



Mechanical and Manufacturing Engineering

# Course Outline

Semester 1 2018

**MANF3100**

**Product and Manufacturing Design**

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# 1. Staff contact details

## Contact details and consultation times for course convenor

Name: Dr Alexander Green  
Office location: Ainsworth Building (J17), Room 507  
Email: [alex.green@unsw.edu.au](mailto:alex.green@unsw.edu.au)

Consultation concerning this course is available immediately after classes. Face to face consultation is preferred.

## Contact details and consultation times for additional lecturer

Dr Erik van Voorthuysen  
Office: Ainsworth Building (J17), Room 507  
Email: [erikv@unsw.edu.au](mailto:erikv@unsw.edu.au)

Consultation concerning this course is available immediately after classes. Face to face consultation is preferred.

Please see the course [Moodle](#).

# 2. Important links

- [Moodle](#)
- [UNSW Mechanical and Manufacturing Engineering](#)
- [Course Outlines](#)
- [Student intranet](#)
- [UNSW Mechanical and Manufacturing Engineering Facebook](#)
- [UNSW Handbook](#)

# 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.

The UNSW website states “The normal workload expectations of a student are approximately 25 hours per semester for each UoC, including class contact hours, other learning activities, preparation and time spent on all assessable work. Thus, for a full-time enrolled student, the normal workload, averaged across the 16 weeks of teaching, study and examination periods, is about 37.5 hours per week.”

This means that 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.

### Contact hours

	Day	Time	Location
<b>Lectures</b>	Monday	12pm – 2pm	Pioneer International Theatre
<b>Demonstrations</b>	Monday	2pm – 4pm	Willis Annex UG Lab

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 focuses on making certain that a complex design—whether mechanical, mechatronic or aerospace—can also be successfully manufactured, from a quality as well as cost perspective.

The key concept is the ability to translate functional requirements of a design into detailed subsystem-, equipment- and ultimately component-level specifications. These design-related specifications are then further developed into process specifications and ultimately support process selection and planning.

Whereas the course has a strong focus on processing and transformation technology, the economic analysis of manufacturing processes is also an important part of the course. The reason for this is that around 70% of manufacturing costs—including material, processing and assembly—are determined by design specifications before the product even hits the factory floor. The remaining 30% of costs are determined by operational decisions, including machine selection, process planning, scheduling, routing and so on.

Topics include an overview of transformation processes and related cost and quality drivers, design for manufacturing related methodologies including quality function deployment (QFD), concurrent design, lifecycle design, value analysis, value engineering, robust design, axiomatic design and tolerance analysis. The course also introduces basic jig and fixture design for different levels of automation and manufacturing processes as well as an introduction to metrology for manufacturing engineers. Modern CAD/CAM systems contain sophisticated functionality and modules that automate some of the analysis and design functions with respect to process planning and even jig design. We have planned for an industry expert to give a guest lecture on this topic.

The course will combine lectures with practical case studies that require the theory taught to be applied to actual product designs and prototypes. Students have the option to bring their own examples and case studies into the course or alternatively select one of the recently developed designs provided in class.

The course aims to develop you into a skilled and all-rounded 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.

The course teaches this approach based on global best-practice methodologies, and incorporates case studies and projects, even your own designs and plans, to apply these methodologies and become proficient at them.

### 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:

	<b>Learning Outcome</b>	<b>EA Stage 1 Competencies</b>
1.	Understand and apply systematic design principles including: <ul style="list-style-type: none"> <li>• Quality Function Deployment (QFD)</li> <li>• VDI-2206 and 2221 Design Standards</li> <li>• Axiomatic and robust design principles</li> <li>• Value analysis and value engineering methods.</li> </ul>	PE1.1, 1.2, 1.3, 1.5, 1.6 PE2.1, 2.2, 2.3, 2.4
2.	Analyze and characterize manufacturing transformation processes in terms of key technical and economic drivers and factors.	PE1.1 PE2.2, 2.3, 2.4 PE 3.1, 3.4
3.	Ability to integrate this information and design intent into CAD/CAM systems.	PE1.1, 1.3, 1.5 PE2.2
4.	Develop an engineering design or prototype into a design that can be effectively and efficiently manufactured to meet customer as well as OEM requirements.	PE1.4, 1.6 PE2.1, 2.2, 2.3, 2.4 PE3.1, 3.2, 3.3, 3.4, 3.5, 3.6
5.	Understand the principles of manufacturing economics as it applies to material transformation processes as well as assembly processes and to apply economic analysis to develop cost and production estimates for your design.	PE1.1 PE2.1, 2.2, 2.3, 2.4 PE 3.1, 3.4
6.	Understand the fundamentals and key technologies used in manufacturing measurement and how this is used to support and guarantee successful manufacturing outcomes.	PE1.1, 1.2, 1.6 PE2.2, 2.3 PE3.3, 3.4

## 4. Teaching strategies

Lectures in the course are designed to cover the terminology and core concepts and theories in the area of design for manufacturing. 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.

Tutorials are designed to provide you with feedback and discussion on the assignments, and to investigate problem areas in greater depth to ensure that you understand the application.

