MONASH University

Unit Guide

ENG2005
Advanced engineering mathematics

Semester 2, 2017

Handbook link:
http://monash.edu.au/pubs/2017handbooks/units/ENG2005.html

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Unit handbook information

Synopsis

Advanced matrix algebra: mxn systems, linear independence, sparse matrices, introduction to second-order tensors. Further ordinary differential equations: systems of ODEs, variation of parameters; boundary-value problems. Fourier series: Euler formulae, convergence, half-range series, solution of ODEs, spectra. Further multivariable calculus: change of variables and chain rule, polar coordinates, line integrals; vector fields; del, divergence, curl and Laplacian; surface and volume integrals; Gauss and Stokes theorems. Partial differential equations: simple PDEs, Laplace, heat and wave equations, superposition, separation of variables, polar coordinates. Advanced numerical methods: solution of linear systems, numerical solution of ODEs and simple PDEs, accuracy, efficiency and stability; discrete Fourier transforms, introduction to PS and FE methods.

Mode of delivery

Clayton (Day)
Malaysia (Day)

At Clayton and Malaysian campuses.

Workload requirements

Four 1-hour lectures (or equivalent), one 2-hour practice class and 6 hours of private study per week

The structure of the unit is:

- Three 1- hour lectures
- One 2-hour practice classes
- Two hours of study on advanced numerical modules
- Five hours of private study per week .

The fourth lecture mentioned in the unit handbook is in fact the equivalent of the 2 hours of self study allocated to the advanced numerical modules (at Clayton only).

Students have access to Moodle (**Modular Object-Oriented Dynamic Learning Environment)** where the online information about weekly workload (lecture, assignments, computer labs) is presented in an interactive style.

Unit relationships

Prerequisites

ENG1005 or ENG1091 or equivalent

Prohibitions

ENG2091, MTH2010, MTH2015

Co-requisites

None

Chief Examiner(s)

Dr Alina Donea (Sem 1+2)

Unit Coordinator(s)

Dr Alina Donea (Clayton - Sem 1), Dr John Head (Clayton - Sem 1)
Dr Simon Clarke (Clayton - Sem 2)
Dr Ooi Ean Hin (Malaysia Sem 1 and 2)

Lecturer(s)

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Other staff details

The numerical module of this unit will be run separately.

Unit Coordinator Assistant: Clayton Campus	Coordinator of the Numerical Module: Clayton Campus:	Coordinator of the Numerical Module: Malaysia Campus:
Dr Santiago Barrera, email: santiago.barrera.acevedo@monash.edu	Dr Mark Flegg, email: mark.flegg@monash.edu	Dr Ean Hin Ooi Phone: +60 3 5514 4436 Email: Ooi.Ean.Hin@monash.edu

Academic overview

Learning outcomes

Upon successful completion of this unit, students will be able to:

1. Use essential concepts related to mxn linear systems, including linear independence and basis, and demonstrate a broad appreciation of tensors
2. Solve systems of simple ordinary differential equations, establish and use their eigenvalues, solve simple second-order boundary-value problems
3. Represent a periodic function with a Fourier series, determine their convergence, calculate even and odd series, and apply these to solving simple periodic systems
4. Perform change of variables for multivariable functions with the chain rule, use polar coordinates, represent 2D and 3D curves parametrically and solve line integrals on these curves
5. Manipulate and evaluate double and triple integrals in Cartesian, cylindrical and spherical coordinates
6. Calculate the gradient, divergence and curl vector operations, and apply these in the evaluation of surface and volume integrals through the Gauss and Stokes theorems
7. Solve elementary partial differential equations, apply boundary and initial conditions as appropriate, and use the method of separation of variables with the wave equation, heat equation and Laplace's equation
8. Appreciate key issues related to the numerical solution of full and sparse linear systems
9. Apply a range of suitable techniques for the numerical solution of ODEs, including using discrete Fourier transforms, PS and FE methods
10. Use a range of suitable simple numerical techniques for the solution of PDEs and appreciate their advantages and disadvantages
11. Use MATLAB and other appropriate software to assist in understanding these mathematical techniques
12. Express and explain mathematical techniques and arguments clearly in words.

