3- Course Specification of Advanced Concrete Technology" (CE585)

I. Course Identification and General Information:						
1.	**Course Title:**	Advanced Concrete Technology				
2.	**Course Code & Number:**	CE585				
3.	**Credit hours:**	C.H				**Credit Hours**
		Lecture.	**Laboratory**	**Seminars.**		
		3	-	-		3
4.	**Study semester at which this course is offered:**	1st semester				
5.	**Pre –requisite (if any):**	Building materials				
6.	**Co –requisite (if any):**	Non				
7.	**Program (s) in which the course is offered:**	Master of Science in structure engineering program Engineering				
8.	**Language of teaching the course:**	English + Arabic				
9.	**Course type**	Elective				
10.	**Location of teaching the course:**	Classroom				
11.	**Prepared By:**	Prof. Dr. Hassan Saad Abdulmughni				
12.	**Date of Approval**					

II. Course Description:

This course is designed for providing an advanced understanding on cement chemistry, hydration reaction of Portland cement, influence of other cementitious materials to the progress of hydration reaction and the ultimate concrete properties, chemical and physical interaction of aggregates and admixtures with the hydrated cement paste and their effects on the performance of fresh and hardened concrete. Concrete durability problems: mechanisms, expected physical and chemical changes occurring on the concrete microstructure during the progress of durability problems and precautions to be taken. Manufacture of special concretes and their properties.

III. Course Intended learning outcomes (CILOs) of the course		Reference PILOs
a.1		A1
a.2	Understand the hydration of PC, influence of other cementitious materials and admixtures and additives on the progress of hydration reaction and on the hydration products being produced in the concrete microstructure,	A2
a.3	Recognize the effects of the early-age properties of concrete on its long-term behaviour	A3
a.4	Understand the mixture design and engineering properties of special concretes such as high-performance concrete, self-consolidating concrete, fibre-reinforced concrete, light weight concrete, etc.	A4

b.1	Use various chemical admixtures and mineral additives to design cement based materials with tailor-made mechanical and durability properties	B1
b.2		B2
b.3	Develop an understanding on the relationship between the microstructure formation and strength and durability issues, the physical and chemical changes occurring on the concrete microstructure during the progress of a concrete durability problem.	B3
c.1		C1
c.2	Bridge the gap between materials science and structural engineering so that concrete can be used properly in structural concrete projects	C2
c3.1	Select special concretes depending on their specific applications	C3
c3.2	Design the concrete mix using ACI and B.S code methods	
d.1	Collect and analyze and organize information and ideas and to convey those ideas clearly and fluently, in both written and spoken forms.	D1
d.2		D2
d.3	Interact effectively with others in order to work towards a common outcome	D3
d.4		D4

(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
a.2 Understand the hydration of PC, influence of other cementitious materials and admixtures and additives on the progress of hydration reaction and on the hydration products being produced in the concrete microstructure,	Lecture self-study presentation	Written exam Student presentation
a.3 Recognize the effects of the early-age properties of concrete on its long-term behaviour		
a.4 Understand the mixture design and engineering properties of special concretes such as high-performance concrete, self-consolidating concrete, fibre-reinforced concrete, light weight concrete, etc.		

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b.1 Use various chemical admixtures and mineral additives to design cement based materials with tailor-made mechanical and durability properties	Lecture self-study presentation	Written exam Presentations/ Presenting researches
b.2 Develop an understanding on the relationship between the microstructure formation and strength and durability issues, the physical and chemical changes occurring on the concrete microstructure during the progress of a concrete durability problem.		

(C) Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	**Teaching strategies**	**Assessment Strategies**
c.2 Bridge the gap between materials science and structural engineering so that concrete can be used properly in structural concrete projects	Lecture self-study presentation	Written exam Presentations/ Presenting researches
c.3.1 Select special concretes depending on their specific applications		
c.3.2 Design the concrete mix using ACI and B.S code methods		

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	**Teaching strategies**	**Assessment Strategies**
d.1 Collect and analyze and organize information and ideas and to convey those ideas clearly and fluently, in both written and spoken forms.	presentation, independent study, Presenting reports, ‘ Presenting researches	survey, presentation, written report.
d.3 Interact effectively with others in order to work towards a common outcome		

