Unit Guide

Diploma of Engineering

Monash College

Table of Contents

Overview

The Diploma of Engineering provides the foundational scientific and mathematical skills and knowledge required in developing and improving new technology, and prepares students to pursue further study in engineering. The course includes core engineering design units, plus units in related disciplines including mathematics, computing, physics and chemistry or biology.

There are two entry points into the Diploma of Engineering - Part One and Part Two - with the entry point for each applicant determined by their academic background and English language level.

Diploma of Engineering Course Outcomes

On completion of the Diploma of Engineering, students should be able to demonstrate the following skills and knowledge and their application:

1. Knowledge of technical and theoretical issues in a variety of engineering disciplines, underpinned by scientific and mathematical theory.
2. Identify and communicate advice in a variety of engineering disciplines to address technical problems in accord with management requirements
3. Utilise technical skills to demonstrate understanding and problem solving in relation to engineering issues involving diverse stakeholders
4. With depth in some areas, critically apply theoretical and technical skills to solve problems in relation to a range of engineering disciplines
5. Manage work priorities and coordinate the work of others in accord with parameters set by management in a number of engineering contexts.

Monash College Diplomas Graduate Attributes

All Monash College courses will develop the following graduate attributes:

- Communication - demonstrated by effective communication in a variety of contexts
- Collaboration - demonstrated by working positively with others to achieve common goals
- Social and Cultural Engagement - demonstrated by respect for diversity and recognition of ethical responsibilities, including towards knowledge creation and academic integrity
- Critical Thinking and Problem Solving - demonstrated by the ability to analyse, evaluate and synthesise information to solve problems and innovate
- Independent Learning - demonstrated by the initiative, reflective practice and resilience necessary for self-directed learning, and possession of the foundational discipline knowledge and skills appropriate to commence their destination studies
- Academic Skills - demonstrated by understanding and appropriate application of scholarly practices and standards.

DIPLOMA PART I			
Unit Code	**Unit Name**	**Unit EFTSL[1]**	**Credit Points[2]**
MCD1160	Introductory Engineering Computing	0.125	6
MCD1170	Introductory Chemistry	0.125	6
MCD1180	Introductory Physics	0.125	6
MCD1700	Introductory Mathematics	0.125	6
MCD1190	Chemistry A	0.125	6
MCD1200	Physics A	0.125	6
MCD1470* or MCD1710^	Engineering Practice* Introductory Biology	0.125 0.125	6 6
MCD1750	Intermediate Mathematics	0.125	6
DIPLOMA PART 2			
Unit Code	**Unit Name**	**Unit EFTSL[1]**	**Credit Points[2]**
MCD4160* MCD4410^	Physics for Engineering* or Blueprints for Life ^	0.125 0.125	6 6
MCD4390 or MCD4420^	Chemistry 1 Life on Earth ^	0.125 0.125	6 6
MCD4490	Advanced Mathematics	0.125	6
MCD4290	Engineering Mobile Apps	0.125	6
MCD4500	Engineering Mathematics	0.125	6
MCD4510	Preparatory Mathematics	0.000	0
MCD4520	Engineering Methods	0.125	6
MCD4530	Engineering Design	0.125	6
MCD4540	Engineering Smart Systems	0.125	6
MCD4600	Intermediate Physics	0.125	6
MCD4770	Professional Practice	0.125	6

* All Engineering streams except Biomedical Engineering
^ Biomedical Engineering stream

1. EFTSL: Effective Full-time Student Load. Each part of the Diploma is equivalent to one year of full-time study. Monash College Diplomas are delivered in an accelerated mode, so you can study more than a standard full-time load in a year.

2. Most Monash units are 6 credit points. To complete a full Monash College Diploma you must pass 96 credit points; if you start in Part 2 you must pass 48 credit points and may also have to complete the Preparatory Maths unit (MCD4510). Credit points in Part 2 units count towards the first year of your Monash University degree.

MCD1160 – Introductory Engineering Computing

Description

Today's engineers rely heavily on the use of computers. To solve problems of practical significance, you need to apply scientific and technical knowledge, common sense, and experience. This unit will provide you with an understanding of basic computer software and programming concepts, and how it is used within the engineering environment. You will learn how to effectively communicate technical information using modern document editing, spreadsheet and presentation applications, and execute professional oral presentations to share your findings. Further, you will develop skills to solve real-world problems using microcontrollers and programming language.

Prerequisites

Nil

Learning Outcomes

On completion of this unit, students should be able to:

1. Use the formatting features of a word processor.
2. Use utilities and advanced features provided with a word processor.
3. Create and format a spreadsheet.
4. Use functions and formulas to perform calculations in a spreadsheet.
5. Use graphics in a spreadsheet.
6. Use advanced facilities of a spreadsheet.
7. Designing professional presentation slides, incorporating text, graphics and sound, and presentation of information, including the use of bullet points
8. Designing slideshows, animation of a slide, slide transitions, use of templates & the auto content wizard.
9. Communicate technical content in effective oral presentations.
10. Implement problem-solving strategies.
11. Decompose problems into simpler problems.
12. Construct and test simple computer programs.
13. Analyse and debug existing programs.
14. Recognise the importance of good practices in programming.
15. Understand how real-world problems can be addressed in the digital age.

