2014 Unit Guide

ENG1091
Mathematics for Engineering

Vector algebra and geometry: equations of lines and planes. Linear algebra: matrix operations, systems of linear equations, eigenvalues and eigenvectors. Calculus: logarithmic differentiation, improper integrals, integration by parts. Sequences and series: convergence, power series, Taylor polynomials. Ordinary differential equations: first order, second order with constant coefficients, boundary value problems, systems of ODEs. Multivariable calculus: partial derivatives, directional derivatives, chain rule, maxima and minima.

Chief Examiner	*Dr. Leo Brewin*	
Unit Coordinator	*Dr. Leo Brewin*	
Mode of delivery	On campus (Clayton and Malaysia)	
Workload	Three 1-hour lectures and one 2-hour tutorial class per week.	
Prerequisites	VCE Specialist Mathematics or ENG1090 or equivalent.	
Prohibitions	ENG1902, MTH1030, MTH1085 or equivalent.	
Campus coordinators	Dr. Leo Brewin (Clayton)	Mr. Yih Jian Yoong (Malaysia)
Email	ENG1091-helpdesk@monash.edu	Yoong.Yih.Jian@monash.edu
Office hours	Please see the ENG1091 website.	Please see the ENG1091 website.
Clayton Lecturers	Dr. Chris Hough (Stream 1) Mr. John McCloughan (Stream 2, weeks 1-6) Dr. Danijel Belusic (Stream 2, weeks 7-12)	
Malaysia Lecturers	Mr. Yih Jian Yoong	
Tutors	Please see the ENG1091 website.	

SEMESTER 2

2014

monash.edu/pubs/handbooks/units/ENG1091.html

1. Academic Overview

Welcome to ENG1091 - Mathematics for Engineering! This is a 6 point unit which contributes to a minor or major in mathematics in all science courses, and it is also suitable for students who wish to strengthen their mathematics skills to support their studies in other science or non-science areas.

1.1 Learning Outcomes

On completion of this unit, students will:

- calculate cross products of vectors;
- use vectors to represent lines and planes;
- perform matrix algebra;
- solve systems of linear equations;
- find eigenvalues and eigenvectors in simple cases;
- use hyperbolic functions;
- perform logarithmic differentiation;
- establish the convergence of improper integrals;
- use further techniques of integration, including integration by parts;
- establish the convergence of numeric and power series;
- construct Taylor series and use Taylor polynomials to approximate functions;
- solve first order ordinary differential equations, including the techniques of
  - exact integration,
  - separable variables, and
  - integrating factor;
- solve systems of first order linear ordinary differential equations with constant coefficients;
- solve second order linear differential equations with constant coefficients;
- set up differential equations with initial or boundary conditions to model simple engineering problems;
- calculate partial derivatives;
- use the gradient vector to find directional derivatives;
- use chain rule;
- calculate small errors using the total differential;
- find maximum and minimum values of functions of two-variables.

1.2 Unit schedule

Week	Lecture topic	Reference
PART I: EUCLIDEAN GEOMTERY and LINEAR ALGEBRA		
1	Lines and planes.	
2	Matrices and determinants.	
3	Systems of linear equations, eigenvalues and eigenvectors.	
PART II: INTEGRATION and SEQUENCES & SERIES		
4	Integration by parts.	
5	Improper integrals.	
6	Infinite series and Taylor Series.	
PART III: ORDINARY DIFFERENTIAL EQUATIONS.		
7	Separable ODEs.	
8	Linear first order ODEs.	
9	Systems of first order linear ordinary differential equations.	
10	Second order linear ordinary differential equations.	
PART IV: Multivariable Calculus.		
11	Multivariable functions and partial derivatives.	
12	Multivariable maxima and minima.	
REVISION AND EXAM PREPARATION		

1.3 Assessment summary

Assessment task	Value	Due in week
Assignment 1: Euclidean Geometry.	5%	3
Assignment 2: Linear Equations and Matrices.	5%	4
Assignment 3: Eigenvalues and Eigenvectors.	5%	5
Assignment 4: Hyperbolic Functions.	5%	7
Assignment 5: Integration and Improper Integrals.	5%	9
Assignment 6: Solutions of ODEs and Infinite Series.	5%	11

2. Teaching Approach

In the first week of the semester there will be just three one-hour lectures. For the remainder of the semester (weeks 2 to 12) there will be three one-hour lectures plus one two hour tutorial (also known as a support, practice or laboratory class).

2.1 Lectures

The material presented in each lecture will be drawn from a printed set of lecture notes. These notes will be available on the unit website and for purchase in the university bookshop. You are expected to bring these notes to lectures and tutorials (support classes). The lectures will be recorded (audio only) and will be available from the MULO website. At the end of each week I will scan the transparencies from the (Clayton campus) lectures and make then available on the unit website.

