

MASS TRANSPORT (ME6203)

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COURSE OUTLINE

- ❖ Introduction
 - Why study “mass transport”?
 - Engineering applications
 - Formulation and solution of transport problems - methodology
- ❖ Transport Phenomena Laws
 - Definitions of fluxes (mass, momentum, energy)
 - Phenomenological laws
 - Differential formulations of conservation equations in three dimensions
 - Solution methodologies; dimensional analysis; scaling of equations of change
- ❖ Molecular Mass Transport
 - Diffusion fluxes; Fick’s Law
 - Diffusion in gases
 - Diffusion in liquids
 - Diffusion in solids
 - Estimation of diffusivity
- ❖ Convective Mass Transport
 - Free convection/laminar flow
 - Forced convection in boundary layers/channel flows
 - Simultaneous heat and mass transfer
- ❖ Mass Exchangers: Applications
 - Simultaneous heat and mass exchangers, e.g. dryers
 - Adsorption
 - Controlled release of drugs
- ❖ Selected Topics
 - Dimensional analysis of transport equations, similitude
 - Models of various dryers e.g. impinging jet, spray, fluid bed, rotary dryers etc.

Note: Practice problems will be recommended. You are encouraged to try to solve them on your own. Solutions to the problems will be discussed in the class two to three weeks after distribution. Please note that written lecture notes will be made available only if the material is not available in the prescribed textbook.

Textbook:

Cussler, E.L., Diffusion: Mass Transfer in Fluid Systems, 2nd Edition, Cambridge Univ. Press, 1997.

Acquisition of the textbook is strongly recommended since there will be reading assignments as well as open book test and examination.

Suggested Reading Material:

- 1. Bird, R.B., Stewart, W.E. and Lightfoot, E.N., Transport Phenomena, Wiley, N.Y., 1960.**
- 2. Mills, A.F., Heat and Mass Transfer, Irwin, 1995.**

Grading Scheme:

**30% Project/term paper (independent individual or team work)
10% Oral presentation of project (questions and discussion)
60% Two tests (open book and one crib sheet)**

Notes:

- 1. Problems will be assigned for optional homework. Selected solutions may be discussed during class periods.**
- 2. Reading assignments will be given mainly from the textbook assigned. Also, only the prescribed textbook will be permitted in the final examination.**
- 3. The tests will be open book, however only the textbook (Cussler) will be allowed. Lecture notes will not be permitted. You will be allowed one crib sheet written on both sides (if you wish).**

Topics for term paper projects (in groups of two) will be suggested during lectures. Students are encouraged to come up with their own suggestions, however they should obtain prior approval before proceeding to work on them.

A written report in prescribed format is required two weeks prior to end of the semester. Each group will make a single Powerpoint presentation (15 minutes maximum) after which there will be a question and answer period. The grade for this assignment will depend on the written report as well as the oral defense of the work. Details will be provided in the class.