

CE 302 Mechanics of Materials	
Department of Civil Engineering King Saud University	
Course Description: CE 302 Mechanics of Materials (Required for a BSCE degree)	Introduction and fundamentals of mechanics of deformable materials. Concept of stress and strain and Hooke's law. Concept of failure, yield and allowable stresses. Factor of safety and allowable stress design. Limitations of strains and deformations. Normal stress under axial loading and bending. Shear stress under shear force and torsion. Shear force and bending moment diagrams. Transformation of stress and strain and Mohr's circle. Buckling of columns. (3,1,0)
Prerequisite	GE 201 Statics, Maths Topics: <ol style="list-style-type: none"> 1. Understanding Force systems 2. Determining Moments and couples 3. Understanding Force and moment equilibrium 4. Understanding Centroids and composite sections 5. Understanding Static moment and moment of inertia
Course Learning Objectives	Students completing successfully the course will be able to: <ol style="list-style-type: none"> 1. Understand the concept of stress and strain 2. Understand the concept of allowable stress and factor of safety 3. Compute deformations under axial load and bending moment 4. Draw shear force and bending moment diagrams 5. Analyze and design beams for bending and shear 6. Compute shear stress in beams 7. Compute shear stress and deformations in shafts under torsion 8. Understand the concept of multiaxial stresses, compute principal 9. Determine stresses and directions in 2d and construct Mohr's circle. 10. Understand the concept of buckling and compute Euler's critical load
Topics Covered	<ol style="list-style-type: none"> 1. Introduction – Concept of Stress (6 hours) 2. Stress and Strain – Axial Loading (8 hours) 3. Torsion (3 hours) 4. Pure Bending (8 hours) 5. Analysis and Design of Beams for Bending (7 hours) 6. Shear Stress in Beams (4 classes) 7. Transformation of Stress and Strain (6 hours) 8. Buckling of columns (3 hours)
Class/ tutorial Schedule	Class is held three times per week in 50-minute lecture sessions. There is also a 50-minute weekly tutorial associated with this course.
Computer Applications	None
Project	None
Contribution of Course to Meeting the Professional Component	<ol style="list-style-type: none"> 1. Students learn stress and strain analysis to be involved in designing various structural components. 2. Students should realize the importance of this basic course for the various civil engineering topics, in particular structural analysis and design
Relationship of Course to Program Outcomes	<ol style="list-style-type: none"> 3. Students apply algebra, elementary calculus, and principles of mechanics. 4. Students are able to identify and formulate an engineering problem and to develop a solution.

	<ol style="list-style-type: none"> 5. Students recognize the importance of analysis in designing structural components. 6. Students are encouraged to submit accurate analysis in an efficient and professional way. 7. Students recognize the importance of reading and understanding technical contents in English in order to achieve life-long learning and be able to carryout their responsibilities. 8. Students are encouraged to improve their writing, communication and presentation skills. 9. Students learn how to analyze and Design a process
Textbook(s) and/or Other Required Material	Mechanics of Materials, 3 rd Edition in SI Units By Beer and Johnston, McGraw Hill.
Prepared by	Prof. Abdelhamid Charif and Dr Mohammed Jamal Shannag
Date of Preparation	May, 2006

There are graded home works, two 90 minutes mid-term exams and a three-hour final exam.

The course grade distribution is as follows:

- 10% Attendance, in-class quizzes and tutorial home-work
- 40% Two Midterm Exams
- 50% Final Examination

