PHYS310

Energy and Entropy

S2 Day 2014

Physics and Astronomy

Contents

General Information

Unit convenor and teaching staff
Unit Convenor
James Cresser
james.cresser@mq.edu.au
Contact via james.cresser@mq.edu.au
E6B2.711
Tuesday 1-5

Lecturer
Daniel Terno
daniel.terno@mq.edu.au
Contact via daniel.terno@mq.edu.au
E6B 2.715

Credit points
3

Prerequisites
PHYS301(P)

Corequisites

Co-badged status

Unit description
The physical world is governed by a myriad of laws, but two overriding thermodynamic principles guide and restrict this behaviour: the conservation of energy and the increase in entropy. This unit brings together the broad range of physical systems and theories studied by students throughout their degree, and explores how they are united and constrained by these two principles. Through rigorous analysis, research projects and group discussion we survey the impact of thermodynamic laws from the microscopic world to our own global energy challenges, while building core skills in communication.

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:

Students will obtain an overview of the interrelationships between the major theories of physics.
Students will obtain an appreciation of the two major perspectives on physics: bottom up approaches, constructing microscopic theories based on fundamental interactions applied to increasingly complex systems, and top-down theories which assume general axiomatic constraints regardless of the type of interaction.
Students will gain experience in integrating disparate areas of physics and mathematics to arrive at an understanding of significant scientific and technological issues affecting the modern world.
Students will gain experience in communicating their understanding in the form of audio-visual presentations, and essay and report writing
Students will gain experience in working in groups, in assigning and sharing responsibilities.
Activities will expose the students to conditions and expectations for students who are either intending to move into a career, or who are intending to go on to postgraduate, research-oriented studies.

Assessment Tasks

Name	Weighting	Due
Assignments (3)	15%	See below for dates
Exercises	5%	Weekly
Exam	30%	9 October
Activity 1 presentation	5%	Week 9
Activity 1 presentation	15%	Week 13
Activity 2 presentation	5%	Week 11
Activity 2 draft submission	5%	Week 12
Activity 2 final report	15%	Week 13
Active Participation	5%	Weeks 9, 11 & 13

Assignments (3)

Due: **See below for dates**
Weighting: **15%**

The first part of the unit will cover material in the general area of thermophysics, encompassing both thermodynamics and statistical mechanics. As is the case with all areas of physics, working on a variety of mathematical and physical problems to address and deepen understanding of the subject material is integral to the learning process. To this end, students will be required to do three assignments in the first half of the session.

Assignment No. Available on iLearn on or before To be submitted for marking 1 8 August 22 August 2 22 August 5 September 3 5 August 19 September
On successful completion you will be able to:

- Students will obtain an overview of the interrelationships between the major theories of physics.
- Students will obtain an appreciation of the two major perspectives on physics: bottom up approaches, constructing microscopic theories based on fundamental interactions applied to increasingly complex systems, and top-down theories which assume general axiomatic constraints regardless of the type of interaction.
- Students will gain experience in communicating their understanding in the form of audio-visual presentations, and essay and report writing

Exercises

Due: **Weekly**
Weighting: **5%**

Weekly exercises consisting of short sharp questions involving the direct application in simple calculations, or clear restatement, of basic principles covered in lectures.

On successful completion you will be able to:

- Students will obtain an overview of the interrelationships between the major theories of physics.
- Students will obtain an appreciation of the two major perspectives on physics: bottom up approaches, constructing microscopic theories based on fundamental interactions applied to increasingly complex systems, and top-down theories which assume general axiomatic constraints regardless of the type of interaction.
- Students will gain experience in communicating their understanding in the form of audio-visual presentations, and essay and report writing

Exam

Due: **9 October**
Weighting: **30%**

A two hour written examination on the material covered in the first half of the unit will be given in week 8.