Assessments

- Test 1 - 10%
- Test 2 - 10%
- Assignment 1 - 25%
- Assignment 2 - 35%
- Lab Participation - 10%
- Weekly Quizzes - 10%

Students must achieve an overall mark of 50% or higher in order to pass this unit.

MCD1170 – Introductory Chemistry

Description

Chemistry is the science of matter and the transformations it can undergo. It plays a central role in medicine, engineering and many sciences. It helps us understand our surroundings and the way we function. Students will investigate the various analytical techniques that are used to analyse substances depending on their properties. The knowledge and skills gained in this unit will be further extended in MCD1190 Chemistry A.

Prerequisites

Students should have completed an equivalent to Victorian VCE Year 11 Chemistry, Units 1 & 2.

Learning Outcomes

On completion of this unit, students should be able to:

1. Express chemical reactions symbolically, qualitatively and quantitatively.
2. Explain the concepts of bonding between atoms and relate this to the properties of compounds.
3. Explain the factors affecting the rate of a reaction and perform calculations for thermochemical equations
4. Calculate equilibrium constants and explain how the position of equilibrium can be altered, including examples from industry.
5. Explain acids and bases and perform calculations related to pH
6. Explain the structure and naming of simple organic molecules.
7. Explain the gas laws and apply calculations related to these
8. Demonstrate proficiency in communicating scientific results through a range of formats (written and oral);
9. Develop practical, report writing and scientific inquiry skills by the investigation of chemical experiments in the laboratory.

Assessments

- Test 1 - 7%
- Test 2 - 8%
- Quizzes - 10%
- Poster / Presentation - 10%
- Laboratory work – 15%
- Final examination - 50%

Students must achieve an overall mark of 50% or higher with a minimum mark of 40% in the final examination in order to pass this unit.

MCD1180 – Introductory Physics

Description

Through the study of physics, we are able to gain a greater understanding of the nature of the universe. Physics strives to reveal nature's underlying simplicity and establish the rules which cause galaxies to form, the toast to burn, or what holds the component parts of a proton together. Physics underlies all of the life and physical sciences, as well as engineering and technology. You will be engaged in practical work to allow you to explore and measure key theories.

Prerequisites

Nil

Learning Outcomes

On completion of this unit, students should be able to:

1. Describe the difference between qualitative and quantitative techniques Record accurate observations and select measuring equipment of appropriate accuracy
2. Recognize the measurement error in selected equipment Identify sources of error in analytical procedures
3. Distinguish between displacement, speed, velocity and acceleration and calculate each of these parameters
4. Demonstrate knowledge of mass, force and their relationship through Newton's laws
5. Identify force and draw free body diagram
6. Differentiate between scalar and vector
7. Differentiate between work, energy, kinetic energy, potential energy and power
8. Define an impulse and its relation to a change of momentum
9. Differentiate between force and torque and apply the laws of equilibrium to practical situations
10. Discuss elastic properties of materials
11. Distinguish between displacement, amplitude, period, frequency and wavelength of a wave
12. Describe behaviour of waves in terms of reflection, refraction, diffraction and interference
13. Calculate properties of standing waves on a string or in a pipe
14. Distinguish between energy, intensity and intensity level in a wave

Assessments

- Laboratory - 20%
- Test 1 - 15%
- Test 2 - 25% (Moderated)
- Weekly In-class Activities - 20%
- Projects - 20%
- No Examination

Students must achieve an overall mark of 50% or higher in order to pass this unit. Overall mark consists of all the internal assessment marks.

MCD1190 – Chemistry A

Description

Chemistry is an important branch of science which has a direct impact upon our lives. For example, knowledge of chemical concepts will assist us to explore new and cheaper energy sources, improve health and safety standards, and develop 'greener' and environmentally friendly processes, which reduce pollution and wastage in the environment. You will investigate, explore and discuss chemical concepts and issues, and solve quantitative and qualitative problems in class.

Prerequisites

MCD1170 Introductory Chemistry or VCE Year 11 Chemistry, Unit 2.

Learning Outcomes

On completion of this unit, students should be able to:

1. Demonstrate the importance of energy transformations in thermochemical and electrochemical reactions.
2. Discuss factors which give rise to chemical kinetics; differential and integrated rate laws.
3. Explain the structure and naming of simple organic molecules.
4. Distinguish between the different chromatographic types and various spectroscopic techniques in order to understand their use in qualitative and quantitative chemical analysis.
5. Relate organic chemical structures to observed chemical reactions, using examples from those involved in human nutrition and global cycling of nutrients.
6. Demonstrate proficiency in communicating scientific results through a range of formats (written and oral);
7. Develop practical, report writing and scientific inquiry skills by the investigation of chemical experiments in the laboratory.

Assessments

- Test 1 - 7%
- Test 2 - 8%
- Quizzes and In-class Activities - 20%
- Presentation - 10%
- Laboratory – 20%
- Final Examination - 35%

Students must achieve an overall mark of 50% or higher in order to pass this unit. Overall mark consists of internal assessments and final examination marks.

MCD1200 – Physics A

Description

This unit continues on from MCD1180 Introductory Physics, and considers the basic concepts of practical investigation, rotational motion, electricity, magnetism and atomic theories. Through practical work, you will relate your theoretical knowledge to experimental processes and engage in critical observation and testing of physical phenomena.

