SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING

SESSION 1, 2009

CVEN9892 Sustainability Assessment and Risk Analysis in Water and Energy Systems Planning

COURSE DETAILS

Units of Credit 6
Contact hours 3 hours per week. For each hour of contact it is expected that a student will put in at least 1.5 hours of private study.

Class Tuesday, 15:00 – 16:00 Room: Mathews 310 (K-F23-310)
Tutorial Tuesday, 16:00 – 18:00 Room: Mathews 310 (K-F23-310)

Course Coordinator and Lecturer Greg Peters
email: g.peters@unsw.edu.au
office: Room 112, Vallentine Annex

Additional Lecturers Ben van den Akker
Email: b.vandenakker@unsw.edu.au
Stuart Khan
Email: s.khan@unsw.edu.au
Deo Prasad
Email: d.prasad@unsw.edu.au
Muriel Watt
Email: m.watt@unsw.edu.au
Hazel Rowley
Email: h.rowley@unsw.edu.au

INFORMATION ABOUT THE COURSE

This course will deepen and apply skills learned in CVEN1701 Environmental Principles and Systems. It also shares and deepens some material in CVEN4727 Environmental Engineering Practice. There are no specific prerequisites for this course but it assumes some familiarity with water supply technologies, will involve computational activities and is aimed at students with an undergraduate degree in engineering.

HANDBOOK DESCRIPTION

The design of water and energy systems has advanced from a cost-benefit basis to the incorporation of quantitative assessments of environmental burdens and the human and environmental risks associated with competing options. This course will equip students with the ability to apply life cycle assessment for quantifying environmental burdens, and an understanding of the factors that define human health and environmental risks. The latter include the presence of chemicals and pathogenic organisms, and the reliability of engineered systems.

OBJECTIVES

This course aims to foster:
• Capacity for analytical and critical thinking and for creative problem solving
• Ability to engage independent and reflective learning
• Skills for collaborative and multi-disciplinary work
• A respect for ethical practice and social responsibility

EXPECTED LEARNING OUTCOMES
At the end of this course, students should be able to complete a simple life cycle assessment using professional software. They should also have a practical understanding of other quantitative options evaluation methods including life cycle costing and quantitative risk assessment.

ASSESSMENT

Students will need to actively project manage their assignment work in order to gain a good mark in the major assignment. Students should expect to spend a significant amount of time working with their team partner to develop their major project.

Students will be assessed throughout the course with assessments linked to a selection of weekly activities. The intent of the earlier assessments will be to check students are gaining basic skills. The major assignment and the exam will test the students’ ability to synthesise the overall course. All material presented during the session, including by guest lecturers, will be examinable in the exam unless otherwise noted.

The formal exam scripts will not be returned. Students who perform poorly in the quizzes and tutorials are recommended to discuss progress with the lecturer during the session.

The Course Coordinator reserves the right to adjust the final scores by scaling if agreed with the Head of School.

Details of each assessment component, the marks assigned to it, the criteria by which marks will be assigned, and the dates of submission are set out below.

ASSIGNMENT POLICIES

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Issue in</th>
<th>Due by 5 pm on</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Major project*</td>
<td>week 1</td>
<td>Friday 5 June</td>
<td>30%</td>
</tr>
<tr>
<td>2. Cost assignment</td>
<td>week 3</td>
<td>Monday 30 March</td>
<td>10%</td>
</tr>
<tr>
<td>3. LCI assignment</td>
<td>week 4</td>
<td>Monday 6 April</td>
<td>10%</td>
</tr>
<tr>
<td>4. Exam</td>
<td>Check schedule</td>
<td>50%</td>
<td></td>
</tr>
</tbody>
</table>

* Group work – the others are individual assessments.

Marking criteria:

All assignments will be marked on the basis of whether the student demonstrates an understanding of the material. Where numerical errors can be identified as simple slips, penalties will not be as large as when errors appear to be a result of a conceptual misunderstanding, or the source of the error is difficult to determine from the working. The major assignment will be additionally assessed with respect to the depth of the analysis, the breadth of its consideration of the question at hand and the clarity of the way in which the answer is presented.

How to submit:

Assignments should be submitted before 2 pm. Assignments should be printed out and deposited in my assignment box in the Civil and Environmental Engineering Building. Take the elevator to the 4th floor of the building, turn right on exiting the elevator and walk to the end of the corridor – its on your right hand side.

Late submission:

Penalties will be applied for late submission. Late work will be penalised at the rate of 10% of the assignment mark per day after the due time and date have expired. If you are sick to the point where you can obtain a doctor’s certificate, this should either be submitted to me or the school office.
MAJOR PROJECT

In the major project, you will carry out elements of a quantitative environmental assessment comparing two engineered systems. This will include a preliminary life cycle assessment and a simple quantitative microbial or chemical risk assessment. Projects will be completed in teams of two students. Teams will pick an enduse for recycled water from the following list of theoretical possibilities:

1. irrigation of private agricultural land
2. irrigation of a municipal sporting field
3. irrigation of household gardens
4. all household outdoor uses (gardens; swimming pools; car-washing...)
5. flushing household toilets
6. flushing household toilets and washing clothes
7. use by household hot water services
8. use by households via an indirect potable scheme
9. use by households via a direct reuse scheme

If you are dealing with households, consider a new suburb of 10,000 people to be constructed on the fringe of a coastal city. Decide whether you want to analyse a centralised supply system or a decentralised system. Do background reading on recycled water treatment and reverse osmosis seawater desalination technologies. Consider the need to transport water from source to your enduse. Consider the need for water storage. Consider the environmental burdens of the treatment process.

