

AE 402  
Fall 2010  
M W F 1:25P – 2:15P, 203 Willard

**Bulletin Description** Design of Concrete Structures for Buildings (3 credits). Applications of principles of engineering mechanics to layout, analysis, design, and detailing of structural elements in concrete for buildings. Prerequisites: AE 221, 222, 308.

**Instructor** Dr. Andres Lepage, P.E., S.E.  
215 Engineering Unit A  
Ph: 865-3013; Email: lepage@psu.edu  
  
Grader: Reynaldo Sanchez (res5348@psu.edu)

**Office Hours** Monday-Wednesday-Friday 2:30-3:30, by appointment or as available.  
(Availability may change due to travel and meetings.)

**Textbook** Wight, J. K., and MacGregor, J. G. (2009). Reinforced Concrete Mechanics and Design, 5th ed., Pearson Prentice Hall, New Jersey. (Required)

American Concrete Institute, Committee 318 (2008). Building Code Requirements for Structural Concrete (ACI 318-08) and Commentary (ACI 318R-08). (Required)  
[Available at the Engineering Copy Center]

**References** ASCE 7-05: Minimum Design Loads for Buildings and Other Structures.  
ANGEL (<https://cms.psu.edu>)

**Grading**

Exam #1:	Oct. 11 (Monday), 6:30-7:45P	25%
Exam #2:	Nov. 10 (Wednesday), 6:30-7:45P	30%
Final Exam	Per university schedule	30%
Homework Assignments		15% (see note below)

- An additional 2 points will be added to the final grade of all students who have turned in every homework assignment and obtained a grade of 8/10 or better on each.

**Notes**

- Use engineering paper for all homework assignments, one side only.
- Homework will be collected at the beginning of the class period on the due date.
- Unreasonably messy and hard to follow homework will be returned, ungraded.
- No late assignments will be accepted.
- Do your own work. All cases of cheating or perceived cheating will be dealt with according to PSU Policy 49-20. Your personal integrity and morals should be more important than any grade.
- All exams are open book and open notes.
- Exams 1 and 2 will be given in the evening and are expected to last 75 minutes. **Conflicts with these exams must be resolved within the first two weeks of the semester.**

## ABET Course Syllabus

### AE 402 – STRUCTURAL DESIGN OF BUILDINGS – CONCRETE

#### *Required (Structures Option)*

- Catalog Description:** AE 402 – Design of Concrete Structures for Buildings, (3 credits). Applications of principles of engineering mechanics to layout, analysis, design, and detailing of structural elements in concrete for buildings.
- Textbook** Wight, J. K., and MacGregor, J. G. (2009). Reinforced Concrete Mechanics and Design, 5th ed., Pearson Prentice Hall, New Jersey.
- American Concrete Institute, Committee 318 (2008). Building Code Requirements for Structural Concrete (ACI 318-08) and Commentary (ACI 318R-08).
- Prerequisite(s):** AE 221, AE 222, AE 308  
Statistics, Strength of Materials, Structural Analysis
- Course Objectives:** This course is designed to provide AE students in the Structures Option with an ability to analyze and design reinforced concrete and an understanding of the theoretical behavior of reinforced concrete members.
- Class/Lab Schedule:** 3 Classes/week, 50 minutes/class
- Estimated Content:** (b) Engineering Science – 1.5 credits  
(b) Engineering Design – 1.5 credits

#### *ABET Expected Outcomes from AE 402*

The table below lists the “Outcomes” expected by ABET from our academic program. Every course is not expected to address every outcome, but rather each course plays a certain role in meeting the expected outcomes.

Expected Outcome	Emphasis in this course
(a) an ability to apply knowledge of mathematics, science and engineering	3
(b) an ability to design and conduct experiments, as well as to analyze and interpret data	
(c) an ability to design a system, component, or process to meet desired needs	3
(d) an ability to function on multi-disciplinary teams	
(e) an ability to identify, formulate, and solve engineering problems	3
(f) an understanding of professional and ethical responsibility	1
(g) an ability to communicate effectively	1
(h) the broad education necessary to understand the impact of engineering solutions in a global and societal context	
(i) a recognition of the need for, and ability to engage in life-long learning	
(j) a knowledge of contemporary issues	
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	3

Emphasis: 3 – Strong; 2 – Moderate; 1 – Little; Blank – Nothing specific expected

Prepared By: Andres Lepage, Assistant Professor of Architectural Engineering

## **Main Course Objectives**

- i) Solid understanding of mechanics and design principles for reinforced concrete members subjected to flexural, shear, and axial forces;
- ii) Develop the ability to perform analysis, design, and detailing of simple reinforced concrete structures.

## **General Approach**

- i) Discuss behavior of concrete members when subjected to basic type of loading;
- ii) Understand basic theory capable of explaining observed response of structural elements;
- iii) Develop practical applications of design principles as bounded by building code requirements

**COURSE OUTLINE**  
**AE 402 – FALL 2009**

The course will not follow strictly the content and organization of the textbook (by Wight and MacGregor - or W&M). There will be reading assignments related to some of the material covered in class. The course covers –but is not limited to– the items listed below.

1. Materials and specifications (W&M Chapters 1, 2 and 3)
  - Historical background
  - Codes and specifications
  - Design methods
  - Concrete properties
  - Properties of reinforcing steels
  
2. Flexure (W&M Chapter 4 and 5)
  - Behavior of beams under increasing moment
  - Singly-reinforced beams
  - Doubly-reinforced beams
  - T beams
  - Continuous beams and one-way slabs
  - Simplified design for flexure
  
3. Shear (W&M Chapter 6)
  - Shear stresses in homogeneous, elastic, uncracked beams
  - Behavior of beams without shear reinforcement
  - Behavior of beams with shear reinforcement
  - Shear design
  
4. Columns (W&M Chapter 11)
  - Elastic behavior
  - Axial strength
  - Lateral ties and spirals
  - Interaction diagrams
  - Design of short columns
  
5. Serviceability (W&M Chapter 9)
  - ACI Code Provisions for Crack Control
  - Control of Deflections
  - Immediate Deflections
  - Long-Term Deflections
  - ACI Code Provisions for Control of Deflections

## Reading Assignments

Wight, J. K., and MacGregor, J. G. (2009). *Reinforced Concrete Mechanics and Design*, 5<sup>th</sup> Ed., Pearson Education, Inc., Upper Saddle River, New Jersey.

### MATERIALS AND SPECIFICATIONS

To complete by 09/10/10:

Chapter 1	§ 1.4, 1.5, 1.6	pp. 4-10
Chapter 2	§ 2.6, 2.7	pp. 20-27
Chapter 3	§ 3.3	pp. 44-52
	§ 3.4	pp. 56-59
	§ 3.5	pp. 64-67
	§ 3.6	pp. 70-72
	§ 3.10, 3.11, 3.14	pp. 88-95

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