ChE 333: MASS TRANSFER (3 :3,1)
Spring 2004

2003 Catalog Data:

• Modes of mass transfer, steady and un-steady molecular diffusion in different co-ordinates. Convective mass transfer. Correclations for convective mass transfer. Analogy between momentum, heat and mass transfer. Mass transfer applications.

Prerequisites: **ChE 301**

Text book: • Mass Transfer: J.R. Welty, R.E. Wilson, and C.E. Wicks, Fundamentals of Momentum, Heat and Mass transfer,4th Edition, John Wiley (2000)

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Reference: Fundmentals of Heat and Mass Transfer: F. I. Incropera and Dewitt, 5th Edition, John Wiley (2000).

Goals : Understanding of mass transfer modes, to able to derive and apply the mass diffusion equations , and to familiarize the student with topics such as steady , unsteady molecular diffusion and convective mass transfer.

Prerequisites by topic:

- Momentum balance
- Heat balance
- Thermodynamics
- Mass balance

Topics:

• Fundamentals of Mass Transfer	(3weeks)
•Differential Equations of Mass Transfer	(3weeks)
• Steady State Molecular Diffusion	(2weeks)
• Unsteady State Molecular Diffusion	(2weeks)
• Convective Mass Transfer	(2weeks)
•Convective Mass Transfer Correlations	(2weeks)

Computer Usage: None
Laboratory Projects: None

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Week	Topics to be covered
1	**Fundamentals of mass transfer** •Molecular mass transfer •The Fick s rate equation. •Related types of molecular mass transfer. H.W. # 1(24.3, 24.6, 24.9)
2	•The diffusion coefficient. •Gas mass diffusivity. •Liquid mass diffusivity.
3	•Pore diffusivity. •Knudsen diffusion. •Solid mass diffusivity. •Convective mass transfer**.** **HW # 2 (24.20, 24.23, 24.26)**
4, 5	Differential equations of mass transfer. •The differential equation for mass transfer**.** •Special forms of the differential mass transfer equations. •Initial and boundary conditions. **H.W # 3 (25.4, 25.7, 25.16)**
6, 7	Steady state molecular diffusion. •One dimensional mass transfer independent of chemical reaction. •Pseudo steady state diffusion. •One dimensional systems associated with chemical reaction. H.W # 4 (26.1, 26.3) H .W #5 (26.5, 26.18, 26.22). Exam. # 1
8, 9	Unsteady state molecular diffusion. •Unsteady state diffusion and Fick s second law. •Transfer diffusion in a semi infinite medium. •Transient diffusion in a finite dimensional medium under conditions of negligible surface resistance. •Concentration time charts for simple geometric shapes. H.W # 6 (27.5, 27.7)

10,11	Convective mass transfer. •Fundamentals considerations in convective mass transfer. •Significant parameters in convective mass transfer. •Dimensional analysis of convective mass transfer. •Exact analysis of the laminar concentration boundary layer. •Approximate analysis of the concentration boundary layer. •Mass, energy and momentum transfer analogies. H.W # 7 (28.8, 28.25, 28.30) Exam. # 1 (Make up).
12, 13	Convective mass transfer correlations. •Flat plate. •single sphere. •Single cylinder. •Mass transfer involving flow through pipes. •Mass transfer in packed and fluidized beds. H.W # 8 (30.1, 30.3, 30.9) H.W. # 9 (30.12, 30.20, 30.21) Exam # 2
14, 15	Interphase Mass Transfer • Equilibrium • Two resistance Theory • Individual Mass-Transfer Coefficients • Over All Mass Transfer Coefficients H.W. # 10 (29.4, 29.10, 29.12)