School of Engineering

MECH3720: Thermodynamics

Singapore PSB
Trimester 1 - 2024 (Singapore)

COURSE OUTLINE

OVERVIEW

Course Description
This course provides a full introduction to engineering thermodynamics with a focus on engineering flow processes as used in the power generation industries. After covering the first and second laws, a number of cycles are studied in detail, i.e. ideal gas and vapour power and refrigeration cycles, as well as applications in air-conditioning. The course is complemented by lectures on how to calculate the fundamental thermodynamic properties of fluids as used in flow processes.

Academic Progress Requirements
Nil

Assumed Knowledge
ENGG2300 Engineering Fluid Mechanics (previously MECH2710).

Contact Hours

Singapore PSB

Laboratory
Face to Face On Campus
3 hour(s) per term
Laboratory classes will be spread across three weeks

Lectorial
Face to Face On Campus
5 hour(s) per week(s) for 13 week(s) starting Week 1

Unit Weighting
10

Workload
Students are required to spend on average 120-140 hours of effort (contact and non-contact) including assessments per 10 unit course.

CONTACTS

Course Coordinator

Singapore PSB
A/Pr Thomas Fiedler
Thomas.Fiedler@newcastle.edu.au
+61 2 4921 6188
Consultation: By email.

Teaching Staff

Other teaching staff will be advised on the course Canvas site.

School Office

School of Engineering (Callaghan)
SENG-ADMIN@newcastle.edu.au
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SYLLABUS

Course Content

- Introduction to energy, work and heat
- Properties of substances
- First law of thermodynamics
- Entropy and the second law of thermodynamics
- Isentropic efficiencies
- Refrigeration and Heat Pump cycles
- Gas Power cycles
- Vapour Power cycles

Course Learning Outcomes

On successful completion of this course, students will be able to:

1. Apply thermodynamic principles (1st and 2nd law of Thermodynamics) to real cycles and process engineering.

2. Solve engineering problems related to thermodynamic systems and processes.

3. Apply experimental techniques related to the measurement and analysis of thermodynamic systems.

4. Communicate experimental results through the preparation of written reports.

Course Materials

Required Text:

- Principles of Engineering Thermodynamics - SI Version, Moran et al., 8th edition (anything from the sixth edition or newer is fine), Wiley.

ASSESSMENTS

This course has 4 assessments. Each assessment is described in more detail in the sections below.

	Assessment Name	Due Date	Involvement	Weighting	Learning Outcomes
1	Assignments	Subject to lectorial progress, most likely in weeks 4 and 6.	Individual	20%	1, 2
2	Laboratory Reports	The pre-lab report MUST be submitted at the beginning of each lab session to the instructor. Post-lab reports are due 7 calendar days after the lab.	Group	20%	1, 2, 3, 4
3	Mid-semester Quiz	The quiz is anticipated to be held in Week 7 during the Lectorial allocated time. Depending on external factors, this quiz may be pushed back 1 week.	Individual	20%	1, 2
4	Thermodynamic Applications Quiz	The Quiz will be held in week 13 during the Lectorial allocated time.	Individual	40%	1, 2

Late Submissions The mark for an assessment item submitted after the designated time on the due date, without an approved extension of time, will be reduced by 10% of the possible maximum mark for that assessment item for each day or part day that the assessment item is late. Note: this applies equally to week and weekend days.

Assessment 1 - Assignments

Assessment Type Written Assignment
Purpose The purpose of the written assignments is to revise the lecture content by solving thermodynamic engineering calculations. These assignments serve as a vital preparation for the Mid-semester Quiz.
Description There are two written assignments with a weight of 10% each. Some support for the solution of these assignments will be provided in the lectorials.
Weighting 20%
Length N/A
Due Date Subject to lectorial progress, most likely in weeks 4 and 6.
Submission Method Online
Assessment Criteria Correct calculations, clear presentation, and correct usage of units.
Return Method Online
Feedback Provided In Person. Q & A session.

Assessment 2 - Laboratory Reports

Assessment Type Report
Purpose Lab reports enable students to prepare and reflect on the Thermodynamic labs. The intent of the labs is to reinforce theoretical learning by exposure to "real-world" thermodynamic systems.
Description Lab reports are split into a pre-lab and post-lab component. The individual weight of each lab report is 6.66%.
Weighting 20%
Due Date The pre-lab report MUST be submitted at the beginning of each lab session to the instructor.
Post-lab reports are due 7 calendar days after the lab.
Submission Method In Class
Online
Pre-lab reports must be submitted to the instructor at the beginning of each lab.
Post-lab report must be submitted using Canvas.
Assessment Criteria Completeness and correctness of the report. Clear presentation and correct usage of units.
Return Method Online
Feedback Provided In Person.

Assessment 3 - Mid-semester Quiz

Assessment Type Quiz
Purpose Assess student learning. Provide feedback to students on their level of understanding of Basic Thermodynamics. The second part of the course relies strongly on the knowledge tested in this Quiz.
Description The mid-semester Quiz covers basic Thermodynamics, i.e. the 1st and 2nd Laws and simple applications thereof.
Weighting 20%
Length 2 hours
Due Date The quiz is anticipated to be held in Week 7 during the Lectorial allocated time. Depending on external factors, this quiz may be pushed back 1 week.
Submission Method Online
Assessment Criteria Correct numerical answers and units.
Correct identification and modification of formulas.
Correct usage of thermodynamic tables.
Clarity of presentation.
Return Method Online
Feedback Provided In Person. Q & A session.

