MONASH University

Unit Guide

ENG1090
Foundation mathematics

Semester 2, 2017

Handbook link:
http://monash.edu.au/pubs/2017handbooks/units/ENG1090.html

Note to students:
It is your responsibility to read this Unit Guide carefully, especially in regard to the expectations and assessment requirements for ENG1090. Please treat it as a detailed description of how the unit will run this semester, and consult it first when unsure how to act or who to contact. You must also check the Moodle site regularly, and take note of all official announcements during the semester.

The first assessed work for ENG1090 is a quiz held in your allocated support class (tutorial) in week 2, covering revision material from prerequisite studies and counting 3.75% towards the final unit mark. Please see the Moodle announcement during week 1 for details.

Final version: 14 July 2017 (no changes since first posted)

Table of contents

Unit handbook information

Synopsis

Functions and coordinate geometry: types of functions, composite functions, inverse functions, modelling of periodic phenomena with trigonometric functions. Complex numbers. Differentiation and integration: concepts and techniques, applications to related rate of change and optimisation problems, areas, volume, and centre of mass. Vectors in two- and three-dimensional space, application to motion and kinematics.

Mode of delivery

Malaysia (Day)

Workload requirements

Three 1 hour lectures (or equivalent), one 2 hour practice class and 7 hours of private study per week

Unit relationships

Prerequisites

Mathematical Methods (CAS)

Prohibitions

MTH1020

Co-requisites

None

Chief Examiner(s)

[Associate Professor Michael Page](#)

Unit Coordinator(s)

[Associate Professor Michael Page](#) (Clayton), [Associate Professor Rajendran Parthiban](#) (Malaysia)

Lecturer(s)

Name: Ms Lily Wong, Room 5-4-23

Campus: School of Engineering, Monash University Malaysia
Phone: N/A
Email: Lily.Wong@monash.edu
Consultation hours: Monday 10-11am

Academic overview

Learning outcomes

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

1. Demonstrate understanding of the properties of common functions and their graphs, use composition of functions, and inverse functions; use trigonometric functions to model periodic behaviour.
2. Represent complex numbers in Cartesian, polar and exponential forms, and on the complex plane.
3. Perform arithmetic and algebra on complex numbers, including finding powers and complex roots of polynomials.
4. Demonstrate understanding of the concepts of limit, continuity, differentiable and integrable functions.
5. Evaluate limits of piecewise functions, and of rational functions at infinity.
6. Use differentiation rules to find derivatives of implicit and explicit functions.
7. Apply differentiation techniques to related rates of change problems and optimisation problems.
8. Use simple integration techniques to find definite and indefinite integrals, including by substitution and partial fractions.
9. Apply integration techniques to calculate areas, average values, volumes, and centres of mass or moment.
10. Perform operations with two and three-dimensional vectors, interpret them geometrically, calculate dot products, find vector resolutes, and apply them to motion of a particle.
11. Solve kinematics problems, and set up and solve problems involving Newton's laws of motion.
12. Express and explain mathematical techniques and arguments clearly in words.

Teaching approach

ENG1090 is taught using a combination of lectures and support classes (tutorials).

There will be thirty three one-hour lectures with normally three one-hour lectures per week. The ENG1090 lectures at the Malaysia campus are presented in lecture theatre 6006 on Mondays at 4-6pm and in lecture theatre 6005 on Tuesdays at 11am-noon. Students are advised to attend every lecture in order to gain full advantage of the teaching and only use the printed materials on Moodle as a fallback to check back on any points that they missed.

Students are also expected to attend one two-hour support class (tutorial) per week from the second week of semester (commencing Thursday 3 August). These support classes are intended to help students gain assistance with the theory described in lectures and the practice exercises

provided on the 'problem sets' – see under 'Learning resources' below for additional details. Most students will have eleven support classes for ENG1090 over weeks 2-12.

Feedback to you

Feedback is provided to ENG1090 students 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:

- individual and group consultations with staff during the weekly two-hour support classes;
- written feedback on five short hand-written assignments submitted at some support classes, usually marked and returned at the next class with sample solutions on Moodle;
- six short quizzes in some support classes with the marked quiz returned at the next class;
- encouraging students to ask questions during or after lectures;
- individual or group consultations at the Lecturer's office during their weekly consultation hours, at other times by appointment via email;
- prompt responses to administrative and curriculum queries via the ENG1090 discussion groups on Moodle;
- timely responses by the Lecturer to emails on individual/private matters (only).

