MECH402

Energy Sustainable Design

S1 Day 2016

Dept of Engineering

Contents

General Information

Unit convenor and teaching staff
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Consultation hours: By Appointment

Credit points
3

Prerequisites
MECH301 and MECH302

Corequisites

Co-badged status

Unit description
The students will learn about energy sustainable design processes, energy efficiency, heating, ventilation and air-conditioning systems design; Psychrometric Analysis, heating and cooling load calculations; air-conditioning equipment selection; duct design methods; concept of refrigeration and its applications; refrigeration cycles; refrigeration compressors, condensers, evaporators, expansion devices; vapour compression system design and analysis.

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 energy sustainable design processes

The students will be able to apply their prior knowledge of thermodynamics and heat

transfer, analytical and strategic thinking to design real world engineering systems.
The students will be able to analyse refrigeration and air-conditioning cycles and apply their acquired knowledge to improve the design and optimize the operating parameters of existing cycle.
The students will develop specific skills of project management, employment-related teamwork and will be able to demonstrate professional dispositions and an ethical stance.

General Assessment Information

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

1. at least 50% marks overall

2. must submit at least 2 assignments and the group project

3. For both the midterm and final examinations, not following instructions as indicated may result in the affected questions not being marked.

4. It is a requirement of the course that students **perform satisfactorily** in the final examination.

5. Late submission of any assessment task will be penalized.

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

Assessment Tasks

Name	Weighting	Due
Assignments	20%	Week 3, 5, 9, and 11
Group Project	20%	Week 12
Mid term test	20%	Week 7
Final Exam	40%	During exam period

Assignments

Due: **Week 3, 5, 9, and 11**
Weighting: **20%**

4 Assignments x 5 marks each

Four individual assignments will test the student's understanding of the course material taught up to the point each assignment is distributed. The student is expected to solve problems which test both the concepts taught as well as the technical capabilities of the students in doing energy sustainable design. These assignments must be completed individually.

On successful completion you will be able to:

- The students will develop comprehensive understanding of energy sustainable design processes
- The students will be able to apply their prior knowledge of thermodynamics and heat transfer, analytical and strategic thinking to design real world engineering systems.
- The students will be able to analyse refrigeration and air-conditioning cycles and apply their acquired knowledge to improve the design and optimize the operating parameters of existing cycle.
- The students will develop specific skills of project management, employment-related teamwork and will be able to demonstrate professional dispositions and an ethical stance.

Group Project

Due: **Week 12**
Weighting: **20%**

Students will be divided to a group of 4. Each group will be given a topic and required to perform heating/cooling load calculation and design in a group report format.

On successful completion you will be able to:

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- The students will develop specific skills of project management, employment-related

teamwork and will be able to demonstrate professional dispositions and an ethical stance.

Mid term test

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

An in-class 1hr test assessing material delivered between weeks 1 and 6.

On successful completion you will be able to:

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- The students will be able to analyse refrigeration and air-conditioning cycles and apply their acquired knowledge to improve the design and optimize the operating parameters of existing cycle.
- The students will develop specific skills of project management, employment-related teamwork and will be able to demonstrate professional dispositions and an ethical stance.

Final Exam

Due: **During exam period**
Weighting: **40%**

Final examination assessing all material delivered throughout the course

On successful completion you will be able to:

- The students will develop comprehensive understanding of energy sustainable design processes
- The students will be able to apply their prior knowledge of thermodynamics and heat transfer, analytical and strategic thinking to design real world engineering systems.
- The students will be able to analyse refrigeration and air-conditioning cycles and apply their acquired knowledge to improve the design and optimize the operating parameters of existing cycle.
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Delivery and Resources

The following texts are recommended:

“Heating, Ventilating and Air Conditioning: Analysis and Design, 6th Edition” by F.C. McQuiston, D. Parker and J.D. Spitler

“Load Estimation and Psychrometrics: Application Manual DA9. Australian Institute of Refrigeration, Air conditioning and Heating”