CE 462 Analysis and Design of Buildings

Department of Civil Engineering King Saud University

<p>Course Description: CE462 : Analysis and Design of Buildings (Required for a BSCE degree for students in the structure field)</p>	<p>Integration and implementation of analysis and design process through a term-long design project of real structures utilizing upto date computer software and including: Idealization and modeling of structures. Preliminary design. Estimation of gravity and wind loads. Approximate methods of analysis and design. Material and durability specifications. Detailing requirements. Preparation of structural drawings.</p>
<p>Prerequisite</p>	<p>CE 461, CE 472 Students are required to master the learning Objectives of CE472 and this is to be assessed early in the semester. Topics related to these learning objectives are:</p> <ol style="list-style-type: none"> 1. Slab-beam-girder floor systems, including one-way slab and one-way joist systems 2. Columns under axial and eccentric loading 3. Slender columns 4. Two-way slab systems 5. Footings
<p>Course learning Objectives</p>	<p>Broad Objectives</p> <ul style="list-style-type: none"> • Develop professional level competence in the design of commonly used reinforced concrete structures by synthesizing previously learnt analysis and design methodologies to design project of real structures utilizing modern computer software. <p>Students completing this course successfully will be able to</p> <ol style="list-style-type: none"> 1. Read and interpret architectural and structural drawings for real-life design projects. 2. Develop an ability to evaluate and critique existing design obtained from professional design offices by redesigning, comparing, and considering alternative systems. This step includes checking the material specifications and detailing requirements. 3. Develop simplified mathematical models for actual three-dimensional concrete buildings and compute required design forces using code approximate coefficients. 4. Use computer software to analyze plane reinforced concrete frames under gravity and wind loading and verify results. 5. Use computer to design beams and columns and verify the resulting design. 6. Use spreadsheets to develop design aids and conduct simplified design of sections. 7. Design two-way slabs on beams using the coefficient methods of SBC-304. 8. Find and properly interpret relevant code provisions.
<p>Topics Covered</p>	<p>Integration and implementation of analysis and design process through a term-long design project of real structures utilizing upto date computer software and including</p> <ol style="list-style-type: none"> 1. Reading and evaluating professional design drawings 2. Considerations of alternative structural systems. 3. Mathematical modeling including assumptions on geometry and loading transfer. 4. Computer analysis and design of frames with emphasis on verifications including usage of approximate methods of analysis and design. 5. Design two-way slabs on beams using the coefficient methods of SBC-304
<p>Class/ Studio Schedule</p>	<p>This course adopts a form of problem-based learning instructional method where the instructor serves as a resource in all stages of this process and provides limited formal instruction until the students (possibly with some guidance) have</p>

	<p>generated a need for it in the context of the problem.</p> <p>There is a 4-hour weekly continuous studio session during which students carryout the tasks associated with this course. Also, a 50-minute lecture session is held one time per week.</p>
Computer Applications	Students spend at least five 4-hour sessions in the computer lab under the supervision of instructor to carryout computer tasks of the course.
Studio projects	All work of this course is carried in the studio or the computer lab under the supervision of instructor with interactive discussion, evaluation and guidance.
Contribution of Course to Meeting the Professional Component	<p>Use of engineering codes and standards (primarily ACI318 or SBC 304) and SBC 301</p> <p>The students are given an open-ended design project as compared to guided design calculations in typical homework assignments. Preliminary design and final design are expected.</p>
Relationship of Course to Program Outcomes	<ol style="list-style-type: none"> 1. Students apply algebra, elementary calculus, and principles of mechanics. 2. Students design structural systems and recognize the interaction with non-structural components 3. Students recognize their role with an engineering team carrying other aspects of design and the interaction of decisions made by various architectural and engineering teams. 4. Students are encouraged to consider alternative systems and parameters to achieve the project goals. 5. Students recognize the ethical and professional responsibility in achieving safe and economical design, and the impact of their design on the well-being of the society. 6. Students develop the background to communicate effectively because the course stresses fundamental principles behind code provisions. 7. Students recognize the need for technical updating on a continuing basis because the course stresses the changing nature of technology, materials, codes and specifications. 8. Students recognize the importance of reading and understanding technical contents in English in order to achieve life-long learning and be able to carryout their responsibilities. 9. Students recognize the important role of computers in facilitating analysis and design of structural members and systems. 10. Students write report and make presentation.
Textbook(s) and/or Other Required Material	<ol style="list-style-type: none"> 1. Reinforced Concrete Design, 4th edition, Macgregor, 1997 2. ACI Building Code (318-95) 3. Saudi Building Code (SBC-304): Concrete Structures 4. Saudi Building Code (SBC-301): Design Loads on structures 5. Design aids and manuals used in previous design courses
Prepared by	Dr. Ahmed Shuraim, Dr. Abdulaziz I. Al-Negheimish
Date of Preparation	Dec., 6 th , 2005

