Class Registrar: Dr Richard Lord

Taught To (Course):
- 5th year MEng Civil Engineering
- 5th year MEng Civil & Environmental Engineering
- 5th year MEng Structural and Architectural Engineering
- MSc in Civil Engineering

Other Lecturers Involved: Mr Andrew Briggs

Credit Weighting: 40

Semester: 1 & 2

Assumed Prerequisites: BEng 2/1 Hons in Civil Engineering or equivalent

Compulsory class

Academic Level: 5

Class Format and Delivery (hours):

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Tutorial</th>
<th>Laboratory</th>
<th>Project</th>
<th>Assignments</th>
<th>Private Study</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>16</td>
<td>16</td>
<td></td>
<td>150</td>
<td>218</td>
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Educational Aim

This class aims to develop ability at multi-disciplinary design, working in small groups, utilising knowledge of fundamental principles of engineering science and material science to create innovative solutions.

This module includes two multidisciplinary projects, a renewable energy project and an industrial project. Students choose one of these projects to work on.

Renewable Energy Project
The project takes in the full breadth of the civil engineering profession from concept to detailed design, from political drivers to financial viability, from environmental issues to technical risk. Students will develop comprehensive and innovative designs that involve structural engineering, geotechnical engineering and water engineering, management, environmental and financial planning.

Industrial Project
In semester 1, the industrial project covers the conceptual design for the civil engineering works required to convert a redundant shipyard into a construction port facility for offshore renewable energy projects. Students will develop holistic conceptual designs which integrate structural engineering, geotechnical engineering, environmental engineering and coastal engineering to create a modern sustainable solution. Semester 2 covers the detailed structural design for the workshop building and dry dock plus aspects of professional practice including design planning and design fees.

Learning Outcomes

On completion of the class the student is expected to be able to

LO1  Apply their knowledge and understanding of mathematics, science and computer based methods to analyse and solve a substantial range of engineering problems.

LO2  Evaluate and synthesize design concepts from a range of areas including some outside engineering and apply them creatively and effectively in engineering projects.

LO3  Research new theories, concepts, models, methods and information in unfamiliar situations, working independently and as a team to plan, delegate and collaborate, to deliver a design project to schedule.

LO4  Apply engineering techniques taking account of a range of commercial and industrial constraints and communicate the resulting design to the client in an appropriate level of technical detail.

(UK SPEC suggests no more than 4 learning outcomes per class. Statements must be broad and be syllabus free and link in with the intended learning outcomes on the course specifications.)
Syllabus

The class will teach the following:

**RENEWABLE ENERGY PROJECT**

The project work will focus on the following themes:

**Background**
- The strategic, political and financial case for development of renewable energy resources
- The available energy resources and technology to harvest the energy
- The current state of the industry, the opportunities and constraints

**The Scheme**
- Energy yield, costs and financial viability
- Outline engineering solution including project planning
- Analysis of loadings and design of members and foundations/anchorages
- Technical risks and mitigation measures
- Outline and detailed civil and structural design of aspects of a shoreside construction/storage facility

**INDUSTRIAL PROJECT**

The project work will focus on the following themes:
- Integrated design
- Optimisation of structural designs
- Engineering professional practice
- Conceptual and detailed structural design
- Interpretation of factual ground investigation reports and preparation of recommendations for foundations, retaining walls and remediation measures
- Sustainability
- Architectural technology
- Coastal engineering

Reports for both projects will be assessed on understanding and competence in these areas as well as the team’s ability to bring all of these aspects together into a coherent and well written report.

Assessment of Learning Outcomes

**Criteria**

For each of the Class Learning Outcomes the following criteria will be used to make judgements on student learning:

[Note: Criteria break the LO down into ‘teachable’ elements but do not become syllabus orientated i.e. no mention of CAD package names, components etc.]

**RENEWABLE ENERGY PROJECT**

**LO1** Apply their knowledge and understanding of mathematics, science and computer based methods to analyse and solve a substantial range of engineering problems.

C1 Apply mathematical models to devise appropriate structural or geotechnical designs
C2 Apply scientific principles to evaluate environmental impacts of a project
C3 Apply computer based models to solve design challenges

**LO2** Evaluate and synthesize design concepts from a range of areas including some outside engineering and apply them creatively and effectively in engineering projects.

C1 Evaluate the political, economic and environmental factors affecting energy production in Scotland
C2 Evaluate the applicability and potential of a range of renewable energy generation technologies
C3 Identify opportunities for renewable energy development for particular technologies and a shortlist of potential sites
LO3  Research new theories, concepts models, methods and information in unfamiliar situations, working independently and as a team to plan, delegate and collaborate, to deliver a design project to schedule.

C1 Identify knowledge gaps and seek appropriate sources of information
C2 Identify component tasks and delegate workloads between group members
C3 Coordinate the combination of tasks and informally review the combined results to meet deadlines

LO4  Apply engineering techniques taking account of a range of commercial and industrial constraints and communicate the resulting design to the client in an appropriate level of technical detail.

