

	Course Code	Name of Course	L	T	P	Credit
OE1	PEO301	Heat and Mass Transfer in Petroleum Operations	3	0	0	9

Course Objective

To provide the basic knowledge of heat transfer phenomena relevant to petroleum operations.

Learning Outcomes

- Understanding different interpretation methodology of various types of well testing
- Skills for performing diagnostic analysis, history matching, and characterization.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Introduction to heat transfer: Typical heat transfer situations, Modes of heat transfer, Introduction to laws, some heat transfer parameters	5	To understand the concept of heat transfer mechanisms
2	Conduction – Fourier’s law and thermal conductivity, Differential equation of heat conduction, boundary conditions and initial conditions, concept of thermal resistance, critical radius. variable thermal conductivity	5	An insight heat transfer by conduction
3	NATURAL CONVECTION Introduction, governing equations, Vertical plate – Pohlhausen solution, horizontal cylinder, horizontal plate, enclosed spaces FORCED CONVECTION Concepts of fluid mechanics, Differential equation of heat convection, Laminar flow heat transfer in circular pipe – constant heat flux and constant wall temperature, thermal entrance region, Turbulent flow heat transfer in circular pipe, pipes of other cross sections, Reynolds analogy	6	To understand the concept of heat transfer by convection
4	HEAT EXCHANGERS Types of heat exchangers, LMTD approach – parallel, counter-flow, multi-pass and cross flow heat exchanger, NTU approach – parallel, counterflow, shell and tube, cross flow heat exchanger	5	To learn the principle and design of different types of heat exchangers
5	Mass Transfer: Introduction; Diffusion mass transfer, Fick’s Law of diffusion; steady state molecular diffusion, Convective mass transfer	5	To understand the concept of mass transfer mechanisms
6	Characterization of separation processes: Equilibrium and rate governed process; Cascading and interstage flow; Vapour-liquid equilibrium and enthalpy concentration diagrams.	5	An insight to mass transfer phenomena during separation processes
7	Principles of distillation; Batch distillation with and without reflux; Steam distillation; Fractionating columns; Calculation of number of plates by McCabe-Thiele and Ponchon-Savarit methods.	6	Principle and design of distillation column
8	Adsorption: Adsorption equilibria; Batch, stagewise and continuous adsorption; Industrial adsorbers; Elution; Ion-exchange. Momentum, heat and Mass Transfer Analogy.	5	The concept of adsorption phenomena and Momentum, heat and Mass Transfer Analogy.
	Total contact hours:	42	

Text Books:

- Fundamentals of Heat and Mass Transfer- Frank P. Incropera
- Heat and Mass Transfer- Rudramoorthy and Mayilsami
- Process Heat Transfer D. Q. Kern