



## 31 Course Specification of Reinforced concrete1

I. Course Identification and General Information:						
1	Course Title:	<i>Reinforced Concrete 1</i>				
2	Course Code & Number:	CE202				
3	Credit hours:	C.H				Credit Hours
		Th.	Tu.	Pr.	Tr.	
		2	2			3
4	Study level/ semester at which this course is offered:	3 <sup>rd</sup> Level / 1 <sup>st</sup> semester				
5	Pre –requisite (if any):	Theory of <b>Structure</b> , Strength of Materials				
6	Co –requisite (if any):	None				
7	Program (s) in which the course is offered:	Civil <b>Engineering</b>				
8	Language of teaching the course:	English+ Arabic				
9	Location of teaching the course:	Class room				
10	Prepared by:	Dr. Abdulwahab Mohammed Al-Nono				
11	Date of Approval					

II. Course Description:	
<p>This course will include topics selected from the following list: the physical and mechanical properties of concrete and some properties of material whose compose of concrete, Advantages &amp; Disadvantages of reinforced concrete, Design Philosophy &amp; Concepts Structural concrete, Basic Assumptions, Elements Behavior of a RC beam Loaded to Failure, Types of Flexural Failure Loads, idea about international codes, safety factors, Finally analysis and Design for rectangular and tie sections for single and double reinforcement under flexural, design beams for shear and torsion, Deflection of Structural concrete Members, Development length of reinforcing bars.</p>	

Prepared by Head of Department  
Dr. Abdulkareem  
Yahya Al khattabi

Quality Assurance Unit  
Ass. Prof. Dr. Mohammad  
Algorafi

Dean of the Faculty  
Prof. Dr. Mohammed  
AL-Bukhaiti

Academic Development  
Center & Quality Assurance  
Ass. Prof. Dr.  
Huda Al-Emad

Rector of Sana'a University  
Prof. Dr. Al-Qassim Mohammed Abbas



III. Course Intended learning outcomes (CILOs) of the course		Referenced PILOs
a.1	Define the effectiveness of physical and mechanical properties of reinforced concrete contents (concrete and steel), and identify the limitations of concrete's dimensions and spacing of steel reinforcement for structural concrete sections.	A1
a.2	Discuss the behavior of a reinforced concrete beam loaded to failure.	A1
a.3	Recognize the reinforced concrete code of practice (ACI-Code) and relevant standards (ASTM).	A2
a.4	Describe the philosophy and concepts for design procedures of structural concrete,	A3
a.5	Define design procedures of the reinforced concrete elements based on the Strength Design Method (SDM) considering the basic design criteria such as safety, serviceability, and economy.	A3
b.1	Differentiate the types of beam's sections, and the carrying capacity of structural element using analysis method.	B1
b.2	Construct good assumptions for calculation of imposed loads, analyze the structure, determination critical sections, and calculation of appropriate cross sections and reinforcements, to produce a safe and economic structures.	B2, B4
c.1	Conduct full design calculations for beams based on the ACI Code under moment, shear and torsion, considering the safety and economic.	C2
d.1	Draw to show the details of reinforced steel in cross and longitudinal sections for beams.	D1

Prepared by Head of Department  
Dr. Abdulkareem  
Yahya Al khattabi

Quality Assurance Unit  
Ass. Prof. Dr. Mohammad  
Algorafi

Dean of the Faculty  
Prof. Dr. Mohammed  
AL-Bukhaiti

Academic Development  
Center & Quality Assurance  
Ass. Prof. Dr.  
Huda Al-Emad

