



COURSE DETAILS

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|-------------------------|---|-------------------------|--|
| Units of Credit | 6 | | |
| Contact hours | 5 hours per week | | |
| Class | Wednesday 12.00-14.00 | Central Lecture Block 7 | |
| | Friday 14.00-15.00 | Central Lecture Block 7 | |
| Tutorial | Friday 15.00-17.00 | | |
| Course Convenor: | Dr. Wei Gao | | |
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| | Phone: 9385 4123 | | |
| Lecturer: | Dr. Sawekchai (Ball) Tangaramvong | | |
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INFORMATION ABOUT THE COURSE

The aim of this course is to extend the understanding of structural behaviour by studying new concepts in the context of design of reinforced concrete structures and to introduce you to the design codes that govern structural design.

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

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

How does this course relate to other course offerings in the discipline?

This course brings together elements you have learnt in Engineering Mechanics, Mechanics of Solids, Materials and Structures. The design elements that you learn in this subject will be later extended in the 4th Year elective courses where you will complete the basics of structural engineering and be sufficiently skilled to design in practice.

HANDBOOK DESCRIPTION

A course on the design of structural elements subject to bending, shear and combined bending and axial compression. Topics covering both concrete and steel design will be covered. These include: concrete mechanical properties, reinforcement types and properties; durability requirements; behaviour of reinforced concrete cross-sections in bending at both service and ultimate loads; ultimate strength analysis and design of cross-sections in flexure (singly and doubly reinforced, ductility); serviceability analysis and design of beams (cracked section analysis, deflection and crack control); ultimate strength in shear; bond anchorage and curtailment (simple and continuous beams and one-way slabs); short and slender concrete columns (interaction diagrams); laterally unsupported steel beams (lateral-torsional buckling in bending and shear strength); steel beam-columns (in-plane and out-of-plane failure); steel members subjected to biaxial bending; steel connections and detailing (force and moment connections); timber beams in bending and shear; simple connections.

EXPECTED LEARNING OUTCOMES

At the end of this course you will have developed the following skills:

Familiarise you with fundamental structural design concepts of members, specifically the design of beams and beam-columns of steel, concrete and other materials for strength, serviceability, durability and fire; detailing of concrete of structures; moment connections in steel structures.

For each hour of contact it is expected that a student will put in at least 1.5 hours of private study.

TEACHING STRATEGIES

Following are our suggested approaches to learning in the course.

| | |
|--|---|
| Private Study | <ul style="list-style-type: none">• Review lecture material and read textbook• Do set problems and assignments• Reflect on class problems and assignments |
| Lectures | <ul style="list-style-type: none">• Find out what you must learn – read ahead.• See methods that are not in the textbook• Follow worked examples• Listen for announcements on course changes |
| Tutorials | <ul style="list-style-type: none">• Be guided by tutors• Practice solving set problems• Ask questions |
| Assessments (multiple choice, tests, examinations, assignments, hand-in tutorials, laboratory reports etc.) | <ul style="list-style-type: none">• Demonstrate your knowledge and skills• Demonstrate higher understanding and problem solving |

ASSESSMENT

Your final mark will be calculated as follows:

| | |
|-------------|------|
| Assignments | AS % |
| Final exam | EX % |

Final mark for the course $(10 * AS * EX) / (6 * AS + 4 * EX) \%$

The effect of using this harmonic mean is to ensure that a minimum performance (at least about 40%) is achieved in the exam component.

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

It is important that you keep up to date with the material being presented in lectures and in the tutorials. Class assessment is based on two design assignments, of equal weighting, with Assignment 1 due Week 7 and Assignment 2 due Week 13. You will have a single final exam that will cover all aspects of the course.

RESOURCES

Textbook:

Foster, S.J., Kilpatrick A.E., and Warner, R.F., “Reinforced Concrete Basics”, Pearson, 2nd Ed., 2010, ISBN: 9781442538450

Recommended Reading:

Trahair, N.S. and Bradford, MA, The Behaviour and Design of Steel Structures to AS4100, 3rd Australian edition, E & FN Spon, London, 1998.

Additional Reading

AS3600-2009, “Concrete Structure”, Standards Australia, 2009.

AS4100-1998, “Steel Structures”, Standards Australia, 1998.

AS1720.1-1997, “Timber Structures part 1: Design Methods”, Standards Australia, 1997.

Moodle (<https://moodle.telt.unsw.edu.au/login/index.php>) - Lecture Notes, Tutorial Exercises, Quiz Problems and Solutions, Assignments, URLs, Discussions, Email.

COURSE PROGRAMME

Note: The week of the scheduled lectures is indicative ONLY and may vary from time to time.

| Week | Lecture | Reading |
|------|---|--------------------------|
| 1 | Introduction to Steel Structures Design. Revision: Design of laterally supported beams (section capacity, local buckling). | TB Chap 1, 4 & 5 |
| 2 | Design of laterally unsupported beams. | TB Chap 6 |
| 3 | Design for shear of steel beams | TB Chap 6 |
| 4 | Design of steel beam-columns. Out-of-plane behaviour of beam-columns. Biaxial bending and compression of beam-columns. | TB Chap 7 |
| 5 | Biaxial bending and compression of beam-columns. | TB Chap 7 |
| 6 | Design of steel connections I: revision of simple connections (bolted and welded); Moment connections | TB Chap 9 |
| 7 | Revision of limit states concepts; aspects of materials; load paths; fire; durability; behaviour of sections. | RCB Chaps 1 & 2 |
| 8 | Flexure behaviour under load; moment-curvature; design for serviceability-deflections. | RCB Chap 3 Sects 3.1-3.3 |
| 9 | Design of concrete members for bending: theory, stress blocks, equilibrium across a section, singly reinforced sections, doubly reinforced sections, T-beams. | RCB Chap 3 Sect 3.4 |
| 10 | Design for transverse shear: theory and models, application. | RCB Chap 3 Sect 3.5 |
| 11 | Design of beam-columns: interaction diagrams, design of stocky columns. | RCB Chap 5 Sect 5.1-5.6 |
| 12 | Design of beam-columns (cont.): design of slender columns, biaxial bending; detailing. | RCB Chap 8 Sect 8.1-8.4 |

COMMON SCHOOL INFORMATION

PLEASE VISIT: <http://www.civeng.unsw.edu.au/info-about/our-school/policies-procedures-guidelines/academic-advice>

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 assessments 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.

NOTES ON ASSESSMENT

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: <http://www.lc.unsw.edu.au/onlib/plag.html>