The University of Southern Queensland

Course Specification

Description: Vector Calculus & Partial Differential Equations						
Subject	Cat-Nbr	Class	Term	Mode	Units	Campus
MAT	2102	14396	2, 2002	ONC	1.00	TWMBA

Academic Group: FOSCI
Academic Org: FOS003
HECS Band: 2
ASCED Code: 010101

STAFFING

Examiner: Sergey Suslov
Moderator: Dmitry Strunin

PRE-REQUISITES

Pre-requisite: MAT 2101

RATIONALE

This course provides mathematical tools and modelling techniques required for an understanding of the principles that permeate much of applied mathematics, mathematical physics and engineering science. These principles are developed primarily in the context of their application to the dynamics of fluid flow.

SYNOPSIS

This course is broadly divided into two interrelated strands. One strand unifies linear algebra and differential calculus into the calculus of vector functions. It develops the differential and integral calculus, establishes their properties, and shows how these properties give formula in general coordinate systems. The course develops the application of these mathematical tools to inviscid and incompressible fluid dynamics. The other strand establishes properties of the basic partial differential equations (PDEs) that arise commonly in applications such as the heat equation, the wave equation and Laplace's equation. It develops the mathematical tools of Fourier transforms, Green's functions and special functions necessary to analyse such PDEs.

OBJECTIVES

On successful completion of this course students will be able to:

- understand the meaning of basic differential operators;
- be able to apply integral theorems of vector calculus;

- be familiar with various rectangular and curvilinear orthogonal coordinate systems;
- use and understand the fundamental partial differential equations describing flow of inviscid fluid;
- use Fourier analysis to approximate periodic functions and to solve differential equations;
- classify partial differential equations;
- use separation of variables to solve basic differential equations;
- construct special functions needed to understand differential equations;
- solve linear differential equations using Green's function.

TOPICS

Description	Weighting (%)
1. Differential Operators: Material derivatives, gradient, divergence, curl	15.00
2. Integral Theorems: Circulation, work, surface and volume integrals	10.00
3. Curvilinear Coordinates: Differential operators and integral theorems in curvilinear coordinates	10.00
4. Applications to Flow of Inviscid Fluid: Venturi effect, Bernoulli's equation, rotational and irrotational flows, streamlines and stream functions, flow in a curved pipe	15.00
5. Fourier Analysis: Fourier series, approximation, Fourier integrals	15.00
6. Partial Differential Equations: Modelling physical systems, wave equation, heat equation, Laplace's equation, 2D membrane	20.00
7. Methods for Partial Differential Equations: Circular membranes, Bessel functions, cylindrical and spherical coordinates, Green's function.	15.00

TEXT and MATERIALS required to be PURCHASED or ACCESSED:

Books can be ordered by fax or telephone. For costs and further details use the 'Book Search' facility at http://bookshop.usq.edu.au by entering the author or title of the text.

Introductory Book 2002, *Course MAT2102 Vector Calculus and Partial Differential Equations*, USQ Distance Education Centre, Toowoomba.

Kreyszig, E. 1999, *Advanced Engineering Mathematics*, 8th edition, Wiley, New York.

Selected Readings 2002, *Course MAT2102 Vector Calculus and Partial Differential Equations*, USQ Distance Education Centre, Toowoomba.

Study Book 1 2002, *Course MAT2102 Vector Calculus and Partial Differential Equations*, USQ Distance Education Centre, Toowoomba.

REFERENCE MATERIALS

Reference materials are materials that, if accessed by students, may improve their knowledge and understanding of the material in the course and enrich their learning experience.

Some electronic resources for this course may be available via its home page: http://www.sci.usq.edu.au/courses/MAT2102.

Electronic Study Book 'MAT2101 Applied Mathematics' (Available:) .

Haberman, R 1998, *Elementary applied partial differential equations: with Fourier series and boundary value problems*, Prentice-Hall, Upper Saddle River.

