MONASH
College

Unit Guide

Diploma of Applied Data Science

Monash College

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Elective Units Rules **

**Students could only choose one combination from Pair A to Pair E as Elective Stream A1 unit and Elective Stream A2 unit. For example, if you choose Pair A, then you will enrol in MCD4390 as Elective Stream A1 in the 1st Trimester of Part 2 and you MUST enrol in MCD4400 as Elective Stream A2 unit in 2nd Trimester of Part 2.

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 grounding in the basic functioning of a computer system and how it is used within the engineering environment. Your knowledge of the following will be extended: advanced Microsoft Word features, Excel, and PowerPoint. Further, you'll learn how to solve real-world problems via the utilisation of a microcontroller and programming language, and you'll create and execute an effective oral presentation to share your findings.

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 Powerpoint 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-word problems can be addressed by the digital-word.

Assessments

- Test 1 - 10%
- Test 2 - 10%
- Assignment 1 - 20%
- Presentation 1 - 5%
- Assignment 2 - 30%
- Presentation 2 - 5%
- 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.
2. Select measuring equipment of appropriate accuracy.
3. Utilise appropriate numbers of significant figures.
4. Recognise the measurement error in selected equipment; identify sources of error in analytical procedures.
5. Distinguish between displacement, speed, velocity and acceleration.
6. Distinguish between scalar and vector quantities.
7. Apply the laws of motion to practical situations.
8. Demonstrate knowledge of mass, force and their relationship through Newton's laws.
9. Differentiate between work, energy, kinetic energy, potential energy and power.
10. Differentiate between force and torque and apply the laws of equilibrium to practical situations.
11. Distinguish between displacement, amplitude, period, frequency and wavelength of a wave.
12. Describe behavior of waves in terms of reflection, refraction, diffraction and interference.
13. Distinguish between energy, intensity and intensity level in a wave.

Assessments

- Test 1 - 5%
- Quizzes - 10%
- Test 2 - 10%
- Laboratory - 20%
- Projects - 15%
- Final Exam - 40%

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. Overall mark consists of internal assessments and final examination 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. Relate organic chemical structures to observed chemical reactions, using examples from those involved in human nutrition and global cycling of nutrients.
3. Discuss factors which give rise to chemical kinetics; differential and integrated rate laws.
4. Analyse the arrangement of elements in the periodic table (including its historical development) and relate trends in properties of elements to their atomic structure.
5. Distinguish between the different chromatographic types and various spectroscopic techniques in order to understand their use in qualitative and quantitative chemical analysis.
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 - 10%
- Poster Presentation - 10%
- Laboratory - 15%
- Final Examination - 50%

Students must achieve an overall mark of 50% or higher with a minimum mark of 45% in the final examination 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. 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 with a minimum mark of 40% in the final examination and a minimum mark of 40% in internal assessment in order to pass this unit. Overall marks consist of internal assessments and final examination marks.

MCD1700 – Introductory Mathematics

Description

The 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 of $0^0, 30^0, 45^0, 60^0, 90^0$ 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.

28. Express vectors using $\underset{\sim}{i}$ and $\underset{\sim}{j}$ components. In R^2.

29. Express Cartesian coordinates in R^2 .

30. Calculated distance between two points in R^2.

31. Use the formula $\left(\dfrac{nx_1 + mx_2}{n+m}, \dfrac{ny_1 + my_2}{n+m} \right)$ to divide a line segment by given ratio.

32. solve problems related in Parallel and perpendicular lines in R^2.

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. Apply properties of rectangle, rhombus, parallelogram and square to solve problems in plane geometry and analytical geometry.

Assessments

- Topic Quizzes - 10%
- Test - 15%
- Assignment - 10%
- Tutorial participation - 5%
- Final Examination - 60%

In order to pass this unit, students must:

- ❖ Achieve at least 65% in the tutorial participation
- ❖ 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

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 principle 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 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 the 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 $\sin^2\theta + \cos^2\theta = 1; \ \tan^2\theta + 1 = \sec^2\theta; \ 1 + \cot^2\theta = \csc^2\theta$ 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 45% in the final examination

- ❖ Achieve an overall mark of 50% or higher

MCD2080 – Business Statistics

Description

This unit is designed to provide skills in data analysis and statistical processes as applied to business and basic business computations and techniques.