Rector of Sana'a University  
Prof. Dr. Al-Qassim Mohammed Abbas



<b>(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:</b>		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
<b>a1-</b> Define the effectiveness of physical and mechanical properties of reinforced concrete contents (concrete and steel), and identify the limitations of concrete's dimensions and spacing of steel reinforcement for structural concrete sections	Lecture Reading	Written exam Written Assignment
<b>a2-</b> Discuss the behavior of a reinforced concrete beam loaded to failure.	Lecture Reading	Written exam Written Assignment
<b>a3-</b> Recognize the reinforced concrete code of practice (ACI-Code) and relevant standards (ASTM).	Lecture Reading	Written exam Written Assignment
<b>a4-</b> Describe the philosophy and concepts for design procedures of structural concrete,	Lecture Reading	Written exam Written Assignment
<b>a5-</b> Define design procedures of the reinforced concrete elements based on the Strength Design Method (SDM) considering the basic design criteria such as safety, serviceability, and economy.	Lecture Reading	Written exam Written Assignment

<b>(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:</b>		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
<b>b1-</b> Differentiate the types of beam's sections, and the carrying capacity of structural element using analysis method.	Lecture Reading Tutorial Exercises	Written exam Written Assignment
<b>b2-</b> Construct good assumptions for calculation of imposed loads, analyze the structure, determination critical sections, and calculation of appropriate cross sections and	Lecture Reading Tutorial Exercises	Written exam Written Assignment

Prepared by Head of Department  
Dr. Abdulkareem  
Yahya Al khattabi

Quality Assurance Unit  
Ass. Prof. Dr. Mohammad  
Algorafi

Dean of the Faculty  
Prof. Dr. Mohammed  
AL-Bukhaiti

Academic Development  
Center & Quality Assurance  
Ass. Prof. Dr.  
Huda Al-Emad

Rector of Sana'a University  
Prof. Dr. Al-Qassim Mohammed Abbas



reinforcements, to produce a safe and economic structures.		
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<b>(C) Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:</b>		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
<b>c1-</b> Conduct full design calculations for beams based on the ACI Code under moment, shear and torsion, considering the safety and economic.	Lecture Tutorial Exercises	Written exam Written Assignment

<b>(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:</b>		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
<b>d.1-</b> Draw to show the details of reinforced steel in cross and longitudinal sections for beams.	Lecture Tutorial, Exercises.	course project

<b>IV. Course Content:</b>					
<b>A – Theoretical Aspect:</b>					
Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	contact hours
1	Introduction:	a3, a4, a5	Working Stress Design (WSD), Strength Design Method (SDM): Limit State Design, Ultimate limit state, Units of measurement, Loads, Types of structural Concrete elements	1	2

Prepared by Head of Department  
Dr. Abdulkareem  
Yahya Al khattabi

Quality Assurance Unit  
Ass. Prof. Dr. Mohammad  
Algorafi

Dean of the Faculty  
Prof. Dr. Mohammed  
AL-Bukhaiti

Academic Development  
Center & Quality Assurance  
Ass. Prof. Dr.  
Huda Al-Emad

Rector of Sana'a University  
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2	Properties of Reinforced Concrete:	a1, a3	Factors Affecting the Strength of Concrete, Compressive Strength, Stress-Strain Curves of Concrete, Tensile Strength of Concrete, Flexural Strength (Modulus of Rupture) of Concrete, Shear Strength, Modulus of Elasticity of Concrete, Steel Reinforcement, Concrete Mixing and Proportioning, Concrete Properties, Class of Structures	2	4
3	Flexural Analysis of RC Beams	a2, a3, a4, a5	<p>Introduction to SDM (Strength Design Method) aims at determining dimensions of structural member, Basic Assumption, Behavior of a RC beam Loaded to Failure, Types of Flexural Failure, Load Factors, Capacity-Reduction Factor, Significance of Analysis &amp; Design Expressions, Equivalent Compressive Stress Distribution, Singly Reinforced Rectangular Section in Bending, Rectangular Sections with Compression Reinforcement, Spacing of Reinforcement &amp; Concrete Cover, Minimum Thickness of Beams and one-way Slabs, Adequacy of Sections</p>	3	6
4	Design of reinforced concrete rectangular section with	a3, a5, b1, b2, c1, d1	Analysis, Design	1	2

Prepared by Head of Department  
Dr. Abdulkareem  
Yahya Al khattabi

Quality Assurance Unit  
Ass. Prof. Dr. Mohammad  
Algorafi

Dean of the Faculty  
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AL-Bukhaiti

