



UNSW Course Outline

MANF4100 Design and Analysis of Product-Process Systems - 2024

Published on the 01 Feb 2024

General Course Information

Course Code : MANF4100

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 : Multimodal

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

The course "Design and Analysis of Product-Process Systems" focuses on the design and analysis of manufacturing processes. It covers the following topics:

1. **Process Design:** An overview of the design of production processes, including flow analysis, process layout, and process improvement techniques.
2. **Linear Programming:** The use of mathematical models to optimise production processes, with a focus on formulating and solving LP problems using computer software.
3. **Forecasting Demand:** Techniques for forecasting future demand for products, including trend analysis and time series analysis.
4. **Production Line Balancing:** The optimisation of production lines, including workstation design, task allocation, and cycle time analysis.
5. **Aggregate Planning and Production Scheduling:** The planning of production over a medium-term horizon, including capacity planning and production scheduling under constraints.

This course provides students with a comprehensive understanding of the design and analysis of manufacturing processes, with a focus on practical applications.

Course Aims

The aim of the course "Design and Analysis of Product-Process Systems" is to provide students with a comprehensive understanding of the design and analysis of manufacturing processes. The course focuses on the following topics: process design, linear programming, forecasting demand, production line balancing, aggregate planning, and production scheduling.

The objective of the course is to equip students with the knowledge and skills required to design and optimise manufacturing processes, taking into consideration the various methods and technologies. Students will learn how to use mathematical models and computer software to analyse production processes and make informed decisions about production planning and scheduling.

Upon completion of the course, students will be able to apply their knowledge to real-world manufacturing problems, and to critically evaluate the performance of production systems. They will also be prepared to pursue further studies in operations management, production engineering, and related fields.

Relationship to Other Courses

N/A

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Understand and apply systematic design principles as part of designing manufacturing systems and factories.
CLO2 : Use appropriate analytical techniques to plan, specify and design a manufacturing system or, for that matter, a business process.
CLO3 : Understand data and information flow within a factory system and how this affects decision making, efficiency and effectiveness of the manufacturing operation.
CLO4 : Understand, implement and manage key manufacturing improvement strategies including lean manufacturing.

Course Learning Outcomes	Assessment Item
CLO1 : Understand and apply systematic design principles as part of designing manufacturing systems and factories.	<ul style="list-style-type: none">• Group project• Online Quiz• Final exam
CLO2 : Use appropriate analytical techniques to plan, specify and design a manufacturing system or, for that matter, a business process.	<ul style="list-style-type: none">• Group project• Online Quiz• Final exam
CLO3 : Understand data and information flow within a factory system and how this affects decision making, efficiency and effectiveness of the manufacturing operation.	<ul style="list-style-type: none">• Group project• Online Quiz• Final exam
CLO4 : Understand, implement and manage key manufacturing improvement strategies including lean manufacturing.	<ul style="list-style-type: none">• Group project

Learning and Teaching Technologies

Moodle - Learning Management System | Microsoft Teams

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.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Group project Assessment Format: Group	30%	Start Date: Week 4 Due Date: Week 7 and 10
Online Quiz Assessment Format: Individual	30%	Start Date: Week 3, 7 and 10 Due Date: Week 3, 7 and 10
Final exam Assessment Format: Individual	40%	Start Date: Exam Period Due Date: Exam Period

Assessment Details

Group project

Assessment Overview

Indicative effort

Part 1: 5 pages

Part 2: 20 pages

Students will work in a team (min. 1, max. 3 members per team) to solve a real-life industry-based problem. The assignment will be conducted in 2 parts:

Part 1:

- Construct a production model in the form of a 'Profit Tree'.
- Formulate this problem as a Linear Program. a. Establish the objective function b. List all decision variables c. List and quantify all relevant constraints.
- Obtain the optimal solution using Linear Programming methods.

Part 1 involves submitting a word document and Excel file - No formal report is required.

Part 2:

Update/correct your base case using the feedback provided in Part 1 of the assignment

- Verify and validate your model.

- List and describe each of the scenarios that you will test using your model.
- Determine the shadow price for each of the constraints.
- Provide professional recommendation for the company.

Part 2 involves writing the assignment up as a professional document with the appropriate headings and chapters.

Assessment criteria

Part 1 (Word and Excel) 5%

- Profit tree (/5)
- Base case setup – including the objective functions, constraints and optimal solution (/2)
- Base case solution accuracy (3)

Part 2 (Report) 25%

- Executive Summary – provide the problem, methodology and recommendations in plain English (/3)
- Improved profit tree (/2)
- Improved base case – including the objective functions, constraints and optimal solution (/2)
- Quality of the scenarios (/3)
- Accuracy of the scenarios (/5)
- Sensitivity analysis – assessment of the shadow price in plain English (/5)
- Recommendation – provide a concise, clear and professional recommendations using plain English for all key findings (/5)
- Documentation – readability of the document (/5)

Marking will be done with a rubric. Feedback will be provided in class within 2 weeks after the assessment is due.

Course Learning Outcomes

- CL01 : Understand and apply systematic design principles as part of designing manufacturing systems and factories.
- CL02 : Use appropriate analytical techniques to plan, specify and design a manufacturing system or, for that matter, a business process.
- CL03 : Understand data and information flow within a factory system and how this affects decision making, efficiency and effectiveness of the manufacturing operation.
- CL04 : Understand, implement and manage key manufacturing improvement strategies including lean manufacturing.

