Mechanical and Manufacturing Engineering

Course Outline

Term 1 2020

ENGG1000

ENGINEERING DESIGN AND INNOVATION

Contents

1. Staff contact details

Contact details and consultation times for course convenor

Project Convenor	Dr. Ang Liu Room 408C, Ainsworth Building (J17) <ang.liu@unsw.edu.au>
Head Demonstrator	Dylan Sanusi-Goh <d.sanusi-goh@unsw.edu.au>

Your first point of contact is your Mentor. Each design team will be assigned a student Mentor to help guide the team throughout the Project. These mentors are all former students who have been very successful in previous design courses and have a wide range of skills and experiences that will, if properly utilised, assist your team to achieve a successful Project outcome. Consultations with your mentor outside of your scheduled time can be made by mutual arrangement.

If your problem cannot be rectified by your mentor, then approach your Project Convenor. However, please note that the work of an academic is irregular in its nature and meetings are often called at short notice. As such, your Project Convenor is unlikely to have regular consultation times, but if they are in their office and your approach is polite, they can probably give you a minute or two.

If your enquiry is of a general nature, post it on the Course or Project Forum on Moodle: https://moodle.telt.unsw.edu.au.

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 6 hours per week (h/w) of face-to-face contact.

Contact hours

	Day	Time	Location
Lectures	Monday	2-4pm	Please refer to your timetable of the course outline
	Thursday	2-3pm	
Mentoring	Monday or Thursday	4-5pm	Various Locations

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

Engineers solve problems. These problems can range from rather simple ones, such as how to keep a door from blowing open on a windy day, to highly complex ones, such as how to land an unmanned spacecraft on the surface of a distant planet. You might ask what these two vastly different types of problems have in common. The answer is simple: Design. Design, however, is anything but simple and it can take an entire lifetime to master.

Design is the act of creating solutions to problems. Oftentimes, we are asked to design an improvement to an existing solution where that new solution can be somewhat predictable – for instance, the next facelift of an existing motor vehicle. Yet, to be competitive engineers, we must strive to look at each problem with a view to innovation. What new technologies, materials and techniques can we bring to bear on the problem – and how can we do this whilst ensuring that we can deliver our solution within real cost and time constraints?

Engineering activity usually results in the creation of a tangible artefact, produced to satisfy human needs. This artefact comes into being through a systematic process of decision-making and activities called the engineering design process. If the artefact is complex (think of an aircraft), knowledge and skills from many diverse engineering disciplines will be needed by the designers to make the design successful. A study of these diverse disciplines of engineering science will occupy much of your time in later years. So as to be able to effectively use the science you learn in those courses, you will need some basic introductory skills and knowledge of engineering product design. This is the focus of the lectures and tutorials in this course and in the area of design in general.

The aims of the course are to:

1. Introduce you to the principles and methods of engineering design.

   We will focus on the skills, concepts and methods needed to design innovative solutions to Engineering problems. We will look at Design as a multi-faceted activity which requires considerable creativity, sound decision making and problem-solving skills as well as excellent interpersonal and communication skills. The problem solving and project management skills that you hone here will be invaluable for later courses in your degree.
2. Involve you in a number of hands-on design and engineering activities.

You will get the opportunity to demonstrate your competency at these skills by experiencing first-hand what is required to design, build and test your solution to an interesting design problem in the same way that professional engineers all over the world are doing right at this moment.

3. Provide a team-based environment so you can experience and learn collaborative skills.

   For the work in the Project, everyone will be assigned to a team for the duration. Most of the activities and assessments in this course will be conducted through the team, although individual performance will be monitored and assessed as it would be in industry. Make use of the wide range of experience within your team – you are all well-educated and capable, and there is much you can learn from one another.

Student learning outcomes

This course is designed to address thee learning outcomes as follows, in corresponding with the Engineers Australia Stage 1 Competency Standards for Professional Engineers. The full list of Stage 1 Competency Standards can be found in Appendix A.