## 5. Course schedule

<b>Week</b>	<b>Lecture / Tutorial Topic</b>	<b>Assessments</b>
<b>1</b>	Design Theory, QFD, Developing Functional Requirements, V-Model design theory, Axiomatic Design, Concurrent Design	
<b>2</b>	Economics, Costing, Value Engineering, Quality, and Process Capability	
<b>3</b>	Computer Aided Manufacturing (CAM)	CAM and Costing
<b>4</b>	Process and Material Selection Methods	
<b>5</b>	Primary Processes	
<b>BREAK</b>	Mid-Semester Break	
<b>6</b>	Secondary Processes	Quiz #1
<b>7</b>	Design for Assembly (DFA), Design for Manufacturing (DFM)	Assignment Part 1
<b>8</b>	Rapid Prototyping, Plastics and Composites, EDM, Laser, Waterjet, PCB and Electronics Manufacturing	Rapid Prototyping
<b>9</b>	Jigs, Fixtures, and Joining	
<b>10</b>	Metrology, limits, fits and tolerancing	
<b>11</b>	Surface Engineering	Quiz #2
<b>12</b>	Revision	Assignment Part 2

## 6. Assessment

### Assessment overview

Assessment	Length	Weight	Learning outcomes assessed	Assessment criteria	Due date and submission requirements	Deadline for absolute fail	Marks returned
Lab 1 and 2	2 hours each	10% Total	2 and 3	Topics assessed include lab attendance, design and costing skills.	Weeks 3 and 8 during class time	N/A	Two weeks after submission
Quiz 1 and 2	1 hour each	40% Total	1 to 6	All course content from weeks 1-11 inclusive.	Week 6 and 11 during class time	N/A	Two weeks after submission
Assignment Part 1	2000 Words	20%	1, 2, 4 and 5	All course content from weeks 1-7 inclusive.	End of Week 7 Submission via Moodle	One week after deadline	Two weeks after submission
Assignment Part 2	3000 Words	30%	1, 2, 4, 5 and 6	All course content from weeks 1-9 inclusive.	End of Week 12 Submission via Moodle	One week after deadline	Upon release of final results

### *Assignments*

Full requirements for Assignment Part 1 and Part 2 will be placed on Moodle. Assistance for the assignment will be provided during allocated tutorial sessions.

### *Quiz 1 and 2*

Quizzes will be conducted during class time (either during the lecture or lab time as confirmed by the lecturer at least one week in advance) on the dates allocated in the table above. Each Quiz is nominally 1 hour, but extra time may be given. Each Quiz will cover all material taught up to that week in the semester.

### *Lab Exercises*

Lab exercises will be held during the laboratory period and the written submission will be due on the day. Requirements for the lab exercises will be given out during the lab.

### *Presentation*

All non-electric submissions should have a standard School cover sheet, which is available from this course's Moodle page.

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*

Late submissions will be penalised 5 marks per calendar day (including weekends). An extension may only be granted in exceptional circumstances. Where an assessment task is worth less than 20% of the total course mark and you have a compelling reason for being unable to submit your work on time, you must seek approval for an extension from the course convenor **before the due date**. Special consideration for assessment tasks of 20% or greater must be processed through [student.unsw.edu.au/special-consideration](http://student.unsw.edu.au/special-consideration).

It is always worth submitting late assessment tasks when possible. Completion of the work, even late, may be taken into account in cases of special consideration.

Where there is no special consideration granted, the 'deadline for absolute fail' in the table above indicates the time after which a submitted assignment will not be marked, and will achieve a score of zero for the purpose of determining overall grade in the course.

### *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**

There is no formal exam for MANF3100.

### **Special consideration and supplementary assessment**

For details of applying for special consideration and conditions for the award of supplementary assessment, see the [School intranet](#), and the information on UNSW's [Special Consideration page](#).

## **7. Attendance**

You are required to attend a minimum of 80% of all classes, including lectures, labs and seminars. It is possible to fail the course if your total absences equal to more than 20% of

the required attendance. Please see the [School intranet](#) and the [UNSW attendance page](#) for more information.

## 8. Expected resources for students

### Textbooks

NONE PRESCRIBED.

### 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., 2<sup>nd</sup> ed., 2002 John Wiley

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

Moodle: <https://moodle.telt.unsw.edu.au/login/index.php>

## 9. 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: restructure of the assessments, purchase of a physical machine, and additional summarised resources.

## 10. 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: [student.unsw.edu.au/plagiarism](http://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](http://www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf)

Further information on School policy and procedures in the event of plagiarism is available on the [intranet](#).

## 11. Administrative matters and links

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

- [Attendance, Participation and Class Etiquette](#)
- [UNSW Email Address](#)
- [Computing Facilities](#)
- [Assessment Matters](#) (including guidelines for assignments, exams and special consideration)
- [Academic Honesty and Plagiarism](#)
- [Student Equity and Disabilities Unit](#)
- [Health and Safety](#)
- [Student Support Services](#)

# Appendix A: Engineers Australia (EA) Competencies

## Stage 1 Competencies for Professional Engineers

	<b>Program Intended Learning Outcomes</b>
<b>PE1: Knowledge and Skill Base</b>	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
<b>PE2: Engineering Application Ability</b>	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
<b>PE3: Professional and Personal Attributes</b>	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