

DEPARTMENT OF CIVIL ENGINEERING

Master of Engineering Studies

Master of Engineering Studies (*Structural and Foundation Engineering*)

Master of Project Management*

Graduate Diploma in Geotechnical Engineering

Graduate Diploma in Structural and Foundation Engineering

Graduate Diploma in Structural Engineering

Graduate Diploma in Project Management*

Graduate Certificate in Greenhouse Gas Mitigation

Graduate Certificate in Project Management*

* only available in distance mode through the Internet.

Master of Engineering Studies (*Structural and Foundation Engineering*) 48 credits 1-2 years, 1.0 years for international students.

Graduate Diploma (*Structural and Foundation Engineering*) 36 credits 1.0 years

Course Structure Option A (Offered in Odd Years, e.g., 2005, 2007, etc.)

Semester 1			Semester 2		
<i>UoS Code</i>	<i>UoS Name</i>	<i>CPs</i>	<i>UoS Code</i>	<i>UoS Name</i>	<i>CPs</i>
CIVL 5450	Analysis and Design of Pile Foundations	6	CIVL 5454	Rock Engineering	6
CIVL 5351	Environmental Geotechnics	6	CIVL 5456	Earth and Rockfill Dams	6
CIVL 5258	Advanced Structural Steel Design	6	CIVL 5265	Advanced Structural Stability Analysis	6
CIVL 5264	Composite Steel-Concrete Structures	6	CIVL 5257	Concrete Structures – Prestressed Concrete	6
Sub-Total		24			24
Total CPs: 48					

Course Structure Option B (Offered in Even Years, e.g., 2006, 2008, etc.)

Semester 1			Semester 2		
<i>UoS Code</i>	<i>UoS Name</i>	<i>CPs</i>	<i>UoS Code</i>	<i>UoS Name</i>	<i>CPs</i>
CIVL 5452	Foundation Engineering	6	CIVL 5455	Engineering Properties of Soils	6
CIVL 5457	Geotechnical Investigation, Instrumentation and Case Studies	6	CIVL 5451	Numerical & Computer Methods in Geotechnical Engineering	6
CIVL 5256	Concrete Structures: Serviceability and strength	6	CIVL 5255	Concrete Structures: Durability and Environmental Response	6
CIVL 5262	Structural Steel Connections	6	CIVL 5263	Stainless Steel and Aluminium Structures	6

Sub-Total	24	24
Total CPs: 48		

Admission: successful completion of a 4 year bachelor of engineering degree in civil engineering, or related disciplines.

Graduate Diploma in Geotechnical Engineering
 Graduate Diploma in Structural and Foundation Engineering
 Graduate Diploma in Structural Engineering

These one year (36 credit point) diplomas can be taken as a one year program or as a pathway to the Master of Engineering Studies.

Admission: successful completion of a 4 year bachelor of engineering degree in civil engineering, or related disciplines.

Graduate Diploma in Geotechnical Engineering

Provides professional engineers with an up to date, soundly based series of units covering a wide range of topics in soil and rock mechanics and foundation engineering. One of the main aims of the program is to demonstrate the application of modern analytical techniques and to show how these relate to more traditional methods of analysis and design. Emphasis is also placed on the importance of appropriate determination and selection of the soil and rock parameters required for practical geotechnical analysis and design. At least half of the credit points are obtained from geotechnical engineering subjects.

Graduate Diploma in Structural and Foundation Engineering

Intended for professional engineers who wish to undertake graduate training in both structural and geotechnical engineering. This course is wider than the Graduate Diploma in Structural Engineering and is aimed at promoting a better understanding of each of these disciplines and their interrelationships the course covers a wide range of units specifically related to structures and their foundations, with emphasis given to their behaviour and interaction, and to the procedures used in their analysis and design. Both steel and concrete structures are considered as well as a wide range of foundation types. At least half of the credit points are obtained from structural and geotechnical engineering subjects.

Graduate Diploma in Structural Engineering

Enables professional engineers to become familiar with recent developments in structural analysis and design. The units will emphasis the relationships between the behaviour of structures and procedures used in their design. The important influence of the properties of structural steel and concrete and of fabrication and construction practices on structural behaviour will be discussed, and methods of avoiding failures will be given.

