London South Bank University

Module Guide

ADVANCED SOLID MECHANICS

EEB-7-306

Level 7

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1. MODULE DETAILS

Module Title:	Advanced Solid Mechanics
Module Level:	7
Module Reference Number:	EEB-7-306
Credit Value:	20
Student Study Hours:	120
Contact Hours:	48
Private Study Hours:	152
Pre-requisite Learning (If applicable):	Solid Mechanics and Dynamics
Co-requisite Modules (If applicable):	
Course(s):	MSc Mechanical Engineering
Year and Semester	2015 Sem 2
Module Coordinator:	Dr Geoff Goss
MC Contact Details (Tel, Email, Room)	T708, gossga@lsbu.ac.uk, 020 7815 7625
Teaching Team:	
Subject Area:	Mechanical Engineering
Summary of Assessment Method:	40% course work 60% examination

2. SHORT DESCRIPTION

The module covers the basic concepts of solid mechanics from a mathematical modelling perspective. It treats the mechanics of point masses, systems of point masses, rigid bodies and flexible bodies in a systematic manner. That approach complements computational modelling techniques such as numerical integration, phase plane analysis and finite elements.

Students studying this module require a good background in analytical techniques, for example linear algebra and differential equations. They will use classical approaches to solid mechanics together with modern approaches and will deal with complex problems in mechanics both systematically and creatively.

3. AIMS OF THE MODULE

The aim of this unit is to extend and deepen the student's knowledge and understanding of engineering solid mechanics, with consideration to mathematical modelling, analysis and real-world engineering design.

4. LEARNING OUTCOMES

Upon completion of this module the student should be able to:

Upon completion of this unit the student will be acquire the following learning outcomes:

Knowledge and Understanding: Demonstrate systematic understanding of current solution techniques for large deformation and nonlinear problems in mechanics.

Intellectual Skills: Be able to formulate initial value and boundary value problems in mechanics. Know the problems relating to finding solutions to nonlinear ordinary differential equations.

Practical Skills: be able to implement and apply finite element methods to solve nonlinear systems of ordinary and partial differential equations.

Transferable Skills: Develop an understanding of the advantages and disadvantages of different modelling and solution techniques, as they apply to mechanics.

5. ASSESSMENT OF THE MODULE

Examination: 70%. This will comprise a closed book written examination.

Assignment: 30%. The assignment will integrate different aspects of analysis and may include use of software, workshops and laboratories. It should normally involve a balance between computer-generated plots, mathematical analysis, experimental data, together with a written report of approximately 1000 words.

6. FEEDBACK

Feedback for all work submitted during the year should be available within two weeks of submission.

7. INTRODUCTION TO STUDYING THE MODULE

7.1 Overview of the Main Content

The module has two core themes – nonlinear dynamics and elasticity theory.

1) Introduction
- Formulation of Problems in Solid Mechanics
- Differential equations as models for mechanical bodies and systems
- Boundary Value Problems and Initial Value Problems

2) Dynamics
- Nonlinear systems
- Phase plane

3) Themes in linear elasticity theory
- 1D problems
- 2D problems

The module involves analysis of linear and nonlinear ordinary and partial differential equations.

Details of all the above will be made available on Noodle.

7.2 Overview of Types of Classes

The module will be delivered by lectures and tutorials and computer laboratory sessions. The delivery will draw upon some case studies.

7.3 Importance of Student Self-Managed Learning Time

Students will need to ensure that they have good analytical skills. The ability to solve ordinary differential equations is essential.

7.4 Employability

This module provides in-depth understanding and knowledge of solid mechanics that underpins mathematical modelling approaches to solid mechanics used in industry, for example finite elements. This module introduces students to a wide range of problem solving techniques; that foster qualities needed for employment in circumstances requiring sound judgement and initiative in complex and unpredictable professional environments.

8. THE PROGRAMME OF TEACHING, LEARNING AND ASSESSMENT

The module involves computer programming. Students will be taught the key elelments of MATLAB

9. STUDENT EVALUATION

NONE (first time the module has run)

10. LEARNING RESOURCES

Key texts

- Rao, S.S. (2005) *Mechanical Vibrations* Pearson
- Inman, Daniel., *Engineering Vibration* Pearson 4th Ed (2014).
- Strogatz , Steven H., *Nonlinear Dynamics and Chaos: With Applications to Physics, Biology* Perseus (1994).
- Theory of Elasticity, by S.P. Timoshenko and J.N. Goodier, McGraw-Hill, New York. Chapters 2, 3, 4
- Hearn, E.J., *Mechanics of Materials 2: The Mechanics of Elastic and Plastic Deformation of Solids and Structural Materials: v. 2* Elsevier, (1997).

Further resources and *Background* Reading:

- Thompson, Erik., *Introduction to the Finite Element Method* Wiley, (2005).
- Meriam, J.L. and Kraige, L.G. (2007) *Engineering Mechanics: Dynamics* 6th Ed, Wiley.
- Hibbeler, R.C. (2007) *Engineering Mechanics: Dynamics* 6th Ed, Pearson.