C1 Estimate costs, timescales and revenue from a proposed design and evaluate the probability of variation due to key risk factors
C2 Evaluate likely project risks and appropriate mitigation measures

INDUSTRIAL PROJECT

LO1  Apply their knowledge and understanding of mathematics, science and computer based methods to analyse and solve a substantial range of engineering problems.

C1 Detailed understanding of structural behaviour and geotechnical principles
C2 Ability at carrying out analysis of structural steelwork, reinforced concrete and settlement of soils utilising both hand calculations and computer software
C3 Ability at deriving loadings applied to structures

LO2  Evaluate and synthesize design concepts from a range of areas including some outside engineering and apply them creatively and effectively in engineering projects.

C1 Able to develop a complex design brief
C2 Able to develop creative conceptual proposals for a range of different types of civil engineering works based on a deep understanding of engineering principles
C3 Able to extract data pertinent to an unfamiliar problem and apply it to develop a solution
C4 Ability at option analysis
C5 Able to create an holistic integrated design incorporating several different types of civil engineering works

LO3  Research new theories, concepts models, methods and information in unfamiliar situations, working independently and as a team to plan, delegate and collaborate, to deliver a design project to schedule.

C1 Knowledge of coastal engineering including dredging
C2 Ability at optimising structural steelwork design
C3 Knowledge of guidance and procedures used to integrate recognised principles of enhancing the sustainability rating of a project

LO4  Apply engineering techniques taking account of a range of commercial and industrial constraints and communicate the resulting design to the client in an appropriate level of technical detail.

C2 Ability at developing, monitoring and updating a programme of work
C3 Knowledge of engineering professional practice including professional fees and specialist contractor designs
C4 Understanding of the role of a civil engineer and a structural engineer working on a multi-disciplinary project

The standards set for each criterion per Class Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.
12 Principles of Assessment and Feedback
(on Learning & Teaching web pages: [www.strath.ac.uk/learnteach/teaching/staff/assessfeedback/12principles/](www.strath.ac.uk/learnteach/teaching/staff/assessfeedback/12principles/))

Please state briefly how these are incorporated in this class.

- The project activities are spread throughout both semesters
- Feedback to each group is given on a weekly basis so that they have the opportunity to improve their work on an ongoing basis.
- The design reviews/presentations at the end of each phase have minimal marks but allows feedback to be given at these key points in the projects so that students can incorporate the advice given into their conceptual design report.
- The group projects encourage peer dialogue covering many issues and also, structured discussion with the teacher.
- Assessment covers a range of skills and abilities (oral presentations, writing, sketching, structural calculations and autocad drawings) so that students who have strengths in some skills, but not others, can still do well in this class.
- Coursework is broken down into the specific topics to be covered and the proportion of the overall marks allocated to each topic is specified.
- Examples of the presentation standard required for calculations and engineering drawings plus model answers to assignments in earlier years are provided on MyPlace.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

<table>
<thead>
<tr>
<th></th>
<th>Examinations</th>
<th>Courseworks</th>
<th>Projects</th>
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<tr>
<td><strong>L/Outcomes</strong></td>
<td>Number</td>
<td>Duration</td>
<td>Weighting</td>
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<td>L01, L02, L03 &amp; L04</td>
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Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.

**Coursework / Submissions deadlines:**

**RENEWABLE ENERGY PROJECT**

REP1: Phase 1 presentation – week 6 semester 1
REP2: Phase 1 report – week 9 semester 1
REP3: Phase 2 presentation - week 7 semester 2
REP4: Phase 2 report – week 10 semester 2

**INDUSTRIAL PROJECT**

IP1: Phase 1 presentation – week 3 semester 1
IP2: Phase 2 design review – week 11 semester 1
IP3: Phase 2 report – week 12 semester 1
IP4: Phase 3 design review – week 9 semester 2
IP5: Phase 3 report – week 10 semester 2

Resit Assessment Procedures:
Coursework to be completed before the August exam diet.

**PLEASE NOTE:**
Students need to gain a summative mark of 50% to pass the class. Students who fail the class at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of coursework.

**Recommended Reading**

The project briefs include extensive lists of references and key information is available on MyPlace in the folder for CL509.
Additional Student Feedback
(Please specify details of when additional feedback will be provided)

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<th>Time</th>
<th>Room No</th>
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Session: Feedback is given on a continual basis throughout both semesters.

Approved:

<table>
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<th>Course Director Signature:</th>
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<th>Date of Last Modifications:</th>
<th>August 2013</th>
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(Updated November 2010)
CLASS TIMETABLE

Class Code: CL509
Class Title: Civil Engineering Design Projects

Brief Description of Assessment:

The Renewable Energy Project is run in two phases with a group presentation and group report at the end of each phase.

The Industrial Project is run in three phases with a group presentation at the end of phase 1, and a group design review and group report at the end of phases 2 and 3.

Assessment Timing:

Indicate on the table below the Start/Submission dates for each Assignment/Project and the timing of each Exam/Class Test(s).

<table>
<thead>
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<th>Semester One</th>
<th>WK1</th>
<th>WK2</th>
<th>WK3</th>
<th>WK4</th>
<th>WK5</th>
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<td>IP5</td>
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