LONDON SOUTH BANK UNIVERSITY

unit guide

ENGINEERING MATHEMATICAL METHODS

REF NO:SCE-2-203

Faculty of Engineering, Science and Built Environment

2008-2009 Semester 1

become what you want to be

Table of contents

1.0 UNIT DETAILS

Unit Title:	Engineering Mathematical methods
Unit Level:	2
Unit Reference Number:	SCE-2-203
Credit Value:	1 unit
Student Study Hours:	150
Contact Hours:	48
Private Study Hours:	102
Pre-requisite Learning (If applicable):	Level 1 Mathematics unit
Co-requisite Units (If applicable):	
Course(s):	Common Engineering programme
Year and Semester	2007-2008 Semester 1
Unit Coordinator:	Professor Lawrence J Dunne
UC Contact Details (Tel, Email, Room)	0207 815 7944 Dunnel@lsbu.ac.uk, T800
Teaching Team	Professor Lawrence J Dunne
	Dr Gabor Nyerges
	Richard Cadbury
	Steve Faulkner
Subject Area:	Common Engineering programme
Summary of Assessment Method:	Examination and coursework

2.0 SHORT DESCRIPTION

The unit is a mathematical methods course for advanced engineers. Emphasis is placed on acquiring mathematical skills and is taught as a mixture of lectures and tutorials. Students are required to do significant amounts of private study and worksheets as a way of acquiring high level mathematical skills.

3.0 AIMS OF THE UNIT

The aim of this unit is to introduce students who are one level above the equivalent of A-level mathematics to the study of more advance mathematical techniques required in an engineering degree.

4.0 LEARNING OUTCOMES

4.1 KNOWLEDGE AND UNDERSTANDING

On successful completion of this unit, you should:

(i) Confidently use techniques of advanced matrix algebra.

(ii) To manipulate vector field operations.

(iii) To solve differential equations by transform techniques

(iv) To solve partial differential equations analytically or numerically as appropriate

(v) To carry out selected optimisation techniques

(vi) Be aware of a range of numerical techniques

(vii) Be familiar with a symbolical manipulation program such as MathCad.

4.2 INTELLECTUAL SKILLS

- Formulate/express mathematical problems
- Analyse and evaluate engineering mathematical literature

4.3 PRACTICAL SKILLS

Solve mathematical problems relevant to engineering

4.4 TRANSFERABLE SKILLS

- Communicate
- Manage oneself & one's time
- Work independently
- Evaluate one's work objectively
- Develop and demonstrate the capacity to learn in unfamiliar situations

5.0 **ASSESMENT OF THE UNIT**

Assessment will be by a 2-hour examination and coursework (2 are issued) in the form of problem exercises, worked by hand and by computer where appropriate. The total time required for coursework is roughly 15 hours. Coursework1 issued in early November or earlier carries 30% of the total coursework mark while the revision coursework issued prior to the Christmas vacation also carries 70% of the total coursework mark. The exact dates for coursework distribution and submission will be announced depending on the progression of the cohort of students. You will be required to submit the complete solutions to the problems and will be expected to take care in your presentation.

6.0 FEEDBACK

As far as possible the mark for a coursework 1 will be available to students via the Blackboard site within 14 working days of submitting the work. Coursework 2 will be initially self-assessed to give rapid feedback prior to the examination and then marked by your tutor in the usual way.

7.0 INTRODUCTION TO STUDYING THE UNIT

7.1 OVERVIEW OF THE MAIN CONTENT

Vectors **(10% contact time)**

Review of vector algebra. Vector fields, grad, div, curl, solenoidal and irrotational fields, path integrals.

Multiple integration **(5% contact time)**

Introduction to Multiple Integration.

Ordinary differential and difference equations **(10% contact time)**

Linear differential equations, Finite difference equations. Application of finite difference techniques to ordinary differential equations.

Partial Differential Equations **(10% contact time)**

Separation of variables, Fourier series solutions, Laplace's equation, diffusion equations.

Laplace Transforms **(10% contact time)**

Introduction to Laplace transforms with application to transfer functions.

Numerical methods **(15% contact time)**

Types of error. Numerical differentiation and integration. Gaussian elimination.

Newton-Raphson method. Solution of polynomial and transcendental equations by iterative methods. Functional representation.

Numerical solution of differential equations

Application of finite difference techniques to partial differential equations.

