



Mechanical and Manufacturing Engineering

# Course Outline

Semester 2 2017

**GSOE9340**

**LIFE CYCLE ENGINEERING**

# Contents

1. Staff contact details .....	3
Contact details and consultation times for course convenor .....	3
Contact details and consultation times for additional lecturers/demonstrators/lab staff .....	3
2. Important links .....	3
3. Course details .....	3
Credit Points .....	3
Contact hours .....	4
Summary and Aims of the course .....	4
Student learning outcomes .....	5
4. Teaching strategies .....	5
5. Course schedule .....	6
6. Assessment .....	7
Assessment overview .....	7
Assignments .....	8
Presentation .....	8
Submission .....	8
Marking .....	8
Examinations .....	8
Calculators .....	8
Special consideration and supplementary assessment .....	9
7. Attendance .....	9
8. Expected resources for students .....	9
9. Course evaluation and development .....	9
10. Academic honesty and plagiarism .....	10
11. Administrative matters and links .....	10
Appendix A: Engineers Australia (EA) Competencies .....	12

# 1. Staff contact details

## Contact details and consultation times for course convenor

Name: Professor Sami Kara (Lecturer In-charge)  
Office Location: Room 301, Ainsworth Building  
Tel: (02) 9385 5757  
Email: [S.Kara@unsw.edu.au](mailto:S.Kara@unsw.edu.au)  
Moodle: <https://moodle.telt.unsw.edu.au/login/index.php>

Consultation concerning this course is available on Monday–Wednesday 0930–1700 whenever I am not otherwise engaged. Please use email as a first resort for consultation. Strictly no consultations will be held on Thursday and Friday.

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

Name: Georg Bienert  
Office Location: Room 301, Ainsworth Building  
Tel: (02) 9385 4126  
Email: [g.bienert@unsw.edu.au](mailto:g.bienert@unsw.edu.au)

Name: Shiva Abdoli  
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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 **3** 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

	<b>Day</b>	<b>Time</b>	<b>Location</b>
<b>Lectures</b>	Wednesday	6 - 8pm	Central Lecture Block 8 (K-E19-105)
<b>Demonstrations</b>	Wednesday	8 – 9pm	Central Lecture Block 8 (K-E19-105)

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

Manufacturing has always been by far the largest contributor to waste generation in our society and therefore provides a huge potential for waste reduction. This is due to the fact that current manufacturing systems are considered to be of an open loop style, whereby manufacturers’ main interests are focused in the areas of design, development, sales and distribution. A shift to a closed loop manufacturing system is proposed to enable manufacturers to take into account the whole product life cycle and move away from open loop manufacturing. This will require engineering of the whole product life cycle of a product from raw material selection, production, usage to disposal in order to reduce the environmental impact of industrial society.

The aim this course is to introduce the tools and techniques associated with engineering of a product life cycle to postgraduate students from technical backgrounds so that they can have an in-depth understanding of how to engineer and manage the entire life of a product from material selection to disposal.

This course is designed to provide postgraduate students with high level knowledge of Life Cycle Engineering principles and practices. The course will follow a typical product life cycle and the associated tools and techniques available. It starts with defining the concept of life cycle engineering, history and potential benefits (ecological and environmental). It then introduces the drivers behind this concept such as legislation and standards, environmental requirements. Next, the concepts of life cycle thinking, Cradle-to-Grave, Cradle-to-Cradle, Energy and Eco-efficiency are introduced. In the following section, generic environmental impact assessment tools and the concept of sustainable product development and the associated eco-design tools are introduced. The course continues with concepts related to usage and the end-of-life stages of product life cycle. These topics include Product collection, Reverse logistics and End-of-Life decision making, Tools and technologies, Disassemble sequence planning, Disassembly technologies, Reuse and remanufacturing

principles, product monitoring and testing, materials recycling techniques. The course finally finishes with economics and future trends such as Economic models, Life Cycle Costing (LCC) and Product Service Systems (PSS).

### 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.	Have gained knowledge in the inter-disciplinary field of Life Cycle Engineering	PE1.3, PE1.5, PE1.6
2.	Develop in-depth understanding of various tools and techniques associated with engineering and managing the whole life cycle of a product	PE2.2
3.	Develop an appreciation of the future trends in the area of triple bottom line of sustainability (economic, ecological and social)	PE1.4

## 4. Teaching strategies

This course is included to give you the skills to appreciate the engineering of product life cycles in order to reduce environmental impact and ultimately to achieve the three pillars of sustainability; namely economic, environmental and social sustainability. The content reflects my experience as a lecturer as well as my practical experience in the manufacturing environment, and practical examples drawn from that experience are used throughout the lectures and demonstrations. Effective learning is supported when you are actively engaged in the learning process and by a climate of enquiry, and these are both achieved in the lectures and demonstrations by way of practical case studies. You become more engaged in the learning process if you can see the relevance of your studies to professional, disciplinary and/or personal contexts, and the relevance is shown in all parts of the lectures and assignments by way of examples drawn from industry.