CE 471 Reinforced Concrete I	
Department of Civil Engineering King Saud University	
Course Description: CE 471 Reinforced Concrete I (Required for BSCE degree)	Fundamentals and design theories based on ultimate strength design and elastic concept. ACI Code requirements. Load factors. Analysis and design of reinforced concrete members subject to flexure, shear and diagonal tension in accordance to ACI strength method. Development length of reinforcement. Deflection and crack controls. 3(3,1,0).
Prerequisite	CE 304 (Properties of Concrete), CE 361 (Structural Analysis), Prerequisite by Topics: <ol style="list-style-type: none"> 1. Understanding the mechanical behavior of concrete and steel, 2. Drawing shear force and bending moment diagrams in beams, 3. Determination of bending and shear stresses in beams, 4. Computation of elastic deflection in beams.
Course learning Objectives	Students completing this course successfully will be able to <ol style="list-style-type: none"> 1. Recognize the importance of building codes. 2. Understand the design process. 3. Establish a clear understanding of the mechanical behaviours of reinforcing steel, concrete and reinforced concrete members. 4. Understand the limit states of a reinforced concrete structure and recognize the importance of each limit state. 5. Understand the basic principles to properly apply the SBC provisions. 6. Understand the flexural behavior of reinforced concrete beams, investigate and design beams for bending and shear. 7. Understand mechanism of bond transfer, development length and anchorage of reinforcement and provide detailing of reinforced concrete beams. 8. Determine the immediate and long term deflections in reinforced concrete beams; apply SBC provisions for crack and deflection control. 9. Develop proficiency in the methods used in current design practice, with particular reference to the provisions of Saudi Building Code.
Topics Covered	<ol style="list-style-type: none"> 1. Introduction, Reinforced concrete and building codes. (2 hours) 2. Limit states and the design of reinforced concrete, structural safety, SBC design procedures, loading and actions. (3 hours) 3. Materials, Concrete, Strength of concrete, stress-strain relationship, durability of concrete and reinforcement (3 hours). 4. Flexural behaviour of reinforced concrete beams, analysis and design of rectangular beams (7 hours). 5. Analysis and design of T-beams and beams with compression reinforcement (7 hours). 6. Analysis and design of reinforced concrete beams for shear. (7 hours) 7. Bond, development lengths, and splicing of reinforcement. (6 hours). 8. Serviceability requirements (Deflection and crack control). (7 hours)
Class/ tutorial Schedule	Class is held three times per week in 50-minute lecture sessions. There is also a 50-minute weekly tutorial associated with this course.
Computer Applications	MS Excel and MATLAB Programs are encouraged to be used during the course.
Project	None.
Contribution of Course to Meeting the Professional	<ol style="list-style-type: none"> 1. Students understand the design process of reinforced concrete structures.

Component	<ol style="list-style-type: none"> 2. Students learn to understand and use code provisions. 3. Students recognize the role of professional societies in developing codes and standards and updating current knowledge.
Relationship of Course to Program Outcomes	<ol style="list-style-type: none"> 1. Students apply knowledge in mathematics, and principles of mechanics. 2. Students understand professional and ethical responsibility in achieving accurate structural design to ensure the occupational and public safety. 3. Students are able to consider alternate design solutions. 4. Students are encouraged to carry out design in an efficient and professional way. 5. Students realize the importance of computers in the design process. 6. Students are able to familiarize themselves with the new developments in techniques, materials, codes and specifications. 7. Students recognize the importance of serviceability in reinforced concrete structures. 8. Students recognize the importance of accurate structural analysis in designing structural components. 9. Students recognize their role with an engineering team carrying other aspects for designing structures, in terms of choosing the structural systems and the interaction of decisions made by various architectural and engineering teams. 10. Students recognize the importance of reading and understanding technical contents in English in order to achieve life-long learning and be able to carryout their responsibilities. 11. Students are encouraged to improve their writing, communication and presentation skills.
Textbook(s) and/or Other Required Material	<ol style="list-style-type: none"> 1. Reinforced Concrete: Mechanics and Design, 4rd edition, by J. G. MacGregor and J. K. White, Prentice-Hall, 2006. 2. The Saudi Building Code (SBC 301), "Design Loads for Buildings and Structures" 3. The Saudi Building Code (SBC 304), "Concrete Structures"
Prepared by	Dr. Mohammad Jamal Shannag and Dr. Saleh Aldeghaither.
Date of Preparation	Feb., 28 th , 2006

