



Course outline

Semester 2 2016

Never Stand Still

Engineering

Mechanical and Manufacturing Engineering

MECH4100

MECHANICAL DESIGN 2

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1. Staff contact details

| | |
|--------------------------------------|--|
| Course convenor/ Lecturer | Dr Shaun Chan J17 Room 402D Email: qing.chan@unsw.edu.au Research: https://research.unsw.edu.au/projects/advanced-combustion-diagnostics-laboratory |
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Students should consult with demonstrators directly during the allocated group sessions or through forum. Students can also approach the head demonstrator via email: unsw.mechdesign2@gmail.com.

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 6 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

Refer to Section 4: Course schedule for the day, time and location for each lecture, problem solving session, workshop, etc.

Prerequisites

MECH3110 and MMAN2300 (MMAN3300).

Summary 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

Aims of the course

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

On completion of MECH4100, it is expected that you will be able to:

- Implement the basic elements of managing a design project and be able to plan and schedule work activities in accordance with standard practice.
- Apply an effective problem solving approach that is deliverable in practice and justify and defend the selection.
- 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.

- Execute effective oral and written presentations to technical audiences.

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. | Implement the basic elements of managing a design project and be able to plan and schedule work activities in accordance with standard practice. | PE1.6, 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. | PE1.1, 1.4, 1.6, 2.1, 2.2, 2.3, 3.3 |
| 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. | PE1.6, 2.1, 2.3, 2.4, 3.5, 3.6 |
| 4. | Execute effective oral and written presentations to technical audiences. | PE 3.2, 3.4 |

3. Teaching strategies

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.

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.

4. Course schedule

| Week | Day | Date | Time | Activity | Location | Task Due |
|------|-------|-----------|-------|---------------------------------------|-----------------|----------|
| 01 | Thurs | 28-Jul-16 | 9-10 | Lecture 1: Introduction | J17-G03 | |
| | Thurs | | 10-11 | Lecture 2: Meeting etiquette | | |
| | Thurs | | 11-12 | Lecture 2: Meeting etiquette | | |
| | Thurs | | | | | |
| | Thurs | | | No tute | | |
| 02 | Thurs | 04-Aug-16 | 9-10 | Project Introductions | J17-G03 | |
| | Thurs | | 10-11 | Project Introductions | | |
| | Thurs | | 11-12 | Project Introductions | | |
| | Thurs | | 12-13 | | | T1 |
| | Thurs | | 13-14 | No tute | | |
| 03 | Thurs | 11-Aug-16 | 9-10 | Lecture 3: Problem Definition | J17-G03 | |
| | Thurs | | 10-11 | Lecture 4: Reflective writing | | |
| | Thurs | | 11-12 | Lecture 4: Reflective writing | | |
| | Thurs | | 12-13 | (Client Meetings) | | T2 |
| | Thurs | | 13-14 | (Client Meetings) | | |
| 04 | Thurs | 18-Aug-16 | 9-10 | Lecture 5: Professionals Australia | J17-G03 | |
| | Thurs | | 10-11 | Lecture 5: Professionals Australia | | |
| | Thurs | | 11-12 | Lecture 5: Professionals Australia | | |
| | Thurs | | 12-13 | Group Session | J17-203/J17-204 | T3 |
| | Thurs | | 13-14 | Group Session | | |
| 05 | Thurs | 25-Aug-16 | 9-10 | Lecture 6: Exploring entrepreneurship | J17-G03 | |
| | Thurs | | 10-11 | Lecture 6: Exploring entrepreneurship | | |
| | Thurs | | 11-12 | Lecture 6: Exploring entrepreneurship | | |
| | Thurs | | 12-13 | Consultations/ Group Session | J17-203/J17-204 | T4 |
| | Thurs | | 13-14 | Consultations/ Group Session | | |
| 06 | Thurs | 01-Sep-16 | 9-10 | Lecture 7: Technical Presentation | J17-G03 | |
| | Thurs | | 10-11 | Lecture 7: Technical Presentation | | |
| | Thurs | | 11-12 | Lecture 7: Technical Presentation | | |
| | Thurs | | 12-13 | Consultations/ Group Session | J17-203/J17-204 | |
| | Thurs | | 13-14 | Consultations/ Group Session | | |
| 07 | Thurs | 08-Sep-16 | 9-10 | Lecture 8: Fatigue Analysis | J17-G03 | |
| | Thurs | | 10-11 | Lecture 8: Fatigue Analysis | | |
| | Thurs | | 11-12 | Lecture 8: Fatigue Analysis | | |
| | Thurs | | 12-13 | Consultations/ Group Session | J17-203/J17-204 | T9A |
| | Thurs | | 13-14 | Consultations/ Group Session | | |

