AERO9660
Advanced Aerospace Propulsion

Term Three // 2020
Course Overview

Staff Contact Details

Convenors

<table>
<thead>
<tr>
<th>Name</th>
<th>Email</th>
<th>Availability</th>
<th>Location</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Olsen</td>
<td><a href="mailto:j.olsen@unsw.edu.au">j.olsen@unsw.edu.au</a></td>
<td>during consultations</td>
<td>Ainsworth Building 311/C</td>
<td>9385 5217</td>
</tr>
</tbody>
</table>

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

The analysis of two-spool, turbofan, gas-turbine engines.

The concept of exergy analysis for open thermodynamic systems and to apply this idea to the components of gas turbine engines.

Chemical rockets and ion thrusters.

The analysis of heat exchangers and to the basic analysis of heat transfer from spacecraft.

Finite time thermodynamics and apply to internal combustion engines.

High-speed propulsion operation, particularly for military jet aircraft.

Electric and hybrid electric propulsion.

Course Aims

Analyse the thermodynamic operation of a two-spool, gas turbine, turbofan engine.

Understand the concept of exergy and to be able to apply this to simple thermodynamic processes and cycles.

Be able to analyse heat exchangers and to appreciate the difficulties involves in analysing heat transfer with respect to spacecraft.

Understand both chemical rockets and ion thrusters.

Understand high-speed propulsion for military aircraft.

Analyse the behaviour of internal combustion engines using the finite time thermodynamics approach.

Understand the difficulties but also the benefits of electric and hybrid electric propulsion systems.

Course Learning Outcomes

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

<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>EA Stage 1 Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Analyse of a two-spool, gas turbine, turbofan engine.</td>
<td>PE1.1, PE1.2, PE1.3, PE2.1, PE2.2</td>
</tr>
<tr>
<td>2. Exergy analysis</td>
<td>PE1.1, PE1.2, PE1.3, PE2.1, PE2.2</td>
</tr>
</tbody>
</table>
### Learning Outcome

<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>EA Stage 1 Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Understanding both chemical rockets and ion thrusters.</td>
<td>PE1.1, PE1.2, PE1.3, PE2.1, PE2.2</td>
</tr>
<tr>
<td>4. Heat exchanger and radiation heat transfer analysis.</td>
<td>PE1.1, PE1.2, PE1.3, PE2.1, PE2.2</td>
</tr>
<tr>
<td>5. Understand finite time thermodynamic analysis</td>
<td>PE1.1, PE1.2, PE1.3, PE2.1, PE2.2</td>
</tr>
<tr>
<td>6. Understand electric and hybrid electric propulsion systems.</td>
<td>PE1.1, PE1.2, PE1.3, PE2.1, PE2.2</td>
</tr>
<tr>
<td>7. Understand high-speed propulsion.</td>
<td>PE1.1, PE1.2, PE1.3, PE2.1, PE2.2</td>
</tr>
</tbody>
</table>

### Teaching Strategies

“Give a man a fish and you feed him for a day. Teach him how to fish and you feed him for a lifetime.”

**Lao Tzu**

Presentation of the material in lectures and discussions so that the students know how to approach complex engineering calculations required in industry.

The problems I suggest you look at are intended to provide you with feedback and to allow you to investigate topics in greater depth. This is to ensure that you understand what you are being taught.

The lectures will not last 4 hours per week. On most weeks, students will be able to consult with the lecturer during that time.
Assessment

Assessment Tasks

<table>
<thead>
<tr>
<th>Assessment task</th>
<th>Weight</th>
<th>Due Date</th>
<th>Student Learning Outcomes Assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignment 1</td>
<td>10%</td>
<td>28/09/2020 11:00 AM</td>
<td>1, 2</td>
</tr>
<tr>
<td>Assignment 2</td>
<td>20%</td>
<td>16/11/2020 11:00 AM</td>
<td>1, 2, 3, 4, 5, 6, 7</td>
</tr>
<tr>
<td>Class Test</td>
<td>20%</td>
<td>26/10/2020 09:00 AM</td>
<td>1, 2, 3, 4</td>
</tr>
<tr>
<td>Final Exam</td>
<td>50%</td>
<td>Not Applicable</td>
<td>1, 2, 3</td>
</tr>
</tbody>
</table>

Assessment Details

Assessment 1: Assignment 1

Details: Small Assignment

Assessment 2: Assignment 2

Start date: Not Applicable

Details: Larger Assignment

Assessment 3: Class Test

Start date: 26/10/2020 09:00 AM

Details: Class Test

Turnitin setting: This is not a Turnitin assignment

Assessment 4: Final Exam

Details: Final Exam that covers everything.
Resources

Prescribed Resources


Recommended Resources


A. Schmidt, 2019, Technical thermodynamics for engineers, basics and applications, Springer.


U. Walter, 2019, Astronautics, the physics of space flight, 3rd edition, Springer.


**Course Evaluation and Development**

This is the second time this course has run.

Some matrial has been heavily upgraded.

**Laboratory Workshop Information**

N/A
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.

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](http://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](http://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

Guidelines

All students are expected to read and be familiar with UNSW guidelines and polices. 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

Synergies in Sound 2016

CRICOS

CRICOS Provider Code: 00098G

Acknowledgement of Country

We acknowledge the Bedegal people who are the traditional custodians of the lands on which UNSW Kensington campus is located.
## Program Intended Learning Outcomes

<table>
<thead>
<tr>
<th>Knowledge and skill base</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PE1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline</td>
<td>✔</td>
</tr>
<tr>
<td>PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline</td>
<td>✔</td>
</tr>
<tr>
<td>PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline</td>
<td>✔</td>
</tr>
<tr>
<td>PE1.4 Discernment of knowledge development and research directions within the engineering discipline</td>
<td></td>
</tr>
<tr>
<td>PE1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline</td>
<td></td>
</tr>
<tr>
<td>PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Engineering application ability</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PE2.1 Application of established engineering methods to complex engineering problem solving</td>
<td>✔</td>
</tr>
<tr>
<td>PE2.2 Fluent application of engineering techniques, tools and resources</td>
<td>✔</td>
</tr>
<tr>
<td>PE2.3 Application of systematic engineering synthesis and design processes</td>
<td></td>
</tr>
<tr>
<td>PE2.4 Application of systematic approaches to the conduct and management of engineering projects</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Professional and personal attributes</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PE3.1 Ethical conduct and professional accountability</td>
<td></td>
</tr>
<tr>
<td>PE3.2 Effective oral and written communication in professional and lay domains</td>
<td></td>
</tr>
<tr>
<td>PE3.3 Creative, innovative and pro-active demeanour</td>
<td></td>
</tr>
<tr>
<td>PE3.4 Professional use and management of information</td>
<td></td>
</tr>
<tr>
<td>PE3.5 Orderly management of self, and professional conduct</td>
<td></td>
</tr>
<tr>
<td>PE3.6 Effective team membership and team leadership</td>
<td></td>
</tr>
</tbody>
</table>