Teaching approach

ENG2005 is taught using a combination of lectures, support classes and computer laboratories. At the Clayton campus casual assistance is also available through the Mathematics Learning Centre in 9, Rainforest Walk or consultation times with your lecturers. The unit will have all lectures audio /videos recorded. Also, students are encouraged to watch short videos before the **lecture** session, to revise previous material and become familiar with the learning outcomes of the lecture. Time is devoted in lecture to new concepts, examples and discussions. Complementary videos related to each mathematical topic (demonstrations of mathematical problems) will be available on

Moodle to enhance the learning experience of students. Recorded (video) information from lectures is also available via Moodle. The lecture notes, the problem sets and the tasks for each numerical module are made available on the Moodle website for ENG2005. Assignments will be posted also on Moodle.

There will be thirty six lectures in Semester 2, held weekly depending on the day of the week of the timetabled lectures.

Written lecture notes will be made available, after lectures, on the Moodle site, under the corresponding mathematical topic.

Students should aim to attend: every lecture in order to gain full advantage of the teaching and use the recordings to check on any points that they missed.

Students are also expected to attend:

- one two-hour support class per week from **the second** week of semester. The support classes are intended to help students gain assistance with the theory described in lectures and the practice exercises given on the 'problem sets'. Quizzes and assignments alternate. Quizzes will happen in the practice classes. Each student will have about 11 support classes for ENG2005 weeks 2-12.
- one hour computer laboratory per fortnight (on either odd or even weeks on Monday-Wednesday) from the **second** week of semester. The computer laboratories are intended to help students with the numerical modules. Students **will be assessed on the numerical modules** which are due at the end of weeks 3, 5, 7, 9 and 11.

Optional drop-in sessions each week on Thursday and Friday will be made available for students requiring additional assistance learning the material for the computer modules.

At Clayton campus there are many different support classes each week (as well as options for computer laboratories) and you will be assigned to a particular class though Allocate+ at http://allocate.timetable.monash.edu. If your circumstances change you can alter your initial allocation no later than the end of Week 3. Once you have been allocated to a particular support class (or laboratory) you must attend only that support class.

Feedback to you

Feedback is provided to ENG2005 students in a variety of ways during the semester, to assist their learning and help them identify the issues for which they may need to seek further assistance. This includes through:

- **Consultation Times:** individual or group consultations at the lecturer's weekly consultation hours, at other times by appointment via email;
- **Support classes:** individual and group consultations and discussion with staff during the weekly support classes;

- **Computer Laboratories:** individual and group consultations with demonstrator during the weekly labs;
- **Mathematics Learning Centre:** assistance through the Mathematics Learning Centre (MLC) for mathematical questions (no assistance with the numerical modules can be provided)
- **Short Assignments:** written feedback on the five assignments submitted to your tutor, is usually marked and returned at the next week support class with sample solutions available on Moodle. All assignments will be released via the Moodle webpage.
- **Short Quizzes:** five short quizzes in the last 20 minutes of your support class, designed to be run every two weeks; the marked quiz returned at the next class
- **Lectures:** encouraging students to ask questions in or after lectures
- **ENG2005 Forums:** on Moodle.

In particular, it is also strongly recommended that you take full advantage of the assistance and feedback provided in the support classes for ENG2005.

If you are having any sort of difficulties consult the appropriate staff (your support class tutor, your lecturer or your campus unit coordinator) as soon as possible after you become aware of the difficulty.

See http://www.monash.edu.au/students for information on some of the support services available within the university.

Important unit information: ***No marks can be carried across from a previous enrolment in the unit.***

Assessment summary

Weekly assignments, quizzes or exercises: 40%
Examination (3 hours): 60%
Students are required to achieve at least 45% in the total continuous assessment component and at least 45% in the final examination component and an overall mark of 50% to achieve a pass grade in the unit. Students failing to achieve this requirement will be given a maximum of 45% in the unit.

Week	Weekly Theory Assessment (% marks)	Numerical Module (NM)	Numerical Module Deadlines
1	No support classes in Week 1. Assignment 1 released.	Students set up Matlab on home computers and familiarize with NM requirements.	No deadlines this week
2	Quiz 1 (2%) in last 20 minutes in your allocated support class.	Module 1 even week labs	No deadlines this week

