Department: Civil & Environmental Engineering

Designation: MSc Level Course

General Catalogue Course Description: Advanced analysis and design methods for reinforced concrete structures. The course will cover analytical techniques for evaluation and design of reinforced concrete frames. The topics include design of beams for flexure and shear, design of two-way slabs, design of beams for torsion, design of columns with slenderness effects, and design of beam-column joints. In addition, the course will cover principles of strut-and-tie models, numerical methods for constructing column interaction diagrams, and design of deep beams and shear walls. The course will also cover ACI Code provisions for seismic resistant design.

Prerequisites: CVEEN 4221 Concrete I

ACI, ACI 318-14 Building Code Requirements for Structural Concrete

Class Schedule: 3-hour lecture/week

Professor Chris Pantelides, Ph.D., S.E., FACI, 2115 MEB

Email: c.pantelides@utah.edu TEL: 801.585.3991

Class Meeting times: MWF 9:40 am – 10:30 am Room WEB 1248

Grading and Evaluation: Homework, two tests, the final, and a journal paper review will make up the grade. Homework=20%, Test 1=20%, Test 2=20%, Comprehensive Final=40%.

Final Exam: Thu., April 25, 2019 – 8:00 am - 10:00 am, Room WEB 1248

Office Hours: Mon., Wed. 10:30 am – noon, Room MEB 2115 or by appointment.

Course Requirements: The course will contain written assignments in terms of homework problems and literature review of articles relevant to the course. In addition, there will be two tests and a final. Students taking the course for graduate credit (CVEEN 6220) will be given additional assignments in terms of additional homework, special problems, and literature review of articles relevant to the course.

Homework: All Homework will be assigned on the lectures shown in the Course Outline and will be due in one week.

Graduate Credit: Students taking the course for graduate credit (CVEEN 6220) will have additional homework assignments, journal article literature reviews, and special problems.
PROGRAM OUTCOMES AND ASSESSMENT

According to the new ABET 2000 requirements, a plan must be implemented to better define and control the educational product. In addressing the program outcomes for this course, the following assessment tools will be used:

- Percent of homework completed (Over 90% is good, 80% is fair and 75% is passing. No student can pass with less than 75%).
- Percent of students who work designated exam problems without a conceptual error (Over 80% is good and 70% is fair).

Program Outcomes

a. **an ability to apply knowledge of mathematics, science, and engineering.**

Knowledge of mathematics is demonstrated through power series in the analysis required for design of structural elements. Physics and engineering are required in the understanding of conceptual models used in the design of structural systems. Homework will be graded and the primary assessment will be percent completed. The two mid-term and final exams will be used to assess this criterion. In addition, a questionnaire will be handed out to evaluate this criterion.

b. **an ability to design and conduct experiments, as well as to analyze and interpret data.**

This criterion will be assessed partially, by reviewing test data obtained in experimental work carried out on the assessment of reinforced concrete joints. A homework assignment will be used to assess this criterion.

c. **an ability to design a sustainable and constructible civil engineering system, component, or process to meet desired needs, and consider life-cycle-cost issues.**

Design concepts are introduced throughout this course. The design concepts covered include constructability, efficiency and economy, life-cycle cost, performance-based design, and comparative design methodologies. This criterion will be assessed by the student’s performance in their homework and tests and through a questionnaire.

d. **an ability to function on multi-disciplinary teams.**

The term project will include analysis, design and constructability components to simulate a multi-disciplinary team. The criterion will be assessed by the design project performance of the teams and the effectiveness of the team participation will be assessed by a questionnaire.

e. **an ability to identify, formulate, and solve structural, geotechnical, transportation, environmental, and water resource engineering problems.**

Structural and to some extend geotechnical problems will be undertaken. The performance of the students in homework and tests will allow assessment of this criterion, along with a questionnaire.
f. **an understanding of professional and ethical responsibility, especially as it relates to health and safety and the importance of professional licensure.**

The emphasis of the course is on design, and safety is of primary concern as evidenced by the use of strength reduction factors and load factors. The issue of professionalism is inherent in all aspects of this course and will be assessed with a questionnaire. Examples of ethical responsibility will be given during the course.

