



MECH9761

Automobile Engine Technology

Term Three // 2020

Course Overview

Staff Contact Details

Convenors

| Name | Email | Availability | Location | Phone |
|------------------|--------------------|---|--------------------------|--------------|
| Prof. Shawn Kook | s.kook@unsw.edu.au | Contactable via the course Teams channels and email | 402E, Ainsworth Building | 02 9385 4091 |

Demonstrators

| Name | Email | Availability | Location | Phone |
|---------------------|-------------------------|---|-------------------------|-------|
| Dongchan Kim (Head) | h.d.kim@unsw.edu.au | Contactable via the course Teams channels and email | 402, Ainsworth Building | |
| Xinyu Liu | xinyu.liu2@unsw.edu.au | Contactable via the course Teams channels and email | 402, Ainsworth Building | |
| Jinxin Yang | jinxin.yang@unsw.edu.au | Contactable via the course Teams channels and email | 402, Ainsworth Building | |
| Yuwei Lu | yuwei.lu@unsw.edu.au | Contactable via the course Teams channels and email | 402, Ainsworth Building | |

School Contact Information

Location

UNSW Mechanical and Manufacturing Engineering

Ainsworth building J17, Level 1

Above Coffee on Campus

Hours

9:00–5:00pm, Monday–Friday*

*Closed on public holidays, School scheduled events and University Shutdown

Web

[School of Mechanical and Manufacturing Engineering](#)

[Engineering Student Support Services](#)

[Engineering Industrial Training](#)

[UNSW Study Abroad and Exchange](#) (for inbound students)

[UNSW Future Students](#)

Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

(+61 2) 9385 4097 – School Office**

**Please note that the School Office will not know when/if your course convenor is on campus or available

Email

[Engineering Student Support Services](#) – current student enquiries

- e.g. enrolment, progression, clash requests, course issues or program-related queries

[Engineering Industrial Training](#) – Industrial training questions

[UNSW Study Abroad](#) – study abroad student enquiries (for inbound students)

[UNSW Exchange](#) – student exchange enquiries (for inbound students)

[UNSW Future Students](#) – potential student enquiries

- e.g. admissions, fees, programs, credit transfer

[School Office](#) – School general office administration enquiries

- NB: the relevant teams listed above must be contacted for all student enquiries

Course Details

Credit Points 6

Summary of the Course

This course introduces the fundamentals of automobile engine design and operation and their impact on 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 spark ignition engines and compression ignition engines. Alternative engine technologies achieving significantly lower emissions and higher efficiency are also learned while fundamental knowledge about fuels and pollutant formation processes is gained. Students learn a hybrid engine technology and their applications to a range of vehicles before an electric-drive powered by battery or fuel cell is discussed in detail. The course includes a lab for the performance test experiments of spark ignition and compression ignition engines. In addition to the lectures and demonstration sessions, a set of interactive online lessons are provided for enhanced learning outcomes.

Course Aims

This course aims to improve understanding of the latest technologies in automobile engines and their operation through which knowledge gained from fluid mechanics, thermodynamics and heat transfer courses exercised. Other courses taken from various engineering schools will also integrate into a total engineering concept with the automobile engine as a working example. The course also aims to advance students' problem solving skill and critical thinking with the basics learned from the course being applied to real research and engineering issues.

Course Learning Outcomes

1. Identify advantages and disadvantages of the operation and efficiency of automobile engines of all types
2. Evaluate the key engine technologies implemented in the current and future automobiles
3. Describe the key pollutants associated with combustion in engines and explain their significance with respect to health and the environment
4. Provide technical explanations to the opportunities and limitations of alternative fuel engines, hybrid engines, and electric-drives

Teaching Strategies

Designed for senior undergraduate and postgraduate students, the Automobile Engine Technology is a learning course rather than a teaching course. The contents in this course stretch from the basic engine components to the most up-to-date engine technologies including hybrids and electric-drives. This will benefit students in a wide spectrum of their goals, namely, from simply taking some experience in the practical engineering problem to developing career in the automobile industry. Students will be challenged by the exam problems that require a full understanding of a range of technologies and the lab assignment that is designed to exercise the data processing and the interpretation of results as engineers do in the real world. This approach is to improve students' ability in dealing with real research and engineering issues.