In particular, it is also strongly recommended that all ENG1090 students take full advantage of the individual assistance and feedback provided in the support classes. The style of teaching and learning at university is different from that at school, and students are expected to take responsibility for their own learning – in most cases, *no one will be keeping a close eye on you*. This is not just true in this unit, but also most other units offered at any university! Assistance is available, but you need to seek it out.

Assessment summary

Weekly assignments or quizzes: 40%
Final 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.

Assessment task	Value	Week due:	Submitted via:
Quiz 1* (20 mins, on 'Background material')	3.75%	week 2*	support class 1
Assignment 1	3.5%	week 3	support class 2
Quiz 2 (20 mins, on weeks 1-2)	3.75%	week 4	support class 3
Assignment 2	3.5%	week 5	support class 4

Quiz 3** (20 mins, on weeks 3-4)	3.75%	week 6**	Monday 28 August in 6006
Assignment 3	3.5%	week 7	support class 6
Quiz 4 (20 mins, on weeks 5-6)	3.75%	week 8	support class 7
Assignment 4***	3.5%	week 9***	support class 8
Quiz 5 (20 mins, on weeks 7-8)	3.75%	week 10	support class 9
Assignment 5	3.5%	week 11	support class 10
Quiz 6 (20 mins, on weeks 9-11)	3.75%	week 12	support class 11
Final examination (3 hours)	60%	Examination period	
Total assessment	**100%**		

The first assessment for ENG1090 is a quiz held in the first support class in week 2, covering prerequisite mathematics knowledge (as listed on the 'Background material' sheet on Moodle).
** *As the normal support classes in week 6 fall on university holidays, Quiz 3 will be held at 5.30 pm in the Monday lecture on that week.*
*** *Students whose normal support class falls on a university holiday (such on Friday 22 September) must hand in their assignment to the Lecturer by 2.45pm on the previous working day.*

Non-submission of assessed work

If you are unable to complete any assessed tasks for this unit, for reasons outside of your control, please read carefully the section below on 'Applications for special consideration'. In accordance with University policy, these must be submitted in a timely manner. See also the section 'Extensions and penalties' towards the end of this Unit Guide.

Use of calculators in ENG1090

One of the objectives of ENG1090, and indeed university-level studies in general, is to help students improve their knowledge and develop a sound understanding of the material in the syllabus. Final answers for some of the problems covered in ENG1090 can often be obtained using calculators (and/or software such as Mathematica or online resources such as 'Wolfram Alpha'), but unfortunately that can encourage a misleading and superficial 'understanding' of the basis or meaning of that answer. For this reason and others, the use of calculators (and extensive formula sheets) is not encouraged or expected in university-level mathematics units, and they are not permitted in quizzes or the final examination in ENG1090. If you already have a suitable calculator and know how to operate it, you may wish to make use of it (or other software) to double-check your answers to questions on the problem sets, but in our experience your effort will be better spent in developing a sound knowledge and understanding by doing calculations by hand initially, and accompanying that with a clear explanation (preferably in English sentences) of how you obtained that answer. Those skills will take you much further.

Assessment requirements

Assessment tasks

Quizzes and assignments during semester determine 40% of the final unit mark for ENG1090, with the remaining 60% based on results from the three-hour final examination.

Students who have attempted this unit previously must complete all assessment tasks again. No marks can be carried across from a previous enrolment in the unit.

Quizzes

These are held *at the start of your normal support class* in weeks 2, 4, 6, 8, 10 and 12 (although in week 6 it will be held earlier, at 5.30pm on the Monday). If you arrive once the quiz has already started then you will have less time to complete it, as to minimise disruption to the class all students must finish the quiz at the same time. Quizzes are 20 minutes in duration, with 5 minutes reading time, and have a short-answer format, sometimes with a few multiple-choice questions. The coverage of each quiz is listed in the 'Assessment summary table' above. The intention of the quizzes is to assist students to keep up with and understand the lecture material, and to provide feedback on their performance. Calculators (or electronic devices of any type) are not permitted at quizzes and no formula sheet is included. Sample solutions are not provided – if you are unsure about the correct answer once your marked quiz is returned, please ask your support-class leader individually to explain how the question should be answered during the support class at which your work is handed back to you.