2.2 Tutorials

In tutorials you will work on problem sets under the guidance of a tutor. The problem sets are contained in the published lecture notes. You are required to attend tutorials, to work on the problem sets and participate in class.

3. Assessment requirements

3.1 Assessment tasks

The assessment for this unit will consist of

- one final exam worth 70%
- six assignments each worth 5%

3.2 Examinations

The final exam will run for three hours and will contain between 8 and 12 questions. Each question may contain many parts. A sample exam with solutions will be made available on the unit web site during the semester.

No calculators, textbooks or notes of any kind will be allowed in the exam. A formula sheet will be provided with the exam and a copy will be available on the unit web site from around the middle of the semester.

3.3 Assignments

There will be six assignments each worth 5% (for a total of 30%). Each assignment will consist of two questions (each worth 15 marks). The first question will be in the form of a typical exam question while the second will be a traditional assignment style question.

In order to get full marks for the assignment style questions you must not only get the correct answer (what a surprise) you will also be expected to provide clear explanations as to how you

arrived at your answers. You will need to use, where appropriate, proper English sentences (this does not include sms or txt) and you should employ correct mathematical terminology and pay due care to how you present your answers. Marks will be deducted for sloppy presentations. The good news is that the exam style question will be marked in a manner similar to a real exam question. It will be sufficient to present your workings and answers as a readable series of (correctly formatted) mathematical statements with the occasional short English statement to help explain steps that are not obvious from the mathematics alone.

Examples of what we expect (and examples of what hope never to see) can be found on the unit web site.

You are not required to use a word processor to prepare your assignments. Neat hand written submissions will be perfectly acceptable.

3.4 Assignment submission

There is only one way to submit your assignments for this unit: **you must hand them to your tutor during your tutorial in the week that the assignment is due**. The submission dates are clearly stated on each assignment. All six assignments will be available at the start of the semester. This should give every student ample opportunity to complete each assignment by the due date.

If you have any reason why you are unable to submit your assignment by the due date you must contact your campus coordinator **before** the due date. In all other cases late penalties will apply as set out in the Faculty of Science policy (see below).

3.5 Assignment coversheet

In accordance with school and university policy, all assignments must include a signed cover sheet. The School of Mathematical Sciences cover sheet can be downloaded from the unit website on Moodle. For Clayton students, hard copies of cover sheets are often available from the School Enquiries Office on the fourth floor of the mathematics building (near the lifts).

3.6 Extensions, late submission and penalties

The Faculty of Science has a strict policy on late submission of work. It stipulates that late assignments will normally be penalised at 10% of the maximum mark per calendar day until one week after the due date, after which a zero mark is awarded. Note in particular the use of **calendar days**. This means that all seven days of the week, including holidays, will be used when counting how many days have lapsed after the due date. It is part of your learning experience at Monash to properly plan your time to meet the given deadlines.

If you know in advance that you may have difficulty in meeting a deadline please contact your campus coordinator as soon as possible **before** the due date. Only in exceptional circumstances will extensions be given **after** the due date has passed.

Tutors are **not authorised** to approve extensions to deadlines.

3.7 Returning marked assignments

Where possible marked assessments will be returned to you at your next support class following the week in which the assessment was due. Your marks will also be posted on the Grade Book on Moodle at around the same time and you should check these have been recorded correctly. If any of them have been entered incorrectly you must query them with your tutor in a timely manner. (If work is consistently being handed back late to you, or your marks are not posted on Moodle within a week of receiving your marked work, please advise the Unit Coordinator.) If you are unable to collect your work at the usual class, please ask your tutor at the next class. Any uncollected work after the end of semester can be retrieved from the Unit Coordinator up until the end of the examination period.

If you believe that an error has been made in the marking of any assessment, for example missed working or a mistake in the addition, you should discuss that with your tutor initially. If you are not satisfied with their response you should contact your campus coordinator to arrange a meeting.

3.8 Resubmission of assignments

You will normally not be allowed to re-submit your work for assessment expect in special cases and only with written consent of the unit coordinator.

3.9 Referencing requirements

Where you include significant pieces of work from other sources (i.e., not written by you), you must provide details of where that material was obtained. If you obtained the information from Wikipedia or Wolfram Alpha then you must provide the URL of the web page. You should follow standard scientific practice where the references are included as a final section of your submitted work.