Prerequisites

MCD1110 Data Analysis and MCD1550 Introduction Mathematics for Business or equivalent

(For Business stream only. For Part 2 students, Part 1 pre-requisites are not applicable)

MCD1110 Data Analysis and MCD1230 Applied Mathematics or equivalent

(For Commerce stream only. For Part 2 students, Part 1 pre-requisites are not applicable)

Learning Outcomes

In this unit you will learn to use basic statistical techniques and apply them to problems across a range of areas in business.

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

1. Use tables, graphs and charts to present data in meaningful forms.

2. Learn standardization techniques of numerical data and be able to calculate measures of central tendency and dispersion for raw data and estimate measures of central tendency and dispersion from grouped data.

3. Explore categorical data and relationships using Excel - Pivot Tables techniques.

4. Identify the main features of the binomial and general discrete probability distributions, and apply these to business problems.

5. Recognise and utilise normal distribution probability curves, and perform associated business calculations involving the use of standard normal tables and statistical functions in Excel.

6. Select a simple random sample and identify possible sources of bias in sample surveys.

7. Use the normal distribution and t-distribution to calculate confidence intervals for population parameters; (both mean and proportions) and use excel to compute the confidence intervals.

8. Use the normal distribution and t-distribution to test statistical hypotheses.

9. Utilise statistical concepts and methods, including correlation and linear regression, to explore and explain the relationship between two variable – as well multiple variables (simple and multiple regressions) including extensions to categorical explanatory variables.

10. Identify and interpret the four basic components of a time series and apply elementary forecasting techniques to time series data

11. Perform simple statistical analysis, calculation and report writing using Excel.

These outcomes are important to a successful career in Business.

MCD2080 – Business Statistics *CONTINUED*

Assessments

Task	Weight
Lecture Practice and Quizzes	15%
Assignment	10% (Week 6)
Tutorial Workshops	15%
Mini Tests	10% (FAT 1: 5%, FAT 2: 5%)
Final Examination	50% (40% hurdle)

* Approved calculator will be allowed for test and exam. Assignment should be done using Excel.

Requirements to Pass the Unit

- In order to achieve a pass in this unit, you must achieve at least 40% (exam hurdle) on the final exam and your overall result must be 50% or higher

- Your overall result combines your internal assessment and your exam results.

- If you receive a 49N grade, you will automatically be awarded a 48N result

Mode of study

This unit is taught in both face-to-face and online modes (subject to the COVID-19 Pandemic and changing situations). There are no work placement components.

MCD4160 – Physics for Engineering

Description

Engineers apply their technical expertise to an enormous variety of situations. In particular, an engineer will develop solutions to problems, design new technologies or utilize existing technologies that requires knowledge of both the macro world, wherein classical physics principles prevail and of the quantum underpinnings of the physical world. This unit acquaints students with physics concepts and related engineering applications that bridge all scales of inquiry.

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 40% in the total continues assessment component

- ❖ Achieve at least 40% in the final examination

- ❖ Achieve an overall mark of 50% or higher

MCD4280 – Engineering Design: Cleaner, Safer, Smarter

Description

Fundamentals of electrical, chemical and materials engineering will be introduced and applied to provide technological solutions for real-world problems. Theory underpinning analogue and digital circuit design; energy and mass balance; materials processing and the role of functional materials will be presented. The contribution of each topic to a contemporary engineering application will be demonstrated.

Team based projects will highlight the multidisciplinary nature of modern engineering. These concepts will be practiced through hands-on projects carried out by teams. Communication and teamwork skills will be developed through teamwork tasks.

Prerequisites

Nil

Learning Outcomes

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

1. Apply (i) Ohm's and Kirchhoff's laws, (ii) equivalent resistance and (iii) Nodal analysis to find voltages and currents for elements in simple electrical circuits. employ standard electrical laboratory equipment to measure electrical quantities used to debug circuits.

2. Analyse basic circuits containing (i) transistors (via the simple model), (ii) resistors and capacitors and to (iii) formulate Thevenin/Norton equivalent circuits. employ fundamental theories of electrical engineering to build analogue and digital circuits

3. Describe the functions of standard electrical laboratory equipment and how to use them to measure electrical quantities in circuits; analyse thermodynamic processes through the application of energy balance concepts

4. Apply the following concepts (i) conservation of mass and (ii) mass and mole fraction, in the mass balance analysis of engineering systems.