Absence from a quiz

Absence from or arriving too late for any quiz will normally lead to a zero mark recorded for that quiz, unless a Special Consideration application (see below) has been approved by the Lecturer. With sufficient notice, it *may* be possible to arrange that you sit a quiz at a different support class in the same week, but only when written permission has been granted *in advance* by the Lecturer (in person or by email). *Support-class leaders (tutors) are not authorised to approve exemptions from quizzes.*

Assignments

These are normally due *at the start of your normal support class* in weeks 3, 5, 7, 9 and 11 (although Assignment 4 for the Friday support class is due on the Thursday at 2.45pm). The requirements for each assignment will be made available on Moodle at the end of the last week of material that they cover (at 3pm on Friday). The method of submission of assignments is described in detail below under 'Assignment submission' so please read that carefully.

Marking criteria for assignments

Assignments for ENG1090 are marked on a range of criteria, including stating relevant reasons behind the process or results used, writing out appropriate and clear steps in the working, doing the working accurately, and then obtaining the correct final answer. All of these aspects are marked individually, and it is not just the final answer that is important. Indeed, it is possible to not

pass an assignment by providing a correct answer with little (or an unclear) explanation. Conversely, quite a few (but not all) marks can be obtained when the stated answer is incorrect but where a very clear and correct method was used, with all reasons provided and all appropriate working shown. But if the final answer is incorrect, for whatever reason, the question will not usually be awarded full marks - so check all working carefully, even for previous parts.

In ENG1090 it is also expected that you will be able to communicate both by using mathematics and by explaining that in written English. S*ome marks are awarded for each assignment on communication skills in explaining the mathematical content*. An outline of the expectations on this is provided in the 'Guidelines for writing mathematics in ENG1090' (which is available on Moodle). The key point is that it is not only the answer that is important, but also explaining (in sentences) clearly and logically how it was obtained.

Examination(s)

The final examination for ENG1090 will be held during the official university examination period at the end of semester. Students must achieve at least 45% in both the total in-semester assessment and the examination components, with an overall mark of at least 50%, to achieve a pass in ENG1090. The date, time and location of the ENG1090 final examination will be published later in the semester. In the meantime you must ensure that you are available for the entire three-week examination period.

The examination is closed-book, and **calculators (of any kind) and summary sheets are NOT permitted**. A very short list of useful (unusual) formulae will be provided at the end of the examination paper, a copy of which will be provided on Moodle towards the end of semester. However, note that this list will NOT include material that is expected to be well known and understood for this and future units. Further information on the format of the final examination paper for ENG1090 will be made available on Moodle towards the end of semester. In accordance with policy for the engineering mathematics units, two sample examination papers (only) will be provided at that time, one with written solutions. These sample papers will *not* be made available earlier in the semester.

Applications for special consideration

If you are unable to complete an assignment, quiz or the final examination due to *exceptional* circumstances, for reasons out of your control, then you may be eligible for Special Consideration. The University has detailed procedures to be followed, see http://www.monash.edu.au/exams/special-consideration.html.

For issues related to quizzes and assignments in ENG1090 is important that you contact the **Lecturer** of this unit as soon as practicable, by email or in person. Students with a valid reason for late submission of an assignment, or for missing a quiz, must provide originals (and a copy) of suitable supporting documentation **within two working days** of the normal deadline for that work.

Applications must be submitted directly to the **Lecturer** but can be sent by email initially and followed-up by a meeting shortly afterwards. The Lecturer will advise you of the outcome of the Special Consideration application by email, and if applicable will advise how to submit approved late assignments.

These procedures are applied strictly for ENG1090 and late applications for Special Consideration are only accepted in exceptional circumstances (such as total incapacity). See also 'Extensions and penalties' towards the end of this Unit Guide.

Special Consideration applications for final end-of-semester examinations are submitted in a different manner, see http://www.monash.edu.au/exams/special-consideration.html.

