# MECH303

## Mechanical Design 2

S1 Day 2018

*Dept of Engineering*

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# General Information

Unit convenor and teaching staff
Unit Convener
Sammy Diasinos
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E6B144
Tuesday and Wednesday, 9 to 10

Lecturer
Wei Xu
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E6B130
Wednesday and Thursday, 2 to 4pm

Wei Xu
wei.xu@mq.edu.au

Credit points
3

Prerequisites
MECH201 and MECH203 and MECH204

Corequisites

Co-badged status

Unit description
In this unit, students will develop their ability to design a mechanical system and the considerations required for manufacturing of that system. Computer Aided Design will be utilised by students to develop a mechanical system to achieve a defined task. Through a series of presentations and detailed report, students will demonstrate the design considerations made during the process of designing the proposed mechanical 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.

## 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:

The student will be able to apply mechanical engineering theory to solve a specific problem.

The student will be able to generate assemblies of models using CAD that will allow the redesign and modification of a system to be more efficient.

The student will be capable of utilising processes that will allow the manufacturing of a component through the use of a Computer Numerically Controlled (CNC) machines as well as an appreciation of the theory associated with them.

The student will become familiar with a number of mass manufacturing production techniques for plastics and be able to apply them to a design with the intention of minimising cost.

The student will become familiar with a series of techniques and design considerations for manufacturing metal components in large quantities in a cost effective method.

The student will demonstrate an ability to conceptualise and realise a mechanical system, through a prototype, that will be a viable and cost effective solution to performing a specified task.

# General Assessment Information

**Student Responsibilities**

Be familiar with University policy and College procedures and act in accordance with those policy and procedures.

It is the responsibility of the student to retain a copy of any work submitted. Students must produce these documents upon request. Copies should be retained until the end of the grade appeal period each term.

Student is to perform the required due diligent for their assessment grade and rectify as soon as possible upon finding any errors.

**Notifications**

Formal notification of assessment tasks, grading rubrics and due dates will be posted on iLearn. Although all reasonable measures to ensure the information is accurate, The University reserves the right to make changes without notice. Each student is responsible for checking iLearn for changes and updates.

**Report and Assignment Tasks**

Assignment Problems will be posted on iLearn at least two weeks before their submission date. Assignment/Lab report solutions will be posted within a week after the submission date. Submissions will not be accepted once the solution is posted.

### Assignment submissions and plagiarism policies

All assignments and reports must be submitted electronically through iLearn (in pdf format) unless otherwise explicitly stated. Submissions will undergo plagiarism checkers using the turnitin software and any work deemed to have 30% or higher similarity score may incur academic penalty. For more details on the policies of academic penalties relating to academic honesty, please refer to the policies and procedures section below.

Submissions are expected to be typed set in a logical layout and sequence and graphs are expected to be drawn using suitable software. Markers WILL NOT grade poorly organized or illegible scans or drafts. The expected workload includes preparation of final copies and clear diagrams.

### Late submissions

Late submissions or absences from tutorials and laboratories will not be accepted. In the event that an assignment or report is submitted late, between 0 and 24 hours a deduction of 25% will be made, between 24 and 48 hours a deduction of 50% will be made, more than 48 hours will result in no marks being awarded. Extenuating circumstances will be considered upon lodgement of a formal notice of disruption of studies.

### Grading and passing requirement for unit

For further details about grading, please refer below in the policies and procedures section. 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).

### Final Examinations

Final examinations will typically take place at the end of the semester. For further information, please refer to the Examination Timetable website on www.mq.edu.au

## Assessment Tasks

| Name | Weighting | Hurdle | Due |
|---|---|---|---|
| Assumed Knowledge Test | 5% | No | Week 2 |

| Name | Weighting | Hurdle | Due |
|---|---|---|---|
| CAD Test | 10% | No | Week 5 |
| Mid-Session Test | 10% | No | Week 8 |
| Project Trial and Presentation | 10% | No | Week 10 |
| Design Report and Competition | 20% | No | Week 12 |
| Manufacturing Report | 10% | No | Week 13 |
| Final examination | 35% | No | Examination period |

## Assumed Knowledge Test

Due: **Week 2**
Weighting: **5%**

A test assessing the assumed knowledge that students are expected to have obtained by completing the pre-requisites for this course.

On successful completion you will be able to:

- The student will be able to apply mechanical engineering theory to solve a specific problem.

## CAD Test

Due: **Week 5**
Weighting: **10%**

Assessment that will allow students to demonstrate their ability to create an assembly CAD model and generate a CNC path.

On successful completion you will be able to:

- The student will be able to generate assemblies of models using CAD that will allow the redesign and modification of a system to be more efficient.
- The student will be capable of utilising processes that will allow the manufacturing of a component through the use of a Computer Numerically Controlled (CNC) machines as well as an appreciation of the theory associated with them.

## Mid-Session Test

Due: **Week 8**
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:

- The student will be capable of utilising processes that will allow the manufacturing of a component through the use of a Computer Numerically Controlled (CNC) machines as well as an appreciation of the theory associated with them.
- The student will become familiar with a number of mass manufacturing production techniques for plastics and be able to apply them to a design with the intention of minimising cost.

