Module (Course Syllabus) Catalogue

2021-2022

College/ Institute	Erbil Technical Engineering College	
Department	Civil Engineering Department	
Module Name	Reinforced Concrete Fundamentals 2	
Module Code	RCF601	
Degree	Technical Diploma ☐ Bachler x High Diploma ☐ Master ☐ PhD ☐	
Semester	6th semester	
Qualification	B.Sc.	
Scientific Title	Engineer	
ECTS (Credits)	6 x 27	
Module type	Prerequisite ☐ Core x Assist. ☐	
Weekly hours	4	
Weekly hours (Theory)	(4)hr Class	(157) Total hrs Workload
Weekly hours (Practical)	(0)hr Class	
Number of Weeks	15	
Lecturer (Theory)	Asst. Prof. Dr. Ayad Zeki	
E-Mail & Mobile NO.	ayad.saber@epu.edu.iq ; (009647504454107)	
Lecturer (Practical)		
E-Mail & Mobile NO.		
Websites	epu.edu.iq	

Course Book

<table>
<tr><td>Course Description</td><td colspan="5">This subject begins Shear design & theories parallel with calculating of development length of the reinforcement bars with cut off and bending points. And finally, we study the design of short columns (Uniaxial and biaxial).</td></tr>
<tr><td>Course objectives</td><td colspan="5">The main aim and purpose behind the study of Reinforced Concrete Fundamentals 2 is to learn:
Shear and Diagonal Tension in Beams.
Bond, Anchorage and Development Length.
Short Columns (Uniaxial and Biaxial).</td></tr>
<tr><td>Student's obligation</td><td colspan="5">The role of students is:
Attendance with reinforced concrete source “Nilson” and “ACI Code”.
Listening and writing the notes and an explanation during the solve of examples.
Discussion of unclear subjects.</td></tr>
<tr><td>Required Learning Materials</td><td colspan="5">Using Data show to view the source (reinforced concrete source “Nilson” and “ACI Code”) this will help the students to learn the using of the sources.
Using white board to give an explanation.
Abbreviations of subjects on the sheet will be given to the students by the lecturer.</td></tr>
<tr><td rowspan="12">Evaluation</td><td colspan="2">Task</td><td>Weight (Marks)</td><td>Due Week</td><td>Relevant Learning Outcome</td></tr>
<tr><td colspan="2">Paper Review</td><td></td><td></td><td></td></tr>
<tr><td rowspan="5">Assignments</td><td>Homework</td><td>10%</td><td>8 , 11</td><td>1 - 3</td></tr>
<tr><td>Class Activity</td><td>2%</td><td>1 - 12</td><td>1 - 3</td></tr>
<tr><td>Report</td><td>8%</td><td>9</td><td>1 - 3</td></tr>
<tr><td>Seminar</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td></td><td></td></tr>
<tr><td>Project</td><td>8%</td><td>11</td><td>1 - 3</td></tr>
<tr><td colspan="2">Quiz</td><td>8%</td><td>4 , 7 , 10</td><td>1 - 3</td></tr>
<tr><td colspan="2">Lab. Reports and Activity</td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Midterm Exam/Theory</td><td>24%</td><td>8</td><td>1 - 2</td></tr>
<tr><td colspan="2">Final Exam/ Theory</td><td>40%</td><td>13</td><td>1 - 3</td></tr>
<tr><td colspan="2">Midterm Exam/Practical</td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Final Exam/ Practical</td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Total</td><td>100%</td><td></td><td></td></tr>
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Specific learning outcome:	The students will learn: **1. Recognize Shear and Diagonal Tension in Beams.** **a.** Reinforced Concrete Beams without Shear Reinforcement (Stirrups). **b.** Reinforced Concrete Beams with Web Reinforcement (Stirrups). **c.** ACI Code provisions for shear design. **d.** Effect of Axial Forces. **2. Explain Bond, Anchorage and Development Length.** **a.** Bond Strength. **b.** Development Length. **c.** Factors Influencing Development Length. **d.** Simplified Equations for Development Length. **e.** Anchorage of Tension Bars by Hook. **f.** Anchorage in Tension using Headed Bars. **g.** Development of Bars in Compression. **h.** Bars Cut-off and Bend Points in Beams. **i.** Bars Splices. ▪ Lap Splice in Tension. ▪ Compression Splices. ▪ Column Splices. **3. Design Short Columns.** **a.** Transverse Ties and Spirals. **b.** Compression plus Bending of Rectangular Columns. **c.** Strain Compatibility Analysis and Interaction Diagrams. **d.** Balanced Failure. **e.** Distributed Reinforcement. **f.** Unsymmetrical Reinforcement. **g.** Circular Columns. **h.** Biaxial Bending. **i.** Load Contour Method. **j.** Reciprocal Load Method. **k.** Bar Splices in Columns and Ties near Beam-Column Joints.
Course References:	• DESIGN of CONCRETE STRUCTURE "Nilson et al. Fifteenth Edition (U.S. Customary Unit)". • ACI 318-14 Code. • Reinforced Concrete Fundamental "Ferguson et al." • Design of Reinforced Concrete Structure "Mashhour and Mahmoud". • اساسيات الخرسانة المسلحة"د.سعد علي الطعان ". • Reinforced Concrete Analysis and Design "S.S.Ray". • Any internet link.