3	Assignment 1 (3%) to be submitted to your tutor. Assignment 2 released.	Module 1 odd week labs	Module 1 codes submitted online by Friday, 11:10 pm (time).
4	Quiz 2 (2%) in last 20 minutes in your allocated support class.	Module 2 odd week labs	Module 1 results on Gradebook prior to lab
5	Assignment 2 (3%) to be submitted to your tutor. Assignment 3 released.	Module 2 even week labs	Module 1 results on Gradebook prior to lab Module 2 codes submitted online by Friday, 11:10 pm (time).
6	Quiz 3 (2%) in last 20 minutes in your allocated support class.	Module 3 odd week labs	Module 2 results on Gradebook prior to lab
7	Assignment 3 (3%) to be submitted to your tutor. Assignment 4 released.	Module 3 even week labs	Module 2 results on Gradebook prior to lab Module 3 codes submitted online by Friday, 11:10 pm (time).
8	Quiz 4 (2%) in last 20 minutes in your allocated support class.	Module 4 even week labs	Module 3 results on Gradebook prior to lab
9	Assignment 4 (3%) to be submitted to your tutor. Assignment 5 released.	Module 4 odd week labs	Module 3 results on Gradebook prior to lab Module 4 codes submitted online by Friday, 11:10 pm (time).
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10	Quiz 5 (2%) in last 20 minutes in your allocated support class.	Module 5 even week labs	Module 4 results on Gradebook prior to lab
11	Assignment 5 (3%) to be submitted to your tutor.	Module 5 odd week labs	Module 4 results on Gradebook prior to lab Module 5 codes submitted online by Friday, 11:10 pm (time).
12			Module 5 results on Gradebook prior to Friday, 11:10 pm (time).

Assessment requirements

Assessment tasks

Quizzes and Assignments run alternatively, from week 2 till week 11 inclusive. Students are not permitted to resit quizzes or resubmit assignments for ENG2005. Strict deadlines are imposed with continuous assessments (quizzes, assignments, numerical module).

Quizzes: There are 5 quizzes for the theoretical part of the unit. Each quiz is worth 2% of the final mark. *The quizzes will run for 20 minutes at the end of each 2-hour support class.*

The intention of the quizzes is to assist students in keeping up with and understanding the lecture material, and to provide feedback on their performance. Sample solutions are not provided. If you are unsure about the correct answer, please ask your support class leader to explain how the correct answer is obtained preferably during the support class at which it is handed back to you. Calculators are not permitted in quizzes, but formula sheets are provided if needed. Different quizzes will be set for different support classes, and you must normally complete the work that is assigned for the support class in which you are enrolled.

Assignments: There are 5 assignments to be completed during the semester. The assignments are due for submission every two weeks (read the assessment unit time table). All assignments will be released via the Moodle webpage. *All assignments must be submitted in your support class, to your allocated tutor.* Each assignment is worth 3% of the final mark. Electronic submission of assignments will not be accepted under any circumstances. Assignments must be submitted in hard copy with a signed cover sheet **at the start** of your allocated support class .

The intention of the assignments is to assist students in keeping up with and understanding the lecture material, and to provide feedback on how to express themselves both mathematically and in written English. Sample solutions are provided on Moodle. To be successful in this unit, students must be able to express a written mathematical argument clearly, using appropriate wording along with mathematical symbols and notation. It is not just the correct answer that is important, but also a clear and logical explanation for how it was obtained. In accordance with university policy, all assignments must include a signed cover sheet (available on Moodle). While every care is taken, it is strongly recommended that you make a copy of your assignment for your records before it is submitted, for example on a scanner or your smartphone. Students who have previously attempted ENG2005 must complete all assessment work again. No marks can be carried across from a previous enrolment in the unit.

Numerical modules:

There are 5 numerical modules in total. Students are expected to complete all the numerical modules using resources that will be provided on Moodle and with the assistance of their laboratory demonstrator. All the modules will be assessed electronically and feedback given in the computer labs. There is a fortnightly deadline for students to submit their MATLAB codes on Moodle. Watch the fortnightly announcement on Moodle (under advanced numerical methods) about deadlines and assessments in each fortnight. Any adjustments or clarifications of these procedures will also be announced on Moodle, so please check the latest announcements carefully. If the student disagrees with their mark for a given module, it is the responsibility of the student to show demonstrators the running MATLAB code that they uploaded to Moodle on the machine they are working on. This can be a computer in the lab or a personal computer. Students are encouraged to challenge their grade for each module if they disagree since the Modules will be marked with the partial aid of computer scripts which may contain some bugs. In the event that student and demonstrator cannot agree, the dispute will be settled by coordinator of the numerical

modules. In such a situation, based on the judgement of the coordinator, students may be awarded more marks or less marks.