After successfully completing this course, you should be able to:

Learning Outcome		**EA Stage 1 Competencies**
1.	Demonstrate an understanding of the process of engineering design and the use of design methods	PE1.5
2.	Understand the dynamics of collaborative teams and how to work effectively within a team to accomplish tasks within given deadlines	PE3.1, PE3.3, PE3.5 PE3.6
3.	Understand the basic elements of project management and be able to plan and schedule work activities in accordance with standard practice	PE3.4, PE3.5
4.	Become familiar with the tangible elements of mechanical and/or electrical design:	PE1.5, PE2.3
5.	Be able to convey your thoughts and ideas effectively in an engineering design report	PE3.2

4. Teaching strategies

The teaching strategies that will be used in this course include:

- The presentation of the material in **Lectures** so that you gain understanding of the underlying concepts that will be needed to perform your assignments and develop your major design Project. The lectures will provide the rationale for the design process followed in the course and some basic engineering principles to act as a starting point for addressing the Project's design brief. The labs and tutorials are intended to provide guidance on your self-directed path of discovering the relevant information and skills needed to successfully complete the Project.

- The provision of experienced design **Mentors** who will provide face-to-face feedback and advice on your progress through the Project and your understanding of engineering design, project management and team development skills.
- Your completion of individual **Tutorials** and group **Assignments** that will give you the opportunity to demonstrate your understanding of the lecture topics and obtain feedback on your comprehension and communication skills.
- A large part of engineering design involves synthesising existing basic engineering components to form new products. To do this well you need to be familiar with some basic engineering science; including materials, manufacturing/workshop processes and testing methods. This is the focus of the **Laboratories.**
- Your work in a **Major Design Project** where you can practise your design skills and demonstrate your understanding of the fundamental concepts of design, teamwork and project management.
- The provision of an electronic **Learning Management System** (LMS). *Moodle* is an on-line learning environment where you can collaborate in discussion groups and acquire the necessary information to complete your assignments through interaction with lecturers, mentors and your peers: https://moodle.telt.unsw.edu.au/

5. Course schedule

ENGG1000 has activities on Mondays 2pm-5pm and Thursdays 2pm-5pm.

It should be noted that the course, by its nature, has a complex and irregular timetable. You need to be vigilant to ensure you are where you are supposed to be. Not all of the locations and times are known at this time (due to uncertainty in enrolment numbers and composition) and you will be informed of these details in lectures and with posts on *Moodle*. It is your responsibility to find out this necessary information.

Week	Monday				Thursday			
	Date	Time	Activity	Location	Date	Time	Activity	Location
1	17-Feb	2-3pm	Common Lecture	Clancy / CLB7	20-Feb	2-3pm	Impromptu Design	Various
		3-4pm	Common Lecture	Clancy / CLB7		3-4pm		Various
		4-5pm				4-5pm	Judging	Clancy
2	24-Feb	2-3pm	Common Lecture	Clancy / CLB7	27-Feb	2-3pm	Project-specific Lecture	Clancy
		3-4pm	Project Launch	Clancy		3-4pm		
		4-5pm	Mentor Session	Various		4-5pm	Mentor Session	Various
3	2-Mar	2-3pm	Common Lecture	Clancy	5-Mar	2-3pm	Project-specific Lecture	Clancy
		3-4pm				3-4pm		
		4-5pm	Mentor Session	Various		4-5pm	Mentor Session	Various
4	9-Mar	2-3pm	Common Lecture	Clancy	12-Mar	2-3pm	Hardware Lab	Willis Annexe 116
		3-4pm				3-4pm		
		4-5pm	Mentor Session	Various		4-5pm	Mentor Session	Various
5	16-Mar	2-3pm		Clancy	19-Mar	2-3pm		Clancy

		3-4pm	Common Lecture			3-4pm	Project-specific Lecture	
		4-5pm	Mentor Session	Various		4-5pm	Mentor Session	Various
6	23-Mar	2-3pm	Project-specific Lecture	Clancy	26-Mar	2-3pm	Design and build session	Clancy
		3-4pm				3-4pm		
		4-5pm	Mentor Session	Various		4-5pm	Mentor Session	Various
7	30-Mar	2-3pm	Project-specific Lecture	Clancy	2-Apr	2-3pm	Design and build session	Clancy
		3-4pm				3-4pm		
		4-5pm	Mentor Session	Various		4-5pm	Mentor Session	Various
8	6-Apr	2-3pm	Project-specific Lecture	Clancy	9-Apr	2-3pm	Compliance Testing	Maker Space
		3-4pm				3-4pm		
		4-5pm	Mentor Session	Various		4-5pm	Mentor Session	Various
9	13-Apr	Public Holiday			16-Apr	2-3pm	Design and build session	Maker Space
						3-4pm		
						4-5pm	Mentor Session	Various
10	20-Apr	2-3pm	Design and build session	Maker Space	23-Apr	2-3pm	Final Testing and Competition	Clancy
		3-4pm				3-4pm		
		4-5pm	Mentor Session	Various		4-5pm		
11	27-Apr	Public Holiday			30-Apr	Exam Study Period		

It should be noted that the schedule may be subject to change at short notice to suit exigencies. Please check Moodle for the latest announcements!

