MANF3510

Process Technology and Automation

Term Three // 2020

School of Mechanical and Manufacturing Engineering // UNSW Engineering

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Dr Erik van Voorthuysen	erikv@unsw.edu.au	Immediately after tutorials, on Moodle, Teams and by appointment	ME507	9385 4147

Lecturers

Name	Email	Availability	Location	Phone
Dr Ron Chan	r.chan@unsw.edu.au	Immediately after tutorials, on Moodle, Teams and by appointment	ME507	9385 5135

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

Course Details

Credit Points 6

Summary of the Course

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 MMAN2130(1130) 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.

The course aims to develop you into a skilled and all-rounded process design engineer able to carry out and manage the key design processes in parallel and concurrently. 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 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 is closely aligned with the characteristics and requirements of small to medium scale manufacturing, entrepreneurial start-ups and prototyping. This course includes a substantial amount of laboratory work.

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).

Topics include: Function and control of CNC machine tools; Sensors and actuators in automated systems; Programming of CNC machine tools and PLCs; Design and classification of industrial robots; Programmable logic controllers.

Course Learning Outcomes

After successfully completing this course, you should be able to:

Learning Outcome	EA Stage 1 Competencies
1. Understand and apply systematic design principles as part of designing automated industrial machines and processes	PE1.1, PE1.5, PE2.1, PE2.3
2. 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	PE1.3, PE2.2, PE2.3, PE3.4
3. Understand the performance and characteristics of major machine elements and building blocks, including robotics, and how to specify and select appropriate equipment items from suppliers	PE1.1, PE1.3
4. Understand the capability and performance of off-the-shelf programmable logic controllers and be able to write and execute basic ladder programming of these devices	PE1.3, PE2.2, PE2.3, PE3.4

Teaching Strategies

The course material will be presented in the form of lectures (synchronous and asynchronous recordings) and associated book chapters and readings. Understanding will be supplemented by practical assignments and projects. Deeper understanding will be achieved during formal tutorial/lab sessions where students work with tutors and lecturer to implement theory on assigned problems and cases using a PLC programming environment and CNC controllers. The examinations will test the understanding of basic theory.

Assessment

Assessment Tasks

Assessment task	Weight	Due Date	Student Learning Outcomes Assessed
Quizzes	20%	07/10/2020 05:00 PM	1, 2, 3, 4
Final exam	40%	Not Applicable	1, 2, 3, 4
Group assignment	20%	30/10/2020 05:00 PM	1, 4
Group Assignment	20%	20/11/2020 05:00 PM	1, 2

Assessment Details

Assessment 1: Quizzes

Start date: 07/10/2020 04:00 PM

Details: There will be two quizzes dealing with material from weeks 1-3 (held in week 4) and weeks 4-9 (held in week 10). Quizzes will be held during scheduled tutorial/lab times

Assessment 2: Final exam

Start date: Not Applicable

Details: There will be a final exam covering all material taught in the course from weeks 1-10. The exam will be held during the formal examination period set by UNSW.

Assessment 3: Group assignment

Start date: Not Applicable

Details: Group Assignment 1 deals with the design of a PLC program and the demonstration that this program works. More details will be posted on Moodle.

Assessment 4: Group Assignment

Start date: Not Applicable

Details: Group Assignment 2 deals with designing a CNC program and demonstrating that it works. More details will be posted on Moodle.

Attendance Requirements

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

Course Schedule

View class timetable

Timetable

Date	Type	Content
O Week: 8 September - 9 September		
Week 1: 14 September - 18 September	Lecture	Part 1: Introduction to Automation Technology and the Internet of Things, Industry 4.0. Part 2: Computer Hardware, Controllers, Sensors, Binary Theory
Week 2: 21 September - 25 September	Lecture	Programmable Logic Controllers (PLC) – Part 1, Boolean Logic
	Tut-Lab	Install Omron Software. PLC basics.
Week 3: 28 September - 2 October	Lecture	Programmable Logic Controllers (PLC) – Part 2
	Tut-Lab	More advanced PLC topics. Introduction to Assignment Part 1.
Week 4: 5 October - 9 October	Lecture	Machine and Systems Design and Analysis, Machining Variables.
	Tut-Lab	Assignment Part 1 Support
Week 5: 12 October - 16 October	Lecture	Industrial Robotics
	Tut-Lab	Assignment Support
Week 6: 19 October - 23 October		Week 6 is a flexibility week and a tutorial will be offered to support the completion of Assignment Part 1.
Week 7: 26 October - 30 October	Lecture	Costing Methods Pneumatic Systems.
	Tutorial	Assignment Part 1 support. Questions on Robotics and Machine Variables
Week 8: 2 November - 6 November	Lecture	Introduction to Computer Aided Manufacturing - Part 1 - concepts of computer numerical control (CNC)
	Tut-Lab	Introduction to Assignment Part 2
Week 9: 9 November - 13 November	Lecture	Introduction to Computer Aided Manufacturing - Part 2: CAM Software Systems (Fusion 360) and Hardware (Denford CNC)
	Tut-Lab	Assignment Part 2 Support
Week 10: 16 November - 20 November	Lecture	Introduction to Computer Aided Manufacturing - Part 3: Analysis of Manufacturing Performance and Costing using CAM, Simulation and Analytical

		Costing Methods
	Tut-Lab	Assignment Part 2 support

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 'High-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

Not available

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 “machine-on-a-board” test rig.

Submission of Assessment Tasks

Assessment submission and marking criteria

Should the course have any non-electronic assessment submission, these should have a standard School cover sheet.

