Course Type	Course Code	Name of Course	L	T	P	Credit
DE	NPED506	Reservoir Simulation	3	0	0	3

Course Objective
Fundamentals aspects of reservoir simulation in different enhanced oil/gas recovery processes.
Learning Outcomes
Upon successful completion of this course, students will have: • Understanding of different simulation models, their theoretical aspects necessary to use in developing algorithms, software for their future research uses.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	**Overview:** reservoir fluid and rock properties, conservation of mass and momentum - continuity equation, equation of motion, Darcy and non-Darcy flow, and single phase flow equation.	4	Understanding properties of reservoir rock and fluid, flow equations require in recovery simulation of reservoir fluid.
2	**Black oil reservoir simulation:** well representation, numerical solution of single phase flow equation, and multiphase flow simulation.	5	Conducting recovery simulation of reservoir fluid by a simple representation of reservoir rock and fluid.
3	**Modeling of hydrocarbon phase behavior:** hydrocarbon phase behavior, equilibrium flash calculations, equation of state (EOS) models such as Peng-Robinson (PR) and Soave-Redlich-Kwong (SRK) EOS.	6	Application of cubic EOS and its use in developing EOS model
4	**Compositional simulator:** compositional mass balance equations, numerical model and discretization, well model, IMPES and AIM formulation, and iterative solution schemes.	6	Understanding of theoretical aspects of compositional simulation
5	**Thermal simulation:** conservation equation of flowing component, conservation equation for solid component, conservation equation of energy, thermal conductivity of rock, solution of linear and nonlinear equations, and IMPES and AIM formulation for thermal simulations.	5	Understanding of theoretical aspects of thermal simulation
6	**Unconventional reservoir simulation:** formulation of dual porosity/dual permeability equations for matrix and fracture blocks, matrix-fracture interaction and transfer, multiple porosity model for shale reservoirs – multiple interacting continua (MINC) model, stimulated reservoir volume (SRV), and formulation of flow equations for CBM reservoirs (diffusive flow in matrix).	6	Understanding of theoretical aspects of recovery simulation for unconventional sources of hydrocarbons.
7	**History Matching (HM):** data preparation, HM parameters, and evaluation of HM	5	Understanding of the approaches used to enhance the reliability of simulation models.
8	**Future Performance Prediction:** prediction process, sensitivity analyses, and validation of model predictions.	5	Understanding of points to be taken care of while analyzing the future recovery predictions.
	Total	**42**	

Text Books:

1. Basic Applied Reservoir Simulation, Ertekin, T., Abou-Kassem J. H. and King, G.R, SPE Textbook Series Volume 7, 2001.
2. Reservoir Simulation, Mattax, C.C. and Dalton R.L., SPE Monograph Volume 13, 1990

Reference:

1. Practical Reservoir Simulation, Carlson, M.R, PennWell, 2003