Hughes-Hallet, D. et al 1998, *Calculus. Single and Multivariable*, 2nd edition, John Wiley & Sons, New York.

Roberts, A.J 1994, *A one-dimensional introduction to continuum mechanics*, World Sci., River Edge, New Jersey.

Study Book 2001, *MAT2100 Algebra and Calculus II*, USQ Distance Education Centre, Toowoomba, Australia.

STUDENT WORKLOAD REQUIREMENTS

ACTIVITY	HOURS
Assessment	45
Examinations	3
Lectures	52
Private Study	62
Tutorial	13

ASSESSMENT DETAILS

Description	Marks Out of	Wtg(%)	Required	Due Date
ASSIGNMENT 1	12.00	12.00	Y	23 Aug 2002
ASSIGNMENT 2	12.00	12.00	Y	30 Aug 2002
ASSIGNMENT 3	12.00	12.00	Y	11 Oct 2002
ASSIGNMENT 4	12.00	12.00	Y	18 Oct 2002
HOMEWORK	12.00	12.00	Y	22 Jul 2002 (see note 5)
3 HR RESTRICTED EXAMINATION	40.00	40.00	Y	END S2 (see note 6)

NOTES:

5. Refer to Examiner for information about assignment due dates.

6. Examination dates will be available during the Semester. Please refer to Examination timetable when published.

OTHER REQUIREMENTS

1 Attendance: It is the students' responsibility to participate actively in all classes scheduled for them, and to study all material provided to them or required to be accessed by them to maximize their chance of meeting the objectives of the course and to be informed of course-related activities and administration.

2 Requirements to Complete Satisfactorily Each Assessment Item: The course assessment for on-campus students includes weekly homework. On-campus students must prepare the answers to the homework questions by the time specified by the examiner, normally by the beginning of the next week's first lecture.

3 Minimum Requirements to Pass the Course: To be assured of a pass in the course, students must (a) obtain at least 50% in the examination and (b) attain at least 50% in the assignments and homework overall.

4 Grading: Final grades for students will be determined by the addition of the marks obtained in each assessment item, weighted as in the Assessment Details.

5 Supplementary and Deferred Examination: If a student obtains an overall passing mark, but does not perform satisfactorily in the examination, the student may, at the discretion of the examiner, be granted a supplementary examination to attempt to increase the mark for that part before being reconsidered for a pass in the course. A student will normally not be granted a deferred examination unless he/she performs satisfactorily in all of the assignments. Any supplementary or deferred examinations for this course will be held during the examination period at the end of the semester of the next offering of this course.

6 Assignments: The due date for an assignment is the date by which a student must despatch it to USQ. The onus is on the student to provide proof of the despatch date, if requested by the examiner. Students must retain a copy of all assignments which must be produced within ten days if and when required by the examiner. In accordance with University's Assignment Extension Policy (Regulation 5.6.1), the examiner of a course may grant an extension of the due date of an assignment in extenuating circumstances. This policy may be found in the USQ Handbook, the Distance Education Student Guide and the Faculty of Sciences' Orientation Handbook for new on-campus students. All students are advised to study and follow the guidelines associated with this policy. An assignment, submitted after the due date without an extension approved by the examiner, will attract a penalty of 20 percent of the assigned mark for each day (or part thereof) that the assignment is late.

7 Examinations: Students should be aware that the University has policies and regulations (Regulation 5.6.2.2) about the use of unfair means and electronic devices in an examination and they should refer to them to determine whether or not actions they intend to take are acceptable to the University. Restricted Examination: only specific materials may be brought into a restricted examination. The only materials that students may bring into the examination room and use in the restricted examination are normally: (a) writing materials (non-electronic and free from material which could give the student an unfair advantage in the examination); (b) calculators which cannot hold textual information (students must indicate on their

examination paper the make and model of any calculator(s) they use during the examination); and (c) one (1) single-side page of A4 size with notes and formulae prepared by students while reviewing the course material.
