



Course Outline

Semester 2 2015

Never Stand Still

Engineering

Mechanical and Manufacturing Engineering

MECH4100

MECHANICAL DESIGN 2

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I. Staff Contact Details

Contact details

Course Convenor: Dr Shaun Chan
J17 room 402D
Email: ging.chan@unsw.edu.au

Main: Ms Zoe Hart
Assistant: Mr Rizwan Fattah
Mr Cheng Wang

Demonstrators: Mr Aqib Chishty (CFD)
Mr David Fulker (CFD)
Mr Darson Li (CFD)
Dr Jay Sul (FEA)
Mr Pujith Vijayarathnam (CFD/FEA)
Mr Shervin Arani (CFD)

Students are encouraged to consult with demonstrators directly during the allocated group sessions. Students can also approach the demonstrators via email: unsw.mechdesign2@gmail.com. The demonstrators are instructed to check the inbox regularly.

Administrative enquiries that are personal and confidential in respect of an individual student can be made to the course convenor (Dr Shaun Chan), if the circumstances require it.

2. Course details

Credit Points:

This is a 6 unit-of-credit (UoC) course, and involves <insert hours> 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.

There is no parallel teaching in this course

Contact Hours

	Day	Time	Location
Lectures	Wednesday	9am – 12noon	<u>Wks 1-7, 12:</u> Central Lecture Block 8 <u>Wks 8-11:</u> Central Lecture Block 8 <i>or</i> Ainsworth 102 <i>or</i> Ainsworth 202
Demonstrations	Wednesday	4 – 5pm	Ainsworth 203
	Wednesday	4 – 5pm	Ainsworth 204

Prerequisites

MECH3110 and MMAN2300 (MMAN3300)

Aims of the Course

This is the final Course in Mechanical Engineering Design. Here you will be expected to apply the knowledge and skills you acquired in the preceding Courses to a real, commercial design problem. To facilitate this, you will be working on a team Project specified by UNSW's Industry Partners.

The Course requires the assembly of large amounts of high-level of documentation and several instances of formal public presentation. The demonstration of team work and collaborative skills – as well as meeting specified deliverables – is essential for satisfactory completion. Interaction with the clients – both in formal meetings and in your regular liaison throughout session – as well as the quality of your reporting of these events will be evaluated to the standards expected of professional consulting engineers.

You will nominate a preference for your Project (and hence Industry Partner) at the end of Week 2. Upon allocation to a Project (by main demonstrator in Week 2), you will engage in activities and negotiated learning with experts from both within and outside the University. Essentially, by the end of Semester your team must have:

- **Formulated the technical specifications for your Design** through a process of negotiation with the Industry Partner and academic staff. The design must be completed with a high level of engineering rigour.
- Understood and **demonstrated that they were responsible for constructing the organisational design of their team**, managing the project and co-ordinating the workload within their team.

Student learning outcomes

This course is designed to address the below learning outcomes 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.	Implement the basic elements of managing a design project and be able to plan and schedule work activities in accordance with standard practice	1.6, 2.1, 2.3, 2.4, 3.1, 3.4, 3.5, 3.6
2.	Apply an effective problem solving approach that is deliverable in practice and justify and defend the selection	1.1, 1.2, 1.3, 1.5, 1.6, 2.1, 2.2, 2.3, 2.4, 3.3, 3.6
3.	Appreciate the need to critically review and reflect on your own capability and to invite peer review ; to benchmark your performance against appropriate standards and to determine areas for your further development	1.6, 2.1, 2.3, 2.4, 3.2, 3.3, 3.4, 3.5, 3.6
4.	Execute effective oral and written presentations to technical audiences	3.2, 3.4

3. Teaching strategies

Technical, professional and personal knowledge and skills are best acquired through a combination of conceptual support, experience, reflection and then planning for the next exercise. This Course provides a range of learning strategies and activities to support this approach. The electronic **Learning Management System (LMS) Moodle** is provided to foster an 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>.