6. Assessment

Assessment overview

Assessment (Task #)	Group Project?	Students per group	Length	Weight	Learning outcomes	Assessment criteria	Due date and submission requirements	Deadline for absolute fail	Marks returned
T1 – Impromptu Design	Yes	5-6	N/A	5%	5	Completion and reflection of design task	Week 2 onsite	/	Two weeks after submission
T2 – EDP Problem Statement	No	N/A	N/A	5%	1	As elaborated by the task specification	Week 3 peer assessment during tutorial	Midnight March 8	Two weeks after submission
T3 – EDP Concept Generation	Yes	6	N/A	10%	1, 2	As elaborated by the task specification	Week 5 peer assessment during tutorial	Midnight March 22	Two weeks after submission
T4 – Design Proposal	Yes	6	10-20 Pages	10%	1, 2, 5	Technical writing skill	Week 6 Moodle submission	Midnight April 5	Two weeks after submission
T5 – Compliance Testing	Yes	6	TBA	15%	2, 3, 4	As elaborated by the task specification	Week 8 onsite inspection	Midnight April 19	One week after submission
T6 – Final Testing and Competition	Yes	6	TBA	25%	2, 3, 4	Performance of design prototypes	Week 10 onsite competition	Midnight May 3	One week after submission
T7 – Design Report	Yes	6	20-30 Pages	15%	1, 2, 3, 5	Technical writing skill	Week 11 Moodle submission	Midnight May 10	Upon release of final results
T8 – Team Evaluation	No	N/A	N/A	/	2, 3	Contribution to teamwork	Multiple times Moodle submission	One day after due date	Upon release of final results
T9 – Design Journal	No	N/A	20-30 pages	15%	3, 5	Documentation of design process	Week 3, 5, 7, 9	One day after due date	One week after submission

Assignments

Detailed descriptions of the assessment tasks for this course will be posted on *Moodle* closer to the time of the assessment. In the meantime, the following is an overview:

T1 Impromptu Design

“Reflection” in this context is a form of personal response to experiences, situations, events or new information. It is like a “processing” phase where thinking and learning take place. The examination of your beliefs, attitudes and assumptions forms the foundation of your understanding. This writing thus involves revisiting your prior experience and knowledge of the topic you are exploring. Then, as a way to achieve clarity and better understanding of what you are learning, you will compare how these relate to the current topic within the Project. You will sum-up questions you may have and conclusions you have drawn. This assessment is in the form of a short essay-style written assignment administered by *The Learning Centre*. This task determines 5% of the course grade.

T2-T3 Engineering Design Process

- T2 (5% of the course grade): you will submit a written statement and make an individual presentation on the problem statement phase of the design process.
- T3 (10% of the course grade): you will submit a written statement and make a group presentation on the concept generation phase of the design process.

T4 Design Proposal

Each design team will submit a design proposal for your prototype. The proposal will be in the form of a professionally formatted engineering report that summarises the design progress with a concrete project plan, budget estimate, and preliminary test results (if any). This is a sufficient design description package that could be handed over to a client if so required. The main content of the report should be no more than 20 pages. This task determines 10% of the course grade.

T5 Compliance Testing

Prior to the final testing, every team must demonstrate that the progress of your prototype is on-track. Your prototype must comply with the rules set-out in the Project specification, especially the safety standards. This task determines 10% of the course grade.

T6 Final Testing and Competition

This is a two-part evaluation on the performance of your design prototype. The first part will be evaluated on the performance of your prototype in a competition. The second part will be a subjective assessment of your prototype by a panel of judges against set criteria specified in the project specification. Detailed guidance will be provided in due time. This task determines 25% of the course grade.

T7 Design Report

You will prepare a design report about the final testing and competition. The report will be in the form of a professional summary that reflects what was achieved, why it worked out the way it did, and how the results could have been better. Discussion should include the materials and construction methods used, issues encountered during the Project and lessons learned. The main content of the report should be no more than 30 pages. This task determiner 15% of the course grade.

