

Trinity College Dublin



JS Handbook

*Civil, Structural
& Environmental Engineering*

2011 – 2012

Table of Contents

	Page
Note on Handbook	2
Course Overview	2
Courses	2
Examinations	2
Assessment	3
Assignments	3
College Regulations	3
Plagiarism	3
European Credit Transfer System (ECTS)	4
Guidelines & Regulations for BAI students undertaking international studies ..	5
Examination Rules	7
JS Coordinator	9
Civil Engineering Library	9
Safety Officer	9
Web Notes	9
Key Dates: 2011 – 2012	9
Academic Year Structure 2011/12	10
Subject Course Descriptions	
3E1a Engineering Analysis	11
3E2 Numerical Methods	13
3E4 Management for Engineers	15
3A1 Engineering Surveying	17
3A2 Structural Design	19
3A3 Hydraulics	21
3A4 Structural Analysis	23
3A5 Soil Mechanics	25
3A7 Transportation & Highway Engineering	27
3A8 Geology for Engineers	30
3A9 Group Design Project	33
Department Staff	37
Lecture Timetable	38
Laboratory Timetable	39

A Note on this Handbook

This handbook applies to all students taking Civil Engineering. It provides a guide to what is expected of you on this programme, and the academic and personal support available to you. Please retain for future reference.

The information provided in this handbook is accurate at time of preparation. Any necessary revisions will be notified to students by e-mail. Please note that, in the event of any conflict or inconsistency between the General Regulations published in the University Calendar and information contained in course handbooks, the provisions of the General Regulations will prevail.

Course Overview

The JS year is broken into two semesters, and the **examinations are at the end of the second semester only**. To do well in your JS year it is important to work consistently. It is particularly important, from your perspective, to work hard this year. In your last two years you have had the comfort that your exam performance did not impact on your final result. However, this is not the case in JS year, as

- Your performance in JS year will constitute **20% of your overall BAI degree** assessment;
- Students wishing to proceed into Year 5 and obtain an **MAI degree** must obtain either
 - an overall II.1 grade (or better) in their SS annual examinations, or
 - **an overall II.2 grade (or better) in both their JS and SS annual examinations.**

Further information on the MAI degree will be provided at a later stage

Courses

School courses

	<u>Semester</u>
3E1 – Engineering Mathematics V	I & II
3E1a – Engineering Analysis	I
3E2 – Engineering Mathematics VI	I & II
Part A: Numerical Methods	I
Part B: Statistics and data analysis	II
3E4 – Management for Engineers	II

Civil Engineering courses

3A1 – Engineering Surveying	II
3A2 – Structural Design	I
3A3 – Hydraulics	II
3A4 – Structural Analysis	I
3A5 – Geotechnical Engineering	I
3A7 – Transportation and Highway Engineering	I
3A8 – Geology for Engineers	II
3A9 – Group Design Project	I & II

Examinations

Examinations in all the above courses take place at the end of the year, i.e., in April / May. All examinations are two hours long.

The School of Engineering examination rules are set out on page 7, including details of the assessment procedure used to determine the BAI degree grade awarded to each student.

Assessment

The marks returned in the annual examinations for the School subjects are based on the annual examination but may, depending on the course, contain a continuous assessment component.

Generally JS Courses have a weighting of 5 ECTS, giving a total of 60 ECTS credits for the year.

Assignments

Assignments should be submitted to the Assignment Boxes on the first floor of the Museum Building, beside the coffee machine, unless advised otherwise. Cover sheets should be fully completed and attached to all assignments submitted.

College Regulations

The College regulations are detailed in the College Calendar and students are expected to be aware of these regulations. As in law, ignorance of the regulations does not constitute a defence. The calendar is available in the College libraries among other places.

Plagiarism

The College's policy on plagiarism is outlined in the general regulations (section H of the Calendar). There is no substitute to reading the regulations but here are a few of the key points.

Plagiarism arises from;

- copying another student's work
- enlisting another person or persons to complete an assignment on the student's behalf
- quoting directly, without acknowledgement, from books, articles or other sources, either in printed, recorded or electronic format
- paraphrasing, without acknowledgement, the writings of other authors

Plagiarism is serious whether the plagiarism is deliberate or has arisen through carelessness.

The key areas of the JS year where plagiarism may be an issue are laboratory and site visit reports. Be careful when you are writing a report to make sure that you reference your work properly, giving credit to the sources you have used.

When submitting individual work, make sure that the work is your own. For example, a literature review chapter within your project dissertation must be written in your own words. Where the material is being repeated verbatim from published, web or other sources, you should use inverted commas, italics and/or present the material in a separate paragraph, to make it clear to the reader that you are quoting directly (and you must reference the source).

For example, the following passage uses both references and direct quotation.

In 1676 Robert Hooke was the first to realise that the ideal shape for an arch ring is that of a funicular polygon (Heyman 1982). He found the shape of funicular polygons experimentally by hanging weights from a string and published this fact in the form of an anagram; whose solution is "*Ut pendet continuum flexile sic stabit contiguum rigidum inversum*" - as the continuous flexible hangs downward so will the continuous rigid stand upward inverted (Hooke 1676).

Where the first reference refers to:

Heyman J., 1982, "The Masonry Arch", Ellis Horwood, Chichester

European Credit Transfer System (ECTS)

The ECTS is an **academic credit transfer and accumulation system** representing the student workload required to achieve the specified objectives of a study programme.

The ECTS weighting for a module is a **measure of the student input or workload** required for that module, based on factors such as the number of contact hours, the number and length of written or verbally presented assessment exercises, class preparation and private study time, laboratory classes, examinations, clinical attendance, professional training placements, and so on as appropriate. There is no intrinsic relationship between the credit volume of a module and its level of difficulty.

In College, **1 ECTS unit is defined as 20-25 hours** of student input so a 10-credit module will be designed to require 200-250 hours of student input including class contact time and assessments.

The College norm for **full-time** study over one academic year at **undergraduate level** is 60 credits.

ECTS credits are awarded to a student only upon successful completion of the course year. Progression from one year to the next is determined by the course regulations. Students who fail a year of their course will not obtain credit for that year even if they have passed certain component courses. Exceptions to this rule are one-year and part-year visiting students, who are awarded credit for individual modules successfully completed.

GUIDELINES AND REGULATIONS FOR B.A.I. STUDENTS UNDERTAKING INTERNATIONAL STUDIES

This document provides guidelines and regulations for students who spend their Junior Sophister year of the B.A.I. programme at an approved foreign host University. Agreements are currently in place with INSA Lyon (France) and Karlsruhe University (Germany).

