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| **Course Code:** | 1018ENG |
| **Course Name:** | Engineering Science |
| **Trimester:** | Trimester 2, 2019 |
| **Program:** | Diploma of Engineering |
| **Credit Points:** | 10 |
| **Course Coordinators:** | Dr Nima Talebian and Dr James A. Kirkup |
| **Document modified:** | 17 May 2019 |

**Teaching Team**

Your lecturer/tutor can be contacted via the email system on the portal.

Dr James A. Kirkup: james.kirkup@staff.griffithcollege.edu.au
Dr. Nima Talebian: nima.talebian@staff.griffithcollege.edu.au

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**Staff Consultation**

Your lecturer/tutor is available each week for consultation outside of normal class times. Times that your lecturer/tutor will be available for consultation will be given in the first week of lectures. A list of times and rooms will be published on the Griffith College Portal under the "myTimetable" link.

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**Prerequisites**

The BRM100 Essential Mathematics is the pre-requisite subject for this course. Furthermore, all the basic and required principles of mathematics and physics will be covered during the course of trimester.

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**Brief Course Description**

This experiential learning-based course introduces the natural and physical sciences that underpin the practice of engineering. Through experiments and projects students will identify, discuss, apply, analyse and evaluate science fundamentals through systematic investigation, interpretation, and

analysis of some engineering problems. Topics covered include basic Newtonian mechanics, electrical and magnetics principles, and fluid mechanics fundamentals.

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**Rationale**

Using the ideas and methods of Physics, almost all the scientific problems can be explained. By the use of Physics, we can explain the reason behind observations we make in our day-by-day life. We can also predict the behaviour of objects or systems under particular conditions they are exposed to. Accordingly, we can contribute in improvement of the devices and tools that we are using now. This contribution often results in development of a totally new apparatus or gadget.

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**Aims**

This course aims to expose students from a variety of educational backgrounds to the power of physics in understanding and control of natural phenomena, both at an empirical and experimental level, as well as at a deductive, theoretical and mathematical level. A variety of essential principles and rules, such as Newton's laws, Vector operations, Kinematics, Electricity and Magnetics, covering a wide range and varied spectrum of necessary knowledge of Physics, are taught and their application into other branches of engineering are explained through hands-on activities and laboratory experimentation. The course further aims to develop insights to practical tools for analysis of problems in applied science disciplines such as statics, dynamics, mechanics of materials, kinematics, electromagnetism, materials science, earth sciences, engineering physics, thermodynamics, and heat transfer.

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**Learning Outcomes**

After successfully completing this course you will be able to:

1. Describe and apply important physical science concepts that underpin the engineering profession (for example, Newtonian mechanics, electricity and magnetics).
2. Apply mathematical techniques to the analysis of simple engineering systems.
3. Use oral and/or written communication skills to relay engineering science concepts.
4. Design and perform experiments and critically analyse the data received to support a theory or experimental objective.
5. Work as an effective team member to develop simple engineering projects.

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**Texts and Supporting Materials**

Mazur, Eric. (2015) Principles & Practice of Physics, Global Edition, Pearson

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**Organisation and Teaching Strategies**

***Class Contact Summary***

Lectures:

The basic concepts and analytical skills will be taught during a 2-hour per week lecture. Students are expected to attend the lectures. Occasionally information may be given to students in lectures that will not necessarily be reproduced on the Griffith College Portal site for the course.

Tutorial Classes:

Students will be guided through key problems associated with the Lectures during a 2-hour per week tutorial and problem solving class.

Workshop Classes:

Discussion of the issues and misconceptions associated with the week's material, demonstrations and simulations to solidify concepts will be presented through a 2-hour per week workshop classes.

Lab Classes:

Students are required to attend and participate in two lab experiments (Mechanics and Electricity) which consist of 8 hours of both guided and experiential laboratory classes (i.e. 4 × 2 hours in specified weeks during the trimester). Students have access to a lab task description sheet for each experiment and a lab demonstrator provides feedback on the approach that students take in each of the labs. These laboratory activities carry a total of 20% of the total marks for the course (see Assessments below). Failure to attend and participate in all laboratory sessions results in failing the course.

***Attendance***

Your attendance in class will be marked twice during every 2-hour class. To receive full attendance, you must be present in the classroom on both occasions. Therefore, you are encouraged to attend and participate in all classes throughout the trimester.

