MECH3003

Mechanical Design 2

Session 1, In person-scheduled-weekday, North Ryde 2022

School of Engineering

Contents

General Information 2

Learning Outcomes 3

General Assessment Information 3

Assessment Tasks 4

Delivery and Resources 9

Unit Schedule 9

Policies and Procedures 9

Changes from Previous Offering 11

Engineers Australia Competency Mapping 11

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General Information

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Credit points
10

Prerequisites
((MECH2001 or MECH201) and (MECH2003 or MECH203) and (MECH2004 or MECH204)) or admission to MEngMechEng

Corequisites

Co-badged status

Unit description
In this unit, students will develop the skills to produce design solutions for complex engineering design problems. The unit covers knowledge in the design of machine components such as gears, belt drives, chain drives, bearings and shaft systems. At the end of the unit, students are expected to demonstrate the ability to design a complete mechanical system as well as the critical details for components of a larger system. The unit will culminate with an opportunity for the students to present a constructed system and demonstrate its ability to achieve the defined task in a competition.

Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at https://www.mq.edu.au/study/calendar-of-dates

Learning Outcomes

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

ULO1: Define a complex mechanical engineering problem into a series of specifications and consider multiple alternative solutions that may achieve these specifications.

ULO3: Conceptualise and analyse an entire mechanical system, numerically, to determine and optimise the requirements of the individual components to ensure a viable and cost-effective solution to performing a specified task.

ULO2: Apply concepts and knowledge in Mechanics of Materials and Materials engineering to create mathematical representations of the performance of common mechanical components to generate effective design choices..

ULO4: Conceptualise and implement the plan to manufacture a prototype of a mechanical design which demonstrates the effectiveness or deficiencies of the numerical analysis undertaken to enhance the design of a multi-faceted mechanical engineering problem.

ULO5: Apply prerequisite unit knowledge to aid the design of solutions for complex engineering problems.

General Assessment Information

Grading and passing requirement for unit

In order to pass this unit a student must obtain a mark of 50 or more for the unit (i.e. obtain a passing grade P/ CR/ D/ HD). For further details about grading, please refer below in the policies and procedures section.

Final and supplementary examinations

If you receive special consideration for the final exam, a supplementary exam will be scheduled by the faculty during a supplementary exam period, typically about 3 to 4 weeks after the normal exam period. By making a special consideration application for the final exam you are declaring yourself available for a resit during the supplementary examination period and will not be eligible for a second special consideration approval based on pre-existing commitments. Please ensure you are familiar with the policy prior to submitting an application. Approved applicants will receive an individual notification one week prior to the exam with the exact date and time of their supplementary examination.

General Faculty Policy on assessment submission deadlines and late submissions

Online quizzes, in-class activities, or scheduled tests and exam must be undertaken at the time indicated in the unit guide. Should these activities be missed due to illness or misadventure,

students may apply for Special Consideration.

All other assessments must be submitted by 5:00 pm (Sydney Time) on their due date.

Should these assessments be missed due to illness or misadventure, students should apply for Special Consideration.

Assessments not submitted by the due date will receive a mark in accordance with the late submission policy as follows:

A 12-hour grace period will be given after which the following deductions will be applied to the awarded assessment mark: 12 to 24 hours late = 10% deduction; for each day thereafter, an additional 10% per day or part thereof will be applied until five days beyond the due date. After this time, a mark of zero (0) will be given. For example, an assessment worth 20% is due 5 pm on 1 January. Student A submits the assessment at 1 pm, 3 January. The assessment received a mark of 15/20. A 20% deduction is then applied to the mark of 15, resulting in the loss of three (3) marks. Student A is then awarded a final mark of 12/20.

Attendance

Their will be no SGTA's in the first week of semester, they will begin as of week two. Students are required to attend the SGTA that they have enrolled in through eStudent. Attendance at the SGTA will be recorded and activities undertaken there will be graded. Some assessments require students to be present physically at the SGTA's or lecture. Any student who can not be physically present is required to notify the unit convener within the first two weeks of session.

Assessment Tasks

Name	Weighting	Hurdle	Due
Diagnostic Test	5%	No	Week 2, Lecture time slot
In class tutorial exercises	5%	No	Weekly SGTA
Mid Session Test	10%	No	Week 8, Lecture time slot
Participation	5%	No	Weekly SGTA
Design Report and Competition	30%	No	Competition: Week 12 Lecture, Report: Friday Week 13
Project Trial and Presentation	10%	No	Week 10 SGTA
Final Examination	35%	No	TBA

Diagnostic Test

Assessment Type [1]: Examination
Indicative Time on Task [2]: 4 hours
Due: **Week 2, Lecture time slot**
Weighting: **5%**

A test assessing the assumed knowledge that students are expected to have obtained by completing the pre-requisites for this unit. Students who fail the diagnostic quiz should consider disenrolling from the unit before the census date.

