STATE UNIVERSITY OF NEW YORK
COLLEGE OF TECHNOLOGY
CANTON, NEW YORK

COURSE OUTLINE

CONS 304 - REINFORCED CONCRETE DESIGN

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CANINO SCHOOL OF ENGINEERING TECHNOLOGY

SCIENCE AND ENGINEERING TECHNOLOGY DEPARTMENT

BACHELOR OF TECHNOLOGY IN CIVIL AND ENVIRONMENTAL ENGINEERING TECHNOLOGY

APRIL 2011

CONS 304 - REINFORCED CONCRETE DESIGN

A. **TITLE**: Reinforced Concrete Design

B. **COURSE NUMBER:** CONS 304

C. **CREDIT HOURS:** 4

D. **WRITING INTENSIVE COURSE**: No

E. **COURSE LENGTH:** 15 Weeks

F. **SEMESTER(S) OFFERED:** Spring

G. **HOURS OF LECTURE, LABORATORY, RECITATION, TUTORIAL, ACTIVITY:**
3 lecture hours and one three hour computation lab per week

H. **CATALOG DESCRIPTION:**

In this course, the fundamentals of cast-in-place reinforced concrete design by the strength design method are introduced. Students design slabs, beams, girders, columns and footings in accordance with current version of American Concrete Institute Code 318. Computations are done by manual methods and spreadsheets. Students are introduced to design software. In the lab, students work through the complete design of a small multi-story commercial building.

I. **PRE-REQUISITES/CO-COURSES:**

a. Pre-requisites: CONS 336 (Structural Analysis) and CONS 280 (Civil Engineering Materials)

J. **GOALS (STUDENT LEARNING OUTCOMES):**

By the end of this course, the student will be able to:

1. Analyze and design a reinforced concrete slab
2. Analyze and design reinforced concrete beam (rectangular and tee-beam)
3. Analyze and design a reinforced concrete girder
4. Detail shear reinforcement for beams
5. Detail splices and anchorages for reinforcement
6. Analyze and design a reinforced concrete column
7. Analyze and design a reinforced concrete footing
8. Make a presentation of a completed design

K. **TEXTS:**

Spiegel, L. and Limbrunner, G. (2007) *Reinforced Concrete Design, 6th Edition*. Upper Saddle River, NJ: Prentice Hall.

-- (2008) *318-08[1]: Building Code Requirements for Structural Concrete and Commentary*. American Concrete Institute

[1] Or the year of the code that is in force when the course is implemented

N. REFERENCES:

O. EQUIPMENT: Technology enhanced classroom

N. GRADING METHOD: A-F

O. MEASUREMENT CRITERIA/METHODS:

- Exams
- Quizzes
- Lab Design Projects
- Homework
- Design presentation

P. DETAILED COURSE OUTLINE:

I. Introduction

A. Concrete and Reinforced Concrete
B. Advantages and Disadvantages of Structural Concrete
C. ACI Code
D. Reinforcing Steel
E. Concrete Mix Materials
F. Dead and Live Loads

II. Fundamental Principles of Bending

A. Behavior of a concrete beam in flexure
B. Analysis of unreinforced beam by the flexure formula
C. The internal couple method of analysis
D. The strength design method for composite material

III. Analysis and Design of Rectangular Reinforced Concrete Beams

A. Balanced, Over-reinforced, and Under-reinforced Beams
B. Criteria for a tension controlled section
C. Detailing requirements
D. Load Factors
E. Strength reduction factors and the maximum practical moment
F. Rectangular Beam Analysis for Moment (Tension Reinforcement only)
G. Rectangular Beam Design for Moment (Tension Reinforcement only)

IV. Slabs

A. Slab nomenclature
B. ACI Criteria for one way slabs
C. Slab analysis
D. Slab design
E. Design of slabs on grade

V. Tee Beams

A. Tee Beam Analysis for Moment (Tension Reinforcement only)
B. Tee Beam Design for Moment (Tension Reinforcement only)
C. Design of compression steel

VI. Girder Design

A. Introduction

B. Calculation of shears and bending moments
C. Girder desing

VII. Design of Shear Reinforcement in Beams

A. Introduction
B. Analysis of beams with no shear reinforcement
C. ACI Code requirements for shear steel
D. Shear Reinforcement Design Procedure
E. Design for torsion

VIII. Development Length - Introduction

A. Development Length - Tension Bars
B. Development Length - Standard Hooks in Tension
C. Development of Web Reinforcement
D. Splices
E. Cutoff of tension bars
F. Additional reinforcing in zones where bars are terminated

IX. Column Design

A. Introduction
B. Strength of Reinforced Concrete Columns - Small Eccentricity
C. Code Requirements Concerning Column Details
D. Analysis of Short Columns - Small Eccentricity
E. Design of Short Columns - Small Eccentricity
F. Summary of Procedure for Analysis and Design of Short Columns with Small Eccentricities
G. Eccentrically loaded columns

X. Footings

A. Introduction
B. Wall Footings
C. Individual Reinforced Concrete Footings for Columns
D. Square Reinforced Concrete Footings
E. Rectangular Reinforced Concrete Footings

Q. LABORATORY OUTLINE:

The laboratory in this course will be devoted to the design of a small reinforced concrete office building. Each of the lab sessions will be devoted to a particular aspect of the project.

1 Shear and bending moment calculations for slabs
2 Shear and bending moment calculations for beams
3 Graphical construction of moment diagrams
4 Design of slabs
5 Design of beams
6 Design of beams (cont.)
7 Design of shear steel for beams
8 Design of girders
9 Design of shear and torsion steel for girders
10 Design of columns
11 Design of footings
12 Design of footings (cont.)
13 Preparation of design drawings and presentation
14 Student design presentations