Compare the recycled water supply system with the alternative of centralised reverse osmosis seawater desalination based on the life cycle greenhouse gas emissions and the health risk posed by a relevant microbe or a chemical of the two options.

Students will recognise that these system descriptions are very simple, and that individual teams will have to use their research skills, imagination and commonsense to flesh-out the details of the options to the point where LCA and RA can be applied to each. For the RA, students are advised to pick a contaminant of relevance to both systems.

Guidance on the application of LCA may be sought from Greg Peters. Guidance on the application of microbial or chemical risk analysis may be sought from Ben van den Akker or Stuart Khan respectively.

The report should include the following sections:

- System descriptions
  - Option A
  - Option B
- Life cycle assessment
  - Goal and scope
  - Life cycle inventory
  - Life cycle impact assessment
  - Interpretation
- Risk assessment
  - Contaminant prevalence
  - Barriers
  - Exposure assessment
  - Dose-Response assessment
  - Risk Characterisation
- Conclusions
## COURSE PROGRAM

### SESSION 1 2009 (2 March – 5 June)

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Lecture topic</th>
<th>Tutorial</th>
<th>Lecturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10 March</td>
<td>Practical Sustainability Frameworks</td>
<td>Team formation</td>
<td>Greg Peters</td>
</tr>
<tr>
<td>2</td>
<td>17 March</td>
<td>The role of quantification in social debates</td>
<td>Examples from the media</td>
<td>Greg Peters</td>
</tr>
<tr>
<td>3</td>
<td>24 March</td>
<td>Costing and pricing resources</td>
<td>Levelised costing</td>
<td>Greg Peters</td>
</tr>
<tr>
<td>4</td>
<td>31 March</td>
<td>Life cycle inventory analysis - LCI</td>
<td>LCI examples</td>
<td>Greg Peters</td>
</tr>
<tr>
<td>5</td>
<td>7 April</td>
<td>Input-output based LCA</td>
<td>Application of IOA</td>
<td>Hazel Rowley</td>
</tr>
<tr>
<td>6</td>
<td>21 April</td>
<td>Life cycle impact assessment - LCIA</td>
<td>GaBi software explained</td>
<td>Greg Peters</td>
</tr>
<tr>
<td>7</td>
<td>28 April</td>
<td>Approaches to MCA</td>
<td>Gabi software laboratory</td>
<td>Greg Peters</td>
</tr>
<tr>
<td>8</td>
<td>5 May</td>
<td>Risk assessment frameworks / Qualitative MRA</td>
<td>RA tutorial</td>
<td>Ben van den Akker</td>
</tr>
<tr>
<td>9</td>
<td>12 May</td>
<td>MRA: dose-response and risk characterisation</td>
<td>MR characterisation</td>
<td>Ben van den Akker</td>
</tr>
<tr>
<td>10</td>
<td>19 May</td>
<td>Quantitative chemical risk assessment</td>
<td>QCRA calculations</td>
<td>Stuart Khan</td>
</tr>
<tr>
<td>11</td>
<td>26 May</td>
<td>Sustainable power systems and energy payback</td>
<td>Assessing power systems</td>
<td>Muriel Watt</td>
</tr>
<tr>
<td>12</td>
<td>2 June</td>
<td>Sustainable built environments and ratings tools</td>
<td>Assessing buildings</td>
<td>Deo Prasad</td>
</tr>
</tbody>
</table>
**RELEVANT RESOURCES**


6. Building related resources:
   
   
   
   
   
   
   f. GB Tool – Green Building Challenge [http://www.greenbuilding.ca](http://www.greenbuilding.ca) (Follow the GBC Links)
   
   
   h. US Green Building Council - Green Building Rating Scheme LEED (Leadership in Energy and Environmental Design) [www.usgbc.org](http://www.usgbc.org)
   
   i. U.K. BREEM (Building Research Establishment Environmental Assessment Method) and EcoHomes [http://www.bre.co.uk/services/BREEAM_and_EcoHomes.html](http://www.bre.co.uk/services/BREEAM_and_EcoHomes.html)


14. See also papers II and IV referred to in this thesis for barrier and exposure characterisation respectively.
COMMON SCHOOL INFORMATION

Common School information may be found at:


To navigate to this website from the Civil and Environmental Engineering School Home page:
-> Current Students -> General Information -> Common School Info for Undergraduate Students

The Common School Information site has information on the following:

1. Dates to Note - important dates relating to enrolling and disenrolling, and a University website (via MyUNSW) with a calendar of other important UNSW dates (session dates, recess weeks, stuvac dates and exam periods).

2. School Contacts
   i. for enrolment or timetable difficulties,
   ii. referral chain of contacts for course difficulties:
      Course Coordinator/Lecturer -> Year Coordinators -> Grievance Officer,
   iii. Advanced Standing, and
   iv. Mentoring.

3. Course Requirements
   i. attendance at lectures, tutorials and laboratory classes,
   ii. participation in tutorials, and
   iii. completion of assessment work.

4. Notes on Assessment
   i. plagiarism (with link to UNSW Learning Centre web site on plagiarism),
   ii. keep a copy of written submissions,
   iii. submitting assignments, and
   iv. late submissions (obtaining extensions and special consideration)

5. Supplementary Exams – includes link to School website with School policy on supplementary exams.
   i. Special Consideration – includes link to UNSW website (New South Q) for downloading forms, requirements for lodging special consideration forms.

6. Solutions to Problems – Troubleshooters
   i. Learning Centre,
   ii. student counsellors, and
   iii. student support services.

7. CEVSOC – student committee membership and link to (unofficial) student CEVSOC website.