of 1 hour (15%)
Seminars	12 sessions of 1 hour (8%)
Practical classes	2 sessions of 1 hour (1%)
Private study	70 hours (47%)
Assessment	44 hours (29%)
Total	150 hours

Private study description

Self-study: 118 hours

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Assessment group D3

	Weighting	Study time	Eligible for self-certification
Assessment component			
Assessed work as specified by department	20%	14 hours	Yes (extension)
Students work in a group of 2 or 3 to design, build and test a truss to carry a certain load. They submit a group report to demonstrate an understanding of force analysis in a truss.			
Reassessment component is the same			
Assessment component			
Poster on lab exercise	20%	5 hours	No
Students work in a group to perform lab exercise on the pin-jointed frame lab and make an A3 size poster individually. Student present poster and demonstrate understanding in static mechanics.			
Reassessment component is the same			
Assessment component			
End of module exam	60%	25 hours	No
The exam will focus on all the content including static and dynamic mechanics. This is mostly about solving and explaining numerical problems in engineering mechanics.			
Reassessment component is the same			

Feedback on assessment

Formative feedback during seminar sessions
Formative feedback; a solution to the seminar questions

Formative feedback through online support
Summative feedback on each piece of coursework (online)
Summative feedback on lab reports/poster
Summative feedback on exam questions

[Past exam papers for WM113](#)

Availability

Post-requisite modules

If you pass this module, you can take:

- WM316-15 Stress Analysis

Courses

This module is Core for:

- Year 1 of DWMS-H7BH Undergraduate Engineering (Degree Apprenticeship)
- Year 1 of UWMS-H7BH Undergraduate Engineering (Degree Apprenticeship)