2- Course Specification of Structural Dynamics (CE 584)

I. Course Identification and General Information:						
1.	**Course Title:**	*Structural Dynamics*				
2.	**Course Code & Number:**	CE 584				
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):**	Math, Structural Analysis, Engineering Mechanics.				
6.	**Co –requisite (if any):**	Non				
7.	**Program (s) in which the course is offered:**	Master of Science in structural engineering program				
8.	**Language of teaching the course:**	English+ Arabic				
9.	**Course type**	Required				
10.	**Location of teaching the course:**	Class room				
11.	**Prepared By:**	Dr. Mohammad Abdulla Algorafi Dr. Mohammed Abdu				
12.	**Date of Approval**					

II. Course Description:

This course deal with Behavior of structures under dynamic loading. It will cover the theory of structural response to dynamic loads. Students will learn the Fundamentals of structural dynamic analysis for Lumped mass systems; free and forced vibration of single and multiple degrees of freedom systems; normal modal analysis; transient dynamic analysis by numerical integration; response spectrum of earthquake

III. Course Intended learning outcomes (CILOs) of the course		Reference PILOs
a.1	Identify the concepts and characteristics of the formulation of the equilibrium equations in structural dynamics.	A1
a.2	Recognize physical phenomenon of the dynamic properties and behavior of civil structures , such as natural frequencies, mode shapes, damping and vibration characteristics of structures under several types of dynamic actions such as free dynamic, harmonic load, and seismic actions..	A1,A2
b.1	Differentiate the effects of various types of dynamic loads, and the defiance	B3

	between the dynamic and the static load.	
b.2	Interpret the particularities of the dynamic response of civil engineering structures SDOF/MDOF in face of the characteristics and the type of actions applied such as effect of the initial conditions; response under free dynamic, harmonic load, impulsive load, any dynamic load and seismic actions.	B2
c.1	Analyze dynamics response of SDOF/MDOF system using fundamental theory, in face of the characteristics and of the type of actions applied such as effect of the initial conditions; response under free dynamic, harmonic load, impulsive load, any dynamic load and seismic actions.	C3
c.2	Formulate the equation of motion for dynamics analysis of structures of SDOF/MDOF system.	C2
d.1	Conduct independently research related to structural dynamic	D3
d.2	Present the ideas Cleary using oral and writing.	D3

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

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
a1. Identify the concepts and characteristics of the formulation of the equilibrium equations in structural dynamics.	Lecture self-study presentation	Written exam Assignment Student presentation
a2. Recognize physical phenomenon of the dynamic properties and behavior of civil structures , such as natural frequencies, mode shapes, damping and vibration characteristics of structures under several types of dynamic actions such as free dynamic, harmonic load, and seismic actions..		

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

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1. Differentiate the effects of various types of dynamic loads, and the defiance between the dynamic and the static load.	Lecture self-study presentation Analysis and Problem Solving.	Written exam Written assignment Presentations/ Presenting researches
b2. Interpret the particularities of the dynamic response of civil engineering structures SDOF/MDOF in face of the characteristics and the type of actions applied such as effect of the initial conditions; response under free dynamic, harmonic load, impulsive load, any dynamic load and seismic actions.		

(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
c1. Analyze dynamics response of SDOF/MDOF system using fundamental theory, in face of the characteristics and of the type of actions applied such as effect of the initial conditions; response under free dynamic, harmonic load, impulsive load, any dynamic load and seismic actions.	Lecture self-study presentation Analysis and Problem Solving.	Written exam Written assignment Presentations/ Presenting researches
c2. Formulate the equation of motion for dynamics analysis of structures of SDOF/MDOF system.		

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
d1.Conduct independently research related to structural dynamic	presentation, independent study, Presenting reports, ‹	present the paper, presentation, written

d2. Present the ideas Cleary using oral and writing.	Presenting researches	report.