Prerequisites

MCD1180 Introductory Physics.

Learning Outcomes

On completion of this unit, students should be able to:

1. Demonstrate knowledge of the value of practical work.
2. Apply the theory of rotational motion.
3. Solve problems involving electricity and magnetism.
4. Analysis and evaluate the construction materials, and evaluate the effect of forces and loads on structures and materials.
5. Explain a range of atomic theories.

Assessments

- Test 1 - 5%
- Quizzes - 10%
- Test 2 - 10%
- Laboratory work - 20%
- Project Work- 15%
- Final Exam - 40%

Students must achieve an overall mark of 50% or higher in order to pass this unit. Overall marks consist of internal assessments and final examination marks.

MCD1470 – Engineering Practice

Description

The practice of engineering involves applying scientific and technical knowledge, common sense and experience to solving problems of practical significance for people. During this unit, you will learn about engineering practices by studying important engineering skills that are not covered in traditional mathematics, chemistry and physics courses, and will apply these skills to projects. Through the study of this unit, you will improve your knowledge of the IT and engineering professions, design and analysis, communication, ethics and economics.

Prerequisites

Nil

Learning Outcomes

On completion of this unit, students should be able to:

1. Undertake a simple design and build project in a competitive team-based environment.
2. Develop conceptual understanding and problem-solving abilities by applying engineering principles.
3. Develop proficiency with technologies for information gathering analysis, simulation, theoretical prediction, access to information, and report preparation.
4. Describe the importance and relevance of engineering and its interdisciplinary ties to other fields and society, in order to become a scientifically literate and ethical citizen.
5. Identify professional issues relevant to a contemporary engineering challenge and appropriate responses.
6. To present and discuss engineering issues and concepts in a range of writing formats, including essay and technical report.
7. Demonstrate proper and ethical scientific and engineering practices, including safety, environment, and record keeping.
8. Interpret scientific and engineering results and draw reasonable conclusions.
9. Work with a small team to plan and manage an engineering project and report on team performance.
10. Communicate effectively through written and oral reports.

Assessments

- Assessment 1: LR - 10%
- Assessment 2: Test 1 - 10%
- Assessment 3: OP1 - 10%
- Assessment 4: Test 2 - 10%
- Assessment 5: Test 3 - 10%
- Assessment 6: Project - 50%

Students must achieve an overall mark of 50% or higher in order to pass this unit.

MCD1700 – Introductory Mathematics

Description

This unit will provide students with the pre-requisite knowledge and skills to progress to the higher levels of mathematics in the STEM diplomas and subsequently in the relevant degree programs.

Prerequisites

Nil

Learning Outcomes

On completion of this unit, students should be able to:

1. Identify number sets in complex domain.
2. Use set notations to describe numbers.
3. Use interval notations to represent number sets.
4. Use real number line to express the number sets.
5. Use Venn diagram to represent number sets.
6. Solve linear and simultaneous linear equations using graphical and algebraic methods.
7. Use simultaneous linear equations to model and solve real world problems.
8. Recognise prime, rational, irrational and complex numbers
9. Apply factor theorem to factorise polynomial functions
10. Solve polynomial equations.
11. Solve quadratic equations using factorizing, quadratic formula or completing the square method.
12. Sketch graphs of quadratic functions.
13. Apply binomial expansion to solve problem in various algebraic contexts.
14. Simplify rational functions inequalities.
15. Plot complex numbers in the Argand diagram.
16. Find the rule for inverse function for given functions and sketch the graph of inverse functions.
17. Solve system of equations and literal equations.
18. Use exponential and logarithmic functions to model application problems.
19. Sketch graphs of exponential and logarithmic functions.
20. Solve exponential and logarithmic equations.
21. Convert radians in to degrees and vice versa.
22. Apply trigonometric ratios in degrees and radians to solve problem in various geometric and analytical geometric contexts.
23. Apply sine and cosine rule solve to solve problem in various geometric and analytical geometric contexts.
24. Sketch the graphs of trigonometric functions of sin, cos, tan, sec, cosec and cot
25. Identify amplitude, period and mid line of $a\sin(bx+c)+d$ and $a\cos(bx+c)+d$
26. Classify vectors and scalars.
27. Apply vector algebra to solve problems in geometry.

MCD1700 – Introductory Mathematics- *CONTINUED*

28. Express vectors using i and j components.
29. Express coordinates in Cartesian coordinates
30. Calculated distance between two points
31. Use the formula +to divide a line segment by given ratio.
32. Solve problems related in Parallel and perpendicular lines
33. Recognise angles relating in parallel lines triangles and polygons.
34. Identify congruent and similar triangles.
35. Apply properties of congruent and similar triangles to solve problems in plane geometry and analytical geometry.
36. Recognise rectangle, rhombus, parallelogram and square from complex geometrical diagrams.
37. Apply properties of rectangle, rhombus, parallelogram and square to solve problems in plane geometry and analytical geometry.