3.10 Special consideration

Information about special consideration that may be granted for this and other units is available at

http://policy.monash.edu/policy-bank/academic/education/assessment/special-consideration-policy.html

4. Unit Resources

4.1 Required resources

Lecture notes

A complete set of lecture notes, written specifically for this unit will be available for purchase form the Monash bookstore and (at no cost) from the unit web site (either as a complete book or as individual chapters). The notes cover all of the material required for this unit including an extensive collection of exercises. It is expected that you will bring your copy to lectures and support classes.

4.2 Recommended resources

Textbooks

The recommended (but not prescribed) textbook for this unit is *Modern Engineering Mathematics* by Glyn James. You can purchase this from the Monash bookstore and there are a limited number of copies in the library.

Please note that there is also an advanced version *Advanced Modern Engineering Mathematics* by the same author but it is not appropriate for this unit. Please make sure you obtain the correct one – *Modern Engineering Mathematics*.

The question some students will ask is: Do I really need to buy James or will the printed lecture notes be sufficient for my study in this unit? It is true that James is a good book but be aware that it is **not used** beyond this unit. The printed lecture notes are much cheaper and do provide all the material, including exercises, that you will need for this unit. You will be adequately prepared for the exam (and for mathematics in later years) if you thoroughly read the printed notes, do all of the supplementary exercises (and the assignments of course). A copy of James will be a bonus but is not essential.

Reading lists

This unit has a reading list that consists of just one book, James *Modern Engineering Mathematics*. The reading list can be accessed form this web site

http://tiny.cc/k7wqsw

4.3 Recommended reading

- Boas, M..L., *Mathematical Methods in the Physical Sciences*. New York, Wiley 1983.
- Stewart, Calculus, *Early Transcendentals Version*, 5th & 6th Eds. 2003, 2008.

4.4 Unit website

Unit information, lecture notes, assignments, exercises, all handouts and notices will be available on the web through Moodle (click here).

4.5 Mathematics Learning Centre

The School of Mathematical Sciences also operates a Mathematics Learning Centre, to provide additional assistance to students who are encountering difficulties with lecture material and exercises in any of their first and second-year mathematics units (including ENG1091).

The Mathematics Learning Centre is located in Room G24 on the ground floor of Building 28 at the Clayton campus and it is open from week 2 of semester on Monday to Friday from 11am–2pm. No appointment is necessary.

5. Feedback

5.1 Our feedback to you

The feedback you will receive during your university studies is probably quite different from what you have been used to in school. The first big difference is the huge number of students undertaking each unit, which does not allow for the same one-on-one interaction as when you learn in small groups. Secondly, university students are adults and hence are expected to take responsibility for their own learning (spoon feeding is now in the past!)

However, you will still receive plenty of feedback on your progress, but you must look for it! In ENG1091, the following opportunities should help you get a sense on how you are doing:

Lectures. Lectures are not just a one way street – you are actively encouraged to ask questions during lectures. If there is some point that you feel unsure about don't be shy, ask the lecturer to clarify the point.

Assignments. Always look through the marked assignments, and read the comments given by your tutor either written on the assignment itself or in class to the whole group. Always ask if there is something that is not clear to you. All topics included in the assignments may be covered in the final exam, therefore it is important that if you lost marks in a particular question that you find out what you did wrong to avoid making the same mistake again in the exam!

Tutorials. Tutorials are the best place to get feedback from both the tutor and your peers. Take the weekly problem sets seriously, and clarify anything that you are unsure about. Many questions included in the problem sets are written in the style of an exam question. Such questions will give you a good feel for what you might see on the final exam.

Consultation outside scheduled classes. You can always receive one-on-one help and feedback from the Mathematics Learning Centre (see below), or during the consultation hours for your lecture (these will be posted on the unit web site).

Sample exams. Towards the end of the semester I will put on Moodle a sample exam with solutions. Work through the exam, and check through the solutions only once you finished your attempt.

5.2 Your Feedback to us

Monash is committed to excellence in education and regularly seeks feedback from students, employers and staff. One of the key formal ways students have to provide feedback is through the Student Evaluation of Teaching and Units (SETU) survey. The Universitys student evaluation policy requires that every unit is evaluated each year. Students are strongly encouraged to complete the surveys. The feedback is anonymous and provides the Faculty with evidence of aspects that students are satisfied and areas for improvement.

For more information on Monash's educational strategy, see:

http://monash.edu.au/about/monash-directions/

and on student evaluations, see:

http://policy.monash.edu/policy-bank/academic/education/quality/student-evaluation-policy.html

5.3 Previous Student Evaluations of this unit

If you wish to view how previous students rated this unit, please go to

https://emuapps.monash.edu.au/unitevaluations/index.jsp

6. Engineers Australia stage 1 competencies

The Engineers Australia Policy on Accreditation of Professional Engineering Programs requires that all programs ensure that their engineering graduates develop to a substantial degree the stage 1 competencies. Listed below are the activities in this unit that will help you to achieve these competencies. Please note that not all stage 1 competencies are relevant to this unit.

