August 24, 2017

University of Southern California

Viterbi School of Engineering

Sonny Astani Department of Civil & Environmental Engineering

CE 537 ADVANCED REINFORCED CONCRETE

Units: 3
Fall 2017—Thursday—6:30-9:10 pm
Location: GFS 207

Instructor: Marios Panagiotou, PhD
Office: KAP 200A
Office Hours: Friday 10:30 – 12:00
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Teaching Assistant: Hadi Aryan, PhD student
Office: KAP 225
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Course Description

The course develops an advanced understanding of seismic analysis, behavior and design of reinforced concrete (RC) structures. The focus is on buildings and bridges. It covers the main aspects of RC structures in terms of materials, components and structural systems. The components discussed are: walls, beams, columns, joints, slabs, foundations, and diaphragms. The structural systems covered are: structural wall buildings, moment frame buildings and highway bridges. Code requirements (ASCE 7-10, ACI 318-14, Caltrans SDC 1.7) are compared with the state of the art of research and practice. The computational modeling of RC components and structures, using existing software, is presented.

Learning Objectives

The course develops an advanced understanding of seismic analysis, behavior and design of reinforced concrete structures in terms of materials, components and structural systems. Comprehension of how code requirements compare with the state of the art of research and practice is achieved. Basic understanding of computational modeling, using existing software, of RC components and structures is attained.

Prerequisite(s): An undergraduate course on reinforced concrete.

Recommended Preparation: Coursework on structural dynamics, nonlinear analysis, and earthquake engineering is beneficial.

Course Notes

There is no single textbook used in this course. Copies of lecture slides and other class information (videos, journal papers, reports) will be posted on Blackboard.

Main References and Suggested (Not Required) Readings

1. Paulay T, Priestley MJN, 1992. Seismic Design of Reinforced Concrete and Masonry Buildings. Wiley: Hoboken, NJ.

2. Priestley, M. J. N., Seible, F., and Calvi, G. M., 1996. Seismic design and retrofit of bridges, Wiley, New York.

3. Priestley MJN, Calvi GM, Kowalsky MJ, 2007. Displacement Based Seismic Design of Structures. IUSS Press, Pavia, Italy.

4. Moehle, JP, 2015. Seismic Design of Reinforced Concrete Buildings, McGraw-Hill.

Code Provisions

1. ACI Committee 318, 2014. ACI 318-14 building code requirements for structural concrete and commentary.

2. American Society of Civil Engineers, 2010. ASCE 7-10 Minimum design loads for buildings and other structures.

3. California Department of Transportation, 2013. Seismic design criteria version 1.7 http://www.dot.ca.gov/hq/esc/earthquake_engineering/sdc/documents/Seismic-Design-Criteria-(SDC-1.7-Full-Version,-OEE-Release).pdf

Software

Bentz E., Collins M., **Response-2000** User manual, University of Toronto
Students need to download and install the software in their personal computers using the following link: http://www.ecf.utoronto.ca/~bentz/r2k.htm

ETABS 2016 Ultimate, 2016. CSi Analysis Reference Manual, Computers and Structures, Inc., CA This software is expected to be installed at the computer labs of USC a few weeks after the beginning of the semester. An evaluation version can be obtained from the following link: https://www.csiamerica.com/support/downloads/software-evaluation-request?productnid=222

Description and Assessment of Assignments

Six homework assignments will count for 36%, in total, of the course grade. A midterm and a final examination will count for 28%, and 36% of the grade, respectively.

Assignment Submission Policy

Assignments will due at the beginning of the lectures.

Grading Timeline

Unless otherwise noted in homework assignments and exams, homework assignments and exams will be returned graded one week after submission.

Course Schedule: A Weekly Breakdown

Details of the course content described below may change depending on the interest of students and course development during the semester.

		Topics/Daily Activities	Readings and Homework	Deliverable/ Due Dates
Week 1 08/24		Summary of the course and logistics Basis of seismic design Reinforced concrete materials		
Week 2 08/31		Reinforced concrete materials (cyclic behavior of concrete, confined concrete, reinforcing steel); Bond between concrete and steel.		HW1 assigned
Week 3 09/07		Nonlinear analysis of components under axial load and moment		
Week 4 09/14		Analysis and behavior of components under shear; Flexure-shear interaction		HW1 due HW2 assigned
Week 5 09/21		Components - special structural walls		
Week 6 09/28		Components - special moment frames		HW2 due HW3 assigned
Week 7 10/05		Connections between columns, beams, walls and slabs; Components - foundations		
Week 8 10/12		Structural systems - seismic design methods		HW3 due HW4 assigned
Week 9 10/19		Structural systems – structural wall buildings		
Week 10 10/26		**MIDTERM EXAMINATION**		
Week 11 11/02		Structural systems - moment frame buildings		HW4 due HW5 assigned
Week 12 11/09		Structural systems - highway bridges		
Week 13 11/16		Strut and tie models Components - diaphragms		HW5 due HW6 assigned
Week 14 11/23		**THANKSGIVING HOLIDAY**		
Week 15 11/30		Performance-based seismic analysis and design of tall core-wall buildings		HW6 due
FINAL				*Schedule of Classes* at www.usc.edu/soc.

Statement on Academic Conduct

Academic Conduct:
Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Part B, Section 11, "Behavior Violating University Standards" https://policy.usc.edu/scampus-part-b/. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct.