Course Title: 3A9 Group Design Project

Code: CE3A9

Level: Junior Sophister

Credits: 10

Lecturer(s): Associate Prof. Alan O’Connor (alan.oconnor@tcd.ie)
Associate Prof. Roger West (rwest@tcd.ie)
Assistant Prof. Sara Pavia (pavias@tcd.ie)
Assistant Prof. Sarah McCormack (sarah.mccormack@tcd.ie)

Course Organisation
Four hours per week made up of 2 one-hour lectures and 1 two-hour Project Sessions are given over two semesters between September and April.

<table>
<thead>
<tr>
<th>Engineering Semester or Term</th>
<th>Start Week</th>
<th>Hours of Associated Practical Sessions</th>
<th>End Week</th>
<th>Lectures</th>
<th>Design Sessions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 and 2</td>
<td>1</td>
<td>0</td>
<td>24</td>
<td>2</td>
<td>48</td>
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Total Contact Hours: 96

Course Description
The group design project replicates all the key stages in a real civil engineering project. The groups are given a series of design briefs and are required to develop solutions, criticising and refining them as the project develops. At the end of each of the three design phases each group produces a written report. During the project, speakers are invited to speak to the students on aspects of design relevant to the particular project.

The project comprises three stages: preliminary planning, structural design and construction planning. The project involves the planning of a construction project.

Learning Outcomes
On completion of this course, students will be able to:
1. function as a member of a design team. Specifically, students will be able to:
   a. Allocate work between members of a group;
   b. Plan as a member of a group;
   c. Prepare oral and written presentations as member of a group.
2. apply engineering knowledge gained in other courses to formulate solutions to multidisciplinary design problems;
3. communicate the details of their design solutions effectively, both verbally and in writing;
4. interpret the requirements from a design brief and formulate and appraise potential solutions. In the case of a construction project, this involves the ability to:
   o Identify functional and operational requirements;
   o Identify the transport and other infrastructural requirements;
   o Appraise the environmental and social impact of the development;
   o Identify and appraise potential sites before making a selection;
   o Develop general arrangement drawings, ensuring that the functional requirements are satisfied;
   o Refine and develop plans to produce detailed structural plans and a viable construction sequence, usually presented in the form of a Gantt Chart;
   o Write a technical specification;
   o Produce a bill of quantities and calculate approximate construction costs;
   o Question the wider responsibilities of the engineering profession.
Course Content
Lectures on the course are directly related to, and are sequenced with, the required outputs of the project phases. In this regard on completion of the course, the student will be able to:

- Describe the roles and obligations of the various parties to a contract in civil engineering and building
- Take off quantities and prepare a Bill of Quantities in accordance with the Civil Engineering Standard Method of Measurement for a simple structural element.
- Write a specification for a concrete or steel structure and have an appreciation of some of the forthcoming changes arising from the introduction of Eurocodes.
- Prepare a reinforced concrete detail drawing and from this prepare a bar bending schedule in accordance with standard principles.
- Develop an understanding of the properties of the ingredients of a concrete mix and be capable of designing a concrete mix to meet certain requirements in terms of durability, strength and workability.
- Identify the various formwork materials and support systems and be able to design formwork to resist certain concrete pressures to produce a finished structure to meet the specified dimensional tolerances.
- Analyse and explain the principles of construction, particularly within the context of the current building regulations
- Identify and design the detailed techniques and/or materials commonly used in the construction of buildings in Ireland.
- Recognise the symptoms of common defects in buildings and specify available remedial measures which may be used.
- Evaluate the environmental principles and practices underlying the construction of buildings.
- Develop a specification for and design environmental services for domestic, commercial and industrial buildings.
- Develop a specification for and design renewable energy options for domestic, commercial and industrial buildings.
- Design timber flooring systems for domestic and industrial use.

In addition this course introduces some additional content related to project management, for example, the development of Gantt charts. However, the majority of the course is concerned with developing communication skills, problem solving skills and group working skills. The content summary that follows details the individual phases of the group project and describes the group debates.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Content</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Site selection, planning and outline design. Foundation design and influence of geology, soils and drainage. Access, traffic management and economic and environmental impacts.</td>
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<tr>
<td>2</td>
<td>Structural design linking with other courses in structural analysis undertaken by the students. Detailed reinforced concrete and structural steelwork for large spans which may require innovative solutions and the use of computer software for drawing and calculation.</td>
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<tr>
<td>3</td>
<td>Construction management and planning including the use of bar charts and critical path networks. Taking off quantities and preparation of a Bill of Quantities using the Standard Method of Measurement, preparation of materials specifications and the calculation of an overall cost estimate for the project.</td>
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Assessment
The assessment is based on: (i) the three written reports that each group produces (worth a total of 75%), (ii) on performance in 8 tutorials (@1%/tutorial, total = 8%), (iii) on a test at the end of semester 1 (worth 8%) and (iv) on site visit reports (worth a total of 9%). Failure to pass any of components (i) – (iv) may result in the student receiving a non-satisfactory report for the course as a whole. Students must pass the 3A9 module to be in good standing at the end of the JS academic year. Students who fail 3A9 will be required to undertake an individual project during the summer in advance of the supplemental examinations.
Recommended Texts
Resource material comprising architectural resource data, preliminary structural design information and the Engineers Ireland code of professional ethics is available to students on the web at http://www.tcd.ie/Civil_engineering/Staff/Dermot.ODwyer/JS_Project.

In addition, students are introduced to range of texts during the project sessions, for example the following texts are frequently used:

- Philosophy of Structures, Eduardo Torroja, University of California Press, 1958
- Aesthetics and Technology in Building, P.L. Nervi, Harvard University Press, 1966
- Structures: from theory to practice, Alan Jennings, Spon Press
- Structures: of why things don’t fall down, J.E. Gordon, Penguin
- The new science of strong materials: or why you don’t fall through the floor, J.E. Gordon, Penguin
- DOE/BRE/TRRL. *Design of Normal Concrete Mixes*. HMSO
- *Standard Method of detailing structural concrete*. I Struct.E.
- *Civil Engineering Standard Method of Measurement*. CESMM3. ICE
- *Building Standards/ Regulation:*
- *National Sustainable Development Policy:*
- *Building Conservation Guidelines:*

Further Information
http://www.tcd.ie/civileng/Staff/Alan.OConnor/