Students must obtain permission to spend their JS year at another University from the International Student Coordinator of the Department responsible for the B.A.I. stream in which they intend to specialise. These applications will then be reviewed by the Director of Teaching and Learning (Undergraduate) and the Head of School for final approval. At present, these coordinators are as follows:

- *Department of Civil, Structural and Environmental Engineering:* Dr Sara Pavia
- *Department of Computer Science:* Ms Mary Sharp
- *Department of Electronic and Electrical Engineering:* Dr Anthony Quinn
- *Department of Mechanical and Manufacturing Engineering:* Professor Henry Rice

Students must obtain at least a II.1 in their SF year in order to be given permission to spend their JS year abroad and must have appropriate language competency for their host University.

Each student must undertake courses that have a combined rating of at least 45 ECTS of which at least 40 ECTS must be in approved technically based engineering modules. Each student must get their module choices approved by their International Student Coordinator.

Students should be aware that some host Universities (typically in Germany) do not return marks using a centralised administrative system. In such cases, students need to take responsibility for obtaining their marks for each subject directly from their lecturers on official College letterhead. These must then be returned to their International Student Coordinator as quickly as possible.

Students must complete the year at the host University and have no entitlement to take supplemental exams at TCD. Students should be aware that some host Universities do not have supplemental exams or may not allow students to sit supplementals if their attendance or performance has been poor.

Students are advised to monitor the course information at their host University very frequently.

Assessment of modules taken in the overseas university will be weighted in the calculation of the final degree results as if the modules had been taken in this university.

MARKING SCHEMES

Firstly, the grades obtained are converted into TCD equivalents as follows:

INSA (Lyon)

ECTS mark returned	TCD equivalent
A	80%
B	65%
C	60%
D	55%
E	45%
Fx	30%
F	20%

Karlsruhe University

The marks obtained from Karlsruhe are based on the German system which grades subjects from 1.0 (very good) to 5.0 (NOT adequate). Grades are converted into TCD equivalents using the following formula:

$$\text{TCD}_{\text{MARK}} = (5 - \text{Karlsruhe}_{\text{MARK}}) / 4 * 100$$

Pass Criteria

In order to pass the JS year, students must:

- acquire 45 credits for modules at the host University, of which 40 credits must be in approved technical engineering modules;
- each student must submit an interim and a final report on their experience to their International Student Coordinator to acquire an additional 15 credits giving a total of 60 credits for the year.

B.A.I. EXAMINATION RULES 2011/2012

Freshman and Junior Sophister

Candidates undertake 60 credits during each of the four years of the degree programme. Each module has an individual rating of 5, 10, 15 or 20 credits, the amount dependent on the level of effort involved. It is the responsibility of each student to ensure that they are undertaking exactly 60 credits per year.

Students who pass the ANNUAL examinations are awarded 60 and an Honors grade for the year. This grade is based on the weighted average achieved, calculated using the credit ratings. In order to pass the ANNUAL examinations, students must:

- have achieved at least 40% in individual modules worth at least 50 ECTS credits **AND**
- have an overall average mark of at least 40% **AND**
- have **EITHER**
not more than 10 module credits with marks of at least 35% and less than 40%
OR
not more than 5 module credits with marks of at least 30% and less than 40%.

Students who have failed the ANNUAL examination are required to take a SUPPLEMENTAL examination in all modules in which they have not satisfied the examiners, as specified on the published examination results.

In order to pass the SUPPLEMENTAL examinations, students must:

- have an overall combined average mark in the ANNUAL and SUPPLEMENTAL examinations taken of not less than 40% **AND**
- have not more than 5 ECTS module credits with marks of at least 35% and less than 40%.

Students who pass the SUPPLEMENTAL examinations obtain an overall **PASS** grade for the year. Overall supplemental marks for all modules are calculated in the same manner using the same weightings as for the annual examinations and include continuous assessment/laboratory marks.

The full set of overall grades is set out below;

<i>Description</i>	<i>Grade</i>	<i>Criterion</i>
First Class Honors	I	mark greater than or equal to 70%
Second Class Honors, First Division	II.1	mark greater than or equal to 60% and less than 70%
Second Class Honors, Second Division	II.2	mark greater than or equal to 50% and less than 60%
Third Class Honors	III	mark greater than or equal to 40% and less than 50%
Fail	F	the candidate has failed to satisfy the criteria listed above
Exclude	EX	the candidate has not made a serious attempt at the examinations <u>or</u> the candidate has not passed the year within eighteen months from that date on which they first became eligible <u>or</u> the candidate has at least one unexplained absence
Deferred	D	the candidate was absent with permission due to medical or other grounds and the result is incomplete
ERASMUS Awaiting Result	ER	Applies to Erasmus / International Exchange students
Result Withheld	RW	it may be necessary for academic or administrative reasons to withhold a result (e.g. unpaid fees or fines)

Withdrawn	WD	the candidate has withdrawn from the course
Repeat year	R	the candidates is given permission to repeat the year IN FULL (applies at SUPPLEMENTAL examinations ONLY)
Pass	P	the candidate may rise to the next year of the degree programme (applies at SUPPLEMENTAL examinations ONLY)

After the Court of Examiners' meeting, ANNUAL and SUPPLEMENTAL examination results are published anonymously in student number order.

Individual module results

All individual module results are published anonymously by student number on the College notice boards, on the local School of Engineering website - <http://www.tcd.ie/Engineering/Results/> (students will need their College username and password) and on the College's Examinations Office website - <http://www.tcd.ie/Examinations/Results/>

Where a mark is not reported for a module the following codes apply where appropriate:

f	=	mark is less than 25%;
a	=	<u>absent with permission/explained absence – may take a SUPPLEMENTAL examination;</u>
A	=	absent without permission or explanation – automatic exclusion;
mc	=	medical certificate supplied to and accepted by the Senior Lecturer;
cr	=	credit for subject e.g. candidate is exempt on the basis of their performance in the Foundation Scholarship examination;
gw	=	grade withheld (e.g. unpaid fees or fines).
p	=	credit for subject passed on previous occasion.

Repeating the year

Candidates must repeat the year IN FULL which includes all continuous assessment requirements and laboratory experiments.

JS Coordinator

Dr. Alan O'Connor is the academic member of staff responsible for the Junior Sophister engineering year. If you have any questions relating to the JS course Dr. O'Connor will be happy to help. If you need to contact Dr. O'Connor, email first at alan.oconnor@tcd.ie

Civil Engineering Library

The Civil Engineering Library is located in the Museum Building, close to the main Civil Engineering Office. The opening hours are Monday – Thursday from 3.30pm – 5.30pm.

Safety Officer

Dr. Sarah McCormack is the member of the academic staff who deals with safety. If you have any questions or concerns relating to safety you should contact Dr. McCormack at sarah.mccormack@tcd.ie Remember safety is everyone's concern, if you see something that is unsafe please notify us.

Web Notes

Some lecturers place notes or additional information on the web: such material can be found at <http://www.tcd.ie/civileng/local/notes/index.php> in the lecturers' subdirectories.

Key Dates: 2011 – 2012

Teaching Terms

First Semester

Monday 26 September 2011 – Friday 16 December 2011

Reading Week: 7 – 11 November 2011

Second Semester

Monday 16 January 2012 – Friday 6 April 2012

Reading Week: 27 February – 2 March 2012

Examination Dates

Annual Examinations 2011: Monday 30 April 2012 to Friday 25 May 2012

Supplemental examinations 2012:

Please check notice-boards for full Exam Timetables

SCHOOL OF ENGINEERING			
Academic Year Structure, 2011/2012			
Calendar week	Week commencing	Outline Structure of Academic Year	Notes
1	29-Aug-11	Supplemental Examinations	Statutory (Michaelmas) term begins
2	05-Sep-11		
3	12-Sep-11	PG Registration	
4	19-Sep-11	UG New Entrant Registration/Freshers' Week	
5	26-Sep-11	Teaching Week 1 Registration continuing studs	
6	03-Oct-11	Teaching Week 2 Registration continuing studs	
7	10-Oct-11	Teaching Week 3 Registration continuing studs	
8	17-Oct-11	Teaching Week 4	
9	24-Oct-11	Teaching Week 5	
10	31-Oct-11	Teaching Week 6 (Monday Public Holiday)	
11	07-Nov-11	Teaching Week 7	Project/Assignment Week - Engineering
12	14-Nov-11	Teaching Week 8	
13	21-Nov-11	Teaching Week 9	
14	28-Nov-11	Teaching Week 10	
15	05-Dec-11	Teaching Week 11	
16	12-Dec-11	Teaching Week 12	Michaelmas term ends Friday 16 December 2011
17	19-Dec-11	Christmas Period	Christmas period. College closed from 23 December until 3 January
18	26-Dec-11		
19	02-Jan-12		
20	09-Jan-12	Foundation Scholarship Examinations	Note: it may be necessary to hold some exams in the preceding week
21	16-Jan-12	Teaching Week 1	Hilary term begins
22	23-Jan-12	Teaching Week 2	
23	30-Jan-12	Teaching Week 3	
24	06-Feb-12	Teaching Week 4	
25	13-Feb-12	Teaching Week 5	
26	20-Feb-12	Teaching Week 6	
27	27-Feb-12	Teaching Week 7	Project/Assign Week-Engineering. SS Oral Present
28	05-Mar-12	Teaching Week 8	
29	12-Mar-12	Teaching Week 9	(St Patrick's Day)
30	19-Mar-12	Teaching Week 10	(Monday Public Holiday)
31	26-Mar-12	Teaching Week 11	
32	02-Apr-12	Teaching Week 12	Hilary Term ends Friday 6 April 2012 (Good Friday)
33	09-Apr-12	Revision	Trinity Term begins(Easter Monday 9 th April)
34	16-Apr-12	Revision Trinity Week	Trinity Monday
35	23-Apr-12	Revision	
36	30-Apr-12	Annual Examinations 1	Annual Examination period: Four weeks at present followed by four weeks for marking, examiners' meetings, publication of results, Courts of First Appeal and Academic Appeals.
37	07-May-12	Annual Examinations 2 (Mon Public Holiday)	
38	14-May-12	Annual Examinations 3	
39	21-May-12	Annual Examinations 4	
40	28-May-12	Marking/Courts of Examiners/Results	
41	04-Jun-12	Marking/Courts of Examiners/Results	SS Court of Examiners meeting Fri 8 th June 2012
42	11-Jun-12	Marking/Courts of Examiners/Results	Statutory (Trinity) term ends JS Court of Examiners meeting Thursday 14 th June 2012
43	18-Jun-12	Marking/Courts of Examiners/Results	
44	25-Jun-12	Courts of First Appeal/Academic Appeals	

3E1a Engineering Analysis (5 ECTS)

Lecturer: Liam Dowling

Course Organisation

Semester	Start Week	End Week	Associated Practical Hours	Lectures		Tutorials	
				Per Week	Total	Per Week	Total
1	1	12	0	3	33	1	11
Total Contact Hours: 44							

Aims/Objectives

This course is developed to strengthen the student's skills in applied engineering analysis and is organised into three main subsections: signal and system analysis; partial differential equations; and optimization. The first section deals with transform analysis applied to engineering signals and systems. The second part of the course deals with methods for solving partial differential equations. The final section focuses on linear and nonlinear optimization for engineering design.

Syllabus

Signal and System Analysis

Properties and applications of Fourier and Laplace transforms.

Linear Time-Invariant Systems: Impulse response and the convolution integral; properties of LTI systems; transfer function and frequency response of an LTI system.

Sampling Theorem: Representation of a continuous-time signal by its samples; undersampling and aliasing; the sampling theorem; reconstruction of a bandlimited signal from its samples.

Partial Differential Equations

Solution by separating variables: the Wave Equation; the Heat Equation; and Laplace's Equation.

Optimization

Linear Programming: The Simplex Algorithm

Unconstrained Optimization: The gradient method; the golden section method

Recommended Text

Kreyszig, E., *Advanced Engineering Mathematics*. 9th ed. New York: Wiley, 2006

Learning Outcomes

On completion of this course the student will be able to:

1. Analyse continuous-time signals using Fourier transforms and Fourier series.
2. Analyse linear time-invariant systems using Fourier and Laplace transform methods.
3. Solve the Wave equation, Heat equation, and Laplace's equation for various initial and boundary conditions.
4. Solve linear programming problems using the Simplex algorithm.
5. Use gradient methods to optimize a function

Teaching Strategies

The course is taught using a combination of lectures and problem solving tutorials.

Assessment

The annual examination counts for 70% and each of the two in-class test counts for 15% of the overall subject mark.