Academic Development  
Center & Quality Assurance  
Ass. Prof. Dr.  
Huda Al-Emad

Rector of Sana'a University  
Prof. Dr. Al-Qassim Mohammed Abbas



	single reinforcement.				
5	Design of doubly reinforced rectangular sections.	a3, a5, b1, b2, c1, d1	Analysis, Design	1	2
6	Design of R.C Beams for shear.	a3, a5, b1, b2, c1, d1	Steps of design for shear. Design of stirrups, Spacing of stirrups, Steps of design for shear.	1	2
7	Analysis and design of tie section.	a3, a5, b1, b2, c1, d1	Analysis, Design	1	2
8	Deflection of Structural Concrete Members	b2, c1	Minimum thickness of flexural members.		
9	Development length of reinforcing bars.	c1, d1	Introduction, Development of bond stress (flexural bond). Test for bond efficiency (pull-out test) Development length in tension, $l_d$ . Development length in compression. Splices of reinforcements: Lap splice in tension $l_s$ , and Lap splice in compression. Cutoff points of bars and moment resistance.	1	2
10	Design of R.C Beams for torsion	c1, d1	Loads, analysis, design.	1	2
11	Draw to show the details of reinforced steel in cross and	d1	details of reinforcement	2	4

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Quality Assurance Unit  
Ass. Prof. Dr. Mohammad  
Algorafi

Dean of the Faculty  
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AL-Bukhaiti

Academic Development  
Center & Quality Assurance  
Ass. Prof. Dr.  
Huda Al-Emad

Rector of Sana'a University  
Prof. Dr. Al-Qassim Mohammed Abbas



longitudinal sections for beams.				
<b>Number of Weeks /and Units Per Semester</b>			<b>14</b>	<b>28</b>

<b>B - Tutorial Aspect:</b>				
<b>Order</b>	<b>Tasks/ Experiments</b>	<b>Number of Weeks</b>	<b>contact hours</b>	<b>Learning Outcomes</b>
1	Types of Flexural Failure of a structural member, {Balanced section, Over-reinforced section and Under-reinforced}	1	2	b1, b2, c1, d1
2	Design of reinforced concrete rectangular section with single reinforcement.	2	4	b1, b2, c1, d1
3	Design of doubly reinforced rectangular sections.	2	4	b1, b2, c1, d1
4	Design of R.C Beams for shear.	1	2	b1, b2, c1, d1
5	Analysis and design of tie section.	2	4	b1, b2, c1, d1
6	Deflection of Structural Concrete Members, beams	2	4	b1, b2, c1, d1
7	Development length of reinforcing bars.			b1, b2, c1, d1
8	Design of R.C Beams for torsion	2	4	b1, b2, c1, d1
9	Draw to show the details of reinforced steel in cross and longitudinal sections for beams.	2	4	d1
<b>Number of Weeks /and Units Per Semester</b>		<b>14</b>	<b>28</b>	

Prepared by Head of Department  
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Yahya Al khattabi

Quality Assurance Unit  
Ass. Prof. Dr. Mohammad  
Algorafi

Dean of the Faculty  
Prof. Dr. Mohammed  
AL-Bukhaiti

Academic Development  
Center & Quality Assurance  
Ass. Prof. Dr.  
Huda Al-Emad

Rector of Sana'a University  
Prof. Dr. Al-Qassim Mohammed Abbas



V. Teaching strategies of the course:
Lecture Reading Tutorial Exercises Exams

Prepared by Head of Department  
Dr. Abdulkareem  
Yahya Al khattabi

Quality Assurance Unit  
Ass. Prof. Dr. Mohammad  
Algorafi

Dean of the Faculty  
Prof. Dr. Mohammed  
AL-Bukhaiti

Academic Development  
Center & Quality Assurance  
Ass. Prof. Dr.  
Huda Al-Emad