This Course attempts to approximate the learning processes that you will encounter upon entering industry. As-such, the Course will be highly activity based. The material presented in **lectures** will be limited to the material necessary to engage in the assessable learning activities:

- A large part of engineering design involves the (effective!) communication of your ideas and the confident justification of your approach. To do this well you need to be able to draft clear and concise reports and engineering drawings which are stand-alone documents. Almost invariably though you will, as a designer, at some point in the tendering process have to give an oral defence for your design. This is the focus of the “**bear pit**” and **presentation** activities.

- A series of Master Classes and CAD/CAE **demonstrations** and **group sessions** will be provided in the School's computer **laboratories** that align to the technical needs of the design problems provided by industry. Students will be expected to determine which of these are relevant to their projects and organise themselves to obtain the necessary information, or help.
- 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. Study of the diverse disciplines of engineering science has occupied much of your time in previous years. You were mostly assessed only in one of those sciences at a time. Yet to create a tangible artefact that is complex (such as an aircraft), knowledge and skills from many diverse engineering disciplines will be needed by the designers to make the design successful. This is the focus of the industry-based project.
- The best engineers – indeed the best professionals in general – constantly analyse their own performance and try to improve the practice of their craft. This “continual improvement” not only delivers a healthier bottom-line for your employer (or yourself as a consultant) but is crucial to something you may only come to appreciate later in life: job satisfaction. The development of this mind-set is the focus of the remaining lectures and the “**reflective writing**” exercises.

Effective learning is supported when you are actively engaged in the learning process. *You become more engaged when you can see the relevance of your studies to professional, disciplinary and/or personal contexts. In lectures and assignments, this relevance is best shown by way of examples drawn from industry.* The final year of your degree program is an ideal opportunity to experience “real world” engineering problems through interaction with industry and to gauge your strengths and weaknesses against their expectations and standards.

In industry, you seldom choose your workmates and the same applies to this course.. For the work in this Course, everyone will be assigned to a team for the duration of the Session. Most of the activities and assessments will be conducted through the team although individual performance will be monitored and assessed – just as it would be in industry.

Dialogue is encouraged between you, others in the class and the staff. Diversity of experiences is acknowledged, as some students in each class have prior industry background. You may draw on your experience to illustrate various aspects of the work you undertake and this should help to motivate and facilitate engagement with the other members of your team.

4. Course schedule

Note that the schedule shown here may be subject to change at short notice to suit exigencies. Check *Moodle* for the latest announcements.

Week	Day	Date	Time	Activity	Location	Task Due	
01	Wed	29-Jul-15	9-10	Lecture 1: Introduction	K-E19-105		
	Wed		10-11	Lecture 2a: Problem Definition			
	Wed		11-12	Lecture 2b: Student enterprise			
	Wed						
	Wed					No tute	
02	Wed	05-Aug-15	9-10	Project Introductions	K-E19-105		
	Wed		10-11	Project Introductions			
	Wed		11-12	Project Introductions			
	Wed						T1
	Wed					No tute	
03	Wed	12-Aug-15	9-10	Lecture 3: Reflective writing	K-E19-105		
	Wed		10-11	Lecture 4: Business culture			
	Wed		11-12	Lecture 4: Business culture			
	Wed			(Client Meetings)		T2	
	Wed			(Client Meetings)			
04	Wed	19-Aug-15	9-10	Lecture 5: Innovation	K-E19-105		
	Wed		10-11	Lecture 5: Innovation			
	Wed		11-12	Lecture 5: Innovation		T3	
	Wed		16-17	Group Session		K-J17-203/K-J17-204	
	Wed		17-18	Group Session			
05	Wed	26-Aug-15	9-10	Lecture 6: Fatigue Analysis	K-E19-105		
	Wed		10-11	Lecture 6: Fatigue Analysis			
	Wed		11-12	Lecture 6: Fatigue Analysis			
	Wed		16-17	Consultations/ Group Session		K-J17-203/K-J17-204	T4
	Wed		17-18	Consultations/ Group Session			
06	Wed	02-Sep-15	9-10	Lecture 7: Technical Presentation	K-E19-105		
	Wed		10-11	Lecture 7: Technical Presentation			
	Wed		11-12	Lecture 7: Technical Presentation			
	Wed		16-17	Consultations/ Group Session		K-J17-203/K-J17-204	
	Wed		17-18	Consultations/ Group Session			
07	Wed	09-Sep-15	9-10	Lecture 8: Meeting etiquette	K-E19-105		
	Wed		10-11	Lecture 8: Meeting etiquette			
	Wed		11-12	Lecture 8: Meeting etiquette			
	Wed		16-17	Consultations/ Group Session		K-J17-203/K-J17-204	
	Wed		17-18	Consultations/ Group Session			

