COURSE OUTLINE

2001ENG
Advanced Engineering Mathematics

Semester 1 - 2008

Academic Organisation:	Griffith School of Engineering
Faculty:	Science, Environment, Engineering and Technology
Credit point value:	10
Student Contribution Band:	Band 2
Course level:	Undergraduate
Campus/Location/Learning Mode:	Gold Coast / On Campus / In Person
Convenor/s:	Dr Jeung-Hwan Doh (Gold Coast)
Enrolment Restrictions:	Restricted: Approval from Head of School
This document was last updated:	5 February 2008

BRIEF COURSE DESCRIPTION

This course deals with advanced Engineering Mathematics topics which provide students with the relevant mathematical tools required in the analysis of physical problems related to engineering. The main topic areas covered are differential equations, vector calculus, Fourier series and partial differential equations with emphasis on using mathematical modelling techniques to solve problems. The mathematical skills derived from this course will enable students to solve specific application problems encountered in the program. Assessment is by one tutorial assignment and examinations.

SECTION A – TEACHING, LEARNING AND ASSESSMENT

COURSE AIMS

The main purpose of the course is to provide students with mathematical skills which would enable them to devise solutions for various mathematical problems that they may encounter in their profession. One of the desired skills of engineers is the ability to solve ordinary and partial differential equations and integrate vector functions in two and three-dimensional space. This course will enable students to become familiar with the mathematical tools required to solve these and similar engineering related problems. The MATLAB computer program is introduced as a tool for modelling and solving of such technical problems. The mathematical skills attained will be used throughout the program in courses related to water and coastal engineering, environmental engineering, micro-electronics, soil mechanics and structural modelling.

LEARNING OUTCOMES

Upon successful completion of the course, student should

1. be able to solve common second order and constant coefficient systems of differential equations and apply them to some realistic problems.
2. understand scalar and vector fields, particularly the grad, div and curl operators.
3. be able to use the integral theorems of Green, Gauss & Stokes to find line, surface & volume integrals
4. understand and be able to work with Fourier series and understand Fourier transforms
5. be able to solve some common first and second order partial differential equations.
6. be able to use MATLAB to solve some of these problems.

CONTENT, ORGANISATION AND TEACHING STRATEGIES

The course content is presented in detail in the course notes published on Learning@Griffith. The course is segmented into **four** modules. The lectures will provide the background, concepts and techniques required to solve mathematical problems and provide worked examples. Problem solving exercises elaborating on the lecture material will be introduced during the tutorial time. Prescribed assignments will consist of textbook-based problems and also involve "real world" applications.

Contact Summary

The delivery contact hours in this course are:

ACTIVITY	HOURS
Lectures	39
Tutorials/Computing lab	13

These contact hours are delivered as a 3 hours of lectures and 1 hour tutorial per week.

CONTENT SUMMARY

As the course is delivered the delivery of is segmented into four modules. It is anticipated Module 1 is taught in Week 1 to 2, Module 2 in Week 3 to 6, Module 3 in Week 7 to 8 and Module 4 in Week 9 to 12. Revision lectures are given in Week 13.

Topic (week)	Course Content Details
1	Ordinary Differential Equations Review Second Order D.E. 2^{nd} order ODE
2	Ordinary Differential Equations 2^{nd} order ODE problem solving Systems of first order D.E.'s
3	The mathematics behind resonance Simple systems of differential equations
4	Converting a 2nd order DE in two first order DE's Calculus in 2D and 3D and vector fields
5	Vectors – brief revision Curves in 2D and 3D analyzed by vectors Scalar fields in 2D and 3D
6	Finding a minimum value on vector field Line integrals of vector fields
7	Line integrals of vector fields- example Green's theorem Conservative vector fields
8	Gauss's theorem over a 3D region Stokes's theorem - the 3D version of Green's theorem
9	Introduction to Fourier series of periodic functions Fourier transforms
10	Building up the Fourier 'series' of a non-periodic function Notation
11	Partial Differential Equations First Order PDE
12	Second Order PDE
13	Matlab Computing lab

ASSESSMENT

Summary of Assessment

Item	Assessment Task	Length	Weighting	Total Marks	Relevant Learning Outcomes	Due Day and Time
1.	Assignment	TBA	15%	100	1,2,3,6	TBA
2.	Mid-Semester Test	50 min	30%	100	1,2,3	Week 7
3.	Final Examination	120 min	55%	100	**3,4,5,6**	Examination week

Assessment Details

Assessment is based on the student's grasp of the underlying concepts and techniques required to solve the mathematical problems derived from real-world examples and textbook problems.