COURSE TITLE: 3E2 Numerical Methods (5 ECTS)

Lecturer: Dr. Ciaran Simms

Course Organisation

Semester	Start Week	End Week	Associated Practical Hours	Lectures		Tutorials	
				Per Week	Total	Per Week	Total
2	1	12	0	3	33	1	11
Total Contact Hours: 44							

Aims/Objectives

- to demonstrate the utility of numerical techniques in solving engineering problems where analytical solutions are not readily available;
- to consolidate the ability to use Matlab and Excel as programming tools to solve engineering problems;
- to use the Taylor Series and other mathematical foundations to derive common numerical techniques and the errors associated with them.

Syllabus

- machine number representation;
- Taylor series and its implications;
- numerical solutions to nonlinear equations;
- numerical solutions to systems of linear equations;
- optimization;
- regression;
- numerical integration;
- numerical solutions to ordinary differential equations;
- numerical solutions using finite difference and finite element methods.

Associated Laboratory/Project Programme

There will be weekly computer laboratory assignments together with one formal numerical methods assignment (assigned during Study/Assignment Week).

Recommended Text(s)

- Numerical Methods for Engineers, Steven Chapra and Raymond Canale, McGraw-Hill International, fifth edition 2006
- Applied Numerical Methods with Matlab for Engineers and Scientists, Steven Chapra, McGraw-Hill International, second edition 2008

Learning Outcomes

On successful completion of this course, students will be able to:

- recognize that numerical techniques are frequently preferable to searching for analytic solutions in solving engineering problems;
- find approximate solutions to engineering problems which can be modeled by systems of linear equations;
- perform numerical integration to calculate approximate integrals of real world functions;
- apply Runge Kutta/Euler techniques to find approximate solutions to real-world engineering problems that can be represented by ordinary differential equations;
- apply basic optimization techniques to find approximate solutions to real-world engineering problems where function is maximized/minimized;
- apply basic finite difference techniques to find approximate solutions to real-world engineering problems which can be represented by partial differential equations;
- apply basic finite element techniques to find approximate solutions to real-world engineering problems where a differential equation can be applied over an arbitrary physical domain.

Teaching Strategies

The course is taught using a combination of lectures, laboratories and computer laboratory based assignments.

Assessment Modes(s)

Formal written end-of-year examination (60%), weekly tutorial-based computer assignments

(25%), Study/Assignment Week Assignment (15%)

3E4 Management for Engineers (5 ECTS)

Lecturer: Dr. Niamh Harty, Ms Joanna Gardiner, Dr. Brian Caulfield

Course Organisation

Semester	Start Week	End Week	Associated Practical Hours	Lectures		Tutorials	
				Per Week	Total	Per Week	Total
2	13	24	0	2	24	1	12
Total Contact Hours: 36							

Course Description

Management for Engineers introduces engineering students to Entrepreneurship and Communication. The aims of the course are:

- To foster a sense of entrepreneurship among the JS Engineering students, by requiring the students to come up with a business idea and during the semester produce a business plan.
- To enable students to communicate well in engineering contexts, both when *talking* about projects, plans and problems, and when *writing* about these.

Learning Outcomes

On completion of this course the student will be able to:

- Prepare a business plan, including details of marketing, market research, finance, legal issues and growth.
- Give a presentation
- Summarise a technical article

Course Content

The course covers the following topics:

Entrepreneurship:

- Coming Up with a Business Idea
- Marketing
- Feasibility
- Market Research
- Legal Issues
- Finance and Accounting
- Business Plan
- Ethics
- Growth of the Business

Communication:

- Intersubjectivity
- Emails
- Reports
- Presentations
- Intercultural communication
- Media Interviews

Recommended Text

To be announced

Assessment Modes

There will be three assignments on entrepreneurship, and two assignments on Communication, plus a final examination.

Entrepreneurship counts for 50% of overall mark in 3E4. Marks for Entrepreneurship will be divided 60% for continuous assessment, and 40% for questions on the Final examination.

Communication counts for 50% of overall mark in 3E4. Marks for Communication will be divided 40% for continuous assessment, and 60% for questions on the Final examination.

Further Information

Web page: http://www.tcd.ie/Engineering/Courses/BAI/JS_Subjects/3E3/

3A1 Engineering Surveying (5 ECTS)

Lecturer: Dr. Brian Caulfield

Course Organisation

Semester	Start Week	End Week	Associated Practical Hours	Lectures		Tutorials	
				Per Week	Total	Per Week	Total
2	1	11	18	3	33	1	11
Total Contact Hours: 62							

Course Description

Engineering surveying is a single semester course developing a foundation understanding of the principles of surveying, intermediate knowledge of the methods and procedures used on site, and hands-on familiarity with a full range of surveying instruments and equipment.

The intention of the course is that students will be able to design and manage surveying projects within a wide range of situations that may be encountered in construction, local authority and general industry, and apart from the intended outcome of plan production or setting out they will be able to analyse for possible errors in both the instrumentation and the methods used.

Learning Outcomes

On completion of this course the student will be able to:

- Design and organize a survey, including estimation of probable errors
- Carry out reconnaissance of the area to establish best possible methods to be used.
- Perform instruments checks to ensure they meet specifications
- Carry out basic surveying techniques
- Map survey coordinates using GIS software
- Analyse, report and where appropriate distribute the survey errors

Course Content

The course covers the following topics

- Linear Measurement
- Levelling
- Angular Measurement
- Total Stations
- Setting Out
- Horizontal & Vertical Curves
- GPS
- Mapping and Modelling

Recommended Text

Uren & Price, Surveying for Engineers, Palgrave Publ.

Other Relevant Texts

W.Schofield, Engineering Surveying, 5th Ed., Elsevier Pubs

Banister, Raymond & Baker Surveying, Longman Publ.

Wolf & Ghilani, Elementary Surveying, Prentice Hall Publ.

Surveying Practicals

During the practical's the students work in teams to carry out basic engineering tasks that would be encountered in a surveying team. These tasks are designed to enable hands-on work with the range of surveying equipment and accessories covered during the lectures:

- Levels : Level survey
- Levels : Two-peg Test
- Theodolites: Theodolite traverse
- Totals Stations: Total station traverse, detail survey
- GPS Survey: Using a GPS to conduct a survey

Each practical requires submission of a report containing tabular result, sketch, error reporting, and commentary on the methods used.

Assessment Modes

The written exam comprises 70% of the year assessment.

Practical Reports: Reports from completion of each of the practical's are assessed in terms of professional reporting:

- a) Scope and purpose of practical
- b) Results
- c) Analysis and conclusion

These reports comprise 20% of the year assessment

Practical Laboratory Exam: A practical laboratory exam is carried out at year end to assess individual familiarity with basic instruments, level, theodolite and total station. This comprises 10% of year assessment.