Rector of Sana'a University  
Prof. Dr. Al-Qassim Mohammed Abbas





<b>VI. Assignments:</b>				
No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1	Assignment 1	a1, a2, a3, a4, a5, b1, b2, b4	4	2
2	Assignment 2	a3, a5, b1, b2, b4, c1, d1	8	2
3	Assignment 3	a3, a5, b1, b2, b4, c1, d1	10	2
4	Assignment 4	a3, a5, b1, b2, b4, c1, d1	13	1.5

<b>VII. Schedule of Assessment Tasks for Students During the Semester:</b>					
No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1	Written assignment	4, 8, 10, 13	7.5	5 %	a1, a2, a3, a4, a5, b1, b2, c1, d1
2	Quizzes.	2 times randomly	7.5	5 %	b1, b2, c1
3	Mid-term exam.	8	30	20 %	a1, a2, a3, a4, a5, b1, b2, c1, d1
4	Final-exam.	End of term	105	70 %	a1, a2, a3, a4, a5, b1, b2, c1, d1
<b>Sum</b>			<b>150</b>	<b>100</b>	

<b>VIII. Learning Resources:</b>	
<ul style="list-style-type: none"> <li>Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).</li> </ul>	
<b>1- Required Textbook(s) (maximum two).</b>	
1-	Structural Concrete, Theory & Design, Fourth Edition (2012), by: M. Nadim Hassoun Akthem Al-manaseer.
2-	Building code requirements for structural concrete and commentary (ACI-318-12)
<b>2- Electronic Materials and Web Sites etc.</b>	
<b>IX. Course Policies:</b>	
<b>1</b>	<b>Class Attendance:</b>

Prepared by Head of Department  
Dr. Abdulkareem  
Yahya Al khattabi

Quality Assurance Unit  
Ass. Prof. Dr. Mohammad  
Algorafi

Dean of the Faculty  
Prof. Dr. Mohammed  
AL-Bukhaiti

Academic Development  
Center & Quality Assurance  
Ass. Prof. Dr.  
Huda Al-Emad

Rector of Sana'a University  
Prof. Dr. Al-Qassim Mohammed Abbas



	The students should have more than 75 % of attendance according to rules and regulations of the faculty.
<b>2</b>	<b>Tardy:</b> The students should respect the timing of attending the lectures. They should attend within 1 minutes from starting of the lecture.
<b>3</b>	<b>Exam Attendance/Punctuality:</b> The student should attend the exam on time. The punctuality should be implemented according to rules and regulations of the faculty for midterm exam and final exam.
<b>4</b>	<b>Assignments &amp; Projects:</b> The assignment is given to the students after each chapter, the student has to submit all the assignments for checking on time.
<b>5</b>	<b>Cheating:</b> If any cheating occurred during the examination, the student is not allowed to continue and he/she has to face the examination committee for <b>enquiries</b> .
<b>6</b>	<b>Plagiarism:</b> The student will be terminated from the Faculty, if one student attends the exam on another behalf according to the policy, rules and regulations of the university.
<b>7</b>	<b>Other policies:</b> -All the teaching materials should be kept out the examination hall. -The mobile phone is not allowed. -There should be a respect between the student and his teacher.

<b>Reviewed By</b>	<b><u>Vice Dean for Academic Affairs and Post Graduate Studies</u></b> <b><u>Dr. Tarek A. Barakat</u></b> <b><u>Dr. Mohammad Algorafi</u></b>
	<b><u>Deputy Rector for Academic Affairs Dr. Ibrahim AlMutaa</u></b> <b><u>Dr. Ahmed mujahed</u></b> <b><u>Dr. Munaser Alsubri</u></b>

## **Template for Course Plan (Syllabus) of**

Prepared by Head of Department  
Dr. Abdulkareem  
Yahya Al khatabi

Quality Assurance Unit  
Ass. Prof. Dr. Mohammad  
Algorafi

Dean of the Faculty  
Prof. Dr. Mohammed  
AL-Bukhaiti

Academic Development  
Center & Quality Assurance  
Ass. Prof. Dr.  
Huda Al-Emad