The assessment of the numerical part is based on a pass/fail/DNC method (the demonstrator will check if the MATLAB code for each lab problem is running correctly and if the results are correct). Pass means that the work shows a satisfactory completion of all objectives of the module. Fail indicates an unsatisfactory performance in the compulsory components. Did not complete (DNC) will be given to a student who fails to hand in a their submission online by the due date or their code does not show any serious attempt at answering the module questions.

Late assessment: Under special consideration (strict rules), students may be assessed in the following week. Only the unit coordinator of the numerical module, can approve late assessments. For medical reasons, a doctor certificate should indicate that the student is incapable of using a computer for a period of at least one week within the module period. Computer codes submitted or presented in other ways other than via the Moodle system are not accepted and Moodle will be electronically disabled for submissions at the due date and time for each Module.

Additional support: At Clayton campus students can seek help on their numerical modules from demonstrators in their allocated computer lab sessions. At Malaysia campus, the computer labs may only be used for assessment feedback, as there is a space limitation. Students at Malaysia campus may seek consultation from the unit coordinator, Dr Ooi. All students are encouraged to utilise the Moodle forum for advanced numerical methods to discuss their works with their fellow students. The forum is moderated by unit coordinators. Selected questions related to numerical modules will be addressed in the forum.

Video tutorials: A series of module specific MATLAB tutorial videos will be placed on Moodle to further assist the learning of students. Keep an eye out for those if you require additional assistance.

Numerical module coordinator: The numerical module coordinator at Clayton is Dr Mark Flegg (mark.flegg@monash.edu). For Malaysian specific numerical module issues, coordinator Dr Ooi Ean Hin (ooi.ean.hin@monash.edu) is the local contact person.

Important

It is acknowledged that students can assist their learning by discussing difficulties and helping each other to solve problems. However, there are limits to which they should assist each other in assessed work without it being considered to be 'inappropriate collusion' or cheating. It is therefore expected that all students should complete all final assessed work for ENG2005 individually and in their own words. Among other things, markers (and our automatic computer scripts) will be looking specifically for instances where the wording of submitted work is very similar and where there are identical errors in algebraic working or logic. Markers may also assess work across multiple classes. ***Instances of suspected cheating will be dealt with seriously, in accordance with Faculty and University policies.*** Note that penalties may apply for the late submission of work please see the section 'Extensions below. and penalties'.

Errors in marking or recording grades

Efforts are made to ensure that marks for assignments, quizzes are awarded as consistently as possible across the various support classes and markers. If you feel that an error may have been made in the marking of any assessment, for example missed, working or incorrect addition of marks, you should discuss that with your support-class leader initially. It is also your responsibility to check in a timely manner that the correct mark for the work has been recorded on Moodle, and

to query that with your support-class leader initially. In accordance with Faculty of Science policy, this should be done no later than two weeks after the return of that work. If you are not satisfied with the response by your support-class leader you may contact the Chief Examiner of the unit (listed on the front page) to arrange a meeting.

Examination(s)

Continuous assessment: 40%
Examination (3 hours): 60%

- Work during semester determines 40% of the final unit mark for ENG2005, with the remaining 60% based on results from the three-hour final examination, to be held in the university examination period at the end of semester. *Note that calculators are not permitted in the final examination.*

- **Students are required to achieve at least 45% in the total continuous assessment component and at least 45% in the final examination component and an overall mark of 50% to achieve a pass grade in the unit.** Students failing to achieve this requirement will be given a maximum of 45% in the unit.

Applications for special consideration

The purpose of Special Consideration is to give a student, whose work for a particular piece of assessment has been adversely affected by exceptional circumstances beyond their control, a further opportunity to demonstrate their ability.

For matters related to special consideration, personal circumstances please first read the special consideration policy: http://www.monash.edu/policy-bank/academic/education/learning-and-teaching/special-consideration-procedures. It is based on the Monash University policy and procedures for Special Consideration and it is the student's responsibility to read and understand the information. If you feel you satisfy the criteria under the special consideration policy then contact directly the *Malaysia Unit Coordinator or the Clayton Unit Coordinator Assistant* (as appropriate).

See also http://www.monash.edu.au/exams/special-consideration.html for university information.

A student whose work during a teaching period or whose performance in an examination or other assessment has been affected by acute illness or other exceptional cause beyond their control may apply in writing to the relevant Faculty for special consideration.

The accepted causes are:

- *acute illness* – e.g. hospital admission, serious injury, severe asthma, severe anxiety or depression. This does not include minor illness such as a mild cold.
- *loss or bereavement* – e.g. death of a close family member.
- *family relationship breakdown*.
- *hardship/trauma* – e.g. victim of crime, sudden loss of income or employment, severe disruption to domestic arrangements.