5. Identify how chemical reactions affect the mass balance analysis of engineering systems; explain how different material processing routes directly influence material structural properties

6. Apply energy balance analysis to determine the enthalpy and temperature of a system for engineering systems with and without chemical reactions; recognise and apply systematic principles of engineering design

7. Determine the expansion of materials as the temperature of the material is increased.

8. Apply the concept of resistivity in calculating the resistance of an electrical component

9. Identify how the band gap of a material influences its optical and electronic properties and explain how the chemistry of a semiconductor affects its electronic properties

10. Function as part of a team and communicate effectively with team members

11. Generate and present written reports in a professional engineering format from a template.

MCD4280 – Engineering Design: Cleaner, Safer, Smarter - *CONTINUED*

Assessments

- Pre-Lecture Online Quizzes - 9%
- Practice Class Participation - 10%
- Project 1 Written Report - 15%
- Project 2 Written Report - 5%
- Project 2 Demonstration - 5%
- Worksheet Booklets - 6%
- Lecture Participation – 5%
- Teamwork and Engineering Professional Identity Reflection - 5%
- Examination – 40%

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

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 gases and real gases.
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.

Assessments

*   Tutorial participation (3 x tutorial tests) - 5%
*   Laboratory component (Prelab / Reports) - 30%
*   Online assessments (12 x pre-workshop quizzes) - 10%
*   Final examination - 55%

In order to pass this unit, students must:

❖   Achieve a minimum mark of 40% (12 out of 30) in the lab component
❖   Achieve at least 40% (48 out of 120) in the final examination
❖   Achieve an overall mark of 50% or higher

MCD4400 – Chemistry 2

Description

You will explore the behaviour and characteristics of chemicals through a number of interesting case studies incorporating a range of significant biological and synthetic molecules. Along the way, students will discuss the formation of inorganic coordination complexes and investigate their role in colour and magnetism, and metals in biological systems. The concepts developed within the workshops and tutorials are complemented through a laboratory program where you will have the opportunity to use a variety of analytical techniques and design their own experiments to solve a range of chemical problems.

Prerequisites

MCD4390 Chemistry I

Learning Outcomes

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

1. Demonstrate a basic understanding of chemical nomenclature.

2. Describe the classification, structure and properties of a wide range of organic compounds according to the functional groups they contain.

3. Discuss the properties of transition elements.

4. Describe a wide range of coordination compounds and their structures, reactions and applications in both synthetic materials and biological materials.

5. Employ spectroscopy analysis to investigate molecular structure.

6. Foster practical skills by exploiting an inquiry-based approach to the chemistry laboratory experience.

7. Communicate chemistry, discuss the social and environmental responsibility of chemists in the global community.

Assessments

*   Lab component (Prelabs / Reports) - 30%

*   Online assessment - 10%

*   Tutorial attendance, participation & assessments - 5%

*   Final exam - 55%

In order to pass this unit, students must:

❖   Achieve at least 40% in the lab practical component

❖   Achieve at least 40% in the final examination

❖   Achieve an overall mark of 50% or higher

MCD4410 – Blueprints for Life

Description

This unit will explore the fundamental processes and patterns common to all life on Earth. It will examine how living organisms grow, develop diverse and complex structures, harness and utilize energy and transmit their life blueprints to the next generation. In this unit, students will progress through fundamental themes in cellular biology, biochemistry, genetics, genomics and microbiology. They will examine contemporary issues in biological sciences and the societal impact that biology has by learning from world-class researchers and industry experts.

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 microbiology 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 proficient in interpreting their results

4. Demonstrate competence and precision in the use of common life sciences equipment and techniques

5. Utilize research skills including database searches to synthesise and interpret information related to scientific research, suing appropriate conventions for scientific attribution

6. Work effectively, responsibly, safely and ethically, both individually and in peer or team contexts

Assessments

- A1: Weekly Assessment Quizzes and Active Participation - 18%

- A2: Practical Assessments - 32%

- A3: Final Examination - 50%

In order to pass this unit, students must:

- ❖ Achieve a minimum mark of 40% in the Weekly Assessment Quizzes and Active Participation

- ❖ Achieve an overall mark of 50% or higher

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

MCD4410 Blueprints for Life

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 - 18%

- Practical Assessment - 32%

- Examination - 50%

In order to pass this unit, students must:

- ❖ Achieve a minimum mark of 40% in the Weekly Assessment Quizzes and Active Participation