On successful completion you will be able to:

- Apply prerequisite unit knowledge to aid the design of solutions for complex engineering problems.

In class tutorial exercises

Assessment Type [1]: Design Task
Indicative Time on Task [2]: 4 hours
Due: **Weekly SGTA**
Weighting: **5%**

A series of exercises that will allow students to apply the design process to optimise individual machine components.

On successful completion you will be able to:

- Conceptualise and analyse an entire mechanical system, numerically, to determine and optimise the requirements of the individual components to ensure a viable and cost-effective solution to performing a specified task.
- Apply concepts and knowledge in Mechanics of Materials and Materials engineering to create mathematical representations of the performance of common mechanical components to generate effective design choices..

Mid Session Test

Assessment Type [1]: Examination
Indicative Time on Task [2]: 12 hours
Due: **Week 8, Lecture time slot**

Weighting: **10%**

A test assessing the students knowledge of material delivered up to and including Week 7

On successful completion you will be able to:

- Define a complex mechanical engineering problem into a series of specifications and consider multiple alternative solutions that may achieve these specifications.
- Apply concepts and knowledge in Mechanics of Materials and Materials engineering to create mathematical representations of the performance of common mechanical components to generate effective design choices..
- Apply prerequisite unit knowledge to aid the design of solutions for complex engineering problems.

Participation

Assessment Type [1]: Participatory task
Indicative Time on Task [2]: 0 hours
Due: **Weekly SGTA**
Weighting: **5%**

This assessment includes students participation in SGTAs and other activities embedded in other learning activities described in the unit.

On successful completion you will be able to:

- Define a complex mechanical engineering problem into a series of specifications and consider multiple alternative solutions that may achieve these specifications.
- Conceptualise and analyse an entire mechanical system, numerically, to determine and optimise the requirements of the individual components to ensure a viable and cost-effective solution to performing a specified task.
- Apply concepts and knowledge in Mechanics of Materials and Materials engineering to create mathematical representations of the performance of common mechanical components to generate effective design choices..
- Conceptualise and implement the plan to manufacture a prototype of a mechanical design which demonstrates the effectiveness or deficiencies of the numerical analysis undertaken to enhance the design of a multi-faceted mechanical engineering problem.

Design Report and Competition

Assessment Type [1]: Creative work
Indicative Time on Task [2]: 30 hours
Due: **Competition: Week 12 Lecture, Report: Friday Week 13**
Weighting: **30%**

Report summarising the design process undertaken for each individual sub-system. This should include; decisions made to achieve the required task, the detailed analysis undertaken that assists with making those decisions, the iterations undertaken to achieve an enhanced final design. Each of the individual sub-systems will be required to be manufactured and assembled into a single working prototype which will be assessed based on the ability of the device to achieve a specified task.

On successful completion you will be able to:

- Define a complex mechanical engineering problem into a series of specifications and consider multiple alternative solutions that may achieve these specifications.
- Conceptualise and analyse an entire mechanical system, numerically, to determine and optimise the requirements of the individual components to ensure a viable and cost-effective solution to performing a specified task.
- Apply concepts and knowledge in Mechanics of Materials and Materials engineering to create mathematical representations of the performance of common mechanical components to generate effective design choices..
- Conceptualise and implement the plan to manufacture a prototype of a mechanical design which demonstrates the effectiveness or deficiencies of the numerical analysis undertaken to enhance the design of a multi-faceted mechanical engineering problem.
- Apply prerequisite unit knowledge to aid the design of solutions for complex engineering problems.

Project Trial and Presentation

Assessment Type [1]: Presentation
Indicative Time on Task [2]: 8 hours
Due: **Week 10 SGTA**
Weighting: **10%**

Presentation describing the concept that the group has selected. The group will also have an opportunity to initially test their concept prior to the final competition. Bonus marks will be

awarded to students who are able to demonstrate a working prototype.

On successful completion you will be able to:

- Define a complex mechanical engineering problem into a series of specifications and consider multiple alternative solutions that may achieve these specifications.
- Conceptualise and analyse an entire mechanical system, numerically, to determine and optimise the requirements of the individual components to ensure a viable and cost-effective solution to performing a specified task.
- Apply concepts and knowledge in Mechanics of Materials and Materials engineering to create mathematical representations of the performance of common mechanical components to generate effective design choices..
- Conceptualise and implement the plan to manufacture a prototype of a mechanical design which demonstrates the effectiveness or deficiencies of the numerical analysis undertaken to enhance the design of a multi-faceted mechanical engineering problem.
- Apply prerequisite unit knowledge to aid the design of solutions for complex engineering problems.

Final Examination

Assessment Type [1]: Examination
Indicative Time on Task [2]: 30 hours
Due: **TBA**
Weighting: **35%**

Final examination assessing all the content delivered throughout the course. This assessment will be invigilated.

