Module Specification

Structural Mechanics and its Applications

Version: 2024-25, v1.0, 14 Jun 2023

Contents

Part 1: Information

Module title: Structural Mechanics and its Applications

Module code: UFME7D-15-2

Level: Level 5

For implementation from: 2024-25

UWE credit rating: 15

ECTS credit rating: 7.5

Faculty: Faculty of Environment & Technology

Department: FET Dept of Engineering Design & Mathematics

Partner institutions: University Centre Weston

Field: Engineering, Design and Mathematics

Module type: Module

Pre-requisites: Fundamentals of Materials for Manufacturing 2023-24, Fundamentals of Mechanical Principles 2023-24

Excluded combinations: None

Co-requisites: None

Continuing professional development: No

Professional, statutory or regulatory body requirements: None

Part 2: Description

Overview: This module gives students access to methods of stress analysis to be used in the design of mechanical components. It builds on the basic first year modules of static analysis and materials. Students' knowledge of stress determining methods are greatly expanded so that they can approach standard situations, including statically indeterminate problems. By the end of this module, the students will be able to combine different loading types, extract principal stresses and apply

failure criteria. While not strictly speaking “stresses”, this section also includes beam deflection, column buckling and strain transformation, as is customary with modern approaches and textbook. Finite elements analysis (FEA) is then briefly introduced as an extension of stress analysis, with an emphasis on practical skills to be able to introduce to some industry standards integrated software. The theory underpinning FEA is not neglected but is presented in a trimmed down way in order to allow students to appreciate and quantify the approximations and hypotheses the method uses. In addition, the simplified stiffness matrix method used for this gives students an additional method to analyse statically indeterminate problems, contributing to a homogeneous feel to the module. The way mechanical parts fail also depends on the material they are made of, and of the manufacturing processes used. Here again, students’ knowledge is expanded to cover the basics of fast fracture, fatigue and creep. This is rounded up by a theoretical introduction to systematic materials and process selection, using the Ashby method.

Features: Not applicable

Educational aims: This module will develop the ability of students to apply stress analysis techniques and demonstrate understanding of material properties in more complex engineering situations including those where computational techniques are required.

Outline syllabus: Stress Analysis: Stress Concentration, Un-symmetric bending, Curved beams, Bending of composite beams, Torsion (non-circular cross sections), Elementary elastic plastic analysis, Buckling of struts, Beams deflections, Mohr’s Circle for stress and strain, Introduction to Rosette analysis, Materials selection and study of failure criteria for ductile and brittle materials.

Part 3: Teaching and learning methods

Teaching and learning methods: The module will present the underlying concepts and principles supported by tutorials, some lab sessions and computer practical sessions as appropriate where more detailed work and discussions on specific engineering problems will take place.

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

MO1 Effectively explain the scientific and mathematical principles of theoretical and experimental stress analysis of standard structural components.

MO2 Describe in detail, material properties and the corresponding modes of failure, including dependence on manufacturing processes and the use of industry recognised methods of material selection from common databases.

MO3 Design realistic engineering components by solving complex problems involving general stress and failure analyses, using a combination of analytical and computational skills.

Hours to be allocated: 150

Contact hours:

Independent study/self-guided study = 114 hours

Face-to-face learning = 33 hours

Total = 150

Reading list: The reading list for this module can be accessed at readinglists.uwe.ac.uk via the following link https://rl.talis.com/3/uwe/lists/96B52288-0817-FAC6-0710-29A8852394D0.html

Part 4: Assessment

Assessment strategy: In this module it is important that students demonstrate their ability to apply stress analysis principles in structural design, to understand the relationships between continuous solid mechanics and Finite Element Analysis (FEA) simulation tools and perform analysis of possible modes of failures that depend on materials properties.

To achieve the above objective the assessment strategy is designed with two assessments.

Assessment 1: A series of e-assessments to assess the use of standard calculation and analysis techniques which will be conducted throughout the duration of the module.

Assessment 2: group FEA and Materials selection report validating against FEA analysis of a mechanical engineering problem.

The resit assessment will follow the same format as the first sit assessment profile and will be comparable.

Assessment tasks:

Online Assignment (First Sit)
Description: A series of e-assessments involving standard calculations and analysis
Weighting: 20 %
Final assessment: No
Group work: No
Learning outcomes tested: MO1, MO2

Report (First Sit)
Description: FEA and Materials selection: group report (2500 words)
Weighting: 80 %
Final assessment: Yes
Group work: Yes
Learning outcomes tested: MO1, MO2, MO3

Online Assignment (Resit)
Description: A series of e-assessments involving standard calculations and analysis
Weighting: 20 %
Final assessment: No
Group work: No
Learning outcomes tested: MO1, MO2

Report (Resit)

Description: FEA and Materials selection report (2500 words)

Weighting: 80 %

Final assessment: Yes

Group work: Yes

Learning outcomes tested: MO1, MO2, MO3

Part 5: Contributes towards

This module contributes towards the following programmes of study:

Electro-mechanical Engineering {Apprenticeship-UCW}[UCW] BEng (Hons) 2023-24

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