Rector of Sana'a University  
Prof. Dr. Al-Qassim Mohammed Abbas



## Reinforced concrete 1

I. Information about Faculty Member Responsible for the Course:						
<b>Name of Faculty Member</b>	Dr. Abdulwahab Mohammed Al-nono	<b>Office Hours</b>				
<b>Location &amp; Telephone No.</b>		SAT	SUN	MON	TUE	WED
<b>E-mail</b>						

II. Course Identification and General Information:						
1	<b>Course Title:</b>	Reinforced Concrete 1				
2	<b>Course Code &amp; Number:</b>	CE202				
3	<b>Credit hours:</b>	C.H				<b>Credit Hours</b>
		Th.	Tu.	Pr.	Tr.	
		2	2			3
4	<b>Study level/ semester at which this course is offered:</b>	3 <sup>rd</sup> Level / 1 <sup>st</sup> semester				
5	<b>Pre –requisite (if any):</b>	Theory of Structure, Strength of Materials				
6	<b>Co –requisite (if any):</b>	None				
7	<b>Program (s) in which the course is offered:</b>	Civil Engineering				
8	<b>Language of teaching the course:</b>	English+ Arabic				
9	<b>Location of teaching the course:</b>	Class room				
10	<b>Prepared by:</b>	Dr. Abdulwahab Mohammed Al-nono				
11	<b>Date of Approval</b>					

Prepared by Head of Department  
Dr. Abdulkareem  
Yahya Al khattabi

Quality Assurance Unit  
Ass. Prof. Dr. Mohammad  
Algorafi

Dean of the Faculty  
Prof. Dr. Mohammed  
AL-Bukhaiti

Academic Development  
Center & Quality Assurance  
Ass. Prof. Dr.  
Huda Al-Emad

Rector of Sana'a University  
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### III. Course Description:

This course will include topics selected from the following list: the physical and mechanical properties of concrete and some properties of material whose compose of concrete, Advantages & Disadvantages of reinforced concrete, Design Philosophy & Concepts Structural concrete, Basic Assumptions, Elements Behavior of a RC beam Loaded to Failure, Types of Flexural Failure Loads, idea about international codes, safety factors, Finally analysis and Design for rectangular and tie sections for single and double reinforcement under flexural, design beams for shear and torsion, Deflection of Structural concrete Members, Development length of reinforcing bars.

### IV. Course Intended learning outcomes (CILOs) of the course

- a.1** Define the effectiveness of physical and mechanical properties of reinforced concrete contents (concrete and steel), and identify the limitations of concrete's dimensions and spacing of steel reinforcement for structural concrete sections. A1
- a.2** Discuss the behavior of a reinforced concrete beam loaded to failure. A1
- a.3** Recognize the reinforced concrete code of practice (ACI-Code) and relevant standards (ASTM). A2
- a.4** Describe the philosophy and concepts for design procedures of structural concrete, A3
- a.5** Define design procedures of the reinforced concrete elements based on the Strength Design Method (SDM) considering the basic design criteria such as safety, serviceability, and economy. A3
- b.1** Differentiate the types of beam's sections, and the carrying capacity of structural element using analysis method. B1
- b.2** Construct good assumptions for calculation of imposed loads, analyze the structure, determination critical sections, and calculation of appropriate cross sections and reinforcements, to produce a safe and economic structures. B2, B4
- c.1** Conduct full design calculations for beams based on the ACI Code under moment, shear and torsion, considering the safety and economic. C2
- d.1** Draw to show the details of reinforced steel in cross and longitudinal sections for beams. D1

Prepared by Head of Department  
Dr. Abdulkareem  
Yahya Al khattabi

Quality Assurance Unit  
Ass. Prof. Dr. Mohammad  
Algorafi

Dean of the Faculty  
Prof. Dr. Mohammed  
AL-Bukhaiti

Academic Development  
Center & Quality Assurance  
Ass. Prof. Dr.  
Huda Al-Emad