Returning assignments

Return of marked work

Marked quizzes and assignments are normally returned at your support class following the one at which they were completed or submitted. Your marks will be posted on 'Grades' on Moodle at around the same time and you should check regularly that they are entered accurately – and if any have been entered incorrectly you must query them with your tutor *in a timely manner*. (If marked work is consistently being handed back late, or your marks are not posted within a week of receiving your marked work, please advise the Lecturer.)

If you are unable to collect your work at the usual support class, please ask your tutor at the next class. Any uncollected work *after the end of semester* can be retrieved from the Lecturer up until the end of the examination period.

Errors in marking

Efforts are made to ensure that marks for assignments, quizzes and tests are awarded as consistently as possible across the various support classes (and markers if applicable). 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 (tutor) initially. If you are not satisfied with the response by your tutor you may contact either the Campus Coordinator or Chief Examiner of ENG1090 to discuss your concerns.

Errors in recording grades

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 the relevant Faculty policy, this should be done *no later than two weeks* after the support class at which that piece of work is normally returned.

Assignment submission

Completed hand-written assignments must normally be handed in to the tutor *at the commencement of your assigned support class*. Separate sheets should be stapled, and each sheet must show your name and student ID. Write and set out your submission neatly.
While care is taken, always make a copy of your final version prior to submission, for example with a phone camera or a scanner.

How and where to submit assignments

Only hard-copy submissions are accepted, normally in person at your support class. Please DO NOT ever email copies to the tutor or Lecturer, DO NOT give them to others to submit on your behalf and DO NOT submit them via the School Office. See below about submitting assignments late, and the penalties that may be applied in that situation.

Cover sheet

All assignments must include a completed *and signed* official cover sheet showing the *day and time* of your normal support class and the *name* of the class leader. The proforma for this sheet can be downloaded from the ENG1090 Moodle site. Read the 'Student statement' fully before signing it.

Academic integrity

It is expected that all students will complete all assessed work for ENG1090 individually, and in their own words. Among other things, markers will be looking specifically for instances where the wording of submitted work is very similar, including identical errors in algebraic working or logic. Markers may also assess work across multiple support classes. *Instances of suspected cheating will be dealt with seriously, in accordance with Faculty and University policies.* This may include penalties when other students copy your work, so keep your completed assignment private.

Submitting early or late assignments

If you are unable to attend your normal support class for any good reason then your assignment should be submitted *to the Lecturer* in person, and write the date and time of submission on the cover sheet. See 'Extensions and penalties' later in this Unit Guide and, if appropriate, under 'Applications for special consideration' above. No responsibility is taken for any assignments that are submitted in any manner other than those specified in this Unit Guide, including by email or being handed to other members of staff.

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	Lectures	Assessment
1	1.1 Basic concepts of functions (revision) 1.2 Inverse functions 1.3 Circular functions I (revision)	None
2	1.4 Circular functions II 1.5 Circular functions III 1.6 Exponential functions (revision)	Quiz 1 (held at normal support class)
3	1.7 Logarithmic functions 2.1 Algebra of complex numbers 2.2 Polar form of complex numbers	Assignment 1 due (at normal support class)
4	2.3 Exponential form 2.4 De Moivre's theorem and powers 2.5 Roots of complex numbers	Quiz 2 (held at normal support class)
5	3.1 Vector algebra 3.2 Direction cosines 3.3 The dot product	Assignment 2 due (at normal support class)
6	3.4 Applications of dot product *(followed by Quiz 3)* 4.1 Limits of discontinuous functions	Quiz 3 ***(held at Monday lecture)***
7	4.2 Continuity 4.3 Infinite limits and limits at infinity 4.4 Definition of derivative	Assignment 3 due (at normal support class)
8	4.5 Techniques of differentiation 4.6 Implicit differentiation 4.7 Applications of differentiation I	Quiz 4 (held at normal support class)
9	4.8 Applications of differentiation II 5.1 The definite integral 5.2 The indefinite integral	Assignment 4 due (at normal support class)
	Mid semester (study) break	
10	5.3 Integration by substitution 5.4 Integration by partial fractions 5.5 Applications of integration I	Quiz 5 (held at normal support class)
11	5.6 Applications of integration II 6.1 Initial value problems for differential equations 6.2 DEs with separable variables	Assignment 5 due (at normal support class)

12	6.3 Vector functions Revision lecture(s)	Quiz 6 (held at normal support class)
	Swot vac	None
	Examination period	Final examination

Where a quiz would normally fall on a university holiday (such as Quiz 3 above) then it will be rescheduled, and see the Moodle announcements for details. Assignments due to be submitted on a university holiday (such as Assignment 4 above) must be submitted to the Lecturer by the notified deadline on the previous working day.