Assessments

- In-class Assessment - 15%
- Test - 15%
- Assignment - 10%
- Final Examination - 60%

In order to pass this unit, students must:

- ❖ Achieve an overall mark of 50% or higher

MCD1710 – Introductory Biology

Description

This unit will explore the fundamental processes and patterns common to life on Earth. It will examine how living organisms grow, develop diverse and complex structures and pass on their genetic material to the next generation. The students will progress through principal themes in biochemistry, cellular structure and systems, cell division and reproduction, genetics and evolution, biodiversity and ecosystems. Students will examine how animals and plants, through the agents of gene mutation and natural selection, are able to adapt to new and changing environments. We will then examine how interactions within and between species and with the non-living environment generate the enormous variety of life on Earth.

Prerequisites

Nil

Learning Outcomes

On completion of this unit, students should be able to:

1. Identify and describe the concepts, processes and practical applications of cell biology, biochemistry, genetics, molecular biology and processes of evolution in society and everyday human life.
2. Demonstrate proficiency in communicating scientific results through a range of formats (written and oral).
3. Formulate hypotheses, collect experimental data and demonstrate proficiency in interpreting their results.
4. Demonstrate understanding of the use of common life sciences equipment and techniques.
5. Utilise research skills including database searches to synthesise and interpret information related to scientific research, using appropriate conventions for scientific attribution.
6. Work effectively, responsibly, safely and ethically, both individually and in peer or team contexts.

Assessments

- A1: Formative Test Assessment with student-led annotated feedback (weekly) - 20%
- A2: Completed Lab Practicals (6 practicals for submissions) - 30%
- A3: Self Access Quizzes (weekly) - 10%
- A4: In class open book summative Test - 40%

In order to pass this unit, students must achieve an overall mark of 50% or higher.

MCD1750 – Intermediate Mathematics

Description

This is unit continues on from MCD1700 Introductory Mathematics. The unit will provide students with the pre-requisite knowledge and skills to progress to the higher levels of mathematics in STEM diplomas and subsequently in the relevant degree programs.

Prerequisites

MCD1700 Introductory Mathematics

Learning Outcomes

On completion of this unit, students should be able to:

1. Apply the concept of vectors in Cartesian form in analytical geometry.
2. Find and apply position vector, magnitude of vector, unit vector, angles between vectors and direction cosines in two and three-dimensional problems.
3. Determine linear dependency and independency in vectors.
4. Find scalar and vector resolute, scalar product of vectors and solve application questions relating to the concepts.
5. Use Pythagorean identities $\sin^2\theta+\cos^2\theta=1;\ \tan^2\theta+1=\sec^2\theta;\ 1+\cot^2\theta=\mathrm{c}\,sc^2\theta$ in problem solving.
6. Apply compound-angle identities in various geometric and analytical geometric applications.
7. Find general solutions of simple and complicated trigonometric equations.
8. Apply limits, continuity and differentiation to solve mathematical problems.
9. Identify and analyse the nature of critical points using derivative tests.
10. Apply differentiation concepts in curve sketching.
11. Understand and represent implicit equations as parametric equations.
12. Apply differentiation to both explicit and parametric equations to solve problems in various contexts of engineering and other disciplines.
13. Perform basic anti-differentiation calculations and the technique of integration by substitution.
14. Apply integration techniques to find areas under curves.

Assessments

- Topic Quizzes - 10%
- Test - 15%
- Oral Presentation - 10%
- Tutorial participation - 5%
- Final examination - 60%

In order to pass this unit, students must:

- ❖ Achieve at least 40% in the total internal assessments
- ❖ Achieve at least 40% in the final examination
- ❖ Achieve an overall mark of 50% or higher

MCD4160 – Physics for Engineering

Description

Through the study of this unit, you will explore engineering concepts such as energy, momentum and angular momentum with applications to planetary orbits, rocket propulsion, precession and flywheels. Applications of oscillations and waves within engineering applications will also be explored. Students will consider: resonance, transmission of energy, Doppler effect and speed measurement, polarization and stress models, diffraction and non-structures, thin film interference and anti-reflecting films together with Quantum Physics, Uncertainty Principle, wave functions, atomic force microscope, lasers and stimulated emission. The practical component develops measurement, analysis, and communication skills.

Prerequisites

MCD1200 Physics A (For Part 2 entry students, Part 1 pre-requisites are not applicable).

Learning Outcomes

On completion of this unit, students should be able to:

1. Apply energy and momentum methods to analyse motion of systems.
2. Explain behaviours involving oscillations and waves and do appropriate analysis and calculations.
3. Explain, and apply basic quantum principles to, situations which are relevant in engineering and technology contexts; do appropriate analysis and calculations.
4. Demonstrate an ability to describe and explain advanced techniques used in relevant engineering or physics contexts.
5. Make reliable measurements, estimate uncertainties, analyse, evaluate and interpret data in cases appropriate to engineering and related to the theory studied.
6. Show an improved ability to work in teams and to communicate and discuss physics concepts, measurements and applications related to engineering and developments in technologies.
7. Approach new problems and find solutions on the basis of general principles, and evaluate the appropriateness of their proposed models or solutions.