IV. Course Content:

A – Lecture Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	contact hours
1	Introduction to Concrete	a.2,c.2, d.1	Concrete Definition and Historical Development Concrete as a Structural Material Good concrete Characteristics of Concrete Types of Concrete Factors Influencing Concrete Properties	1	3
2	Concrete Materials	a.2, a.3, b.3, c.2, c.3.1, d.1, d3	Cementitious Binders Aggregates Water	1	3
3	Properties of fresh concrete	a.2, a.3, a.4, b.3, c.2, c.3.1, d.1, d3	Workability, factors affecting, measurement of workability, different tests for workability, segregation, bleeding, process of manufacture of concrete -batching, mixing, transportation, compaction,	1	3

			curing of concrete, curing methods,		
4	Chemical and mineral admixtures in concrete	a.2, a.3, a.4, b.1 b.3, c.2, c.3.1, d.1, d3	Accelerators Set-retarders Water reducing admixtures High range water reducing admixtures Mineral admixtures	2	6
5	Mechanical properties of concrete	a.2, a.3, a.4, b.1 b.3, c.2, c.3.1, d.1, d3	Strength of concrete, w/c ratio, gel/space ratio, gain of strength with age, maturity concept of concrete, effect of maximum size of aggregate on strength, relation between compressive and tensile strength, factors affecting modulus of elasticity, definition and factors affecting creep and shrinkage	1	3
	Midterm Exam			1	3
6	Structure of Concrete	a.2, a.3, a.4, b.1 b.3, c.2, c.3.1, d.1, d3	Introduction Structural Levels Structure of Concrete in Nanometer Scale: C–S–H Structure Transition Zone in Concrete Microstructural Engineering	2	6
7	Permeability and durability	a.2, a.3, a.4, b.1 b.3, c.2, c.3.1, d.1, d3	Strength and durability relationship, effect of w/c on durability Permeability Sulfate attack Attack by sea water Corrosion of reinforcement Alkali – aggregate reaction	1	3
8	Special concretes	a.2, a.3, a.4, b.1 b.3, c.2, c.3.1, d.1, d3	High performance concrete Self-consolidating concrete Fiber reinforced concrete	1	3
9	Lightweight concrete	a.2, a.3, a.4, b.1 b.3, c.2, c.3.1, d.1, d3	Classification of LWC Types of LWC Properties of LWC Aerated concrete No-fines concrete	2	6
10	Mix Design	a.2, a.3, a.4, b.1 b.3, c.2, c.3.1, c.3.2 d.1, d3	Factors to be considered American method British method	1	3
11	Temperature problems in concrete	a.2, a.3, a.4, b.1 b.3, c.2, c.3.1, d.1, d3	Hot-weather problems Cold-weather problems Large concrete masses	1	3
	Final Exam			1	3
Number of Weeks /and Units Per Semester				**16**	**48**

B - Laboratory Aspect:

Order	Tasks/ Experiments	Number of Weeks	contact hours	Learning Outcomes
1				
2				
3				

V. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1	Assignments presentation **	5-15	10	10%	a.2, a.3, a.4, b.1 b.3, c.2, c.3.1, c.3.2 d.1, d3
2	Midterm exam	7	10	10%	a.2, a.3, a.4, b.1 b.3, c.2, c.3.1, d.1, d3
	Quizzes	two times randomly	10	10%	a.2, a.3, a.4, b.1 b.3, c.2, c.3.1, c.3.2 d.1, d3
3	Term paper*	15	20	20 %	a.2, a.3, a.4, b.1 b.3, c.2, c.3.1, c.3.2 d.1, d3
5	Final exam	16	50	50%	a.2, a.3, a.4, b.1 b.3, c.2, c.3.1, c.3.2 d.1, d3
Total			**100%**	**100%**	

***A term paper** must be submitted before the end of classes. Groups of up to 2 students can work on one term paper project. The paper must be written in the format of the ACI Materials Journal. The topic of the paper could be selected from a list provided by the instructor. A topic proposed by a student can be used if approved by the instructor.

****PRESENTATION** Each student/group (up to 2) of students will have a 30-minute presentation of their term paper followed by a 15-minute question period at least one week before the end of classes.

VI. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark

VII. Report:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark

VIII. Learning Resources and Facilities:

- Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).

1- Required Textbook(s) (maximum two).

1. Neville A.M., , 2005"Properties of Concrete", Prentice Hall
2. R. Santhakumar, 2006 „ Concrete Technology", Oxford Universities Press

2- Essential References.