CE 472
REINFORCED CONCRETE II

Department of Civil Engineering
King Saud University

<p>Course Description: CE472 REINFORCED CONCRETE II (Required for a BSCE degree)</p>	<p>Design of floor systems, one-way, two-way, ribbed and flat slabs. Design for torsion, combined shear and torsion by the strength method. Design of continuous beams. ACI moment redistribution for minimum rotation capacity. Design of columns under axial and eccentric loadings, short and long columns. Staircases. Types of footings.</p>
<p>Prerequisite</p>	<p>CE 461, CE 471 Prerequisites by Topics:</p> <ol style="list-style-type: none"> 1. Determination of forces, moments and deflections for a beam under given gravity loading 2. Understanding Pattern loading and influence lines 3. Solution of statically indeterminate structures using moment distribution 4. Understanding specified material properties for design 5. understanding design criteria of strength and serviceability 6. flexural design of beams and shear design of beams according to codes of practice 7. Computing the cracking moment and effective moment of inertia for a section 8. Computing development length for rebars 9. Loads and Design Combinations
<p>Course learning Objectives</p>	<p>Students completing this course successfully will be able to</p> <ol style="list-style-type: none"> 1. Explain the factors affecting the selection of a one-way solid slab or one-way joist systems for a given beam-girder layout. 2. Compute design loads on a typical strip, estimate thickness dimensions and show the idealization of load transfer to beams, girders and columns. 3. Compute required flexural and shear strengths on slab strips, ribs, beams, and girders using ACI coefficients (when applicable) and elastic analysis. 4. Design critical sections within the constraints of code design criteria of safety, serviceability and economy using fundamental principles as well as design aids. 5. Compute nominal and design strength of a column section for points in the compression controlled and tensions controlled zones using equilibrium and compatibility requirements. 6. Investigate slenderness and stability of columns and evaluate their effects on column design 7. Check the adequacy of column strength using generated axial load-moment interaction diagrams considering both uni-axial and biaxial moments 8. Model regular two-way slab systems by 2-D design frames. 9. Determine the required strength moments in design strips in accordance with the Direct Design Method 10. Provide flexural design and detailing of two-way slabs to satisfy design criteria. 11. Verify slab and footing safety against one-way and two-way modes of failure in shear. 12. Compute single footing dimensions on the basis of loading and soil properties. 13. Carryout flexural design and detailing in both direction 14. Recognize the role of codes and specifications in the design process 15. Make reasonable assumptions and test those against fundamental knowledge. 16. Conceive design alternatives.
<p>Topics Covered</p>	<ol style="list-style-type: none"> 1. Slab-beam-girder floor systems 2. Columns under axial and eccentric loading 3. Slender columns 4. Two-way slab systems 5. Footings 6. Staircases
<p>Class/ tutorial Schedule</p>	<p>Class is held three times per week in 50-minute lecture sessions. There is also a 50-minute weekly tutorial associated with this course.</p>

Computer Applications	Computer spreadsheets are encouraged for developing design aids and carrying out systematic steps of design.
Projects	None.
Contribution of Course to Meeting the Professional Component	<ol style="list-style-type: none"> 1. Students use latest codes, design manual for designing structural systems within appropriate constraints including satisfying design criteria. 2. Students recognize the role of professional societies in developing codes and standards and updating current knowledge.
Relationship of Course to Program Outcomes	<ol style="list-style-type: none"> 1. Students apply algebra, elementary calculus, and principles of mechanics. 2. Students design structural systems and recognize the interaction with non-structural components 3. Students recognize their role with an engineering team carrying other aspects of design and the interaction of decisions made by various architectural and engineering teams. 4. Students are encouraged to consider alternative systems and parameters to achieve the project goals. 5. Students recognize the ethical and professional responsibility in achieving safe and economical design, and the impact of their design on the well-being of the society. 6. Students develop the background to communicate effectively because the course stresses fundamental principles behind code provisions. 7. Students recognize the need for technical updating on a continuing basis because the course stresses the changing nature of technology, materials, codes and specifications. 8. Students recognize the importance of reading and understanding technical contents in English in order to achieve life-long learning and be able to carryout their responsibilities. 9. Students recognize the important role of computers in facilitating analysis and design of structural members and systems.
Textbook(s) and/or Other Required Material	<ol style="list-style-type: none"> 1. Reinforced Concrete: Mechanics and Design, 3rd ed. by J. G. MacGregor 2. Building Code Requirements for Reinforced Concrete (ACI 318-95M or SBC304)
Prepared by	Dr. Ahmed Shuraim, Prof. Abdelhamid Charif
Date of Preparation	Dec., 6 th , 2005