Module Descriptor Form

Civil and Environmental Engineering

CL207 - Structural Mechanics And Materials 2

Module Code	CL207	**Module Title**	Structural Mechanics And Materials 2				
Module Registrar	Bhowmik, Dr Basuraj						
Other Staff Involved	Dr Stephen Suryasentana (Lecturer), Mrs Viola Valentine (Lecturer)						
Credit Weighting	20	**Semester**	1/2	**Elective**	No	**Academic Level**	2
Pre-requisites							
Required for	CL313						

Module Format and Delivery (hours):

Lectures	Tutorials	Assignments	Labs	Private Study	Total
20	20	40	1	119	200

Educational Aim

This module aims to:

introduce students to qualitative analysis of indeterminate structures, loadings on structures, analysis of structures and validation and verification of results, and the conceptual design process. It also aims to introduce deflection, torsion, bending-induced stress and plastic analysis of beams, and buckling of columns.

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Syllabus

This module will teach the following:

Semester 1: (Design)

- Qualitative analysis of indeterminate beams and frames
- Load paths in simple frames and structures
- Introduction to loadings in accordance with Eurocodes
- Structural Safety, Reliability, and Design Philosophy
- Characteristic and ultimate loads
- Load combinations and pattern loading
- Modelling statically indeterminate structures using structural analysis software
- Conceptual design process

Semester 2: (Analysis)

- Bending moment expression
- Deflection of beams
- Torsion of beams
- Bending induced stress and sectional properties for beams
- Plastic properties and plastic analysis for beams
- Buckling analysis of columns

Learning Outcomes

On Completion of the module, the student is expected to be able to:

LO: 1	Carry out qualitative analysis of statically indeterminate beams and frames.
LO: 2	Understand the basic principles of limit state design.
LO: 3	Understand the actions of loadings on structures.
LO: 4	Understand the principles of validation and verification of results using proprietary structural analysis software.
LO: 5	Understand the process of conceptual design of structures.
LO: 6	Calculate bending induced stresses.
LO: 7	Calculate deflection of simple beams.
LO: 8	Analyse problems of torsion for simple structures, e.g., beams with circular section.
LO: 9	Carry out plastic analysis for beam sections.
LO: 10	Analyse buckling of columns.

(UK SPEC suggests no more than 4 learning outcomes per module. Statements must be broad and be syllabus free and link in with the intended learning outcomes on the programme specifications.)

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Assessment of Learning Outcomes - Criteria

Learning Outcome: **1**

	Criteria
1	Understand the difference between determinate and indeterminate structures.
2	Ability to sketch the deflection, reaction and bending moment and shear diagrams for a range of indeterminate beam and frame configurations.
3	Understand the structural significance of the points of contraflexure and hinges.

Learning Outcome: **2**

	Criteria
1	Ability to define the load paths in statically determinate framed structures.
2	Ability to calculate the characteristic and ultimate values for permanent and variable actions in accordance with Eurocodes 0 and 1.
3	Appreciation of load combinations and pattern loading in accordance with Eurocodes 0 and 1.
4	Understand the concept of basic probability, distributions, structural reliability, and probability of failure.

Learning Outcome: **3**

	Criteria
1	Knowledge of different loading combinations on structures.
2	Appreciation of how different loadings affect structural performance.

Learning Outcome: **4**

	Criteria
1	Knowledge of sensitivity analysis for validating an analysis model and methods of verifying results.
2	Ability at verifying results for simple structural models.

Learning Outcome: **5**

	Criteria
1	Understand the conceptual design process within the overall design of structures.
2	Ability at developing a viable and distinct conceptual structural solution against a set brief.

Learning Outcome: **6**

	Criteria
1	Understand the sectional properties for beams, e.g., first moment of area and second moment of area.
2	Understand the engineer’s bending formula and physical meanings.
3	Ability to analyse the bending induced stress development at the cross-section.

Learning Outcome: **7**

	Criteria
1	Understand bending resistance property of cross-section of beams.

2	Ability to determine the bending moment expression with respect to location.
3	Ability to use double-integration method to calculate the deflection of beams.