Rector of Sana'a University  
Prof. Dr. Al-Qassim Mohammed Abbas



<b>V. Course Content:</b>				
<ul style="list-style-type: none"> <li>Distribution of Semester Weekly Plan Of course Topics/Items and Activities.</li> </ul>				
<b>A – Theoretical Aspect:</b>				
<b>Order</b>	<b>Topics List</b>	<b>Sub Topics List</b>	<b>Week Due</b>	<b>Contact Hours</b>
1	Introduction:	Working Stress Design (WSD), Strength Design Method (SDM): Limit State Design, Ultimate limit state, Units of measurement, Loads, Types of structural Concrete elements	1	2
2	Properties of Reinforced Concrete:	Factors Affecting the Strength of Concrete, Compressive Strength, Stress-Strain Curves of Concrete, Tensile Strength of Concrete, Flexural Strength (Modulus of Rupture) of Concrete, Shear Strength, Modulus of Elasticity of Concrete, Steel Reinforcement, Concrete Mixing and Proportioning, Concrete Properties, Class of Structures	2,3	4
3	Flexural Analysis of RC Beams	Introduction to SDM (Strength Design Method) aims at determining dimensions of structural member, Basic Assumption, Behavior of a RC beam Loaded to Failure, Types of Flexural Failure, Load Factors, Capacity-Reduction Factor, Significance of Analysis & Design Expressions, Equivalent Compressive Stress Distribution, Singly Reinforced Rectangular Section in Bending, Rectangular Sections with Compression Reinforcement,	4,5,6	6

Prepared by Head of Department  
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Yahya Al khattabi

Quality Assurance Unit  
Ass. Prof. Dr. Mohammad  
Algorafi

Dean of the Faculty  
Prof. Dr. Mohammed  
AL-Bukhaiti

Academic Development  
Center & Quality Assurance  
Ass. Prof. Dr.  
Huda Al-Emad

Rector of Sana'a University  
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		Spacing of Reinforcement & Concrete Cover, Minimum Thickness of Beams and one-way Slabs, Adequacy of Sections		
4	Design of reinforced concrete rectangular section with single reinforcement.	Analysis, Design	7	2
5	Midterm Exam		8	2
6	Design of doubly reinforced rectangular sections.	Analysis, Design	9	2
7	Design of R.C Beams for shear.	Steps of design for shear. Design of stirrups, Spacing of stirrups, Steps of design for shear.	10	2
8	Analysis and design of tie section.	Analysis, Design	11	2
9	Deflection of Structural Concrete Members	Minimum thickness of flexural members.		
10	Development length of reinforcing bars.	Introduction, Development of bond stress (flexural bond). Test for bond efficiency (pull-out test) Development length in tension, $l_d$ . Development length in compression. Splices of reinforcements: Lap splice in tension $l_s$ , and Lap splice in compression. Cutoff points of bars and moment resistance.	12	2

Prepared by Head of Department  
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Quality Assurance Unit  
Ass. Prof. Dr. Mohammad  
Algorafi

Dean of the Faculty  
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AL-Bukhaiti

Academic Development  
Center & Quality Assurance  
Ass. Prof. Dr.  
Huda Al-Emad

Rector of Sana'a University  
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11	Design of R.C Beams for torsion	Loads, analysis, design.	13	2
12	Draw to show the details of reinforced steel in cross and longitudinal sections for beams.	details of reinforcement	14,15	4
13	Final exam		16	2
<b>Number of Weeks /and Units Per Semester</b>			<b>16</b>	<b>32</b>

<b>B - Tutorial Aspect:</b>			
Order	Topics List	Week Due	Contact Hours
1	Types of Flexural Failure of a structural member, {Balanced section, Over-reinforced section and Under-reinforced}	1	2
2	Design of reinforced concrete rectangular section with single reinforcement.	2,3	4
3	Design of doubly reinforced rectangular sections.	4,5	4
4	Design of R.C Beams for shear.	6	2
5	Analysis and design of tie section.	7,8	4
6	Deflection of Structural concrete Members, beams	9,10	4
7	Development length of reinforcing bars.		
8	Design of R.C Beams for torsion	11,12	4
9	Draw to show the details of reinforced steel in cross and longitudinal sections for beams.	13,14	4
<b>Number of Weeks /and Units Per Semester</b>		<b>14</b>	<b>28</b>

