UNSW SYDNEY | Australia's Global University

Mechanical and Manufacturing Engineering

Course Outline

Term 1 2019

MANF4100

DESIGN AND ANALYSIS OF PRODUCT-PROCESS SYSTEMS

Contents

1. Staff contact details

Contact details and consultation times for course convenor

Name: Dr Ron Chan
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Consultation concerning this course is available immediately after the classes. Direct consultation is preferred.

Contact details and consultation times for additional lecturers/demonstrators/lab staff

Please see the course Moodle.

2. Important links

- Moodle
- Lab Access
- Computing Facilities
- Student Resources
- Course Outlines
- Engineering Student Support Services Centre

3. Course details

Credit points

This is a 6 unit-of-credit (UoC) course, and involves 4 hours per week (h/w) of face-to-face contact.

Contact hours

	Day	Time	Location
Lectures	Tuesday	09:00 – 12:00	Ainsworth G02
	Wednesday	14:00 – 15:00	OMB G31

Please refer to your class timetable for the learning activities you are enrolled in and attend only those classes.

Summary and Aims of the course

This course teaches students the principles and applications of CAD/CAM in product and manufacturing design and is highly relevant to future trends in automation and manufacturing processes. It teaches the underlying theory of CAD/CAM, but most importantly teaches students the skills needed to design using CAD/CAM. The School operates a number of design platforms, most notably SolidWorks and SolidCAM software. The course teaches the essential steps that one takes to develop a product from concept to manufacture starting with CAD, and progressing to simulation, using CAM and CAE software support.

This course will enable students to explore and gain further understanding of how CAD/CAM can be used in Manufacturing Industry. This course will also provide students with opportunity to explore innovation in design using SolidWorks, SolidCAM and the Denford CAM software.

Student learning outcomes

This course is designed to address the learning outcomes below and the corresponding Engineers Australia Stage 1 Competency Standards for Professional Engineers as shown. The full list of Stage 1 Competency Standards may be found in Appendix A.

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, including Linear Programming 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 of the manufacturing operation.	PE1.1, PE1.2, PE2.1
4.	Understand, implement and manage key manufacturing improvement strategies including lean manufacturing.	PE2.4, PE3.2, PE3.3

4. Teaching strategies

Lectures in the course are designed to cover the terminology and core concepts and theories in the area of manufacturing process design. They do not simply reiterate the texts, but build on the lecture topics using examples taken directly from industry to show how the theory is applied in practice and the details of when, where and how it should be applied. The first assignment prompts students in applying engineering design using CAD. The second assignment is a group assignment with an individual submission that exposes students to the real-world situation by applying CAD and CAM to produce a commercial

product. Demonstrations will be provided during the course of completing this project. The group demonstrations are arranged to provide teams with personalised feedback.

5. Course schedule

Date	Topic (Ainsworth G02) Tuesday 09:00-12:00 (OMB G31) Wednesday 14:00-15:00	Lecture Content
Week 1	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
Week 2	Line Balancing	• Flexibility • Reliability • Agility • Scalability • Economic Factors • Sustainable Manufacturing • Line Balancing
Week 3	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
Week 4	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

Date	Topic (Ainsworth G02) Tuesday 09:00-12:00 (OMB G31) Wednesday 14:00-15:00	Lecture Content
Week 5	Resource Allocation – Linear Programming 1	• Formulating an LP problem • Simplex Method • Geometry of the Simplex Method • Using Microsoft Excel Solver
Week 6	Transportation Models – Linear Programming 2	• Formulating a Transportation problem • Northwest Corner Method • Sensitivity analysis
Week 7	Factor Layout Planning & Factory Location Selection	• Strategic Importance of Layout Decisions • Types of Layout • Process Layout Cost Calculation • Product Layout • The Economics of Transportation • Factor Rating Method • Centre of Gravity Method
Week 8	Aggregate Planning and Production Scheduling	• Sales and Operations Planning • Aggregate Planning Methods • Master production schedule • Level Production
Week 9	Materials Requirements Planning, Lean Manufacturing	• Material requirements planning • Enterprise resource planning • MRP explosion • Order quantities analysis • Lean production
Week 10	Human Factors and Job Design	• Labour Planning • Job Design • Ergonomics • Statistical Methods Analysis and Time Studies

