# CVLE 322 Reinforced Concrete Design I

## Course Syllabus – Spring 2015-2016

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| **Curricular Area** | | Civil Engineering – Structural Sequence | |
| **Type of Course** | | Mandatory - Major | |
| **Catalogue Description** | | Introduction working stress and limit state methods of design. Sections subjected to :normal force, bending moment, and shear, eccentric force, torsion, bond development and anchorage, code requirements, detailing, applications: columns and beams . Prereq: CVLE 211. | |
| **Prerequisites by Courses** | | CVLE 111 Statics, | |
| **Prerequisites by Topics** | | Statics, Internal actions, and elementary structural analysis | |
| **Instructors** | | Dr. Ayman Trad<br>(a.trad@bau.edu.lb)<br>Block B Building<br>Office 302 (Phone Ext 4307) | Dr. Hassan Ghanem<br>(h.ghanem@bau.edu.lb)<br>Block D Building<br>Office XX (Phone Ext 4308) |
| **Course schedule/rooms** | | Section T1<br>Monday 12:00 – 13:00 pm (BT110)<br>Wednesday 10:00 – 11:00 am (BT110)<br>Friday 08:00 – 09:00 am (BT110) | Section T2<br>Monday 10:00 – 11:00 am (BT110)<br>Wednesday 11:00 – 12:00 pm (BT110)<br>Friday 09:00 – 10:00 am (BT110) |
| **Office Hours** | | Monday 08:00 – 10:00 am<br>Wednesday: 12:00 – 14:00 pm<br>Friday 14:0 - 16:00 Pm<br>By appointment. | Monday 11:00 – 12:00 pm<br>Tuesday: 08:30 - 09:30 am<br>Wednesday: 09:00 – 11:00 am<br>Thursday: 08-09:30 am & 12:30 – 13:30<br>By appointment. |
| **Load** | | 3 credits; 3 Lecture-sessions/week – 50 min per session | |
| **Textbook** | | Wight J. K., and Macgregor J. G., Reinforced Concrete, Mechanics and Design, Fifth Edition, Pearson International Edition, 2012. | |
| **Reference Books** | | 1- Nawy E. G, Reinforced Concrete, A fundamental Approach, Sixth Edition, Pearson International Edition, 2012.<br>2- McCormac J. C, and Nelson Jr. J. K, Design of Reinforced Concrete, Seven Edition, John Willey and sons, 2006.<br>3- Kong F. K, Evans R. H, Reinforced and Prestressed Concrete, 3rd Edition, Chapman and Hall, 1990.<br>4- Yehia A. Daou, Reinforced Concrete Design Data Book, Beirut Arab University, 2010. | |
| **Topics** | **Week [1]** | 1. Review of basic concepts of reinforced concrete structures | |
| | **Week [2]** | 2. **Methods of Design, Ultimate and Serviceability Limit State**<br>• Behavior of concrete members, Elastic and ultimate behavior | |
| | **Week [3-4]** | 3. **Safety Factors and Design Strength**<br>• Safety factors for loads, Material reduction factors<br>• Types of loads, Characteristic loads and characteristic strength<br>• Nominal and Design strength<br>• Load cases and Combinations | |
| | **Week [5-7]** | **4. Design of Flexural R. C. Beams**<br>(a) Limit State Design Method<br>• Stress / strain relations of the materials, Equivalent rectangular stress block.<br>• Design of rectangular sections with tension steel only.<br>• Design of rectangular sections with tension and compression steel<br>• Design of flanged sections with tension steel only.<br>• Design of flanged sections with tension and compression steel. | |