***Preparation and Participation in Class***

You are expected to read the relevant chapter/s and complete all works stated in the content schedule before the required class. This weekly preparation both in-class and independently will help in preparing you for each of the assessments. Peer study groups can be useful in assisting with your weekly preparation.

***Consultation Times***

Attendance during consultation times is optional and students are encouraged to use this extra help to enable them to meet the stated learning outcomes. See "Staff Consultation" above.

***Course Materials***

Lecture notes will be made available to students on the student portal prior to each lecture. It is strongly advised to print out the notes and bring them to each class so that your personal notes and any extra information can be added for future use.

***Independent Study***

You are expected to reinforce your learning from class time by undertaking sufficient independent study so that you can achieve the learning outcomes of the course. You are urged to study approximately 6 hours per week outside of class time.

***Program Progression***

Students are reminded that satisfactory Program Progression requires that attendance in classes is maintained at equal to or greater than 80%, and that GPA is maintained at equal to or greater than 3.5 in any trimester. See Griffith College Policy Library – Program Progression Policy for more information.

**Course Content Schedule**

The following table demonstrates various teaching and learning activities of this course, and their pertinent weeks of occurrence.

| Weeks | Topics | Activities | Readings* |
|---|---|---|---|
| **1** | **Introduction, Foundation and 1D Motion:** Introduction and admin<br>Chapter 1 goal: To become familiar with the topics included in the discipline of physics and some physical systems of interest, and to develop a pallet of background knowledge and skills that will be used in this course.<br>Chapter 2 goal: To develop the description of motion in one dimension from both graphical and mathematical perspectives. Physicists call this topic kinematics. | Lecture / Tutorial | Ch. 1 and 2 |
| | No session | Workshop | - |
| **2** | **Acceleration and Momentum:** Chapter 3 goal: To extend the description of motion in one dimension to include changes in velocity. This type of motion is called acceleration.<br>Chapter 4 goal: To begin a theoretical analysis of motion using the concepts of inertia and momentum. | Lecture / Tutorial | Ch. 3 and 4 |
| | **Foundation and 1D motion** | Workshop | - |
| **3** | **Energy and Principle of Relativity:** Chapter 5 goal: To continue a theoretical analysis of motion using the concept of energy. Chapter 6 goal: To investigate whether or not the laws of conservation of energy and conservation of momentum depend on the velocity of an observer. | Lecture / Tutorial | Ch. 5 and 6 |
| | **Acceleration and Momentum** | Workshop | - |
| **4** | **Interactions and Force:** Chapter 7 goal: To investigate how interactions convert energy from one form to another in physical processes within the universe.<br>Chapter 8 goal: To learn how to analyze interacting systems that are neither isolated nor closed using the concept of force. | Lecture / Tutorial | Ch. 7 and 8 |
| | **Energy and Principle of Relativity** | Workshop | - |
| | Experiment 1 – First Session** | Laboratory | - |
| **5** | **Work and Motion in a plane:** Chapter 9 goal: To learn how to analyze the change in energy of a system due to external influences. This type of energy change is called work.<br>Chapter 10 goal: Develop the tools that allow us to deal with motion that takes place in two dimensions. | Lecture / Tutorial | Ch. 9 and 10 |

| Weeks | Topics | Activities | Readings* |
|---|---|---|---|
| | **Interactions and Force** | Workshop | - |
| | Experiment 1 – Second Session | Laboratory | - |
| **6** | **Motion in a Circle and Torque:** Chapter 11 goal: Develop the tools that allow us to understand the kinematics and dynamics of particles and extended objects moving in circular motion centered on an axis of rotation.<br>Chapter 12 goal: To study the causes of the changes in rotational motion using the concepts of torque and angular momentum. | Lecture / Tutorial | Ch. 11 and 12 |
| | **Work and Motion in a plane** | Workshop | - |
| **7** | **Electric Interactions and mid-term recap:** Chapter 22 goal: To begin the study of electricity, one of the four fundamental interactions of the universe. We will focus on static situations in this chapter.<br>Recap for mid trimester exam. | Lecture / Tutorial | Ch. 22 |
| | **Motion in a Circle and Torque** | Workshop | - |
| **8** | **The Electric Field and Gauss's Law:** Chapter 23 goal: To develop the force field concept for the long-range nature of the electrostatic interaction.<br>Chapter 24 goal: To develop tools for analyzing electrostatic properties of charge distributions using the concepts of work and energy. | Lecture / Tutorial | Ch. 23 and 24 |
| | **Electric Interactions** | Workshop | - |
| **9** | **Energy in Electrostatic and Charge storage:** Chapter 25 goal: To develop tools for analyzing electrostatic properties of charge distributions using the concepts of work and energy.<br>Chapter 26 goal: To develop tools for analyzing the changes in energy that are involved with separating positive and negative charge carriers and how the separated charges can be stored in simple arrangements of conductors. | Lecture / Tutorial | Ch. 25 and 26 |
| | **The Electric Field and Gauss's Law** | Workshop | - |
| **10** | **Magnetic Interactions and Magnetic field:** Chapter 27 goal: To discuss interactions between magnets, introduce the concept of a magnetic field, and explore the connection between electricity and magnetism.<br>Chapter 28 goal: To discuss the relationship between the motion of charged particles and magnetism. We will see that all magnetism is due to charged particles in motion. | Lecture / Tutorial | Ch. 27 and 28 |
| | **Energy in Electrostatic and Charge storage** | Workshop | - |

