BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
INSTRUCTION DIVISION

FIRST SEMESTER 2015-2016

Course Handout (Part II)

Date 03/08/2015

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 : **CE F212**
Course Title : Transport Phenomena
Instructor-in-charge : **SHIBANI KHANRA JHA**

Course Description and Scope & Objective
Transport Phenomena is an introductory course which basically covers all the fundamental aspects of fluid mechanics; especially the classical and well established laws of conservation of mass, energy and momentum in is most generalized form. This course emphasizes on understanding these governing laws and its widespread engineering applications. The unified contents of this course will enable the students to tackle the real life problems in more comprehensive manner and provide a broader view on the subject. At the end of the course students will be able to understand the characteristics of fluid statics as well as fluid dynamics. They will be able to establish the relevant mathematics describing the fundamentals of fluid statics, kinematics and dynamics. They will be able to understand the concept of system and control volume approach and relation between them. Also, this course will be helpful for students as a prerequisite for further advanced courses of fluid mechanics at graduate as well as post graduate level. Students will be assigned demonstration projects which will expose them to understand the behavior of fluids under static and dynamic conditions.

Text Book:

TB1. Fox, R.W. and McDonald, A.T., Introduction to Fluid Mechanics, John Wiley and Sons Inc., Singapore, Seventh Edition, 2011.
TB2. Modi, P.N. and Seth, S.M., Hydraulics and Fluid Mechanics, Standard Book House, New Delhi, 2009.

Reference Books:

RB1. Bird, R.B., Stewart, W.E. and Lightfoot, E.N., Transport Phenomena, John Wiley and Sons Pte. Ltd., Second Edition, 2006.
RB2. Munson B.R., D.F. Young, T.H. Okiishi, Fundamentals of Fluid Mechanics, John Wiley and Sons (Asia) Pte. Ltd., Sixth Edition, 2009.
RB3. Welty J., C. E. Wicks, R. E. Wilson, G. L. Rorrer, Fundamentals of Momentum, Heat and Mass Transfer, John Wiley and Sons, Fourth Edition, 2009.
RB4. Shames, I. H., Mechanics of Fluids, McGraw-Hill Company, Second Edition, 1982.

Course Plan:

Lec. No.	Learning Objectives	Topics to be covered	Reference
1, 2	To understand Basic Properties of Fluids	Concepts and Definitions: Characteristics of fluids, dimensions, dimensional homogeneity, and units, measures of fluid mass and weight, ideal gas law, viscosity, compressibility of fluids, vapor pressure, surface tension.	CHAP 1, 2 TB1
3, 4, 5, 6,7	To understand fluid Statics: Fluid at Rest, Fluid Pressure and its Effect on fluid behaviour	Pressure at a point, basic equation for pressure field, pressure variation in a fluid at rest, standard atmosphere, measurement of pressure, piezometer, manometer, hydrostatic force on a plane surface, buoyancy, flotation, and stability, pressure variation in a fluid under rigid body motion.	CHAP 3 TB1
8, 9, 10, 11, 12, 13,14, 15	Fundamentals of fluid flow in terms of kinematics of Fluid Motion	Description of a Fluid in Motion: Study of various flow pattern, Stream line, path line, streak line, Stream function, velocity potential, Flow net, The velocity field, the acceleration field, Control Volume and System Representations, The Reynolds Transport Theorem	CHAP 3 RB3, Notes
16, 17, 18, 19, 20, 21	Study of Flow Analysis using Control Volumes	Conservation of mass - the continuity equation, Newton's second law-the linear momentum and moment-of-momentum equations, First/second law of thermodynamics–the energy equation	CHAP 4 TB1
22, 23, 24, 25	To understand Fluids in Motion - The Bernoulli Equation	Newton's second law, static, stagnation, dynamic, and total pressure, Bernoulli equation, the energy line and the hydraulic grade line, restriction on use of the Bernoulli equation.	CHAP 6 TB1

26, 27, 28, 29	Study of Flow Analysis using Differential Methods	Fluid element kinematics, conservation of mass, conservation of linear momentum, inviscid flow, viscous flow: stress-deformation relationships, The Navier-Stokes equations	CHAP 5 TB1
30, 31, 32, 33	To understand Dimensional Analysis, modeling, and similitude	Dimensional analysis: Buckingham Pi theorem, determination of Pi terms, common dimensionless groups in fluid mechanics, modeling and similitude	CHAP 7 TB1
34, 35, 36	Study of flow pattern through orifices and mouthpieces	Various types of orifices and mouthpieces	CHAP 9 TB2
37, 38, 39	Study of flow pattern over notches and weirs	Various types of notches and weirs	CHAP 10 TB2
40, 41, 42	Study of flow pattern through pipes	Flow in Closed Conduits: General characteristics of pipe flow, fully developed laminar and turbulent flow, Darcy-Weisbach equation	CHAP 8 TB1; CHAP 11 TB2

Note to Students: Along with the text books, student may seek the notes by IC.

Evaluation Scheme

No.	Evaluation Component	Duration	Weightage (%)	Date & Time	Nature of Component
1	Mid-Sem	90 min	30	6/10 8:00 - 9:30 AM	CB
2	Comprehensive	180 min	45	3/12 FN	CB+OB
3	Tutorial/Quiz/Project		25	Will be announced in class at regular interval	

Chamber Consultation Hour: Consultation Hour to be announced in class (**Dr. Shibani Khanra Jha–6021 I NAB**)

Make-up Policy:

1. No makeup for Tutorial/ Quiz/ Project/ Mid-semester will be granted. Make-up will be granted only for reasonable cases. However, prior permission of IC as well as ID is must.
2. For medical cases, a certificate from the concerned physician of the Medical Centre as well as statement of inability to attend the examination from hostel warden must be produced to IC as well as ID.

Notices: All notices concerning the course will be displayed on Nalanda as well as will be announced in class at regular interval.

Instructor-in-charge

CE F212