Detailed Assessment Description

See above

Student will be working in a group of 3-4 members.

Assignment submission Turnitin type

Not Applicable

Online Quiz

Assessment Overview

Students have to conduct 3 online quizzes during exam time. Each quiz is equally weighted of their final assessment mark.

Indicative Effort

- Complete the exam within 75 minutes
- Correct value entered (in filling-the-box questions)
- Correct choice of answer (in multiple choice questions)

Students are expected to submit their working out at the end each quiz. The working out can be in the form of handwritten notes, Excel files, Minitab files or equivalent that demonstrate the student's own work.

Marking will be done with a rubric. Feedback will be provided in class.

Course Learning Outcomes

- CL01 : Understand and apply systematic design principles as part of designing manufacturing systems and factories.
- CL02 : Use appropriate analytical techniques to plan, specify and design a manufacturing system or, for that matter, a business process.
- CL03 : Understand data and information flow within a factory system and how this affects decision making, efficiency and effectiveness of the manufacturing operation.

Detailed Assessment Description

See above

Assessment Length

75 minutes

Assignment submission Turnitin type

Not Applicable

Final exam

Assessment Overview

The final exam will be centrally managed and will cover all contents in the course.

Indicative Effort

- Complete the exam within 120 minutes
- Correct value entered (in filling-the-box questions)
- Correct choice of answer (in multiple choice questions)

Students are expected to submit their working out at the end of the exam. The working out can be in the form of handwritten notes, Excel files, Minitab files or equivalent that demonstrate the student's own work.

Course Learning Outcomes

- CL01 : Understand and apply systematic design principles as part of designing manufacturing systems and factories.
- CL02 : Use appropriate analytical techniques to plan, specify and design a manufacturing system or, for that matter, a business process.
- CL03 : Understand data and information flow within a factory system and how this affects decision making, efficiency and effectiveness of the manufacturing operation.

Detailed Assessment Description

See above

Submission notes

Moodle Exam

Assignment submission Turnitin type

This is not a Turnitin assignment

General Assessment Information

Grading Basis

Standard

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 12 February - 18 February	Lecture	<ul style="list-style-type: none"> • 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
Week 2 : 19 February - 25 February	Lecture	<ul style="list-style-type: none"> • Flexibility • Reliability • Agility • Scalability • Economic Factors • Sustainable Manufacturing • Line Balancing
Week 3 : 26 February - 3 March	Lecture	<ul style="list-style-type: none"> • Formulating an LP problem • Simplex Method • Geometry of the Simplex Method • Using Microsoft Excel Solver
	Assessment	Quiz 1 <ul style="list-style-type: none"> • Content covered - Week 1 and 2 content • You MUST complete your quiz within the strict time window • You get 1 attempt to this quiz with 75 minutes time limit
Week 4 : 4 March - 10 March	Lecture	<ul style="list-style-type: none"> • Formulating a Transportation problem • Northwest Corner Method • Sensitivity analysis
Week 5 : 11 March - 17 March	Lecture	<ul style="list-style-type: none"> • Transportation Model • North-West Corner Method • Simplified Simplex Method for Transportation Model
Week 6 : 18 March - 24 March	Lecture	<ul style="list-style-type: none"> • Q&A Session • Assignment support and Q&A
Week 7 : 25 March - 31 March	Lecture	<ul style="list-style-type: none"> • Forecasting Time Horizons • Types of Forecasts • The Forecasting Process • Time Series Forecasting • Moving Average • Exponential Smoothing • Measuring Forecasting Error • Trend Adjustment • Seasonal Variation
	Assessment	Quiz 2 <ul style="list-style-type: none"> • Content covered - Week 3 to 6 content • You MUST complete your quiz within the strict time window • You get 1 attempt to this quiz with 75 minutes time limit
	Assessment	Assignment 1 due
Week 8 : 1 April - 7 April	Lecture	<ul style="list-style-type: none"> • Sales and Operations Planning • Aggregate Planning Methods • Master production schedule • Level Production
Week 9 : 8 April - 14 April	Lecture	<ul style="list-style-type: none"> • Material requirements planning • Enterprise resource planning • MRP explosion • Order quantities analysis • Lean production
Week 10 : 15 April - 21 April	Lecture	• Exam Revision
	Assessment	Quiz 3 <ul style="list-style-type: none"> • Content covered - Week 8 and 9 content • You MUST complete your quiz within the strict time window • You get 1 attempt to this quiz with 75 minutes time limit
	Assessment	Assignment 2 due

Attendance Requirements

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

Course 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

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

Course Evaluation and Development

In this course, recent improvements resulting from student feedback include provide major assignment feedback prior to the final report submission.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Ron Chan		ME507, Ainsworth Building	9385 1535	Send Ron a text using Microsoft Team to book a private consultation session outside class time	No	Yes
Lecturer	Erik van Voorthuysen		erikv@unsw.edu.au	9385 4147	Send Erik a text using Microsoft Team to book a private consultation session outside class time	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 policies. 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. 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](#)