College of Engineering

Department of Civil Engineering

CE 574 Behavior of Reinforced Concrete Members

Credit and Contact hours	3 / 3 (Lectures), 0 (Tutorials), 0 (Laboratory)
Required, or Elective	Required
Course Description	The course is intended to provide in-depth understanding of how reinforced concrete (RC) members behave under imposed loads and deformations starting from basic behavior to how ACI 318-19/ SBC 304-24 design code equations were introduced and derived. Reinforced concrete materials: factors affecting strength and deformability, stress/strain relations, and confinement models. Short and slender members under axial load only or both flexure and axial load: sectional analysis, plastic hinges and ductility of members, and inelastic deformations. Behavior of (RC) members in Shear: sectional design, compression field theories, and Truss analogy (strut-and-tie models). Anchorage: bond and development of bars, splices, hooks, mechanical devices, and Structural continuity.
Prerequisites or Co-requisites	Under graduate Course CE 370 Reinforced Concrete Design-I, or any equivalent course that covers the basic concept of flexural and shear behavior of reinforced concrete components, such as slabs, beams, columns, walls, and footings. In addition to design for serviceability requirements, bond, development lengths, and splicing of reinforcement.
Course Learning Outcomes	Students completing this course successfully will be able to:

Course Learning Outcomes (CLOs)	***Related Student Outcomes (SO)***
CLO1. Recognize advanced engineering knowledge, concepts and techniques to identify, interpret and analyze complex and real-life engineering problems. K1	**SO1**
CLO2. Analyze reinforced concrete members under extreme imposed loads and deformations using available models in the literature, Excel or programming languages. S1	**SO2**
CLO3. Apply experimentally proposed models for structural concrete, using finite element software packages, or numerical methods to determine the strength and deformation capacity. S2	**SO3**
CLO4. Justify the available models for reinforced concrete members in the literature with more confidence and compare its behavior. S4	**SO5**
CLO5. Evaluate existing structural concrete elements using finite element software packages, or numerical methods. S4	**SO5**
CLO6. Demonstrate professional engineering and ethical values in assigned projects, assignments, and research work with high academic integrity. V1	**SO6**

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<tr><td>Student Outcomes related to this Course</td><td>SO 1 Recognize advanced engineering knowledge, concepts, and techniques to identify, interpret, and analyze complex and real-life engineering problems.
SO 2 Provide solutions for complex and real-life engineering problems through critical thinking and the use of modern engineering tools, and identify their impact on social, global, cultural, environmental, safety, and economic factors.
SO 3 Investigate scientific research problems independently or through teamwork using critical thinking, appropriate techniques, advanced tools, and management principles.
SO 5 Design novel advanced Civil Engineering systems and evaluate their performance, sustainability, and effectiveness for engineering practice and their impact in global, economic, environmental, and societal contexts
SO 6 Demonstrate scientific integrity, ethical responsibility, and academic values in scientific publications, research projects, and thesis work.</td></tr>
<tr><td>Topics Covered</td><td><table>
<tr><th>List of Topics</th><th>Related CLOs</th></tr>
<tr><td>1. Course description and introduction to reinforced concrete members</td><td>CLO1,CLO6</td></tr>
<tr><td>2. Reinforced concrete materials</td><td>CLO1,CLO3, CLO4</td></tr>
<tr><td>3. Stress/strain relations for concrete and steel</td><td>CLO1, CLO3,CLO4</td></tr>
<tr><td>4. Confinement and proposed models</td><td>CLO2, CLO3, CLO4</td></tr>
<tr><td>5. Ductility of reinforced concrete members</td><td>CLO2, CLO3, CLO4</td></tr>
<tr><td>6. Short compression members</td><td>CLO2, CLO5,CLO6</td></tr>
<tr><td>7. Flexure and axial loads of short and slender columns</td><td>CLO2, CLO5,CLO6</td></tr>
<tr><td>8. Sectional analysis and deformations</td><td>CLO2, CLO3, CLO4,CLO6</td></tr>
<tr><td>9. Shear strength of reinforced concrete members</td><td>CLO2, CLO3, CLO4,CLO6</td></tr>
<tr><td>10. Anchorage</td><td>CLO2, CLO3, CLO4,CLO6</td></tr>
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<tr><td>Textbook(s) and Other Required Material</td><td>• Code Requirements for Structural Concrete (ACI 318-19)
• Saudi Building Code for Concrete Structures (SBC 304-24)
• Reinforced Concrete: Mechanics and Design, 8th edition (2021), James K.Wight. (Mandatory)
• Reinforced Concrete Structure, 1st edition (1991), Robert Park & Thomas Paulay, (recommended)
• Seismic Design of Reinforced Concrete Buildings, 1st edition (2014), Jack Moehle (recommended)
• Seismic Design of Reinforced Concrete and Masonry Buildings, 1st edition (1992), T. Paulay, M. J. N. Priestly, (recommended)
• Assigned readings and notes will be posted on LMS website (Blackboard)</td></tr>
<tr><td>Grading System</td><td>Assignments 15%
Project, report and oral presentation 15%
Mid-term exam 30%</td></tr>
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	Final exam 40%
Instructors	Dr. Ali S. Alqarni; Office 2A25; email: aalqarni@ksu,edu.sa
Date of Review	November, 2024