Faculty of Engineering & Technology

Finite Element Analysis with Applications in Petroleum Engineering

Information :

Course Code :	PE 407	**Level** :	Undergraduate	**Course Hours :**	4.00- Hours

Department :	Department of Petroleum Engineering

Instructor Information :

Title	Name	Office hours
Lecturer	Salah Ahmed Ebrahem Badr	4
Lecturer	Salah Ahmed Ebrahem Badr	4
Assistant Lecturer	YOUSSEF ELSAYED ABDELHAFEZ KANDIEL	
Teaching Assistant	Mohamed Osama Mohamed Abbas	
Teaching Assistant	AHMED NAGUIB ABDELAZIZ ABDELAZIZ GHONIM	
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Area Of Study :

The Main Goals of this course are preparing students to:
- Understand the basic theory behind the finite element method
- Use the finite element method for the solution of practical engineering problems
- Understand the concept of numerical methods
- Use Newton Raphson method
- Use Bisection method
- Use Secant Method
- Use False position method
- Use Gaussian Elimination method
- Applying in MATLAB/Fortran and petroleum engineering field

Description :

This course deals with the finite element method and its applications to solve practical petroleum engineering problems. This course gives basic knowledge about the Finite Element Method including element formulations, numerical solution procedures and modelling details. The course will also give the students the ability to use MATLAB/Fortran program to solve any petroleum problems and other applications.

Course outcomes :

a.Knowledge and Understanding: :

1 -	Describe the concept of approximation in the analysis of engineering problems
2 -	Identify numerical methods suitable for commonly arising Petroleum Engineering problems.
3 -	Explain the underlying mathematics behind finite element analysis software solvers
4 -	Write simple methods in a high-level programming language and use available software resources.
5 -	Describe main features of numerical problems and algorithms

b.Intellectual Skills: :

1 -	Apply different numerical methods to solve large petroleum engineering problems.
2 -	Write MATLAB or Fortran program using different numerical methods.
3 -	Solve petroleum engineering problems by using mathematics and physics knowledge.

c.Professional and Practical Skills: :

1 -	Apply the numerical and Finite Element Methods to practical situations, with specific emphasis on its application to petroleum engineering problems

d.General and Transferable Skills: :

1 -	Use MATLAB/Fortran program and present the results within multidisciplinary team.

Course Topic And Contents :

Topic	No. of hours	Lecture	Tutorial / Practical
Introduction to numerical methods	6	4	2
Newton Raphson method; Bisection method	6	4	2
Secant method; False Position method; introduction to Fortran; Mathematical functions	12	8	4
Basic plotting; Matrix generation; Introduction to programming in Fortran.	12	8	4
Interpolation and smoothing. Differentiation and integration of discrete data series.	12	8	4
Numerical methods in Fortran	12	8	4
Matrix Problems; Gauss Elimination and Gauss-Jordan	12	8	4
Numerical Solution of PDEs, Transient solution of the diffusivity equation in one dimension, using finite differences).	6	4	2
Introduction to FEA; Discretization; FE Terminology	6	4	2
Field Problems	6	4	2

Teaching And Learning Methodologies :

Interactive Lecturing
Discussion
Problem-based Learning
Research
Experiential Learning

Course Assessment :

Methods of assessment	Relative weight %	Week No	Assess What
Assignment	10.00		
Final Exam	40.00		
Lab. Exam	5.00		

Mid- Exam	25.00		
Participation	10.00		
Quizzes	10.00		

Recommended books :

- Chapra, S. C., & Canale, R. P. (2010). Numerical methods for engineers. Boston: McGraw-
- Hill Higher Education.
Hoffman, J. D., & Frankel, S. (2001). Numerical methods for engineers and scientists. CRC press.

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