ELEC295

Fundamentals of Energy Conversion and Storage

S1 Day 2018

Dept of Engineering

Contents

Disclaimer

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General Information

Unit convenor and teaching staff

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Monday 1 PM-3 PM

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Thursday 11.00 AM-1.00 PM

Tutor
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Tuesdat 10 AM-12 PM

Credit points
3

Prerequisites
(MATH132 or MATH135) and ((PHYS106 and PHYS107) or (PHYS140 and PHYS143))

Corequisites

Co-badged status

Unit description
This unit develops fundamental knowledge and skills in the area of energy conversion and storage technologies and their applications. Foundation knowledge and skill in physics and mathematics is assumed. Topics covered include: Forms of energy - electric, magnetic, chemical, thermal, pneumatic, kinetic, etc. Sources of energy (especially renewable energy) - photovoltaics, wind generation, fuel cells, etc. Energy conversion - methods, efficiency, limitations. Storage of energy - batteries, supercapacitors, thermal energy, mechanical energy, embodied energy, etc. The concepts studied in this unit, and the knowledge and skills gained, are required in advanced units in the area of electrical and/or energy systems engineering.

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:

Describe physical basis for, and associated performance characteristics of, various energy conversion and storage technologies.

Outline the safety, and economic issues concerning energy technology and systems.

Identify, formulate and provide solutions to complex problems with intellectual independence for finding the performance of energy conversion from one form to another.

Analyse energy conversion and storage systems in terms of accepted performance parameters.

Evaluate energy conversion and storage requirements and design or select suitable solutions to those requirements

General Assessment Information

Student Responsibilities

Be familiar with University policy and College procedures and act in accordance with those policy 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.

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 Tutorial

Tutorail problems and laboratory manual will be posted on iLearn at least one week before lab and tutorial session. Tutorial solutions will be posted within a week 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 turnitin for plagiarism checks. Submissions will undergo automatic plagiarism checking. For more details on the policies of academic penalties relating to academic honesty, please refer to the University policies and procedures. A template for writing report with detail instructions will be uploaded on iLearn. Marking rubrics will be provided at the time of posting.

Late submissions

An assessment item submitted after the due date, without an approved extension from the Course Convenor, will be penalised. The standard penalty is the reduction of the mark allocated to the assessment item by 10% of the maximum mark applicable for the assessment item, for each working day or part working day that the item is late. Assessment items submitted more than five working days after the due date are awarded zero marks.

Conditions required to pass the unit: eg: Grading and passing requirement for unit

In order to pass this unit a student must obtain a mark of 50 or more for the unit (i.e. obtain a passing grade P/ CR/ D/ HD). For further details about grading, please refer below in the policies and procedures section.

Hurdle Requirements

The final examination is a hurdle requirement. A grade of 40% or more in the final examination is a condition of passing this unit.

Return of Assessment Items and Notification of Availability of Feedback on Assessment

Marks for all assessment items including the final exam will be recorded in the Marks Centre and made available to students through iLearn. The marked laboratory reports and tutorial assignments will be returned to the students normally at the next scheduled session, or as advised by the laboratory supervisor. Feedback for quizzes using clickers will be provided immediately at the end of session.

Final Examinations

Final examinations will typically take place at the end of the semester. The final exam will cover all of the course content. This will be a closed book exam, and involve short answers and problem solving. The duration of the exam will be 3 hours. For further information, please refer to the Examination Timetable website on www.mq.edu.au.

Criteria & Marking: (i) Accuracy, (ii) procedure, (ii) communications of assumptions, and (iv) completeness.

Assessment Tasks

Name	Weighting	Hurdle	Due
Tutorial	20%	No	At the end of tutorial session
Laboratory	20%	No	4 PM Friday, next week
Quiz	10%	No	During lecture time
Final Exam	50%	Yes	Examination period

Tutorial

Due: **At the end of tutorial session**
Weighting: **20%**

There are six tutorial sessions throughout the semester including the review one (last tutorial). In each tutorial you will solve several problems. A few example questions will be solved interactively by the lecturer in the scheduled tutorial class. You will be asked to solve remaining questions either individually or as a group. You will submit the solution document to the lecturer at the end of the class. The problems will be designed to help you enhance your understanding of the topics covered in lectures and provide you with an opportunity to apply the knowledge you have learned from lectures to solve practical problems.

Each tutorial is worth 4% and you will loose that mark if you dont attend in the tutorial session. In the tutorial class you will analyze the performance characteristics of various energy conversion and storage technologies. Criteria & Marking: (i) calculation accuracy; (ii) communications of assumptions; (iii) methodology; (iv) completeness. Feedback will be provided in the next tutorial class. Detail of the marking criteria will also be notified on iLearn.

On successful completion you will be able to:

- Identify, formulate and provide solutions to complex problems with intellectual independence for finding the performance of energy conversion from one form to another.
- Analyse energy conversion and storage systems in terms of accepted performance parameters.
- Evaluate energy conversion and storage requirements and design or select suitable solutions to those requirements

Laboratory

Due: **4 PM Friday, next week**

Weighting: **20%**

The laboratories are strongly recommended; attendance, participation, and completion of all the laboratory activities are required in order to satisfactorily complete the course. You are required to record all the laboratory results (and printouts) and submit a complete report for each experiment. Completion of a laboratory activity is determined by having the laboratory tutor sign off the student log book, nominally at the end of the laboratory class.