On successful completion you will be able to:

- Define a complex mechanical engineering problem into a series of specifications and consider multiple alternative solutions that may achieve these specifications.
- Apply concepts and knowledge in Mechanics of Materials and Materials engineering to create mathematical representations of the performance of common mechanical components to generate effective design choices..
- Apply prerequisite unit knowledge to aid the design of solutions for complex engineering problems.

[1] If you need help with your assignment, please contact:

- the academic teaching staff in your unit for guidance in understanding or completing this type of assessment
- the Writing Centre for academic skills support.

[2] Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation

Delivery and Resources

SGTA's

SGTA's begin as of week 2 in the semester. Students are required to attend the SGTA that they have enrolled in through eStudent. Attendance at the SGTA will be recorded and activities undertaken their will be graded. It is necessary for students to be physically present at the SGTA's to facilitate the group work required to be undertaken for this unit.

Recommended and/or Required texts

The following text are recommended for this unit:

- Richard G Budynas, “Shigley’s Mechanical Engineering Design.” McGrawll Hill, 11th SI edition.

Technology used/required.

This unit requires all students to utilise a common CAD package to facilitate the transfer of designs and information. The CAD software that must be used is CREO 6.0. All assessment tasks where CAD or manufacturing drawings are required must be undertaken with this version of the software. Please note that CREO is not available on Mac OS, therefore this must be installed using windows OS. A scientific calculator is also required for all assessment tasks.

Unit Schedule

Refer to iLearn and lecture notes for the unit schedule

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://policies.mq.edu.au). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy
- Academic Progression Policy

- Assessment Policy
- Fitness to Practice Procedure
- Assessment Procedure
- Complaints Resolution Procedure for Students and Members of the Public
- Special Consideration Policy

Students seeking more policy resources can visit Student Policies (https://students.mq.edu.au/support/study/policies). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

To find other policies relating to Teaching and Learning, visit Policy Central (https://policies.mq.edu.au) and use the search tool.

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/admin/other-resources/student-conduct

Results

Results published on platform other than eStudent, (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit ask.mq.edu.au or if you are a Global MBA student contact globalmba.support@mq.edu.au

Academic Integrity

At Macquarie, we believe academic integrity – honesty, respect, trust, responsibility, fairness and courage – is at the core of learning, teaching and research. We recognise that meeting the expectations required to complete your assessments can be challenging. So, we offer you a range of resources and services to help you reach your potential, including free online writing and maths support, academic skills development and wellbeing consultations.

Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

The Writing Centre

The Writing Centre provides resources to develop your English language proficiency, academic writing, and communication skills.

- Workshops
- Chat with a WriteWISE peer writing leader
- Access StudyWISE
- Upload an assignment to Studiosity
- Complete the Academic Integrity Module

The Library provides online and face to face support to help you find and use relevant information resources.

- Subject and Research Guides
- Ask a Librarian

Student Services and Support

Macquarie University offers a range of Student Support Services including:

- IT Support
- Accessibility and disability support with study
- Mental health support
- Safety support to respond to bullying, harassment, sexual harassment and sexual assault
- Social support including information about finances, tenancy and legal issues

Student Enquiries

Got a question? Ask us via AskMQ, or contact Service Connect.

IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.

Changes from Previous Offering

The weighting of the assessment tasks has been altered to now accomodate an additional task which grades students participation in SGTA's.

Engineers Australia Competency Mapping

EA Competency Standard		Unit Learning Outcomes
Knowledge and Skill Base	1.1 Comprehensive, theory-based understanding of the underpinning fundamentals applicable to the engineering discipline.	ULO1, ULO2, UO3, ULO4, ULO5
	1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing.	
	1.3 In-depth understanding of specialist bodies of knowledge	ULO1, ULO2, UO3, ULO4, ULO5
	1.4 Discernment of knowledge development and research directions	

	1.5 Knowledge of engineering design practice	ULO1, ULO2, UO3, ULO4, ULO5
	1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice.	
Engineering Application Ability	2.1 Application of established engineering methods to complex problem solving	ULO1, ULO2, UO3, ULO4
	2.2 Fluent application of engineering techniques, tools and resources.	ULO1, ULO2, UO3, ULO4
	2.3 Application of systematic engineering synthesis and design processes.	ULO1, ULO2, UO3, ULO4, ULO5
	2.4 Application of systematic approaches to the conduct and management of engineering projects.	UO3, ULO4
Professional and Personal Attributes	3.1 Ethical conduct and professional accountability.	UO3, ULO4
	3.2 Effective oral and written communication in professional and lay domains.	UO3, ULO4
	3.3 Creative, innovative and pro-active demeanour.	UO3, ULO4
	3.4 Professional use and management of information.	UO3, ULO4
	3.5 Orderly management of self, and professional conduct.	UO3, ULO4
	3.6 Effective team membership and team leadership	UO3