Assessments

- Quizzes / Assignment - 10%
- Test 1 (Mechanics) - 14%
- Test 2 (Oscillation and Waves) - 14%
- Laboratory Work - 22%
- Final Examination - 40%

In order to pass this unit, students must:

- ❖ Achieve at least 45% in the total internal assessments
- ❖ Achieve at least 45% in the final examination
- ❖ Achieve an overall mark of 50% or higher

MCD4290 – Engineering Mobile Apps

Description

This unit introduces students to the use of Information Technology (IT) in modern engineering practice. Students will learn an object-oriented approach to both computer systems and software engineering for solving engineering problems. Students will work in small teams to develop a mobile application that meets a contemporary need in engineering. The fundamental stages in the software development lifecycle will be introduced, including requirements analysis, design, implementing and verification. Students will use IT tools to support the engineering process.

Prerequisites

Nil

Learning Outcomes

On completion of this unit, students should be able to:

1. Describe the capabilities and limitations of mobile computing devices, as well as the interaction between developments in IT and their use in modern Engineering practice.
2. Construct mobile applications that utilise device capabilities to solve engineering problems using a simple object-oriented software approach.
3. Employ IT tools for aspects of the software engineering process, including a code editor, debugger, shared code repository and version control system, task-tracking and team communication tools.
4. Prepare written technical documentation in a standard design formalism from a template.
5. Complete tasks as part of a team, and communicate effectively with team members.
6. Prepare and deliver oral presentations in a professional engineering format.

Assessments

- Class Test - 4%
- Assignment 1 - 8%
- Assignment 2 – 22%
- Presentation - 4%
- Practical Class Work – 5.5%
- Tutorial Class Work – 5.5%
- Weekly Quizzes – 11%
- Examination - 40%

In order to pass this unit, students must:

- ❖ Achieve an overall mark of 50% or higher

MCD4390 – Chemistry 1

Description

This unit has been designed to provide a fundamental understanding, as well as the ability to gain knowledge in different aspects of chemistry including physical chemistry principles theoretical and practical tasks that are relevant to the university level of learning.

Prerequisites

MCD1190 Chemistry A or VCE year 12 Chemistry

Learning Outcomes

On completion of this unit, students should be able to:

1. Discuss the features of atomic structure and the construction of the periodic table of elements.
2. Interpret relationships between electronic structure and bonding.
3. Explore a wide range of molecular structures and investigate aspects of stereochemistry such as isomerism and chirality.
4. Distinguish between ideal gasses and real gasses.
5. Recognise factors which give rise to polarity and its relationship to intermolecular bonding.
6. Define the first and second laws of thermodynamics and apply enthalpy and entropy.
7. Discuss factors which give rise to chemical kinetics.
8. Apply acid-base chemistry in the understanding of dynamic equilibria.
9. Foster the acquisition of practical skills by exploiting an inquiry-based approach to the chemistry laboratory experience.
10. Communicate chemistry and discuss the social and environmental responsibility of chemists in the global community.

Assessments

- Tutorial participation (3x tutorial tests) - 10%
- Laboratory component (Online Reports) - 30%
- Online assessments (12 x pre-workshop quizzes) - 10%
- Final examination - 50%

In order to pass this unit, students must:

- ❖ Achieve a minimum mark of 45% in the lab component.
- ❖ Achieve an overall mark of 50%.

MCD4420 – Life on Earth

Description

This unit views the extraordinary diversity of life on Earth through the prism of evolutionary theory and in the context of human and environmental health. Students will examine how animals and plants, through the agents of gene mutation and natural selection, are able to adapt to new and changing environments. Diverse physiological, reproductive and behavioural solutions to life's challenges will be used to illustrate how evolutionary forces and constraints shape us and the world around us. We will then examine how interactions within and between species and with the non-living environment generate the immense ecological variety seen on Earth. Contemporary issues and the societal impact of biology will be explored by learning from world-class researchers and industry experts.

Students will undertake self-directed learning through the online environment. These online activities, readings and instructional videos will be complemented by face-to-face workshops where they will collaborate with peers and teaching staff to deepen their understanding of the biological concepts introduced each week. Students will gain hands-on experience and develop experimental and analytical skills in the laboratory environment.

Prerequisites

Nil

Learning Outcomes

On completion of this unit, students should be able to:

1. Identify and describe the role of biological concepts and processes of evolution, plant and animal physiology, reproduction and life history strategies and core ecological concepts in society and everyday human life.
2. Demonstrate proficiency in communicating scientific results through a range of formats (written and oral).
3. Formulate hypotheses, collect experimental data and demonstrate proficiency in interpreting their results.
4. Demonstrate understanding of the use of common life sciences equipment and techniques.
5. Utilise research skills including database searches to synthesise and interpret information related to scientific research, using appropriate conventions for scientific attribution.
6. Work effectively, responsibly, safely and ethically, both individually and in peer or team contexts.

Assessments

- Weekly Assessment Quiz and Active Participation - 20%
- Practical Assessment - 30%
- Examination - 50%

In order to pass this unit, students must:

- ❖ Achieve a minimum mark of 45% in the Weekly Assessment Quizzes and Active Participation
- ❖ Achieve an overall mark of 50% or higher

MCD4490 – Advanced Mathematics

Description

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

Prerequisites

MCD1750 Intermediate Mathematics or Mathematical Methods Units 3 & 4 equivalent.

