



**UNSW**

## UNSW Course Outline

# MTRN9400 Control of Robotic Systems - 2024

Published on the 09 Sep 2024

## General Course Information

**Course Code :** MTRN9400

**Year :** 2024

**Term :** Term 3

**Teaching Period :** T3

**Is a multi-term course? :** No

**Faculty :** Faculty of Engineering

**Academic Unit :** School of Mechanical and Manufacturing Engineering

**Delivery Mode :** In Person

**Delivery Format :** Standard

**Delivery Location :** Kensington

**Campus :** Sydney

**Study Level :** Undergraduate, Postgraduate

**Units of Credit :** 6

### Useful Links

[Handbook Class Timetable](#)

## Course Details & Outcomes

### Course Description

This course provides a mathematical introduction to the mechanics and control of robotic systems including robot manipulators, mobile ground robots and quadrotors. By the end of the course, students are expected to learn the fundamental concepts and core principles of

nonlinear control theory and Lyapunov stability, adaptive control and robust control, and are expected to learn how to control the motion of different robotic systems such as rigid manipulators, unicycle robots and quadrotors using nonlinear controllers. The course projects require students to use simulation software and control theory to model and control different robotic systems.

## Course Aims

This course introduces the basic nonlinear control theory required to analyse and design controllers for robotic systems. The course will explain some of the basic controllers such as robust and adaptive controllers and will explain how these controllers can be applied to robotic systems. The main robotic systems studied in this course are rigid robot manipulators and quadrotors.

This is an elective course for Mechatronics undergraduate students and it aims to broaden the students' understanding of how robots are autonomously controlled in many industrial and service roles.

## Course Learning Outcomes

Course Learning Outcomes
CLO1 : Kinematic and dynamic modeling of robot manipulators and quadcopters.
CLO2 : Describe control stability of nonlinear systems.
CLO3 : Describe different control algorithms and apply them to robotic systems.

Course Learning Outcomes	Assessment Item
CLO1 : Kinematic and dynamic modeling of robot manipulators and quadcopters.	<ul style="list-style-type: none"><li>• Individual Projects</li><li>• Tests and Quizzes</li></ul>
CLO2 : Describe control stability of nonlinear systems.	<ul style="list-style-type: none"><li>• Individual Projects</li></ul>
CLO3 : Describe different control algorithms and apply them to robotic systems.	<ul style="list-style-type: none"><li>• Tests and Quizzes</li><li>• Individual Projects</li></ul>

## Learning and Teaching Technologies

Moodle - Learning Management System | Microsoft Teams | Kahoot and YouTube

# Assessments

## Assessment Structure

Assessment Item	Weight	Relevant Dates
Individual Projects Assessment Format: Individual	45%	Start Date: Not Applicable Due Date: Not Applicable
Tests and Quizzes Assessment Format: Individual	55%	Start Date: Not Applicable Due Date: Not Applicable

## Assessment Details

### Individual Projects

#### Assessment Overview

There are two individual projects that contribute to 45% of the overall grade: Individual Project 1, worth 25%, and Individual Project 2, worth 20%.

Individual Project 1 focuses on the control of robot manipulators, while Individual Project 2 focuses on quadcopter control. For both projects, you will need to utilize MATLAB for the simulation aspects and submit a report detailing your work.

A comprehensive project description, including the marking criteria, will be provided to guide you through the projects. Feedback on each project will be provided within two weeks after the respective due dates.

#### Course Learning Outcomes

- CLO1 : Kinematic and dynamic modeling of robot manipulators and quadcopters.
- CLO2 : Describe control stability of nonlinear systems.
- CLO3 : Describe different control algorithms and apply them to robotic systems.

#### Detailed Assessment Description

**Individual project 1 (25%)**: This assignment will be released on Friday Week 5 and is due at 5:00pm on Friday Week 7. Deadline for absolute fail: 5:00pm Wednesday Week 8. Assignment marks will be released within two weeks after the submission deadline. Details about this assignment will be announced on the course Teams channel.

**Individual project 2 (20%)**: This assignment will be released on Monday Week 10 and is due at 5:00pm on Monday Week 12. Deadline for absolute fail: 5:00pm Saturday Week 12. Assignment marks will be released within two weeks after the submission deadline. Details about this assignment will be announced on the course Teams channel.

