University of Jordan
School of Engineering
Civil Engineering department

Spring 2017

Reinforced Concrete 1 0931451, (3 Credit hours)

Instructors
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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 (7th 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 \( \phi \) 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 **ATTENDANCE** 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.