Students must lodge applications for in-semester special consideration related to the continuous assessment, with the appropriate documentation and evidence, by the relevant method:

- for special consideration, no later than two University working days after the due date of the affected assessment.
- students may lodge an application for early approval of a deferred assessment until five University working days before the examination for which special consideration is sought.

Assignment submission

The assignments are due fortnightly (Assignment 1 will be released in Week 1, and is due in Week 3, Assignment). Read the assessment table for details for each assignment. They should be submitted to your allocated tutor in your support class.

If you are unable to attend your normal support class for any good reason (under special considerations) then your assignment should be submitted to the unit coordinator in person or under the office door, and write the date and time of submission on the cover sheet. Penalties will apply for later submission. Email submission of assignments is not accepted.

Unit schedule

The table below shows the planned schedule of activities and assessment for this unit but from time to time it may be necessary to adjust this for operational reasons. Please listen for announcements in lectures and/or check official announcements on Moodle regularly.

Week	UNIT SCHEDULE (guide only) Lectures	Assessment
1	1. Linear nxn and mxn systems of equations 2. Free and basic variables, solution spaces, LU-decomp 3. Eigenvalues and eigenvectors, including multiple and complex values	
2	1. Cartesian tensors, properties, simple examples 2. Partial derivatives, 2D chain rule, along curves, change of coordinates (eg linear, polar) 3. Double integrals, change of order of integration, Jacobian, polar coordinates	**Quiz 1**: basic linear algebra
3	1. Triple integrals, order of integration, applications to centre of mass, moment of inertia 2. Triple integrals in cylindrical and spherical polar coordinates 3. Vector functions: scalar fields, vector fields in 2D and 3D.	**Assignment 1**: EigenValues /Eigenvectors Chain rule
4	1. Tangents to curves, arc length of a curve 2. The del operator, grad, div, Laplace operator, curl 3. Line integrals and applications, conservative fields, energy, path independence	**Quiz 2**: Double Integrals
5	1. Curves on a surface or surface element, orientation /visualisation 2. Surface area of curved surfaces, examples and visualisation 3. Surface flux integrals, Integration of a scalar field over a curved surface	**Assignment 2:** Triple Integrals, Scalar and Vector fields
6		**Quiz 3**:

	1. Divergence (Gauss) theorem; applications 2. Stokes theorem and applications 3. Path independence and Greens theorem in the plane	Line integrals, Arc length of a curve
7	1. Periodic functions (rectified, sawtooth) 2. Fourier series and Fourier coefficients (real), examples for simple 2π-periodic functions 3. Fourier series of arbitrary period, further examples, convergence	**Assigment 3**: Surface area, Surface flux integrals of curves surfaces
8	1. Fourier cosine and sine series, half-range expansion of non-periodic functions 2. Application to forced oscillations, harmonics and energy theorem 3. Homogeneous second-order ODEs, linear independence, Wronskian, general solution	**Quiz 4**: Divergence or Stokes or Green's Th
9	1. Non-homogeneous first and second-order ODEs 2. Systems of linear ODEs, convert to second-order form, using eigenvalues/eigenvectors 3. Boundary value problems in second order ODE; method of separation of variables	**Assignment 4**: Fourier series coefficients of simple 2 pi periodic functions
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10	1. Partial differential equations. Linear PDEs 2. Advection and Wave equations; (linear) characteristics and D'Alembert's solution 3. Wave equation, discussions and applications	**Quiz 5**: Homogeneous ODE, Wronskian
11	1. Heat equation by separation of variables part I - finding general solution in rectangle 2. Heat equation by separation of variables part II - insulating BCs 3. Laplace equation by separation of variables in Cartesian coords	**Assignment 5**: PDE
12	1. Laplace equation by separation of variables in polar coords	

	2. Further examples and applications of second-order PDEs 3. Revision	
13	SWOT VAC	none

Module number	**Advanced numerical methods (Self-directed - 12 lectures equivalent)**
1 (weeks 2 and 3)	Primer on MATLAB and linear systems
2 (weeks 4 and 5)	Numerical methods for initial value problems and boundary value problems
3 (weeks 6 and 7)	Introduction to Fast Fourier Transforms and Pseudo-Spectral Method for ODEs
4 (weeks 8 and 9)	Numerical methods for hyperbolic and parabolic PDEs
5 (weeks 10 and 11)	Numerical methods for Elliptic PDEs and the Finite Element Method

Due topublic holidays in Malaysia, some topics will be delivered in the following lecture, with ample material available online (videos taken by lecturers)

Your feedback to us

One of the formal ways students have to provide feedback on teaching and their learning experience is through the Student Evaluation of Teaching and Units (SETU) survey. The feedback is anonymous and provides the Faculty with evidence of aspects that students are satisfied with and areas for improvement.