g. **an ability to communicate effectively using written, graphical and verbal skills.**

This criterion will be assessed by several homework assignments that will require written reports. Assessment of this criterion will be evaluated in the questionnaire.

h. **the broad education necessary to understand the ethical, economic, environmental, social, and political impact of engineering solutions in a global and societal context.**

This criterion will be addressed by comparing the economic and social impact of design decisions. Assessment of this criterion will be evaluated in the questionnaire.

i. **a recognition of the need for, and an ability to engage in life-long learning and continuing engineering education as a necessary part of professional practice.**

This will be stressed throughout the course as evidenced by the continuing upgrades of the ACI Building Code, and will be assessed by a questionnaire.

j. **a knowledge of contemporary issues that are affecting our urban environments.**

This criterion is addressed in the analysis techniques for gravity and lateral loads, which prepares students for design for seismic loads. This criterion will be assessed by the questionnaire.

k. **an understanding of and ability to use the techniques, skills and modern engineering tools necessary for professional civil engineering practice.**

The course deals with design and the techniques learned here are necessary for professional engineering practice. The students will be exposed to modern numerical methods for the design of reinforced concrete elements. This criterion will be assessed by the questionnaire.
The new ACI 318-14 Building Code was reorganized to present all design and detailing requirements for structural systems or for individual members in chapters devoted to those individual subjects. ACI 318-14 has been developed to address design requirements for specific member types such as beams, columns, walls, and diaphragms. This means that the design provisions for a specific member type are contained within a single chapter. The chapters have been arranged to follow the process and chronology of design and construction. Information and procedures common to the design of members are located in utility chapters.

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Ch. 13-1 to 13-7 Direct Design Method for Two-way Slabs
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Ch. 19-1 to 19-4 Earthquakes and Seismic Response Spectra
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Ch. 19-5 to 19-7 Ductility of RC & ACI Code Provisions for Seismic Resistance
Ch. 19-8 to 19-14 Special Moment Frames
Ch. 19-8 to 19-14 Special Moment Frames
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Final
This policy reflects the mission of the Department of Civil and Environmental Engineering (CVEEN) to promote high professional standards. Its purpose is three-fold: (1) instill ethical work principles, (2) cultivate professional presentation of engineering calculations, and (3) develop problem-solving skills.

**Ethics**

If you are having difficulty understanding a homework assignment, you should seek help from the course's instructor or teaching assistant. You may work with others in order to understand the concept(s) covered on a homework assignment. However, inappropriate assistance, such as copying solutions from others or from previous years' homework assignment solutions, is unacceptable. You are not discouraged from studying together, but each student is expected to do their own work and submit their own assignments. Plagiarism of any sort will not be tolerated. Students should also familiarize themselves with the University regulations regarding academic misconduct. Failure to comply with this policy will result in either reduced credit, rejection of homework which will be considered as non-submittal, or receipt of a failing grade at the discretion of the instructor. Student code of conduct violations will be pursued in accordance with University Policy.

**Format**

Your homework assignment solution must adhere to the following formatting rules.

1. Use only one side of 8.5 X 11 inch paper. Use engineering paper and pencil for handwritten solutions. Computer printouts must be on white paper. Each problem must be started on a separate piece of paper.

2. All solutions must be neatly written (or electronically generated), well organized, and logical. For engineering homework problems, the following sequence of categories should be used and will be required in your classes:
   a) Statement of Problem
   b) Required
   c) Assumptions
   d) Solution
   e) Summary of Answers

3. Number, title, and label each graph or table required by the assignment.

4. Generally, graphs should be drawn on a separate piece of paper (one graph per page) and should take up most of the page.

5. Use the same justification (left, center, right, or decimal) for all data in a table.

6. Sample calculations must accompany computer spreadsheet solutions.

7. Your name, the course number, assignment number, and problem number must appear on the top of each sheet of the assignment. Number the pages.

8. Bind the assignment with one metal staple in the upper left hand corner of the pages. Do not use paper clips or dog-eared pages.