On successful completion you will be able to:

- Students will obtain an overview of the interrelationships between the major theories of physics.
- Students will obtain an appreciation of the two major perspectives on physics: bottom up approaches, constructing microscopic theories based on fundamental interactions applied to increasingly complex systems, and top-down theories which assume general axiomatic constraints regardless of the type of interaction.
- Students will gain experience in communicating their understanding in the form of audio-visual presentations, and essay and report writing

Activity 1 presentation

Due: **Week 9**
Weighting: **5%**

During week 9 students will deliver **informal whiteboard presentations** of their Activity 1 topic. The presentation is to be done by groups, with 10 minutes maximum time allocated to each student. It is possible, but not mandatory, for one member of the group to present the background information then followed by the presentation of the current research by the other member.

On successful completion you will be able to:

- Students will obtain an overview of the interrelationships between the major theories of physics.
- Students will gain experience in integrating disparate areas of physics and mathematics to arrive at an understanding of significant scientific and technological issues affecting the modern world.
- Students will gain experience in communicating their understanding in the form of audio-visual presentations, and essay and report writing
- Students will gain experience in working in groups, in assigning and sharing responsibilities.
- Activities will expose the students to conditions and expectations for students who are either intending to move into a career, or who are intending to go on to postgraduate, research-oriented studies.

Activity 1 presentation

Due: **Week 13**
Weighting: **15%**

During week 13 students will give individual presentations of the Activity 1 articles (so each

article will be presented by two students independently), **using any medium they wish**. The presentation time is 20 minutes which is followed by 5 minutes of questions and discussions. The last part of the presentation should be aimed at either/or funding agency, private investors, industry making a case for funding/investment.

On successful completion you will be able to:

- Activities will expose the students to conditions and expectations for students who are either intending to move into a career, or who are intending to go on to postgraduate, research-oriented studies.

Activity 2 presentation

Due: **Week 11**
Weighting: **5%**

During week 11 the students are to give 5 minute presentations explaining the rationale for choosing a particular topic and its impact on the society.

On successful completion you will be able to:

- Students will obtain an overview of the interrelationships between the major theories of physics.
- Students will gain experience in integrating disparate areas of physics and mathematics to arrive at an understanding of significant scientific and technological issues affecting the modern world.
- Students will gain experience in communicating their understanding in the form of audio-visual presentations, and essay and report writing
- Students will gain experience in working in groups, in assigning and sharing responsibilities.
- Activities will expose the students to conditions and expectations for students who are either intending to move into a career, or who are intending to go on to postgraduate, research-oriented studies.

Activity 2 draft submission

Due: **Week 12**
Weighting: **5%**

The draft reports on Activity 2 are to be presented to D. Terno and discussed individually during week 12. The appointment is to be made during the unit hours. The grid will be announced during week 11 and will be filled on a "first come, first serve" basis.

On successful completion you will be able to:

- Activities will expose the students to conditions and expectations for students who are either intending to move into a career, or who are intending to go on to postgraduate, research-oriented studies.

Activity 2 final report

Due: **Week 13**
Weighting: **15%**

The final report is to be submitted by Friday Nov 14 17:00 AEST.

The report should be approximately 10 pages.

On successful completion you will be able to:

- Activities will expose the students to conditions and expectations for students who are either intending to move into a career, or who are intending to go on to postgraduate, research-oriented studies.

Active Participation

Due: **Weeks 9, 11 & 13**
Weighting: **5%**

An additional 5 marks will be awarded for participation during the discussions following presentations.

On successful completion you will be able to:

- Activities will expose the students to conditions and expectations for students who are either intending to move into a career, or who are intending to go on to postgraduate, research-oriented studies.

Delivery and Resources

Classes

All classes in the first half of the session will be lectures or tutorials presented as white-board/ black-board/computer-generated slides.

The second half of the unit will be project based along with student presentations.

Class times and locations

- Thursday 3 – 5pm C4A320
- Friday 2 – 4pm C4A325

Required and Recommended Texts and/or Materials

Required Text

- Stephen J Blundell and Katherine M Blundell: Concepts in Thermal Physics 2nd edition.

