

**Faculty of Engineering & Technology**

**Applied Reservoir Simulation**

**Information :**

**Course Code :** PET 511

**Level :** Undergraduate

**Course Hours :** 3.00- Hours

**Department :** Department of Petroleum Engineering

**Instructor Information :**

| Title               | Name  | Office hours |
|---------------------|---|--------------|
| Associate Professor | Adel Mohamed Salem Ragab                      | 10           |
| Lecturer            | Mostafa Magdy El Sayed Abd El Hafiz           |              |
| Teaching Assistant  | Taha Abdelhamid Abdelmaqsoud Abdelhamid Yehia |              |

**Area Of Study :**

- Define study objectives
- Data preparation and analysis
- Pre-simulation analysis (Analytical methods)
- Select simulator type
- Building static model
- Building dynamic model
- Reporting

**Description :**

Simulation of actual reservoir problems using both field and individual well models to determine well spacing, production effects of secondary and enhanced recovery processes, future rate predictions and recovery, coning effects, relative permeability adjustments and other history matching techniques.

**Course outcomes :**

**a. Knowledge and Understanding: :**

|     |  |
|-----|--|
| 1 - | Review mathematics to construct different models of simulation study.  |
| 2 - | Utilize formation evaluations, well logging and well test analysis to prepare the data for simulation study. |
| 3 - | Outline the principles of petroleum field development plan using simulation study.                           |
| 4 - | Utilize the methodologies of solving reservoir simulation problems.  |
| 5 - | 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 simulation case studies 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 - | Carry out specialized engineering design of reservoir simulation projects.      |
| 3 - | Select well locations based on reservoir saturation maps from simulation study. |
| 4 - | Deal with the high level of uncertainty of reservoir simulation different data. |
| 5 - | Prepare technical reports of reservoir simulation studies.                      |
| 6 - | 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                                   |
| 5 - | Search for information to complete the simulation study.                        |

**Course Topic And Contents :**

| Topic   | No. of hours | Lecture | Tutorial / Practical |
|---|--------------|---------|----------------------|
| Introduction to Reservoir Simulation study  | 6            | 3       | 3                    |
| Define study objectives   | 6            | 3       | 3                    |
| Geological & petro physical data  | 6            | 3       | 3                    |
| Fluid contact model   | 6            | 3       | 3                    |
| Relative perm & Capillary pressure model  | 9            | 6       | 3                    |
| Fluid phases model (PVT)  | 9            | 6       | 3                    |
| Vertical lift performance model   | 6            | 3       | 3                    |
| Pre-simulation reservoir evaluation , simulator selection, static &dynamic model construction | 15           | 9       | 6                    |
| History matching/forecasting & Cases study  | 12           | 9       | 3                    |

**Teaching And Learning Methodologies :**

|                        |
|------------------------|
| Interactive Lecture    |
| 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 :**

- Á. M. R. Islam, M. E. Hossain, S. Hossien Mousavizadegan, Shabbir Mustafiz, Jamal H. Abou-Kassem. 2016 . Advanced Petroleum Reservoir Simulation: Towards Developing Reservoir Emulators, 2nd Edition, Wiley.
- Á. M. Rafiqul Islam, S.H. Mousavizadegan, S. Mustafiz, Jamal H. Abou-Kassem . 2010. Advanced Petroleum Reservoir Simulation. John Wiley & Sons, Inc.
- Á. Abdus Satter, Ghulam Iqbal, Jim Buchwalter. 2008. Practical Enhanced Reservoir Engineering: Assisted With Simulation Software, PennWell Corp.
- Á. Amal Hussein Abou-Kassem, Syed Mohammad Farouq Ali, M. Rafiq Islam. 2006. Petroleum Reservoir Simulation: A Basic Approach, Gulf Publishing Company.
- Á. J.R. Fanchi, 2006. Principles of Applied Reservoir Simulation 3rd Ed, Elsevier Publishing
- Á. Additional Textbooks:
- Á. M. R. Carlson. 2003. Practical Reservoir Simulation, PennWell Books.
- Á. T. Ertekin, J.H. Abou-Kassem, and G.R. King, 2001. Applied Reservoir Simulation, SPE Textbook Series.
- Á. Herriot Watt. 2000. Reservoir Simulation textbook.
- Á. C.C. Mattax and R. L. Dalton, 1990. Reservoir Simulation, SPE Monograph Vol 13.
- Á. K. Aziz, and A. Settari, 1979. Petroleum Reservoir Simulation. Elsevier Applied Science Publishers, Barking, UK.