CVEN9806 Prestressed Concrete Design

Semester 1, 2016

Never Stand Still | Faculty of Engineering | School of Civil and Environmental Engineering

COURSE DETAILS

Units of Credit	6	
Contact hours	3 hours per week	
Class	Tuesday, 6 to 9pm	CE101
Lecturer	Associate Professor Mario M. Attard	
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Campus Map:	CE – Civil and Environmental Building	
	http://www.facilities.unsw.edu.au/sites/all/files/KENC%20Campus%20Map_6.pdf	

INFORMATION ABOUT THE COURSE

1 Introduction to Prestressed Concrete:

1.1 Methods of Prestressing. Forces Imposed By Prestressing (Straight, Draped And Kinked Tendon Profiles). Load Balancing. Introductory Examples. Design Requirements: Strength And Serviceability. Material Properties.

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:

3.1 Limit State Design. Rectangular Stress Block. Ultimate Moment Capacity. Effect of Non-Prestressed Steel. Ductility.
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;

HANDBOOK DESCRIPTION

Introduction to prestressed concrete. Design for serviceability. Design for strength. Statically indeterminate beams. Behaviour and design of two-way slabs. End block design.

Refer to Online Handbook available at:

http://www.handbook.unsw.edu.au/undergraduate/courses/2016/CVEN9806.html

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.

TEACHING STRATEGIES

The teaching strategies that will be used and their rationale. Give some suggested approaches to learning in the course.

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 the engineering practice and will provide an opportunity for reflection on learning.
- **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.

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.*
- 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 years 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:

1. Be familiar with the types of prestressed concrete members, their fabrication, design and use.
2. Be familiar with the Australian Standard for Prestressed Concrete Design AS3600.
3. Proportion the dimensions of simple structural prestressed concrete members such as simply supported beams, continuous beams, one-way slabs and two-way slabs.
4. Proportion reinforcement for flexural and shear strength.
5. Be able to use the software package RAPT for the design of prestressed concrete continuous beams and slabs.
6. Perform a literature review, plan and carry out a small project
7. Work effectively in a team

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 **hand-in class problem sessions**, **one major assignment** and **a final exam**. These components will address problems consistent with those you are likely to face as professional Civil/Environmental Engineer.

- The purpose of **Hand-in class problem sessions** and **Major Assignment** will be to provide you with a clear study framework. It will also provide you with the opportunity to develop self-learning and problem solving skills. Hand-in class problem sessions and Quizzes will serve as a basis for discussion with your demonstrator and lecturer.
- *A mark* ***of at least 40%*** *in* ***the final examination*** *is required before the class work is included in the final mark.* The formal exam scripts will not be returned.

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

Hand-in class problem sessions:	**15%**
Major Assignment:	**25%**
Final Exam:	**60%**
	100%

There are no exemptions from any part of this assessment. If you are repeating the subject you must complete all components this year.

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

Assessment Mapping to Learning Outcomes:

AS → LO Mapping			Learning Outcomes (LO)				
Assessments (As)	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**LO6**	**LO7**
As1 Hand-in class problems (15%)	**-**	**4**	**5**	**6**	**-**	**-**	**-**
As2 Major Assignment (25%)	**1**	**4**	**2**	**4**	**5**	**4**	**5**
As3 Final Exam (60%)	**-**	**6**	**24**	**30**	**-**	**-**	**-**
Overall	**1**	**14**	**31**	**40**	**5**	**4**	**5**

RESOURCES

Reference

Gilbert, Mickleborough and Ranzi, Design of Prestressed Concrete to AS3600-2009, Second Edition, CRC Press, 2015.

Additional Readings

Gilbert and Mickleborough, The Design of Prestressed Concrete, Unwin Hyman, London, 1990.

Standards Australia, Australian Standard for Concrete Structures, AS3600

Warner, RF, Foster, SJ, and Kilpatrick AE, “Reinforced Concrete Basics”, Pearson, 2007

Warner, Rangan, Hall and Faulkes, Concrete Structures.

Warner and Faulkes, Prestressed Concrete, Longman, 1989.

Nilson, A.H., Design of Prestressed Concrete, John Wiley and Sons, 1978.

Lin, T.Y., Design of Prestressed Concrete Structures, John Wiley, 1963.

American Concrete Inst ACI318-89, Building Code requirements for Reinf. Conc.

Cement and Concrete Association of Australia, Concrete Design Handbook, 1990. Cement and Concrete Association of Australia, Concrete Design Workshop Worked Examples, 1990.

Nawy, Edward G., Prestressed Concrete – A Fundamental Approach, Fourth Edition Pearson Education Inc., 2003

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

Websites

http://www.vsl-intrafor.com VSL Prestressing (Aust.) Pty Ltd

Technology Enabled Learning and Teaching Wed Site and login to Moodle

http://telt.unsw.edu.au/
https://moodle.telt.unsw.edu.au/login/index.php

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"

CLASS PROBLEM SESSIONS

The class problem sessions begin in the 2nd week of semester. Each class will have a one, two or three demonstrators and we encourage you to develop a close working relationship with your demonstrator and the rest of your class problem group.

COURSE PROGRAM

Week	Topic	Assessment
1	**Introduction to Prestressed Concrete:**	
2	**Design for Serviceability**	
3	**Design for Serviceability**	
4	**Design of Pretensioned Girder**	Work Class Problem 1
	Mid-Semester Break 25th March to 3rd April	
5	**No Classes**	
6	**Statically Indeterminate Beams:** Load Balancing	
7	**Statically Indeterminate Beams:** Practical Tendon Profiles	Work Class Problem 2
8	**Design of Post-Tensioned Slabs**	
9	**Design for Flexural Strength:** Limit State Design	
10	**Design for Shear Strength:**	Work Class Problem 3
11	**Design for Transfer Strength:** Limit State Design	
12	**End Block Design:**	**Final Submission of Major Assignment**
13	**Revision**	

DATE INFORMATION

Refer to MyUNSW for Important Dates available at:

https://my.unsw.edu.au/student/resources/KeyDates.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 Course and Teaching Evaluation and Improvement (CATEI) process, and (ii) Focus Group Meetings.

As part of the CATEI 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,
- 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:

http://www.engineering.unsw.edu.au/civil-engineering/resources/academic-advice