CIVE 352 – Reinforced Concrete Structures and Green Construction

Term – FALL 2015 (201509)

Instructor
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Office Hours
Days: Posted outside office
Time: Posted outside office
Location: EOW 343

Course Objectives
Strength and design of reinforced concrete structures; fundamental behaviour under various stresses; concepts of concrete plasticity and fracture mechanics; failure, safety and design criteria; high-performance concrete materials. Applications in complex systems and innovative design. Building envelopes, building science, green buildings and case studies.

Learning Outcomes
- Develop an understanding of design philosophy, loading patterns & distribution
- Describe mechanical properties of materials used for reinforced concrete
- Develop an understanding of behavior of flexural members: beams and one-way slabs (single span and continuous)
- Design flexural members: beams and one-way slabs (single span and continuous)
- Check deflection control requirements of beams and one-way slabs
- Calculate factored load capacity and design of reinforced concrete columns
- Develop an understanding of development length and anchorage requirements in RC members
- Identify new, alternate and green materials for design of RC members
- Conduct laboratory tests on RC beams to determine failure mechanisms

Syllabus
- Refer to the table (page 4)

A-Section(s): A01 / CRN 10618

Days: Tuesdays and Fridays
Time: 9:30-11:20 (T), 8:30-9:20 (F)

Location: ECS 108 (lectures), Tutorials (ELW B 220), Labs (CIVE Materials Facility)
Required Text
Title: Reinforced Concrete Design: A practical approach
Author: Brzev and Pao [a]
Publisher: Pearson
Year: 2013 (2nd edition)

Optional Text
Title:
Author:
Publisher:
Year:

Other learning resources:
Required:
1. Lab/safety gear: Lab coats are mandatory during any labs. For some lab sessions it is recommended that you wear old clothes and rubber boots. Safety glasses are required and CSA approved steel toed shoes are highly recommended.
2. Valid WHMIS training (Instructions to be provided by the instructor)
3. Computer program S-FRAME

Recommended:
2. CSA A23.3
3. ACI 318: Building Code Requirements for Structural Concrete and Commentary
4. ASTM standards

References:

Assessment:
Projects: 10%
Assignments, quizzes, Lab& Tutorial participation and safety 20%
Exam 1 25%
Exam 2 30%
Exam 3 15%
100%

Refer to the last two pages for tentative due dates

Note:
1. ATTENDANCE and submission of lab assignments are mandatory requirements for this course. Failure to comply will result in a grade of N being awarded for the course
2. Makeup Test, Exams or Quizzes: There will be no makeup tests, exams or quizzes. If you miss a test, exam or quiz, you will receive zero marks.

The final grade obtained from the above marking scheme for the purpose of GPA calculation will be based on the percentage-to-grade point conversion table as listed in the current Undergraduate Calendar.

There will be no supplemental examination for this course.

Note to Students:
Students who have issues with the conduct of the course should discuss them with the instructor first. If these discussions do not resolve the issue, then students should feel free to contact the Chair of the Department by
email or the Chair’s Secretary to set up an appointment.

**Accommodation of Religious Observance**
See entry in current Undergraduate Calendar

**Policy on Inclusivity and Diversity**
See entry in current Undergraduate Calendar

**Standards of Professional Behaviour**
You are advised to read the Faculty of Engineering document Standards for Professional Behaviour in current Undergraduate Calendar, which contains important information regarding conduct in courses, labs, and in the general use of facilities.

Cheating, plagiarism and other forms of academic fraud are taken very seriously by both the University and the Department. You should consult entry in current Undergraduate Calendar for the UVic policy on academic integrity.

