Strategic Plan for Learning and Teaching
Department of Chemical Engineering

Branch Name:	Chemical Engineering (CHE)	**Session :**	2018-2019
Subject Name:	Transport Phenomena	**Year:**	4th
Subject Code:	CHE 701	**Semester :**	7th

Course Objective:	The objective of this course is to impart the fundamental knowledge to solve real life problems involving transports of momentum, energy and mass in biological, mechanical and chemical systems using a unified approach
Course Outcome:	• The students will be able to acquire the knowledge of basic principles of transport processes • acquire the ability to do heat, mass and momentum transfer analysis to analyze industrial problems along with appropriate boundary conditions • Ability to develop steady and time dependent solutions along with their limitations

Teaching-Learning Plan:

Lecture Class No.	Reference to the WBUT Syllabus	Subject Topics to be discussed/ covered/ delivered	Text book / Referred book Sl.No.
1	**I (Basic Concept of Momentum, Heat and Mass Transport)**	Concept of unified approach to Momentum, Heat and Mass Transport through Transport Phenomena	1
2		Assumptions of Transport phenomena; Similarity of Mass, Momentum and Energy transfer, Diffusivities, Transport Theorem	
3		Review of Vectors & related problems	
4		Review of Tensors & related problems	
5		Viscosity, Newton's law of viscosity, calculation of momentum flux	
6		Non-Newtonian fluids – Bingham model & problems	
7		Ostwald-de Waele model & problems	
8		Eyring model & problems	
9		Reiner-Philippoff model & problems	
10		Shell momentum balance and boundary conditions & related problems	
11	**II (Momentum Transport)**	Flow of a falling film with constant/variable viscosity	1
12		Flow of Newtonian or Non- Newtonian fluid through a circular tube	
13		Flow of Newtonian or Non- Newtonian fluid through annulus, Flow of two adjacent immiscible fluids	
14		Flow of a film on outside of circular tube, Creeping flow around a sphere	
15		Equations of Continuity and Motion in rectangular (Cartesian) coordinate system, Expression of stress tensor for Newtonian and non-Newtonian fluids	
16		Special forms of equation of Motion – Euler equation, Navier-Stokes equation	
17		Transformation of equations of Continuity and Motion to cylindrical coordinate system by changing variables and using vector calculus	
18		Use of the above conservation equations – Steady incompressible flow	

		through circular tube, Laminar flow between two flat stationary/moving plates	
19		Concept of Boundary layer and Boundary layer theory	
20		Concept of turbulence, Time-smoothed quantities, Reynolds' decomposition, RANS (Reynolds Averaged Navier-Stokes equation)	
21	**III (Energy Transport)**	Dimensional analysis of equations of Continuity and Motion	1
22		Modes of heat transfer; concepts of (a) thermal conductivity – constant and temperature dependent, (b) thermal diffusivity and (c) heat transfer coefficient	
23		Fourier's law of heat conduction. Shell energy balance and boundary conditions – Heat conduction with electrical, nuclear, viscous and chemical heat source,	
24		Heat conduction through composite walls, Heat conduction in fins, Heat conduction from a sphere to stagnant fluid	
25		Free convection – flow between two vertical walls	
26		Equation of energy (general convection-diffusion equation) – rectangular coordinate system	
27		Use of the Energy equation - Unsteady state conduction in finite and semi-infinite slabs.	
28		Concept of thermal boundary layer vis-a-vis hydrodynamic boundary laye	
29		Effect of Prandtl number on thermal boundary layer thickness.	
30		**QUIZ**	
31	**IV (Mass Transport**)	Concentrations, Velocities and Mass and Molar fluxes. Concept of Mass diffusivity and Mass transfer coefficient. Fick's law of diffusion	1
32		Shell mass balance and boundary conditions – Diffusion through stagnant gas film, Diffusion in a falling film	
33			
34		Diffusion with heterogeneous chemical reaction, Equations of Continuity for binary mixture	
35			
36		Simplification of general equation for special cases	
37		Dimensional analysis of the equations of Continuity – role of Schmidt number	
38			
39		Generalized Transport Equation:	
40		Concept of coupled equations.	

Recommended Text/ Reference Books:

Sl.No.	Name of Text/ Reference Book	Name of Author	Publisher & edition
1	Transport Phenomena.	R. Byron Bird, Warren E. Stewart and N. Lightfoot.	John Wiley & Sons Inc

Course Co-ordinator / Faculty

Sl. No.	Name of the Course Co-ordinator / Faculty	Signature of Course coordinator / Faculty		Signature of HOD	
1	Prof. (Dr.) Jyoti Prakash Sarkar				