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AL-Bukhaiti

Academic Development  
Center & Quality Assurance  
Ass. Prof. Dr.  
Huda Al-Emad

Rector of Sana'a University  
Prof. Dr. Al-Qassim Mohammed Abbas



<b>VI. Teaching strategies of the course:</b>	
Lecture	
Reading	
Tutorial	
Exercises	
Exams	

<b>VII. Assignments:</b>				
No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1	Assignment 1	a1, a2, a3, a4, a5, b1, b2, b4	4	2
2	Assignment 2	a3, a5, b1, b2, b4, c1, d1	8	2
3	Assignment 3	a3, a5, b1, b2, b4, c1, d1	10	2
4	Assignment 4	a3, a5, b1, b2, b4, c1, d1	13	1.5

<b>VIII. Schedule of Assessment Tasks for Students During the Semester:</b>				
Assessment	Type of Assessment Tasks	Week Due	Mark	Proportion of Final Assessment
1	Written assignment	4, 8, 10, 13	7.5	5 %
2	Quizzes.	2 times randomly	7.5	5 %
3	Mid-term exam.	8	30	20 %
4	Final-exam.	End of term	105	70 %
5	<b>Sum</b>		<b>150</b>	<b>100%</b>

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AL-Bukhaiti

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Rector of Sana'a University  
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<b>IX. Learning Resources:</b>
<ul style="list-style-type: none"> <li>• Written in the following order: (Author – Year of publication – Title – Edition – Place of publication – Publisher).</li> </ul>
<b>1- Required Textbook(s) (maximum two ).</b>
<ul style="list-style-type: none"> <li>• 1-Structural Concrete, Theory &amp; Design, Fourth Edition (2012), by: M. Nadim Hassoun and Akthem Al-manaseer.</li> <li>• 2- Building code requirements for structural concrete and commentary (ACI-318-12)</li> </ul>
<b>2- Electronic Materials and Web Sites etc.</b>

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AL-Bukhaiti

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Center & Quality Assurance  
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Rector of Sana'a University  
Prof. Dr. Al-Qassim Mohammed Abbas



<b>X. Course Policies:</b>	
Unless otherwise stated, the normal course administration policies and rules of the Faculty of ----- apply. For the policy, see: -----	
1	<b>Class Attendance:</b> The students should have more than 75 % of attendance according to rules and regulations of the faculty.
2	<b>Tardy:</b> The students should respect the timing of attending the lectures. They should attend within 1 minutes from starting of the lecture.
3	<b>Exam Attendance/Punctuality:</b> The student should attend the exam on time. The punctuality should be implemented according to rules and regulations of the faculty for midterm exam and final exam.
4	<b>Assignments &amp; Projects:</b> The assignment is given to the students after each chapter, the student has to submit all the assignments for checking on time.
5	<b>Cheating:</b> If any cheating occurred during the examination, the student is not allowed to continue and he/she has to face the examination committee for <b>enquiries</b> .
6	<b>Plagiarism:</b> The student will be terminated from the Faculty, if one student attends the exam on another behalf according to the policy, rules and regulations of the university.
7	<b>Other policies:</b> - All the teaching materials should be kept out the examination hall. -The mobile phone is not allowed. -There should be a respect between the student and his teacher.

Prepared by Head of Department  
Dr. Abdulkareem  
Yahya Al khattabi

Quality Assurance Unit  
Ass. Prof. Dr. Mohammad  
Algorafi

Dean of the Faculty  
Prof. Dr. Mohammed  
AL-Bukhaiti

Academic Development  
Center & Quality Assurance  
Ass. Prof. Dr.  
Huda Al-Emad

Rector of Sana'a University  
Prof. Dr. Al-Qassim Mohammed Abbas