LONDON SOUTH BANK UNIVERSITY

unit guide

Strength of Materials

BCE-2-211

Faculty of Engineering, Science and the Built Environment

2007-08

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1 UNIT DETAILS

Unit Title:	Strength of Materials
Unit Level:	2
Unit Reference Number:	BCE-2-211
Credit Value:	1.0
Student Study Hours:	90
Contact Hours:	60
Pre-requisite Learning (If applicable):	BCE-1-221, Mechanics
Course(s):	BSc (Hons) Civil Engineering BSc (Hons) Architectural Engineering
Year and Semester	Year 2; Semester 2
Unit Coordinator:	M H Datoo
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Subject Area:	Civil Engineering
Summary of Assessment Method:	2 Courseworks, 1 Examination

2 SHORT DESCRIPTION

This Unit builds on and extends the work covered in the Mechanics Unit at Level 1. Methods of calculating the section properties are taught. Students are introduced to the concept and calculations of stresses and strains arising from a combination of load applications – axial, shear, bending and torsion. The state of two-dimensional stress at a point is covered here, together with the calculations of principal stresses. Also covered will be the analysis of three pin frames.

3 AIMS OF THE UNIT

To apply the fundamental principles of stress analysis for determinate structures in determining the stresses due to axial, shear, bending, torsion and, combined axial and bending, load conditions.

4 LEARNING OUTCOMES

4.1KNOWLEDGE AND UNDERSTANDING

- understand the structural behaviour of material under stress
- distinguish between symmetric and unsymmetric sections
- apply the linear laws of elasticity as related to stress and strain
- appreciate the engineers theory of bending
- appreciate the existence of shear stresses
- appreciate the concept of a complex stress system
- apply the Mohr circle of stress
- analyse three pin frames

4.2 INTELLECTUAL SKILLS

- calculate the structural properties of single and compound sections, both symmetric and singly-symmetric
- calculate the bending stress on symmetric and singly symmetric sections
- determine the effect of combined axial and bending stress
- calculations for shear stresses due to shear forces
- analyse the shear stresses arising from torsional loads
- calculate the principal stresses and their corresponding planes

4.3 PRACTICAL SKILLS

- perform, analyse and interpret results from structural tests

4.4 TRANSFERABLE SKILLS

- calculation of section properties to uncommon structural sections
- appreciation of load types and their corresponding stress systems
- appreciation of the failure modes and planes in multi axial loading systems
- usage of IT packages for the production of reports and drawings

5 INTRODUCTION TO STUDYING THE UNIT

5.1 OVERVIEW OF THE MAIN CONTENT

Behaviour of Materials
The nature of stress and strain for ductile and brittle materials

Stress and Strain
Analysis and relationships between stress and strain; elastic constants

Section Properties
Revision of single section properties: area, first and second moment of areas, section modulus, radius of gyration. Extension to compound sections.

Axial Stress
Derivation and application of axial stress

Bending Stress
Derivation and application of bending stress

Combined Stresses
Combined stress due to axial and bending

Shear stress
Complementary shear stress; shear stress distribution due to shear force

Torsion
Torsional stresses in circular bars

Complex Stresses
Transformation of stresses; principal stresses; Mohr's Circle

Three Pin Frames
Analysis of three pin frames, reactions and bending moments

5.2 OVERVIEW OF TYPES OF CLASSES

Lectures and tutorials will be supplemented by printed handouts, worked solutions to tutorials and past examination questions. The lectures are complemented by laboratory exercises and supervised in-class open book tests.

The timetabled day is Mondays pm. The teaching block will normally be a lecture – break – lecture - followed by a tutorial/class test/laboratory.

5.3 IMPORTANCE OF STUDENT SELF-MANAGED LEARNING TIME

The successful passing of this unit is very much dependent on the student spending a lot more private study time. For this unit, this involves the student attempting all the tutorial sheets, and past examination questions (certainly the last five years). A unit like this cannot be studied at the last minute; the effort has to be continuous and steady throughout the semester.

6 THE PROGRAMME OF TEACHING, LEARNING AND ASSESSMENT

Week Beginning	Teaching Week No	Lecture
289 January 2008	1	Materials behaviour Stress and strain
4 February	2	Section properties
11 February	3	Compound sections
18 February	4	Bending stress
25 February	5	Combined axial and bending
3 March	6	Combined axial and bending
10 March	7	Shear stress
17 March		Easter vacation
24 March		Easter vacation
31 March		Easter vacation
7 April	8	Torsional shear stress
14 April	9	Complex stress
21 April	10	Mohr circle
28 April	11	Three pin frames
5 May	12	Bank Holiday
12 May	13	Revision
19 May	14	Examinations
26 May		Recess
2 Jun	15	Examinations

Coursework 1 (Combined Bending) Hand-in Date

Monday, 24 March 2008

7 ASSESMENT OF THE UNIT

70% 3 hour end of unit written examination. Five out of seven questions to be attempted.

10% Coursework 1 will involve laboratory testing of an I-section subjected to combined axial and bending.

20% Coursework 2 is based on a series of open book in-class tests.
Students missing a test will get a zero mark, unless a doctor's medical note is produced – confirming illness on the day of the test, in which case the average will be adjusted accordingly. For any other exemption, the average will be adjusted only upon a supported Mitigating Circumstances procedure.

8 LEARNING RESOURCES

8.1 CORE MATERIALS

Smith; Materials and Structures, Longman, 1986.

Marshall & Nelson; Structures, Longman, 1990.

Croxton & Martin; Solving Problems in Structures, Volume 1, Longman, 1991.

Whitlow; Materials and Structures, Longman, 1991.

Durka, Morgan & Williams; Structural Mechanics, Longman, 1996.

Smith; Introduction to Structural Mechanics, Palgrave, 2001

Arya, Design of Structural Elements, Spon, 2003.

Hulse, Sherwin and Cain, Solid Mechanics, Palgrave, 2003.

Jennings, A, Structures – From Theory to Practice, Spon, 2004

McKenzie; Design of Structural Elements, Palgrave, 2004.

Bedford & Fowler, Statics, Pearson, 2005.

Megson; Structural and Stress Analysis, Elsevier, 2005.

Hibbeler, Mechanics of Materials, Pearson, 2005.

Hibbeler, Statics, Pearson, 2007.

Hibbeler, Structural Analysis, Pearson, 2006.

McKenzie, Examples in Structural Analysis, Taylor & Francis, 2006.

MDSolids software, www.mdsolids.com (and on LSBU Network)