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:

The Moodle page for ENG1090 was completed restructured in 2017 in response to student feedback. The teaching methods of solving problems live in the lecture (by hand), in combination with detailed prepared slides shown on the screen, was originally developed for ENG1090 based on student feedback, as was the recording of lectures (at Clayton). The regular pattern of interspersed quizzes and assignments, and the marking of those within a week, apparently continue to be favoured by many students. At Clayton, the printing all of the ENG1090 teaching materials on Moodle as a spiral-bound book (and selling that to students via the Bookshop) was originally introduced in response to student comments.

The Unit Coordinator at Clayton examines all of the student SETU comments carefully each year and adjustments to the teaching are often made where the comments and suggestions are educationally sound. Identification of specific issues are particularly appreciated. (That said, it may be better to make comments or raise issues *prior* to the end of semester so you may also benefit.)

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

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

Unit resources

Learning resources

Moodle site

Students must check [Moodle website](#) for ENG1090 regularly for any announcements and act upon that information in a timely manner. The online teaching materials and resources for this unit are updated frequently throughout semester.

Students without their own computer or device, can access these materials via the Monash Library, or at an open-access computer laboratory.

Prescribed text

The prescribed textbook for ENG1090 (and the subsequent unit ENG1005) is James, Glyn: *Modern Engineering Mathematics*, **fifth** edition 2015, Pearson/Prentice Hall. Some of the problems on the problem sets (see below) refer to this textbook so it is important to have access to it. Copies are available in the library but with large numbers of students enrolled in ENG1090 and ENG1005 this semester it may be more convenient to have your own copy (and then perhaps sell it later).

Lecture notes

Copies of the lecture slides for ENG1090 are made available on Moodle. Note that the slides do not provide a complete record of the lecture as they do not include the additional worked examples that will be completed by the lecturer (live and by hand) on the screen during the lecture. Rather, the intention of providing the slides in advance is to enable students to annotate their copy during the lecture and to write in the worked examples for themselves. The material covered is quite sequential and it is likely that students will fall behind quickly if they miss more than a lecture or two in a row. You are therefore actively encouraged to keep up with the lectures and assessments.

Problem sets

A total of six 'problem sets', with practice exercises for the material covered in lectures, are provided during the semester – one for each of the six major topic areas. These are included in the book of lectures slides or can be downloaded from Moodle. Some questions from the textbook are included on these problem sets, especially on applications in engineering contexts, so students will need to have access to that book. Additional exercises can be found in the relevant sections of the textbook, or in similar books in the library (eg on the same shelf).

Weekly support classes

Two-hour weekly support classes (or 'tutorials') for ENG1090 commence from the second week of semester. If you have any difficulties with any material covered in lectures, or questions on the problem sets, you should actively seek assistance in your support class or approach the lecturer. Try all of the questions for yourself first but ask for help if you are having trouble getting started. Short final answers for most of the exercises are provided but the intention is that further individual assistance on *how* to undertake and complete a problem is made available during each support class. Take advantage of that assistance in a timely manner. Note that if you leave all of your queries to late in semester there may be insufficient time or support available to have them all answered before the final examination. Therefore, it is *strongly* advised that you address any difficulties *as soon as they become apparent*.

Support class sheets

'Support class sheets' will be provided on Moodle weekly, as a guide to the planned activities for each support class. These identify a small number of problems that are recommended (and

expected) that all students will complete during that class and over the subsequent week. All of the other questions on problem sets should be *completed in your own private study time*.

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

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

For details on how a Special Consideration application must be submitted, please see that section earlier in this unit guide.