Learning Outcome: **8**

	Criteria
1	Understand the basic concepts of torsion, e.g., torque, shear stress etc.
2	Ability to calculate the shear stresses for given torques applied on different structures.

Learning Outcome: **9**

	Criteria
1	Understand the plasticity development within the cross-section of beams.
2	Ability to calculate the plastic capability of beam sections.

Learning Outcome: **10**

	Criteria
1	Understand the principles of stable and unstable equilibrium.
2	Ability to apply Euler's theory to calculate the critical buckling load.
3	Understand the effect of material strength limit and material or geometric imperfections on buckling.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

To Pass the module, students need to gain a summative mark of: 40%

Description	Semester	Start Week	Duration	Weight	Submission Week	Linked Criteria
Assignment S22 Conceptual Design	1	9		10%	10	LO 2: C1 LO 5: C1, C2
Assignment S21 Modelling and Analysis	1	7		15%	11	LO 1: C1, C2, C3 LO 2: C1, C2, C3, C4 LO 3: C1, C2 LO 4: C1, C2
Semester 1 Exam. Closed Book	1		2.00	25%	E	LO 1: C1, C2, C3 LO 2: C1, C2, C3, C4 LO 3: C1, C2
5No Quizzes	2	2		5%	8	LO 6: C1, C2, C3 LO 7: C1, C2, C3 LO 8: C1, C2
Lab report	2	4		10%	9	LO 6: C1, C2, C3 LO 7: C1, C2, C3 LO 8: C1, C2
Semester 2 Exam. Closed Book	2		2.00	35%	E	LO 6: C1, C2, C3 LO 7: C1, C2, C3 LO 8: C1, C2 LO 9: C1, C2 LO 10: C1, C2, C3

Principles of Assessment Feedback

(within Assessment and Feedback Policy at:
https://www.strath.ac.uk/staff/policies/academic/http://www.strath.ac.uk/learnteach/informationforstaff/staff/assessfeedback/12principles/)

These are incorporated in this module as follows:

1. Marking criteria are outlined clearly in the assignment brief and multiple opportunities for questions are available, either in class or through electronic correspondence. Each marking sheet is taken directly from assignment briefs.

2. Group assignments encourage interaction between peer groups and with the instructor.

3. Tutorial questions are provided to support student self-assessment and reflection.

4. Departmental policy is to carry out mid-term class assessments and provide feedback to students.

Additional Information

Students need to gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of exam. Students who are absent from both exams will be returned as Absent.

Resit Procedure

Students who fail the module at the first attempt will need to resit an exam for each semester that they failed. If a student has failed both semesters (S1 & S2), then they will need to resit two exams, one for S1 material and another exam for S2 material, each accounting for 50%. Students must achieve a mark of 40% overall in the resit to pass the module. No marks from any previous attempts will be transferred to the resit attempt.

Recommended Reading

***Purchase recommended **Highly recommended reading *For reference

** Structural and Stress Analysis', 2nd ed. by T.H.G.Megson, pub. Elsevier, 2005. ISBN 0 7506 6221 2
** Introduction to Structural Mechanics', by P.S. Smith, pub. Palgrave, 2001. ISBN 0-333-96255-9
** Structural Analysis' SI edition, by R.C. Hibbeler, pub. Pearson, 2005. ISBN 013-124-572-4
** Understanding Structural Analysis' by David Brohn, ISBN 0-246-12238 – 2
** 'Reliability of Structures' by Nowak and Collins, 2nd Edition, ISBN-10 9780415675758
* Structural Analysis', 3rd ed. By A Kassimali, pub.Thomson, 2005. ISBN 0-534-39168-0
* Modern Structural Analysis - Modelling Process and Guidance' by Iain A MacLeod. ICE Publishing. ISBN 9780727732798-072773279X.
*BS EN 1990, Eurocode 0: Basis of Structural Design.
*BS EN 1991, Eurocode 1: Actions on Structures – Part 1-1.

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Module Timetable

Week	Semester 1	Semester 2
0		
1		
2		
3		
4		
5		
6		
7		
8		Submission 5%
9		Submission 10%
10	Submission 10%	
11	Submission 15%	
E	Examination 25%	Examination 35%

Date of Last Modification

15-09-2025