## Assignment submission Turnitin type

This is not a Turnitin assignment

## Generative AI Permission Level

### No Assistance

This assessment is designed for you to complete without the use of any generative AI. You are not permitted to use any generative AI tools, software or service to search for or generate information or answers.

For more information on Generative AI and permitted use please see [here](#).

## Tests and Quizzes

### Assessment Overview

#### **Weekly quizzes (14% in total)**

Weekly quizzes account for 14% of the total grade. There will be a total of 8 quizzes, each worth 1.75%. The quizzes will be conducted online through Moodle, and feedback and grades will be given within 24 hours after each quiz ends.

#### **Tests (41%)**

There will be two tests: Test 1 accounts for 23% of the total grade, while Test 2 is worth 18%.

Feedback for each test will be provided through Moodle within 2 weeks after the test.

### Course Learning Outcomes

- CLO1 : Kinematic and dynamic modeling of robot manipulators and quadcopters.
- CLO3 : Describe different control algorithms and apply them to robotic systems.

### Detailed Assessment Description

**Weekly quizzes (14% in total)** - All weeks except Week 1 and 6. In total 8 quizzes (1.75 each).

Quizzes start at 9am Tuesday and close at 9am Wednesday.

**Test 1 (23%)** at 6:00pm Tuesday Week 5 in J17-202/204. The test will include contents from weeks 1, 2 and 3 lectures and problem sets of weeks 1-4. Details about the test will be announced on the course Teams channel.

**Test 2 (18%)** at 6:00pm Tuesday Week 10 in J17-203/204. The test will include contents from weeks 4-7 lectures and problem sets of weeks 5-10. Details about the test will be announced on the course Teams channel

### Assignment submission Turnitin type

Not Applicable

### Generative AI Permission Level

No Assistance

This assessment is designed for you to complete without the use of any generative AI. You are not permitted to use any generative AI tools, software or service to search for or generate information or answers.

For more information on Generative AI and permitted use please see [here](#).

## General Assessment Information

### Grading Basis

Standard

## Course Schedule

### Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

## Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Lecturer	Mohammad D eghat					No	Yes
Head demonstrator	Donglin Sui					No	No
Demonstrator	Zeinab Ebrahi mi					No	No
	Olivia Yem					No	No

## Other Useful Information

### Academic Information

#### I. Special consideration and supplementary assessment

If you have experienced an illness or misadventure beyond your control that will interfere with your assessment performance, you are eligible to apply for Special Consideration prior to, or within 3 working days of, submitting an assessment or sitting an exam.

Please note that UNSW has a Fit to Sit rule, which means that if you sit an exam, you are declaring yourself fit enough to do so and cannot later apply for Special Consideration.

For details of applying for Special Consideration and conditions for the award of supplementary assessment, please see the information on UNSW's [Special Consideration page](#).

## II. Administrative matters and links

All students are expected to read and be familiar with UNSW guidelines and polices. In particular, students should be familiar with the following:

- [Attendance](#)
- [UNSW Email Address](#)
- [Special Consideration](#)
- [Exams](#)
- [Approved Calculators](#)
- [Academic Honesty and Plagiarism](#)
- [Equitable Learning Services](#)

## III. Equity and diversity

Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course convener prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equitable Learning Services. Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

## IV. Professional Outcomes and Program Design

Students are able to review the relevant professional outcomes and program designs for their streams by going to the following link: <https://www.unsw.edu.au/engineering/student-life/student-resources/program-design>.

*Note: This course outline sets out the description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published. Moodle or your primary learning management system (LMS) should be consulted for the up-to-date class descriptions. If there is any inconsistency in the description of activities between the University timetable and the Course Outline/Moodle/LMS, the description in the Course Outline/Moodle/LMS applies.*

## **Academic Honesty and Plagiarism**

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.*

Plagiarism is a type of intellectual theft. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement. UNSW has produced a website with a wealth of resources to support students to understand and avoid plagiarism, visit: [student.unsw.edu.au/plagiarism](http://student.unsw.edu.au/plagiarism). The Learning Centre assists students with understanding academic integrity and how not to plagiarise. They also hold workshops and can help students one-on-one.