Technology used and required

Unit web page

The web page for this unit can be found at http://ilearn.mq.edu.au

Please check this web page regularly for announcements and material available for downloading. Some learning resources for the unit will be provided in hardcopy rather on-line.

Teaching and Learning Strategy

The first half of this unit is taught through lectures and tutorials. We strongly encourage students to attend lectures because they provide a much more interactive and effective learning experience than studying a textbook. Questions during and outside lectures are strongly encouraged in this unit - please do not be afraid to ask, as it is likely that your classmates will also want to know the answer. You should aim to read the relevant sections of the textbook before and after lectures and discuss the content with classmates and lecturers.

You should aim to spend 3 hours per week working on the assignments. You may wish to discuss your assignment problems with other students and the lecturers, but you are required to hand in your own work (see the note on plagiarism below). Assignments are provided as one of the key learning activities for this unit, they are not there just for assessment. It is by applying knowledge learned from lectures and textbooks to solve problems that you are best able to test and develop your skills and understanding of the material.

The second half of the unit will focus on project work that will involve presentations on progress and report writing.

Unit Schedule

Schedule of assessable tasks and related materials

Week No.	Activity
1	Assignment 1 posted on iLearn
2	
3	Assignment 1 submitted Assignment 2 posted on iLearn Activity topics announced

5	Assignment 1 returned Assignment 2 submitted Assignment 3 posted on iLearn
6	
7	Assignment 2 returned Assignment 3 submitted
Mid-session break	**22 Sept – 3 Oct**
8	Assignment 3 returned Examination
9	Informal whiteboard Activity 1 presentations
10	Supplementary classes on relevant topics if necessary.
11	Activity 2 informal presentations
12	Draft activity 2 report due
13	Activity 1 formal presentations Final activity 2 report due

Learning and Teaching Activities

Activity 1: understanding and presenting scientific results

During this activity students will choose a research article and an accompanying informal (popular science) discussion of the research topic. A list of research articles together with their informal overviews will be given to the students not later than week 6. The students are expected to form groups of two and select the article by the end of week 7. The articles are allocated on a "first come, first serve basis". If none of the articles seems suitable, an alternative [subject to approval] can be presented. In case of the odd number of students alternative arrangements will be found subject to the approval of the teaching staff. The students will then give presentations on the topic on two occasions, the first in Week 9 will be informal, the second in Week 13 will be at the level of a short seminar.

Activity 2: impact/application of energy and entropy concepts

For this activity, students will be required to choose any topic that is concerned with energy and entropy and its role in /impact on society, and prepare a written report. A broad list of topics will be announced by the end of week 2. This activity is individual. During week 11 the students are to give 5 minute presentations explaining the rationale for choosing a particular topic and its impact on society. Drafts on the final report are to be presented to D. Terno and discussed individually during the week 12 and a final report is to be submitted by Friday Nov 14 17:00 AEST.

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

Assessment Policy http://mq.edu.au/policy/docs/assessment/policy.html

Grading Policy http://mq.edu.au/policy/docs/grading/policy.html

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

Grievance Management Policy http://mq.edu.au/policy/docs/grievance_management/policy.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/

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://informatics.mq.edu.au/help/.

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

Graduate Capabilities

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

- Students will gain experience in communicating their understanding in the form of audio-visual presentations, and essay and report writing
- Students will gain experience in working in groups, in assigning and sharing responsibilities.

Assessment tasks

- Assignments (3)
- Exam
- Activity 1 presentation
- Activity 1 presentation
- Activity 2 presentation
- Activity 2 draft submission
- Activity 2 final report
- Active Participation

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

- Students will obtain an overview of the interrelationships between the major theories of physics.
- Students will obtain an appreciation of the two major perspectives on physics: bottom up approaches, constructing microscopic theories based on fundamental interactions applied to increasingly complex systems, and top-down theories which assume general axiomatic constraints regardless of the type of interaction.
- Students will gain experience in integrating disparate areas of physics and mathematics to arrive at an understanding of significant scientific and technological issues affecting the modern world.
- Students will gain experience in communicating their understanding in the form of audio-visual presentations, and essay and report writing
- Students will gain experience in working in groups, in assigning and sharing responsibilities.
- Activities will expose the students to conditions and expectations for students who are either intending to move into a career, or who are intending to go on to postgraduate, research-oriented studies.

Assessment tasks

- Assignments (3)
- Exercises
- Exam
- Activity 1 presentation
- Activity 1 presentation
- Activity 2 presentation
- Activity 2 draft submission
- Activity 2 final report
- Active Participation

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

- Students will obtain an overview of the interrelationships between the major theories of physics.
- Students will obtain an appreciation of the two major perspectives on physics: bottom up approaches, constructing microscopic theories based on fundamental interactions applied to increasingly complex systems, and top-down theories which assume general axiomatic constraints regardless of the type of interaction.
- Students will gain experience in integrating disparate areas of physics and mathematics to arrive at an understanding of significant scientific and technological issues affecting the modern world.

Assessment tasks

- Assignments (3)
- Exercises
- Exam
- Activity 1 presentation
- Activity 1 presentation
- Activity 2 presentation
- Activity 2 draft submission
- Activity 2 final report

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

- Students will obtain an overview of the interrelationships between the major theories of physics.
- Students will obtain an appreciation of the two major perspectives on physics: bottom up approaches, constructing microscopic theories based on fundamental interactions

applied to increasingly complex systems, and top-down theories which assume general axiomatic constraints regardless of the type of interaction.
- Students will gain experience in integrating disparate areas of physics and mathematics to arrive at an understanding of significant scientific and technological issues affecting the modern world.
- Students will gain experience in communicating their understanding in the form of audio-visual presentations, and essay and report writing
- Students will gain experience in working in groups, in assigning and sharing responsibilities.

Assessment tasks

- Assignments (3)
- Exercises
- Exam
- Activity 1 presentation
- Activity 1 presentation
- Activity 2 presentation
- Activity 2 draft submission
- Activity 2 final report
- Active Participation

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

- Students will obtain an appreciation of the two major perspectives on physics: bottom up approaches, constructing microscopic theories based on fundamental interactions applied to increasingly complex systems, and top-down theories which assume general axiomatic constraints regardless of the type of interaction.
- Students will gain experience in integrating disparate areas of physics and mathematics to arrive at an understanding of significant scientific and technological issues affecting the modern world.
- Students will gain experience in communicating their understanding in the form of audio-

visual presentations, and essay and report writing
- Students will gain experience in working in groups, in assigning and sharing responsibilities.

Assessment tasks

- Assignments (3)
- Exercises
- Exam
- Activity 1 presentation
- Activity 2 presentation
- Activity 2 draft submission
- Activity 2 final report

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

- Students will gain experience in communicating their understanding in the form of audio-visual presentations, and essay and report writing

Assessment tasks

- Assignments (3)
- Exercises
- Exam
- Activity 1 presentation
- Activity 1 presentation
- Activity 2 presentation
- Activity 2 draft submission
- Activity 2 final report

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

- Students will gain experience in communicating their understanding in the form of audio-visual presentations, and essay and report writing
- Students will gain experience in working in groups, in assigning and sharing responsibilities.

Assessment tasks

- Assignments (3)
- Exercises
- Exam
- Activity 1 presentation
- Activity 1 presentation
- Activity 2 presentation
- Activity 2 draft submission
- Activity 2 final report
- Active Participation

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 outcomes

- Students will gain experience in integrating disparate areas of physics and mathematics to arrive at an understanding of significant scientific and technological issues affecting the modern world.
- Students will gain experience in communicating their understanding in the form of audio-visual presentations, and essay and report writing
- Students will gain experience in working in groups, in assigning and sharing responsibilities.
- Activities will expose the students to conditions and expectations for students who are either intending to move into a career, or who are intending to go on to postgraduate,

research-oriented studies.

