

1. **Department, number, and title of course**

Department of Civil Engineering, CENG 4311, Reinforced Concrete Design

2. **Elective Course**

3. **Course (catalog) description**

Introduction to the design of reinforced concrete structural members; design of beams, one-way slabs, columns, and footings, with reference to the most recent ACI 318 design code and other supporting design documents, development length provisions, design for serviceability, use of high-strength materials, composite construction. Introduction to pre-cast/prestressed concrete.

4. **Prerequisite(s)**

CENG 3325, Structural Analysis

5. **Textbook(s) and/or other required material**

Reinforced Concrete Mechanics and Design, 4th Edition, by James G. MacGregor
Published by Prentice Hall, Upper Saddle River, NJ, 2005.

Building Code Requirements for Structural Concrete (318M-05) and Commentary (318RM-05), by American Concrete Institute (ACI). Published by ACI, Farmington Hills, Michigan, 2005.

Design and Control of Concrete Mixtures, 14th Edition, by Portland Cement Association (PCA). Published by PCA, Skokie, Illinois 2002.

6. **Course Objectives**

- a. Explain the advantages and disadvantages of using reinforced concrete as a building material.
- b. Describe the behavior of reinforced concrete members and structural systems.
- c. Use ACI 318-05 and the ACI Strength Design methodology.
- d. Analyze and design reinforced concrete beams with a rectangular cross-section.
- e. Analyze and design slabs on grade.
- f. Analyze and design one-way slabs.
- g. Analyze and design reinforced concrete T-beams.
- h. Analyze and design doubly reinforced concrete beams.
- i. Calculate the development length of a reinforcing bar.
- j. Perform crack-width checks on a reinforced concrete beam.
- k. Calculate deflection of a reinforced concrete beam and determine if the beam meets ACI deflection standards.
- l. Model and analyze a statically indeterminate reinforced concrete frame.
- m. Analyze and design short reinforced concrete columns.
- n. Analyze and design reinforced concrete spread footings.
- o. Describe how individual structural elements are connected to develop a building design.
- p. Describe the steps necessary to construct a RC structural component and the areas for concern regarding quality of construction.
- q. Use *Mathcad* and *Excel* spreadsheets to solve engineering analysis and design problems.

7. **Topics Covered**

- Design of flexural members: beams, T-beams, one-way slabs, and doubly reinforced beams.
- Shear design.
- Development lengths of reinforcing bars.
- Serviceability provisions.
- Design for combined axial load and flexure (columns).
- Behavior and design of column footings.
- Slabs on grade.

8. ***Class/laboratory schedule, i.e., number of sessions each week and duration of each session***
 LESSONS: 45 @ 50 min (3.0 Att/wk) LABS: 0

9. ***Contribution of course to meeting the professional component***
 3.0 Credit Hours (ES=0.5, ED=2.5)
 This is an entry-level structural design course that focuses on the behavior of reinforced concrete and the techniques of designing reinforced concrete structures. The course incorporates industry standard codes and manuals for both analysis and design. It provides the requisite knowledge for follow on reinforced concrete design course. The student design problem is modeled on the design of a real, existing or planned structure.

10. ***Relationship of course to program outcomes***
 The course director's assessment of how this course contributes to the civil engineering program outcomes is listed below. The following scale is used:
 1=No Contribution; 2=Small Contribution; 3=Average Contribution; 4=Large Contribution; 5=Very Large Contribution

CIVIL ENGINEERING PROGRAM OUTCOMES	Course Director Assessment
Program Outcomes	
Students who qualify for graduation with a civil engineering major will demonstrate:	
Can apply knowledge of traditional mathematics to solve problems	5
Can apply knowledge of traditional science (calculus-based physics, Chemistry, additional science) to solve problems	2
Can apply knowledge of traditional engineering skills to solve problems	5
Can use modern engineering tools to solve problems	5
Can design and conduct experiments, as well as analyze and interpret data in more than one civil engineering discipline	1
Can design systems, components, and processes considering standards and engineering constraints	5
Can recognize the strengths and areas for possible improvement of their creative designs	4
Can work independently as well as part of a multidisciplinary design team	3
Can identify, formulate, and solve engineering design problems using engineering models in the discipline of structural engineering	5
Can identify, formulate, and solve engineering design problems using engineering models in the discipline of transportation engineering	1
Can identify, formulate, and solve engineering design problems using engineering models in the discipline of construction management	2
Can identify, formulate, and solve engineering design problems using engineering models in the discipline of hydrology and hydraulic design	1
Can analyze a situation and make appropriate professional decisions	3
Can analyze a situation and make appropriate ethical decisions	2
Have effective oral, written, and graphical communication skills	4
Demonstrate a commitment to learning and continued professional development outside the class	3
Incorporate contemporary issues during problem solving	2
Determine the impact of engineering solutions in a global and societal context	2
Can explain professional practice issues	1
Can explain leadership principles and attitudes	1
Can explain management concepts and processes	1
Can explain concepts of business practices	1
Can explain public policy and public administration	2

11. ***Person(s) who prepared this description and date of preparation***
 Ronald W. Welch, P.E., Professor, 24 October, 2007.