Department of Civil Engineering

College of Technical Engineering

University of Erbil Polytechnic

Subject: Finite Element Method

Course Book: MSc – Structures Group

Lecturer's name:

Dr. Sarkawt A. Hasan

Academic Year: 2023/2024

Course Book

1. Course name	Finite Element Method
2. Lecturer in charge	Dr. Sarkawt A. Hasan
3. Department/ College	Civil Engineering /Technical Engineering
4. Contact	e-mail: sarkawt.hasan@gmail.com
5. Time (in hours) per week	Theory: 3 Practical: 0
6. Office hours	3 hrs
7. Course code	----------
8. Teacher's academic profile	Dr. Sarkawt A. Hasan BSc Civil Engineering/Salahadeen University 1991 MSc Structures/Salahadeen University 1994 PhD Structures /Nottingham University 2011 Website: http://orcid.org/0000-0002-1127-386X https://scholar.google.com/citations?user=LvF2hHkAAAAJ&hl=en Assistant Lecturer / Engineering College / Salahadeen University 1994-2000 Teaching (*Civil Drawing, Engineering Drawing, Geometric Descriptive, Construction Methods and Equipment, Administration and Economy, Programming (Basic), Programming (Fortran))* Lecturer/Erbil Technical College/2003 till now Teaching (*Structures, Strength of Martial, Reinforced Concrete, Bridge Engineering, Civil Drawing, Engineering Drawing, Construction Technique, Mathematic, Civil Engineering Computer Applications, Programming (Visual Basic).*
9. Keywords	**Numerical Methods, Simulation, Modelling, FEM**

10. Course overview:

Finite element method

The course covers the principles of the numerical solution of structural problems using the finite element method. Through the introduction, the main idea of the finite element method will be represented.

The explanation of the method will be started by studying the spring system to cover the method of the displacement that mainly used in the finite element method. The idea of spring system will be more detailed through the principles of the minimum potential energy.

Then the idea of the FEM will be applied to truss element, then those of two-dimensional problems.

11. Course objective:

Upon Completion of the course, students will be able to analyze a variety civil engineering structures (by hand calculation and by computer analysis Software (ANSYS)) using Finite Element Analysis and including the following tasks:

- Being able to understand the concepts involved in numerical simulation of the structural problems;
- Stress, Strain and deflection analysis for 2D and 3D Elasticity Problems
- Using ANSYS to verify the results obtained by hand calculation;

12. Student's obligation

The students are required to:

- Attend all the lectures and participate in the discussion and the class work;
- Reading and practising on the problems given in previous lectures before attending a new one;
- starts numerical simulation by the specified software using the method of the finite element method
- Participate in all tests and exams**.**

13. Forms of teaching

The lectures will be given to the students in CD and hard copy including also the references.
The topics in the course will be presented using the traditional lecture format, data show, seminars, and practical applications. Students are encouraged to work with software applications.

14. Assessment scheme

Coursework will be weighted as follows:

1	Mid-Term Exam	20%
2	Daily Practical Part (the attendance)	5%
3	Quizzes	5%
4	Paper Submission	50%
5	Final exam	50%
		50% + 50% = 100%

15. Student learning outcome:

At the successful completion of this course, the students will be able to (Manually and using Computer software):

- Identifies the theoretical basis of finite element method such as discretization process, element formation, shape functions and Gaussian integration
- Discerns simple elements in the finite element method.
- Constructs the framework of the finite element method.
- Assessing the behavior of a structure building under static loading using a finite element computer package.

16. Course Reading List and References:

A) Main:

"A First Course in the Finite Element Method", by Daryl Logan, Fifth edition.

" Finte Element Procedures", Klause-Jurgen Bathe, Prentice-Hall of India Private Limited, New Delhi, 2007.

-"Finite Element Analysis: Theory and Application with ANSYS" Saeed Moaveni, 3rd Edition, Pearson Education, Inc. New Jersey, USA.

B) Supplementary:

"Structural and Thermal Analysis by FEM using ANSYS: Tutorials" , PSG School of Technology..

"Structural Analysis: A unified Classical and matrix Approach", Ghali, A., Neville, A.M., and Brown, T.G.2003, Apon Press, London, Uk. Chapters 17, 18)

"The Finite Element Method practical course: A practical Course", G. R. Liu, S. S. Quek, 1st Edition, Butterworth HEINEMAAN Press, 2003

"Handbook of STRUCTURAL ENGINEERING", Edited by WAI-FAH CHEN & ERIC M. LUI, 2005 by CRC Press, NewYork, 2005. (Chapters 2.10)

17. The Topics:

Week	Hour	Date	Topic
1	3		Introduction and the finite element method (CH1)
2	3		Introduction to the Stiffness (Displacement) Method (CH2)
3	3		Development of Truss Equations (CH3)
4	3		Development of Beam Equations (CH4)
5	3		Frame and Grid Equations (CH5)
6	3		Development of the Plane Stress and Plane Strain Stiffness Equations (CH6)
7	3		Practical Considerations in Modeling; Interpreting Results; and Examples of Plane Stress/Strain Analysis (CH7)
8	3		Development of the Linear-Strain Triangle Equations (CH8)
9	3		Isoparametric Formulation (CH10)

10	3		Plate Bending Element (CH12)
11	3		ANSYS Application
12	3		ANSYS Application
13	3		ANSYS Application

The mentioned Chapters are as per "Daryl Logan" book

18. Practical Topics:

The course is almost theoretical with software applications.

19. Examinations:

The final examination will consist of two parts: theoretical plus software applications.

20. Extra notes:

21. Peer review **پێداچوونەوەی هاوەڵ**