The modern methods of analyzing structural behaviour will be presented and demonstrated on computer systems. Practical structures in steel, reinforced or prestressed concrete or of composite construction will be considered, including buildings, bridges, industrial structures and storage structures.

At least half of the credit points are obtained from structural engineering subjects.

Graduate Certificate in Greenhouse Gas Mitigation

This graduate certificate can be completed in 6 months (24 credit points).

The program is designed for professional engineers who wish to contribute to managing greenhouse gas in the future. The course delivers specialized information about controlling carbon dioxide emissions from businesses both large and small and in generating sinks of greenhouse gas.

Core units of study are supplemented with the legal socio-economic issues surrounding climate change and the central role engineers will play in managing the risks involved.

OTHER UNITS OF STUDY OFFERED IN CIVIL ENGINEERING

Compulsory Unit for all new MES students

ENGG5001, Professional Development - Semester 1, 2004 (see EIE units for a description of the contents of this compulsory unit.

Environmental	Credit points	Unit of Study	Semester offered
CIVL 5353	4	Environmental Oceanography and Meteorology	1/Every year
CIVL 5654	4	Ocean Mixing	2/Every year
ENGG 5601	6	Greenhouse Gas Mitigation	2/Every year
ENGG 5610	6	Environmental Studies (offered at the University of Tokyo only)	1/Every year
Other			
CIVL 5851	6	Civil Engineering Project	Both/Every year
CIVL 5852	12	Project	Both/Every year
CIVL 5853	2	Seminar	Both/Every year
ENGG 5001	6	Professional Development	1/Every year

DESCRIPTIONS OF UNITS OF STUDY

ENGG 5001 Professional Development
Compulsory Unit of Study

6 credit points

This unit of study is compulsory for all new MES students enrolled in the Faculty of Engineering. Coordinator: Professor Ron Johnston, ACIIC

Classes: lectures, tutorials and workshops (2 hours per week), offered in Semester 1 (may be taught as an intensive format if appropriate)

Assessment: Essay, presentation, participation in group project, project report.

Objectives: To provide:

- an introduction to the various elements of engineering practice
- an understanding of the role of the engineer in industry
- basic knowledge of the law of contracts and legal responsibility
- teamwork and leadership skills
- an understanding of professional responsibilities of engineers
- competence in verbal communication and presentations
- competence in reading and writing reports
- an understanding of ethical considerations.

Outcomes: Students will have a working competence in the various elements of engineering practice, and enhanced communication skills that will assist them in their other technical courses.

Syllabus Summary:

- Some Heroic Engineers
- The various roles of engineers
- Professional and legal responsibilities
- Teamwork
- Leadership
- Creativity
- Effective verbal communication
- Effective written communication
- Ethical issues
- Engineering case studies – successes and disasters
- Management of risk

Reference book: To be nominated by the lecturers.

ENGG 5601 Greenhouse Gas Mitigation

6 credit points

Unit of study designed for the environmental engineering students, either MES or Grad. Cert. of GHG Mitigation.

Session: 2. Classes: Classes 26 hours lectures 13 hours tutorial/lab/site visits. Offered every year.

Assessment: Assignments and final examination.

Objectives: To develop an understanding of, the significance of carbon dioxide in climate; the role of increasing fossil fuel energy conversion efficiency; the international framework for carbon sinks; the size, cost, potential and nature of terrestrial and oceanic sinks of carbon; the amelioration of the impacts of climate change.

Outcomes: Students will be able to make recommendations of the most cost effective approach to enterprises meeting carbon dioxide limits expected to be imposed as a result of the Kyoto Protocol.

Syllabus summary: Greenhouse science, energy efficiency, carbon sinks, climate change amelioration.

Reference book:

P. Riemer, A. Smith, K. Thambimuthu (1998). Greenhouse Gas Mitigation, Elsevier, Amsterdam. p777.

CIVL 5257 Concrete Structures: Prestressed Concrete

6 Credit Points

Unit of Study For the degree of Engineering Studies, Graduate Diploma in Structural Engineering.

Session: 1, Classes: Lectures – 26 hours on Monday, in odd numbered years (e.g. 2005).

Assessment: Assignment submissions, as indicated at the commencement of the course.