1. Assignment

   The assignment will assess the ability of the student to bring together various aspects of the course material and apply that knowledge to particular real-world problems. The assignment also provides continuous feedback to both the students and the teaching team regarding progress and conduct of

the course. Students are encouraged to discuss assignments in groups before arriving at their own solutions.

2. Mid Semester Test
   The mid semester test is closed book with duration of 50 minutes. A one-page formula sheet is provided. The test provides students with the opportunity to study and perform under 'exam' type conditions. It also provides feedback to both the students and the teaching team regarding progress and conduct of the course.

3. Final Examination
   The duration of the final examination is 2 hours and it is closed book. A two-page bring one A4 page sheet of formulas is provided. The final examination are to assess the student's knowledge and understanding of the topics covered in the course and the ability to apply that understanding to the solution of practical problems.

To be eligible to pass the course, students are required to satisfactorily complete all items of assessment and achieve at least 50 (fifty) percent of total mark. In addition, they must obtain at least 40 (forty) percent in the final examination in order to achieve a grade of "Pass" or above.

Return of Assessment Items and Notification of Availability of Feedback on Assessment

The marked tutorial assignments will be returned to the students two weeks after submission at their respectively tutorial classes. The mid semester test will be marked within 2 weeks after the exam is conducted and the exam paper will be returned to the students during the lecture time. The tutorial marks and the mid semester exam marks/solutions will be made available at Learning@Griffith resources.

GRADUATE SKILLS

The Griffith Graduate Statement states the characteristics that the University seeks to engender in its graduates through its degree programs.

Convenors *are encouraged to* make reference to graduate skills development within the subsections *Learning Outcomes, Content, Organisation and Teaching Strategies* and *Assessment*.

In this section, convenors *are required to* summarise how this course contributes to the development of all or some of these graduate skills by checking the appropriate boxes in the following table.

Graduate Skills	Taught	Practised	Assessed
Effective communication (written)	☐	☐	☐
Effective communication (oral)	☐	☐	☐
Effective communication (interpersonal)	☐	☐	☐
Information literacy	☐	☒	☐
Problem solving	☒	☒	☒
Critical evaluation	☐	☒	☒
Work autonomously	☐	☒	☒
Work in teams	☐	☐	☐
Creativity and innovation	☐	☒	☒
Ethical behaviour in social / professional / work environments	☐	☐	☐
Responsible, effective citizenship	☐	☐	☐

Professional Skills

Listed below are the discipline specific graduate skills:

- Basic sciences fundamentals
- Problem identification, formulation and solution

TEACHING TEAM

Course Convenor

Convenor Details	Gold Coast
Campus Convenor	Dr. Jeung-Hwan Doh
Email	j.doh@griffith.edu.au
Office Location	G09_1.24
Phone	07 5552 9141
Fax	07 5552 8065
Consultation times	Will be announced at Learning@Griffith website in Week 1

Additional teaching team members

Professor David Thiel (Nathan)

Email D.Thiel@griffith.edu.au

Office N44 3.11 (Nathan, Engineering) Phone 07 3735 7192

Moderator Details	Gold Coast
Moderator	Dr. Hong Zhang
Office Location	G09 1.22
Email	H.zhang@griffith.edu.au
Phone	07 5552 9015

COURSE COMMUNICATIONS

The Course Convenor (Lecturer) is available for consultation, for Gold coast and Nathan campus students, at times in the above section. The students are required to check their email and Learning@Griffith website on a regular basis.

TEXTS AND SUPPORTING MATERIALS

There is no prescribed text for this course. A study guide and lecture summary will be provided and will be available from the course website at Learning@Griffith.