Stage 1 competencies.	**Activities used in this unit to develop stage 1 competencies.**
PE1.1 Knowledge of science and engineering fundamentals.	The lectures, teaching materials and support-class activities develop and assess students' knowledge of mathematics and analysis techniques. Relevance to engineering applications is reinforced. Working from first principles is also emphasised.
PE1.2 In-depth technical competence in at least one engineering discipline.	
PE1.3 Techniques and resources.	Mathematical models of simple applications to engineering are introduced, analysed and interpreted in the lectures, prescribed text, problem sets and written assignments.
PE1.4 General knowledge.	The unit covers a large number of topics and presents well established results.
PE2.1 Ability to undertake problem identification, formulation, and solution.	Problem identification, formulation, simplification and solution are an essential part of all problem sets, support class activities, written assignments and quizzes. Students are encouraged to explain their mathematical reasoning in words, not just as symbols.
PE2.2 Understanding of social, cultural, global, and environmental responsibilities and the need to employ principles of sustainable development.	
PE2.3 Ability to utilise a systems approach to complex problems and to design and operational performance.	Wherever appropriate, students are trained in lectures to understand the relative advantages and disadvantages of simplified mathematical models and mathematical techniques.
PE2.4 Proficiency in engineering design.	
PE2.5 Ability to conduct an engineering project.	Students develop an understanding of mathematical models in lectures and many support-class activities.
PE2.6 Understanding of the business environment	
PE3.1 Ability to communicate effectively, with the engineering team and with the community at large.	Students are trained in support classes to write their explanations in a manner that is understandable to their colleagues. This is assessed in assignments.
PE3.2 Ability to manage information and documentation.	Students are encouraged in both lectures and support classes to express themselves clearly, and draw clear diagrams that illustrate their reasoning.
PE3.3 Capacity for creativity and innovation.	In lectures students are encouraged to develop their own approaches to problems from first principles. Support classes and assignments are used to provide individual feedback on such approaches.
PE3.4 Understanding of professional and ethical responsibilities, and commitment to them.	
PE3.5 Ability to function effectively as an individual and in multidisciplinary and multicultural teams, as a team leader or manager as well as an effective team member.	
PE3.6 Capacity for lifelong learning and professional development.	Students are provided with links to supplementary materials on the unit website and encouraged to use other resources on the internet that assist their learning.
PE3.7 Professional attitudes.	

7. Policies

Monash has educational policies, procedures and guidelines, which are designed to ensure that staff and students are aware of the University's academic standards, and to provide advice on how they might uphold them. You can find Monash's Education Policies at:

http://policy.monash.edu/policy-bank/academic/education/index.html

Key educational policies include:

- Plagiarism
  http://policy.monash.edu/policy-bank/academic/education/conduct/plagiarism-policy.html
- Assessment in Coursework Programs
  http://policy.monash.edu/policy-bank/academic/education/assessment/assessment-in-coursework-policy.html
- Special Consideration
  http://policy.monash.edu/policy-bank/academic/education/assessment/special-consideration-policy.html
- Grading Scale
  http://policy.monash.edu/policy-bank/academic/education/assessment/grading-scale-policy.html
- Discipline: Student Policy
  http://policy.monash.edu/policy-bank/academic/education/conduct/student-discipline-policy.html
- Academic Calendar and Semesters
  http://monash.edu/students/key-dates/
- Orientation and Transition
  http://monash.edu/orientation/contacts/index.html
- Academic and Administrative Complaints and Grievances Policy
  http://policy.monash.edu/policy-bank/academic/education/management/complaints-grievance-policy.html
- Graduate Attributes
  http://policy.monash.edu/policy-bank/academic/education/management/monash-graduate-attributes-policy.html

8. Student Services

The University provides many different kinds of services to help you gain the most from your studies. Contact your tutor if you need advice and see the range of services available at

http://monash.edu/students

8.1 Monash University Library

The Monash University Library provides a range of services and resources that enable you to save time and be more effective in your learning and research. Go to

http://lib.monash.edu

or the library tab in my.monash portal for more information.

8.2 Disability Liaison Unit

Students who have a disability or medical condition are welcome to contact the Disability Liaison Unit to discuss academic support services. Disability Liaison Officers (DLOs) visit all Victorian campuses on a regular basis

- Website: http://monash.edu/equity-diversity/disability/index.html
- Telephone: 03 9905 5704 to book an appointment with a DLO;
- Email: dlu@monash.edu
- Drop In: Equity and Diversity Centre, Level 1 Gallery, Building 55, Clayton Campus.