	1. Mehta and Monteiro, 2006,,Concrete-Micro structure, "Properties and Materials", McGraw Hill 2. Neville A. M. and Brooks J. J., , 2010 "Concrete Technology", Pearson Education 3. Lea, , 2017 "Chemistry of Cement and Concrete", Butterworth-Heinemann Ltd, 5e 4. Technical Journals including ACI Materials Journal, Cement and Concrete Research, etc.
3- Electronic Materials and Web Sites *etc*.	
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Educational and research Facilities and Equipment Required	
Technology Resources (AV, data show, Smart Board, software, etc.)	
	-
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	
-	

IX. Course Policies:

22.	**Class Attendance:** The students should have more than 75 % of attendance according to rules and regulations of the faculty.
23.	**Tardy:** The students should respect the timing of attending the lectures. They should attend within 10 minutes from starting of the lecture.
24.	**Exam Attendance/Punctuality:** 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.
25.	**Assignments & Projects:** The assignment is given to the students after each chapter, the student has to submit all the assignments for checking on time.
26.	**Cheating:** If any cheating occurred during the examination, the student is not allowed to continue and he/she has to face the examination committee for enquires.
27.	**Plagiarism:** 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.
28.	**Other policies:** • 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.

Reviewed By	**Prof. Dr. Abdulmalek Al-Jolahy**

Prepared By:	Prof. Dr. Hassan Saad Abdulmoghni
Pre –requisite:	Building materials (BSc)

Credit hours				
Th.	Sem.	Pr.	Tr.	TOTAL
3	-	-	-	3

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Course Content:

Order	Units/Topics List	Sub Topics List	Number of Weeks	contact hours
1	Introduction to Concrete	Concrete Definition and Historical Development Concrete as a Structural Material Good concrete Characteristics of Concrete Types of Concrete Factors Influencing Concrete Properties Approaches to Study Concrete	1	3
2	Concrete Materials	Cementitious Binders Aggregates Admixtures Water	1	3
3	Properties of fresh concrete	Workability, factors affecting, measurement of workability, different tests for workability, segregation, bleeding, process of manufacture of concrete -batching, mixing, transportation, compaction, curing of concrete, curing methods,	1	3
4	Chemical and mineral admixtures in concrete	Accelerators Set-retarders Water reducing admixtures High range water reducing admixtures Mineral admixtures	2	6
5	Mechanical properties of concrete	Strength of concrete, w/c ratio, gel/space ratio, gain of strength with age, maturity concept of concrete, effect of maximum	2	6

		size of aggregate on strength, relation between compressive and tensile strength, factors affecting modulus of elasticity, definition and factors affecting creep and shrinkage		
	Midterm Exam		1(8)	3
6	Structure of Concrete	Introduction Structural Levels Structure of Concrete in Nanometer Scale: C–S–H Structure Transition Zone in Concrete Microstructural Engineering	1	3
7	Permeability and durability	Strength and durability relationship, effect of w/c on durability Permeability Sulfate attack Attack by sea water Corrosion of reinforcement Alkali – aggregate reaction	1	3
8	. Special concretes	High performance concrete Self-consolidating concrete Fiber reinforced concrete Lightweight concrete	1	3
9	Lightweight concrete	Classification of LWC Types of LWC Properties of LWC Aerated concrete No-fines concrete	2	6
10	Mix Design	Factors to be considered American method British method	1	3
11	Temperature problems in concrete	Hot-weather problems Cold-weather problems Large concrete masses	1	3
12	Final Exam		1	3
Number of Weeks /and Units Per Semester			16	48

Schedule of Assessment Tasks for Students during the Semester:

Assessment	Type of Assessment Tasks	Week Due	Mark	Proportion of Final Assessment
1	Assignments (presentation)	5-15	5	10%
2	Midterm exam	8	20	20%
3	Term paper	14	30	30 %
4	Final exam	16	50	40%
	Total		100	100%

Learning Resources:

1- Textbook(s)

- Technology, Neville A. M., & Brooks J. J., Prentice Hall,2008.

2- References.

- Properties of Concrete, Neville A. M., Prentice Hall, 2005
- Concrete- Microstructure, Properties and Materials, Mehta P. K., Monteiro P. J. M., McGraw- Hill, 2006.

3- Electronic Materials and Web Sites *etc*.

A term paper must be submitted 2 weeks before last class. Groups of up to 2 students can work on one term paper project. The paper must be written in the format of the ACI Materials Journal. The topic of the paper could be selected from a list provided by the instructor. A topic proposed by a student can be used if approved by the instructor.

PRESENTATION Each student/group of students will have a 15-minute presentation of their term paper followed by a 5-minute question period at least one week before the end of classes.