SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING
Semester 1, 2018

CVEN9806 PRESTRESSED CONCRETE

COURSE DETAILS

<table>
<thead>
<tr>
<th>Units of Credit</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact hours</td>
<td>3 hours per week</td>
</tr>
<tr>
<td>Class</td>
<td>Wednesday 6 to 9pm CE101</td>
</tr>
<tr>
<td>Lecturer</td>
<td>Associate Professor Mario M. Attard</td>
</tr>
<tr>
<td>Email:</td>
<td><a href="mailto:m.attard@unsw.edu.au">m.attard@unsw.edu.au</a></td>
</tr>
<tr>
<td>Phone:</td>
<td>+61 2 9385 5075</td>
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INFORMATION ABOUT THE COURSE

1. Introduction to Prestressed Concrete:

2. Design for Serviceability:
   2.1 Stress limits. Serviceability criteria. Determination of prestress and eccentricity. Cable profiles.
   2.2 Cracked section analysis. Effect of cracking at service loads. Short-term cracked section analysis.
   2.3 Short-term deflection calculations. Crack control. Losses of prestress.

3. Design for Strength:
   3.2 Transfer Strength.
   3.3 Design For Shear. Effect of Prestress on Shear. Flexure-Shear And Web-Shear Cracking. Stirrup Design.

4. Statically Indeterminate Beams:
   4.1 Introduction to Continuous Prestressed Concrete Beams; Secondary Moments; Method of Equivalent Loads; Load Balancing;
   4.2 Practical Tendon Profiles; Moment Redistribution; Secondary Effects at Ultimate;

6. End Block Design:
   5.1 Bursting and Spalling Forces in Post-Tensioned End-Blocks; Single and Multiple Anchorages; Design and Analysis; Transmission Lengths in Pretensioned Members;

This course will also provide you with opportunities to develop the following graduate attributes:

- the capacity for analytical and independent critical thinking;
- skills related to lifelong learning, such as self-reflection (ability to apply theory to practice in familiar and unfamiliar situations); and
- collaborative and teamwork skills.
HANDBOOK DESCRIPTION


Refer to Online Handbook available at:

OBJECTIVES

- Establish the philosophies and principles of the structural design of prestressed concrete.
- Present techniques for proportioning and detailing simple structural members in prestressed concrete.
- Develop an insight into the behaviour of prestressed concrete structural members both at service loads and overloads.
- To give you an opportunity to develop and reflect on graduate attributes such as critical thinking and problem solving, lifelong learning skills and collaborative skills.

TEACHING STRATEGIES

The teaching strategies that will be used include:

- **Lectures** that will focus on the development and application of generalised problem-solving processes for the stress, strain and deformation analysis of structures. Lectures will also emphasise the relationship of the content to engineering practice and will provide an opportunity for reflection on learning. The lectures are recorded and should be available on the Moodle course page.
- **Problem** classes will concentrate on strategies for solving such problems. You will be encouraged, from time to time, to work in small groups to solve problems.
- **Moodle Blended Learning Course Page** provides a step by step guide on the course. There is a discussion forum to help provide interaction and help from your peers. Links to video recordings and learning modules to help you learn the solution techniques for many of the subject areas.

Suggested approaches to learning in this course include:

- Regular participation in lectures and class problem sessions. *Review lecture and class problem material. Follow worked examples. Reflect on class problems and quizzes.*
- Complete all the required tasks in the Moodle course page for this course.
- Weekly reading and recording of your learning.
- Appropriate preparation for class problem activities.
- Planning your time to achieve all assessment requirements (see assessment).
- We encourage you to work with your peers. A good way to learn the material is in small study groups. Such groups work best if members have attempted the problems individually before meeting as a group. A valued and honest collaboration occurs when, for example, you “get stuck” early on in attacking an exercise and go to your classmate with a relevant question. Your classmate then has the opportunity to learn from your question as well as help you. You then bring something to the collaboration. You can learn too from last year’s problem sets and quizzes if used as a check or corrective when you seem to have hit a dead end.
- Students who perform poorly in the quizzes are strongly encouraged to discuss their progress with the lecturers during the semester. Please do not suffer in silence – seek the help at an early stage! We would like you to make most of this learning process and receive a high grade in the course.

EXPECTED LEARNING OUTCOMES

At the end of this course, if a student has attended the lectures reflective on the presented material and participated in the classes, it is expected that they will be able to proportion the dimensions of simple structural prestressed concrete members such as simply supported beams, continuous beams, one-way slabs and two-way slabs. They should be able to proportion reinforcement for flexural and shear strength and be able to check deflections and detail to control cracking. In particular the learning outcomes are:

**LO1.** Be familiar with the types of prestressed concrete members, their fabrication, design and use.
**LO2.** Be familiar with the Australian Standard for Prestressed Concrete Design AS3600.
**LO3.** Proportion the dimensions of simple structural prestressed concrete members such as simply supported beams, continuous beams, one-way slabs and two-way slabs.
**LO4.** Proportion reinforcement for flexural and shear strength.
**LO5.** Be able to use the software package RAPT for the design of prestressed concrete continuous beams and slabs.