Objectives: To develop an advanced understanding of the behaviour, analysis and design of prestressed concrete structures.

Outcomes: Students will develop skills in the analysis and design of prestressed concrete beams, columns and slabs, to satisfy the serviceability and strength provisions of the Australian Concrete Structures Standard.

Syllabus Summary: The behaviour and design of prestressed concrete structures and structural elements including beams, columns, slabs etc. Topics covered will include steel and concrete materials, prestress losses, flexural and shear behaviour at service loads and ultimate loads, short and long term deflections, load balancing and anchorage zones.

Reference books:

Warner et al, Concrete structures (Longman)
Australian Standard AS 3600 Concrete Structures

CIVL 5258 Advanced Structural Steel Design

6 Credit points

Session: 1. Classes: 2 hour lecture each week on Thursday afternoons, in odd numbered years (e.g. 2005). Prerequisite: BE or equivalent.

Assessment: Assignment submissions, as indicated at the commencement of the Unit of Study.

Unit of study for the degree of Master of Engineering Studies, Graduate Diploma in Structural Engineering.

Objective: To develop an advanced understanding of the behaviour and design of hot-rolled and cold-formed structures to Australian and international standards.

Expected outcomes: Students will understand the principles for the design of hot-rolled steel and cold-formed steel structures. They will appreciate the difference between hot-rolled steel design, cold-formed steel design, Australian, British and USA standards and specifications.

Syllabus summary: International design standards, International material standards, Limit states design philosophy and approaches, Loading standards, Methods of analysis, Flexural members section and member capacity, Flexural members international comparisons, Compression members section and member capacity, Compression members international comparisons, Beam-column members capacity, beam-column members international comparisons, bolted connections and welded connections

References:

AS/NZS4600:1996, Cold-formed Steel Structures, Standards Australia, Sydney, 1996.
AS/NZS4100:1998, Steel Structures, Standards Australia, Sydney, 1998.
GJ Hancock, MJ Clarke and TJ Wilkinson, CIVL 3206 Steel Structures 1 – Lecture Notes, Department of Civil Engineering, University of Sydney, Semester 2, 2001
GJ Hancock, Design of Cold-Formed Steel Structures to AS/NZS 4600, AISC, 1998
GJ Hancock, TM Murray and DS Ellifritt, Cold-Formed steel structures to the AISI Specification, Marcel Dekker, New York, 2001

NS Trahair and MA Bradford, *The Behaviour and Design of Steel Structures*, 3rd Edition, Chapman and Hall, London, 1998
American Institute of Steel Construction, *Load and Resistance Factor Design Specification for Steel Structural Members*, December, 1994
British Standards, *Structural Use of Steel in Buildings, Part 1, Code of Practice for Design of Rolled and Welded Sections*, 2000GJ Hancock, TM Murray and DS Ellifritt, Cold-Formed steel structures to the AISI Specification, Marcel Dekker, New York, 2001
NS Trahair and MA Bradford, *The Behaviour and Design of Steel Structures*, 3rd Edition, Chapman and Hall, London, 1998
NS Trahair, MA Bradford and DA Nethercot, *The Behaviour and Design of Steel Structures to B55950*, 3rd British Edition, Spon Press, 2001.
American Institute of Steel Construction, *Load and Resistance Factor Design Specification for Steel Structural Members*, December, 1994
British Standards, *Structural Use of Steel in Buildings, Part 1, Code of Practice for Design of Rolled and Welded Sections*, 2000

CIVL5264 Composite steel-concrete structures

6 credit points

Unit of study for the degree of Master of Engineering Studies, Graduate Diploma in Structural Engineering

Session: 1. Classes: 2 hour lecture per week on Monday afternoons in odd numbered years (e.g. 2005)

Prerequisite: BE or equivalent

Assessment: Assignment submissions, as indicated at the commencement of the course

Objectives: To develop an understanding of the behaviour and design of composite steel-concrete structures

Expected outcomes: Students will understand the basic principles for the design of steel-concrete composite structures. In particular, they will develop an understanding of the procedures required for the design of composite beams, slabs and columns; they will also be introduced to the concepts of composite connection design. Design guidelines will reflect requirements of the Australian Standards, Eurocodes, British Standards and American Standards.

