UNIVERSITY of BRADFORD

Module Descriptor

Module Details	
Module Title	Structural Mechanics and Analysis
Module Code	CSE5011-B
Academic Year	2024/5
Credits	20
School	School of Built Environment, Architecture & Creative Industries
FHEQ Level	FHEQ Level 5

Contact Hours	
Type	Hours
Directed Study	140
Laboratories	3
Lectures	36
Tutorials	21

Availability	
Occurrence	Location / Period
BDA	University of Bradford / Academic Year

Module Aims

Structural Mechanics and Structural Analysis are fundamental subjects in Civil Engineering that form the basis for structural design. This module provides students with an understanding of the key concepts and the skills to solve different structural engineering problems. The main aims of the module are as follows:
1. To enable students to evaluate the concepts of a general three-dimensional stress and strain state and to relate these concepts to the behaviour of actual materials and structural elements.
2. To extend the students? ability to deal with normal force, shear force and bending moment in statically determinate beam assemblies with internal hinges and cranked members.
3. To introduce methods for determining the displacements in statically determinate beams, frames and trusses. To introduce and develop understanding of the flexibility method, with applications to indeterminate beams, frames and trusses with a single redundancy.
4. To articulate structural mechanics and analysis concepts in a clear, concise manner.
5. To work collaboratively in understanding and solving structural mechanics and analysis problems.

Outline Syllabus

Fundamental assumptions of solid mechanics.
Stress state; principal stresses, maximum shear stress, two-dimensional stress states, plane stress and plane strain.
Mohr's circle of stress.
Torsion - the torsion equation.
Work of external loads.
Total potential energy.
Strain energy methods.
Unit load method for calculating deflections.
Thick cylinder.
Elasticity and plasticity. Yield criteria and their application.
Buckling instabilities - the Euler criterion.
Brittle and ductile behaviour. Fundamentals of fracture mechanics - stress intensity, strain energy release rate, plastic zone size.
Methods for determining internal forces in beam assemblies.
Methods for counting and identifying redundancies.
Unit load method for evaluating displacements in a variety of statically determinate structures.
Flexibility method for solving indeterminate beams, frames and trusses with a single redundancy.
Moment distribution method for beam and frame.
Appreciating the effects of different loads on pin-jointed trusses and framed structures.

Learning Outcomes

Outcome Number	Description
01	Develop communication skills to explain the basic concepts and fundamental assumptions of solid and structural mechanics.
02	Solve engineering problems relating to stress and strain analysis.
03	Formulate and solve solid mechanics problem related to engineering activities.
04	Apply appropriate hand calculations to the analysis of simple linear elastic structures.
05	Identify particular classes of structural analysis problem and adapt standard solution methods.
06	Work collaboratively with others.

Learning, Teaching and Assessment Strategy

Students will participate in lectures, tutorials, laboratory work and independent study to explore concepts and solve real-world problems. The teaching and learning methods have been selected to engage students in developing their knowledge and understanding of structural mechanics and analysis through formal learning opportunities such as lectures, experiential learning through laboratory sessions, and informal learning through solving and discussing problem sheets with their peers. Timetabled tutorials will be mainly dedicated to working on these problem sheets, but students are expected to continue working on these, either independently or collaboratively with their peers, during directed study time.
To support accessibility, clarity and comprehension all teaching material is provided online, allowing students to customise the display of information and their learning experience as a whole.

The module will be summatively assessed through a presentation in the middle of the first semester (20%), an examination (40%) at the end of the first semester and an examination (40%) at the end of the second semester. The presentation will be carried out in groups, with each group selecting which topics they can be assessed on, providing a degree of autonomy over their learning. This exercise will help to develop their team working and communication skills. Students will receive timely feedback from their presentation to support them in developing the skills and knowledge required for the exams. The summative assessments will be carefully designed in order to ensure that students achieve the module learning outcomes listed above. Students with specific needs will be offered additional support in preparing for and taking the assessments as appropriate.

The examinations will concern the application of practical skills to the knowledge base of the module and will assess learning outcomes 2, 3, 4 and 5.

Mode of Assessment

Type	Method	Description	Weighting
Summative	Presentation	Presentation with questions and answers (20 mins) in pairs/small groups.	20%
Summative	Examination - Closed Book	Closed Book Examination (2 hours)	40%
Summative	Examination - Closed Book	Closed Book Examination (2 hours)	40%

Reading List

To access the reading list for this module, please visit https://bradford.rl.talis.com/index.html

Please note:
This module descriptor has been published in advance of the academic year to which it applies. Every effort has been made to ensure that the information is accurate at the time of publication, but minor changes may occur given the interval between publishing and commencement of teaching. Upon commencement of the module, students will receive a handbook with further detail about the module and any changes will be discussed and/or communicated at this point.
