



The University of Southern Queensland

Course Specification

Description: Low-Dimensional Modelling in Hydrodynamics

Subject	Cat-Nbr	Class	Term	Mode	Units	Campus
MAT	4104	20375	1, 2003	ONC	1.00	TWMB

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

STAFFING

Examiner: Tony Roberts
Moderator: Dmitry Strunin

RATIONALE

Most physical situations of interest in the world around us have an enormous number of fine details which are of little concern in many situations. The practical equations which scientists deal with are simplifications of the 'true' but intractable or overly-complicated equations that describe all the fine detail. The process of creating simple model approximations for otherwise intractably detailed dynamical descriptions, sometimes called dimensional reduction, is addressed in this course.

SYNOPSIS

This course combines both fluid dynamics and modern dynamical systems theory. We develop methods to derive relatively simple dynamical models in the application of the techniques to important classes of fluid flows. The principles of the modelling process that are developed apply universally to any evolving system. The triple aim is to explore: algebraic techniques; fluid applications; and general modelling principles. This course is only available to students enrolled in honours or masters programs.

OBJECTIVES

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

- demonstrate an understanding of the dynamics of viscous fluid flow and contaminant transport;
- use the rationale of discarding dynamical modes to form a simple model of dynamical system;
- implement the algebraic analysis needed to construct a model;
- demonstrate an understanding of and interpret models of fluid dynamics.

TOPICS

Description	Weighting (%)
1. A selection of the following topics will be covered:	100.00
1.1. Fluid dynamics: Navier-Stokes equation; boundary conditions; heat and mass transfer.	
1.2. The centre manifold - Taylor-Couette problem: Couette flow; stability; existence, relevance and approximation of the centre manifold model; Landau equations; computer algebra iteration.	
1.3. Hopf bifurcation in salty water: overstability in double convection; the homological equation; chaos in triple convection.	
1.4. Slow variations in space - dispersion and films: Poiseuille flow; dispersion in pipes and the slowly-varying approximation; thin fluid films; global models.	
1.5. Initial conditions: forecasting, dispersion, relevance, asymptotic completeness.	

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.

To be advised.

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.

To be advised.

STUDENT WORKLOAD REQUIREMENTS

ACTIVITY	HOURS
Assessment	40
Examinations	3
Lectures	39
Private Study	80

ASSESSMENT DETAILS

Description	Marks Out of	Wtg(%)	Required	Due Date
ASSIGNMENT 1	20.00	5.00	Y	04 Mar 2003 (see note)
ASSIGNMENT 2	20.00	5.00	Y	04 Mar 2003 (see note)
ASSIGNMENT 3	20.00	5.00	Y	04 Mar 2003 (see note)
ASSIGNMENT 4	20.00	5.00	Y	04 Mar 2003 (see note)
3 HOUR RESTRICTED EXAM	100.00	80.00	Y	END S1 (see note)

NOTES:

- . The examiner will advise students of the due dates of assignments.
- . As in Note 1.
- . As in Note 1.
- . As in Note 1.
- . Examination dates will be available during the Semester. Please refer to Examination timetable when published.

IMPORTANT ASSESSMENT INFORMATION

- 1 Attendance requirements:
There are no attendance requirements for this course. However, it is the students' responsibility to study all material provided to them or required to be accessed by them to maximise their chance of meeting the objectives of the course and to be informed of course-related activities and administration.
- 2 Requirements for students to complete each assessment item satisfactorily:
To complete each of the assessment items satisfactorily, students must obtain at least 50% of the marks available for each assessment item.
- 3 Penalties for late submission of required work:
If students submit assignments after the due date without prior approval then a penalty of 20% of the total marks available for the assignment will apply for each working day late.
- 4 Requirements for student to be awarded a passing grade in the course:
To be assured of receiving a passing grade a student must attempt all of the summative assessment items, achieve at least 40% in the examination, achieve an aggregated mark of at least 50% in the total marks allocated for the assignments, and at least 50% of the available weighted marks for the summative assessment items.
- 5 Method used to combine assessment results to attain final grade:
The final grades for students will be assigned on the basis of the weighted aggregate of the marks obtained for each of the summative assessment items in the course.
- 6 Examination information:

In a Restricted Examination, candidates are allowed access to specific materials during the examination. The only materials that candidates may use in the restricted examination for this course are: writing materials (non-electronic and free from material which could give the student an unfair advantage in the examination); 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). Students whose first language is not English, may, with the Examiner's approval, take an appropriate non- electronic translation dictionary into the examination. Students who wish to use a translation dictionary **MUST** request and receive written approval from the Examiner at least one week before the examination date. Translation dictionaries will be subject to perusal and may be removed from the candidate's possession until appropriate disciplinary action is completed if found to contain material that could give the candidate an unfair advantage.

- 7 Examination period when Deferred/Supplementary examinations will be held:
Any Deferred or Supplementary examinations for this course will be held during the examination period at the end of the semester of the next offering of this course.
- 8 University Regulations:
Students should read USQ Regulations 5.1 Definitions, 5.6. Assessment, and 5.10 Academic Misconduct for further information and to avoid actions which might contravene University Regulations. These regulations can be found at the URL <http://www.usq.edu.au/SECARIAT/calendar/Part5/> or in the printed version of the current USQ Handbook.

ASSESSMENT NOTES

- 9 The due date for an assignment is the date by which a student must despatch the assignment to the 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 each item submitted for assessment. This must be produced within five days if required by the Examiner. The examiner may grant an extension of the due date of an assignment in extenuating circumstances.