Other late assignment submissions for ENG1090 may be accepted but will be penalised at 10% of the maximum mark per calendar day (or part thereof), in accordance with the relevant Faculty policy on '*Penalty for late submission of work for assessment policy*'. If you are unable to attend your normal support class for any good reason then your assignment should be submitted ***directly to the Lecturer***, either in person or under their office door (see the contact details early in this unit guide), preferably with a concurrent follow-up email as a timestamp. If an assignment is submitted after any students have received back their marked work, or once sample assignment solutions have been published on Moodle, then that work may be marked for feedback purposes, but no marks will be recorded or credited for that piece of assessment.

*Other tutors or staff are **not** authorised to approve extensions to assignment deadlines (or absence from quizzes) and tutors must apply the normal faculty (10% per calendar day) penalty strictly to all late assignments that they receive directly.*

If you have any queries in relation to extensions or penalties, please contact the Campus Coordinator or Chief Examiner *in a timely manner*.

Other unit information

Accreditation information for the Malaysia campus

Academic Overview

Program Education Objectives

The School of Engineering 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 (POs)

The general engineering discipline has developed a set of Program Outcomes (POs) for all of its graduates based on the competencies required by the Malaysian Engineering Accreditation Council.

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.	Assignments, quizzes and the final examination.
PO2 **Problem solving and analysis:** Identify, formulate, survey research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.	N/A
PO3 **Design/development of solutions:**	N/A

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.	
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.	N/A
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.	N/A
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.	N/A
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.	N/A
PO8 **Professional ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.	N/A
PO9 **Communication:** Communicate effectively on 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.	N/A
PO10 **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.	N/A
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.	N/A
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.	N/A

Learning Outcomes

OBE requirements to Learning Outcomes (LOs)

Learning Outcomes (LOs) for Outcome Based Education (OBE) requirements	Handbook Learning Outcomes (LOs)
LO1 Apply suitable mathematical techniques to solve problems involving Geometry and Calculus. *Geometry:* • Vectors: dot products *Calculus:* • Functions and their graphs • Complex numbers • Limits and continuity • Differentiation • Integration • Solving differential equations	1. Demonstrate understanding of the properties of common functions and their graphs, use composition of functions, and inverse functions; use trigonometric functions to model periodic behaviour. 2. Represent complex numbers in Cartesian, polar and exponential forms, and on the complex plane. 3. Perform arithmetic and algebra on complex numbers, including finding powers and complex roots of polynomials. 4. Demonstrate understanding of the concepts of limit, continuity, differentiable and integrable functions. 5. Evaluate limits of piecewise functions, and of rational functions at infinity. 6. Use differentiation rules to find derivatives of implicit and explicit functions. 7. Apply differentiation techniques to related rates of change problems and optimisation problems. 8. Use simple integration techniques to find definite and indefinite integrals, including by substitution and partial fractions. 9. Apply integration techniques to calculate areas, average values, volumes, centres of mass, moment, and work. 10. Perform operations with two and three-dimensional vectors, interpret them geometrically, calculate dot products, find vector resolute, and apply them to motion of a particle. 11. Solve kinematics problems, and set up and solve problems involving Newton's laws of motion. 12. Express and explain mathematical techniques and arguments clearly in words.

Relationship between Unit Learning Outcomes and Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
LO1	√											

Relationship between OBE Learning Outcomes and Assessments

	LO1
Final Exam: 60%	C3

Quiz 1: 3.75%	C3
Quiz 2: 3.75%	C3
Quiz 3: 3.75%	C3
Quiz 4: 3.75%	C3
Quiz 5: 3.75%	C3
Quiz 6: 3.75%	C3
Assignment 1: 3.5%	C3
Assignment 2: 3.5%	C3
Assignment 3: 3.5%	C3
Assignment 4: 3.5%	C3
Assignment 5: 3.5%	C3

Note: Total of 5 Assignments and 6 Quizzes = 40%

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:

Cognitive

Level	Category
C1	Knowledge: Remembers previously learned material
C2	Comprehension: Grasps the meaning of material (lowest level of understanding)
C3	

ENG1090 Foundation mathematics - Semester 2 (S2-01) - 2017

	Application: Uses learning in new and concrete situations (higher level of understanding)	
C4	Analysis: Understands both the content and structure of material	
C5	Synthesis: Formulates new structures from existing knowledge and skills	
C6	Evaluation: Judges the value of material for a given purpose	