Previous student evaluations of this unit

In response to previous SETU results of this unit, the following changes have been made:

Based on the feedback received from students:

- We make now available videos with more worked examples based on the maths concepts introduced during lectures.
- Moodle site is now interactive, with a variety of resources available for different student learning style; we encourage to participate in the small online questions in Moodle (effort is rewarded)
- Quizzes and assignments are run now alternatively every two weeks, with more marks allocated for assignments.
- The Unit coordinator will have also the role of a roaming tutor, aiming at visiting all support classes, to help and listen to students feedback on this unit.

If you wish to view how previous students rated this unit, please go to;
https://unitevaluations.connect.monash.edu.au/unitevaluations/index.jsp

Unit resources

Learning resources

Monash Library Unit Reading List (if applicable to the unit):
http://readinglists.lib.monash.edu/index.html

Required resources

Students generally must be able to complete the requirements of their course without the imposition of fees that are additional to the student contribution amount or tuition fees. However, students may be charged certain incidental fees or be expected to make certain purchases to support their study. For more information about this, refer to the Higher Education Administrative Information for Providers, Chapter 18, Incidental Fees at http://education.gov.au/help-resources-providers

Recommended resources

The recommended text for ENG2005 is the very popular book by: Erwin Kreyszig,

Advanced Engineering Mathematics 10th edition. John Wiley & Son Inc. 2011.

The book can be purchased in three forms:

1. E-Text (E-texts are not available through campus bookshops)
2. Binder Ready
3. Text (bookstore)

Technology requirements

Students must regularly check Moodle for announcements. The unit coordinator will send general email to students about the content taught in lectures and warn about future assessments, and also suggest interesting material to read.

The Moodle site has pre-lecture reading material and post-lecture thoughts, which help with the learning outcomes.

Required Software (and/or hardware)

1. Students will use MATLAB to assist in understanding the numerical module aspect of this unit

Alina Donea will use Java Applets, and cdf Mathematica notebooks. To access *Mathematica* notebooks (available on moodle), you can download the free cdf viewer from http://www.wolfram.com/cdf-player/ (available for linux, mac, and windows). This will allow you to view the text and images, run the animations, and use the manipulators. You won't be able to evaluate new *Mathematica* code though. If you wish to install the full version of *Mathematica* instead, see the instructions on the ENG2091 moodle page.

You may find it helpful to use a calculator, graphic software or computer algebra software to help with some calculations for the assignment (how all your work if you do that, explain all steps), but ***Note that the use of calculators is not allowed in test and in the final examination*.**

Other information

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

Graduate Attributes Policy

http://www.monash.edu/policy-bank/academic/education/course-governance-and-design/course-design-policy

Student Charter

http://www.monash.edu/students/policies/student-charter.html

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://www.monash.edu/students

http://www.monash.edu.my/student-services/

Monash University Library

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

Go to http://www.monash.edu/library or http://www.lib.monash.edu.my/ or the library tab in http://my.monash.edu portal for more information.

Disability Support Services

Students who have a disability, ongoing medical or mental health condition are welcome to contact Disability Support Services.

Disability Support Services also support students who are carers of a person who is aged and frail or has a disability, medical condition or mental health condition.

Disability Advisers visit all Victorian campuses on a regular basis.

- Website: monash.edu/disability
- Telephone: 03 9905 5704 to book an appointment with an Adviser;
- Email: disabilitysupportservices@monash.edu
- Drop In: Level 1, Western Annexe, 21 Chancellors Walk (Campus Centre) Clayton Campus

For students at Malaysia campus, please contact the Student Wellbeing and Activities Office located in Building 2, Level 2, Room 2238.
http://www.monash.edu.my/student-services/wellbeing-and-activities/disability-support

Plagiarism, cheating and collusion

Monash University has strict policies on plagiarism, cheating and collusion, and the penalties can be severe. Full details of the policy can be found at:
http://www.policy.monash.edu/policy-bank/academic/education/conduct/student-academic-integrity-policy.html

