



Engineering for Sustainable Development (MECH 4400)

Semester 1 2007

Credit: 6 points

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Updated 28th February 2007 (No supplementary exam available)

UNIT DESCRIPTION

Your Lecturers

James Trevelyan has about 20 years of experience as a professional engineer working in aerospace, defence and industrial research. He has been a full-time academic since 1992 though his association with teaching at UWA goes back to 1975. His current research is a study of engineering practice, particularly in maintenance and asset management. Before then he spent several years working on landmine clearance and water supply problems in the developing world, particularly in Pakistan. Internationally he is best known for the development of robots for shearing sheep between 1977 and 1992, what was then the largest single research project at The University of Western Australia.

Margot Jupp has worked the last 20 years in the minerals and gas industry. Margot received her degree in Chemical Engineering from Queen's University in Canada. She has worked as a chemical engineer and an environmental engineer in the mineral sands, alumina, and gas industries in Canada, Denmark and Australia.

Unit content

This course aims to introduce you to real engineering practice in which the details of technical solutions are often the least important decision that you will have to make. To date the majority of the course work you have done has prepared you to answer some narrow technical questions of engineering. For excellence in engineering it is essential you incorporate people constraints, economics and environmental issues into design and other engineering decisions. This course will introduce you to the aspects that you will have to address in your careers as engineers. Sustainable engineering means taking these aspects into account in a systematic manner and we will show you some of the tools you will need to do this effectively.

This unit will cover the following tools:

- Communication – both formal and interpersonal
- Management Systems (ISO 14001, 18000 and 9000)
- Risk Management
- Project Management

These tools will be put into practise through tutorial assignments and 2 study projects. Through these projects you will also be introduced to typical engineering project stakeholders and their different perspectives regarding sustainability.

Important stakeholders for which issues will be investigated include:

- Corporations (board of Directors, shareholders)
- Employees (operators/maintainers, engineers, management, legal, finance)
- Government (State - DEC DIOER, Commonwealth, multinational institutions)
- Community (action groups, individuals, other industry, NGOs and government as a representative of the people)

Learning outcomes

On completion of this unit, you should be able to:

- Understand that engineering requires co-ordinated work with lots of people involved.
- Understand the some of the stakeholders involved in project development and appreciate the conflicting pressure generated.
- Understand and contribute to contemporary debates on environmental and social sustainability.
- Understand the principles of negotiation and influencing.
- Understand the fundamentals of risk communication.
- Know the basic elements of engineering process management systems.
- Understand and be able to perform a basic risk assessment.
- Understand the basics of project management.
- Understand the ethical responsibilities of engineers, particularly on social and environmental issues.
- Understand that an engineer is not expected to know everything nor be able to do everything but needs to know whom to ask for help.
- Improve your team work skills.

CLASSES

Lectures (Mon, Wed, Thur at 12 noon)

There are 3 lectures per week by industry and university speakers. Lectures will be recorded when possible, but students should make every effort to attend and participate.

Two students will be selected at each industry lecture to have lunch with the guest speaker at the UWA club: one on performance in tutorial exercises and one by random chance.

You will be asked to help transcribe important lectures from time to time. This will be done collaboratively as a tutorial group exercise using WebCT6 to coordinate the work. Each student will be required to transcribe (or check) about 4 minutes of the lecture. Details will be provided when needed. You will receive credit towards the final unit mark for your contributions.

Tutorials (Thur, Fri)

Tutorials will run through the semester from the second week. Attendance is strongly recommended. There is a choice of times on Thursdays and Fridays.

Register your tutorial preference on the OLCR system as soon as possible (see timetable web page <http://www.timetable.uwa.edu.au/>).

- Tutorial exercises will be based on lectures and text book
- From week 7 onwards, the tutorial groups will facilitate participation in the simulated major project negotiations.
- Participation will be worth 5% of total unit assessment and tutorial exercises another 10%.

Project & Team Meetings (Wed afternoons)

These meetings start later in the semester. They provide an opportunity for team meetings. You will participate in the Radioactive Waste Water Transport project and simulated major project negotiation in teams.

The face-to-face meetings for the negotiations will also take place on Wednesday afternoons.

Practicals – (2 Friday afternoons)

The aim of this project is to transport simulated radioactive waste water across the UWA campus to a disposal site in an environmentally and socially responsible manner. This is the first major piece of assessed work for this unit.

There will be two practicals on Friday afternoons. Both will require 2 – 3 hours work.

The first practical in about week 4 of the semester will provide time for you to survey parts of the UWA campus for the Radioactive Water Transport project for your team. The second will be to conduct the Radioactive Waste Water Transport project.

During the second practical after the mid-semester break you will help transport the waste water.

You will work in a team for this project : the teams will be created from the tutorial groups.

