MECH301

Thermodynamics

S1 Day 2019

School of Engineering

Contents

General Information

Unit convenor and teaching staff
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Contact via 02 9850 2249
44 Waterloo Road, Room 118
Monday 2.00 - 4.00 pm

Credit points
3

Prerequisites
6cp at 200 level including MECH202

Corequisites

Co-badged status

Unit description
The unit is designed to give a comprehensive understanding of thermodynamics to the engineering students. The unit will provide the students with detailed understanding of energy systems and application of energy systems in practical engineering. In particular, the students will learn the concepts of energy, enthalpy, entropy, energy transfer, mass and energy balance, laws of thermodynamics, design principles of thermo-fluid systems, use of the property tables and how to the improve the design of the existing thermo-fluid systems.

Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at https://www.mq.edu.au/study/calendar-of-dates

Learning Outcomes

On successful completion of this unit, you will be able to:

The students will develop comprehensive understanding of the Laws of Thermodynamics and Energy systems including properties of substances, state and equilibrium.
The students will able to demonstrate the concept of energy, enthalpy, entropy, entropy balance, energy balance and energy transfer.
The students will be able to analyse mass and energy transfer in both closed and open systems in steady and unsteady states.
The students will be able to analyse gas power cycle, vapour and combined power cycle,

refrigeration cycle and air-conditioning cycle and apply their knowledge of thermodynamics to improve the design and optimize the operating parameters of existing cycle.

The students will develop specific skills on team work and written communication skills through technical report writing and laboratory work.

General Assessment Information

Student Responsibilities

Be familiar with University policy and College procedures and act in accordance with those policies and procedures. It is the responsibility of the student to retain a copy of any work submitted. Students must produce these documents upon request. Copies should be retained until the end of the grade appeal period each term. The student is to perform the required due diligent for their assessment grade and rectify as soon as possible upon finding any errors.

Notifications

Formal notification of assessment tasks, grading rubrics, and due dates will be posted on iLearn. Although all reasonable measures to ensure the information is accurate, The University reserves the right to make changes without notice. Each student is responsible for checking iLearn for changes and updates.

Report and Assignment Tasks

Assignment Problems will be posted on iLearn at least one week before their submission date. Assignment solutions will be posted within 7 working days after the submission date. Submissions will not be accepted once the solution is posted.

Assignment submissions and plagiarism policies

All assignments and reports must be submitted electronically through iLearn (in pdf format) in the appropriate space provided for submissions in ilearn. Submissions will undergo plagiarism checkers using the Turnitin software and any work deemed to have 30% or higher similarity score may incur an academic penalty. For more details on the policies of academic penalties relating to academic honesty, please refer to the policies and procedures section below. Submissions are expected to be either handwritten or typed in a logical layout and sequence. Markers WILL NOT grade poorly organized or illegible scans or drafts. The expected workload includes preparation of final copies and clear diagrams.

Late submissions

Late submissions or absences from tutorials and laboratories will not be accepted without prior arrangement being made at least one week before the submission date. Extenuating circumstances will be considered upon lodgement of a formal notice of disruption of studies.

Grading and passing requirement for unit

In order to pass the unit satisfactorily, the students need to fulfill the following criteria:

1. At least 50% marks overall

For further details about grading, please refer below in the policies and procedures section.

The unit will be graded according to the Macquarie University Grading policy. The following grades will be used according to the listed numerical range:

HD	High Distinction	85-100
D	Distinction	75-84
Cr	Credit	65-74
P	Pass	50-64
F	Fail	0-49

Final Examinations Final examinations will typically take place at the end of the semester. For further information, please refer to the Examination Timetable website on www.mq.edu.au

Assessment Tasks

Name	Weighting	Hurdle	Due
Active Engagement	6%	No	Week 1 to Week 13
Assignments	12%	No	Week 6, Week 12
Practicals and lab report	12%	No	Week 5, Week 9, Week 13
Mid-term test	20%	No	Week 7
Final exam	50%	No	TBA

Active Engagement

Due: **Week 1 to Week 13**
Weighting: **6%**

Active engagement in the unit throughout the semester.

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- The students will be able to analyse mass and energy transfer in both closed and open systems in steady and unsteady states.

- The students will be able to analyse gas power cycle, vapour and combined power cycle, refrigeration cycle and air-conditioning cycle and apply their knowledge of thermodynamics to improve the design and optimize the operating parameters of existing cycle.
- The students will develop specific skills on team work and written communication skills through technical report writing and laboratory work.

Assignments

Due: **Week 6, Week 12**
Weighting: **12%**

Assignments based on problem-solving, 2 x 6% each

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Practicals and lab report

Due: **Week 5, Week 9, Week 13**
Weighting: **12%**

3 Laboratory reports on 3 practical sessions 3 x 4% each

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Mid-term test

Due: **Week 7**
Weighting: **20%**

Mid-semester examination

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Final exam

Due: **TBA**
Weighting: **50%**

Final Examination to be held during examination week.