Criteria & Marking: (i) design decision, (ii) completeness (iii) analyse results, (iv) accuracy and (v) structure and quality of the report. Detail of the marking criteria will also be notified on iLearn.

On successful completion you will be able to:

- Outline the safety, and economic issues concerning energy technology and systems.
- Analyse energy conversion and storage systems in terms of accepted performance parameters.
- Evaluate energy conversion and storage requirements and design or select suitable solutions to those requirements

Quiz

Due: **During lecture time**
Weighting: **10%**

During 'lecture' times in the classroom each week, you will be asked a series of questions which will reflect work in class (calculations, review of taught material, etc.) or reading assignments between classes. You will give your answer using the clickers.

On successful completion you will be able to:

- Describe physical basis for, and associated performance characteristics of, various energy conversion and storage technologies.

Final Exam

Due: **Examination period**
Weighting: **50%**
This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)

The final exam will cover all of the course content. This will be a closed book exam, and involve short answers and problem solving. The duration of the exam will be 3 hours. **This is an hurdle exam and to receive a passing grade, the student must achieve at least 40% in the final exam and an aggregate mark of at least 50% overall**.

On successful completion you will be able to:

- Evaluate energy conversion and storage requirements and design or select suitable

solutions to those requirements

Delivery and Resources

-Aldo Vieira da Rosa, Fundamentals of Renewable Energy Processes, Third Edition, Academic Press (Elsevier), ISBN: 978-0-12-397219-4

- Fuchs and Masoum, Power Conversion of Renewable Energy Systems. Springer 2011, ISBN 978-1-4419-7979-7.

Unit Schedule

ELEC295 S1 2018 Weekly Plan						
Version 5 26/9/2016 (check iLearn for updates)			JH-Jahangir Hossain, NK-Nikos Kopidakis			
W	Lecture date	Lecture Topics	Lecturer	Date	Tutorial	Laboratory session
1	28/2/18	Introduction and review of basic concepts	JH	28/2/18	No Tutorial	No laboratory session
2	7/3/18	Energy Forms and Changes, Electromechanical Energy Conversion	JH	8/3/18	Review of basic concept	
3	14/3/18	Transformer-I	JH	13/3/18		Transformer
4	21/3/18	Transformer-II	JH	22/03/2018	Electromagnetic Energy Conversion	
5	28/3/18	Wind Energy Conversion	JH	29/03/2018		Wind Turbine
6	4/4/18	Hydroelectric Energy Conversion	JH	3/04/2018	Wind Turbine	
7	11/4/18	PV	NK	12/04/2018		PV
	16/4/18	Recess				
	23/4/18					
8	2/5/18	Solar Energy Conversion	NK	1/05/2018	PV	
9	9/5/18	Hydrogen production and storage	NK	10/05/2018		Fuel Cell

10	16/5/18	Fuel cells	NK	15/05/2018	Storage	
11	23/5/18	Energy Storage and Batteries	NK	24/05/2018		Storage
12	30/5/18	Non-electrical Energy Storage	NK		Revision	
13	6/6/18	Unit review	NK			
Learning outcomes:						
1. Describe physical basis for, and associated performance characteristics of, various energy conversion and storage technologies						
2. Outline the relevant regulatory, safety, and economic issues concerning energy technology and systems						
3. Identify, formulate and provide solutions to complex problems with intellectual independence for finding the performance of energy conversion from one form to another.						
4. Analyse energy conversion and storage systems in terms of accepted performance parameters						
5. Evaluate energy conversion and storage requirements and design or select suitable solutions to those requirements						
Assessments:						
1. Quiz 10%, 2. Tutorial 20%, 3. Laboratory 20% and 4. Final Exam-50%						
Lecture: Wednesday 9.00-11.00 AM (12 Second Wy-430)						
Laboratory (Odd weeks-3,5,7,9,11)-Tuesday 2PM-5PM, E6A_235						
Tutorial (Even weeks-2,4,6,8,10,12)-Thursday 1PM-3 PM, 9 Walys Wlk_235						

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 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 outcome

- Analyse energy conversion and storage systems in terms of accepted performance parameters.

Assessment tasks

- Laboratory
- Final Exam

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 outcome

- Evaluate energy conversion and storage requirements and design or select suitable solutions to those requirements

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 outcome

- Describe physical basis for, and associated performance characteristics of, various

energy conversion and storage technologies.

Assessment tasks

- Quiz
- 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

- Identify, formulate and provide solutions to complex problems with intellectual independence for finding the performance of energy conversion from one form to another.
- Evaluate energy conversion and storage requirements and design or select suitable solutions to those requirements

Assessment tasks

- Tutorial
- 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 outcome

- Identify, formulate and provide solutions to complex problems with intellectual independence for finding the performance of energy conversion from one form to another.

Assessment tasks

- Tutorial

- 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

- Describe physical basis for, and associated performance characteristics of, various energy conversion and storage technologies.
- Analyse energy conversion and storage systems in terms of accepted performance parameters.

Assessment tasks

- Laboratory
- 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:

Assessment task

- Laboratory

Socially and Environmentally Active and Responsible

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

Learning outcome

- Outline the safety, and economic issues concerning energy technology and systems.

Changes from Previous Offering

The annual course survey results show that students have been extremely pleased with the course curriculum and teaching methods. They mention that this course is one of the best structured with strong and clear links among the taught topics, course objectives and assessments. The feedback from previous cohort of students was that they would benefit from clear and detail marking criterias. The convenor has revised the marking criterias and will make available in due time.