UNSW SYDNEY | Australia's Global University

Mechanical and Manufacturing Engineering

Course Outline

Semester 2 2018

MECH9761

AUTOMOBILE ENGINE TECHNOLOGY

Contents

1. Staff contact details

Contact details and consultation times for course convenor

The lecturer and demonstrators will be available to answer questions regarding the course during normal office hours and by e-mail (preferred).

Name: Associate Professor Shawn Kook
Office location: Room 402E, Ainsworth Building (J17)
Tel: (02) 9385 4091
Email: s.kook@unsw.edu.au
Moodle: https://moodle.telt.unsw.edu.au/login/index.php

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

Demonstrator (Head)	Harsh Goyal	harsh.goyal@unsw.edu.au	Room 402, Ainsworth Building (J17)
Demonstrator	Lingzhe Rao	lingzhe.rao@unsw.edu.au	
Demonstrator	Dongchan Kim	h.d.kim@unsw.edu.au	
Demonstrator	Xinyu Liu	xinyu.liu2@unsw.edu.au	

2. Important links

- Moodle
- UNSW Mechanical and Manufacturing Engineering
- Course Outlines
- Student intranet
- UNSW Mechanical and Manufacturing Engineering Facebook
- UNSW Handbook

3. Course details

Credit Points

This is a 6 unit-of-credit (UoC) course, and involves 3 hours per week (h/w) of face-to-face contact.

The UNSW website states “The normal workload expectations of a student are approximately 25 hours per semester for each UoC, including class contact hours, other learning activities, preparation and time spent on all assessable work. Thus, for a full-time enrolled student, the normal workload, averaged across the 16 weeks of teaching, study and examination periods, is about 37.5 hours per week.”

This means that you should aim to spend about 9 h/w on this course. The additional time should be spent in making sure that you understand the lecture material, completing the set assignments, further reading, and revising for any examinations.

Contact hours

	Week	Day	Time	Location
Lectures	1-5, 8-12	Friday	2pm - 4pm	Webster Theatre B
Demonstrations	2-5, 8-13	Friday	4pm - 5pm	Undergraduate: Ainsworth Building (J17) Room 102 Postgraduate: Ainsworth Building (J17) Room 202
Laboratories	6, 7	Friday	2pm - 5pm	Willis Annexe (J18) Room 116C Undergraduate Teaching Lab

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

This course introduces the fundamentals of how the design and operation of automobile engines affect the performance and emissions. The fluid flow, thermodynamics, combustion, and fuel properties are studied with reference to engine power, efficiency, and pollutants formation. Students examine the design features and operating characteristics of different types of automobile engines including petrol engines and diesel engines, as well as the next-generation combustion engines including homogeneous-charge compression-ignition (HCCI) and gasoline compression ignition (GCI) engines. The key features of alternative fuels (including biofuels), hybrid, fuel cell, and electricity powered engines are also discussed. The course includes a lab for the performance test experiments of petrol and diesel engines.

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.	Identify advantages and disadvantages of the operation and efficiency of automobile engines of all types;	PE1.5, PE2.3, PE3.3
2.	Describe the key pollutants associated with combustion in engines and explain their significance with respect to health and the environment;	PE1.6, PE3.1, PE2.2
3.	Perform basic calculations relating to the performance and emissions of automobile engines and analyse engine performance chart.	PE1.1, PE1.3, PE2.1
4.	Provide technical explanations to the opportunities and limitations of alternative fuel engines, hybrid engines, and electric vehicles.	PE3.2, PE3.4, PE3.6

4. Teaching strategies

For the lectures, students are highly encouraged to study the given topics before they attend the class. The suggested readings and the lecture notes uploaded to the Moodle page prior to the class are minimum requirements. Students should keep an eye on the latest news and journal articles regarding the engine technologies and try to relate those to the topics taught in the lecture. Refer to section 8 “Expected resources for students”.

Weekly demonstrations will be run for the example problems, lab preparation and review as well as the assignment submission/return. Students will take hands-on experiences by solving the example problems from the engine data and the lab assignment based on the actual data obtained from the lab. Not only calculation-type questions but also description-type questions will be tackled so that students can develop their skills to explain what they understand about the new technology in an effective way. An engineer’s ability to explain new concepts and technologies in their own language is equally important as one’s capability to understand them. This postgraduate/elective course will provide the opportunity to develop both skills using one of the most attractive engineering applications – car engines.

