UNSW Course Outline

MANF3510 Process Technology and Automation - 2024

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General Course Information

Course Code : MANF3510
Year : 2024
Term : Term 2
Teaching Period : T2
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
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

Key factors for success in modern manufacturing include quality, productivity, efficiency, flexibility, agility, and customer satisfaction all while maintaining control over cost. Depending on the characteristics of the product and its market, an appropriate manufacturing process needs to

be designed. This course is closely aligned with the characteristics and requirements of small to medium scale manufacturing, entrepreneurial start-ups and prototyping.

MANF3510 builds on knowledge gained in MMAN1130(2130) Design and Manufacturing and DESN2000 Engineering Design, where the aim is to develop a design or prototype into a product that can be successfully manufactured. MANF3510 takes this concept to the next stage through teaching you how to design a manufacturing process by specifying, selecting and integrating the basic building blocks of process technology and automation into a successful manufacturing process or machine. The course contains appropriate theory and also focuses on the required practical knowledge to be able to put this theory into practice.

This course focuses on manufacturing technology as well as the main building blocks of industrial automation including materials handling technologies and actuation technologies such as pneumatics, electric motors, solenoids, switches, programmable logic controllers, CNC technology and industrial robotics. The aim of the course is to build understanding of the behaviour and specify the appropriate level of process technology and automation aligned with a specific product design.

Course Aims

Key factors for success in modern manufacturing include quality, productivity, efficiency, flexibility, customer satisfaction and control over cost and logistics. Depending on the characteristics of the product and its market, an appropriate manufacturing system and key enabling technologies (such as automation) need to be selected. This course deals with common manufacturing processes and technologies, the control of these processes as well as materials handling and robotics. This course therefore aims to equip students with the knowledge and ability to specify and select process automation and technology in the design of intelligent manufacturing systems.

The course covers the basic technology and elements used to design computerised and automated manufacturing systems. It deals with the principles of numerically controlled machine tools and their elements, from basic machines to the level of sophisticated turning and machining centers. It then covers in more detail, assisted by tutorial work, the procedure of CNC programming, industrial robots and their programming and programmable logic controllers (PLC).

As a core course for Mechanical and Manufacturing Engineering, MANF3510 aims to develop you into a skilled and all-rounded process design engineer able to integrate the design of an industrial process aligned with product design and requirements for automation, productivity and quality. Design is inherently complex and a systematic, yet flexible, agile and interdisciplinary approach is required to bring product to the market successfully and in less time, using appropriate technology.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Apply systematic design principles as part of designing automated industrial machines and processes
CLO2 : Use appropriate CAD/CAM and CNC technology to design a component and generate the CNC code to manufacture that component using CNC and/or 3D rapid prototyping manufacturing technology
CLO3 : Assess performance and characteristics of major machine elements and building blocks, including robotics, and specify and select appropriate equipment items from suppliers
CLO4 : Write and execute ladder programming for off the shell programmable logic controllers

Course Learning Outcomes	Assessment Item
CLO1 : Apply systematic design principles as part of designing automated industrial machines and processes	• Quizzes • Final exam
CLO2 : Use appropriate CAD/CAM and CNC technology to design a component and generate the CNC code to manufacture that component using CNC and/or 3D rapid prototyping manufacturing technology	• Group assignment • Quizzes • Final exam
CLO3 : Assess performance and characteristics of major machine elements and building blocks, including robotics, and specify and select appropriate equipment items from suppliers	• Quizzes • Final exam
CLO4 : Write and execute ladder programming for off the shell programmable logic controllers	• Final exam

Learning and Teaching Technologies

Moodle - Learning Management System | Microsoft Teams

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Quizzes Assessment Format: Individual	20%	Start Date: Weeks 4 & 10 during the tutorial Due Date: Weeks 4 & 10 during the tutorial
Group assignment Assessment Format: Group	40%	Start Date: Not Applicable Due Date: End of Week 7 and 10
Final exam Assessment Format: Individual	40%	Start Date: Refer to Term 2 Exam Timetable Due Date: Refer to Term 2 Exam Timetable

Assessment Details

Quizzes

Assessment Overview

Each quiz will be of 1 hour duration. There will be two quizzes. Quizzes will be online and of 1 hour duration each. Each quiz will require the submission of written answers and calculations.