3A2 Structural Design (5 ECTS)

Lecturers: Prof. Brian Broderick and Prof. Biswajit Basu

Course Organisation

This course runs for the 11 weeks during the 1st semester, with three lectures and a tutorial every week. In addition, students complete four laboratory experiments.

Engineering Semester or Term	Start Week	Hours of Associated Practical Sessions	End Week	Lectures		Tutorials	
				Per Week	Total	Per Week	Total
1	1	8	11	3	33	1	11
Total Contact Hours: 52							

Course Description

In this course, students learn to design, dimension and detail elementary steel and reinforced concrete members: beams, columns/struts and ties. The course consists of two equal parts – structural steelwork and reinforced concrete. The course takes place in the first semester and consists of lectures, tutorials/design studies and laboratories.

Learning Outcomes

At the end of the course students should be able to:

- describe the engineering properties of structural steel, reinforcing steel and concrete
- distinguish between serviceability and ultimate limit states, and apply appropriate partial safety factors
- discriminate between the different types of failure observed in reinforced concrete and structural steelwork, and identify when each of these is likely to occur
- describe the elasto-plastic response of steel beams and of under- and over-reinforced concrete beams
- describe the types of failure displayed by bolted steel connections
- calculate the ultimate resistances of steel and RC members from first principles and using design code methods
- evaluate the shear and bearing resistances of a bolted connection
- draw bending moment and shear force diagrams for statically determinate beams
- design structural steel and RC members to possess required bending, shear, buckling and tensile resistances
- choose suitable steel and RC beam and column section sizes for given situations
- select suitable member sizes in a steel truss
- develop bending-shear and bending-axial force interaction diagrams and expressions
- observe the experimental response of steel and RC specimens under load, identify and describe the forms of failure displayed, calculate the resistances of the test specimens and compare with theoretical or design values, write a laboratory report

Course Content

- *Introduction to Structural Design*: Serviceability and ultimate limit states, forms of failure, partial safety factors, characteristic and design values.
- *Material properties*: Uniaxial behaviour of structural steel, reinforcing steel and concrete; engineering properties, design values for steel and concrete grades.
- *Steel Tension members*: Examples of members under axial tension; effect of holes, effect of steel grade; design approach; worked example.
- *Compression members*: Pure axial compression; axial compression with bending; failure modes; cross-section analysis; member buckling resistance, slenderness, imperfections; buckling curves and design tables, bending moment-axial force interaction in RC members; design code provisions.
- *Steel members in bending*: Examples; comparison of truss and I-section behaviour; review of elastic theory, extension to plastic sections, shape factors; local buckling and section classification; elastic shear distribution, shear resistance, coincident high shear and bending moment; web buckling, web bearing
- *RC members in bending*: Properties of composite, uncracked and cracked sections, ultimate bending moment resistance of RC sections, singly- and doubly-reinforced sections; under- and over-reinforced beams; shear in RC sections.

Laboratory Experiments

Elastic-plastic steel beam, bolted connections, over- and under-reinforced concrete beams, deflection and strain response of RC beams.

Assessment

85% of the assessment is due to a two hour examination. The remaining 15% is allocated for coursework (laboratory experiments/reports and tutorials/design studies) divided equally between the steel and reinforced concrete parts of the course.

Recommended Texts

- Reinforced and Prestressed Concrete Design, O'Brien and Dixon, *Longman*
- Reinforced and Prestressed Concrete, Kong and Evans, *Van Nostrand Reinhold*
- Reinforced Concrete Structures, Park and Paulay, *Wiley*
- Structural Steelwork Design, Dowling, Owens and Knowles, *Butterworths*
- Design of Structural Steelwork, McKenzie, *Macmillan*

Further Information

http://www.tcd.ie/Civil_engineering/Staff/Biswajit.Basu/3A2/

3A3 Hydraulics (5 ECTS)

Lecturers: Dr. Aonghus Mc Nabola

Course Organisation

This course runs for 11 weeks of the academic year and comprises three lectures per week for the entire period. There are three one hour associated laboratory periods and one group project which comprise the continuous assessment portion of the course. Tutorials on each element of the course are set on a formative basis, for student feedback only.

Engineering Semester	Start Week	Hours of Associated Practical Sessions	End Week	Lectures		Tutorials	
				Per Week	Total	Per Week	Total
2	22	3	33	3	33		12
Total Contact Hours: 45							

Course Description

Hydraulics is a one semester course which provides students with the basic concepts of hydraulic engineering. The course reviews the relevant aspects of fluid flow developed in 2E5, such as Bernoulli's equation, and the momentum and continuity relationships and demonstrates how these are developed for use in engineering design. The course develops the concept of analysing time varying problems using quasi-steady state relationship and compares the results with some readily developed closed form solutions. The methods of developing head/discharge relationships for pipe flows which includes for friction loss are formulated. The principles involved in the flow of water in open channels are explained and relationships are developed to allow the estimation of the discharge in open channels and the depth variation behind control structures. The methods used to analyse pipe networks, with and without pumps within the system, are developed. The design of water distribution systems providing an adequate supply of water to consumers is also examined. Finally, the course looks at the subject of Urban Drainage, initially comparing combined systems against separate systems. The calculation of hydraulic loads for the network is then demonstrated for both wastewater quantities and also storm water predictions from the analysis of rainfall events. The hydraulic design of the pipe network to these loads is then before moving onto the design of Combined Sewer Overflows which are used to relieve the system hydraulically under storm conditions.

Learning outcomes

On successful completion of the course, students will be able:

- Estimate the flows in pipes and channels from devices such as notches, weirs and flumes.
- To analyse the simple time varying flow problems by assuming quasi-steady flow.
- To develop the head/discharge relationship for pipes, allowing for friction in the pipes and loss of head at bends etc.
- To estimate flow of water in channels.
- To estimate the depth variation in open channels associated with backwater and drawdown curves.
- To analyse the flows and head in pipe networks and to assess the affect of including pumps within these systems.

- To estimate the flow in gravity systems
- To design water distribution networks
- To calculate the hydraulic load on an urban drainage network from both wastewater and storm water under different design storm conditions.
- To design the size and assess the efficiency of a Combined Sewer Overflow at different settings.

Course Content

- Velocity & Discharge
- The Momentum Equation
- Energy and Flow of water in pipes
- Quasi-Steady Flow
- Open channel flow
- Pipe network analysis
- Pump-Pipe Systems
- Pumps
- Urban Drainage Systems
- Design of Water Distribution Systems

Recommended Text

Mechanics of Fluids, Massey (Taylor & Francis).

