



## Course Specifications

<b>Course Title:</b>	Reinforced Concrete I
<b>Course Code:</b>	CE 312
<b>Program:</b>	B.Sc. in Civil Engineering
<b>Department:</b>	Civil Engineering
<b>College:</b>	Jubail University College
<b>Institution:</b>	Jubail University College

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## A. Course Identification

<b>1. Credit hours:</b>	3
<b>2. Course type</b>	
a.	University <input type="checkbox"/> College <input type="checkbox"/> Department <input checked="" type="checkbox"/> Others <input type="checkbox"/>
b.	Required <input checked="" type="checkbox"/> Elective <input type="checkbox"/>
<b>3. Level/year at which this course is offered:</b>	Level 5, Third Year
<b>4. Pre-requisites for this course (if any):</b>	CE 308 Structural Materials CE 309 Structural Analysis I
<b>5. Co-requisites for this course (if any):</b>	None

### 6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	✓	100
2	Blended		
3	E-learning		
4	Correspondence		
5	Other		

### 7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
<b>Contact Hours</b>		
1	Lecture	30
2	Laboratory/Studio	45
3	Tutorial	
4	Others (specify)	
	<b>Total</b>	<b>75</b>

## B. Course Objectives and Learning Outcomes

### 1. Course Description

*CE 312 Reinforced Concrete 1 (2-3-3)*

*Pre-requisite: CE 309, CE 308*

Review of properties of structural concrete and reinforcing steel; behavior and design of reinforced rectangular and T-section in flexure; Use of computers in beam design for flexure; behavior and design of beams for shear, bond, and development length including splices and cut-off points; design; design of one-way slab, design of continuous beams with computer application for analysis; control of deflection and cracking; design of short columns; design of single footing; design project of a simple multi-story building with one-way flooring system which integrates the design of the different structural components

## 2. Course Main Objective

The main purpose of this course is to prepare students for analysis and design of reinforced concrete members (beam, one-way slab, short column and single footing) as per the standard code of practice.

## 3. Course Learning Outcomes

CLOs		Aligned PLOs
1	<b>Knowledge and Understanding</b>	
	N/A	
2	<b>Skills</b>	
2.1	Analyze reinforced concrete sections for the capacity and suitability	1
2.2	Design reinforced concrete components of structure as per the standard codes of practice	2
2.3	Use computer software to analyze Structural Components	2
2.4	Communicate the design details effectively	3
2.5	Function effectively on a team to achieve the goals of design project	5
3	<b>Values</b>	
	N/A	

## C. Course Content

No	List of Topics	Contact Hours
1	<b><u>Unit 1. Design methodologies</u></b> 1.1 Introduction & course overview, 1.2 Design concepts & codes, history of Reinforced concrete (RC), 1.3 Materials required; steel and concrete, Material properties and their consideration in RC behavior and design 1.4 Design methodologies, Design process, 1.5 Types of Loads and load combinations, safety factors, Determination of member loads, pattern loads, analysis examples, 1.6 Flexural members – basic behavior and preview of the ACI Code methods.	10
2	<b><u>Unit 2. Analysis of Singly reinforced beam</u></b> 2.1 Modeling and analysis of singly reinforced beams 2.2 Flexural members; calculation of reinforcement, strain and ductility 2.3 Flexural members; limits of flexural reinforcement amounts; balanced conditions, under-reinforced, over-reinforced. 2.4 Flexural analysis of general shaped members	10
3	<b><u>Unit 3. Design of singly reinforced beam</u></b> 3.1 Design of singly reinforced beams for flexure – general procedures 3.2 ACI guidelines for cover, spacing, deflections and other restrictions on reinforcement placement. 3.3 Examples on flexural analysis and design 3.4 Design of one-way slabs.	15
4	<b><u>Unit 4. Crack control</u></b> 4.1 Flexural crack control, 4.2 Reinforcement details for crack control.	5
5	<b><u>Unit 5. Doubly reinforced beam</u></b> 5.1 Advantages of doubly reinforced concrete beams	10

	5.2 Analysis of doubly reinforced concrete beam 5.3 Design of Doubly reinforced beams 5.4 Criteria for effective flange width of a T-beam. 5.5 Analysis and Design of T-beams;	
6	<b>Unit 6. Shear Design</b> 6.1 Shear strength of a concrete beam 6.2 Design of shear reinforcement in RC beams 6.3 Spacing of shear reinforcement	5
7	<b>Unit 7. Column Design</b> 7.1 Columns; behavior, general requirements; 7.2 Design of short columns 7.3 Columns with bending, Interaction diagrams,	5
8	<b>Unit 8. Footing Design</b> 8.1 Loads acting on a footing 8.2 Design of Wall footing 8.3 Design of isolated column footing	5
9	<b>Unit 9. Deflection of beams</b> 9.1 Deflections of RC beams 9.2 Maximum acceptable limits of deflections 9.3 Moment redistribution,	5
10	<b>Unit 10. Development length and splices</b> 10.1 Development of reinforcement 10.2 Code requirements for reinforcement bar lengths and cutoffs, 10.3 Splices of rebar	5
<b>Total</b>		75