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LO6. Perform a literature review, plan and carry out a small project
LO7. Work effectively in a team.

These learning outcomes map to Engineers Australia Stage 1 Competencies 1.1 & 1.2

1.1. Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline.

1.2. Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline.

Self-centred and self-directed learning (expectations of the students):

In addition to the class problem sessions, you are expected to commit 6 - 8 hours per week (1.5 hours for each hour of contact) to independent learning and general problem solving.

**ASSESSMENT**

Assessment will be based on completion of online Moodle modules, one major assignment and a final exam. These components will address problems consistent with those you are likely to face as a professional Civil/Environmental Engineer.

- The **online Moodle modules** are learning modules to help you learn the solution strategies for the major topics. The assessment is based on completion of the modules.
- The final exam is given because the course learning outcomes include a significant level of technical learning that can be effectively assessed in an exam environment and because exams have high reliability. It is primarily designed to align with UNSW graduate attributes 2 and 3.
- A **mark of at least 40% in the final examination is required before the class work (hand-in quizzes and online tasks) is included in the final mark.** The formal exam scripts will not be returned but you are permitted to view the marked script.

The relative value of each of the assessable tasks is as follows:

<table>
<thead>
<tr>
<th>Item</th>
<th>Marks</th>
<th>Due Date</th>
<th>Criteria</th>
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<tbody>
<tr>
<td><strong>Online Learning Modules</strong></td>
<td>10%</td>
<td>See Course Program</td>
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<tr>
<td><strong>Major Assignment</strong></td>
<td>30%</td>
<td>Week 11</td>
<td>The assignment is undertaken in groups. The assignment will be given out early in the semester. This team project is a core part of this course. Engineering design is normally a team-based activity, and the team project helps students to learn to do design in a team-based environment. Broadly, the assessment criteria are teamwork, coherent application of formal design processes, and the quality of the design. <strong>Late Submission:</strong> 10% of the full mark will be deducted for late submission for each business day that the assignment is submitted late unless approval has been given by the lecturer.</td>
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<tr>
<td><strong>Final Examination</strong></td>
<td>60%*</td>
<td>Final Examination Period</td>
<td>The final exam is a 2hr Open Book examination. The exam covers all the worked covered during the semester. Marks are awarded for correct answers and there are marks for getting the method correct.</td>
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*Note: A mark of at least 40% in the final examination is required before the class work is included.

The examinations and online modules show evidence of application of theoretical concepts to solving problems. There are no exemptions from any part of this assessment.

**Note:** The course coordinator reserves the right to adjust the final scores by scaling if agreed to by the Head of School.

**Supplementary Examinations for Semester 1 2018** will be held on Saturday 14th July 2018 – Saturday 21st July 2018 (inclusive) should you be required to sit one. You are required to be available during these dates. Please do not to make any personal or travel arrangements during this period.
RESOURCES

Reference

Additional Readings
Standards Australia, Australian Standard for Concrete Structures, AS3600
Warner, Rangan, Hall and Faulkies, Concrete Structures.
Loo, Yew-Chaye and Chowdhury, Sanaul Huq, Reinforced and Prestressed Concrete, Analysis and Design with emphasis on application of AS3600-2009, Cambridge University Press, 2010

Industry Websites
http://www.vsl.com VSL Prestressing (Aust.) Pty Ltd
http://www.raptsoftware.com/ RAPT Software
www.nationalprecast.com.au National Precast Concrete Association Australia
www.precastrnz.org.nz Precast New Zealand Inc.
www pci.org Precast/Prestressed Concrete Institute – USA
www.precast.org National Precast Concrete Association - USA
www.britishprecast.org British Precast Concrete Federation
www.cpci.ca Canadian Precast/Prestressed Concrete Institute
www.cpi-tv.com Concrete Plant International – the Concrete channel

Technology Enabled Learning and Teaching Website and Login to Moodle
http://telt.unsw.edu.au/

Pearson MasterEngineering
http://www.pearsonmylabandmastering.com/northamerica/masteringengineering/

UNSW Library Database
Access Engineering – platform of e-books, videos and interactive tables and graphs.
Look at the Curriculum Map and select “Strength of Materials”