Syllabus summary: Composite construction; Design of composite beams and slabs: composite action, shear connectors, degree of shear connection, partial shear interaction, time effects; Design of composite columns; Composite connections.

References:

AS2327.1:2003, *Composite structures – Part 1: Simply supported beams*. Sydney: Standards Australia, 2003.

Eurocode 4:2004, *EC4 Design of composite steel and concrete structures – Part 1.1: general rules and rules for buildings*, British Standards Institution, 2004.

Johnson RP and Anderson D. *Designers' handbook to Eurocode 4*. Thomas Telford, London, 1993.

Johnson RP. *Composite structures of steel and concrete*. 3rd edn. Blackwell Scientific Publications, Oxford, UK. 2004.

Nethercot D. *Composite construction*. Routledge, London, 2003.

Oehlers DJ and Bradford MA. *Composite steel and concrete structural members: fundamental behaviour*. Pergamon Press, Oxford, 1995.

CIVL5265 Advanced Structural Stability and Analysis

6 Credit points

Unit of study for the degree of Master of Engineering Studies, Graduate Diploma in Structural Engineering.

Session: 2. Classes: 2 hour lecture per week on Monday afternoons in odd numbered years (e.g. 2005). Prerequisite: BE or equivalent

Assessment: Assignment submissions, as indicated at the commencement of the course

Objectives: To develop an understanding of the stability analysis of structures at advanced level.

Expected outcomes: Students will understand the basic principles for the stability analysis of structures, including buckling analysis and second order large displacement analysis. Students will have an appreciation of the evolution of analyses from first-order linear analysis through buckling analysis to large displacement nonlinear analysis. The relationship between the level of analysis and the strain-displacement relations will be understood in the context of frame, plate and cable structures.

Syllabus summary: Strain-displacement relationships for frame, plate and cable structures. Lagrangian and updated Lagrangian methods of analysis. Matrix analysis of frame structures. Large displacement of plate structures. Interaction buckling. Commercial computer software, benchmarking and verification of 2nd order analyses, analysis of cable structures by computer, form finding of cable structures.

References:

Hancock GJ, Clarke MJ, Trahair NS, Bridge, RQ. Analysis of steel structures to AS4100 – Lecture Notes. Department of Civil Engineering, University of Sydney.

Harrison, HB. Structural analysis and Design – some microcomputer applications. Pergamon Press, 1990.

Buchholdt HA. An introduction to cable roof structures.

CIVL 5351 Environmental Geotechnics

6 credit points

Unit of study for the degree of Master of Engineering Studies, Graduate Diploma in Geotechnical Engineering or Graduate Diploma in Structural and Foundation Engineering.

Session: 1. Classes: 2 hour lecture each week on Thursday afternoons, in odd numbered years (e.g. 2005). Prerequisite: BE or equivalent.

Assessment: Assignment submissions, as indicated at the commencement of the Unit of Study.

Objectives: To develop an understanding of the geotechnical aspects of the design and management of industrial and domestic waste disposal systems.

Expected outcomes: Students should gain an advanced understanding of: the role of geotechnics in the design of waste management systems; current design methods and technologies. In particular, they should be able to predict: likely interactions between waste and soil; of pollutant movement in the ground, and be able to evaluate strategies for the containment of industrial and domestic wastes and mine tailings.

Syllabus summary: Landfill design, including clay mineralogy, effects of chemicals on soil permeability, flow rates through membranes, effect of punctures, composite liners, mechanisms of mass transport, diffusion, dispersion, advective transport, sorption, predicting transport time, solutions to advection-dispersion equation, design of liners, stability of clay liners on slopes, design of covers, infiltration rates. Tailings disposal, including types of tailings dams, design of dams, water balances, rehabilitation, use of slope stability and seepage software.

References:

S. G. Vick Planning, Design and Analysis of Tailings Dams (Wiley).

R.K. Rowe, R.M. Quigley & J.R. Booker Clayey Barrier Systems for Waste Disposal Facilities.

Library classification: 624.151

CIVL 5353 Environmental Oceanography and Meteorology

4 credit points

Unit of study for the degree of Master of Engineering Studies, Graduate Diploma in Geotechnical Engineering or Graduate Diploma in Structural and Foundation Engineering, Graduate Certificate of Greenhouse Gas Mitigation.