| Weeks | Topics | Activities | Readings* |
|---|---|---|---|
| | Experiment 2 – First Session | Laboratory | - |
| **11** | **Changing magnetic field and Electric Circuits:** Chapter 29 goal: To discuss the electric fields that accompanying changing magnetic fields. We will discover a similarity between the interactions between moving charge carriers with stationary magnetic fields and stationary charge carriers with changing magnetic fields.<br>Chapter 31 goal: To explore the basic principles of electric circuits powered by sources of electric potential energy that maintain a constant potential difference, such as batteries. | Lecture / Tutorial | Ch. 29 and 31 |
| | **Magnetic Interactions and Magnetic field** | Workshop | - |
| | Experiment 2 – Second Session | Laboratory | - |
| **12** | **Electronics and Recap for final exam:** Chapter 32 goal: To explore the basic principles of electric circuits and electronics powered by sources of AC electric current. Series combinations of resistors, capacitors, and inductors will be discussed.<br>Recap for final exam. | Lecture / Tutorial | Ch. 32 |
| | **Changing magnetic field and Electric Circuits** | Workshop | - |

* The chapter numbers refer to the course textbook (see “Texts and Supporting Materials” above).

** Laboratory sessions may be scheduled in different weeks. Check Student Portal for up-to-date information.

**Assessments**

Various assessment items of this course is as explained below. The requirements to pass the course are also explained.

***Summary of Assessment items***

| Item | Assessment Tasks | Weighting | Relevant Learning Outcomes | Due Weeks |
|---|---|---|---|---|
| 1 | In-class Quizzes | 10% | 1, 2 and 3 | 1, 3, 6, 8, 10 |
| 2 | On-line Quizzes (Using Wiley Plus) | 10% | 1, 2 and 3 | 2, 4, 7, 9, 11 |
| 2 | Mid-trimester Exam | 25% | 1,2, and 3 | 7 |
| 3 | Laboratory Activities and Projects - Mechanics (Experiment 1, 2 Sessions) | 15% | 1, 2, 3, 4 and 5 | 4 and 6 |
| 4 | Laboratory Activities and Projects - Electricity (Experiment 2, 2 Sessions) | 15% | 1, 2, 3, 4 and 5 | 10 and 11 |
| 5 | Final Exam | 25% | 1, 2 and 3 | TBA |

***Assessment Details***

In-class and On-line Quizzes

The in-class and on-line Quizzes will assess students' knowledge and understanding of the Physics science concepts covered in the course and the ability to apply that understanding to the solution of practical problems. Each of the quizzes carries 2% of the total course mark.

Mid-trimester Exam

The mid-trimester exam is a closed-book test which provides feedback to both the students and the teaching team regarding progress and conduct of the course halfway through the course. This exam also encourages the students to keep up to date with their work.

Laboratory Activities

The laboratory activities assess the ability of the students to apply the taught principles to design, conduct, analyse and interpret actual experimental data. Also the laboratory activities will allow students to verify the fundamental laws of various systems and to compare the predicted response to the theoretically calculated behaviour of those system. Experiment 1 (Mechanics) deals with the concept of momentum, energy conservation and collision in two separate sessions. Experiment 2 (Electricity) deals with the concept of resistors, currents and circuits in two separate sessions.