- ❖ Achieve an overall mark of 50% or higher

MCD4430 – Data Challenges 1

Description

This is the first in a series of data challenges units which collectively develop a broad range of knowledge and transferable skills through studio-based learning, applied problem-solving and exploration of a broad diversity of cross-disciplinary and industry-relevant data science case studies over the course. In recent years the world has seen an explosion in the quantity and variety of data routinely recorded and analysed by research and industry. The data may come from a variety of sources, including scientific experiments and measurements, legal documents, archives, human interactions such as browsing data or social networks on the Internet, mobile phone usage or financial transactions. Data science provides the analytical and visualisation techniques required by practitioners to obtain insights into their data. This inquiry-based boot camp unit will include an introduction to important elements of data science, how it is impacting on society, and the role it will play in addressing problems and issues across the sciences, business arena and industry. You will be exposed to the characteristics of data science over and above the core task of data analysis. Through interdisciplinary team-based workshops you will begin to collaboratively explore examples of complex problems which have been solved through the fusion of data science, mathematics and statistics, social, business, IT and interdisciplinary knowledge.

Prerequisites

Nil

Learning Outcomes

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

1. Identify the principles of scientific thinking and apply them in the context of data science.

2. Reflect upon how to create and deliver results in interdisciplinary teams.

3. Critique the ethical and multicultural dimensions associated with data science decisions, use and quality and their possible impacts on organisations and society.

4. Communicate outcomes effectively in a range of formats including orally, visually and in written form.

5. Identify the various steps to perform data analysis and visualization.

6. Explore the importance of data in a variety of fields including science, IT and business.

Assessments

- Final Written Group Report - 20%

- Final Oral Report - 15%

- Preliminary Report - 10%

- Preliminary Interview - 5%

- Reflective Journal - 20%

- Essay - 10%

- Workshop/studio participation – 20%

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

MCD4440 – Discrete Mathematics for Computer Science

Description

This unit introduces fundamental discrete mathematics topics including combinatorics, sets, relations and functions; methods of logic and proof, especially proof by induction; probability theory, Bayes' theorem; recursion; recurrence relations; trees and other graphs. It establishes the mathematical basis required for studies in Computer Science and Software Engineering.

Prerequisites

Nil

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

1. Identify basic methods of proof, particularly induction, and apply them to solve problems in mathematics and computer science.

2. Manipulate sets, relations, functions and their associated concepts, and apply these to solve problems in mathematics and computer science.

3. Use and analyse simple first and second order recurrence relations.

4. Use trees and graphs to solve problems in computer science.

5. Apply counting principles in combinatorics.

6. Describe the principles of elementary probability theory, evaluate conditional probabilities and use Bayes' Theorem.

Assessments

- ALP Quizzes - 5%

- Topic quizzes - 10%

- Participation - 10%

- Oral Presentation - 5%

- Mid-trimester Test - 15%

- Assignment - 5%

- Final Exam - 50%

In order to pass this unit, students must:

- ❖ Achieve 40% or more in the unit's examination, and

- ❖ Attempt all internal assessments and achieve 40% or more

- ❖ Achieve an overall unit mark of 50% or more.

MCD4450 – Data Challenges 2

Description

This is the second in a series of data challenges units which collectively develop a broad range of knowledge and transferable skills through studio-based learning, applied problem-solving and exploration of a broad diversity of cross-disciplinary and industry-relevant data science case studies over the course. In recent years the world has seen an explosion in the quantity and variety of data routinely recorded and analysed by research and industry. The data may come from a variety of sources, including scientific experiments and measurements, legal documents, archives, human interactions such as browsing data or social networks on the Internet, mobile phone usage or financial transactions. Data science provides the analytical and visualisation techniques required by practitioners to obtain insights into their data. This inquiry-based boot camp unit will include an introduction to important elements of data science, how it is impacting on society, and the role it will play in addressing problems and issues across the sciences, business arena and industry.

Prerequisites

MCD4430 Data Challenges 1

Learning Outcomes

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

1. Identify the principles of scientific thinking and apply them in the context of data science.

2. Reflect upon how to create and deliver results in interdisciplinary teams.

3. Critique the ethical and multicultural dimensions associated with data science decisions, use and quality and their possible impacts on organisations and society.

4. Communicate outcomes effectively in a range of formats including orally, visually and in written form.

5. Identify the various steps to perform data analysis and visualization.

6. Explore the importance of data in a variety of fields including science, IT and business.

Assessments

- Weekly Quizzes - 5%

- Reflective journal (weekly entry) - 5%

- Preliminary report - 5%

- Preliminary interview - 5%

- Essay - 20%

- Final oral report - 10%

- Final written Individual report - 10%

- Final written Group report - 25%

- Reflective journal (final version) - 15%

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

MCD4490 – Advanced Mathematics

Description

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 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 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. Apply differentiation techniques to related rates of change problems and optimization problems.