All submissions are expected to be neat and clearly set out. Your results are the pinnacle of all your hard work and should be treated with due respect. Presenting results clearly gives the marker the best chance of understanding your method; even if the numerical results are incorrect.

Marking guidelines for assignment submissions will be provided at the same time as assignment details to assist with meeting assessable requirements. Submissions will be marked according to the marking guidelines provided.

Late policy

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of 20 percent (20%) 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.

Work submitted after the ‘deadline for absolute fail’ is not 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 are clearly indicated in the course outline, and such assessments receive a mark of zero if not completed by the specified date. Examples include:

1. Weekly online tests or laboratory work worth a small proportion of the subject mark, or
2. Online quizzes where answers are released to students on completion, or
3. Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date, or
4. Pass/Fail assessment tasks.

Examinations

You must be available for all quizzes, tests and examinations. For courses that have final examinations, these are held during the University examination periods: February for Summer Term, May for T1, August for T2, and November/December for T3.

Please visit myUNSW for Provisional Examination timetable publish dates. For further information on exams, please see the Exams webpage.

Special Consideration

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 submitting an assessment or sitting an exam.

UNSW now has a Fit to Sit / Submit rule, which means that if you attempt an exam or submit a piece of assessment, 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.

Please note that students will **not** be required to provide **any** documentary evidence to support absences from any classes missed **because of COVID-19 public health measures such as isolation**. UNSW will **not** be insisting on medical certificates from anyone deemed to be a positive case, or when they have recovered. Such certificates are difficult to obtain and put an unnecessary strain on students and medical staff.

Applications for special consideration **will** be required for assessment and participation absences – but no documentary evidence **for COVID 19 illness or isolation** will be required in T3.

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. 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.

If plagiarism is found in your work when you are in first year, your lecturer will offer you assistance to improve your academic skills. They may ask you to look at some online resources, attend the Learning Centre, or sometimes resubmit your work with the problem fixed. However more serious instances in first year, such as stealing another student's work or paying someone to do your work, may be investigated under the Student Misconduct Procedures.

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) even suspension from the university. The Student Misconduct Procedures are available here:

www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf

Academic Information

Credit points

Course credit is calculated in Units-Of-Credit (UOC). The normal workload expectation for one UOC is approximately 25 hours per term. This includes class contact hours, private study, other learning activities, preparation and time spent on all assessable work.

Most coursework courses at UNSW are 6 UOC and involve an estimated 150 hours to complete. Each course includes a prescribed number of hours per week (h/w) of scheduled face-to-face and/or online contact. Any additional time beyond the prescribed contact hours should be spent in making sure that you understand the lecture material, completing the set assignments, further reading, and revising for any examinations.

On-campus class attendance

Public distancing conditions must be followed for all T3 face-to-face classes. To ensure this, only students enrolled in those classes will be allowed in the room. Class rosters will be attached to corresponding rooms and circulated among lab demonstrators. No over-enrolment is allowed in face-to-face class. Students enrolled in online classes can swap their enrolment from online to other additional, **but limited**, number of on-campus classes by Sunday, Week 1. Please refer to your course's Microsoft Teams and Moodle sites for more information about class attendance for in-person and online class sections/activities.

Your health and the health of those in your class is critically important. You must stay at home if you are sick or have been advised to self-isolate by NSW health or government authorities. Current alerts and a list of hotspots can be found here. **You will not be penalised for missing a face-to-face activity due to illness or a requirement to self-isolate.** We will work with you to ensure continuity of learning during your isolation and have plans in place for you to catch up on any content or learning activities you may miss. Where this might not be possible, an application for fee remission may be discussed. Further information is available on any course Moodle or Teams site.

In certain classroom and laboratory situations where 1.5 metres physical distancing cannot be maintained or there is a high risk that it cannot be maintained, face masks will be considered **mandatory PPE** for students and staff.

For more information, please refer to the
FAQs: https://www.covid-19.unsw.edu.au/safe-return-campus-faqs

Guidelines

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

Important Links

- Moodle
- Lab Access
- Health and Safety
- Computing Facilities
- Student Resources
- Course Outlines
- Engineering Student Support Services Centre
- Makerspace
- UNSW Timetable
- UNSW Handbook
- UNSW Mechanical and Manufacturing Engineering
- Equitable Learning Services

Image Credit

Synergies in Sound 2016

CRICOS

CRICOS Provider Code: 00098G

Acknowledgement of Country

We acknowledge the Bedegal people who are the traditional custodians of the lands on which UNSW Kensington campus is located.

Appendix: Engineers Australia (EA) Professional Engineer Competency Standard

Program Intended Learning Outcomes	
Knowledge and skill base	
PE1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline	✓
PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline	
PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline	✓
PE1.4 Discernment of knowledge development and research directions within the engineering discipline	
PE1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline	✓
PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline	
Engineering application ability	
PE2.1 Application of established engineering methods to complex engineering problem solving	✓
PE2.2 Fluent application of engineering techniques, tools and resources	✓
PE2.3 Application of systematic engineering synthesis and design processes	✓
PE2.4 Application of systematic approaches to the conduct and management of engineering projects	
Professional and personal attributes	
PE3.1 Ethical conduct and professional accountability	
PE3.2 Effective oral and written communication in professional and lay domains	
PE3.3 Creative, innovative and pro-active demeanour	
PE3.4 Professional use and management of information	✓
PE3.5 Orderly management of self, and professional conduct	
PE3.6 Effective team membership and team leadership	