Extensions and penalties

Late assignment submissions for this unit may be accepted but will be penalised at 10% of the maximum mark per calendar day (or part thereof), in accordance with the Faculty of Science '*Penalty for late submission of work for assessment policy'* at http://intranet.monash.edu.au/science/staff/education/policies-procedures/late-submission.html

Late Submission:

In accordance with faculty policy, late submission of assignments will normally be penalised at 10% of the maximum mark per calendar day (~1% per two-hour period, including over weekends) until the time when solutions are published on Moodle, after which a zero mark is awarded Students with a valid reason for late submission of an assignment must provide the Unit /Campus Coordinator at their campus with originals (and a copy) of appropriate documentation as soon as practicable after the normal deadline.
Support-class leaders are not authorised to approve extensions to assignment submission deadlines. See also http://www.monash.edu.au/exams/special-consideration.html for university information.

Other unit information

The lecturers will use an electronic tablet or just overhead projectors to write notes. The lectures will be audio and video recorded too. These written notes will be available after each lecture on Moodle.

For additional maths problems linked to the problem sets (see below), we will provide a list of suggested worked examples from Kreyszig's book. So if you want to know more about the materials studied in this unit or you want to have more practice, you will need to have access to this books. Some copies are available in the library or available online, but there are around 600 students enrolled in ENG2005 this semester in two campuses, so you may find it easier to purchase your own copy if you need more practice.

Problem Sets

The 'problem sets', with practice exercises for the material covered in lectures, can be found in as a separate book, covering the six major topics in the unit. Answers to these problems can be found immediately following each problem set. Additional exercises can also be found in the relevant sections of the textbooks. Limited solutions will be made available online.

Advanced Numerical Modules:

The pdf instructions on how to run each numerical module are on Moodle, under the topic: **"Advanced Numerical Modules".**

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 ENG2005). No information on the numerical modules will be provided at MLC. The Mathematics Learning Centre is located in on the ground floor of 9 Rainforest Walk (Mathematics Building) at the Clayton campus and it is open from week 2 of semester on Monday to Friday from noon-2 pm. No appointment is necessary.

INFORMATION FOR MALAYSIA

ACADEMIC OVERVIEW

Program Education Objectives

The Engineering programme expects to produce graduates, who

1. have successful careers in Engineering
2. engage in multicultural and globalized engineering teams
3. demonstrate career progression towards senior management and leadership positions

Program Outcomes

The Mechanical Engineering has developed a set of Program Outcomes (POs) for all of its graduates based on the Malaysian Engineering Accreditation Council's manual.

Program Outcomes	Activities used in this unit to develop program outcomes
PO1 Engineering knowledge: Apply knowledge of mathematics, natural science, engineering fundamentals and specialization in Engineering to the solution of complex engineering problems.	The lectures, teaching materials and support-class activities develop and assess students' knowledge of mathematics and analysis techniques.
PO2 Problem analysis: Identify, formulate, survey research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.	NA
PO3 Design/Development of solutions: Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	NA
PO4 Research-based investigation of systems: Conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.	NA
PO5 Modern tool usage: Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering problems, with an understanding of the limitations.	Students undertake a self-directed numerical module that requires them to use Matlab to implement the different numerical methods of the unit.
PO6 Engineers and society: Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex engineering problems.	NA
PO7 Environment and sustainability: Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex engineering problems in societal and environmental contexts.	NA
PO8 Professional ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.	NA
PO9 Communication: Communicate effectively on	NA

complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	
PO10 Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.	NA
PO11 Lifelong learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	NA
PO12 Project management and finance: Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	NA

Relationship between Unit Learning Outcomes and Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
LO1	X											
LO2					X							
LO3	X											

Key			No emphasis
	X		Emphasized and assessed in the unit

Mapping of LOs between handbook LOs (LC) and Malaysia OBE LOs

	LC1	LC2	LC3	LC4	LC5	LC6	LC7	LC8	LC9	LC10	LC11	LC12
LO1	X	X	X	X	X	X	X					
LO2								X	X	X	X	X
LO3								X	X	X		X

Relationship between Unit Learning Outcomes and Assessments

No.	Learning Outcomes	Assessment

		Quiz	Assignment	Final exam
1	Apply concepts of vector calculus, periodic functions, separation of variables, matrix solution techniques, Fourier series solutions and ODE solution principles to solve mathematical and Engineering problems.	C2	C3	C6
2	Write, develop and optimize computer codes for the numerical methods using Matlab to solve mathematical problems of the unit		P3	
3	Select appropriate numerical algorithm to solve mathematical problems.			C1

The topics to be assessed can vary depending on how the semester is run.