7. Use differentiation rules to find derivatives of implicit and explicit functions.

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. Solve kinematics problems and set up and solve problems involving Newton's laws of motion.

11. 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 40% in the total internal assessments

- ❖ Achieve at least 40% 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.   Solve first order ordinary differential equations, including by separable variables and integrating factors.

7.   Solve second order linear differential equations with constant coefficients.

8.   Use differential equations to model simple engineering problems.

9.   Evaluate and invert Laplace transforms and use them to solve ordinary differential equations.

10. 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

- ❖   Achieve at least 40% in the final examination

- ❖   Achieve an overall mark of 50% or higher

MCD4700 – Introduction to Computer Systems, Networks and Security

Description

The unit introduces students to fundamentals of computer systems, networks and security. It provides basic knowledge of computer organisation and architecture, operating systems, networking architecture, technology and operation. It introduces the concepts of security goals for protecting common modern computer systems and communication networks from adversaries and the deployment of suitable countermeasures to achieve these goals.

Prerequisites

Nil

Learning Outcomes

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

1. Analyse simple logic circuits.
2. Explain and analyse key computer structure and its operations.
3. Analyse and evaluate various strategies used by an operating system in managing the system resources and running applications efficiently.
4. Describe the operation of communication and networking models and develop simple solutions to network problems.
5. Critically assess the security threats and risks to an organisation's information assets and propose suitable security control technologies that can be applied to reduce the security risks or in making procurement decisions.

Assessments

- Practical Class Work - 15%
- Assignment 1 - 20%
- Assignment 2 - 15%
- Midterm Test – 10%
- Final Examination - 40%

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

MCD4710 – Introduction to Algorithms and Programming

Description

This unit introduces programming fundamentals and the Python language to students. The unit provides a foundational understanding of program design and implementation of algorithms to solve simple problems. Fundamental programming control structures, built in and complex datatypes and mechanisms for modularity will be presented in Python. Topics covered will include basic input and output, program control structures, basic data structures and modular program structure. Problem-solving strategies and techniques for algorithm development, iteration and recursion, algorithm efficiency and the limitations of algorithms will be introduced.

Prerequisites

Completed at least one of: (MCD2130, MCD4490, OR MCD4500) and MCD4720.

Learning Outcomes

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

1. Recognise the relationship between a problem description and program design.
2. Implement problem solving strategies.
3. Demonstrate how basic data structures (list, graphs, trees, sets, tables) function.
4. Investigate different strategies for algorithm development and evaluate these to select an appropriate solution to a given problem.
5. Decompose problems into simpler problems.
6. Determine the complexity of simple algorithms.
7. Recognise the limitations of algorithms.

Assessments

- Mid-trimester Test 1 - 8%
- Assignment 1 - 8%
- Mid-trimester Test 2 - 12%
- Assignment 2 - 10%
- In-lecture Quizzes - 6%
- Tutorial work - 6%
- Laboratory Work - 10%
- Final Examination - 40%

In order to pass this unit, students must:

- ❖ Achieve at least 40% in the unit's total non-examination
- ❖ Achieve at least 40% in the unit's examination
- ❖ Achieve an overall mark of 50% or higher

MCD4730 – Foundations of 3D

Description

This unit is an introduction to the techniques, frameworks and processes comprising 3D modelling and 3D imaging. Foundations of 3D aims to give students an understanding of 3D modelling by developing skills in 3D model creation for a variety of contexts, including 3D prototyping, 3D visualisation and 3D modelling for games and animation. Students will communicate their knowledge of 3D theory through the production of designs that demonstrate geometrical modelling, texture mapping, virtual lighting techniques, camera positioning, and rendering procedures.

Prerequisites

Nil

Learning Outcomes

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

1.   Evaluate and assess techniques used in the 3D creation process.

2.   Research, evaluate and implement 3D geometry, 3D texturing and 3D rendering techniques.

3.   Develop and modify 3D models and 3D environments.

4.   Design, create and detail 3D models and 3D scenes for diverse media.

Assessments

- Assignment 1 - 20%
- Assignment 2 - 20%
- Assignment 3 - 30%
- Tutorial Test 1 - 10%
- Tutorial Test 2 - 10%
- Tutorial Test 3 - 10%

In order to pass this unit, students must:

- ❖   Achieve at least 40% in the unit's total non-examination
- ❖   Achieve at least 40% in the unit's examination
- ❖   Achieve an overall mark of 50% or higher