Advanced Transport Phenomena - Web course

COURSE OUTLINE

This advanced course in " Transport Phenomena " deals with the transport of energy, mass and momentum in chemically reacting fluids.

The basic principles of these fields are here generalized and reformulated so as to be able to deal with chemically-reacting flow systems of current and future engineering interest.

Principles are developed and illustrated here for the rational design of engineering equipment (chemical reactor analysis, separation processes, multiphase transport, etc.).

Emphasis will be placed on the use of fundamental laws, and a judicious blend of experimental, analytical and numerical methods to develop required understanding and necessary mathematical models for essential portions of engineering problems involving transport processes.

Contents:

1. Introduction: Examples; Types/Uses of Control Volumes; Notion of Conservation Principles and Constitutive Laws; Illustrations of Use.
2. Conservation Principles: Mass, Momentum, Energy, Entropy; Alternative Forms; statement of Assumptions.
3. Constitutive Laws: Diffusion Flux Laws/ Coefficients, general constraints; Momentum/ Energy/ Mass Diffusion Laws; Multi-component mass diffusion; Reaction rates, mechanisms, time-scales.
4. Momentum Transport Mechanisms, Rates & Coefficients in CRFS.
5. Energy Transport Mechanisms, Rates & Coefficients in CRFS.
6. Mass Transport Mechanisms, Rates & Coefficients in CRFS.
7. Analogies & Similitude Analyses with Application to CRFS.
8. Problem-Solving Techniques, Aids, Philosophy.

COURSE DETAIL

S.No	Topics	No. of Hours
1	Introduction: Examples; Types/Uses of Control Volumes; Notion of Conservation Principles and Constitutive Laws; Illustrations of Use.	2
2	Conservation Principles: Mass, Momentum, Energy, Entropy; Alternative Forms; statement of Assumptions.	5
3	Constitutive Laws: Diffusion Flux Laws/ Coefficients,	5

NP-TEL

NPTEL

http://nptel.iitm.ac.in

Chemical Engineering

Pre-requisites:

UG courses in Fluid Mechanics, Heat Transfer, Mass Transfer, Chemical Reaction Engineering.

Additional Reading:

1. " Chemically Reacting Flow: Theory and Practice ", Robert J. Kee, Michael E. Coltrin, Peter Glarborg, Wiley, 2003.
2. " Transport Phenomena ", R. Byron Bird, Warren E. Stewart and Edwin N Lightfoot, 2nd Edition, Wiley, 2001.

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	general constraints; Momentum/ Energy/ Mass Diffusion Laws; Multi-component mass diffusion; Reaction rates, mechanisms, time-scales.	
4	Momentum Transport Mechanisms, Rates & Coefficients in CRFS.	8
5	Energy Transport Mechanisms, Rates & Coefficients in CRFS.	8
6	Mass Transport Mechanisms, Rates & Coefficients in CRFS.	8
7	Analogies & Similitude Analyses with Application to CRFS.	3
8	Problem-Solving Techniques, Aids, Philosophy.	3
	Total	42

References:

1. " Transport Processes in Chemically Reacting Flow Systems ", Rosner, Daniel E; Dover 2000.