University of Jordan

School of Engineering

Civil Engineering department

Spring 2017

Reinforced Concrete 1 0931451, (3 Credit hours)

Spring 2017

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Office hours 11-12 Sunday, Tuesday and Thursday.

Recommended books Design of Reinforced Concrete (9th edition) by McCormac and Brown.

Design of Concrete Structures (14th edition) by Nilson, Darwin and Dolan.

Reinforced Concrete: Mechanics and Design (□th□edition) by MacGregor and Weight.

Course outline

- Properties of concrete and steel.
- Working stress design, allowable stresses, cracked and uncracked sections, strength design and stress block.
- Singly and doubly reinforced sections, rectangular, T-sections and other shapes.
- Concepts of ductile and brittle behaviour.
- Design for bending, shear design, bond requirements and development length.
- One-way solid and ribbed slabs.
- Design of axially and eccentrically loaded short columns and interaction curves.

Grading

The marks will be distributed as follows

- Project 10%
- Midterm Exam 30%
- Participation, Homework and Quizzes 10%
- Final Exam 50%

Course goals

- The student will be able to distinguish between the properties of concrete and reinforcement.
- The student will be able to analyse rectangular, doubly reinforced and T reinforced concrete beams
- The student will be able to design rectangular, doubly reinforced and T reinforced concrete beams
- The student will be able to analyse and design one way slabs.
- The student will be able to design the development length in beams.
- The student will be able to design beams for shear
- The student will be able to analyse and design short columns subjected to pure axial loads and axial loads and bending moments.
- The student will be able to construct and use interaction diagrams.

ABET Outcomes

Course addresses ABET Student Outcome(s): c, e, I and k.

- An ability to design a system, component, or process to meet desired needs with in realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.[ABET: 3c]
- An ability to identify, formulate and solve engineering problems [ABET: 3e].
- A recognition of the need for, and an ability to engage in life-long learning [ABET: 3I]
- An ability to use modern engineering techniques, skills, and computing tools necessary for engineering practice [ABET: 3k]

Brief list of topics to be covered

Introduction

- Concrete and Reinforced Concrete
- Advantages and disadvantages of Reinforced Concrete as a Structural Material
- Compatibility of Concrete and Steel
- Design Codes
- Types of Portland Cement
- Properties of Concrete
- Reinforcing Steel
- SI Bar Sizes and Material Strengths
- Introduction to Loads

Flexural Analysis of Beams

- Cracking Moment
- Elastic Stresses—Concrete Cracked
- Ultimate or Nominal Flexural Moments

Strength Analysis of Beams According to ACI Code

- Design Methods
- Advantages of Strength Design

- Structural Safety
- Derivation of Beam Expressions
- Strains in Flexural Member
- Balanced Sections, Tension-Controlled Sections, and Compression-Controlled or Brittle Sections
- Strength Reduction or ϕ Factors
- Minimum Percentage of Steel
- Design of Rectangular Beams and One-Way Slabs
- Load Factors
- Design of Rectangular Beams
- Miscellaneous Beam Considerations
- Bundled Bars
- One-Way Slabs
- Cantilever Beams and Continuous Beams

Analysis and Design of T Beams and Doubly Reinforced Beams

- Analysis of T Beams
- Design of T Beams
- Compression Steel
- Design of Doubly Reinforced Beams

Bond, Development Lengths, and Splices

- Cutting Off or Bending Bars
- Bond Stresses
- Development Lengths for Tension Reinforcing
- Development Lengths for Bundled Bars
- Hooks

Shear and Diagonal Tension

- Shear Stresses in Concrete Beams
- Shear Strength of Concrete
- Shear Cracking of Reinforced Concrete Beams
- Web Reinforcement
- Behaviour of Beams with Web Reinforcement
- Design for Shear
- Economical Spacing of Stirrups

Introduction to Columns

- Types of Columns
- Axial Load Capacity of Columns
- Failure of Tied and Spiral Columns
- Code Requirements for Cast-in-Place Columns,
- Safety Provisions for Columns
- Design of Axially Loaded Columns

Design of Short Columns Subject to Axial Load and Bending

- Axial Load and Bending
- The Plastic Centroid
- Development of Interaction Diagrams
- Use of Interaction Diagrams
- Design and Analysis of Eccentrically Loaded Columns Using Interaction Diagrams

Continuous Reinforced Concrete Structures

- Approximate Analysis of Continuous Frames for Vertical Loads

Policies

- **CHEATING WILL RESULT IN AN F GRADE.**
- Students are expected to attend every class session. The university policy regarding the **ATTENDENCE** will be **STRICTLY** enforced.
- You are **NOT ALLOWED** to use **CELL PHONE** in class.
- If you have a course-related question, please see the instructor during office hours or set an appointment by **email**.
- You are expected to arrive in class and be seated **on time** and not leave the classroom before the instructor dismisses class.