Dialogue is encouraged between you, others in the class and the lecturers. Diversity of experiences is acknowledged, as some students in each class have prior experience in a manufacturing environment. Your experiences are drawn on to illustrate various aspects, and this helps to increase motivation and engagement.

It is expected that assignments will be marked and handed back as soon as possible. You will have feedback and discussion while the assignment is fresh in your mind, to improve the learning experience.

The subject will be presented in the form of lectures and demonstrations. Each weekly class will consist of a 1-1.5 hr lecture followed by a demonstration example or case study related to the material covered in the lecture. A typical session would consist of a lecture covering the main elements of the topic for the week, interspersed with a number of individual or group exercises. Students are advised to read the relevant Units of the subject material BEFORE attending the class. Some of the exercises appearing in the subject material will be discussed in class. In other cases (particularly numerical exercises) worked solutions will be handed out separately.

## 5. Course schedule

Week	Topic	Location	Suggested Readings
1	Introduction to the subject and key drivers of change, Life cycle engineering framework	Central Lecture Block 8 (K-E19-105)	Readings 1 and 2
2	Life Cycle Strategy and Management	Central Lecture Block 8 (K-E19-105)	Readings 3 and 4
3	Energy and Resource Efficiency of Product and Processes	Central Lecture Block 8 (K-E19-105)	Reading 5 and 6
4	Environmental Footprint of Product and Processes	Central Lecture Block 8 (K-E19-105)	Readings 7, 8, 9
5	Life Cycle Costing and Eco-efficiency	Central Lecture Block 8 (K-E19-105)	Readings 10, 11, 12
6	Environmentally Sustainable Product Development -1	Central Lecture Block 8 (K-E19-105)	Readings 13 and 14
7	Environmentally Sustainable Product Development -2	Central Lecture Block 8 (K-E19-105)	Readings 15 and 16
8	Product Usage	Central Lecture Block 8 (K-E19-105)	Readings 17 and 18
9	Product Collection and Recovery	Central Lecture Block 8 (K-E19-105)	Readings 19 and 20
10	Product End-of-Life Management -1	Central Lecture Block 8 (K-E19-105)	Readings 21
11	Product End-of-Life Management -2	Central Lecture Block 8 (K-E19-105)	Readings 21 and 22
12	Product End-of-Life Management -1	Central Lecture Block 8 (K-E19-105)	Readings 23 and 24
13	Review of Lecture / Industry speaker	Central Lecture Block 8 (K-E19-105)	

## 6. Assessment

### Assessment overview

Assessment	Length	Weight	Learning outcomes assessed	Assessment criteria	Due date and submission requirements	Deadline for absolute fail	Marks returned
Group assignment 1	2500 words	25%	1 and 2	Detailed assessment criteria will be uploaded in Moodle	Week 4 in the lecture	Midnight Sunday 1 <sup>st</sup> October	Two weeks after submission
Group assignment 2	2500 words	25%	2 and 3	Detailed assessment criteria will be uploaded in Moodle	Week 6 in the lecture	N/A	Two week after the submission
Midsession Test 1	10 short answer questions	25%	1 and 2	Course content from week 1-5	Week 7 in the lecture	N/A	Two weeks after the assessment
Midsession Test 2	10 short answer questions	25%	2 and 3	Course content from weeks 6-11	Week 12 in the lecture	N/A	Two week after the assessment

Details of the assignments, detailed assessment criteria and the due dates will be uploaded to Moodle prior to the assignment

## **Assignments**

### *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. Special consideration for assessment tasks 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**

You must be available for all tests and examinations. Final examinations for each course are held during the University examination periods, which are June for Semester 1 and November for Semester 2.

Provisional Examination timetables are generally published on myUNSW in May for Semester 1 and September for Semester 2.

For further information on exams, please see the [Exams](#) section on the intranet.

### *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 shown at [student.unsw.edu.au/exam-approved-calculators-and-computers](http://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 School Office or the Engineering Student Centre prior to the examination. Calculators not bearing an “Approved” sticker will not be allowed into the examination room.

### **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**

A list of reference books will be provided during the course delivery, some of which can be found in the UNSW Library: <https://www.library.unsw.edu.au/>

Additional readings will be handed out during each class.

The course will be administered using Moodle. Therefore course administration and some lecture materials may be uploaded to Moodle. Students are advised to use Moodle for class communications.

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 changing the guest lecturers, more demonstrations and taking into account diverse student backgrounds through different demonstrations.

## 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