COURSE PROGRAM

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Assessment Given Out</th>
<th>Submission Date</th>
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<tbody>
<tr>
<td>1 - 26th Feb</td>
<td>Introduction to Prestressed Concrete:</td>
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<td>2 – 5th March</td>
<td>Design for Serviceability</td>
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<td>3 – 12th March</td>
<td>Losses</td>
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<td>On-Line Module 1</td>
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<td>4 – 19th March</td>
<td>Design of Pretensioned Girder Bridges – Kenny Luu</td>
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<tr>
<td>5 – 26th March</td>
<td>Design of Post-Tensioned Members using RAPT</td>
<td>Major Assignment</td>
<td>On-Line Module 2</td>
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<tr>
<td>Date Range</td>
<td>Course Content</td>
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<tr>
<td>6 – 9th April</td>
<td>Design of Post-Tensioned Slabs (field trip wk)</td>
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<td>7 – 16th April</td>
<td>Slatically Indeterminate Beams: Load Balancing &amp; Practical Tendon Profiles</td>
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<td>8 – 23rd April</td>
<td>No Class - Anzac Holiday on the 25th April</td>
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<td>9 – 30th April</td>
<td>Flexural Strength: Limit State Design</td>
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<td>10 – 7th May</td>
<td>Shear Strength: Limit State Design</td>
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<tr>
<td>11 – 14th May</td>
<td>Transfer Strength: Limit State Design</td>
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<tr>
<td>12 – 21st May</td>
<td>End Block Design:</td>
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<td>13 – 28th May</td>
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**DATES TO NOTE**
Refer to MyUNSW for Important Dates available at:

https://my.unsw.edu.au/student/dates.html

**PLAGIARISM**
Beware! An assignment that includes plagiarised material will receive a 0% Fail, and students who plagiarise may fail the course. Students who plagiarise are also liable to disciplinary action, including exclusion from enrolment.

Plagiarism is the use of another person’s work or ideas as if they were your own. When it is necessary or desirable to use other people’s material you should adequately acknowledge whose words or ideas they are and where you found them (giving the complete reference details, including page number(s)). The Learning Centre provides further information on what constitutes Plagiarism at:

https://student.unsw.edu.au/plagiarism

**COURSE EVALUATION AND DEVELOPMENT**
The School of Civil and Environmental Engineering evaluates each course each time it is run through (i) the UNSW MyExperience Surveys, and (ii) Focus Group Meetings.

As part of the MyExperience process, your student evaluations on various aspects of the course are graded; the Course Coordinator prepares a summary report for the Head of School. Any problem areas are identified for remedial action, and ideas for making improvements to the course are noted for action the next time that the course is run.

Focus Group Meetings are conducted by the four Year Managers (academic staff) for any students who wish to attend, in each year of the civil and/or environmental engineering programs. Student comments on each course are collected and disseminated to the Lecturers concerned, noting any points which can help improve the course.

**ACADEMIC ADVICE**
For information about:
- Notes on assessments and plagiarism,
- School policy on Supplementary exams,
- Special Considerations, student.unsw.edu.au/special-consideration
- Solutions to Problems,
- Year Managers and Grievance Officer of Teaching and Learning Committee, and
- CEVSOC.

Refer to Academic Advice on the School website available at:

https://www.engineering.unsw.edu.au/civil-engineering/student-resources/policies-procedures-and-forms/academic-advice
### Program Intended Learning Outcomes

<table>
<thead>
<tr>
<th>PE1: Knowledge and Skill Base</th>
<th>PE2: Engineering Application Ability</th>
<th>PE3: Professional and Personal Attributes</th>
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</thead>
<tbody>
<tr>
<td>PE1.1 Comprehensive, theory-based understanding of underpinning fundamentals</td>
<td>PE2.1 Application of established engineering methods to complex problem solving</td>
<td>PE3.1 Ethical conduct and professional accountability</td>
</tr>
<tr>
<td>PE1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing</td>
<td>PE2.2 Fluent application of engineering techniques, tools and resources</td>
<td>PE3.2 Effective oral and written communication (professional and lay domains)</td>
</tr>
<tr>
<td>PE1.3 In-depth understanding of specialist bodies of knowledge</td>
<td>PE2.3 Application of systematic engineering synthesis and design processes</td>
<td>PE3.3 Creative, innovative and pro-active demeanour</td>
</tr>
<tr>
<td>PE1.4 Discernment of knowledge development and research directions</td>
<td>PE2.4 Application of systematic approaches to the conduct and management of engineering projects</td>
<td>PE3.4 Professional use and management of information</td>
</tr>
<tr>
<td>PE1.5 Knowledge of engineering design practice</td>
<td></td>
<td>PE3.5 Orderly management of self, and professional conduct</td>
</tr>
<tr>
<td>PE1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice</td>
<td></td>
<td>PE3.6 Effective team membership and team leadership</td>
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