Learning Outcomes

On completion of this unit, students should 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 behavior.
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. 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.
5. Demonstrate understanding of the concepts of limit, continuity, differentiable and integrable functions.
6. Evaluate limits of piecewise functions and of rational functions at infinity.
7. Use differentiation rules to find derivatives of implicit and explicit functions.
8. Apply differentiation techniques to related rates of change problems and optimisation problems.
9. Use simple integration techniques to find definite and indefinite integrals, including by substitution and partial fractions.
10. Apply integration techniques to calculate areas, average values, volumes, and centres of mass or moment.
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.

Assessments

- Assignment - 5%
- Test - 10%
- Oral Presentation - 5%
- Lecture quiz and attendance - 10%
- Tutorial participation - 10%
- Final Examination - 60%

In order to pass this unit, students must:

- ❖ Attempt all internal assessments and achieve at least 45% in the total internal assessments

MCD4490 – Advanced Mathematics - *CONTINUED*

- Achieve at least 45% in the final examination
- Achieve an overall mark of 50% or higher

MCD4500 – Engineering Mathematics

Description

Vector algebra and geometry: equations of lines and planes. Linear algebra: matrix operations, up to 3x3 systems of linear equations, eigenvalues and eigenvectors. Calculus: improper integrals, integration by parts. Sequences and series: fundamentals of convergence, Taylor series, use in error analysis. Ordinary differential equations: first order, second order with constant coefficients, repeated roots, simple non-homogeneous cases. Laplace transforms: elementary functions, inversion by tables; shifting; derivatives, applications to ODEs. Multivariable calculus: partial derivatives, gradient and directional derivatives, maxima and minima.

Prerequisites

MCD4490 Advanced Mathematics

Learning Outcomes

On completion of this unit, students should be able to:

1. Evaluate cross products of vectors and use vectors to represent lines and planes.
2. Perform matrix algebra.
3. Solve up to 3x3 systems of linear equations and find eigenvalues and eigenvectors.
4. Use hyperbolic functions.
5. Evaluate improper integrals of elementary functions and use integration by parts.
6. Appreciate convergence of numeric and power series, construct Taylor series and estimate errors in numerical approximations.
7. Solve first order ordinary differential equations, including by separable variables and integrating factors.
8. Solve second order linear differential equations with constant coefficients.
9. Use differential equations to model simple engineering problems.
10. Evaluate and invert Laplace transforms and use them to solve ordinary differential equations.
11. Calculate partial derivatives, use the gradient vector to find directional derivatives and find extreme values of two-variable functions.
12. Express and explain mathematical techniques and arguments clearly in words.

Assessments

- Assignment 1 - 5%
- Test - 10%
- Assignment 2 - 5%
- Lecture quiz and attendance - 10%
- Tutorial participation - 10%
- Examination - 60%

In order to pass this unit, students must:

- ❖ Attempt all internal assessments and achieve at least 40% in the total internal assessments

MCD4500 – Engineering Mathematics- *CONTINUED*

- Achieve at least 40% in the final examination
- Achieve an overall mark of 50% or higher

MCD4510 – Preparatory Mathematics (P-Math)

Description

This is a compulsory unit for students directly entering the Monash College Diploma of Engineering, Part 2 without having previously completed the Diploma of Engineering, Part 1. For these students, the unit is the prerequisite to the compulsory unit MCD4490 Advanced Mathematics.

This unit develops knowledge and skills in mathematical logic, functions and transformations, introductory calculus (differentiation and integration) and vectors.

Prerequisites

Nil

Learning Outcomes

On completion of this unit, students should be able to:

1 Understanding sets, numbers and logic. Revising functions, relations & sketching quadratics and polynomial division.

2 Recognise power, exponential, logarithmic and trigonometric functions (and trigonometric reciprocals) and be familiar with their properties, graphs, and applications.

3 Apply calculus-based techniques in the solution of problems including differentiation and integration of functions using a range of techniques; graphical analysis of functions; calculating tangents and normals to curves; finding areas; understanding constant, average and instantaneous rates of change; curve sketching, and applications of calculus.

4 Understand the concept of 2-dimensional vectors by applying basic vector operations and calculating the directional cosine of vectors.

5 Use problem-solving strategies such as: inductive and deductive reasoning and logical proof; partitioning problems into sub-problems; identifying and working on related or simplified problems; generalisation; justification of solution processes or assumptions; checking the validity and reasonableness of solutions.

6 Communicate arguments and strategies when solving problems by using appropriate mathematical language, conventions, and representations.

7 Use mathematical knowledge to solve problems set in ‘real world’ contexts and apply skills in both routine and non-routine situations.

Assessments

- Numbers, Logic and Polynomials Online Test - 10%
- Group Presentation Task - 10%
- Exponential, Logarithmic & Circular Functions Test - 15%
- Calculus Test – 15%
- Participation - 10%
- Examination - 40%

In order to pass this unit, students must:

- ❖ Attempt all internal assessments.
- ❖ Achieve an overall mark of 50% or higher

MCD4520 – Engineering Methods

Description

This unit develops methods for analyzing complex problems. The basics of statics and material properties are introduced and used to analyze structures such as beams, cantilevers and truss sections. This knowledge is used to design, analyze, build and test a structural component. Simplifications are implicit in the methods used in this analysis. These simplifications will be examined carefully and scrutinized in a broader cross-disciplinary context through problems related to the system being designed. The methods considered will include: the use of simplifications, assumptions, constraints, boundary conditions and levels of required precision.