CONTACT DETAILS

Note that all written communication with lecturers and tutors should be conducted through WebCT. Only use WebCT E-mail for personal matters: all other questions should be asked through the WebCT discussion forums so others can see and contribute to the responses.

Lecturers:

James Trevelyan (<http://www.mech.uwa.edu.au/jpt/>), room 2.64, tel 3057

Margot Jupp, room G.55, tel 1806

Tutors

Philippa O'Neill, room 2.14, tel 8572

Sabbia Tilli, room G.32, tel 3058

Sule Nair, room G.38, tel 3601

Vinay Domal room 1.63 tel 3608

Shan Varghese, room 1.20 tel 4748

RIGHTS AND RESPONSIBILITIES

Use of student feedback

WebCT will provide an anonymous feedback discussion forum which you can use to make comments on how the course could be improved. SURF, SPOT and possibly other surveys will be used to collect your evaluation of the course.

Charter of student rights

This Charter of Student Rights upholds the fundamental rights of students who undertake their education at the University of Western Australia.

It recognises that excellence in teaching and learning requires students to be active participants in their educational experience. It upholds the ethos that in addition to the University's role of awarding formal academic qualifications to students, the University must strive to instil in all students independent scholarly learning, critical judgement, academic integrity and ethical sensitivity.

Please refer to the guild website the full charter of student rights, located at http://www.guild.uwa.edu.au/info/student_help/student_rights/charter.shtml.

Student Guild contact details

The University of Western Australia Student Guild
35 Stirling Highway
Crawley WA 6009
Phone: (+61 8) 6488 2295
Facsimile: (+61 8) 6488 1041
E-mail: enquiries@guild.uwa.edu.au
Website: <http://www.guild.uwa.edu.au>

Ethical Scholarship, Academic Literacy and Academic Misconduct

Ethical scholarship is the pursuit of scholarly enquiry marked by honesty and integrity.

Academic Literacy is the capacity to undertake study and research, and to communicate findings and knowledge, in a manner appropriate to the particular disciplinary conventions and scholarly standards expected at university level.

Academic misconduct is any activity or practice engaged in by a student that breaches explicit guidelines relating to the production of work for assessment, in a manner that compromises or defeats the purpose of that assessment. **Students must not engage in academic misconduct.** Any such activity undermines an ethos of ethical scholarship. Academic misconduct includes, but is not limited to cheating, or attempting to cheat, through:

- Collusion
- Inappropriate collaboration

- Plagiarism
- Misrepresenting or fabricating data or results or other assessable work
- Inappropriate electronic data sourcing/collection
- Breaching rules specified for the conduct of examinations in a way that may compromise or defeat the purposes of assessment.

Penalties for academic misconduct vary according to seriousness of the case, and may include the requirement to do further work or repeat work; deduction of marks; the award of zero marks for the assessment; failure of one or more units; suspension from a course of study; exclusion from the University, non-conferral of a degree, diploma or other award to which the student would otherwise have been entitled.

Refer to the [Ethical Scholarship, Academic Literacy and Academic Misconduct](#) and to the faculty policy at <http://www.ecm.uwa.edu.au/for/students/plagiarism>.

Appeals against academic assessment

If students feel they have been unfairly assessed, they have the right to appeal their mark by submitting an Appeal Against Academic Assessment form to the Head of School and Faculty Office. See the faculty policy at: <http://www.ecm.uwa.edu.au/for/students/exams>).

The form must be submitted within **twelve working days** of the formal despatch of your unit assessment. It is recommended that students contact the Guild Education Officers to aid them in the appeals process. They can be contacted on +61 8 6488 2295 or education@guild.uwa.edu.au. Full regulations governing appeals procedures are available in the University Handbook, available online at <http://www.publishing.uwa.edu.au/handbooks/interfaculty/PFAAAA.html>.

ASSESSMENT

Full details on the requirements for each aspect of assessment will be provided with handouts. This is only a summary.

Item	Weight(%)
Tutorial exercises, transcriptions, participation.	15
Radioactive water transport operational plan (late March)	20
Bluewater energy project	
Position Paper (late April)	10
Agreement (late May)	5
Personal experience (late May)	10
Examination (June)	40
Total	100

The examination will consist of:

- a) A short answer section testing your knowledge of sustainability issues, engineering responses, and current debates (see news media), and
- b) an essay on a sustainability-related engineering issue such as sustainable water supplies and distribution. The choice of topics will be announced several weeks before the final examination, and tutorial exercises will contribute towards your preparation for the examination.

This unit's marks may be scaled in line with the Faculty of Engineering, Computing and Mathematics policy on Assessment Practices and Procedures. See: <http://www.ecm.uwa.edu.au/for/students/assess>.

