

Module Details	
Module Title	Structural Mechanics and Analysis
Module Code	CSE5011-B
Academic Year	2022/3
Credits	20
School	Department of Civil and Structural Engineering
FHEQ Level	FHEQ Level 5

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

Availability	
Occurrence	Location / Period
BDA	University of Bradford / Semester 1

Module Aims
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. To extend the ability to deal with normal force, shear force and bending moment in statically determinate beam assemblies with internal hinges and cranked members. 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. To articulate structural mechanics and analysis concepts in a clear, concise manner. 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

Concepts are introduced and explained in depth using interactive lectures. Students are provided with tutorial sheets to work on during their directed study time in order to further develop their understanding. Issues with the lecture material and tutorial sheets are discussed with the tutor during tutorial sessions. Understanding of the structural concepts is further enhanced using the laboratory class. Oral feedback is given during the laboratory sessions and tutorials.

Students will complete two summative assessments: a presentation during the semester and an exam at the end of the semester.

For the presentation, they will work in pairs/small groups, and choose two topics from the syllabus on which to prepare the presentation. This exercise will help to develop their team working and communication skills. Furthermore, timely feedback on their performance in the presentation will help them to evaluate their attainment of the learning outcomes (1 and 6) and to prepare for the examination at the end of the semester.

The examination 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 & answers (20m) in pairs/small groups Presentation with Q&A (20 mins) in pairs/small groups	30%
Summative	Examination - Closed Book	Closed book examination (3 hours)	70%

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.