5. Course schedule

Week	Lecture (2-4pm)	Suggested Readings	Demonstration (4-5pm)
1	Automobile Industry Why still combustion engines?	Online lecture module 1	
2	Engine classification Thermodynamic Cycle Analysis	Online lecture module 2 Heywood book pp. 7-12, 161-173 Otto & Diesel cycle section of the Thermodynamics text book	- Demonstration questions
3	Engine Performance Parameters	Online lecture module 3 Heywood book pp. 42-54, 383-388, 508-511	- Demonstration questions
4	Spark Ignition (SI) Engine	Online lecture module 4 Heywood book pp. 294-296, 301-304, 314-316, 326-336, 371-375, 390-404, 413-418, 437-443, 450-457	- Demonstration questions
5	Compression Ignition (CI) Engine	Online lecture module 5 Heywood book pp. 491-493, 517-532, 536-549, 555-561	- Demonstration questions
6	**Lab** for group 1~3		
			Mid-session test for group 4-6
7	**Lab** for group 4~6		
			Mid-session test for group 1-3
8	Pollutants and After-treatment	Online lecture module 8 Heywood book Chapter 11 An Introduction to Combustion: Chapter 15	- **Lab report** submission due for group 1-3 - Demonstration questions
9	Fuels and Alternative Fuels Engine	Online lecture module 9 Heywood book Chapter 3 An Introduction to Combustion: Chapter 2	- **Lab report** submission due for group 4-6 - Demonstration questions
10	Hybrid Engines	Online lecture module 10 Heywood book pp. 64-68, 470-478, 541-542, 550-552	- Marked **mid-session test** papers return - Demonstration questions
11	Battery Electric Vehicles	Online lecture module 11/12	- Demo questions
12	Fuel Cell Vehicles		- Demo questions
13			- Marked **lab report** to be returned - Revision

6. Assessment

Assessment overview

Assessment	Length	Weight	Learning outcomes assessed	Assessment criteria	Due date and submission requirements	Deadline for absolute fail	Marks returned
Online interactive lectures	10 modules	10% (1% each)	1, 4	Comprehension of technical concepts	A total of 10 modules must be completed by week 13 demo	Week 13 demo	Completion counts 1%, which is recorded immediately on Moodle
Mid-session test	1 hour	20%	1, 2, 3, 4	Course content from week 1-4 inclusive.	Week 6 or 7 when you do not attend the lab	N/A	Week 10 demo
Lab assignment	Four tasks	Lab attendance 5%, Report 15%	1, 4	Lecture materials from weeks 1-4	A pdf file uploaded to Moodle Turnitin by week 8 or 9 demo depending on your lab schedule	One week from the due date	Week 12 demo
Final exam	2 hours	50%	1, 2, 3, 4	All course content from weeks 1-12 inclusive.	Exam period, date TBC	N/A	Upon release of final results

All the assessment tasks are found on Moodle.

All submissions should follow the instructions provided to each assignment

Assignments

Presentation

All submission should be uploaded to Moodle in a pdf format.

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 per cent (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, 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.

7. Expected resources for students

Lecture notes will be uploaded to Moodle prior to the lecture.

Moodle: https://moodle.telt.unsw.edu.au/login/index.php

Text book reading is suggested for improved understanding; however, all the assessments are based on the materials provided by the lecturer and demonstrators. Please refer to the course schedule for the suggested reading from the text books. The selected text books are:

Internal Combustion Engine Fundamentals, J. B. Heywood, McGraw-Hill, 1988

An Introduction to Combustion, S. R. Turns, Mc-Graw-Hill, 2000

Copies of these text books are available in the UNSW bookshop and library.
https://www.library.unsw.edu.au/

Additional readings for the up-to-date engine technologies and combustion science can be found in the variety of journals. Students can get a free access to the full contents of the articles from the following websites (need an access through the UNSW IP address):

SAE (Society of Automotive Engineers) Digital Library
http://digitallibrary.sae.org/quicksearch/

Progress in Energy and Combustion Science
http://www.sciencedirect.com/science/journal/03601285

Fuel (the journal)
http://www.sciencedirect.com/science/journal/00162361

Energy and Fuels
http://pubs.acs.org/journal/enfuem

Combustion and Flame
http://www.sciencedirect.com/science/journal/00102180

Proceedings of the Combustion Institute
http://www.sciencedirect.com/science/journal/15407489

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 much clearer marking criteria on the assignments and much more attractive lecture times (previously it was on Fri afternoon).

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: 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.

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, Participation and Class Etiquette
- UNSW Email Address
- Computing Facilities
- Assessment Matters (including guidelines for assignments, exams and special consideration)
- Exams
- Approved Calculators
- Academic Honesty and Plagiarism
- Student Equity and Disabilities Unit
- Health and Safety
- Student Support Services

Appendix A: Engineers Australia (EA) Competencies

Stage 1 Competencies for Professional Engineers

	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