UNSW SYDNEY | Australia's Global University

Mechanical and Manufacturing Engineering

Course Outline

Term 2 2019

GSOE9340

Life Cycle Engineering

Contents

1. Staff contact details

Contact details and consultation times for course convenor

Name: Prof Sami Kara
Office location: Room 301A, Ainsworth Building
Tel: (02) 9385 5757
Email: S.Kara@unsw.edu.au
Moodle: https://moodle.telt.unsw.edu.au/login/index.php

Moodle discussion should be used for all course related communication. For others, email should be used as an alternative.

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

Name: Dr Shiva Abdoli (Other lecturer/Demonstrator)
Office Location: Room 301, Ainsworth Building
Tel: (02) 9385 6851
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Please see the course Moodle.

2. Important links

- Moodle
- Lab Access
- Computing Facilities
- Student Resources
- Course Outlines
- Engineering Student Support Services Centre
- Makerspace
- UNSW Timetable
- UNSW Handbook
- UNSW Mechanical and Manufacturing Engineering

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 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.

Contact hours

	Day	Time	Location
Lectures	Tuesday	6pm - 8pm	Richie theatre
Demonstrations	Tuesday	8pm – 9pm	Richie theatre

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 of 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 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, and 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.
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.
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. The following table briefly summarizes the course requirements and the expectations from students in order to succeed in the course.

Lectures	• Find out what you must learn • Follow worked examples • Hear announcements on course changes • Participate in class discussions
Assessments	• Demonstrate your knowledge and skills • Demonstrate higher understanding and problem-solving
Private Study	• Review lecture material • Complete set problems and assignments • Reflect on class problems and assignments • Keep up with announcements and download materials from Moodle
Moodle Site	• Complete pre-lecture activities to be prepared for class • Gain access to quizzes by completing the pre-lecture activities • Participate in discussion groups • Access lecture notes and recordings • Access homework solutions, past exam solutions

5. Course schedule

Week	Topic	Location	Suggested Readings

1	Introduction, Sustainability and Drivers	Richie Theatre	Lecture slides and readings on Moodle
2	Life Cycle Engineering Framework and Mitigation Strategies	Richie Theatre	Lecture slides and readings on Moodle
3	Environmental Footprint of Products and Processes	Richie Theatre	Lecture slides and readings on Moodle
4	Life Cycle Costing, Material Flow Cost Accounting and Eco-Efficiency	Richie Theatre	Lecture slides and readings on Moodle
5	Energy and Resource Efficiency of Products and Processes	Richie Theatre	Lecture slides and readings on Moodle
6	Environmental Sustainability in Supply Chains	Richie Theatre	Lecture slides and readings on Moodle
7	Environmentally Sustainable Product Development	Richie Theatre	Lecture slides and readings on Moodle
8	Product Usage	Richie Theatre	Lecture slides and readings on Moodle
9	End-of Life Management of Products: Reverse Logistics	Richie Theatre	Lecture slides and readings on Moodle
10	End-of Life Management of Products: EoL Product Hierarchy	Richie Theatre	Lecture slides and readings on Moodle

6. Assessment

Assessment overview

Assessment	Group Project? (4 Students per group)	Length	Weight	Learning outcomes assessed	Assessment criteria	Due date and submission requirements	Deadline for absolute fail	Marks returned
Quizzes 1 to 5	No	N/A	10%	1, 2 and 3	Relevant weeks of lecture material	Post-unit activity. Quizzes must be completed before the next week's lecture	N/A	Two weeks after submission
Group Assignment 1	Yes (4)	2500 words	30%	1 and 2	Week 1 to 3 material	Week 4, Tuesday 25 June by midnight	31 June	Two weeks after submission
Group assignment 2	Yes (4)	2500 words	30%	1 and 2	Week 3 to 7	Week 8, Tuesday 23 July by midnight	29 July	Two weeks after submission
Test	No	90 minutes	30%	1, 2 and 3	Week 1 to 9 material	Week 10, during the lecture	N/A	Two weeks after submission

Assignments

Presentation

All non-electronic 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

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.

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 will interfere with your assessment performance, you are eligible to apply for Special Consideration prior to submitting an assessment or sitting an exam.

Please note that UNSW now has a Fit to Sit / Submit rule, which means that if you sit 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.

7. Expected resources for students

A list of reference books and reading materials 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.

UNSW Library website: https://www.library.unsw.edu.au/
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 entirely revising the course under the UNSW PVCE Digital-uplift scheme.

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 UNSW guidelines and polices. 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

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