Session: 1. Classes: Lectures 26 hrs Monday afternoons. Offered every year.

Assessment: Assignments, 2 hour exam.

Objectives: To obtain an understanding of the basic meteorology and oceanography relevant to an environmental engineer.

Outcomes: An appreciation will be obtained of the equation governing geophysical fluid dynamics and knowledge of the sources for forecasts of the environment.

Syllabus summary: The impact of the air or water environment on engineering projects or the implications of construction or industrial processes on the atmosphere or the ocean need to be assessed with a knowledge of the fundamental processes governing the hydrosphere. Topics include historical review of the important physical concepts. The equations of fluid mechanics and the simplifications for a rotating earth. The routine collection of data. Numerical models. Forecasting.

Reference books:

Hasse, L. and F. Dobson, Introductory Physics of the Atmosphere and Ocean, D. Reidel Publishing Co., Holland, 1986.

Jones, I S F and Y Toba, Wind stress over the Ocean. Cambridge University Press, Cambridge, 2001.

Wells, N., The Atmosphere & Ocean, Taylor & Francis, 1986.

Stommel, H., A View of the Sea. A Discussion Between a Chief Engineer and an Oceanographer about the Machinery of the Ocean Circulation, Princeton University Press, 1987.

Jones I.S.F. and J.E. Jones, Oceanography in the Days of Sail, Hale & Iremonger, Sydney, 1992.

CIVL 5450 Analysis and Design of Pile Foundations

6 credit points

Unit of study for the degree of Master of Engineering Studies, Graduate Diploma in Geotechnical Engineering or Graduate Diploma in Structural and Foundation Engineering.

Session: 1. Classes: 2 hour lecture each week on Thursday afternoons, in odd numbered years (e.g. 2005).

Prerequisite: BE or equivalent.

Assessment: Assignment submissions, as indicated at the commencement of the Unit of Study.

Assessment: Assignment submissions, as indicated at the commencement of the course.

Objectives: To develop an understanding of the modern principles of design of pile foundations and the application of those principles to practice.

Expected outcomes: Students should gain an advanced understanding of the types of pile foundations used in practice, and the procedures for analysis of pile foundations under various types of loading, and gain experience in carrying out pile design for real geotechnical profiles.

Syllabus summary: Types of piles and their uses, effects of pile installation, axial capacity of piles and pile groups, settlement of pile foundations, ultimate lateral capacity, lateral deformations, analysis of pile groups subjected to general loading conditions, piled raft foundations, piles subjected to ground movements, pile load testing, code provisions for pile design.

References:

H.G. Poulos and E.H. Davis (1980) "Pile foundation analysis and design", John Wiley, New York.

W.G.K. Fleming, A.J. Weltman, M.F. Randolph and W.K. Elson (1992). "Piling Engineering". 2nd Edition, Surrey Univ. Press.

CIVL 5454 Rock Engineering

6 Credit points

Unit of study for the degree of Master of Engineering Studies, Graduate Diploma in Geotechnical Engineering.

Session: 2. Classes: 2 hour lecture each week on Thursday afternoons, in odd numbered years (e.g. 2005). Prerequisite: BE or equivalent.

Assessment: Assignment submissions, as indicated at the commencement of the Unit of Study.

Objectives: to develop an understanding of the behaviour and design of engineering structures in rock masses

Expected outcomes: Students will have learnt how to classify and characterise rocks and rock masses for engineering purposes and developed an understanding of basic rock mechanics. Etc.

Syllabus summary: Introduction to rock mechanics and rock engineering. Index properties and engineering characterisation of rocks and rock masses. Planes of weakness in rock masses. Rock material strength and rock mass strength. Rock deformability. In situ stress conditions in rock masses. Underground openings. Rock slopes.