The outcome of the structural analysis and testing will be compared and the suitability of the simplifications used will be scrutinized. You will gain knowledge about the methods engineers use to address complex problems across disciplines. Alongside this “engineering thinking”, you will also gain insight into the role of different specializations of engineering in society. Communication and teamwork skills will be developed through teamwork tasks.

Prerequisites

This is a core unit in the Monash College Diploma of Engineering, Part 2.

Learning Outcomes

On completion of this unit, students should be able to:

1. Determine reactions and internal member forces in simple truss and beam systems and carry out limit state design to select appropriately sized members.

2. Determine the strength of structural materials to inform engineering designs with considerations to performance, cost, sustainability and societal impact.

3. Determine the steady-state performance of simple systems involving levers, gears, springs and pulleys using appropriate engineering problem-solving methodologies.

4. Propose concept designs that solve engineering problems and justify finalized design with considerations of key variables, assumptions and system boundaries.

5. Identify appropriate engineering tools and techniques to develop, validate and convey designs and solutions.

6. Identify roles and responsibilities within a team and reflect on self and team behaviors that contribute to the successful conduct of a project.

Assessments

- Pre-Workshop Quizzes - 5%
- Post workshop work - 5%
- Test 1 - 5%
- Test 2 - 10%
- Labs and Projects - 25%
- Final Exam - 50%

To pass the unit, students are required to achieve an overall mark of 50% and satisfy the following hurdle requirements:

- at least 45% in the total continuous assessments A1-A5 component AND
- at least 45% in the final examination component. Students failing to achieve these hurdle requirements will be given a maximum of 48% in the unit.

MCD4530 – Engineering Design

Description

This unit covers the engineering design process, which is a method used by engineers from all disciplines to determine a solution to a problem or address a need. You will use design thinking models to define the problem, create innovative conceptual designs, prototype possible design solutions, refine several designs to a single final design, and determine the specifications of the final design. In order to simulate a real-world experience, you are required to determine the role of the stakeholders in the project, and consider the economic, environmental, Indigenous, social and ethical aspects of your proposal.

You will be working in a team throughout the semester to gain the communication skills which are highly desired by industries. You will be required to reflect on your work to help improve your interpersonal and teamwork skills contributing to your personal growth. You will also consider the value of engineering ethics and the Code of Ethics whilst learning the engineering design process. Engineers need to submit proposals and pitch their ideas to stakeholders within communities and their team members. They will give presentations to their peers, to their project managers, and to possible stakeholders to develop these presentation skills

Prerequisites

Nil

Learning Outcomes

1. Discern fundamental chemical, materials, mechanical and environmental engineering knowledge, principles and concepts to propose solutions to a humanitarian engineering problem.

2. Identify design requirements from a provided brief and analyse potential solutions using first principles of mathematics and natural and engineering sciences.

3. Identify societal, health, safety, legal and cultural issues relevant to your project including the Indigenous context, and your consequent responsibilities as an engineer.

4. Determine appropriate principles of sustainable design and development, including embodied energy, renewable materials, availability, costs, etc, of a proposed solution using a systems approach to design.

5. Discern the ethical considerations of working with diverse communities and stakeholders, and demonstrate your commitment to the Engineers Australia Code of Ethics and established norms of professional conduct throughout your project.

6. Describe project progress and outputs to stakeholders verbally through pitches, in writing through professional engineering documentation, and graphically through drawings and visualizations.

7. Describe the principles of team norms, collaboration and dynamics, define your professional goals and discern the practices that lead to successful teamwork in a multicultural context.

Assessments

- Weekly Progress Reports (WPR) – Individual- 15%
- Process Engineering Design Report – Team – 15%
- Content Knowledge Test – Individual – 15%
- EWB Design Video Report – Individual - 15%

- Final Design Report - Team -20%
- Pitch Presentation and Prototype - Team - 10%
- Professional Identity Reflection – Individual – 10%

In order to pass this unit, students must:

Attempt all internal assessments and achieve at least 45% in the total individual assessment items.

MCD4540 – Engineering Smart Systems

Description

This unit aims to introduce the fundamentals of software, electrical, electronic and mechatronics engineering, required to prepare students for engineering studies. The fundamental stages in the software and hardware development life cycle will be introduced, including requirements analysis, functional analysis, design integration and verification. Concepts such as Boolean Logic, Ohm's and Kirchhoff's Laws, Nodal Analysis and Thevenin Equivalence will also be introduced. These will be used to analyse and design solutions that contain electrical components including capacitors, semiconductor devices such as diodes, transistors and basic microcontrollers.

Prerequisites

Co-requisites

Learning Outcomes

On completion of this unit, students should be able to:

1) Discuss requirements of a smart system from component to integrated perspective.

2) Define programs using Python, discern problem-solving strategies in decomposing problems using algorithms and describe software engineering processes.

3) Select fundamental circuit analysis techniques to solve problems in circuits that contain common electrical and electronic components.

4) Propose a design solution in response to a given scenario through requirements and functional analysis, evaluate that solution from an integrated system perspective.

