Course	Course	Name of Course	L	Т	Р	Credit
Туре	Code					
OE	CEO401	Flow and Transport through Porous Media	3	0	0	9

Course Objective

This course is designed to provide students a fundamental understanding of flow and transport processes occurring within the porous systems.

Learning Outcomes

Upon successful completion of this course, students will:

- Understand theoretical principles for characterizing and predicting single phase flow processes in porous systems.
- Have an in-depth knowledge of multiphase flow processes in porous systems.
- Have a basic understanding on flow and transport processes in fractured rock systems.
- Understand various transport mechanisms influencing the fate and transport of solutes in porous systems.

Unit No.	Topics to be Covered	Lectures	Learning Outcome
1	Introduction to Flow through Porous Media: Types of Porous Media. Application of study- Groundwater engineering, Oil Exploration, Mining, Waste Disposal, Geothermal Energy Extraction Single Phase Fluid Flow: Introduction to single phase and multiphase fluid systems. Concept of Porosity, Permeability, Factors affecting Porosity and Permeability, Correlations between porosity and permeability, Fluid movement below and above the water table, Reynolds number in Porous Media Flow, Darcy's Law and range of validity, Experimental determination of permeability- Constant and variable head Permeameters, Mass, Momentum and Energy Conservation Equations for Fluid movement in Porous media, Steady state flow concepts- Laminar and Turbulent flow, Derivation of Diffusivity Equation for Single phase fluid flow.	16	Understand theoretical principles for characterizing and predicting single phase flow processes in porous systems.
2	Multiphase fluid flow: Multiphase flow through porous systems, Concept of Relative Permeability, Saturation, Wettability and Capillary Pressure, Capillary pressure-Saturation relationship, Darcy's Law for Multiphase flow, Immiscible displacement, BuckleyLeverett theory, Multiphase mass continuity equation. Fractured rock-system: Flow and Transport mechanism through fractured rock systems, Comparison between flow and transport processes through classical porous media and fractured rock systems.	14	Have an in-depth knowledge of multiphase flow processes in porous systems. Have a basic understanding on flow and transport processes in fractured rock systems.
3	Transport Mechanisms: Advection, Diffusion, Fick's Law, Hydrodynamic Dispersion, Concept of Tortuosity, Advection- Dispersion Equation, Sorption- Physisorption and Chemisorption, Equilibrium and Kinetic Sorption, Dissolution, Biodegradation, Radio-active decay, Introduction to Contaminant Transport Modeling, Concept of Single- component and Multi-component solute transport.	12	Understand various transport mechanisms influencing the fate and transport of solutes in porous systems.

Text Books:

- 1. Amit, P. (2014), Introduction to Fluid Flow through Porous Media, Lambert Academic Publishing.
- 2. Civan, F.(2011), Porous media transport phenomena, John Wiley & Sons, Inc.

Reference Books:

- 1. Sahimi, M. (2011), Flow and Transport in Porous Media and Fractured Rock: From Classical Methods to Modern Approaches, 2nd Edition, Wiley VCH Verlag GmbH & Co. KGaA._
- 2. Bear, J.(1972), Dynamics of fluids in porous media, Environmental science series, New York.
- 3. Rastogi, A.K. (2007), Numerical Groundwater Hydrology, 1st Edition, Penram International Publishing.