There will be no supplementary examinations will be available for this unit

Late Submission Penalties

A penalty of 10% per week or part thereof may be applied to any late assignment submissions, up to a maximum of 30%. A 40% penalty will apply if submissions are handed in after other students have received their marked work back. These penalties may be waived or reduced in cases of sickness or other special circumstances, and written evidence must be submitted to the faculty office (and a brief note summarising the circumstances must be sent to the unit coordinator). If you read this sentence, please send a WebCT E-mail to James Trevelyan with the subject line "red swallow".

TEXTBOOK(S) & RESOURCES

Unit Website

<http://www.mech.uwa.edu.au/unit/MECH4400/>

Required text

K. C. Hargroves and M. H. Smith, eds. *The Natural Advantage of Nations*.
Paperback ed. 2005, Earthscan: London.

Copies of this text will be available in the Mathematics and Physical Sciences Library.

Additional Reading

Gore, A. (2006) *An Inconvenient Truth*. (Film or book)

Jared Diamond (2005), *Collapse- How Societies Choose to Fail or Succeed*

Tim Flannery (2005), *Weathermakers*

Paul Kennedy (1993), *Preparing for the 21st Century*

Additional resources & reading material

Journals

- IEAust Environmental Engineering Journal
- Engineers Australia

Databases

- Factiva – newspaper articles

UNIT CONTENT – INSTITUTION OF ENGINEERS OUTCOMES

Ability to apply knowledge of basic science and engineering fundamentals	Practical exercise reinforces this ability.
Ability to communicate effectively, not only with engineers but also with the community at large	Assessed through practical exercise and simulated negotiations.
In-depth technical competence in at least one engineering discipline	Required for the course.
Ability to undertake problem identification, formulation and solution	Assessed through practical exercise and simulated negotiations.
Ability to utilise systems approach to design and operational performance	Assessed through practical exercise and simulated negotiations.
Ability to function effectively as an individual and in multi-disciplinary and multi-cultural teams, with the capacity to be leader or manager as well as an effective team member	Assessed through practical exercise and simulated negotiations.
Understanding of the social, cultural, global and environmental responsibilities of the professional engineer and the need for sustainable development	Assessed through practical exercises and examination.
Understanding of the principles of sustainable design and development	Assessed through practical exercises and examination.
Understanding of professional and ethical responsibilities and commitment to them	Assessed through practical exercises and examination.
Expectation of the need to undertake life-long learning and capacity to do so	Most of the technical information you need to complete the project work is not explicitly covered in lectures and tutorials. You need to be able to find this for yourself and in doing so you will acquire self-learning skills that will be essential for you as an engineer.

UNIT CONTENT – UWA ENGINEERING OUTCOMES

Engineering-specific Generic Skills	
Appreciation of Engineering beyond the narrow discipline; ability to develop links between different areas.	Management systems content address this issue - the need to understand function in the broader engineering context before deciding how to implement function.
Appreciation of the changing nature of the	Addressed in case studies

engineering context.	
Understanding of non-technical constraints in achieving engineering solutions.	Practical, simulated negotiation exercise.
Human interface skills.	Risk communication content.
Understanding of professional and ethical responsibility and of the impact of engineering solutions in a global and societal context.	Whole course addresses this issue.
Understanding the nature, needs, and importance of research, both fundamental and applied.	Research feeds into the unit – students are required to read research results.
Project management skills, including environmental, financial and human factors.	Project work in practicals builds skills for project management
Design skills.	Not applicable
Instrumentation and data processing skills.	Not applicable
Risk management skills.	Practical exercise covers this issue.
Technical Skills	
Understanding of dimensions of physical and engineering quantities; ability to make order-of-magnitude estimates.	Not applicable
Understanding the difference between analog and digital.	Not applicable
Understanding the difference between continuum and discrete.	Not applicable
Ability to develop a simplified physical and/or mathematical model of a phenomenon or a process.	Not applicable
Visualisation and graphics skills.	Skills are reinforced in design and practical exercises and reports
Appropriate practical "workshop" skills.	Practical exercise provides an opportunity for this.
Programming and computing skills.	Not applicable
Basic mathematical skills (see Attachment).	Not applicable
Appreciation of Mechanics, Electronics and Signal Processing.	Not applicable
Knowledge and understanding of principal physical and chemical properties of matter.	Not applicable
Understanding health and safety issues.	Practical provides direct exposure to this.
Understanding codes and specifications.	Practical provides direct exposure to this.
Understanding of legislative aspects of engineering activities.	Practical provides direct exposure to this.

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REVISION HISTORY

Revision	Description	Date	Prepared by
1	2007 Course	Jan 2007	M Jupp
2	2007 Course	Feb 2007	J Trevelyan
3	2007 Course	Feb 28 2007	J Trevelyan