| Week | Day | Date | Time | Activity | Location | Task Due |
|-------|-------|-----------|-------|----------------------------------|----------------------------------|----------|
| 08 | Thurs | 15-Sep-16 | 9-10 | Design Workshop | Michael Crouch Innovation Centre | |
| | Thurs | | 10-11 | Design Workshop | | |
| | Thurs | | 11-12 | Design Workshop | | |
| | Thurs | 12-13 | 12-13 | Group Session/ LEAP | J17-203/J17-204 | |
| | Thurs | | 13-14 | Group Session/ LEAP | | |
| 09 | Thurs | 22-Sep-16 | 9-10 | Design Workshop | Michael Crouch Innovation Centre | |
| | Thurs | | 10-11 | Design Workshop | | |
| | Thurs | | 11-12 | Design Workshop | | |
| | Thurs | 12-13 | 12-13 | Group Session/ LEAP | J17-203/J17-204 | |
| | Thurs | | 13-14 | Group Session/ LEAP | | |
| Break | | | - | - | | - |
| | | | - | - | | - |
| | | | - | - | | - |
| | | | - | - | | - |
| | | | - | - | | - |
| 10 | Thurs | 06-Oct-16 | 9-10 | Bear Pit | J17-G03/K15-G31/H20-G1 | |
| | Thurs | | 10-11 | Bear Pit | | |
| | Thurs | | 11-12 | Bear Pit | | T5 |
| | Thurs | 12-13 | 12-13 | Group Session/ LEAP | J17-203/J17-204 | |
| | Thurs | | 13-14 | Group Session/ LEAP | | |
| 11 | Thurs | 13-Oct-16 | 9-10 | Bear Pit | J17-G03/K15-G31/H20-G1 | |
| | Thurs | | 10-11 | Bear Pit | | |
| | Thurs | | 11-12 | Bear Pit | | T5 |
| | Thurs | 12-13 | 12-13 | Group Session | J17-203/J17-204 | |
| | Thurs | | 13-14 | Group Session | | |
| 12 | Thurs | 20-Oct-16 | 9-10 | Final Presentations | J17-G03 | |
| | Thurs | | 10-11 | Final Presentations | | |
| | Thurs | | 11-12 | Final Presentations | | T6A/B |
| | Thurs | 12-13 | 12-13 | Group Session | J17-203/J17-204 | |
| | Thurs | | 13-14 | Group Session | | |
| 13 | Thurs | 27-Oct-16 | 9-10 | Final Presentations | J17-G03 | |
| | Thurs | | 10-11 | Final Presentations | | |
| | Thurs | | 11-12 | Final Presentations | | T6A/B |
| | Thurs | 12-13 | 12-13 | | J17-203/J17-204 | |
| | Thurs | | 13-14 | Room booked but no demonstrators | | |
| | | | | Final Design Report | | T7 |
| | | | | Feedback from Client | | T8 |
| | | | | Peer Assessment | | T9B |

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.

5. Assessment

Assessment overview

| Task | Activity | Weight | | LOs |
|--------------|----------------------|------------|-----------|----------|
| | | Individual | Team | Assessed |
| T1 | Project Selection | - | - | - |
| T2 | Client Interview | - | - | - |
| T3 | Reflective Writing | 10 | - | 3, 4. |
| T4 | Consultation | - | 10 | 1, 2. |
| T5 | Bear Pit | - | 10 | 2, 4. |
| T6A | Final Presentation | - | 10 | 2, 4. |
| T6B | Feedback from Mentor | - | 10 | 1 |
| T7 | Final Design Report | - | 30 | 1, 2. |
| T8 | Feedback from Client | - | 20 | 3, 4. |
| T9A | Peer Assessment | - | (-45) | - |
| Total | | 10 | 90 | |

Note: Details regarding the submission and return (typically 2 weeks after submission) of each assessment will be provided when the assessment task is set. These details will be presented in lectures and posted on Moodle.

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 requires your team to explain how the work is progressing, what the significant issues are for the design projects. 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 has 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*.

Assignments

Presentation

All submissions are expected to be neat and clearly set out. Your results are the pinnacle of all your hard work. Presenting them clearly gives the marker the best chance of understanding your method; even if the numerical results are incorrect.

Submission

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

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.

Examinations

There is no examination for this course. The following text is provided for general information.

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

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](#).

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 2016-S2, The computer laboratories (J17-203 and J17-204) have been booked for MECH4100 between 12:00 and 14:00 on Thursdays 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.

In this course, recent improvements resulting from student feedback include the broadening of 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: 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

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

9. Administrative matters

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](#)

*Shaun Chan
8th July 2016*

Appendix A: Engineers Australia (EA) 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 |