Unit Schedule

Week	Topic	Lecturer	Laboratory/Tutorial	Assessments
1	Energy sustainable design processes, energy efficiency	Dr. Huda	No tutorial	
2	Concept of refrigeration and its applications; refrigeration cycles	Dr. Lee	Refrigeration cycles	
3	Refrigeration compressors, condensers, evaporators, expansion devices	Dr. Lee	Refrigeration cycles	Assignment 1 due
4	Vapour compression system design and analysis	Dr. Lee	Vapour compression cycles	
5	Psychrometric Analysis heating and cooling load calculations	Dr. Lee	Vapour compression cycles	Assignment 2 due
6	Psychrometric Analysis heating and cooling load calculations	Dr. Lee	Applied Psychrometrics	
7	Psychrometric Analysis heating and cooling load calculations	Dr. Lee	Midterm Examination	
8	Use of CONTAM Program	Dr. Lee	Applied Psychrometrics	
9	Heating, ventilation and air-conditioning systems design process	Dr. Lee	Tutorial on CONTAM	Assignment 3 due

10	Air-conditioning equipment selection; duct design methods;	Dr. Lee	Air Duct tutorial	
11	Sustainable buildings, materials, resource efficiency, fire safety	Dr. Lee	Group Project	Assignment 4 due
12	No lecture	Dr. Lee	Group Project	Group Project due
13	Revision	Dr. Lee	No Tutorial	

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central. Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy http://mq.edu.au/policy/docs/academic_honesty/policy.html

New Assessment Policy in effect from Session 2 2016 http://mq.edu.au/policy/docs/assessment/policy_2016.html. For more information visit http://students.mq.edu.au/events/2016/07/19/new_assessment_policy_in_place_from_session_2/

Assessment Policy prior to Session 2 2016 http://mq.edu.au/policy/docs/assessment/policy.html

Grading Policy prior to Session 2 2016 http://mq.edu.au/policy/docs/grading/policy.html

Grade Appeal Policy http://mq.edu.au/policy/docs/gradeappeal/policy.html

Complaint Management Procedure for Students and Members of the Public http://www.mq.edu.au/policy/docs/complaint_management/procedure.html

Disruption to Studies Policy http://www.mq.edu.au/policy/docs/disruption_studies/policy.html *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

In addition, a number of other policies can be found in the Learning and Teaching Category of 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/support/student_conduct/

Results

Results shown in *iLearn*, 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.

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

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 energy sustainable design processes
- The students will be able to analyse refrigeration and air-conditioning cycles and apply their acquired knowledge to improve the design and optimize the operating parameters of existing cycle.

- The students will develop specific skills of project management, employment-related teamwork and will be able to demonstrate professional dispositions and an ethical stance.

Assessment tasks

- Assignments
- Group Project

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 be able to apply their prior knowledge of thermodynamics and heat transfer, analytical and strategic thinking to design real world engineering systems.
- The students will develop specific skills of project management, employment-related teamwork and will be able to demonstrate professional dispositions and an ethical stance.

Assessment task

- Group Project

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:

Learning outcomes

- The students will develop comprehensive understanding of energy sustainable design processes
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their acquired knowledge to improve the design and optimize the operating parameters of existing cycle.
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Assessment tasks

- Assignments
- Group Project
- 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.

This graduate capability is supported by:

Learning outcomes

- The students will develop comprehensive understanding of energy sustainable design processes
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Assessment tasks

- Assignments
- Group Project
- 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.

This graduate capability is supported by:

Learning outcomes

- The students will develop comprehensive understanding of energy sustainable design processes
- The students will be able to apply their prior knowledge of thermodynamics and heat transfer, analytical and strategic thinking to design real world engineering systems.
- The students will be able to analyse refrigeration and air-conditioning cycles and apply their acquired knowledge to improve the design and optimize the operating parameters of existing cycle.

Assessment tasks

- Assignments
- Group Project
- Mid term test
- Final Exam

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

- The students will develop comprehensive understanding of energy sustainable design processes
- The students will be able to apply their prior knowledge of thermodynamics and heat transfer, analytical and strategic thinking to design real world engineering systems.
- The students will be able to analyse refrigeration and air-conditioning cycles and apply their acquired knowledge to improve the design and optimize the operating parameters of existing cycle.
- The students will develop specific skills of project management, employment-related teamwork and will be able to demonstrate professional dispositions and an ethical

stance.

Assessment tasks

- Assignments
- Group Project
- 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 outcome

- The students will develop specific skills of project management, employment-related teamwork and will be able to demonstrate professional dispositions and an ethical stance.

Assessment task

- Group Project

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 of project management, employment-related teamwork and will be able to demonstrate professional dispositions and an ethical stance.

Assessment tasks

- Assignments

- Mid term test
- Final Exam