**Course Lecture Notes**
Unless otherwise noted, all course materials supplied to students in this course have been prepared by the instructor and are intended for use in this course only. These materials are NOT to be re-circulated digitally, whether by email or by uploading or copying to websites, or to others not enrolled in this course. Violation of this policy may in some cases constitute a breach of academic integrity as defined in the UVic Calendar.
<table>
<thead>
<tr>
<th>Lecture (wk of)</th>
<th>Topics Covered</th>
<th>Relevant Reading*</th>
<th>Recommended Problems</th>
<th>Labs/Tutorials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sept 7 (Classes begin 9)</td>
<td>Introduction and conditioning (FBDs/SFD/ BMD)</td>
<td>Noted in handout#1</td>
<td>TBA</td>
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<tr>
<td>14</td>
<td>Introduction to design codes, loads, and design philosophy &amp; Materials for reinforced concrete</td>
<td>1.1-1.3; 1.6-1.8; 2.3; 2.6</td>
<td>TBA</td>
<td>Assigned problems</td>
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<tr>
<td>21</td>
<td>Behaviour of flexural members (beams and one-way slabs)</td>
<td>3.1-3.6</td>
<td>TBA</td>
<td>Possible site visit (on campus)</td>
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<td>28</td>
<td>Exam 1 &amp; Behaviour of flexural members (beams and one-way slabs)</td>
<td>3.1-3.6</td>
<td>-</td>
<td>Intro to S-Frame (Guest presenter) &amp; Assignment 1 due</td>
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<td>Oct 5</td>
<td>Deflection control requirements &amp; Assign Project (Introduction to S-FRAME)</td>
<td>4.1-4.2; 4.5; 4.7-4.8</td>
<td>TBA</td>
<td>Safety orientation-CIVE Materials Lab</td>
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<td>12 (Thanksgiving)</td>
<td>Flexural design of beams and one-way slabs</td>
<td>5.1-5.7</td>
<td>TBA</td>
<td>Project- Mold and rebar cage</td>
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<td>19</td>
<td>Shear design of beams and one-way slabs</td>
<td>6.1-6.8</td>
<td>TBA</td>
<td>Project- Specimen construction- concrete placement</td>
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<td>26</td>
<td>Continuous beams and one-way slabs; floor design and drawings</td>
<td>10.1-10.3; 10.6; 11.2-11.3; 11.5</td>
<td>TBA</td>
<td>Assigned problems &amp; Assignment 2 due</td>
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<tr>
<td>Nov 2</td>
<td>Exam 2 &amp; Columns- axial loading and flexure</td>
<td>8.1-8.3; 8.6-8.9; 8.11</td>
<td>TBA</td>
<td>Assigned problems</td>
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<tr>
<td>9 (9-11 reading break)</td>
<td>Guest speaker- (UNISOL)- Design issues with alternate materials (RE) and footings</td>
<td>TBA</td>
<td>Reading break</td>
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<tr>
<td>16</td>
<td>Development and anchorage of reinforcement</td>
<td>9.1-9.6; 9.9</td>
<td>TBA</td>
<td>“Big B” Design Competition- CIVE Materials Lab. Project (P1) submission</td>
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<tr>
<td>23</td>
<td>Exam 3 &amp;......Review &amp; Use of alternative reinforcement (FRP)- Green construction. Project (P2) submission. Nov 27th</td>
<td>TBA</td>
<td>Open session&amp; project due</td>
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<td>30</td>
<td>Green options- student Big B presentations</td>
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* refer to the textbook
Assignment Details (TBC)

<table>
<thead>
<tr>
<th>ASSIGNMENT</th>
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<th>DUE DATE:</th>
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<tbody>
<tr>
<td>A1</td>
<td>Flexure</td>
<td>Oct 2, 2015</td>
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<tr>
<td>A2</td>
<td>Shear</td>
<td>Oct 30, 2015</td>
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<tr>
<th>P1</th>
<th>GROUP PROJECT (Big B competition): Design validation of flexural reinforced concrete members</th>
<th>Week of Nov 16th (TBC)</th>
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<td></td>
<td>The project involves optimizing design of a flexural member. Constraints will be provided for design. Constraints include shape, size, weight, strength requirements, etc. Students will be required to validate the performance in the lab. The project will also require students to propose an alternative design using FRP rebar using S-FRAME. This will be presented in class. Bonus marks for proposing a sustainable material/technology (use ACI sustainability guide)</td>
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| P2         | Design of single-storey structure | Friday, Nov 27th |

Note: Late assignments or assignments that are not neat or legible will not be graded.