Assessment

Information about the assessment tasks are found on the Team channels. All submissions should be made via Moodle following the instructions provided to each assignment.

Assessment Tasks

| Assessment task | Weight | Due Date | Student Learning Outcomes Assessed |
|-------------------------------------|--------|---------------------|------------------------------------|
| Online interactive lectures part I | 4% | 09/10/2020 06:00 PM | 1, 2 |
| Online interactive lectures part II | 6% | 27/11/2020 06:00 PM | 2, 3, 4 |
| Mid-term test | 20% | 13/10/2020 12:30 PM | 1, 2 |
| Lab report | 20% | 28/10/2020 11:30 AM | 1, 2, 3 |
| Final exam | 50% | Not Applicable | 1, 2, 3, 4 |

Assessment Details

Assessment 1: Online interactive lectures part I

Start date: 08/09/2020 09:00 AM

Details:

Out of 10 online lecture modules, the first four modules should be completed by the end of Week 4. Each module counts 1%, which can be earned at the completion and shows up on the Moodle Grade.

Turnitin setting: This is not a Turnitin assignment

Assessment 2: Online interactive lectures part II

Start date: 09/09/2020 12:00 PM

Details:

Out of 10 online lecture modules, the last six modules should be completed by the end of Week 11. Each module counts 1%, which can be earned at the completion and shows up on the Moodle Grade.

Turnitin setting: This is not a Turnitin assignment

Assessment 3: Mid-term test

Start date: 13/10/2020 11:30 AM

Length: 1 hour

Details:

1-hour mid-term exam to check students' learning progress of the basic knowledge of engine-related theory and technology taught in early weeks.

Turnitin setting: This assignment is submitted through Turnitin and students do not see Turnitin similarity reports.

Assessment 4: Lab report

Start date: 07/10/2020 09:00 AM

Length: Three tasks

Details:

Data reporting and technical discussion of the observed trends from the lab tests.

Submission notes: Due by the start of week 7 or week 8 demo depending on the lab group selection

Turnitin setting: This assignment is submitted through Turnitin and students do not see Turnitin similarity reports.

Assessment 5: Final exam

Start date: Not Applicable

Length: 2 hours

Details:

Final exam questions developed for the entire lecture content

Turnitin setting: This assignment is submitted through Turnitin and students do not see Turnitin similarity reports.

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

Course Schedule

[View class timetable](#)

Timetable

| Date | Type | Content |
|-------------------------------------|-----------------|---|
| O Week: 8 September - 9 September | Online Activity | Visit the course's Team and read announcements made on each channel |
| Week 1: 14 September - 18 September | Lecture | Automobile Industry & Why still combustion engines? Suggested readings: Online lecture module 1 |
| | Online Activity | Complete the interactive online lecture module 1 |
| | Tutorial | Solve tutorial questions regarding week 1 lecture content |
| Week 2: 21 September - 25 September | Lecture | Engine classification & Thermodynamic Cycle Analysis Suggested readings: Online lecture module 2, Heywood Book Chapter 1 & Chapter 5, Otto & Diesel cycle section of the Thermodynamics textbook |
| | Online Activity | Complete the interactive online lecture module 2 |
| | Tutorial | Solve tutorial questions regarding week 2 lecture content |
| Week 3: 28 September - 2 October | Lecture | Engine Performance Parameters Suggested readings: Online lecture module 3, Heywood Book Chapter 2, Chapter 4, and Chapter 15 |
| | Online Activity | Complete the interactive online lecture module 3 |
| | Tutorial | Solve tutorial questions regarding week 3 lecture content |
| Week 4: 5 October - 9 October | Lecture | Spark Ignition (SI) Engines Suggested readings: Online lecture module 4, Heywood Book Chapter 6.8, Chapter 7, Chapter 8.4 and Chapter 9 |
| | Online Activity | Complete the interactive online lecture module 4 |
| | Tutorial | Solve tutorial questions regarding week 4 lecture content |
| | Tut-Lab | Engine labs for group 1, 2 and 3 |
| Week 5: 12 October - 16 October | Lecture | Compression Ignition (CI) Engines |