5) Identify appropriate engineering tools and techniques to develop and validate a solution.

6) Identify the ethical considerations of data collection and analysis in engineering designs that may impact the suitability of solutions.

7) Describe project progress and outputs to stakeholders in review meetings, demonstrations and documentation.

8) Identify roles and responsibilities within a team and reflect on self and team behaviours that contribute to the successful conduct of a project.

Assessments

- Workshop related activities: 5%
- Practical work: 15%
- Project: 20%
- Test 1: 5%
- Test 2: 5%
- Final examination: 50%

In order to pass this unit, students must:

- ❖ Achieve at least 45% in the total internal assessments
- ❖ Achieve at least 45% in the final examination
- ❖ Achieve an overall mark of 50% or higher

MCD4550 – Engineering Numerical Analysis

Description

This unit introduces computing fundamentals in the context of dynamical systems. Programming structures including arrays, loops, conditional statements, and functions will be presented through the MATLAB environment. This use of MATLAB will initially focus on the analysis of physical systems involving linear and rotational motions that can be solved analytically. These systems will be analysed via kinematic, kinetic, and energy-based methods.

The unit will then examine a wider range of complex engineering and dynamical systems that do not exhibit analytical solutions. Problems related to these systems will be solved using numerical methods for linear regression, root-finding, integration, ordinary differential equations, and systems of linear equations. The underlying assumptions and uncertainties associated with the models and numerical methods will be emphasised.

Prerequisites: MCD4540, MCD4490

Co-requisites: MCD4500

Learning Outcomes

On completion of this unit, students should be able to:

1) Identify appropriate programming structures and functions to solve simple computational tasks.
2) Determine the motion of particles and rigid bodies using fundamental concepts of kinematics, kinetics and energy methods to analyse simple physical systems.
3) Select and implement appropriate programming structures and functions to solve problems involving the motion of particles and rigid bodies as well as other engineering problems.
4) Discern mathematical and computational information in prose descriptions of diverse engineering problems and incorporate this into analytically- and numerically-computed solutions.
5) Describe uncertainties and errors associated with numerical models and methods and their implications on the computed results.

Assessments

- Workshop related activities: 5%
- Practical work: 25%
- Test 1: 3.5%
- Test 2: 3.5%
- Assignment: 10%
- Test 3: 3%
- Final examination: 50%

In order to pass this unit, students must:

- ❖ Achieve at least 45% in the total internal assessments
- ❖ Achieve at least 45% in the final examination
- ❖ Achieve an overall mark of 50% or higher

MCD4600 – Intermediate Physics

Description

This unit continues on from MCD1180 Introductory Physics, and considers the basic concepts of practical investigation, rotational motion, electricity, magnetism and atomic theories. Through practical work, you will relate your theoretical knowledge to experimental processes and engage in critical observation and testing of physical phenomena.

Prerequisites

MCD1180 Introductory Physics.

Learning Outcomes

On completion of this unit, students should be able to:

1. Demonstrate knowledge of the value of practical work.
2. Apply the theory of rotational motion.
3. Solve problems involving electricity and magnetism.
4. Analysis and evaluate the construction materials, and evaluate the effect of forces and loads on structures and materials.
5. Explain a range of atomic theories.

Assessments

- Test 1 - 5%
- Quizzes - 10%
- Test 2 - 10%
- Laboratory work - 20%
- Project Work- 15%
- Final Exam - 40%

Students must achieve an overall mark of 50% or higher in order to pass this unit. Overall marks consist of internal assessments and final examination marks.

MCD4770 – Professional Practice

Description

The practice of engineering involves applying scientific and technical knowledge, common sense and experience to solving problems of practical significance for people. During this unit, you will learn about engineering practices by studying important engineering skills that are not covered in traditional mathematics, chemistry and physics courses, and will apply these skills to projects. Through the study of this unit, you will improve your knowledge of the IT and engineering professions, design and analysis, communication, ethics and economics.

Prerequisites

Nil

Learning Outcomes

On completion of this unit, students should be able to:

1. Undertake a simple design and build project in a competitive team-based environment.
2. Develop conceptual understanding and problem-solving abilities by applying engineering principles.
3. Develop proficiency with technologies for information gathering analysis, simulation, theoretical prediction, access to information, and report preparation.
4. Describe the importance and relevance of engineering and its interdisciplinary ties to other fields and society, in order to become a scientifically literate and ethical citizen.
5. Identify professional issues relevant to a contemporary engineering challenge and appropriate responses.
6. To present and discuss engineering issues and concepts in a range of writing formats, including essay and technical report.
7. Demonstrate proper and ethical scientific and engineering practices, including safety, environment, and record keeping.
8. Interpret scientific and engineering results and draw reasonable conclusions.
9. Work with a small team to plan and manage an engineering project and report on team performance.
10. Communicate effectively through written and oral reports.

Assessments

- Assessment 1: LR - 10%
- Assessment 2: Test 1 - 10%
- Assessment 3: OP1 - 10%
- Assessment 4: Test 2 - 10%
- Assessment 5: Test 3 - 10%
- Assessment 6: Project - 50%

Students must achieve an overall mark of 50% or higher in order to pass this unit.