## D. Teaching and Assessment

### 1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	<b>Knowledge and Understanding</b>		
	N/A		
2.0	<b>Skills</b>		
2.1	Analyze reinforced concrete sections for the capacity and suitability	Interactive learning Collaborative learning Self-Directed Learning	Quizzes, Midterm, Assignments, Final
2.2	Design reinforced concrete components of structure as per the standard codes of practice		Quizzes, Midterm, Assignment, Final, Project
2.3	Use computer software to analyze Structural Components		Project
2.4	Communicate the design details effectively		Project Presentation
2.5	Function effectively on a team to achieving the goals of design project		Project
3.0	<b>Values</b>		
	N/A		

### 2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Quiz 1	4	5%

#	Assessment task*	Week Due	Percentage of Total Assessment Score
2	Assignment 1	6	5%
3	Mid-term LT	8	20%
4	Mid-term LB	9	5%
5	Quiz 2	12	5%
6	Assignment 2	14	5%
7	Project	15	5%
8	Performance Lab	15	10%
9	Final Exam LB	16	10%
10	Final Exam LT	17-19	30%

\*Assessment task (i.e., written test, oral test, oral presentation, group project, essay, etc.)

## E. Student Academic Counseling and Support

**Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :**

- Office hours 3 hr/week; students can go in times of office hours for teacher to explain what could not be understood from the lesson.
- Students can communicate with a staff member outside the official working hours by email.
- Students are also encouraged to visit their academic advisors.

## F. Learning Resources and Facilities

### 1. Learning Resources

<b>Required Textbooks</b>	<a href="#">McCormack, J. C.</a> and <a href="#">Brown, R. H.</a> (2014). Design of Reinforced Concrete, USA: John Wiley & sons, Inc.
<b>Essential References Materials</b>	<a href="#">Nawy, E. G.</a> (2008), Reinforced Concrete: A fundamental Approach, USA: Prentice Hall Publisher. <a href="#">Wight, J. K.</a> (2015). Reinforced Concrete: Mechanics and Design, USA: Prentice Hall Publisher.
<b>Electronic Materials</b>	<ul style="list-style-type: none"> <li>• Online RC Calculators <a href="http://civilengineer.webinfolist.com/design/beamanalysis.htm">http://civilengineer.webinfolist.com/design/beamanalysis.htm</a></li> <li>• Civil Engineering Resources <a href="https://twitter.com/civilweb">https://twitter.com/civilweb</a></li> <li>• Civil Engineering Calculators <a href="https://facebook.com/CivilEngineeringCalculators">https://facebook.com/CivilEngineeringCalculators</a></li> </ul>
<b>Other Learning Materials</b>	ACI-318: <i>Building Code Requirements for Structural Concrete Software for Structural Analysis and Design</i> (STAAD Pro ,ETABS, SAFE, etc)

### 2. Facilities Required

Item	Resources
<b>Accommodation</b> (Classrooms, laboratories, demonstration rooms/labs, etc.)	Lecture rooms with a capacity of at least 25 students and fitted with multimedia projector and a computer.

Item	Resources
<b>Technology Resources</b> (AV, data show, Smart Board, software, etc.)	<i>Software for Structural Analysis and Design (STAAD Pro ,ETABS, SAFE, etc.)</i>
<b>Other Resources</b> (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

## G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment as per QMS-Policy-006 Feedback Survey, QMS-QAP-116 Monitoring Students' Satisfaction	Students	Indirect: Analyzing the results of the following surveys Course Evaluation Survey(CES), Program Evaluation Survey (PES), Student Experience Survey (SES)
Quality of Exam papers and Verifying Standards of Student Achievement as per QMS-Policy-004 Policy for Examinations and Marking, QMS-ACP-102 Procedure for Marking Examinations	Examination Committee	Direct: Peer review of examination papers and review or double check a minimum of three or 10% of answer papers. Verifying the entries in the Activity Mark Sheet.
Achievement of learning outcomes as per QMS-Policy-001 Course Review, QMS-CDP-106, QMS-CDP-112 Curriculum Review	Faculty	Direct: Course Report (Section B-3)
Implementation of the action plans based on previous semester as per QMS-Policy-001 Course Review, QMS-CDP-106 Procedure for Course Review, QMS-CDP-112 Procedure for Curriculum Review	Faculty	Direct and Indirect: Course report (Section G-1, G-2)
Monitoring Teaching and Learning as per QMS-Policy-005 Monitoring of Teaching and Learning	Chairperson/Program Director/Course Director	Indirect: Feedback by Chairperson/Program director/Course director. Program Delivery Record.
Effectiveness of planned Teaching Strategies QMS-Policy-001 Course Review	Faculty	Indirect: Course Report (Section B-4)
Course effectiveness and planning for improvement as per QMS-Policy-001 Course Review, QMS-CDP-106 Procedure for Course	Faculty	Direct and Indirect: Course report (Section G-3)

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Review, QMS- CDP-112 Procedure for Curriculum Review		
Verifying Standards of Student Achievement and Quality of Exam papers as per QMS-ACP-119 External Assessment Review	Assessment External Reviewer	Direct: Report of assessment external reviewer. Review of sample of ten or 10% of student's assessments and coursework scripts.

**Evaluation areas** (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)

**Evaluators** (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify))

**Assessment Methods** (Direct, Indirect)

## H. Specification Approval Data

Council / Committee	Civil Engineering Department Council
Reference No.	REG MIN-CED-10
Date	27-04-2020

## Appendix A Revision Details

Revision no.	DESCRIPTION	Reference MoMs			
		DC		CDC	
		Sem	#	Sem	#
1	Revision of Course Teaching Strategies and action verbs based on the comments of NCAAA reviewer	392	4	392	4
2	Course Specification Template 2018	402			