5- Course Specification of "Finite Element Method of Structural Analysis" (CE 581)

Prepared By:	**Prof. Dr. Ahmed Hasan Alwathaf**
Pre –requisite:	**1. Matrix Analysis of Structures**

Credit hours				
Th.	Sem.	Pr.	Tr.	TOTAL
2	-	2	-	3

Course Description:

FEA is a design/research tool that is extensively used in industry and research institutions. The course covers the fundamentals of finite element analysis including and using finite element analysis to solve problems related to structures. The course emphasizes on the underlying theory, assumption, and modeling issues as well as providing hands-on experience using finite element SAP/ABAQUS software to model, analyze structural systems.

Course Content:

1. Theoretical Aspect

Order	Units/Topics List	Sub Topics List	Number of Weeks	contact hours
1	An Introduction to FE Method	Physical Problems in Engineering Computational Modelling using the FEM Simulation	1	2
2	Mechanics of Solids and Structures	Equations for Three-Dimensional Solids Equations for Two-Dimensional Solids Equations for Truss Members Equations for Beams Equations for Plates	2	4
3	Fundamentals for FE Method	Strong and Weak Forms Hamilton's Principle FEM Procedure Shape Functions Gauss Integration Static Analysis	2	4
4	Formulations of Finite Element	Trusses Flexural Element Two-Dimensional Element Plates and Shells 3D Solids	2	4
	Midterm Exam		1(8)	2
5	Special Purpose Elements	Iso-parametric Finite Element Crack Tip Elements Methods for Infinite Domains Finite Strip Elements Strip Element Method (SEM)	2	4
6	Modeling Techniques	Geometry Modelling Meshing Mesh Compatibility Use of Symmetry Modelling of Offsets Modelling of Supports	2	4

		Modelling of Joints Other Applications of MPC Equations Implementation of MPC Equations		
8	Material Behavior Modeling	Linear elastic models Failure criteria Von mises model Brittle material model Drucker-Prager model Other models	2	4
	Presentation of course-projects 1		1	3
	Final Exam		1	3
Number of Weeks /and Units Per Semester			**16**	**34**

2. Software Practical Aspect

Order	Units/Topics List	Sub Topics List	Number of Weeks	contact hours
1	Software installation		1	2
2	Introduction to the software tools		2	4
3	Modelling and analyzing of Trusses		1	2
4	Modelling and analyzing of beams and frames		1	2
5	Modelling and analyzing of Two-Dimensional structures		2	4
	Midterm exam		1 (8)	2
6	Modelling and analyzing of Plates and Shells		2	4
7	Modelling and analyzing of 3D Solid structures		2	4
8	Special modeling and analyses cases		2	4
	Presentation of course-projects 2		1	3
	Final Exam		1	3
Number of Weeks /and Units Per Semester			**16**	**34**

Schedule of Assessment Tasks for Students during the Semester:

Assessment	Type of Assessment Tasks	Week Due	Mark	Proportion of Final Assessment
1	Assignments	2,4,6,8,10,12	5	5%
2	Software modeling	3, 5, 7, 9,	5	5%

	assignments	11,13		
3	Midterm exam	8	10	10%
4	Software Practical Midterm exam	8	10	10%
5	Course project 1 (research)	15	10	10%
6	Course project 2 (software modeling)	15	10	10%
7	Final exam	16	40	40%
8	Software Practical Final exam	16	10	10%
	Total		100	100%

Learning Resources:

1- Textbook(s)

- Cook, R. D. Finite element modelling for stress analysis. John Wiley & Sons Inc.1995.
- G. R. Liu, S. S. Quek. The Finite Element Method: A Practical Course. Butterworth-Heinemann, 2003.

2- References.

- Zienkiewicz, O. C. and Taylor, R. L., The Finite Element Method, 5th edition, Butterworth- Heinemann, 2000.
- Chandrupatla, T. R. And Belegundu, A. D. Introduction to Finite Elements in Engineering. Prentice-Hall Int. Inc, 1991.
- Hinton, E. and Owen, D. R. Finite Elements Programming, Academic Press London, UK. 1983.

3- Electronic Materials and Web Sites *etc*.