MANF4100

Design and Analysis of Product-Process Systems

Term One // 2021

School of Mechanical and Manufacturing Engineering // UNSW Engineering

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Ron Chan	r.chan@unsw.edu.au	Consultation concerning this course is available immediately after the classes. Direct consultation is preferred.	ME507, Ainsworth Building	9385 1535

Lecturers

Name	Email	Availability	Location	Phone
Erik van Voorthuysen	erikv@unsw.edu.au	Consultation concerning this course is available immediately after the classes. Direct consultation is preferred.	erikv@unsw.edu.au	9385 4147

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

This course integrates the theory and knowledge from first and second year of engineering science courses into the theory and practice of designing and analysing automated and computer-integrated manufacturing systems. The design of such systems is complex and needs to consider multiple factors and design drivers, including the nature and characteristics of the product, the market, the manufacturing breadth and scope of the organisation, the appropriate level of manufacturing flexibility, manufacturing and materials handling technology as well as demographic characteristics such as regional workforce skills and hourly pay rates and environmental factors. The performance of such systems needs to be understood in the early stages of concurrent product-process design and continuously adapted and improved as the needs and requirements change throughout the product (and process) life cycle.

Course Aims

The course builds on the knowledge of the basic elements of computerized manufacture, and incorporates and integrates this fundamental knowledge into the design of computerised production strategies and systems. This course will focus on the tools, analyses and frameworks for selecting and designing computerised and automated production systems, including the fundamentals of flexible manufacturing and Group Technology, as well as the technical and organizational aspects of flexible manufacturing cells and systems.

Most production strategies and systems are computer enabled. Here we refer to a wide range of applications, including but not limited to the design function (both product and process), manufacturing management, product planning, quality control and machine/process control. The successful integration of a majority of these applications may be termed Computer Integrated Manufacturing or CIM. The course also covers the principles of computer aided manufacture, including process planning, CAD/CAM and computer integrated manufacturing.

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 manufacturing systems and factories.	PE1.1, PE1.5, PE1.6
2. Use appropriate analytical techniques to plan, specify and design a manufacturing system or, for that matter, a business process.	PE1.1, PE2.2, PE2.3
3. Understand data and information flow within a factory system and how this affects decision making, efficiency and effectiveness	PE1.1, PE1.2, PE2.1

Learning Outcome	EA Stage 1 Competencies
of the manufacturing operation.	
4. Understand, implement and manage key manufacturing improvement strategies including lean manufacturing.	PE2.4, PE3.2, PE3.3

Teaching Strategies

The course material will be presented in the form of lectures and associated book chapters and readings. Understanding will be supplemented by case studies and examples discussed in class. Deeper understanding will be achieved by means of students selecting their own application for designing a product-process system for the manufacture of a product they themselves select or have worked on as part of their mechanical component. The mid-session examinations will test the understanding of basic theory.

Additional Course Information

This is a 6 unit-of-credit (UoC) course and involves 3 hours per week (h/w) of face-to-face contact. The normal workload expectations of a student are approximately 25 hours per term for each UOC, including class contact hours, other learning activities, preparation and time spent on all assessable work.
You should aim to spend about 9 h/w on this course. The additional time should be spent in making sure that you understand the lecture material, completing the set assignments, further reading, and revising for any examinations.

Assessment

Assessment Tasks

Assessment task	Weight	Due Date	Student Learning Outcomes Assessed
Group project x 2	40%	Week 6 and 10	1, 2, 3, 4
Online Quiz x 3	20%	Week 3, 7 and 9	1, 2, 3
Final exam	40%	Exam Period	1, 2, 3

Assessment Details

Assessment 1: Group project x 2

Start date: Week 1-2

Length: 3000 words

Details: The assignment instructions will be posted on Moodle/Teams or handed out in class, and a reminder announcement will be made about due date for the assignments. The assignments support the learning outcomes by incorporating an appropriate mix of activities such as issue analysis and fact-based data analysis that support the design of appropriate solutions and strategies. The assignments also support collaborative teamwork and integration of different ideas and components into an overall coherent quality management strategy.

Turnitin setting: This assignment is submitted through Turnitin and students do not see Turnitin similarity reports.

Assessment 2: Online Quiz x 3

Start date: Not Applicable

Details: The quiz will be conducted fully online using Moodle Quiz function.