Hydraulics in civil and environmental engineering, Chadwick & Morfett (E & FN Spon).

Urban Drainage, Butler & Davies (E & FN Spon).

Assessment

The annual examination is a two hour exam in May/June with three questions to be answered out of a choice of four. The three laboratories contribute to 10% of the final marks and the group project will contribute another 10% , giving a total of 20% of the course mark for continuous assessment.

Further information

Webpage http://www.tcd.ie/Civil_engineering/Staff/Aonghus.McNabola

3A4 Structural Analysis (5 ECTS)

Lecturer: Dr. Dermot O'Dwyer

Course Organization

The course runs for all of the 1st semester. The course comprises three hours of lectures and one tutorial/problem solving hour each week. In addition, each student attends three laboratory sessions. There are a total of 48 contact hours for this course.

Engineering Semester or Term	Start Week	Hours of Associated Practical Sessions	End Week	Lectures		Tutorials	
				Per Week	Total	Per Week	Total
Term 1	1	4	12	3	36	1	12
Total Contact Hours:48							

Course Description

This course introduces students to the techniques of structural analysis used to calculate the member forces, stresses, strains and displacements of statically indeterminate structures. The course covers the application of virtual work, the stiffness (displacement) and flexibility (force) methods of structural analysis, the moment area method, and the qualitative analysis of structures.

The presentation of the moment area method is designed to complement the students' mathematical training in their freshman years. The moment area method is presented as a differential equation that must be solved subject to boundary conditions. In addition, MaCauley bracket notation is introduced to facilitate the integration of piecewise continuous functions.

The qualitative analysis is essential to this course. Whereas the other sections of the course aim to foster the students' ability to analyse engineering structures, qualitative analysis develops the students' ability to: conceptualise structural behaviour, hypothesise different potential structural responses and appraise the validity of their solutions. Given that most structural analysis is now carried out using computer programs, the ability to predict the qualitative behaviour of a structure, independently of computer analysis, is a key skill.

Learning Outcomes

On completion of this course:

- 1 The student will be able to analyze statically indeterminate structures using both the stiffness and flexibility methods of analysis. Such analyses require that the student can
 - Identify the degree of indeterminacy of the structure
 - Identify a suitable system of releases (flexibility method) or an appropriate set of degrees of freedom (stiffness method)
 - Assemble the flexibility or stiffness matrices using the details of the structure
 - Construct the force vector (stiffness method) or displacement vector (flexibility method)
 - Formulate and solve the equilibrium equations (stiffness method) or boundary conditions (flexibility method)

- Use the solution of the system equations to identify the structural response of the individual component of the structure.
- 2 The student will be able to apply the moment area method to analyze multi-span beam structures subject to a variety of vertical loading including point loads, patch loading, uniform loading and triangular loading. In addition the student will be able to incorporate support settlements and will be able to use the moment area method to compose the standard tables used in the flexibility and stiffness method.
 - 3 The student will be able to utilize the method of virtual work to calculate the displacement of plane frames. The student will be able to use either integration tables or direct integration to calculate displacements.
 - 4 The student will be able to develop qualitative diagrams showing the displaced shape, bending moments and support reactions for an indeterminate plane frame. To do this the student must be capable of conceptualizing the response of the structure, synthesize diagrams showing probable response, critique the diagrams for consistency and amend them as necessary until the displaced shape, bending moments and support reactions are mutually consistent and agree with the loads and boundary conditions of the structure.

Course Content

- Qualitative analysis
- Flexibility method
- Moment area method
- Virtual Work
- Stiffness method

Practicals

The course includes a number of physical and computer based practical sessions covering:

- Qualitative analysis
- Flexibility analysis
- Virtual work

Assessment

The assessment is via a two hour examination held during April / May.

Recommended Texts

A series of purpose written notes are available on the web at http://www.tcd.ie/Civil_engineering/Staff/Dermot.ODwyer/3A4/. In addition, the following texts are suggested:

- Structural Analysis, 4th Ed., Ghali and Neville, E & FN Spon
- Understanding Structural Analysis, David M Brohn, New Paradigm Solutions
- 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

Further Information

http://www.tcd.ie/Civil_engineering/Staff/Dermot.ODwyer/3A4/

3A5 Soil Mechanics (5 ECTS)

Lecturers: Prof. Mark Dyer and Dr. Brendan O’Kelly

Course Organisation

This course runs for 11 weeks of the academic year and comprises three lectures per week for the entire period. There are three one hour associated laboratory periods. Three tutorials are handed out during the semester for submission by the students within a two week period. The solutions of these tutorials are discussed during the lecture periods.

Engineering Semester	Start Week	Hours of Associated Practical Sessions	End Week	Lectures		Tutorials	
				Per Week	Total	Per Week	Total
1	1	3	11	3	33		3
Total Contact Hours: 36							

Course Description

Soil Mechanics provides students with a basic knowledge of the fundamental concepts of soil behaviour and gives an introduction into general geotechnical engineering. The course describes the relationship between soils and its geological origins and demonstrates the significance of the particles size distribution and mineralogy of the soil on its engineering behaviour. The effects of the compaction process on the engineering properties of soil are discussed and methods are developed to allow students to design fills. The course explains the principles involved in the flow of water through soils, including the methods of analysis and the use of these methods to estimate water pressures and flows in a variety of differing engineering situations. The important concept of effective stress is described and examples of its significance in geotechnical engineering are developed. The course discusses the shear strength of soils and develops methods for applying this knowledge in the analysis of bearing pressure for foundations and in the estimation of earth pressures behind earth retaining structures. Methods of analysis of the consolidation of soils are discussed and analytical methods are developed to estimate ground movements due to the consolidation of the soil.

Learning outcomes

On successful completion of the course, students will be able:

- To explain the significant aspects that must be considered when describing and classifying soils.
- To analyse the compaction characteristics of a soil in order to assess its suitability as an engineering material.
- To explain the methods of measurement of the permeability of soils.
- To estimate the total head, pore water pressures and discharges to be expected in a variety of engineering design situations.
- To explain the concept of effective stress and its relationship with the shear strength of soils.
- To estimate the amount of settlement to be expected with the consolidation of soil.
- To estimate the ability of a soil to support a foundation
- To estimate the earth pressures on an earth retaining structure.

Course Content

- Description and classification of soils
- Compaction technology
- Seepage
- Effective stress
- Shear strength
- Ground investigation
- Bearing capacity of soil
- Consolidation of soils
- Earth pressures

Recommended Text

Craig R. F., Soil Mechanics, Chapman & Hall.