Matrix computation (15% contact time)

Advanced matrix algebra. Further techniques for solution of linear equations – Triangular decomposition, Gaussian elimination, Gauss-Seidel method.

Eigenvalue problems, orthogonal expansions. Positive and negative definite forms, Hessian matrices and use in optimisation.

Optimisation (10% contact time)

Constrained and unconstrained optimisation. Lagrange undetermined multipliers.

Non-linear optimisation.

Fourier Transforms (15% contact time)

Fourier transforms. Fourier series solutions and Signal representation

7.2 OVERVIEW OF TYPES OF CLASSES

Lectures and tutorial classes, using examples selected from topics relevant to more advanced engineering. Students are encouraged to check their work using mathematical software as appropriate.

7.3 IMPORTANCE OF STUDENT SELF-MANAGED LEARNING TIME

Experience shows that the acquisition of skill in mathematical methods requires considerable amount of practice. Hence, you must devote time to working through problems in your own time. Try to spend a little time on most days working on some mathematical problem which may have been set as a coursework. This way you will be best placed to give a good unit performance.

7.4 EMPLOYABILITY

Mathematical skills are in high demand from employers and are required for the professional recognition of all engineers and physical scientists.

8.0THE PROGRAMME OF TEACHING, LEARNING AND ASSESSMENT

The programme of classes below is intended only as a guide and is subject to modification according to rate of progress and unforeseen factors

2008/9 Semester 1 Timetable for SCE_2_203 EMM2 Engineering Mathematical Methods

Please note: This timetable is always subject to alterations..

	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00
Mon									
Tue	09:00 - 11:00 *Lect* in B307 with 88 Students **Dunne, L** X2F, E2F, E2P, EE2P, M2F, M2P Changed: 08 Sep 08		11:00 - 12:45 *Tut* in B332 with 34 Students **Faulkner, S** E2P Weeks: 1-12, Changed: 18 Sep 08	12:45 - 14:30 *Tut* in B466 with 26 Students **Faulkner, S** X2F, M2F Weeks: 1-12, Changed: 18 Sep 08					
			11:00 - 12:45 *Tut* in B330 with 28 Students **Nyerges, G** E2F, EE2P, M2P Weeks: 1-12,						
Wed									
Thu					13:00 - 15:00 *Lect* in B468 with 112 Students **Dunne, L** CP2F, CP2FX, PE2F, PE2Fx, EE2F			15:30 - 17:15 *Tut* in B330 with 36 Students **Dunne, L** PE2F, PE2Fx Weeks: 1-12,	
Fri	09:00 - 11:00 *Tut* in B332 with 40 Students **Cadbury, R** EE2F Weeks: 1-12,						15:00 - 16:45 *Tut* in B361 with 36 Students **Dunne, L** CP2F, CP2FX Weeks: 1-12,		

Average hours per week	*Lect* **4.00**	*Tut* **9.92**	**Total 13.92**

The subject of the lectures are very roughly as follows

Week 1: Introduction to Matrix algebra

Week 2: Triangular decomposition, Gauss-Seidel and Jacobi Methods

Week 3: Eigenproblems and Power Method

Week 4: Partial differentiation. Introduction to vectors.

Week 5: Vector Field theory

Week 6: Multiple integration

Week 7: Optimisation, Lagrange Multipliers

Week 8: Ordinary differential equations

Week 9: Laplace transforms

Week 10: Partial Differential equations

Week 11: Partial Differential equations

Week 12: Fourier Series

9.0LEARNING RESOURCES

9.1CORE MATERIALS

Core reading

- Advanced Engineering Mathematics, A.Bajpai, L.Mustoe, D.Walker, J.Wiley 1995, Chichester UK.
- Advanced Modern Engineering Mathematics, Glyn James, Addison -Wesley 1993.

9.2OPTIONAL MATERIALS

Optional reading

- Mathematical Techniques, an introduction for the engineering, physical and mathematical sciences, 2nd ed, D.W.Jordan & P.Smith, Oxford, 1997.
- MathCad user's Guide, Math soft Inc.Mass., USA, 2003 (available on-line).

9.3 BLACKBOARD SITE

Information about this unit and selected learning material (but not lecture notes! –you must attend classes) is available on the Engineering Mathematical Methods Blackboard site available via the London South Bank University Web pages. Assignment material may be

downloaded from this site.

You may view previous exam papers at

http://www.library.lsbu.ac.uk/dbtw-wpd/exec/dbtwpub.dll