

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
Professor	Hamdy Mohamed Ahmed Mahmoud	10
Teaching Assistant	Akram Rabie Hamed Ragheb Tobar	

Area Of Study :

The Main Goals of this course are:

- ✓ Understand the theory behind the finite element method for the solution of practical engineering problems.
- ✓ Understand the concept of numerical methods, Newton Raphson, Bisection, Secant, False position and Gaussian Elimination methods.
- ✓ Apply numerical methods using software tools in MATLAB.

Description :

This course introduces finite element analysis (FEA) methods and applications of subsurface engineering. The course is intended to provide a fundamental understanding of FEA software and experience in creating meshes for petroleum reservoirs or other subsurface features.

Course outcomes :

a.Knowledge and Understanding: :

1 -	Explain the concept of approximation in the analysis of engineering problems
2 -	Demonstrate the concept of analytical and numerical methods
3 -	Explain the underlying mathematics behind finite element analysis software solvers
4 -	Illustrate a finite element to investigate a real world engineering problem.
5 -	Explain the underlying basis of physical laws relevant to the finite elements analysis
6 -	Describe qualitatively and quantitatively process, relationships and techniques relevant to finite elements.

b.Intellectual Skills: :

1 -	Apply different numerical methods to solve large petroleum problems.
2 -	Write matlab program using different numerical methods.
3 -	Identify the most common problems encountered in finite element analysis
4 -	Solve the different problems using matlab.
5 -	Identify the most common problems encountered in finite element analysis

c.Professional and Practical Skills: :

1 -	Apply the Finite Element Method to practical situations , with specific emphasis on its application to petroleum engineering problems
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2 - Use computer program to solve the problems using the concept of numerical methods

d.General and Transferable Skills: :

1 - Communicate effectively.

Course Topic And Contents :

Topic	No. of hours	Lecture	Tutorial / Practical
Introduction to FEA; Discretisation; FE Terminology.	6	4	2
A General FE Problem Solving Approach; Modelling Assumptions;	6	4	2
Validation; Sources of Error in FE; Computational Resources;	6	4	2
Introduction to numerical methods	6	4	2
Newton Raphson method; Bisection method	6	4	2
Secant method; False Position method; introduction to MATLAB; Mathematical functions	12	8	4
Basic plotting; Matrix generation; Introduction to programming in MATLAB;	12	8	4
Control flow and operators in MATLAB;	12	8	4
Numerical methods in MATLAB	12	8	4
Field problems	12	8	4

Course Assessment :

Methods of assessment	Relative weight %	Week No	Assess What
1st Midterm	25.00		
2nd Midterm	25.00		
Final Exam	40.00		
Performance	10.00		