Quiz 1 will cover material taught in weeks 1 - 3 specifically Boolean Algebra, PLC theory and Ladder Programming. Marks and feedback will be returned within two weeks of completion of the quiz.

Quiz 2 will cover material taught in weeks 4 - 9 specifically machining theory and robotics. Marks and feedback will be returned prior to the final exam.

Course Learning Outcomes

- CLO1 : Apply systematic design principles as part of designing automated industrial machines and processes
- CLO2 : Use appropriate CAD/CAM and CNC technology to design a component and generate the CNC code to manufacture that component using CNC and/or 3D rapid prototyping manufacturing technology
- CLO3 : Assess performance and characteristics of major machine elements and building blocks, including robotics, and specify and select appropriate equipment items from suppliers

Assessment Length

1 hour

Submission notes

Quizzes will be held online and during the designated tutorial times. The quizzes must be

undertaken during the allocated time, unless special consideration has been granted. The deadline for absolute failure is accordingly the end of the quiz allocated time.

Group assignment

Assessment Overview

The Group Assignment consists of two assignments, both of which are to be completed as a team or group, but each of these also has an individual component.

Group Assignment 1 deals with the design of a PLC program and the demonstration that this program works.

Group Assignment 2 deals with designing a CNC program and demonstrating that it works.

Assignments will require an in-person Viva Examination (this is where the group is assessed as a team and also where individual competency is assessed) as well as a written report not exceeding 5 pages each. Feedback for both assignments is given immediately during the VIVA examination process.

Assessment criteria

Assignment 1:

1. Your mark will be based on three components:
   a. The demonstration of your control system during the demonstration.
   b. Questions asked of all group members during the demonstration, and this reflects individual competence in programming a PLC.
   c. The written report.

High marks will be awarded for:
   1. Clear and understandable flowchart and finite state machine, detailing all key functions, states of the system, logic, and including any operator actions.
   2. Well-developed and documented PLC code, with clear labeling, layout and structure.
   3. The code and flowchart should be consistent.
   4. Professional presentation of your demonstration and the report.
   5. Correct functioning of your ladder program during the demonstration under a variety of test scenarios.
   6. Clear understanding of the program by all individuals during the demonstration.

Assignment 2:

1. Your mark will be based on three components:
   a. The demonstration of your CNC program during the demonstration.
   b. Questions asked of all group members during the demonstration, and this reflects individual competence in programming a CNC machine.
   c. Analysis of the process and operation as part of a written report.

High marks will be awarded for:

1. Appropriate sequence of operations
2. Appropriate tools used for each operation.
3. Efficient removal of material
4. Correct speed and doc selection
5. Comprehensiveness and accuracy of analysis
6. Professional presentation

Course Learning Outcomes

- CLO2 : Use appropriate CAD/CAM and CNC technology to design a component and generate the CNC code to manufacture that component using CNC and/or 3D rapid prototyping manufacturing technology

Assessment Length

In person VIVA examination and a submitted report not exceeding 5 pages

Submission notes

The deadline for absolute failure for each part of the assignment will be one week after the submission date in Week 7 and 10.

Assessment information

Recommended group size is 4-6 members.

Final exam

Assessment Overview

There will be a two-hour final exam covering all material taught in the course.

Course Learning Outcomes

- CLO1 : Apply systematic design principles as part of designing automated industrial machines and processes
- CLO2 : Use appropriate CAD/CAM and CNC technology to design a component and generate the CNC code to manufacture that component using CNC and/or 3D rapid prototyping

manufacturing technology
- CLO3 : Assess performance and characteristics of major machine elements and building blocks, including robotics, and specify and select appropriate equipment items from suppliers
- CLO4 : Write and execute ladder programming for off the shell programmable logic controllers

Assessment Length

2 hours

Submission notes

Invigilated exam. The exam must be undertaken during the allocated time, unless special consideration has been granted. The deadline for absolute failure is accordingly the end of the exam allocated time.