Assessment 3: Final exam

Start date: Exam Period

Details: The final exam covers all contents of the course from Week 1 to 10 inclusive. The final exam will be conducted fully online using Moodle Quiz function.

Turnitin setting: This is not a Turnitin assignment

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 February - 12 February		
Week 1: 15 February - 19 February	Lecture	**Introduction to Product-Process Systems, Key Factors of Success** • Global Manufacturing Issues • Comparison of Manufacturing Sectors • Competitive Strategy • Push – Pull Systems • Volume – Variety • Productivity – Flexibility • Global – Local Manufacturing • Product-Process Matrix • Production Process Strategies **Suggested Readings** Heizer, Operations management: sustainability and supply chain management, Part 1, Chapter 1 and 2
Week 2: 22 February - 26 February	Lecture	**Line Balancing** • Flexibility • Reliability • Agility • Scalability • Economic Factors • Sustainable Manufacturing • Line Balancing **Suggested Readings** Heizer, Operations management: sustainability and supply chain management, Part 2, Chapter 9
Week 3: 1 March - 5 March	Lecture	**Process Design and Analysis** • Time Horizon in Capacity Planning • Design – Effective Capacity, Capacity Utilisation and Efficiency • Analysis of Flow and Throughput Rate • Bottleneck Analysis and the Theory of Constraints • Breakeven Analysis, Cost-Volume Analysis

		Suggested Readings Heizer, Operations management: sustainability and supply chain management, Part 2, Chapter 7
Week 4: 8 March - 12 March	Lecture	**Resource Allocation – Linear Programming 1** • Formulating an LP problem • Simplex Method • Geometry of the Simplex Method • Using Microsoft Excel Solver **Suggested Readings** Heizer, Operations management: sustainability and supply chain management, Part 4, Module B
Week 5: 15 March - 19 March	Lecture	**Transportation Models – Linear Programming 2** • Formulating a Transportation problem • Northwest Corner Method • Sensitivity analysis **Suggested Readings** Heizer, Operations management: sustainability and supply chain management, Part 4, Module C
Week 6: 22 March - 26 March	Lecture	**Forecasting Techniques** • Forecasting Time Horizons • Types of Forecasts • The Forecasting Process • Time Series Forecasting • Moving Average • Exponential Smoothing • Measuring Forecasting Error • Trend Adjustment • Seasonal Variation • Regression Analysis **Suggested Readings** Heizer, Operations management: sustainability and supply chain management, Part 1, Chapter 4
Week 7: 29 March - 2 April	Lecture	**Forecasting Techniques** • Forecasting Time Horizons • Types of Forecasts • The Forecasting Process • Time Series Forecasting • Moving Average

		• Exponential Smoothing • Measuring Forecasting Error • Trend Adjustment • Seasonal Variation • Regression Analysis **Suggested Readings** Heizer, Operations management: sustainability and supply chain management, Part 1, Chapter 4
Week 8: 5 April - 9 April	Lecture	**Aggregate Planning and Production Scheduling** • Sales and Operations Planning • Aggregate Planning Methods • Master production schedule • Level Production **Suggested Readings** Heizer, Operations management: sustainability and supply chain management, Part 3, Chapter 12 and 13
Week 9: 12 April - 16 April	Lecture	**Materials Requirements Planning, Lean Manufacturing** • Material requirements planning • Enterprise resource planning • MRP explosion • Order quantities analysis • Lean production **Suggested Readings** Heizer, Operations management: sustainability and supply chain management, Part 3, Chapter 14, 15 and 16
Week 10: 19 April - 23 April	Blended	**Exam Revision** Q&A session will be provided live during lecture time.

Resources

Prescribed Resources

Operations Management – Sustainability and Supply Chain Management, J. Heizer and B. Render, 2016, Pearson Education. 9781292148656

You can find a free e-copy of the textbook from the UNSW library.

Recommended Resources

Operations Management – Sustainability and Supply Chain Management, J. Heizer and B. Render, 2016, Pearson Education. 9781292148656

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Course Evaluation and Development

In this course, recent improvements resulting from student feedback include the continuous use of VIVA assessment and feedback as it received positive feedback when the course was revised since 2019.

Laboratory Workshop Information

N/A

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.

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, for both regular and intensive terms. 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 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 a **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 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	