Course Type	Course Code	Name of Course	L	T	P	Credit
DE4	PED406	Reservoir Modeling and Simulation	3	0	0	9

Course Objective
The objective of the course is to provide the basic knowledge of reservoir modeling and simulation and its application for maximizing economic recovery of hydrocarbon from a hydrocarbon reservoir.
Learning Outcomes
Upon successful completion of this course, students will have the: Exposure of modeling and simulation concepts Ability to forecast the future production behavior of the well and field. Ability to determine the optimum conditions to maximize the economic recovery of hydrocarbon

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	**Introduction & Overview:** Definition, Objectives and applications of reservoir simulation with brief overview of the system, steps of the reservoir simulation.	3	This will help students understand the need for reservoir simulation.
2	**Basic Reservoir Analysis:** Volumetrics, Material Balance, Decline Curve Analysis, Reservoir Fluid and Rock Properties, Conservation of Mass and Momentum—Continuity Equation, Equation of Motion, Darcy and Non-Darcy Flow, Basic Single Phase flow equation.	6	This unit will help student in understanding the basic concepts which are essential to start reservoir simulation studies.
3	**Fundamentals of Reservoir Simulation:** Introduction to partial differential equations, Finite difference approximation to linear flow equations, Concept of Transmissibility and Geometric Factor, Discretization, Block Centred and Point Centred Grid distribution, Formulation of Flow equation for grid blocks, Boundary grid-block treatment and formulation of flow equation, Control Volume Finite Difference (CVFD) terminology for flow equation representation, Numerical solution of incompressible single phase flow equation	10	This will help students to learn how to write fluid flow equations for single phase flow through grid blocks in a discretized simulation model.
4	**Well Representation in Simulators:** Concept of equivalent radius for well block pressure, Well geometric factor, Treatment of wells in 2D areal flow, Well model, Multiblock wells, Estimation of wellbore geometric factor	6	Students will learn how to represent a well in a gridded simulation model; students will understand the basic equations that differentiate between local flow in a grid block and global flow between grid blocks.
5	**Slightly Compressible and Compressible Fluids:** Formulation of grid block flow equations and numerical solution; IMPES and AIM formulation; Concept of material balance check for validity of numerical solution	6	This unit will help students understand the impact of pressure dependent fluid density on the formulation of flow equations in a gridded simulation model.
6	**Multiphase Flow in Black Oil Simulation:** Impact of Relative Permeability and Capillary Pressure on fluid flow; Formulation of grid block flow equations and numerical solution; General Flow equations for Oil/Water, Gas/Water, Oil/Gas and Black Oil Model. Introduction to Streamline Simulation.	6	This unit will help students understand the impact of multiphase flow on the formulation of flow equations in a gridded simulation model.

7	**History Matching and Forecasting Future Performance:** Validity of the Reservoir Model, Strategy & Plans, Adjustment of parameters, Pressures, Pressure gradients, GOR-WOR behavior Automatic History Matching. Planning prediction cases, Preparation of input data, making a smooth transition from history to predictions, Review & Analysis of predicted performance, Evaluating & Monitoring predicted performance	5	This will help student in developing the knowledge on how to calibrate a simulation model with the observed data and how to use the calibrated model to predict the future performance of a hydrocarbon reservoir.
	Total contact hours:	**42**	

Text Books:

1. Principles of Applied Reservoir Simulation - John R Fanchi
2. Practical Reservoir Simulation - M. R. Carlson

References:

1. Fundamentals of numerical reservoir simulation - Donald W. Peaceman