

Department of Civil & Environmental Engineering
University of Connecticut, Storrs, CT 06269

Fall 2019

(August 27 – December 5, 2019)

Course Number & Title: CE4542/CE5542- Earthquake Engineering **Credits:** 3 Units
Subject: Course Syllabus/Outline **Date:** August 26, 2019
Instructors: Prof. Lanbo Liu, Ph.D. Prof. Ramesh B. Malla, Ph.D., F. ASCE
Office Rooms: CAST 331 CAST 323
Phone numbers: 860-486-1388 860-486-3683
E-mails: Lanbo.Liu@UConn.edu Ramesh.Malla@UConn.edu
Office Hours: By appointment Tu., Th. 2-3 PM or by appointment
Lecture Class Schedule: Tu/Th 12:30PM - 1:45PM
Class Room: McHugh Hall 109 (formerly Laurel Hall 109)
Grading: *Homework Assignments* = 50% (8-10 total; 4-5 in each part)
Project/Term Paper = 50% (20% Oral presentation; 30% Written report)

Course Catalog Description:

CE 5542. Earthquake Engineering (Three credits. Not open for credit to students who have passed CE 4542.)

CE 4542. Earthquake Engineering (Three credits. Prerequisite or corequisite: CE 3510 and 3610. Recommended preparation: CE/ENVE 3530/GSCI 3710. This course and CE 5542 may not both be taken for credit.)

Global tectonics and earthquake sources, seismic wave propagation, strong ground motion analysis, seismic hazards, site effects and liquefaction, seismic load to slopes, retaining structures and foundations, structure response to dynamic loads; term paper.

PART I: Geotechnical Earthquake Engineering

WEEK 01-07 (August 27 -October 10, 2019)

Instructor: Prof. Lanbo Liu

Reference book: Geotechnical Earthquake Engineering, by S. L. Kramer, Prentice-Hall.

Week 01 (Tue/Thu, Aug. 27th, 29th):

Introduction and Syllabus: Earthquake Engineering
Reading: Kramer Ch. 1

Week 02 (Tue/Thu, Sept. 3rd, 5th):

Earth Structure (PREM model), wave propagation.
Reading: Kramer Ch. 2, 5

Week 03 (Tue/Thu, Sept. 10th, 12th):

Strong ground motion fundamentals

Reading: E&S Ch. 1; Kramer Ch. 2, 5

Week 04 (Tue/Thu, Sept. 17th, 19th):

Strong ground motion II; seismic hazards.

Reading: Kramer Ch. 3, 4

Week 05 (Tue/Thu, Sept. 24th, 26th):

Site effect/liquefaction

Reading: Kramer Ch. 8, 9

Week 06 (Tue/Thu, Oct. 1st, 3rd):

Landslides and retaining structures

Reading: Kramer Ch. 10, 11

Week 07 (Tue/Thu, Oct. 8th, 10th):

Seismic response of foundation and piles

Reading: Kramer Ch. 7, 12

PART II: Structural Earthquake Engineering

WEEKS 08 – 15 (October 15-December 5, 2019)

Instructor: Prof. Ramesh B. Malla

Tentative/Subject to Change

(Final version will be provided in the first day of class for the PART II Module)

Week 08:

Introduction, Structural Damages due to Earthquakes; Structural Response Framework, Structural Response Characteristics

(References: Clough and Penzien; Elnashai, and Sarno; Newmark and Rosenblueth; and Lecture Handout)

Week 9:

Single Degree-of-Freedom (SDOF) Systems:- Structural Modeling, Equations of Motion, Damped and Undamped Vibration, Free and Forced Response under Periodic and non-periodic loadings.

(References: Clough and Penzien; Chopra; Craig; Paz; Scawthorn and Chen; Tedesco et al; and Lecture Handout)

Week 10:

Multi-Degrees-of-Freedom (MDOF) Systems:- Structural Modeling, Equations of Motion, Damped and Undamped Vibration, Free and Forced Response

(References: Clough and Penzien; Chopra; Craig; Paz; Scawthorn and Chen; Tedesco et al; and Lecture Handout)

Week 11:

Analysis of Earthquake Response- Response Spectra Method; Response Spectra for Elastic and Inelastic Design; Building Code Requirements

(References: Armouti; Clough and Penzien; Chopra; Craig; Farzad; Gioncu and Mazzolani; Newmark and Rosenblueth; Paz; Scawthorn and Chen; Tedesco et al; and Lecture Handout)

Week 12:

Structural Modeling & Analysis under Earthquake Loading using Finite Element Software (Computer lab)

Week 13:

Earthquake Resistance/Protective/Strengthening/Retrofitting Methods, Systems, and Designs

(References: Agarwal and Shrikhande; Dowrick; Green; Khan; Newmark and Rosenblueth; Scawthorn and Chen; Wakabayashi; and Lecture Handout)

Week 14:

Thanksgiving Break (No class)

Week 15:

Project Oral Presentations by Students.

Useful Reference Books:

- Dynamics of Structures - Theory and Applications to Earthquake Engineering by Anil K. Chopra, Prentice Hall
- Dynamics of Structures by R. Clough and J. Penzien, McGraw-Hill
- Fundamentals of Earthquake Engineering by N.M. Newmark and R. Rosenblueth, Prentice Hall
- Fundamentals of Earthquake Engineering by A. S. Elnashai, and L. D. Sarno, Wiley Ltd.
- Structural Dynamics - Theory & Computations by Mario Paz, Van Nostrand
- Earthquake Resistant Design - A Manual for Engineers and Architects by D.J. Dowrick, John Wiley & Sons
- Earthquake resistance design of structures by Pankaj Agarwal and Manish Shrikhande, PHI Learning Pvt. Ltd