Week	Day	Date	Time	Activity	Location	Task Due
08	Wed	16-Sep-15	9-10	Bear Pit 1a	K-E19-105/K-J17-102/K-J17-202	
	Wed		10-11	Bear Pit 1a		
	Wed		11-12	Bear Pit 1a		
	Wed	16-17	Group Session/ LEAP		K-J17-203/K-J17-204	
	Wed	17-18	Group Session/ LEAP			
09	Wed	23-Sep-15	9-10	Bear Pit 1b	K-E19-105/K-J17-102/K-J17-202	
	Wed		10-11	Bear Pit 1b		
	Wed		11-12	Bear Pit 1b		
	Wed	16-17	Group Session/ LEAP		K-J17-203/K-J17-204	
	Wed	17-18	Group Session/ LEAP			
Break			-	-		-
			-	-		-
			-	-		-
			-	-		-
			-	-		-
10	Wed	07-Oct-15	9-10	Bear Pit 2a	K-E19-105/K-J17-102/K-J17-202	
	Wed		10-11	Bear Pit 2a		
	Wed		11-12	Bear Pit 2a		
	Wed	16-17	Group Session/ LEAP		K-E19-105/K-J17-102/K-J17-202	
	Wed	17-18	Group Session/ LEAP			
11	Wed	14-Oct-15	9-10	Bear Pit 2b	K-E19-105/K-J17-102/K-J17-202	
	Wed		10-11	Bear Pit 2b		
	Wed		11-12	Bear Pit 2b		
	Wed	9-10	Group Session		K-J17-203/K-J17-204	
	Wed	9-10	Group Session			
12	Wed	21-Oct-15	9-10	Final Presentations	K-E19-105	
	Wed		10-11	Final Presentations		
	Wed		11-12	Final Presentations		
	Wed	16-17	Group Session		K-J17-203/K-J17-204	
	Wed	17-18	Group Session			
13	Wed	28-Oct-15	9-10	Final Presentations	K-E19-105	
	Wed		10-11	Final Presentations		
	Wed		11-12	Final Presentations		
	Wed	16-17			K-J17-203/K-J17-204	
	Wed	17-18	Room booked but no demonstrators			
				Final Design Report		T7
				Feedback from Client		T8
				Peer Assessment		T9

For some assessment tasks you will split into groups and be required to attend different rooms. Details will be posted on *Moodle* prior to the assessments.

Again note: Details regarding the submission of each assessment will be provided when the assessment task is set. These details will be presented in lectures and posted on *Moodle*.

5. Assessment

Content

Assessment in this Course consists of a mixture of individual and team assessments as described in this table:

Task	Activity	Weight		Learning outcomes assessed	Due date and requirements
		Individual	Team		
T1	Project selection	-	-	-	5 th Aug, via Moodle
T2	Client interview	-	-	1, 4	12 th Aug, discuss with client
T3	Reflective writing	10	-	3, 4	19 th Aug, via Moodle
T4	Consultation	-	10	2, 3	26 th Aug, or 2 nd Sept or 9 th Sept, in class
T5-A	Bear pit 1/2	10	-	2, 4	16 th or 23 rd Sept, in class
T5-B	Bear pit 2/2	-	10	2, 4	7 th or 14 th Oct, in class
T6-A	Final presentation	-	10	2, 3, 4	21 st Oct or 28 th Oct, in class
T6-B	Feedback from mentor	-	5	2, 3	21 st Oct or 28 th Oct, in class
T7	Final design report	-	20	1, 2, 3, 4	30 th Oct, via Moodle
T8	Feedback from client	-	25	1, 2, 3, 4	November, between staff and client
T9	Peer assessment	-	(-40)	1, 3	November, via Moodle
	Total	20	80		

As can be seen, the total Course marks consists of **20% individual** and **80% team** marks. Team work is an important part of the assessment and we expect each member to play his or her part in making your team into a successful team.

