BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
HYDERABAD CAMPUS
INSTRUCTION DIVISION
First Semester 2016-2017
Course Handout (Part-II)

Date: 01/08/2016

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : **CHE F414**
Course Title : **Transport Phenomena**
Instructor-in-charge : **Dr. Vikranth Kumar Surasani**

1. **Course Description**:
   Analogy among momentum, heat and mass transport phenomena; Shell balance approach for all three transport phenomena, Boundary layer concepts, velocity, temperature and concentration distribution in laminar flow; Velocity distributions in turbulent flow.

2. **Scope and Objective of the Course**:
   Transport phenomena are a subject of importance both in science and engineering. All the three transport mechanisms such as momentum, heat and mass transfer frequently occur in chemical processes either individually or simultaneously. The aim of this course is to feel the physics of the process and then use the knowledge of the transport phenomena to represent the process behavior. Finally the aim is to analyze a few real life problems to understand the complexity of the chemical processes in view of three transport mechanisms.
3. **Books:**
   Text Book
   1. Bird, Stewart and Lightfoot, 'Transport Phenomena', John Wiley & Sons, 2002, 2nd edition

   Reference Books
   1. Fox and McDonald, 'Introduction to fluid dynamics,' John Wiley & Sons, 2008, 7th edition
   2. Holman, J.P., 'Heat transfer', McGraw Hill, 1997, 8th edition
4. **Course Plan:**

Lecture No.	Learning Objectives	Topics to be covered	Text Book Chap./Sec
1	Introduction	Scope and objectives of course, methodology	Ch. 0
2 - 3	Molecular momentum transport	Newton's law and molecular theories of viscosity	1.1-1.5
4	Convective momentum transport	Convective momentum transport	1.7
5	Momentum balances	Shell momentum balances, boundary conditions	2.1
6 - 8	Velocity distributions in laminar flow	Examples	2.2-2.5
9	Equations of change for isothermal systems	Equations of continuity, motion and mechanical energy	3.1-3.3
10 - 11	Applications of equations of change	Examples	3.5-3.6
12	Applications of equations of	Dimensional analysis	3.7

	change		
13	Velocity distributions with more than one independent variables	Time-dependent flow of Newtonian fluids	4.1
14 - 15	Stream functions and velocity potential	Solving flow problems using stream functions and velocity potential	4.2-4.3
16	Flow near solid surfaces	Boundary layer theory	4.4
17	Turbulent flow	Time-smoothed equations of change and velocity profiles	5.1-5.3
18 - 19	Velocity distributions in turbulent flow	Empirical expressions for turbulent momentum flux; turbulent flow in ducts etc.	5.4-5.6
20	Molecular energy transport	Fourier's law of heat conduction, molecular theories of thermal conductivity	9.1-9.6
21	Convective energy transport	Convective transport of energy, work associated with molecular motions	9.7-9.8
22 - 23	Energy balances	Shell energy balances, examples	10.1-10.7
24	Convection	Forced and free convection	10.8-10.9
25	Equations of change for non isothermal systems	Various forms of energy equations	11.1-11.3
26 - 27	Applications of equations of change	Examples	11.4
28	Applications of equations of change	Dimensional analysis	11.5
29 - 30	Temperature distributions with more than one independent variable	Unsteady state heat conduction in solids and in laminar flow	12.1-12.3
31	Boundary layer theory	Boundary layer theory for non-isothermal flow	12.4
32	Molecular mass transport	Fick's law of binary diffusion, molecular theories of diffusion	17.1-17.6
33	Convective mass transport	Mass and molar transport by convection, summary of mass and molar fluxes	17.7-17.8
34	Mass balances	Shell mass balance, boundary conditions	18.1
35 - 37	Concentration distributions in solids and laminar flow	Examples	18.2-18.7
38	Equations of change for multicomponent systems	Equations of continuity, summary of multicomponent equations of change	19.1-19.3
39	Applications of equations of change for multicomponent systems	Examples/Dimensional Analysis	19.4

40 - 41	Temperature distributions in turbulent flow	Time-smoothed equations of change and temperature profiles for turbulent flow in tubes	13.1-13.4

5. **Evaluation Scheme**:

EC No.	Evaluation Component	Duration	Weightage (%)	Date & Time	Remarks
1	Test I	1hr	15	13/9, 2.30--3.30PM	CB
2	Test II	1hr	15	21/10, 2.30--3.30PM	OB
3	Class Tests		10	TBA	CB
4	Assignments		20	TBA	OB
5	Comprehensive Exam	3 hrs	40	13/12 AN	OB+CB

Notices:
Notices, if any, concerning the course will be uploaded on the CMS.

Make-up:
Make-up will be granted for genuine cases only. Prior permission of IC is compulsory.

Chamber Consultation Hour: It will be announced in the class.

Instructor-in-charge
(CHE F414)