Assessment 4 - Thermodynamic Applications Quiz

Assessment Type Quiz
Purpose Comprehensive assessment of student learning of the entire course content.
Description The Thermodynamic Applications Quiz covers the following Thermodynamics Applications: refrigeration, heat pump, and gas power and vapour power cycles.
Weighting 40%
Length 2 hours
Due Date The Quiz will be held in week 13 during the Lectorial allocated time.
Submission Method In Class
Assessment Criteria Correct numerical answers and units.
Correct identification and modification of formulas.
Correct usage of thermodynamic tables.
Clarity of presentation.
Return Method Not Returned
Feedback Provided In Person.

ADDITIONAL INFORMATION

Grading Scheme This course is graded as follows:

Range of Marks	Grade	Description
85-100	High Distinction (HD)	Outstanding standard indicating comprehensive knowledge and understanding of the relevant materials; demonstration of an outstanding level of academic achievement; mastery of skills*; and achievement of all assessment objectives.
75-84	Distinction (D)	Excellent standard indicating a very high level of knowledge and understanding of the relevant materials; demonstration of a very high level of academic ability; sound development of skills*; and achievement of all assessment objectives.
65-74	Credit (C)	Good standard indicating a high level of knowledge and understanding of the relevant materials; demonstration of a high level of academic achievement; reasonable development of skills*; and achievement of all learning outcomes.
50-64	Pass (P)	Satisfactory standard indicating an adequate knowledge and understanding of the relevant materials; demonstration of an adequate level of academic achievement; satisfactory development of skills*; and achievement of all learning outcomes.

0-49	Fail (FF)	Failure to satisfactorily achieve learning outcomes. If all compulsory course components are not completed the mark will be zero. A fail grade may also be awarded following disciplinary action.

*Skills are those identified for the purposes of assessment task(s).

Attendance

Attendance/participation will be recorded in the following components:

- Laboratory (Method of recording: Sign-in sheet.)

Communication Methods

Communication methods used in this course include:

- Canvas Course Site: Students will receive communications via the posting of content or announcements on the Canvas course site.
- Email: Students will receive communications via their student email account.

Course Evaluation

Each year feedback is sought from students and other stakeholders about the courses offered in the University for the purposes of identifying areas of excellence and potential improvement.

Oral Interviews (Vivas)

As part of the evaluation process of any assessment item in this course an oral examination (viva) may be conducted. The purpose of the oral examination is to verify the authorship of the material submitted in response to the assessment task. The oral examination will be conducted in accordance with the principles set out in the Oral Examination (viva) Procedure. In cases where the oral examination reveals the assessment item may not be the student's own work the case will be dealt with under the Student Conduct Rule.

Academic Misconduct

All students are required to meet the academic integrity standards of the University. These standards reinforce the importance of integrity and honesty in an academic environment. Academic Integrity policies apply to all students of the University in all modes of study and in all locations. For the Student Academic Integrity Policy, refer to https://policies.newcastle.edu.au/document/view-current.php?id=35.

Adverse Circumstances

The University acknowledges the right of students to seek consideration for the impact of allowable adverse circumstances that may affect their performance in assessment item(s). Applications for special consideration due to adverse circumstances will be made using the online Adverse Circumstances system where:

1. the assessment item is a major assessment item; or
2. the assessment item is a minor assessment item and the Course Co-ordinator has specified in the Course Outline that students may apply the online Adverse Circumstances system;
3. you are requesting a change of placement; or
4. the course has a compulsory attendance requirement.

Before applying you must refer to the Adverse Circumstance Affecting Assessment Items Procedure available at:
https://policies.newcastle.edu.au/document/view-current.php?id=236

Important Policy Information

The Help button in the Canvas Navigation menu contains helpful information for using the Learning Management System. Students should familiarise themselves with the policies and procedures at https://www.newcastle.edu.au/current-students/no-room-for/policies-and-procedures that support a safe and respectful environment at the University.

This course outline was approved by the Head of School on 15th November 2023. No alteration of this course outline is permitted without Head of School approval. If a change is approved, students will be notified and an amended course outline will be provided in the same manner as the original.

Graduate Profile Statements

This course builds students' capacity in the following University of Newcastle Bachelor of Engineering Graduate Profile Statements (based on 2011 Engineers Australia revised Stage 1 Competency Standards for Professional Engineers):

UON Att.	University of Newcastle Bachelor of Engineering Graduate Profile Statements/ Engineers Australia Stage 1 competency statements	Taught	Practised	Assessed	Skill Level (1-4)
	Professional Attributes				
11	3.1. Ethical conduct and professional accountability				
12	3.2. Effective oral and written communication in professional and lay domains.		X	X	3
13	3.3. Creative, innovative and pro-active demeanour.				
14	3.4. Professional use and management of information.	X	X	X	3
15	3.5. Orderly management of self, and professional conduct.		X	X	2
16	3.6. Effective team membership and team leadership.		X		2
	Engineering Ability				
7	2.1. Application of established engineering methods to complex engineering problem solving.	X	X	X	3
8	2.2. Fluent application of engineering techniques, tools and resources.	X	X	X	3
9	2.3. Application of systematic engineering synthesis and design processes.				
10	2.4. Application of systematic approaches to the conduct and management of engineering projects.				
	Knowledge Base				
1	1.1. Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline.	X	X	X	3
2	1.2. Conceptual understanding of the, mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline.				
3	1.3. In-depth understanding of specialist bodies of knowledge within the engineering discipline.	X	X	X	3
4	1.4. Discernment of knowledge development and research directions within the engineering discipline.				
5	1.5. Knowledge of contextual factors impacting the engineering discipline.	X			3
6	1.6. Understanding of the scope, principles, norms, accountabilities and bounds of contemporary engineering practice in the specific discipline.				