Each experiment has a pre-lab quiz valued 20% of the experiment mark. A 20% mark for full attendance and performance in each experiment is recorded for each student by the lab demonstrator. The data collected in each lab session is analysed and reported through separate lab reports for each session (i.e. two reports for each experiments and four reports in total). The reports carry a total of 60% mark for each experiment.

Final exam

The final exam will assess the students' knowledge and understanding of the topics covered in the course and the ability to apply that understanding to the solution of practical problems. The examination paper is devised also to test the students' computational skills, as well as the ability to apply that knowledge to engineering design problems. The final exam will be closed book. Marks will be awarded according to correctness of the procedures, accuracy of the solutions and clarity of the presentation.

***Requirements to pass the course:***

Students are required to complete all items of assessment and achieve an aggregate mark of at least 50% overall. Students must also achieve at least 40% in the final exam, as well as each of the laboratory activities, in order to achieve a grade of "Pass" or above. Failure to reach to the above-mentioned 40% hurdle results in failing the course.

***Submission and Return of Assessment Items***

The lab reports are submitted online to the course page on the student portal. You must be able to produce a copy of all work submitted if so requested. Copies should be retained until after the release of final results for the course.

***Extensions***

To apply for an extension of time for an assessment item you must submit a written request to your lecturer via the Student Website at least 48 hours before the date the assessment item is due. Grounds for extensions are usually: serious illness, accident, disability, bereavement or other compassionate circumstances and must be able to be substantiated with relevant documentation (e.g. medical certificate). Please refer to the Griffith College Policy Library for guidelines regarding extensions and deferred assessment.

***Penalties for late submission without an approved extension***

Penalties apply to assignments that are submitted after the due date without an approved extension. Please refer to the Griffith College Policy Library - Assessment Policy for guidelines and penalties for late submission.

***Assessment Feedback***

Marks awarded for assessment items will also be available on the on-line grades system on the student portal within fourteen [14] days of the due date.

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**Additional Course Information**

Nil.

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**Generic Skills**

Griffith College aims to develop graduates who have an open and critical approach to learning and a capacity for lifelong learning. Through engagement in their studies, students are provided with opportunities to begin the development of these and other generic skills. In particular, studies in this course will give you opportunities to begin and develop the following skills:

| Generic Skills | Taught | Practised | Assessed |
|---|---|---|---|
| Written Communication | Yes | Yes | Yes |
| Oral Communication | | Yes | Yes |
| Information Literacy | Yes | Yes | Yes |
| Secondary Research | | | |
| Critical and Innovative Thinking | Yes | Yes | Yes |
| Academic Integrity | Yes | Yes | Yes |
| Self-directed Learning | | Yes | Yes |
| Team Work | | Yes | Yes |
| Cultural Intelligence | | Yes | Yes |
| English Language Proficiency | | Yes | |

**Academic Integrity**

Griffith College is committed to maintaining high academic standards to protect the value of its qualifications. Academic integrity means acting with the values of honesty, trust, fairness, respect and responsibility in learning, teaching and research. It is important for students, teachers, researchers and all staff to act in an honest way, be responsible for their actions, and show fairness in every part of their work. Academic integrity is important for an individual's and the College's reputation.

All staff and students of the College are responsible for academic integrity. As a student, you are expected to conduct your studies honestly, ethically and in accordance with accepted standards of academic conduct. Any form of academic conduct that is contrary to these standards is considered a breach of academic integrity and is unacceptable. Please ensure that you are familiar with the Griffith College Academic Integrity Policy; this policy provides an overview of some of the behaviours that are considered breaches of academic integrity, as well as the penalties and processes involved when a breach is identified.

Some students deliberately breach academic integrity standards with intent to deceive. This conscious, pre-meditated form of cheating is considered to be one of the most serious forms of fraudulent academic behaviour, for which the College has zero tolerance and for which penalties, including exclusion from the College, will be applied. However, Griffith College also recognises many students breach academic integrity standards without intent to deceive. In these cases, students may be required to undertake additional educational activities to remediate their behaviour and may also be provided appropriate advice by academic staff. As you undertake your studies, your lecturers, tutors and academic advisors will provide you with guidance to understand and maintain academic integrity; however, it is also your responsibility to seek out guidance if and when you are unsure about appropriate academic conduct. In the case of a breach of academic integrity made against a student, he or she may request the guidance and support of a Student Learning Advisor or Student Counsellor. For further information please refer to the Academic Integrity Policy on the Griffith College Policy Library.