Module Specification

Mechanics of Materials

Version: 2025-26, v3.0, Approved

Contents

Part 1: Information

Module title: Mechanics of Materials

Module code: UFMFP9-15-3

Level: Level 6

For implementation from: 2025-26

UWE credit rating: 15

ECTS credit rating: 7.5

College: College of Arts, Technology and Environment

School: CATE School of Engineering

Partner institutions: None

Field: Engineering, Design and Mathematics

Module type: Module

Pre-requisites: Structural Mechanics 2024-25

Excluded combinations: None

Co-requisites: None

Continuing professional development: No

Professional, statutory or regulatory body requirements: None

Part 2: Description

Overview: This modules gives students access to advanced methods of stress analysis to be used in the design of mechanical components. It builds on level 5 module "Structural mechanics" in the following ways

Students' knowledge of stress determining techniques are expanded by considering several energy methods and introducing the formalism for plasticity.

Student's knowledge of failure mechanisms are expanded by considering more realistic and complex aspects of fracture mechanics, fatigue and creep.

Finally, the module will introduce real engineering scenarios that involve design, analysis and recommendations, to holistically tie the analysis and failure aspects together.

Features: Not applicable

Educational aims: In this module, students apply their knowledge and understanding of advanced stress analysis techniques and detailed failure mechanisms to solve complex engineering problems and design mechanical components.

Outline syllabus: Indicative Content (Syllabus) for Mechanics of Materials:

Elastic energy for axial loads, torsion, bending and shear.
Energy methods: unit load (virtual work) and Castigliano's theorem for trusses, beams and combined problems, including statically indeterminate ones
Impact
Introduction to plasticity for torsion and bending, calculation of residual stresses
Fracture mechanics (TBD)
Fatigue (stochastic aspects, corrections beyond Goodman's, multiaxial fatigue)
Introduction to creep

Part 3: Teaching and learning methods

Teaching and learning methods: The module is organised around the structural analysis and design of typical mechanical components, including complex factors such as the effect of physical impacts, fracture, fatigue and creep.

Lectures will be used to present the problems and explore the key features and issues. Workshops will be used for more detailed discussions and actual calculations.
Typically students will work in pairs.

Module Learning outcomes: On successful completion of this module students will achieve the following learning outcomes.

MO1 Explain and apply and explain scientific and mathematical principles of advanced stress analysis using energy methods for mechanical components. (SM1m, SM2m, SM5m)

MO2 Determine failure mechanisms (plasticity, fracture mechanics, fatigue and creep) for mechanical components using clearly defined scientific and mathematical principles. (SM1m, SM2m, SM5m)

MO3 Analyse complex mechanical components, including hypotheses and results validation. (EA1m, EA2, EA3m, EA6m)

MO4 Design complex mechanical components using detailed analyses of stress and failure. (D3m, D7m, EL4, EL5, EL6, P8m)

Hours to be allocated: 150

Contact hours:

Independent study/self-guided study = 114 hours

Face-to-face learning = 36 hours

Reading list: The reading list for this module can be accessed at readinglists.uwe.ac.uk via the following link https://uwe.rl.talis.com/modules/ufmfp9-15-3.html

Part 4: Assessment

Assessment strategy: The assessment will be organised around an industrially relevant case study involving a structural element design task.
Students (typically working in pairs) will be expected to demonstrate understanding and ability to apply basic principles and taught processes through the production of a 10 page technical report.

The report will not be marked but will form the basis for the controlled assessment which will take the form of a 30 minute oral presentation by each pair on the work

including a series of questions that will determine the individual mark.

In addition, in order to allow students to practice and gain rapid feedback on the use of standard calculation and analysis techniques. Students will be assessed with a series of e-assessments (10% of the module mark).

Resit is the same as the first sit.

Resit deliverable(s) will be scaled appropriately to group size and task complexity.

Assessment tasks:

Online Assignment (First Sit)
Description: Series of online e-assessments, covering energy methods (trusses, beams) impact, fracture mechanics, fatigue and creep.
Weighting: 10 %
Final assessment: No
Group work: No
Learning outcomes tested: MO1, MO2, MO3

Presentation (First Sit)
Description: Viva style presentation, based on the 10 page technical report student pairs have produced to solve an industrially relevant mechanical design problem (30 mins).
Weighting: 90 %
Final assessment: Yes
Group work: Yes
Learning outcomes tested: MO1, MO2, MO3, MO4

Online Assignment (Resit)
Description: Series of online e-assessments, covering energy methods (trusses, beams) impact, fracture mechanics, fatigue and creep.
Weighting: 10 %
Final assessment: No

Group work: No
Learning outcomes tested: MO1, MO2, MO3

Presentation (Resit)
Description: Viva style presentation, based on the 10 page technical report student pairs have produced to solve an industrially relevant mechanical design problem (30 mins).

Resit deliverable(s) will be scaled appropriately to group size and task complexity
Weighting: 90 %
Final assessment: Yes
Group work: Yes
Learning outcomes tested: MO1, MO2, MO3, MO4

Part 5: Contributes towards

This module contributes towards the following programmes of study:

Mechanical Engineering (Mechatronics) [BIET] BEng (Hons) 2024-25

Mechanical Engineering (Manufacturing) [BIET] BEng (Hons) 2025-26

Mechanical Engineering (Mechatronics) [AustonSingapore] - WITHDRAWN BEng (Hons) 2025-26

Mechanical Engineering (Manufacturing) [AustonSingapore] BEng (Hons) 2025-26

Mechanical Engineering [Frenchay] BEng (Hons) 2023-24

Mechanical Engineering [Frenchay] MEng 2023-24

Mechanical Engineering [Sep][PT][Frenchay][7yrs] MEng 2021-22

Mechanical Engineering and Technology {Foundation} [Oct][SW][GCET][5yrs] BEng (Hons) 2021-22

Mechanical Engineering and Technology {Foundation} [Feb][SW][GCET][5yrs] BEng (Hons) 2021-22

Mechanical Engineering and Technology {Foundation} [GCET] BEng (Hons) 2022-23

Mechanical Engineering and Technology (Vehicle Technology) {Foundation} [GCET] BEng (Hons) 2022-23

Mechanical Engineering {Apprenticeship-UCS} {Top-Up} [Frenchay] BEng (Hons) 2025-26

Mechanical Engineering {Apprenticeship-UCW} {Top-Up} [Frenchay] BEng (Hons) 2025-26

Mechanical Engineering {Apprenticeship-GlosColl} {Top-Up} [Frenchay] BEng (Hons) 2025-26

Mechanical Engineering [Frenchay] MEng 2022-23

Mechanical Engineering [Frenchay] MEng 2023-24

Mechanical Engineering and Vehicle Technology {Foundation} [Feb][FT][GCET][4yrs] - Withdrawn BEng (Hons) 2022-23

Mechanical Engineering and Vehicle Technology {Foundation} [Oct][FT][GCET][4yrs] - Withdrawn BEng (Hons) 2022-23

Mechanical Engineering {Foundation}[Sep][SW][Frenchay][5yrs] BEng (Hons) 2021-22

Mechanical Engineering [Frenchay] MEng 2022-23

Mechanical Engineering [Frenchay] BEng (Hons) 2022-23

Mechanical Engineering and Technology {Foundation} [GCET] BEng (Hons) 2022-23

Mechanical Engineering and Technology (Vehicle Technology) {Foundation} [GCET] BEng (Hons) 2022-23

Mechanical Engineering {Foundation} [Frenchay] BEng (Hons) 2022-23

Mechanical Engineering [Sep][PT][Frenchay][6yrs] BEng (Hons) 2021-22