## Project Trial and Presentation

Due: **Week 10**
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.

On successful completion you will be able to:

- The student will be able to generate assemblies of models using CAD that will allow the redesign and modification of a system to be more efficient.
- The student will demonstrate an ability to conceptualise and realise a mechanical system, through a prototype, that will be a viable and cost effective solution to performing a specified task.

## Design Report and Competition

Due: **Week 12**
Weighting: **20%**

Report summarising the design decisions made to achieve the required task as well as the analysis undertaken that assists with making those decisions as well as a demonstration of mechanical device with a mark awarded based on the ability of the device to achieve a specified task.

On successful completion you will be able to:

- The student will be able to apply mechanical engineering theory to solve a specific problem.
- The student will be able to generate assemblies of models using CAD that will allow the redesign and modification of a system to be more efficient.
- The student will demonstrate an ability to conceptualise and realise a mechanical system, through a prototype, that will be a viable and cost effective solution to performing

a specified task.

## Manufacturing Report

Due: **Week 13**
Weighting: **10%**

Report indicating how the prototype will be mass manufactured using the techniques introduced during this unit.

On successful completion you will be able to:

- The student will be able to apply mechanical engineering theory to solve a specific problem.
- The student will be capable of utilising processes that will allow the manufacturing of a component through the use of a Computer Numerically Controlled (CNC) machines as well as an appreciation of the theory associated with them.
- The student will become familiar with a number of mass manufacturing production techniques for plastics and be able to apply them to a design with the intention of minimising cost.
- The student will become familiar with a series of techniques and design considerations for manufacturing metal components in large quantities in a cost effective method.
- The student will demonstrate an ability to conceptualise and realise a mechanical system, through a prototype, that will be a viable and cost effective solution to performing a specified task.

## Final examination

Due: **Examination period**
Weighting: **35%**

Final examination assessing all the content delivered throughout the course.

On successful completion you will be able to:

- The student will be able to apply mechanical engineering theory to solve a specific problem.
- The student will be capable of utilising processes that will allow the manufacturing of a component through the use of a Computer Numerically Controlled (CNC) machines as well as an appreciation of the theory associated with them.
- The student will become familiar with a number of mass manufacturing production techniques for plastics and be able to apply them to a design with the intention of minimising cost.

- The student will become familiar with a series of techniques and design considerations for manufacturing metal components in large quantities in a cost effective method.
- The student will demonstrate an ability to conceptualise and realise a mechanical system, through a prototype, that will be a viable and cost effective solution to performing a specified task.

# Delivery and Resources

The main text required for this course is: Introduction to Manufacturing Processes by Mikell P. Groover

# Unit Schedule

| Week | Lecture Topic | Lecturer | Tutorial Activity | Assessments |
|---|---|---|---|---|
| 1 | Introduction and CAD Assemblies | Dr Diasinos | No Tutorials or Practicals | |
| 2 | ***Diagnostic Test*** and Device Requirements | Dr Diasinos | CAD Assembly tutorial | ***In lecture test*** |
| 3 | Manufacturing Automation | Dr Diasinos | CNC Milling tutorial | |
| 4 | Material Removal Methods | Dr Diasinos | CNC Milling tutorial | |
| 5 | Rapid Prototyping | Dr Diasinos | ***CAD Test*** | ***In tutorial test*** |
| 6 | Polymers and Composites | Dr Xu | Case Study/Design Project Discussion | |
| 7 | Sheet forming and Joining | Dr Xu | Case Study/Design Analyse Project | |
| 8 | ***Mid-Session Test*** | Dr Diasinos | Manufacturing theory tutorials/ Design Analyse Project | ***In lecture test*** |
| 9 | Metal Casting | Dr Xu | Manufacturing theory tutorials/ Design Analyse Project | |
| 10 | Metal Forming 1 | Dr Xu | ***Project Trial and Presentation*** | ***In tutorial practical assessment*** |
| 11 | Metal Forming 2 | Dr Xu | Project Design or Build | |
| 12 | ***Design Competition*** | Dr Xu and Dr Diasinos | Presentation Feedback | ***In lecture practical assessment and Design Report Due*** |
| 13 | Revision | Dr Xu and Dr Diasinos | Revision | ***Manufacturing Report Due*** |

# Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://staff.m

q.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). 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
- Grade Appeal Policy
- Complaint Management Procedure for Students and Members of the Public
- Special Consideration Policy *(**Note:** The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.)*

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

If you would like to see all the policies relevant to Learning and Teaching visit Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central).

## Student Code of Conduct

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

## Results

Results shown in *iLearn*, 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.

# Student Support

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

## Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to improve your marks and take control of your study.

- Workshops
- StudyWise
- Academic Integrity Module for Students
- Ask a Learning Adviser

## Student Services and Support

Students with a disability are encouraged to contact the Disability Service who can provide appropriate help with any issues that arise during their studies.