6. Assessment

Assessment overview

Assessment	Group Project?	If Group, # Students per group	Length	Weight	Learning outcomes assessed	Assessment criteria	Due date and submission requirements	Deadline for absolute fail	Marks returned
Online Quiz x 3	No	N/A	Multiple choice and short answer questions	15% (5% each)	1, 2 and 3	Lecture and demonstration contents	Week 3, 6, 9	Immediately after the quiz is closed on Moodle	1 week after the quiz is closed
Group Assignment 1	Yes	Min 3 Max 4	5-page main body text	10%	1, 2, 3 and 4	See Assignment Section	Week 5	1 week after the due date	2 weeks after submission
Group Assignment 2 (Continuation of Assignment 1)	Yes	Min 3 Max 4	15-page main body text	30%	1, 2, 3 and 4	See Assignment Section	Week 10	1 week after the due date	2 weeks after submission
Final Exam	No	N/A	2-hour, short answer questions	45%	1, 2 and 3	All lecture and demonstration contents	Exam period, date TBC	N/A	Upon release of final results

Assignments

The assignment instructions will be posted on Moodle 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 team work and integration of different ideas and components into an overall coherent quality management strategy.

The following criteria will be used to grade assignments:

Presentation

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.

Submission

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:

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

Marking

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.

Examinations

You must be available for all tests and examinations. Final examinations for each course 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.

Online Quiz

Three quizzes (Quiz 1, 2 and 3) will be conducted online via Moodle. The format of the quiz is like those that are done on paper, which consist of multiple-choice questions, calculations and short answer questions. The link to the quiz will be available on Wednesday of the quiz week from 11:00 to 12:00. Each student gets ONE attempt to complete the quiz within the time limit. The feedback of the quiz will be provided 1-week after the quiz is closed. Note that the quiz questions are randomly drawn from a question bank with similar theme and difficulty, numerical questions may appear with random input numbers, so students will not expect to get the exact same question. Students are expected to complete the quiz individually.

Calculators

You will need to provide your own calculator of a make and model approved by UNSW for the examinations. The list of approved calculators is available at student.unsw.edu.au/exam-approved-calculators-and-computers

It is your responsibility to ensure that your calculator is of an approved make and model, and to obtain an "Approved" sticker for it from the Engineering Student Supper Services Centre prior to the examination. Calculators not bearing an "Approved" sticker will not be allowed into the examination room.

Special consideration and supplementary assessment

If you have experienced an illness or misadventure beyond your control that has interfered with your assessment performance, you are eligible to 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.

7. Expected resources for students

Reference books (available via UNSW library)

1. Operations Management – Sustainability and Supply Chain Management, J. Heizer and B. Render, 2014, Pearson Education.

E-books (available via UNSW library)

1. Manufacturing Process Selection Handbook: From Design to Manufacture, Swift K.G., Booker J.D., 2013, Burlington, Elsevier Science.
2. Production and Operations Management, S. Anil Kumar and N. Suresh, 2007, New Age International Publishers.

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

Additional lecture notes and materials will be given via Moodle: https://moodle.telt.unsw.edu.au/login/index.php

8. 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 more demonstrator support to the student major group project.

9. 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

10. Administrative matters and links

All students are expected to read and be familiar with School guidelines and polices, available on the intranet. In particular, students should be familiar with the following:

- Attendance
- UNSW Email Address
- Computing Facilities
- Special Consideration
- Exams
- Approved Calculators
- Academic Honesty and Plagiarism
- Student Equity and Disabilities Unit
- Health and Safety
- Lab Access
- Makerspace
- UNSW Timetable
- UNSW Handbook
- UNSW Mechanical and Manufacturing Engineering

Appendix A: Engineers Australia (EA) Competencies

Stage 1 Competencies for Professional Engineers

	Program Intended Learning Outcomes
PE1: Knowledge and Skill Base	PE1.1 Comprehensive, theory-based understanding of underpinning fundamentals
	PE1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing
	PE1.3 In-depth understanding of specialist bodies of knowledge
	PE1.4 Discernment of knowledge development and research directions
	PE1.5 Knowledge of engineering design practice
	PE1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice
PE2: Engineering Application Ability	PE2.1 Application of established engineering methods to complex 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
PE3: Professional and Personal Attributes	PE3.1 Ethical conduct and professional accountability
	PE3.2 Effective oral and written communication (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