UNSW Course Outline

MMAN3200 Linear Systems and Control - 2024

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General Course Information

Course Code : MMAN3200
Year : 2024
Term : Term 1
Teaching Period : T1
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 : Postgraduate, Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

This course aims to introduce students to the fundamental principles of control theory for dynamic systems. It provides an overview of modelling, feedback control, and stability analysis as the essential foundation for implementing control systems in electrical, mechanical, and

aeronautical applications.

The course covers the following topis. Models of physical systems: differential equations for physical systems including mechanical, electrical, hydraulic, thermal and pneumatic systems; linearisation. System analysis techniques: solution by Laplace transform method. Transfer functions and block diagrams. System response: response of first and second order systems to impulse step, ramp and periodic inputs; higher order system response; concept of system stability, applications. Concept of control. Stability criteria; use of Root Locus and Bode for system analysis and modification. Simulation of linear and non-linear systems. The matrix exponential and state space notation. The transfer matrix. Pole and state feedback, controllability and observability. Use of MATLAB as a simulation environment.

The course is offered in terms 1 (T1) and 2 (T2). The majority of places in T1 will be reserved for Mechatronics students. The majority of places in T2 will be reserved for Aerospace, Mechanical and Mechanical and Manufacturing students.

Course Aims

In this course, students will gain insight into system modelling and feedback control design and analysis for linear systems.

In particular, the course will improve students understanding on how to analyse and control a wide range of mechanical, electrical, hydraulic, thermal and pneumatic systems.

Students will enhance their problem-solving abilities and deepen their engineering knowledge through the practical or simulation-based project in the course.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Create linear mathematical models on a variety of systems
CLO2 : Analyse linear time invariant continuous systems in both time- and complex- domains
CLO3 : Interpret and model systems through state space representation

Course Learning Outcomes	Assessment Item
CLO1 : Create linear mathematical models on a variety of systems	• Quizzes • Individual Project • Final Exam
CLO2 : Analyse linear time invariant continuous systems in both time- and complex- domains	• Quizzes • Individual Project • Final Exam
CLO3 : Interpret and model systems through state space representation	• Individual Project • Final Exam

Learning and Teaching Technologies

Moodle - Learning Management System | Microsoft Teams | Echo 360

Additional Course Information

Additional matters: Several necessary mathematical concepts learnt in MATH2018/2019 are regarded as prerequisite knowledge for MMAN3200, in particular the Laplace Transform, and Vector and Matrix Algebra. Academic staff will be glad to answer questions from students about these topics.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Quizzes Assessment Format: Individual	35%	Start Date: Not Applicable Due Date: Not Applicable
Individual Project Assessment Format: Individual	20%	Start Date: 6pm Mon Week 8 Due Date: 6pm Mon Week 10
Final Exam Assessment Format: Individual	45%	Start Date: Not Applicable Due Date: Not Applicable

Assessment Details

Quizzes

Assessment Overview

Information about the quizzes will be provided in the course outline.

Feedback on the quizzes will be provided within two weeks of the quizzes.

Course Learning Outcomes

- CLO1 : Create linear mathematical models on a variety of systems
- CLO2 : Analyse linear time invariant continuous systems in both time- and complex- domains

Detailed Assessment Description

There are four quizzes and a midterm exam in this course.

The quizzes are in weeks 2, 4, 7 and 9 and via Moodle. Each quiz is worth 2 marks (2 marks × 4 quizzes = 8 marks). Quizzes open at 8am Monday and close at 1pm Tuesday. You can take the quiz at any time whithin this period. The marks will be release within 24 hours after the quiz ends.

The midterm exam is worth 27 marks and will cover the contents from weeks 1 to 4 inclusive. Marks will be returned within two weeks. The midterm exam is in-person and is on Tuesday 18:00 - 20:00 during week 5. Information about the midterm exam venue will be released one week before the exam.

Assessment information

Assignment submission Turnitin type

This is not a Turnitin assignment

Individual Project

Assessment Overview

Assessment length: 20 pages maximum

This is an individual project. Description and marking criteria will be provided will be provided.

Feedback on the assessment task will be provided within two weeks of the submission deadline.

Course Learning Outcomes

- CLO1 : Create linear mathematical models on a variety of systems
- CLO2 : Analyse linear time invariant continuous systems in both time- and complex- domains

- CLO3 : Interpret and model systems through state space representation

Assessment Length

20 pages maximum

Submission notes

Reports will be submitted via Moodle.

Assessment information

The deadline for absolute fail is 20/04/2024 at 6pm, which is five days after the deadline.

Assignment submission Turnitin type

This is not a Turnitin assignment

Final Exam

Assessment Overview

Assessment length: 2 hours

Final examination will be focusing on the material covered in the second half of the term.

The date and time of the final exam will be set centrally by the examination unit. The marks will be
released at the same time when all marks for the term are released.

Course Learning Outcomes

- CLO1 : Create linear mathematical models on a variety of systems
- CLO2 : Analyse linear time invariant continuous systems in both time- and complex- domains
- CLO3 : Interpret and model systems through state space representation

Assessment Length

2 hours

Submission notes

Online test in form of a Moodle quiz

Assessment information

The date and time of the final exam will be set centrally by the examination unit.

Assignment submission Turnitin type

This is not a Turnitin assignment

General Assessment Information

Grading Basis

Standard

Course Schedule

Attendance Requirements

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

Course Resources

Prescribed Resources

Lecture notes are provided, as well as sets of problems.

Example code of simulations in Matlab and Simulink will be provided too.

UNSW Library website: https://www.library.unsw.edu.au/

Moodle: https://moodle.telt.unsw.edu.au/login/index.php

Recommended Resources

Most of these books are available in the library.

- The main textbook is:
  - Franklin, Gene F., J. David Powell, and Abbas Emami-Naeini. "Feedback control of dynamic systems". London: Pearson, 2015.
- Other recommended texts:
  - Ogata, K. “Modern Control Engineering” (5th edition), Pearson
  - Dhanalakshmi, K. "Modeling, analysis and control of dynamic systems" (2nd edn) by William J. Palm III, John Wiley & Sons, Inc., New York.
  - Johnson, M., J. Wilkie, and R. Katebi. "Control Engineering–an Introductory Course." (2002).
  - Nise, Norman S. "Control systems engineering". John Wiley & Sons, 2020.

Course Evaluation and Development

Feedback on the course is gathered periodically using various means, including the UNSW myExperience process, informal discussion in the final class for the course, and the School’s Student/Staff meetings. Your feedback is taken seriously, and continual improvements are made to the course based, in part, on such feedback.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Mohammad Deghat		Building J17, Room 510M	9385 1650	By appointment (email or MS Teams)	No	Yes

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 Plagarism

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. 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

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

The purpose of a review of results is if there was a marking error. Review of results is for when you have cause to believe that there is a marking error. Review of Results cannot be used to get feedback. If you would like feedback for assessments prior to the final exam, you are welcome to contact the course convenor directly. No feedback will be provided on final exams.

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.

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