| | | |
|------------------------------------|-----------------|--|
| October | | Suggested readings: Online lecture module 5, Heywood Book Chapter 8.3 and Chapter 10 |
| | Assessment | Mid-term test for the course content taught in week 1, 2, 3 and 4. The test takes place during the tutorial time. |
| | Tutorial | No tutorial |
| | Tut-Lab | Engine labs for group 4, 5 and 6 |
| Week 6: 19 October - 23 October | Online Activity | Flexibility week with no course activities. The Teams channels are left open for Q&A. Good time to complete the overdue online interactive lecture modules. Good time to revise week 1-5 content in preparation for more advanced topics taught in week 7 - 10. |
| Week 7: 26 October - 30 October | Lecture | Pollutants and After-treatment Suggested readings: Online lecture module 6, Heywood Book Chapter 11 |
| | Online Activity | Complete the interactive online lecture module 6 |
| | Assessment | Lab report submission by the start of tutorial for lab group 1, 2 and 3 |
| | Tutorial | Solve tutorial questions regarding week 5 and 7 lecture content |
| | Assessment | Marked mid-term exam papers will be returned to students by week 7 tutorial. |
| Week 8: 2 November - 6 November | Lecture | Fossil Fuels and Alternative/Renewable Fuel Engines Suggested readings: Online lecture module 7 |
| | Online Activity | Complete the interactive online lecture module 7 |
| | Assessment | Lab report submission by the start of tutorial for lab group 4, 5 and 6 |
| | Tutorial | Solve tutorial questions regarding week 8 lecture content |
| | | |
| Week 9: 9 November - 13 November | Lecture | Hybrid Engines Suggested readings; Online lecture module 8 |
| | Online Activity | Complete the interactive online lecture module 8 |
| | Tutorial | Solve tutorial questions regarding week 9 lecture content |
| Week 10: 16 November - 20 November | Lecture | Electric-Drives (Electric motor, battery and fuel cell) |

| | |
|-----------------|--|
| | Suggested readings: Online lecture module 9 & 10 |
| Online Activity | Complete the interactive online lecture module 9 and 10 |
| Tutorial | Solve tutorial questions regarding week 10 lecture content |
| Assessment | Marked lab reports will be returned to students by the end of week 10. |

Resources

Prescribed Resources

Lecture notes will be uploaded to the Team Lecture channel prior to the lecture.

Tutorial questions will be uploaded to the Team Demonstration/Tutorial/Problem Solving Session channel prior to the tutorial.

Textbook reading is suggested for improved understanding; however, all of the assessments are based on the materials provided by the lecturer and tutors. Please refer to the course schedule for the suggested reading from the textbook. The selected textbook is:

Internal Combustion Engine Fundamentals Second Edition, J. B. Heywood, McGraw-Hill, 2018

Copies of these textbooks are available in the UNSW bookshop, e-book stores and Main Library Level 6.

<https://www.library.unsw.edu.au/>

Recommended Resources

Additional readings for the up-to-date engine technologies 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>

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

Laboratory Workshop Information

The lab group selection and the session scheduling is internally managed. Please check the Teams Lab channel to find the details.

Submission of Assessment Tasks

Assessment submission and marking criteria

Should the course have any non-electronic assessment submission, these should have a standard School cover sheet, which the course convenor will provide to you.

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.

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.

Late policy

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:

1. Weekly online tests or laboratory work worth a small proportion of the subject mark, or
2. Online quizzes where answers are released to students on completion, or
3. Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date, or
4. Pass/Fail assessment tasks.