Assessment

Written Exam, Laboratory Experimental Reports and Tutorials. The examination questions are designed to test the student's ability to use the knowledge gained in lectures to solve practical problems. The laboratory experiments are used to develop a knowledge of the testing procedures used in geotechnical engineering.

Further information

Web page: http://www.tcd.ie/Civil_engineering/Staff/Eric.Farrell/JSSoilWeb/

3A7 Transportation and Highway Engineering (5 ECTS)

Course Organisation

The course is divided into two parts, *Transportation Engineering* and *Highway Engineering*

Engineering Semester	Start Week	End Week	Lectures per week	Total
1	1	11	3	33

Part 1: Highway Engineering

Lecturer: Prof. M. O'Mahony

Course Objectives

The objective of this part of the course is to enable students to differentiate between road pavement structures, to analyse road pavement structures, to differentiate between the different types of materials used and to design road pavements. The introduction of the design concepts, material properties and performance criteria are used together with vehicle loading criteria to demonstrate to the students how they are combined to design and construct road pavements. Another objective is to distil the principles of geometric design, both vertical and horizontal. To give the students the satisfaction of producing for themselves a full road pavement design, they are taken through one of the available methods and they perform examples so they can see how the principles and their application come together in a design.

Learning Outcomes

At the end of this section of the course, the student will be capable of

- Selecting the appropriate materials for use in different road layers
- To evaluate the quality and performance of unbound and bound road materials
- Perform road pavement design and analysis
- Drawing up an appropriate road monitoring and maintenance programme
- Interpret geometric design fundamentals, in relation to safety and driver comfort, focusing on horizontal and vertical alignment
- Design the geometric curves of a road pavement

Course Content:

1. Introduction
2. Unbound Flexible Pavement Materials – Capping material and subbase
3. Bitumen – Properties and laboratory tests for property characterisation
4. Bituminous Materials – Open textured macadam, hot rolled asphalt, mastic asphalt and dense bituminous macadam
5. Flexible Pavement Design – Principles of design, design method and examples
6. Rigid Pavements – Properties of concrete, rigid pavement design and construction
7. Geometric Design – Fundamentals of forces on vehicles travelling on curved sections of road,
Horizontal and vertical alignment, designed on the basis of safety and driver comfort

Recommended Texts:

Highway Engineering, M. Rogers, Blackwell Publishing

Highway Engineering, CA O'Flaherty, Edward Arnold

Part II: Transport Engineering

Lecturers: Prof. M. O'Mahony, Dr. B. Caulfield

Course Objectives:

The first objective of this part of the course is to enable the civil engineering students to formulate the fundamental principles of traffic flow, traffic characteristic measurements and their interpretation for infrastructure changes or development. The next objective is to enable them to employ what influences driver behaviour, particularly in relation to road safety, in the road design. Traffic signal timing design is included with a number of worked examples along with urban traffic control. The final objective of this part of the course is to develop the students' thinking on how to approach the determination of solutions for urban traffic congestion problems with particular emphasis on the need for input from other disciplines in coming up with those solutions.

Learning Outcomes

At the end of this section of the course, the student will be capable of:

- Designing traffic signal timings for junctions
- Performing the traffic studies necessary before making changes to or designing new road infrastructure
- Exposing them to interdisciplinary approaches in solving engineering problems
- Assess and conceptualise driver behaviour when developing engineering solutions to improve road safety
- Engaging with other disciplines to formulate policies for dealing with urban traffic congestion problems
- Discuss and debate solutions to urban congestion

Course Content

1. Introduction – Definitions of basic terms
2. Traffic Flow – Methods for measuring traffic flow, speed and other characteristics of traffic. Traffic studies, accidents, impacts of new infrastructure.
3. Traffic Signal Timing Calculations – Saturation flow, optimum cycle time, effective green period and dealing with right turning traffic.
4. Urban Traffic Control
5. Driver Behaviour and Safety – Psychology of drivers, how drivers react in different situations, how to use knowledge of driver behaviour in designing engineering solutions.
6. Urban Congestion and Solutions – Public transport, demand management, promotion of non-car modes, integrated transport policies and freight management.

Recommended Texts

Highway Traffic Analysis and Design, RJ Salter and NB Hounsell, Macmillan

Principles of Highway Engineering and Traffic Analysis, FL Mannering and WP Kilareski, Wiley

Formal notes for the course are available on the web. The notes are placed on the web in advance of the lectures so the students can take them to lectures for annotation and insertion of their own comments.

Assessment

Assessment is performed by examination. The examination is two hours long and the paper is divided into two sections, Transportation Engineering and Highway Engineering, with four questions in each section. Students are expected to answer 5 questions with at least two chosen from each section.

3A8 Geology for Engineers (5 ECTS)

Lecturers: Dr. Quentin Crowley, Mr. Bruce D Misstear

Course Organisation

This course consists of 33 lectures over 11 weeks, together with 4 practical exercises and a fieldtrip to a local site of geological interest. All practicals, the field trip and 9 weeks of lectures (geology) are given by Quentin Crowley, the remaining lectures (hydrogeology) are given by Bruce Misstear.

Engineering Semester or Term	Start Week	Hours of Associated Practical Sessions	End Week	Lectures		Tutorials	
				Per Week	Total	Per Week	Total
2	12	9	22	3	33	0	0
Total Contact Hours: 42							

Course Description

Geology for Engineers provides an introduction to several areas of Earth Sciences that impact the engineer, including geological materials, earth surface processes, hydrocarbon exploration and production, natural disasters and climate change. Engineers often need to work with geologists. This course will enable the student to operate effectively in such a team by explaining terminology and concepts in the fields stated above. The course also provides the engineer with a natural, regional-scale context in which to place site-specific questions. Financial and time pressures on the engineer necessarily force him/her to concentrate on the site-specific aspects of geology, such as the mechanical properties of the ground and the local risk of natural hazards like flooding, subsidence or earthquakes. This course provides examples of how such local-scale phenomena can be better predicted using knowledge of regional-scale geological processes. The student will learn the kind of questions that geologists can answer, allowing him/her to better assess how much time/money to spend on geological investigations for any given project.