General Assessment Information

Grading Basis

Standard

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 0 : 20 May - 26 May	Other	There are no activities in Week 0.
Week 1 : 27 May - 2 June	Lecture	Part 1: Introduction to Automation Technology and the Internet of Things, Industry 4.0. Part 2: Computer Hardware, Controllers, Sensors, Binary Theory
	Laboratory	Tutorial: Distribute PLCs and install PLC programming software.
Week 2 : 3 June - 9 June	Lecture	Programmable Logic Controllers (PLC) – Part 1, Boolean Logic
	Laboratory	Tutorial: Install Omron Software (continue). PLC basics.
Week 3 : 10 June - 16 June	Lecture	Programmable Logic Controllers (PLC) – Part 2
	Laboratory	Tutorial: More advanced PLC topics. Introduction to Assignment Part 1.
Week 4 : 17 June - 23 June	Lecture	Machine and Systems Design and Analysis, Machining Variables.
	Laboratory	Tutorial: Assignment Part 1 Support.
	Assessment	Quiz 1.
Week 5 : 24 June - 30 June	Lecture	Industrial Robotics.
	Laboratory	Assignment Part 1 Support.
Week 6 : 1 July - 7 July	Other	Week 6 is a flexibility week and a tutorial will be offered to support the completion of Assignment Part 1.
Week 7 : 8 July - 14 July	Lecture	Industrial Robotics (continued), Pneumatic Systems (introduction), Costing Methods.
	Laboratory	Assignment Part 1 support. Questions on Robotics and Machine Variables
	Assessment	Assignment Submission: Each assignment will be submitted on Moodle and each Team will make an appointment for a VIVA examination in Week 8.
Week 8 : 15 July - 21 July	Lecture	Introduction to Computer Aided Manufacturing - Part 1 - concepts of computer numerical control (CNC)
	Laboratory	Introduction to Assignment Part 2.
Week 9 : 22 July - 28 July	Lecture	Introduction to Computer Aided Manufacturing - Part 2: CAM Software Systems (Fusion 360) and Hardware (Denford CNC).
	Laboratory	Assignment Part 2 support.
Week 10 : 29 July - 4 August	Lecture	Introduction to Computer Aided Manufacturing - Part 3: Analysis of Manufacturing Performance and Costing using CAM, Simulation and Analytical Costing Methods.
	Laboratory	Assignment Part 2 Support.
	Assessment	Quiz 2.
	Assessment	Group assignment: Each assignment will be submitted on Moodle and a tab will be created in the relevant week. VIVA examinations will commence after submission.

Attendance Requirements

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

Course Resources

Prescribed Resources

Lecture notes and recorded videos for all topics will be posted on Moodle. For all e-Books and reference books please visit the UNSW Library website: https://www.library.unsw.edu.au/

Textbooks

Industrial Automation - Hands-on, Frank Lamb, 2013, McGraw Hill. This textbook is available through the bookstore at UNSW and a copy will be put into the ÔHigh-Use Collection' section of our library.

Reference books

1. Manufacturing Process Selection Handbook: From Design to Manufacture, Swift K.G., Booker J.D., 2013, Burlington, Elsevier Science, ISBN 9780080993607 - available from our library electronically.

2. Applied Metrology for Manufacturing Engineering, Grous A, 2011, ISTE, John Wiley & Sons, Inc, ISBN 9781848211889.

3. Low-cost Jigs, Fixtures & Gages, for limited production, Boyes W.E. ed., Society of Manufacturing Engineers, 1986, Dearborn, Michigan.

4. Fundamentals of Modern Manufacturing, Groover M.P., 2nd ed., 2002 John Wiley. UNSW Library website: https://www.library.unsw.edu.au/ Moodle: https://moodle.telt.unsw.edu.au/login/index.php

Recommended Resources

see above

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. In this course, recent improvements resulting from student feedback include a more streamlined CNC assignment and a recently redesigned PLC Òmachine-on-a-boardÓ test rig.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Erik van Voorthuysen		ME507	93854147	Immediately after lectures	No	No
Lecturer	Ron Chan		ME507	93851535	Immediately after lectures	No	No
	Erik Van Voorthuysen					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