Examinations

You must be available for all quizzes, tests and examinations. For courses that have final examinations, these are held during the University examination periods: February for Summer Term, May for T1, August for T2, and November/December for T3.

Please visit myUNSW for Provisional Examination timetable publish dates. For further information on exams, please see the [Exams](#) webpage.

Special Consideration

If you have experienced an illness or misadventure beyond your control that will interfere with your

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

UNSW now has a [Fit to Sit / Submit rule](#), which means that if you attempt an exam or submit a piece of assessment, you are declaring yourself fit enough to do so and cannot later apply for Special Consideration.

For details of applying for Special Consideration and conditions for the award of supplementary assessment, please see the information on UNSW's [Special Consideration page](#).

Please note that students will **not** be required to provide **any** documentary evidence to support absences from any classes missed **because of COVID-19 public health measures such as isolation**. UNSW will **not** be insisting on medical certificates from anyone deemed to be a positive case, or when they have recovered. Such certificates are difficult to obtain and put an unnecessary strain on students and medical staff.

Applications for special consideration **will** be required for assessment and participation absences – but no documentary evidence **for COVID 19 illness or isolation** will be required in T3.

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

Academic Information

Credit points

Course credit is calculated in Units-Of-Credit (UOC). The normal workload expectation for one UOC is approximately 25 hours per term. This includes class contact hours, private study, other learning activities, preparation and time spent on all assessable work.

Most coursework courses at UNSW are 6 UOC and involve an estimated 150 hours to complete. Each course includes a prescribed number of hours per week (h/w) of scheduled face-to-face and/or online contact. Any additional time beyond the prescribed contact hours should be spent in making sure that you understand the lecture material, completing the set assignments, further reading, and revising for any examinations.

On-campus class attendance

Public distancing conditions must be followed for all T3 face-to-face classes. To ensure this, only students enrolled in those classes will be allowed in the room. Class rosters will be attached to corresponding rooms and circulated among lab demonstrators. No over-enrolment is allowed in face-to-face class. Students enrolled in online classes can swap their enrolment from online to other additional, **but limited**, number of on-campus classes by Sunday, Week 1. Please refer to your course's Microsoft Teams and Moodle sites for more information about class attendance for in-person and online class sections/activities.

Your health and the health of those in your class is critically important. You must stay at home if you are sick or have been advised to self-isolate by [NSW health](#) or government authorities. Current alerts and a list of hotspots can be found [here](#). **You will not be penalised for missing a face-to-face activity due to illness or a requirement to self-isolate.** We will work with you to ensure continuity of learning during your isolation and have plans in place for you to catch up on any content or learning activities you may miss. Where this might not be possible, an application for fee remission may be discussed. Further information is available on any course Moodle or Teams site.

In certain classroom and laboratory situations where 1.5 metres physical distancing cannot be maintained or there is a high risk that it cannot be maintained, face masks will be considered **mandatory PPE** for students and staff.

For more information, please refer to the FAQs: <https://www.covid-19.unsw.edu.au/safe-return-campus-faqs>

Other Matters

Guidelines

All students are expected to read and be familiar with UNSW guidelines and policies. In particular, students should be familiar with the following:

- [Attendance](#)
- [UNSW Email Address](#)
- [Special Consideration](#)
- [Exams](#)

- [Approved Calculators](#)
- [Academic Honesty and Plagiarism](#)

Important Links

- [Moodle](#)
- [Lab Access](#)
- [Health and Safety](#)
- [Computing Facilities](#)
- [Student Resources](#)
- [Course Outlines](#)
- [Engineering Student Support Services Centre](#)
- [Makerspace](#)
- [UNSW Timetable](#)
- [UNSW Handbook](#)
- [UNSW Mechanical and Manufacturing Engineering](#)
- [Equitable Learning Services](#)

Image Credit

Pictures of the UNSW Engine Research Laboratory facilities

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Acknowledgement of Country

We acknowledge the Bedegal people who are the traditional custodians of the lands on which UNSW Kensington campus is located.