Course topics (Theory)	Week	Learning Outcome
1. Shear Design & Theories.	1-4	1
2. Development Length of the Reinforcement.	5-7	2
3. Design of Reinforced Concrete Columns (Short & Long).	8-12	3
Practical Topics	**Week**	**Learning Outcome**

Questions Example Design

- The column of 14 x 28 in. reinforced with 2#9 and 4#11 bars as shown in Fig.1. Load P_n will be applied with eccentricity $\boldsymbol{e}$ about the strong axis. Using concrete of $\boldsymbol{f'_c = 7{,}000\ psi}$ strength, longitudinal bars with $\boldsymbol{f_y = 60{,}000\ psi}$ assume the bars in each side on the same center line then fill the blank cells to complete the table shown below. **(28 Marks)**

cases	c in	P_n kips	M_n in-kips
Balance			
Tension failure region	**8**		
Compression failure region	**20**		

- The section shown in Fig.2, four No.9 column bars from the floor below are to be lab spliced with four No.8 column bars from above, and the splice is to be made just above a construction joint at floor level. The column, measuring 10 in. x 16 in. in cross section, will be subject to compression only for all load combinations. Transverse reinforcement consists of No.3 ties at 8 in. spacing. All vertical bars may be assumed to be fully stressed. Calculate the required splice length. Material strengths are normal concrete with f'_c = 5,000 psi and f_y = 55,000 psi.

(12 Marks)

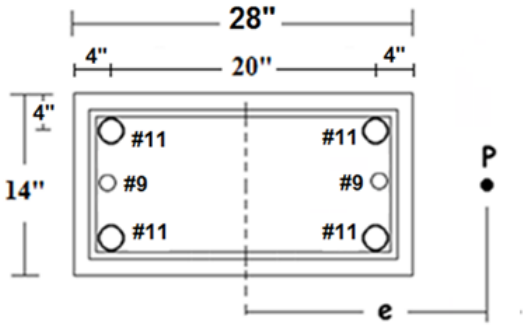

Fig. 1

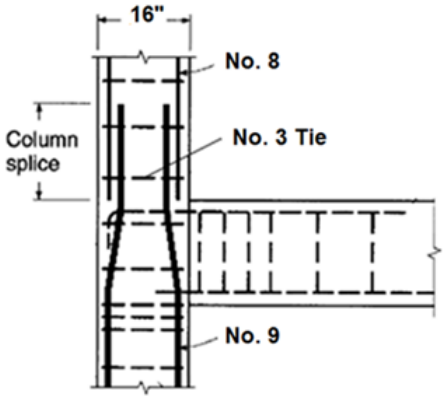

Fig. 2

- A simply supported beam shown in Fig.3 carry a single concentrated factor load of 80 kips at mid-span, the vertical stirrups are #3 with f_y = 40,000 psi. By using simplify equations design the web reinforcement for the following cases:
  1. Concrete with f_c' = 3,600 psi and no axial force.
  2. Concrete with f_c' = 6,400 psi with axial compression force = 200 kips. **(22 Marks)**

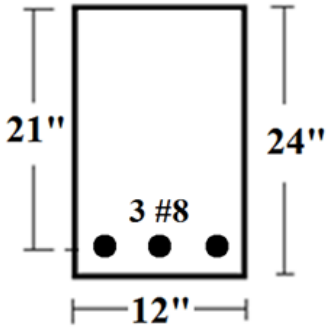

Fig. 3

Extra notes:

External Evaluator

As a Professor I have reviewed the course book related to Reinforced Concrete Fundamentals 1, I found the coarse book is satisfies and adequate for the reinforced concrete third year of civil engineering.

Prof. Dr. Mereen Hassan Fahmi Rasheed