Recommended Text (optional)

The following textbooks contain useful material for this subject and are available from the Griffith Library:

- E Kreyzig, Advanced Engineering Mathematics, John Wiley and Sons (various editions). The 9th edition is the most recent (2006) but any edition after the 6th is quite useful as well.
- Reza Malek-Madani, Advanced Engineering Mathematics, vols 1 and 2, Addison Wesley, 1998

- M Tinker and R Lambourne, Further Mathematics for the Physical Sciences, Open University/Wiley, 2000
- T L Harman et al, Advanced Engineering Mathematics with Matlab, Brookes/Cole 2000
- H M Schey, Div, grad, curl and all that, W.W. Norton 2006

Recommended Readings/References and Equipment

Washington, A.J., 1995,*Basic Technical mathematics with Calculus*, 6th Ed., Addison-Wesley.
James, G., 1992, *Modern Engineering Mathematics*, Addison-Wesley.
O'Neil, P.V., 1995, *Advanced Engineering Mathematics*, 4th Ed., PWS Publishing.
Reza M.M., 1998, *Advanced Engineering Mathematics (with MATLAB)* Vol I & II, Addison-Wesley.
Stroud, K.A., 1995, *Engineering Mathematics*, 4th Ed., Macmillan.
Stroud, K.A., 1995, *Further Engineering Mathematics*, 3rd Ed., Macmillan.
Strauss, W.A., 1992, *Partial differential Equations: An Introduction*, Wiley.
Thomas, G.B. & Finney, R.L., 1996, *Calculus*, 9th Ed., Addison-Wesley.

SECTION B – ADDITIONAL COURSE INFORMATION

Students should refer to the Learning@Griffith website for further information about this course.

Administration

Unless otherwise stated, the normal course administration policies and rules of the School of Engineering apply. See the School of Engineering Notice Board for details.

The attention of students is drawn to the University's Policy on Academic Misconduct. http://www62.gu.edu.au/policylibrary.nsf/mainsearch/352f26aa1a1011e64a256bbb0062fd5f?opendocument . It is recommended that students read this policy.

Assignment Submissions, Extensions and Penalties

For tutorial exercises, whereas students may work together in problem solving, the calculations and writing up should be the sole work of the student submitting.

If the student does not submit their tutorial assignments by the due date, penalties will apply. Students seeking an extension of time in which to submit their tutorial assignments must apply in writing to the Course Convenor. Normally, the only ground on which an extension will be granted is the illness of the student.

Course Evaluation

A formal survey of the students in the form of evaluation of course and teaching will be undertaken towards the end of the semester. The results of survey will be discussed by the teaching team and any necessary modifications to the course planned for the next offering.

SECTION C – KEY UNIVERSITY INFORMATION

ACADEMIC MISCONDUCT

Students must conduct their studies at the University honestly, ethically and in accordance with accepted standards of academic conduct. Any form of academic conduct that is contrary to these standards is academic misconduct, for which the University may penalise a student. Specifically it is academic misconduct for a student to:

present copied, falsified or improperly obtained data as if it were the result of laboratory work, field trips or other investigatory work;

include in the student's individual work material that is the result of significant assistance from another person if that assistance was unacceptable according to the instructions or guidelines for that work;

assist another student in the presentation of that student's individual work in a way that is unacceptable according to the instructions or guidelines for that work;

cheat; (Cheating is dishonest conduct in assessment);

plagiarise (Plagiarism is knowingly presenting the work or property of another person as if it were one's own.)

Visit the University's *Policy on Academic Misconduct* for further details.

KEY STUDENT-RELATED POLICIES

All University policy documents are accessible to students via the University's Policy Library website at: www.griffith.edu.au/policylibrary. Links to key policy documents are included below for easy reference:

Student Charter

Student Administration Policy

Assessment Policy

Academic Calendar

Health and Safety Policy

Academic Standing, Progression and Exclusion Policy

Policy on Student Grievances and Appeals

Examinations Timetabling Policy and Procedures

Guideline on Student E-Mail

UNIVERSITY SUPPORT RESOURCES

The University provides many facilities and support services to assist students in their studies. Links to information about University support resources available to students are included below for easy reference:

Learning Centres - the University provides access to common use computing facilities for educational purposes. For details visit www.griffith.edu.au/cuse

Learning@Griffith - there is a dedicated website for this course via the Learning@Griffith student portal.

Student Services facilitate student access to and success at their academic studies. Student Services includes: Careers and Employment Service; Chaplaincy; Counselling Service; Health Service; Student Equity Services (incorporating the Disabilities Service); and the Welfare Office.

Learning Services within the Division of Information Services provides learning support in three skill areas: computing skills; library skills; and academic skills. The study skills resources on the website include self-help tasks focusing on critical thinking, exam skills, note taking, preparing presentations, referencing, writing, proof reading, and time management.