IV. Course Content:

A – Lecture Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	contact hours
1	An Overview of Structural Dynamics	a1, b1	An Overview of Structural Dynamics	1	3
2	Introduction of SDOF	a1,,c2	Equations of Motion, Problem Statement, and Solution Methods SDOF	1	3
3	Free Vibration-SDOF	a2,b1,c1	a. Definition of natural frequency/period b. Simple harmonic motion c. Effect of damping	2	6
4	Response to Harmonic and Periodic Excitations- SDOF	a2,b1,b2,c1,d2	a. Dynamic Response Factors b. Resonance c. Transmissibility	3	9
5	Response to Arbitrary Excitations and Numerical Evaluation of Dynamic Response	a2,b1,b2,c1,d1	a.Unit impulse b. Central Difference Method	1	3
6	Earthquake Response of Linear Systems	a2,b1,b2,c1,d1,d2	a. Response Spectrum	1	3
7	Introduction of MDOF	a1,,c2	Equations of Motion, Problem Statement, and Solution Methods MDOF	1	3
8	Free Vibration MDOF	a2,b1,b2,c1,d2	a. Generalized Eigenvalue Problem, Frequencies and Mode Shapes b. Modal Superposition	2	6
9	Damping in Structures MDOF	a2,b1,b2,c1,d2		2	6
Number of Weeks /and Units Per Semester				**14**	**42**

B - Laboratory Aspect:

Order	Tasks/ Experiments	Number of Weeks	contact hours	Learning Outcomes
1				
2				
3				
4				
5				
6				
7				
Number of Weeks /and Units Per Semester				

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	assignment	2,4, 7, 8, 10, 11, 13, 14	15	10	a1,a2,b1,b2,c1,c2
2	Research activity	During class	7.5	5	b1,b2, d1,d2
3	Quizzes	Three times randomly	7.5	5	b1,b2,c1,c2
5	Midterm Exam	9	30	20	a1,a2,b1,b2,c1,c2
6	Final-exam	16	90	60	a1,a2,b1,b2,c1,c2
7					
Total			**150%**	**100%**	

VI. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1	Equations of Motion of SDOF	a1,,c2	2	1
2	Free Vibration-SDOF	a2,b1,c1	4	2
3	Response to Harmonic Excitations- SDOF	a2,b1,b2,c1,d2	7	2
4	Numerical Evaluation of Dynamic Response	a2,b1,b2,c1,d1	8	2
5	Earthquake Response of Linear Systems	a2,b1,b2,c1,d1,d2	10	2
6	Introduction of MDOF	a1,,c2	11	2
7	Free Vibration MDOF	a2,b1,c1	13	2
8	Damping in Structures MDOF	a2,b1,b2,c1,d2	14	2
	Number of Weeks /and Units Per Semester			

VII. Report:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1			4	1
2			6	1
3			8	1
4			10	1.5
5			11	1.5
6			14	1.5

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. A.K. Chopra, Dynamics of Structures – Theory and Applications to Earthquake Engineering,4th ed., Prentice Hall, Upper Saddle River, NJ; 2012.
2. J.W. Clough and J. Penzien, Dynamics of Structures, McGraw-Hill, New York, NY;1993.

2- Essential References.

1. G.V. Berg, Elements of Structural Dynamics, Prentice-Hall, Englewood Cliffs, NJ; 1989.
2. N.M. Newmark, E. Rosenblueth, Fundamentals of Earthquake Engineering, Prentice-Hall, Englewood,NJ; 1971.
3. J.J. Connor, Introduction to Structural Motion Control, Prentice Hall, Upper Saddle River,NJ; 2003.
4. Leonard Meirovitch, "Fundamentals of Vibrations ", McGraw Hill, ISBN 0070413452

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.)

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Other Resources
(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)

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IX. Course Policies:

15.	**Class Attendance:** The students should have more than 75 % of attendance according to rules and regulations of the faculty.
16.	**Tardy:** The students should respect the timing of attending the lectures. They should attend within 10 minutes from starting of the lecture.
17.	**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.
18.	**Assignments & Projects**: The assignment is given to the students after each chapter, the student has to submit all the assignments for checking on time.
19.	**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.
20.	**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.
21.	**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	**Vice Dean for Academic Affairs and Post Graduate Studies** **Dr. Tarek A. Barakat** **Dr. Ahmed Alwathaf** **Dr. Mohammad Algorafi**
	Dr. Ahmed mujahed **Dr. Munaser Alsubri**