Assessment tasks

- Assignments (3)
- Exam
- Activity 1 presentation
- Activity 2 presentation

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 outcomes

- Students will gain experience in integrating disparate areas of physics and mathematics to arrive at an understanding of significant scientific and technological issues affecting the modern world.
- Students will gain experience in communicating their understanding in the form of audio-visual presentations, and essay and report writing
- Students will gain experience in working in groups, in assigning and sharing responsibilities.
- Activities will expose the students to conditions and expectations for students who are either intending to move into a career, or who are intending to go on to postgraduate, research-oriented studies.

Assessment tasks

- Assignments (3)
- Exam
- Activity 1 presentation
- Activity 2 presentation

Changes from Previous Offering

The second part of the unit involves projects based on popular and technical (research) publications on topics central to the unit, rather than an experimental research project. In response to student comments at the Student Liaison Committee meeting in 2013, the following changes have been made Comment: Too much content & not enough time. Response: Content of the unit has been revised. An extra tutorial has been added each week. The essay and

accompanying presentation for the first half of the unit as been removed. Comment: Students feel they would benefit from weekly exercises. Response: A weekly exercise has been added to the assessment tasks

Feedback

Student Liaison Committee

The Physics Department values quality teaching and engages in periodic student evaluations of its units, external reviews of its programs and course units, and seeks formal feedback from students via focus groups and the Student Liaison Committee. Please consider being a member of this committee, which meets once during the semester (lunch provided), with the purpose of improving teaching via student feedback. The class will be asked to nominate two students as representatives for the PHYS310 unit on the student liaison committee. This nomination process will be conducted during lectures and the lecturer will forward the names to the Head of Department. The SLC meetings are minuted and student representatives receive copies of the minutes from the two preceding SLC meetings prior to the meeting. An update on the responses that have been made by the department to the feedback obtained at the two preceding SLC meetings are reported by the Head of Department at the beginning of each SLC meeting. These responses are also minuted. The feedback is acted upon in a number of ways mostly initiated via Department of Physics and Astronomy meetings, where decisions on actions are taken.

For responses to the 2013 SLC meeting comments on PHYS310, see `Changes from previous offering'.

Report Information and Guidelines

The Reports for the portfolio have prescribed parts. Students have the flexibility to add additional material but should do so after the compulsory parts have been included.

- In their reports students should focus on the science and technology.
- Whenever possible, constitutive equations must be given. We expect that students at this stage should be able to identify physics behind the technology.
- Reports must have some quantitative component such as numerical problems – they need to be posed by students and solved.
- Bonus points will be awarded for reports which have some MATLAB or Mathematica simulations.
- Bonus points will be also given for drawing information by interviewing at external organisations (potential employers...)
- Reports could (but do not have to) include discussion of society impact. Any such material must be based on **quality multiple evidence** and with high level of critical analysis and assessment. Students should carefully screen for potential bias in the sources of information used. If any statistics are quoted, then at least two independent

sources should be given. Critical evaluation of information sources is essential part of this kind ofanalysis.

- Each Portfolio Report should be between 1500 and 2500 word in length (excluding figure captions and references).
- Submission of report 1 will require a brief (~10 mins) `no prompts' presentation to the class.
- Reports 2 and 3 will be concluded by a 15 min powerpoint presentation regarding an energy topic of your choice. After these presentations students will swap information and correct/supplement their reports, before final submission for assessment.
- Your reports will be based on library/internet research. Upon completing your reports, you should have some awareness of real industry/business problem(s) in the area of energy and be the technical, economic and policy expert on the topic that you have chosen.