Learning Outcomes

On completion of this course the student will be able to:

- Recognise standard terminology, including basic classification systems for geological materials, and terminology applied to important plate tectonic, surface and climatic processes.
- Describe the formation and internal structure of planet Earth and describe plate tectonic theory.
- Explain how natural hazards such as earthquakes, tsunamis and volcanoes relate to plate tectonic processes, and explain difficulties in predicting natural disasters.
- Explain the generation of hydrocarbons within sedimentary basins, use simple exploration techniques, and compare technologies for hydrocarbon exploration and extraction.
- Describe the roles of glacial, fluvial, hill slope, coastal and submarine processes in forming the natural environment, and appraise whether engineering solutions are appropriate in managing surface processes.
- Explain the major controls on global climate, describe evidence for natural climate change in the geological record, and assess the engineer's role in managing anthropogenic climate change.

- Define basic terms in hydrogeology and apply equations of groundwater flow to simple engineering situations.

Course Content

- Planet Earth [Dr Q. Crowley]
 - Earth's internal structure: core, mantle, crust
 - Plate tectonics – Deformation of the plates: faulting and folding
 - Earthquake seismology
 - Describing and classifying rocks and minerals
 - Measuring geological time
- Volcanic Processes [Dr Q. Crowley]
 - Controls on physical properties of magma
 - Principles of multi-phase geophysical flows
 - Eruption dynamics
 - Important mineral deposits produced by volcanic processes
- Sedimentary basins and Hydrocarbons [Dr Q. Crowley]
 - Imaging sedimentary basins using reflection seismology
 - Types of sedimentary basin
 - Generation of hydrocarbons within sedimentary basins
 - Hydrocarbon exploration techniques
- Geology of Ireland [Dr Q. Crowley]
 - Tectonic overview
 - Basement structure
 - Examples of igneous rock
 - Main occurrences of metamorphic rock
 - Clastic and carbonate sediments
- Earth surface processes [Dr Q. Crowley]
 - Glacial landforms and sediments
 - Weathering, slope and river processes
 - Coastal processes
 - Role of society in controlling surface processes
- Natural hazards [Dr Q. Crowley]
 - Earthquakes
 - Tsunamis
 - Volcanic hazards
- Climate [Dr Q. Crowley]
 - Role of atmosphere, oceans and the solid Earth in controlling climate
 - The Greenhouse Effect
 - Milankovitch cycles
 - Gas hydrates and CO₂ sequestration
 - Geological history of climate change
 - Role of society in moderating climate change
- Hydrogeology [B.D. Misstear]
 - Hydrogeological terms
 - Occurrence of groundwater
 - Groundwater head and groundwater flow
 - Application of hydrogeology to landfill site selection and design
 - Groundwater protection

Assessment

Assessment is by one two hour exam at the end of the second semester. All of the material taught in the course (including practicals and field trip) is examinable.

Recommended Texts

This course focuses on areas of earth sciences of interest to the engineer. The course website contains illustrated sets of notes that relate directly to each group of geology lectures. These notes are designed to explain the important geological and geophysical processes in language understandable by physical scientists. The notes contain references to specific sections of a number of textbooks and websites in order to encourage students to further improve their knowledge. Recommended texts include:

Understanding Earth (second edition), Press & Siever
The Solid Earth (second edition), Fowler
Introducing Groundwater (second edition), Price
Water wells and boreholes, Misstear, Banks & Clark

Further Information

Course website, including geology handout notes, practical exercises and past exam papers: <http://www.tcd.ie/Geology/MAIN-PAGE/ce3a8.php>

3A9 Group Project (10 ECTS)

Lecturer: Dr. Alan O'Connor, Dr. Roger West, Dr. Sara Pavia, Dr. Sarah McCormack

Four hours per week made up of 2 No. 1 hour lectures and 1 No. 2 hour Project Session are given over two semesters between October and April.

Engineering Semester or Term	Start Week	Hours of Associated Practical Sessions	End Week	Lectures		Design Sessions	
				Per Week	Total	Per Week	Total
Semesters 1 & 2	1	0	24	2	48	2	48
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:

- The student will be able to function as a member of a design team. Specifically, students will be able to:
 - 1 Allocate work between members of a group
 - 2 Plan as a member of a group
 - 3 Prepare oral and written presentations as member of a group
- The student will be able to applying engineering knowledge gained in other courses to formulate solutions to multidisciplinary design problems
- The student will be able to communicate the details of their design solutions effectively, both verbally and in writing
- The students will be able to 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:
 - 1 Identify functional and operational requirements
 - 2 Identify the transport and other infrastructural requirements
 - 3 Appraise the environmental and social impact of the development
 - 4 Identify and appraise potential sites before making a selection
 - 5 Develop general arrangement drawings, ensuring that the functional requirements are satisfied
 - 6 Refine and develop plans to produce detailed structural plans and a viable construction sequence, usually presented in the form of a Gantt Chart
 - 7 Write a technical specification
 - 8 Produce a bill of quantities and calculate approximate construction costs
 - 9 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.

Phase	Content
1	Site selection, planning and outline design. Foundation design and influence of geology, soils and drainage. Access, traffic management and economic and environmental impacts.
2	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.
3	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.

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 No 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.

Site Visits Reports

Site visits are scheduled for 2-5pm, every Friday during the First Semester. There will be four site visits. At the end of First Semester 4 site visits' reports and one safety lecture report are required to be submitted.

Further details on the site visits will be provided on the departmental website.

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:

- Developments in Structural Form, Rowland Mainstone, Architectural Press, England, 2001
- *Irish Construction Price Book*. Spon Second Ed. 2004
- Architect's Data, Ernst Neufert, Blackwell Science, U.K. 1987
- 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
- AC Twort and J Gordon Rees 4th Ed. 2004. *Civil Engineering Project Management*. Elsevier
- 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
- Fleming, E. (2005) *Construction Technology, an illustrated introduction* Blackwell Publishing.
- Chudley, R. (2001) *Construction Technology Handbook. 4th ed*. Essex: Longman Scientific and Technical
- *Building Standards/ Regulation*:
<http://www.environ.ie/DOEI/DOEIPol.nsf/wvNavView/wwdConstruction?OpenDocument&Lang=en>
- *National Sustainable Development Policy*:
<http://www.environ.ie/DOEI/DOEIPol.nsf/wvNavView/Sustainable+Development:+A+Strategy+for+Ireland?OpenDocument&Lang=en>
- *Building Conservation Guidelines*:

<http://www.viron.ie/DOEI/doi/pub.nsf/wv/InfoView/17407B65C95D10D280256F0F003DB979?OpenDocument&Lang=en#i2>

Further Information

<http://www.tcd.ie/civileng/Staff/Alan.OConnor/>

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The Civil Engineering Office is open Monday – Friday, from 9am to 5pm, and is closed for lunch from 1-2pm.