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| | **Week [13-15]** | (b) Working stress method Method<br>• Design of rectangular sections with tension steel only.<br>• Design of rectangular sections with tension and compression steel<br>• Design of flanged sections with tension steel only.<br>• Design of flanged sections with tension and compression steel.<br><br>5. **Shear Strength of R. C. Beams**<br>• Types of Shear failure<br>• Shear strength of concrete members without shear reinforcement<br>• Critical sections for shear .<br>• Types of shear Reinforcement<br>• Design examples<br><br>6. **Torsional Strength of R. C. Beams**<br>• Types of failure<br>• Torsional strength of concrete members<br>• Critical sections for torsion<br>• Types of torsion Reinforcement<br>• Design examples<br><br>**7. Development length of steel Reinforcement of R. C. Beams**<br>• Bond strength of concrete<br>• Factors affecting the development length.<br>• Development length of tension reinforcement<br>• Development length of compression reinforcement<br>• Development length of bundled steel bars<br>• Design examples<br><br>8**. Reinforced Concrete Columns**<br>• Types of Failure<br>• Types of columns<br>• Columns subjected to axial and eccentric loads<br>• Column Interaction Diagrams<br>• Design examples |

| **Learning Outcomes** **Correlation with** | **Program Outcomes** | **Program Objectives** |
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| Students will know the fundamental structural concepts of reinforced concrete slabs and the basic principles of structural analysis. | a | 1 |
| Students will demonstrate the ability to determine the state of stability, durability and safety of reinforced concrete slabs at service and ultimate states. | a, b | 2 |
| Students will demonstrate the ability to apply the fundamental principles of structural analysis to analyze and design all types of slabs. | a, b | 2 |
| Students will demonstrate familiarity with theories and concepts used in the design of reinforced concrete slabs. | a, b | 2 |
| Students will demonstrate the ability to use ideas and techniques some of which are at the forefront of the discipline. | a, b | 2 |
| Students are familiar with available structural analysis computer programs and will demonstrate the ability to practice their use while working in teams. | e, g, h | 2, 4 |

| Learning Outcomes Assessment Tools | Exams | HW s | Lab Reports | Project Report | Course Survey |
|---|---|---|---|---|---|
| Students will know the fundamental structural concepts of reinforced concrete slabs and the basic principles of structural analysis. | ✓ | ✓ | | | ✓ |
| Students will demonstrate the ability to determine the state of stability, durability and safety of reinforced concrete slabs at service and ultimate states. | ✓ | ✓ | | | ✓ |
| Students will demonstrate the ability to apply the fundamental principles of structural analysis to analyze and design all types of slabs. | ✓ | ✓ | | | ✓ |
| Students will demonstrate familiarity with theories and concepts used in the design of reinforced concrete slabs. | ✓ | ✓ | | | ✓ |
| Students will demonstrate the ability to use ideas and techniques some of which are at the forefront of the discipline. | ✓ | ✓ | | | ✓ |
| Students are familiar with available structural analysis computer programs and will demonstrate the ability to practice their use while working in teams. | ✓ | ✓ | | | ✓ |

## ***Assessment:***

1. Attendance (as below).
2. Individual weekly homework assignments and project (Modeling, computer/manual analysis, validation, synthesis, and report) (5%)
3. Two 1.5-hour quizzes (25%+30%)
4. 2-hour final exam. (40%)
5. **ZERO-TOLERANCE** policy on cheating and plagiarism.

***Attendance:*** Attendance is **mandatory**. Class attendance will be taken and students will be penalized for absences according to the rules set by BAU regulations, and specified in the CE Student Manual; i.e. students who miss more than one-fifth of the sessions of any course in the first ten weeks of the semester will be required to withdraw from the course with a grade of "W".

## ***1Assessment Dates:***

| | Section T1 | Section T2 |
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| **Exam** | **Test 1: March** X, 2016 (BT 112)<br>**Test 2: April X**, 2016 (BT 112)<br>**Final Exam: May X**, 2016 (Block B) | **Test 1: March** X, 2016 (BT 110)<br>**Test 2: April X**, 2016 (BT 110)<br>**Final Exam: May X**, 2016 (Block B) |

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| **Course Coordinator** | Prof. Yehya Temsah |
| **Date** | February, 2016 |