Report 1: Energy in the universe

issues to be covered:

- Energy production in the stars on the example of Sun, nuclear fusion

- energy transport from a star to a planet - free space transport but the possibility of absorption/scattering
- energy storage by planets –
- distribution of energy within a planet atmosphere
- greenhouse effect
- climate modeling

Report 2: Energy in society

Conventional energy sources.

Select one topic from the list. Please make sure that all topics have been selected by the class. Several students may choose the same topic.

1. Thermal (coal, gas) Power Plants. (Also including Transport of electric energy – how do we send energy from the power plant to the home? What are the energy losses, how these are minimised?

2.2 .Nuclear Power Generation (nuclear fusion)

1. 2.3 Hydroelectric Power
2. Also including Storage of electric energy -this will cover for example, battery

technologies andany other methods to store electricity..National and international system of energy distributionwould also be an interesting subject to discuss.

Students may (but do not have to) discuss issues such as CO2 generation, impact of open coal mines on the environment and/or spent nuclear fuel. If they choose to do so, they should describe technologies to moderate their impact.

Your report should also include a comparison of your chosen energy source with other conventional energy sources. This section of your report will draw on the material collected by your colleagues (this will be presented at the talk session).

Report 3 (Renewable/sustainable energy)

1. 3.1.. Solar Thermal Energy Conversion,
2. 3.2.Photovoltaic Power Generation,
3. 3.3.Geothermal Energy and Energy from Hydrogen

Those who feel they do not have enough material may choose to add material from thefollowing list :

3.5 Biomass Energy, ocean and wind energy.

Reports 2 and 3 could address questions such as

- Where do we get our existing energy supplies and what are the costs and benefits of conventional energy sources?
- What are the technical, cost and fundamentals of commercialized and emerging renewing energy technologies?
- How can we measure the cost and technical performance of renewable energy technologies?
- What are the obstacles and limitations to the widespread use of renewable technologies?

Your report should also include a comparison of your chosen energy source with other renewable energy sources. This section of your report will draw on the material collected by your colleagues (this will be presented at the talk session).

Life-sustaining energy

One page reflection sheet may include the following information:

Fossil Fuels Cycle

Requirements in order to complete the unit satisfactorily

Satisfactory performance in all assessment components of this unit is required.

To pass the unit, students must obtain satisfactory assessments on assignments, on the reports and presentations, and perform at a satisfactory level in the mid-session examination.

Standards Expectation

Grading

An aggregate standard number grade (SNG) corresponding to a pass (P) is required to pass this unit.

High Distinction (HD, 85-100%): provides consistent evidence of deep and critical understanding in relation to the learning outcomes. There is substantial originality and insight in identifying, generating and communicating competing arguments, perspectives or problem solving approaches; critical evaluation of problems, their solutions and their implications; creativity in application.

Distinction (D, 75-84%): provides evidence of integration and evaluation of critical ideas, principles and theories, distinctive insight and ability in applying relevant skills and concepts in relation to learning outcomes. There is demonstration of frequent originality in defining and analysing issues or problems and providing solutions; and the use of means of communication appropriate to the discipline and the audience.

Credit (Cr, 66-74%): provides evidence of learning that goes beyond replication of content knowledge or skills relevant to the learning outcomes. There is demonstration of substantial understanding of fundamental concepts in the field of study and the ability to apply these concepts in a variety of contexts; plus communication of ideas fluently and clearly in terms of the conventions of the discipline.

Pass (P, 50-65%): provides sufficient evidence of the achievement of learning outcomes. There is demonstration of understanding and application of fundamental concepts of the field of study; and communication of information and ideas adequately in terms of the conventions of the discipline. The learning attainment is considered satisfactory or adequate or competent or capable in relation to the specified outcomes.

Fail (F, 0-49%): does not provide evidence of attainment of all learning outcomes. There is missing or partial or superficial or faulty understanding and application of the fundamental concepts in the field of study; and incomplete, confusing or lacking communication of ideas in ways that give little attention to the conventions of the discipline.