

**General Information:**

**Instructor:** Dr. Asad Esmaily  
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**Phone:** (785) - 532 6063  
**Class schedule:**  
*Class:* Mon., Fri., 1:30 pm – 2:20 pm, Durland 2144  
*Lab:* Tue., 3:30 pm- 5:20 pm, Seaton Hall 127  
**Office hours:** Mon. 2:30pm-3:30pm, Fri. 10:00am-11:30am  
Other times may always be arranged by appointment.  
**Course Web site:** [https://online.ksu.edu/CE\\_544/](https://online.ksu.edu/CE_544/)  
(You need your KSU user name and password to login)

**Description:**

Analysis and design of reinforced concrete beams, columns, slabs, retaining walls and footings; with emphasis on current ACI Building Code.

**Prerequisites by topics:**

Analysis of statically determinate and indeterminate structural systems.  
Mechanical properties and composition of plain concrete.  
Mechanical properties of steel.  
Strength of materials (mechanics of materials).

**Textbook and Reference:**

*Textbook:* James C. McCormac, “**Design of Reinforced Concrete**”, 5th Edition, ISBN 0-471-39576-5

*Reference:* “**Building Code Requirements for Structural Concrete (ACI 318-02) and Commentary**”, American Concrete Institute, 2002.

*Additional Recommended Text:* Nilson, Darwin, Dolan, “**Design of Concrete Structures**”, 13<sup>th</sup> edition, McGraw Hill, ISBN 0-07-248305-9

## Objectives and Outcomes:

### Objectives:

- ✚ To understand the behavior of reinforced concrete as a building material and as structural elements.
- ✚ To learn the process of analysis and design of reinforced concrete members and structures.
- ✚ To become familiar with the code and specifications and to learn how to use them.

### Outcomes:

At the conclusion of this course, the students will have an understanding of:

- ✚ basic properties of concrete, reinforcement and reinforced concrete
- ✚ fundamental theory of reinforced concrete design
- ✚ fundamental analysis methods for flexural and shear design of beams and design of footings and short compression members
- ✚ the existing standards and building codes for design of concrete structures

At the conclusion of this course, the students will be able to:

- ✚ apply knowledge of mathematics, science, and engineering by developing the basic equations of force equilibrium and displacement compatibility to analyze reinforced concrete sections.
- ✚ create simple computer programs to analyze and design a reinforced concrete member (beam, short column)
- ✚ evaluate serviceability, and strength of a given reinforced concrete structural member for a given condition.
- ✚ design a reinforced concrete beam, short column, footing under a certain condition for a pre-determined serviceability or strength limit, using the ACI building code

## Grading:

Homework and Assignments	15%
Project (Lab work)	15%
Midterm	30 %
Final	40 %

## Homework and Lab Assignment:

To learn the material in this course it will be necessary to work all of the assigned problems and keep up to date. Fifty percent will be deducted for homework one lecture late. No credit will be given for homework more than one lecture late. Engineering paper should be used, one side only. All work should be done in pencil using engineering lettering. Diagrams should be drawn neatly using a straight edge. If homework is illegible it will not be graded. Computations should be arranged in logical order and each step fully recorded. Final answers

should be boxed. Homework should be handed in at the beginning of class. All problems from a homework-set must be stapled and handed in at the same time. The class will be divided into several groups to design, construct and test a reinforced concrete beam throughout the semester. Participation in this activity understanding the whole process, and submission of a very brief report will count 15% towards your overall grade.

### **General Remarks:**

1. Office hours and any other pertinent issue will be decided **during the first week of classes**. (First meeting on Friday August 22) Dates will be fixed afterwards except for unforeseen circumstances.
2. In case I miss an office hour due to unexpected circumstances, a message will be posted on the class web site with a reschedule time. So plan to check the online **message board** before coming to my office
3. Any important notice regarding the course will be sent to you by e-mail besides being posted on the course web site. So, please make sure that we have your correct e-mail address and check your e-mail every now and then.

### **Course Outline:**

The following is a tentative list of topics that will be covered in this course:

- I. Design of Beams For Flexure
  - A. Rectangular, Singly-Reinforced
    1. Service Level Stresses
    2. Strength Design Method
  - B. Rectangular, Doubly Reinforced, Strength Design
  - C. T-Beams, Strength Design
- II. Strength Design of Beams for Shear
- III. Bond, Anchorage, Development Length
- IV. Serviceability Requirements
  - Crack Control
  - Deflection Control
- V. Strength Design of Compression Members
  - Short Columns
  - Long Columns (brief)
- VII. Design of Footings

## **Tentative Class Schedule:**

<b><u>Session #</u></b>	<b><u>Topic</u></b>
1	Introduction - Concrete, Structural Forms, Loads, Design Basis, Fundamental Assumptions for Reinforced Concrete Behavior - CHAPTER 1.
2	Materials - Cement, Aggregates, Placing, Compacting, Curing, Quality Control, Admixtures, Reinforcing bars.
3, 4	Flexural Analysis of Beams- CHAPTER 2.
5, 6	Design of rectangular beams and one-way slabs- CHAPTER 3. <b>Lab Project Assigned.</b>
7, 8	Analysis and Design of T beams and doubly reinforced beams - CHAPTER 4.
9, 10	Analysis and Design of T beams and doubly reinforced beams - CHAPTER 4 (continued).
11	REVIEW
<b>12</b>	<b>TEST 1</b>
13, 14	Shear and Diagonal Tension - CHAPTER 7.
15, 16	Shear and Diagonal Tension - CHAPTER 7 (Continued).
17, 18	Bond, Development Length and Splices - CHAPTER 6
19, 20	Serviceability - CHAPTER 5.
21, 22	Introduction to Columns - CHAPTER 8.
23, 24	Column Interaction Diagrams, Analysis of short Columns - CHAPTER 9.
25, 26	Design of short Columns - CHAPTER 9 (continued).
<b>27</b>	<b>Thanksgiving Holiday (approximate date!)</b>
28, 29	Footings - CHAPTER 11 (Tentative and if we can have time). [ <b>Lab. Test around this date</b> ]
30	Footings -CHAPTER 11 (continued).
31	<b>Lab Project Brief Report due. REVIEW</b>
32	<b>Final Exam – (as per KSU schedule). December 17<sup>th</sup> 11:50 am to 1:40 pm.</b>

The instructor reserves the right to change part or all of the information contained herein (e.g. the number of exams and assignments as well as their weights, class schedule, etc.) solely at his discretion.