To ensure that all students participate equitably in team assessments, there will be a **Peer Review** process where each student will be evaluated by every member of their team. The results of this Peer Review will determine your final team mark.

The Peer Review component will allow for a maximum of 50% reduction in your team mark. *That is, you stand to lose up to $(0.5 \times 80) = 40$ marks off your total Course mark for non-participation in team assessment activities.*

The team work will be conducted in groups allocated to a project specified by an Industry Partner. The Industry Partners will present an introduction to their projects in either

Week 2 and you will then get the opportunity to express a preference for which project you would like to work on. **If you don't submit your preferences by the specified means and date, Course staff will allocate you to a project of their choosing.**

Summary of Assessment Tasks

The assessment tasks for this Course are described below:

T1 *Project Selection and Placement*

In Week 2, the Industry Partners will present the Projects they have on offer. You will then express a preference for which Project you'd like to work on. Preference will be given to students with higher WAM.

T2 *Client Interview*

Having been placed in a Project Team, you must then formally meet with your Industry Partner some time in Week 3. Whilst there are no marks awarded for your participation *per se*, your professional conduct at this meeting will be noted and will contribute toward your score in T8.

T3 *Reflective Writing*

“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 Course. You will sum-up questions you may and conclusions you have drawn.

T4 *Consultation Sessions*

You will meet with Course staffs to discuss your approach to your project. Your ability to define your problem, to plan ahead, in addition to your conduct during the meetings and consultation sessions will be assessed.

T5 *Bear Pit*

The Bear Pit is an opportunity for you to improve your oral communication skills through a focus on public speaking and persuasion. This activity will also test your ability to adapt to new circumstances: that is to think on your feet. This is often an activity which provokes much anxiety – yet it is only through experience that you can expect to improve this much sought after ability to communicate your thoughts clearly and effectively.

The task will require each member of your team to be prepared to defend your role in the team by explaining how your work is progressing, what the significant issues are, and how your work relates to the roles and progress of your team members in achieving a successful design project outcome. Assessment will focus on the clarity, audibility, content knowledge and persuasiveness of your oral defence as judged by both your peers and academic staff.

T6A *Final Presentation*

This is where you will present your work to your client company. Your mark for this particular assessment will be determined by the demonstrators and Course staff - but remember: that to score well in assessment T8, you will need to impress the client.

T6B *Feedback from Mentor*

This is where your mentors will be providing feedback to the Course staff on your team's performance throughout the semester. Your team's overall performance will be assessed with regards to the professionalism, communication level, time-management and record keeping ability that your team have demonstrated throughout the course.

T7 *Final Report*

The report will be in the form of a professional engineering document. In this document you will detail the brief you were given at the start of the project. You will then show how you worked from an initial statement of the problem, following a sound process to develop a design to satisfy the client's needs.

The report will include all of the information required for the client to implement the design. If drawings are included they will be to AS 1100. The particular challenge of this report will be to adequately convey the information within the prescribed length limit.

T8 *Feedback from Client*

Your Industry Partner will comment on your performance. Your overall performance will be considered with regard to how well you addressed the client's needs, the rigour of your approach to solving their problem and ultimately the usefulness to them of your work.

T9 *Peer Assessment*

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

Submission and Marking of Assessments

Details regarding the submission of each assessment will be provided when the assessment task is set. These details will be presented in lectures and posted on *Moodle*.

- Some tasks will be submitted electronically (on-line) using the *Calibrated Peer Review* system, accessible via *Moodle*. Your marks will be determined by your peers.