## Student Enquiries

For all student enquiries, visit Student Connect at ask.mq.edu.au

## 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.

# Graduate Capabilities

## Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be imaginative and open to experience and capable of innovation at work and in the community. We want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:

### Learning outcomes

- The student will be able to apply mechanical engineering theory to solve a specific problem.
- The student will be able to generate assemblies of models using CAD that will allow the redesign and modification of a system to be more efficient.
- The student will be capable of utilising processes that will allow the manufacturing of a component through the use of a Computer Numerically Controlled (CNC) machines as well as an appreciation of the theory associated with them.
- The student will demonstrate an ability to conceptualise and realise a mechanical system, through a prototype, that will be a viable and cost effective solution to performing a specified task.

### Assessment tasks

- Assumed Knowledge Test
- CAD Test
- Project Trial and Presentation
- Design Report and Competition

- Manufacturing Report
- Final examination

## Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

### Learning outcomes

- The student will be able to apply mechanical engineering theory to solve a specific problem.
- The student will be able to generate assemblies of models using CAD that will allow the redesign and modification of a system to be more efficient.
- The student will be capable of utilising processes that will allow the manufacturing of a component through the use of a Computer Numerically Controlled (CNC) machines as well as an appreciation of the theory associated with them.
- The student will become familiar with a number of mass manufacturing production techniques for plastics and be able to apply them to a design with the intention of minimising cost.
- The student will become familiar with a series of techniques and design considerations for manufacturing metal components in large quantities in a cost effective method.

### Assessment tasks

- Project Trial and Presentation
- Design Report and Competition
- Manufacturing Report
- Final examination

## Commitment to Continuous Learning

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they participate in the world. They will be capable of reflecting on their experiences and relationships with others and the environment, learning from them, and growing - personally, professionally and socially.

This graduate capability is supported by:

## Learning outcomes

- The student will be able to generate assemblies of models using CAD that will allow the redesign and modification of a system to be more efficient.
- The student will be capable of utilising processes that will allow the manufacturing of a component through the use of a Computer Numerically Controlled (CNC) machines as well as an appreciation of the theory associated with them.
- The student will demonstrate an ability to conceptualise and realise a mechanical system, through a prototype, that will be a viable and cost effective solution to performing a specified task.

## Assessment tasks

- CAD Test
- Project Trial and Presentation
- Design Report and Competition

# Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

## Learning outcomes

- The student will be able to apply mechanical engineering theory to solve a specific problem.
- The student will be able to generate assemblies of models using CAD that will allow the redesign and modification of a system to be more efficient.
- The student will be capable of utilising processes that will allow the manufacturing of a component through the use of a Computer Numerically Controlled (CNC) machines as well as an appreciation of the theory associated with them.
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for manufacturing metal components in large quantities in a cost effective method.
- The student will demonstrate an ability to conceptualise and realise a mechanical system, through a prototype, that will be a viable and cost effective solution to performing a specified task.

## Assessment tasks

- Assumed Knowledge Test
- CAD Test
- Mid-Session Test
- Project Trial and Presentation
- Design Report and Competition
- Manufacturing Report
- Final examination

# Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

This graduate capability is supported by:

## Learning outcomes

- The student will be able to apply mechanical engineering theory to solve a specific problem.
- The student will be able to generate assemblies of models using CAD that will allow the redesign and modification of a system to be more efficient.
- The student will be capable of utilising processes that will allow the manufacturing of a component through the use of a Computer Numerically Controlled (CNC) machines as well as an appreciation of the theory associated with them.
- The student will become familiar with a number of mass manufacturing production techniques for plastics and be able to apply them to a design with the intention of minimising cost.
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- The student will demonstrate an ability to conceptualise and realise a mechanical system, through a prototype, that will be a viable and cost effective solution to performing a specified task.

## Assessment tasks

- Assumed Knowledge Test
- CAD Test
- Mid-Session Test
- Project Trial and Presentation
- Design Report and Competition
- Manufacturing Report
- Final examination

# Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

## Learning outcomes

- The student will be able to apply mechanical engineering theory to solve a specific problem.
- The student will become familiar with a number of mass manufacturing production techniques for plastics and be able to apply them to a design with the intention of minimising cost.
- The student will become familiar with a series of techniques and design considerations for manufacturing metal components in large quantities in a cost effective method.
- The student will demonstrate an ability to conceptualise and realise a mechanical system, through a prototype, that will be a viable and cost effective solution to performing a specified task.

## Assessment tasks

- CAD Test
- Mid-Session Test
- Project Trial and Presentation
- Design Report and Competition
- Manufacturing Report

## Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

### Learning outcomes

- The student will be able to generate assemblies of models using CAD that will allow the redesign and modification of a system to be more efficient.
- The student will demonstrate an ability to conceptualise and realise a mechanical system, through a prototype, that will be a viable and cost effective solution to performing a specified task.

### Assessment tasks

- Assumed Knowledge Test
- CAD Test
- Mid-Session Test
- Project Trial and Presentation
- Design Report and Competition
- Manufacturing Report
- Final examination

## Changes in response to student feedback

To provide greater opportunities for students to demonstrate their ability to design a mechanical system, the task for the design competition has been completely revitalised relative to the previous offerings.