INSTRUCTOR: Dr. Gordon Warn  
226B Sackett Building  
Ph: (814) 863-2786  
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Office hours: T 3:30-5pm, Th 1-2:30pm

TEACHING ASSISTANT: Ms. Corinne Seifert  
Email: cms5220@psu.edu  
Office hours: T 9-11am, W 4-6pm  
Location: 321 Sackett Building

LECTURES:  
T Th  
11:15 – 12:30 pm

LOCATION:  
220 Hammond Building

DESCRIPTION: This course will cover the design of reinforced concrete (RC) beams, slabs and columns with a focus on the mechanics of reinforced concrete and strength design procedures. Prerequisite: CE 340 (Structural Analysis); Prerequisite or concurrent: CE 336 (Material Science for Civil Engineers)

OBJECTIVES: RC design is about applying your knowledge of statics and strength of materials to size and proportion RC elements to satisfy minimum safety requirements or more stringent design requirements. After this course you should be able to:

1. Analyze a RC element subjected to any combination of axial force, shear force and bending moment
2. Design a RC beam/one-way slab for flexure adhering to the ACI requirements
3. Design a RC beam/one-way slab for shear adhering to the ACI requirements
4. Design a short RC column adhering to the ACI requirements

ACI 318-08. *Building Code Requirements for Structural Concrete and Commentary*. American Concrete Institute, Farmington Hills, MI. (available in the Engineering Copy Center 101 Engineering Unit A)


READING AND HOMEWORK: Targeted reading will be assigned during the semester. These are selected textbook sections related directly to the material covered in class. You are expected to read the assigned section prior to class and will be tested on reading assignments as part of the midterm and final exams. Homework assignments will generally be assigned weekly and should be handed to Dr. Warn at the beginning of class on the due date. Late homework will not be accepted. Your solutions should be neatly organized on engineering paper with each problem starting on a new page (using only the front of the paper). Points will be deducted if the following are not included:

1. Your name on each page of stapled solutions
2. Problem statement including what is given and what needs to be determined
3. Solutions clearly boxed with proper units.

An example of a recommended format for your homework solutions will be posted on ANGEL prior to the first homework assignment.

LABORATORY: There will be a laboratory component in this class. Two large scale reinforced concrete beams will be built and tested by students and teaching assistants. Each student will hand in an individual laboratory report on the due date (to be announced in class). Attendance during the testing of the beam is mandatory. If you do not attend the laboratory testing all points allocated to the laboratory portion of the grade will be forfeited.

IN CLASS ASSIGNMENT/PARTICIPATION: Approximately every week there will be a short in class assignment designed to reinforce (no pun intended!) the general concept of reinforced concrete design while lectures probe more detailed topics throughout the semester. In class assignments will be broken down into 50% participation points (that is 50 percent credit for attempting) and 50% credit for correctly completing the assignment. No partial credit will be given. In class assignments will vary between open book/notes to closed book/notes, individual and group effort.
EXAMS:
Exam dates are indicated below: please plan your schedule accordingly as exceptions will only be made under extreme circumstances. The midterm exams will be held during class period. More details will be provided prior to the midterm examination.

Exam Schedule:
Midterm Exam 1: Thursday, February 17th
Midterm Exam 2: Thursday, March 24th
Final: TBD (Check e-lion)

GRADING:
Homework (≈11) 20% Final Grade calculation:
Participation (10) 5% \[ G = 0.2H + 0.05P + 0.05L + 0.2M_1 + 0.2M_2 + 0.3F \]
Laboratory (2 parts) 5%
Midterm 1 20%
Midterm 2 20%
Final 30%
Total 100%

Grade scale:
A: \( G > 90 \) C+: 65 < G < 70
A-: 85 < G < 90 C: 60 < G < 65
B+: 80 < G < 85 D: 50 < G < 60
B: 75 < G < 80 F: G < 50
B-: 70 < G < 75

Note: I reserve the right to change the grade scale at any point during the semester. Doing so will only improve your grade.

ACADEMIC INTEGRITY:
Each student is expected to do his or her own work. Group work is encouraged however original solutions/work is required of each student. Violators of academic integrity including copying, cheating, plagiarism, will receive at a minimum a zero on the graded activity (homework, quiz, lab, exam, etc) and possibly a failing grade in the course. All violators of academic integrity will have a violation report placed in the offender’s permanent files. If you are not familiar with the academic integrity as defined by Penn State’s faculty senate I encourage you to visit the following website:
http://www.engr.psu.edu/CurrentStudents/acadinteg.aspx

EMAIL:
Due to the nature of the course content, homework problems and exam questions, it is not effective to answer student questions via email. Questions on these components of the course are best addressed in person during the specified office hours and therefore will not be answered by email. Email pertaining to the operation of the course (missed class, conflicts, etc) will be answered during regular hours (i.e., 8 am to 5 pm).

ANGEL:
General course information will be posted on ANGEL (https://cms.psu.edu/frames.aspx) along with homework assignments, homework solutions, relevant links and announcements. Make a habit of checking your ANGEL account daily.
TENTATIVE COURSE OUTLINE:

TOPIC

Introduction (Chapters 1, 2 and 3):
  Overview
  Reinforced Concrete Materials
  Loading, Actions and Location of Reinforcement
  Design Philosophy

Beams: Flexure (Chapters 4 and 5)
  Behavior
  Analysis and Design of Singly-Reinforced Beams
  Analysis and Design of Doubly-Reinforced Beams
  T-Beams

Beams: Shear (Chapter 6)
  Behavior
  Reinforcement
  Analysis with and without Stirrups
  Design

Reinforcement: Detailing (Chapter 8)
  Bond and Development
  Anchorage / Curtailment
  Splices

Columns: Combined Axial Load and Bending (Chapter 11)
  Behavior
  Axial-Moment Interaction
  Analysis and Design

Continuous Beams and One-Way Slabs (Chapter 10):
  Analysis
  Design

Serviceability (Chapter 9)
  Cracking
  Deflections