- Written assessments should usually be submitted electronically. Again, watch *Moodle* and attend lectures for exact details of the submission due dates and times.
- *All written assignments will be assessed on your ability to adhere to the recommended formats for submission and on the quality of your discussion in relation to the content.* Whilst it is appreciated that, for some students, English is a second language - this Course will require you to submit written work that is of a reasonable standard for a first year engineering student. If you feel that this may be a problem for you, please contact the Learning Centre as soon as possible for additional assistance: www.lc.unsw.edu.au
- Late submissions attract a penalty of five marks per calendar day, unless prior dispensation has been given; i.e. see the Course Convenor before the due date to avoid penalty. It is always worth submitting as, in the event of difficulty making the final grade, any late penalties may be removed. For assignments where peer reviews are involved, late submissions will not be permitted.
- **Special Consideration:** *There are no formal examinations for this Course.* In the event of illness or accident please contact the Course Convenor immediately.

For more information on submission of assignments, see [Administrative Matters for All Courses](#) available on the School website.

6. Expected Resources for students

Learning Management System

The electronic Learning Management System (LMS) will be your main source of day-to-day information regarding administration of the Course: <https://moodle.telt.unsw.edu.au>.

Moodle will be used to distribute information relevant to the Course and will also be used as a portal for online discussions both within your team and perhaps between your team and your Industry Partner.

Moodle should be checked frequently throughout the duration of the Course.

Computer Laboratories

For 2015-S2, The computer laboratories (J17-203 and J17-204) have been booked for MECH4100 between 16:00 and 18:00 on Wednesdays between Weeks 3 and 13 (inclusive).

Client Meetings

Wisdom is gained most effectively by attempting to avoid the (often painful) mistakes of those who have come before you. Your client will be able to assist you – within reason – by providing you with the advice, feedback and encouragement so that you may perform effectively as an engineering designer. Make full use of these experienced people but do so in a professional manner. **Your clients are busy people - like yourselves – often with the added responsibility of having multi-million dollar budgets to juggle. Please make specific arrangements with them if contact is required outside of the allocated meeting times for your team.**

Suggested Reading

Whilst there is not a prescribed textbook for this Course, you may find the following materials instructive:

- Dym, C.L and Little, P. (2009). *Engineering Design: A Project-Based Introduction*, 3rd edition, John Wiley and Sons.
- Voland, G. (2004). *Engineering by Design*, 2nd Edition, Pearson/Prentice Hall.
- Dominick, P.G. et al. (2001). *Tools and Tactics of Design*, John Wiley and Sons.
- Cross, N. (2000). *Engineering Design Methods: Strategies for Product Design*, 3rd edition, John Wiley and Sons.

There are numerous valuable resources available on the web and additional sources will be provided in lectures and group sessions.

The UNSW Library

Students seeking additional resources can also obtain assistance from the UNSW Library. One starting point for assistance is: <http://www.library.unsw.edu.au/servicesfor/index.html>.

7. Course evaluation and development

Feedback on the course is gathered periodically using various means, including the Course and Teaching Evaluation and Improvement (CATEI) 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.

Engineering Design is a team effort and we are interested in your feedback. We want your suggestions of what is good and should be retained, and what is not so good and should be improved – with ideas on how to do it. *The usual UNSW Course and Teaching Evaluation and Improvement (CATEI) surveys will be distributed at the end of Semester, though we welcome your informal feedback throughout the duration of the Course.* From 2013, the main improvement has been to broaden the range of Industry Partners and Projects available. The LEAP sessions has also been postponed to give students more time to give further

thoughts about their projects, prior to the meetings and consultation sessions. The group size (number of students per group) has been increased to reduce students' workload.

8. 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: <https://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:

<http://www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf>

Further information on School policy and procedures in the event of plagiarism is presented in a School handout, [Administrative Matters](#), available on the School website.

9. Administrative Matters

You are expected to have read and be familiar with *Administrative Matters*, available on the School website: https://www.engineering.unsw.edu.au/mechanical-engineering/sites/mech/files/u41/S1-2015_Admin-Matters.pdf

This document contains important information on student responsibilities and support, including special consideration, assessment, health and safety, and student equity and diversity.

Shaun Chan
July 2015

Appendix A: Engineers Australia (EA) Professional Engineer Competency Standards

	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