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Delivery and Resources

Primary Text: Thermodynamics: An Engineering Approach (9th Edition in SI Units) by Yunus A. Cengel and Michael A. Boles

Supporting Texts: 1. Engineering Thermodynamics (4th Edition) by Rogers and Mayhew 2. Principles of Engineering Thermodynamics (7th Edition) by Moran, Shapiro, Boettner and Bailey

Unit Schedule

Week	Lecture Topics	Key Topics to be Covered	Learning activity/ Assessment task
1	Introduction and Basic Concepts	Thermodynamics and Energy, Dimension and Units, Different Applications and definitions related to Thermodynamics, Processes and Cycle	Lecture only
2	Energy, Energy Transfer and General Energy Analysis	Forms of energy, Energy transfer by work and heat, First law of Thermodynamics, Energy efficiency	Lecture + Tutorial
3	Properties of pure substances	Properties of pure substances, Phase change processes, Property diagram and property tables, Equation of state	Lecture + Tutorial
4	Energy Analysis of Closed Systems	Closed system, Moving boundary work, Energy balance for Closed systems, Internal energy, enthalpy and specific heats.	Lecture + Tutorial + Practical 1

5	Mass and Energy Analysis of Control Volumes	Conservation of mass, Flow work and Energy of a Flowing Fluid, Energy Analysis of Steady flow systems, Energy Analysis of Unsteady flow process	Lecture + Tutorial + **Lab report 1 due**
6	The Second Law of Thermodynamics	The Second Law, Thermal energy reservoir, Heat engines, Refrigerators and Heat pumps, Reversible and Irreversible Processes, The Carnot Cycle	Lecture + Tutorial + **Assignment 1 due**
7	Entropy	Entropy, Entropy diagrams, Entropy change, Entropy balance,	Lecture + Tutorial + **Midterm Test**
8	Exergy	Exergy, Exergy change of a system, Exergy transfer by heat, work and mass, Exergy balance.	Lecture + Tutorial + Practical 2
9	Gas Power Cycles	Analysis of Power Cycles, The Carnot Cycle, Otto Cycle, Diesel Cycle, Stirling and Ericsson Cycles, Brayton Cycle	Lecture + Tutorial + **Lab report 2 due**
10	Vapor and Combined Power Cycles	Rankine Cycle, Efficiency of Rankine Cycle, Regeneration, Cogeneration, Combined Gas-Vapor Power Cycles	Lecture + Tutorial
11	Refrigeration Cycles	Refrigeration and Heat Pumps, Reversed Carnot Cycle, Refrigeration Cycles	Lecture + Tutorial
12	Gas Vapor Mixture and Air Conditioning	Gas Mixtures, Properties of Gas Vapor Mixtures, Properties of Air, Air-Conditioning Processes	Lecture + Tutorial + Practical 3 / **Assignment 2 due**

13	Renewable Energy	Renewable Energy, Solar, Wind, Hydro, Geothermal and Biomass Energy.	Lecture + Tutorial + **Lab report 3 due**

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy
- Academic Progression Policy
- Assessment Policy
- Fitness to Practice Procedure
- Grade Appeal Policy
- Complaint Management Procedure for Students and Members of the Public
- Special Consideration Policy *(**Note:** The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.)*

Undergraduate students seeking more policy resources can visit the Student Policy Gateway (https://students.mq.edu.au/support/study/student-policy-gateway). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

If you would like to see all the policies relevant to Learning and Teaching visit Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central).

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/study/getting-started/student-conduct

Results

Results published on platform other than eStudent, (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit ask.mq.edu.au or if you are a Global MBA student contact globalmba.support@mq.edu.au

Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to improve your marks and take control of your study.

- Workshops
- StudyWise
- Academic Integrity Module for Students
- Ask a Learning Adviser

Student Services and Support

Students with a disability are encouraged to contact the Disability Service who can provide appropriate help with any issues that arise during their studies.

Student Enquiries

For all student enquiries, visit Student Connect at ask.mq.edu.au

If you are a Global MBA student contact globalmba.support@mq.edu.au

IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.

Graduate Capabilities

Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be imaginative and open to experience and capable of innovation at work and in the community. We want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:

Learning outcomes

- The students will develop comprehensive understanding of the Laws of Thermodynamics and Energy systems including properties of substances, state and equilibrium.
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- The students will develop specific skills on team work and written communication skills through technical report writing and laboratory work.

Assessment tasks

- Assignments
- Practicals and lab report

Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

Learning outcomes

- The students will develop comprehensive understanding of the Laws of Thermodynamics and Energy systems including properties of substances, state and equilibrium.
- The students will develop specific skills on team work and written communication skills through technical report writing and laboratory work.

Commitment to Continuous Learning

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they participate in the world. They will be capable of reflecting on their experiences and relationships with others and the environment, learning from them, and growing - personally, professionally and socially.

This graduate capability is supported by:

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Assessment tasks

- Active Engagement
- Assignments
- Practicals and lab report
- Mid-term test
- Final exam

Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

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- Mid-term test

- Final exam

Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

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Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

Learning outcomes

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- Mid-term test
- Final exam

Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

Learning outcomes

- The students will develop comprehensive understanding of the Laws of Thermodynamics and Energy systems including properties of substances, state and equilibrium.
- The students will develop specific skills on team work and written communication skills through technical report writing and laboratory work.

Assessment tasks

- Active Engagement
- Practicals and lab report

- Final exam

Engaged and Ethical Local and Global citizens

As local citizens our graduates will be aware of indigenous perspectives and of the nation's historical context. They will be engaged with the challenges of contemporary society and with knowledge and ideas. We want our graduates to have respect for diversity, to be open-minded, sensitive to others and inclusive, and to be open to other cultures and perspectives: they should have a level of cultural literacy. Our graduates should be aware of disadvantage and social justice, and be willing to participate to help create a wiser and better society.

This graduate capability is supported by:

Learning outcome

- The students will develop specific skills on team work and written communication skills through technical report writing and laboratory work.

Assessment tasks

- Active Engagement
- Practicals and lab report
- Mid-term test

Changes from Previous Offering

There are some changes in the assessment components as follows:

1. There are 2 assignments in this current offering. Previous year's offering had 3 assignments. Total assignment marks are also reduced to 12%

2. Practicals and lab report marks are increased to 12% in this current offering.