Bloom's Taxonomy:

Three domains of educational activities have been identified under the general taxonomy known as Bloom's.

- **Cognitive**: mental skills (*Head*)
- **Affective**: growth in feelings or emotional areas (*Heart*)
- **Psychomotor**: manual or physical skills (*Hand*)

The *cognitive* domain involves **knowledge** and the development of intellectual skills. This includes the recall or recognition of specific facts, procedural patterns, and concepts that serve in the development of intellectual abilities and skills.

The *affective* domain includes the **attitudes** with which someone deals with things emotionally, such as feelings, values, appreciation, enthusiasms and motivations.

The *psychomotor* domain includes physical movement, coordination, and use of the motor-skill areas. Development of these skills requires practice and is measured in terms of speed, precision, distance, procedures, or techniques in execution.

Key for the table above:

Level	Category
C1	Remembering: Recall or retrieve previous learned information.
C2	Understanding: Comprehending the meaning, translation, interpolation, and interpretation of instructions and problems. State a problem in one's own words.
C3	Applying: Use a concept in a new situation or unprompted use of an abstraction. Applies what was learned in the classroom into novel situations in the work place.
C4	Analyzing: Separates material or concepts into component parts so that its organizational structure may be understood. Distinguishes between facts and inferences.
C5	Evaluating: Make judgments about the value of ideas or materials.

C6	Creating: Builds a structure or pattern from diverse elements. Put parts together to form a whole, with emphasis on creating a new meaning or structure.

Teaching Approach

1. Three hours lecture per week: To introduce the mathematical theories to the students. Replacement classes will be held on days when the scheduled lecture falls on a public holiday.
2. Two hours tutorial per week: To show some examples of how to apply the mathematical theories learnt from the lectures.
3. Complementary recorded lectures will be uploaded to help students to revise. However, note that recorded lectures are **NOT** substitutes for attending lectures or reading the lecture notes.
4. **Minimum** of seven hours of independent study per week: Self-study by the students.

Numerical Module

1. One hour lecture per week: To introduce the theory and concept pertaining to the numerical module to be covered on that particular week.
2. The numerical module is a **self-directed** module and students are expected to download the reading materials from Moodle and to answer all Problems.
3. If students have any questions regarding the module, they may seek consultation either from the unit coordinator Dr Ooi, Dr Chang **OR** by posting their questions in a specialized forum in Moodle.
4. Students must submit their codes/solutions in two forms, i.e. the *.m file and the PDF containing responses to the solutions, online via the Moodle webpage according to the assessment table shown below.

Assignment submission

1. All assignments are due fortnightly from the dates they are released in Moodle.
2. All submissions must be done during the tutorial classes. Submission to assignment boxes or to the Lecturer/Tutor outside of the allocated tutorials will not be accepted without a valid reason.
3. Students whose tutorials fall on a public holiday during the week of Assignment submissions will submit their assignment through an allocated Assignment box.

Assessment summary (Malaysia campus)

Week	Assessment (Support class)	Assignment	Numerical Module (NM)	NM deadlines
1 (24 Jul)	No support class	Assignment 1 released	Student familiarize with Matlab and NM requirements	
2 (31 Jul)	Quiz 1 (2%)		Module 1 released	
3 (7 Aug)	Assignment 1 submission (4%)	Assignment 2 released		Module 1 codes submission by 11 Aug 11.10pm

4 (14 Aug)	Quiz 2 (2%)		Module 2 released	
5 (21 Aug)	Assignment 2 submission (4%)	Assignment 3 released		Module 2 codes submission by 25 Aug 11.10pm
6 (28 Aug)	Quiz 3 (2%)		Module 3 released	
7 (4 Sep)	Assignment 3 submission (4%)	Assignment 4 released		Module 3 codes submission by 8 Sep 11.10pm
8 (11 Sep)	Quiz 4 (2%)		Module 4 released	
9 (18 Sep)	Assignment 4 submission (4%)	Assignment 5 released		Module 4 codes submission by 22 Sep 11.10pm
Mid semester break				
10 (2 Oct)	Quiz 5 (2%)		Module 5 released	
11 (9 Oct)	Assignment 5 submission (4%)			Module 5 codes submission by 13 Oct 11.10pm
12 (16 Oct)				

*Arrangements will be made for quizzes for students whose tutorial classes fall on a public holiday.