

ChBE 6260 Fall 2009 Course Outline

1. Review of basic principles and math

Review concepts of transport. Introduction to tensor and vector calculus; index notation.

Readings: Lecture Notes: packets 1 (Intro), 2 (Math Review)
BSL (reserve): Appendix A

2. Mass Transfer Fundamentals; Diffusion Coefficients

Concentration-Flux Relationships. Diffusion in gases-liquids and solids.

Readings: Hines and Maddox: Chapter 1, 2.1-2.5

3. General Conservation Equations

Kinematics derivatives, spatial derivatives, Reynolds Transport Theorem. Conservation laws in a continuous medium. Boundary Conditions.

Readings: Lecture Notes: packets 3 (Kinematics), 4 (Conservation Laws)

4. Shell balances - Scaling- 1D problems

Derivation of differential balances for simple geometry using shell balances. Simplification of general transport equations using scaling concepts. 1-D problems.

Readings: Lecture Notes: packets 5 (Scaling), 6 (Shell Balances)
Hines and Maddox: Chapter 3

5. 1D diffusion problems

Steady-state, non-steady state problems.

Readings: Lecture Notes: packet 7 (1D problems)
Hines and Maddox: Chapter 3

6. 2D diffusion problems

Steady-state, non-steady state problems.

Readings: Lecture Notes: packet 8 (2D problems)
Hines and Maddox: Chapter 4

7. 3D diffusion problems

Steady-state, non-steady state problems.

Readings: Lecture Notes: packet 9 (3D problems)

8. Convective mass transfer-Boundary Layers

Concentration-Heat-Momentum boundary layers over flat plates and in cylindrical tubes. Analytical derivation of transfer coefficients and correlations. Heat-Mass-Momentum analogy. Planar, Cylindrical, Spherical geometry.

Readings: Lecture Notes: packet 10
Hines and Maddox: Chapter 6

9. Computational Methods for solving Transport Phenomena

The Finite Volume Method: application to solving mass and heat transfer problems.

Readings: Lecture Notes: packet 11 (pages 246-260, 265-271)
Patankar: Chapters 5, 6

10. Mass Transfer Coefficients

Film model – Penetration Theory – Total mass transfer coefficients.

Readings: Lecture Notes: packet 12
Hines and Maddox: Chapter 5