References:

1. Amir, J.M. (1986). Piling in Rock, A.A. Balkema, Rotterdam.
2. Bell, F.G. (editor) (1992). Engineering in Rock Masses. Butterworth-Heinemann, Oxford.
3. Bieniawski, Z. (1984). Rock Mechanics Design in Mining and Tunneling, A.A Balkema, Rotterdam.
4. Brady, B.H.G. and Brown, E.T. (1985). Rock Mechanics for Underground Mining, George Alien & Unwin, London.
5. Brown, E.T. (editor) (1981). Rock Characterisation, Testing and Monitoring - ISRM Suggested Methods, Pergamon Press, Oxford.
6. Charlez, Ph.A. (1991). Rock Mechanics – Vol. 1 Theoretical Fundamentals. Editions Technip. Paris.
7. Farmer, I. (1983). Engineering Behaviour of Rocks, 2nd edition, Chapman & Hall, London.
8. Franklin, J.A. and Dusseault, M.B. (1989). Rock Engineering. McGraw-Hill Publishing Co., New York.

9. Franklin, J.A. and Dusseault, M.B. (1991). Rock Engineering Applications. McGraw-Hill Publishing Co., New York.
10. Goodman, R.E. (1980). Introduction to Rock Mechanics, John Wiley & Sons, New York.
11. Hoek, E. and Brady, J. (1981). Rock Slope Engineering, 3rd edition, Institution of Mining and Metallurgy, London.
12. Hoek, E. and Brown, E.T. (1980). Underground Excavations in Rock, Institution of Mining and Metallurgy, London.
13. Hudson, J.A. (1989). Rock Mechanics Principles in Engineering Practice, CIRIA Butterworths, London.
14. Jaeger, J.C. and Cook, N.G.W. (1979). Fundamentals of Rock Mechanics, 3rd edition, Chapman & Hall, London.
15. Kirkaldie, L. (editor) (1988). Rock Classification Systems for Engineering Purposes. Special Technical Publication, ASTM (STP984).
16. Wittke, W. (1990). Rock Mechanics – Theory and Applications With Case Histories. Springer-Verlag, Berlin.
17. Wyllie, D.C. (1991). Foundations in Rock, E&FN Spon, London..

CIVL 5456 Earth and Rockfill Dams

6 credit points

Unit of study for the degree of Master of Engineering Studies, Graduate Diploma in Geotechnical Engineering or Graduate Diploma in Structural and Foundation Engineering.

Session: 2. Classes: 2 hour lecture each week on Thursday afternoons, in odd numbered years (e.g. 2005). Prerequisite: BE or equivalent.

Assessment: Assignment submissions, as indicated at the commencement of the Unit of Study.

Objectives: To develop an understanding of the design and monitoring of earth and rockfill dams.

Expected outcomes: Students should gain an understanding of the role of geotechnics in the design of Earth and Rockfill dams, and be able to apply hand and computer based techniques to the design of such dams.

Syllabus summary: Types of E & R dams, zoning, design of filters, piping, dispersive soils and tests for identifying dispersive soils, stability of E&R embankments, computer based analysis of stability, instrumentation, design of rip rap, flow and seepage in E&R dams, seepage control and cut-offs, grouting, numerical analysis of seepage, deformation of embankments and foundations, preparation of foundations, design for earthquake resistance of E&R dams.

References:

R.Fell, P. McGregor and D. Stapledon Geotechnical Engineering of Embankment Dams, Balkema, 1992.

J.B. Cooke and J.L. Sherard (eds) Concrete Face Rockfill Dams, ASCE, 1985.

CIVL 5654 Ocean Mixing

4 credit points

Unit of study for the degree of Master of Engineering Studies, Graduate Diploma in Geotechnical Engineering or Graduate Diploma in Structural and Foundation Engineering or Graduate Certificate of Greenhouse Gas Mitigation.

Session: 2. Prerequisite: Environmental Oceanography and Meteorology CIVL 5353.

Classes: Lectures – 26 hours on Monday afternoons. Offered every year.

Assessment: Assignments and 2 hour exam.

Objectives: To introduce the physics of mixing in the ocean of pollutants. To provide access to data needed for design.

Outcomes: Competency in engineering aspects of disposal of pollutants in the ocean.

Syllabus summary: Turbulent diffusion, dilution advection. Wind mixing and ocean stratification. Ocean outfalls. Ocean dumping. Coastal cooling water systems. Ocean Nourishment.

Reference books:

Fisher, Hugo B., E. John List, Robert C.Y. Koh, Jorg Imberger, Norman H. Brooks, Mixing in Inland and Coastal Waters, Academic Press, (1979).

Csanady, C T (1972) Turbulent Diffusion in the Environment. D Reidel, pp.248.