

Reservoir Modelling and Simulation

- 1.1 Course Number: PE 442
- 1.2 Contact Hours: 3-0-2 Credits: 11
- 1.3 Semester-offered: 4th Year-Even
- 1.4 Prerequisite: Reservoir engineering I and II, Engineering mathematics
- 1.5 Syllabus Committee Member: Dr. Vishnu Chandrasekharan Nair, Dr. Amit Kumar

2. OBJECTIVES

The course aims at giving the students basic knowledge of numerical simulation of fluid flow in petroleum reservoirs.

3. COURSE CONTENT

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topic	Lectures
1	Introduction to reservoir simulation	Introduction, Historical development, Uses and misuses of reservoir simulators, Prerequisites for a simulation study, Major elements of a reservoir simulation study	4
2	Simulator equations	Simulator equations, Formulation of reservoir simulator equations, Equation-of-state Two-phase flow, Three-phase flow, Models for three-phase relative permeability, Compositional models, The black oil model	12
3	Solution of Simulator equations	Numerical methods, Finite-difference method, Explicit method, Implicit method, Model and grid selection, Model types, Number and size of grid blocks, Time step size, Grid orientation effects, General guidelines for grid design, Treatment of wells.	12
5	Model initialization and History matching.	Model initialization, Pseudo-functions, Types of pseudo-functions, History Matching, Sensitivity analysis, Resent developments in Reservoir simulation	12

	Total	40
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List of Practical

1. Introduction to CMG user interface and filetypes
2. Create a Black-Oil simulation model using Builder – Preprocessing
3. Analysis of graph and 3D simulation results using Results – Postprocessing
4. Sensitivity Analysis and Assisted History Matching using CMOST
5. PVT modelling for Compositional model using WinProp
6. Modeling of Thermal flooding using GEM/STARS – 1
7. Modeling of Thermal flooding using GEM/STARS – 2
8. Modelling of Chemical flooding using GEM/STARS – 1
9. Modelling of Chemical flooding using GEM/STARS – 2
- 10. Geomechanics in Reservoir Simulation**

4. READINGS

4.1 TEXT BOOKS:

4.1.1. Aziz, Khalid, and Antonin Settari. Petroleum reservoir simulation. 2002.

4.1.2 Peaceman, Donald W. Fundamentals of Numerical Reservoir Simulation. 1977

4.2 REFERENCE BOOKS:

4.2.1. Ertekin, Turgay, Jamal H. Abou-Kassen, and Gregory R. King. Basic Applied Reservoir Simulations. Society of Petroleum Engineers, 2001.

5. OUTCOME OF THE COURSE

At the end of the course, the students will be able to

- Explain the mathematical and computational concepts behind commercial reservoir simulators
- Explain the physical laws that govern fluid flow in porous media
- Formulate single-phase and multi-phase flow in petroleum reservoirs