T8 Team Evaluation

To ensure that all students participate equitably in team assessments, there will be a team evaluation process whereby each student will be evaluated by every member of their team. The results of this team evaluation will determine your final team mark. Details of this process will be made available on *Moodle*.

It should be note that a total of 65% of the course grade is a result of team effort. The team evaluation component will constitute a maximum of 50% that may be subtracted from your team mark. *That is, you stand to lose up to 32.5% from the course grade for non-participation in team assessment activities.*

T9 Design Journal

A good engineer always keeps a notebook at hand so that any information gathered in the field can be immediately written down or sketched and so not forgotten. You are expected to keep a notebook for the duration of the Project in which you will do all your rough working, sketches etc. Mentors will, on a regular basis, assign marks when you present your notebook at mentoring sessions. This task determines 15% of the course grade.

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
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.

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

Learning Management System

The Learning Management System (LMS) will be your main source of day-to-day information regarding administration of the course and Project. *Moodle* is an on-line learning environment where you can collaborate in discussion groups and acquire the necessary information to complete your assignments through interaction with lecturers, mentors and your peers: http://moodle.telt.unsw.edu.au

It is the responsibility of each student to make sure that their logins to these websites are functional and that all assessment tasks are submitted on time. *These websites are not under the individual control of the lecturer, and as such do not have the 10% per day late penalty – any late submission will automatically receive a mark of zero.* This is especially true for excuses like "my internet was down" – missed submissions for reasons such as these are merely a result of poor planning on the part of the student. It is your responsibility to make sure the submission is made ahead of time.

Textbook

Some of your assessment tasks will require access to this text:

- Dym, C.L. and Little, P. (2014). *Engineering Design: A Project-Based Introduction*, 4th edition, John Wiley and Sons.

You should have some access to a copy as it provides useful reading on a number of relevant topics. It is available as a published book and as an eBook. There are copies available for purchase from the UNSW Bookshop and from the University Library Reserved Collection. To save money, your Team could buy a shared copy.

Additional Reading

Other useful references include but are not limited to:

- Cross, N. (2000). *Engineering Design Methods: Strategies for Product Design*, 3rd edition, John Wiley and Sons.
- Dowling, D., Carew, A., and Hadgraft, R. (2010). *Engineering Your Future: An Australasian Guide*, John Wiley & Sons.
- Horenstein, M.N. (2010). *Design Concepts for Engineers*, 4th Edition, Prentice Hall.
- Samuel, A., *Make and Test Projects in Engineering Design – Creativity, Engagement and Learning,* Springer-Verlag London Limited (2006)
- Voland, G. (2004). *Engineering by Design*, 2nd Edition, Pearson/Prentice Hall.

Laboratories

A good engineering designer requires a significant amount skill. This is very similar to learning to ride a bike. You can talk about it for as long as you like, but sooner or later you need to actually get on the bike and ride it. While falling off is a perfectly acceptable outcome for a novice, there are skills that can be developed before you begin.

In each Lab, you will be assessed by your efforts at completing a specified number of activities. These are hands-on activities that are structured to improve your skills in design and aid you in the success of your Major Design Project. Do not copy answers from other students (because they may be wrong!) or ask laboratory staff as soon as you encounter a difficulty. One of the qualities of a successful engineer is the ability to work things out by thinking through the underlying principles first before asking questions. At university, in general, high quality questions will elicit high quality answers.

For the safety of all in the Laboratories, strict safety precautions must always be observed:

- You are not permitted to work unsupervised in the laboratories.
- Thongs, open-toed sandals or bare feet expose the feet to the risk of injury and are not permitted in laboratories. Footwear must completely cover the feet, including the instep and toes, or you will be required to leave the laboratories.
- Long hair and loose items of clothing, such as unbuttoned long sleeves, untucked or unbuttoned shirts or jackets and scarves are a safety hazard and have caused many serious injuries. You will not be using heavy rotating machinery in this course, but please get into the habit of wearing safe clothing in laboratories and workshops.
- The “Introduction to Laboratory Safety” (ILS) will emphasise all these.

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 simplifying the design project, removing the requirement of TAFE training, and increasing the amount of visual material in the Hardware lectures.

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