

**Faculty of Engineering & Technology**  
**Fundamentals of Petroleum Reservoir Simulation**

**Information :**

**Course Code :** PET 510

**Level :** Undergraduate

**Course Hours :** 3.00- Hours

**Department :** Department of Petroleum Engineering

**Instructor Information :**

Title	Name	Office hours
Associate Professor	Adel Mohamed Salem Ragab	7
Associate Professor	Adel Mohamed Salem Ragab	7
Lecturer	El Saeid Mohamed El Saeid Eissa	6
Teaching Assistant	Taha Abdelhamid Abdelmaqsoud Abdelhamid Yehia	
Teaching Assistant	Taha Abdelhamid Abdelmaqsoud Abdelhamid Yehia	
Teaching Assistant	Reham Shawket Mostafa Taha Khalaaf	

**Area Of Study :**

1. Reservoir simulation definition and applications in petroleum industries.
2. Types of reservoir models and examples in petroleum industries.
3. Reservoir simulation stages to build the reservoir model.
4. Formulation of partial differential and finite difference equations of reservoir model.
5. Well representation in reservoir model
6. Solve simulation equations using direct or iterative methods
7. Understand the fully implicit and IMPES solution strategies for solving flow equations.

**Description :**

An introduction to petroleum reservoir simulation. Fundamentals of finite difference approximation of the partial differential equations of flow through porous media. Discussion of various simulation schemes, data handling, boundary conditions. Use of a dry gas and black oil simulators.

**Course outcomes :**

**a.Knowledge and Understanding: :**

1 -	Review mathematics to construct simulation equations of reservoir model.
2 -	Utilize formation evaluations, well logging and well test analysis to prepare the data for simulation study.
3 -	Utilize the methodologies of solving reservoir simulation problems.
4 -	Outline the petroleum engineering technologies to advance the simulation study.

**b.Intellectual Skills: :**

1 -	Apply the principles of engineering science in developing solutions of the reservoir simulation equations.
2 -	Design actual well representation in oil and gas reservoirs.
3 -	Identify saturation and pressure maps using simulation study.
4 -	Select the best method to be used in enhanced oil recovery (EOR) using simulation study.

**c. Professional and Practical Skills: :**

1 -	Apply partial differential and finite difference mathematical equations of simulation models.
2 -	Deal with the high level of uncertainty of reservoir simulation different data.
3 -	Prepare technical reports of reservoir simulation studies.
4 -	Use commercial simulation software to select optimum EOR methods.

**d. General and Transferable Skills: :**

1 -	Collaborate effectively within multidisciplinary of reservoir simulation teams.
2 -	Communicate effectively to complete reservoir simulation study.
3 -	Lead and motivate individual of simulation study
4 -	Effectively manage tasks, time, and resources

**Course Topic And Contents :**

Topic	No. of hours	Lecture	Tutorial / Practical
Reservoir simulation definition and applications	8	6	2
Types of reservoir simulation models	8	6	2
Partial differential equations of simulation models	10	6	4
Finite difference equations of simulation model	7	3	4
Well representation of simulation model	6	3	3
Initial and boundary conditions	6	3	3
Solving of simulation equations by direct and iterative methods	9	6	3
Data preparation of simulation models	6	3	3
Simulator Selection	6	3	3
History matching and reservoir forecasting	9	6	3

**Teaching And Learning Methodologies :**

Interactive Lecturing
Discussion
Problem-based Learning

**Course Assessment :**

Methods of assessment	Relative weight %	Week No	Assess What
Assignments	15.00		
Final Exam	40.00		
Mid- Exam	25.00		
Participations	10.00		
Quizzes	10.00		

**Recommended books :**

1. Jamal Hussein Abou-Kassem, Syed Mohammad Farouq Ali, M. Rafiq Islam. 2006. Petroleum Reservoir Simulation: A Basic Approach, Gulf Publishing Company.
2. M. R. Carlson. 2003. Practical Reservoir Simulation, PennWell Books.
3. T. Ertekin, J.H. Abou-Kassem, and G.R. King, 2001. Applied Reservoir Simulation, SPE Textbook Series.
4. Herriot Watt. 2000. Reservoir Simulation textbook.
5. C.C. Mattax and R. L. Dalton, 1990. Reservoir Simulation, SPE Monograph Vol 13.
6. K. Aziz, and A. Settari, 1979. Petroleum Reservoir Simulation. Elsevier Applied Science Publishers, Barking, UK.