

CAE 307 Structural Design II

Spring 2005

2004-2005 Catalog Data: Design loads, factor of safety, load and resistance factors for concrete structures. Properties of concrete-making materials and the proportioning of concrete mixtures. Experimental and analytical study of plain and reinforced concrete subjected to various states of stress. Failure theories and the ultimate strength of plain and reinforced concrete structural components. The design of beams, columns and slabs in reinforced concrete. Prerequisite: MMAE 202, CAE 304, CAE 315. (2-3-3) (D)(C)

Textbook: A.H. Nilson, D. Darwin, and C. W. Dolan, *Design of Concrete Structures*, 13th edition, McGraw-Hill, ©2004.

Building Code Requirements for Reinforced Concrete and Commentary, (ACI 318-02), American Concrete Institute, 2004.

Laboratory Manual, CAE 307, Structural Design II.

References: ASTM Standards in ACI 301, 318, and 349 ACI Publication SP-71 (84), American Concrete Institute, P.O. Box 19159, Redford Station, Detroit, MI.

Mehta, P. and Monteiro, P., *Concrete*, 2nd edition, Prentice-Hall, 1993.

Hibbeler, R., *Structural Analysis*, 3rd edition, Prentice Hall, ©1995.

Neville, A. and Brooks, J., *Concrete Technology*, Addison-Wesley, ©1997.

Mindess, S. and Young, J.F., *Concrete*, Prentice-Hall, ©1981.

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Goals and Objectives: The goals of this course are: to develop awareness of the structural design process especially as it pertains to the design of reinforced concrete structural members and assemblages; to become familiar with ACI 318 Building Code and Commentary; and to gain experience with laboratory procedures pertaining to plain and reinforced concrete. These goals will be accomplished through lectures, assigned homeworks, lab experiments, and assigned lab reports.

Prerequisites by topic:

1. Statics
2. Strength of Materials
3. Elementary Structural Analysis
4. Use of software packages for spreadsheets, word processing, and graphing.

Lecture Topics:

1. Review of Elementary Structural Analysis
2. Concrete and its Constituents
3. Properties of Hardened Concrete
4. Properties of Steel Reinforcement
5. Flexure of R/C Beams Under Service Loads.

6. Review of T-Beams and Doubly Reinforced Beams.
7. Short and Long-Term Deflections of R/C Beams.
8. Ultimate Strength of T-Beams and Double Reinforced Beams.
9. Shear in R/C Beams.
10. Continuity in R/C Beams.
11. Design of One-Way R/C Slabs.
12. Design of Simple R/C Columns.

Laboratory Topics:

1. Cement and Cement Paste.
2. Properties of Aggregates.
3. Properties of Fresh and Hardened Concrete including the Design of Concrete Mixtures.
4. The Flexural Strength of Reinforced Concrete Beams.
(each laboratory period is 150 minutes)

Computer Usage:

1. Computers are used for structural analysis.
2. Computers are used to prepare laboratory reports.
3. Use of Mathcad and Autocad is highly encouraged.

Estimated Science/Design Content: Engineering Science: 0%
Engineering Design: 100%

Expected Knowledge Gain: Upon successful completion of this course, a student must be able to:

1. obtain design loads,
2. design structural members made of reinforced concrete which are consistent with the provisions of the ACI Building Code,
3. prepare calculation sheets for design,
4. prepare detail drawings,
5. perform standard laboratory procedures pertaining to plain and reinforced concrete.

Assessment Measures:

1. Student grades in homework problems, midterm and final examinations, and laboratory reports.
2. Completeness of design computations.
3. Completeness and presentation of laboratory reports.
4. Comments provided by students in their end-of-the-semester instructor/course evaluations.

Homework Assignments: The goals of the homework assignments are to develop design skills; emphasize concepts covered in the lecture through assigned problems; monitor your understanding of the material covered in the course; and to provide you with feedback. All homework is to be submitted on engineering pad sheets written on one side only. All homework assignments will be due by 4 pm of the due date. Homework assignments can be turned in at my office AM 213 (slipped under the door if I am not there) or can be turned in at my mailbox in AM 228. Late homework assignments will be accepted but with a reduced credit of 25% **for each** day of lateness. You are encouraged to work on the homeworks in groups. However, please note that it is your responsibility to make sure you understand the material as you will not be allowed to consult with your classmates during examinations.

Reading Assignments: Students will be responsible for all assigned reading material whether covered in class or not.

Laboratory Reports: Three short form laboratory reports and one long form laboratory report are required. The format for the lab reports will be described in the lab sessions. Laboratory reports are due by 4 pm of the due date and will be reduced 20% **for each** day of lateness. All lab reports including graphs must be done on computer.

Requirements: The final grade for the course will be distributed amongst the various activities as follows:

Homeworks:	25%	
Lab Reports:	30%	
Mid-Term Exam:	20%	date to be determined
Final Exam:	25%	date to be determined

Notes: Homework solutions and exam solutions will be posted on Blackboard and temporarily at <http://www.iit.edu/~santiago>. You will need **Adobe Acrobat Reader** to view the PDF files. This software can be downloaded from the web for free.

Prepared by: E. De Santiago

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