You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting and the proper referencing of sources in preparing all assessment tasks.

Repeated plagiarism (even in first year), plagiarism after first year, or serious instances, may also be investigated under the Student Misconduct Procedures. The penalties under the procedures can include a reduction in marks, failing a course or for the most serious matters (like plagiarism in an honours thesis or contract cheating) even suspension from the university. The Student Misconduct Procedures are available here:

[www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf](http://www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf)

## **Submission of Assessment Tasks**

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of five percent (5%) of the maximum mark possible for that assessment item, per calendar day.

The late penalty is applied per calendar day (including weekends and public holidays) that the assessment is overdue. There is no pro-rata of the late penalty for submissions made part way through a day. This is for all assessments where a penalty applies.

Work submitted after five days (120 hours) will not be accepted and a mark of zero will be

awarded for that assessment item.

For some assessment items, a late penalty may not be appropriate. These will be clearly indicated in the course outline, and such assessments will receive a mark of zero if not completed by the specified date. Examples include:

- Weekly online tests or laboratory work worth a small proportion of the subject mark;
- Exams, peer feedback and team evaluation surveys;
- Online quizzes where answers are released to students on completion;
- Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date; and,
- Pass/Fail assessment tasks.

## **Faculty-specific Information**

[Engineering Student Support Services](#) – The Nucleus - enrolment, progression checks, clash requests, course issues or program-related queries

[Engineering Industrial Training](#) – Industrial training questions

[UNSW Study Abroad](#) – study abroad student enquiries (for inbound students)

[UNSW Exchange](#) – student exchange enquiries (for inbound students)

[UNSW Future Students](#) – potential student enquiries e.g. admissions, fees, programs, credit transfer

## **Phone**

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

## **School-specific Information**

### **Short Extensions**

Short extensions are not currently applicable to Mechanical and Manufacturing Engineering Courses.

## **Review of Results**

If you believe that there has been a marking error, you can request a review of results. Review of results cannot be used to get feedback.

If you would like feedback for assessments, you are welcome to contact the course convenor directly.

## **Use of AI**

The use of AI is prohibited unless explicitly permitted by the course convenor. Please respect this and be aware that penalties will apply when unauthorised use is detected, such as through Turnitin. If the use of generative AI, such as ChatGPT, is allowed in a specific assessment, they must be properly credited, and your submissions must be substantially your own work.

## **Final Exam in Exam Period**

For courses with a centrally timetabled final exam, students must be available for the entire exam period from Mon-Sat until your exact exam date is confirmed.

## **School Contact Information**

### **Location**

UNSW Mechanical and Manufacturing Engineering

Ainsworth building J17, Level 1

Above Coffee on Campus

### **Hours**

9:00–5:00pm, Monday–Friday\*

\*Closed on public holidays, School scheduled events and University Shutdown

### **Web**

[School of Mechanical and Manufacturing Engineering](#)

## Engineering Student Support Services

### Engineering Industrial Training

UNSW Study Abroad and Exchange (for inbound students)

### UNSW Future Students

#### **Phone**

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

(+61 2) 9385 4097 – School Office\*\*

\*\*Please note that the School Office will not know when/if your course convenor is on campus or available

#### **Email**

Engineering Student Support Services – current student enquiries

- e.g. enrolment, progression, clash requests, course issues or program-related queries

Engineering Industrial Training – Industrial training questions

UNSW Study Abroad – study abroad student enquiries (for inbound students)

UNSW Exchange – student exchange enquiries (for inbound students)

UNSW Future Students – potential student enquiries

- e.g. admissions, fees, programs, credit transfer

School Office – School general office administration enquiries

- NB: the relevant teams listed above must be contacted for all student enquiries. The School will only be able to refer students on to the relevant team if contacted

#### **Important Links**

- [Student Wellbeing](#)
- [Urgent Mental Health & Support](#)
- [Equitable Learning Services](#)
- [Faculty Transitional Arrangements for COVID-19](#)
- [Moodle](#)
- [Lab Access](#)
- [Computing Facilities](#)
- [Student Resources](#)
- [Course Outlines](#)
- [Makerspace](#)
- [UNSW Timetable](#)
- [UNSW Handbook](#)