Indian Institute of Technology, Kanpur
Proposal for a New Course

1. Course Number: CHE6xx

2. Course Title: Fundamentals of reservoir engineering

3. Per Week Lectures: 3___(L), Tutorial:0____(T), Laboratory:0___(P), Additional Hours[0-2]:0__(A), Credits (3*L+0*T+P+A):9___ Duration of Course: Full Semester

4. Proposing Department: Chemical Engineering

Other Departments/IDPs which may be interested in the proposed course: SEE, ES

Other faculty members interested in teaching the proposed course: Indranil Saha Dalal

5. Proposing Instructor(s): Himanshu Sharma, Raj Deo Tewari

6. Course description:

A) Objectives: Reservoir engineering involves understanding fluid flow in the subsurface porous media and optimizing the production of oil and gas from the subsurface. The same set of principles are also useful in gas storage applications including CO_2 sequestration, hydrogen storage, etc. The objective of this course is to provide a fundamental understanding of fluid flow in porous media and reservoir engineering.

B) Contents (preferably in the form of 5 to 10 broad titles):

S. No.	Broad Title	Topics	No. of Lectures
1.	Introduction to reservoir engineering	• What is reservoir engineering? • Reservoir engineering data and deliverables • Role of reservoir engineers • Basic reservoir engineering principles • Reservoir engineering in oil & gas Industry	2
2.	Reservoir Rock and Fluid Properties	• Porous media composition • Darcy's law • Porosity/Permeability • Capillary pressure • Wettability • Relative permeability • Rock compressibility • Hydrocarbon fluid properties • Equation of state	3
3.	Reservoir Pressure and Temperature	• Pressure gradients • Normal and abnormal pressures • High Pressure High Temperature reservoirs • Repeat formation testers (RFT) • Hydrocarbon contacts	2
4.	Reservoir Energy and Recovery Efficiency	• Solution gas drive • Gas cap drive • Water drive • Combination drive	3

		• Compaction drive • Gravity drainage	
5.	Material balance and Decline curve analysis	• Concepts of material balance equations • Material balance for oil and gas reservoirs • Use of material balance for analysis of drive mechanisms • Decline curve analysis ✓ Exponential decline ✓ Harmonic decline ✓ Hyperbolic decline ✓ Linear decline	7
6.	Flow in porous media	• Diffusivity equation in 3D • Solution to Laplace's equation for line source sink • Radial diffusivity equation • Special forms for compressible fluids and real gases • Transient and unsteady state flow • Superposition in space • Multi-rate well tests	9
7.	Fluid displacement	• Recovery techniques • Two-phase flow in porous media • Mass balance, fractional flow curves • Buckley-Leverett theory • Sweep efficiency • Capillary end effects • Diffusion in porous media • Miscible flooding • Enhanced oil recovery	9
8.	Reservoir simulations	• What is reservoir simulation and why are simulators used • Types of simulation models and their applications • Black oil versus compositional models • Input data for reservoir simulation • How simulation models work • History matching and performance prediction • Common modelling difficulties and errors in computed results • Aquifer modelling • Reservoir simulation as a reservoir surveillance and management tool • Uses and misuses of reservoir simulation • Considerations for grid design • Golden rules of reservoir simulation • Advances in Reservoir simulation	5

C) Pre-requisites: None

D) Short summary for including in the Course of Study Booklet: This fundamental course on reservoir engineering covers important aspects of multiphase flow in porous media, and oil & gas recovery from the subsurface. Analytical methods to estimate reservoir properties and oil displacement in porous media along with simulation exercises on actual oil fields will be covered.

7. Recommended books:
(a) Fundamentals of reservoir engineering, LP Dake, 1983, Elsevier
(b) Imperial College Lectures in Petroleum Engineering, Volume 2: Reservoir engineering, Martin J Blunt, 2017, World Scientific Europe Ltd.

Dated: 21-11-2025 Proposer:

Dated: 24 11 2025 DUGC/DPGC Convener:

This course is approved/not approved

Chairman, SUGC/SPGC

Dated: