Transport Phenomena CHE06402-01 and Transport Phenomena For Engineers CHE06514-01

**Tentative Schedule for Spring 2017 Revised (3/1/17)**

Polymath: Nonlinear Equation Solver (NLE)

Polymath: Differential Equation Solver (DEQ) & COMSOL

ASPEN

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| **Date:** | **Proposed Topics for 3 Credit Hour Class** Wednesday 5PM-7:45PM (ROW 340)  **This is a tentative list of topics that will be updated under Schedule of Topics in Blackboard** |
| **January** 18 Wednesday | Course Introduction **Review of Process Fluid Transport (Fluid Flow)**  **Chapter 2 Principles of Momentum Transfer**  2.9 Shell Momentum Balances for Laminar Flow Between Parallel Plates  Shell Momentum Balances for Non-Newtonian Laminar Flow Between Parallel Plates Navier Stokes Equations: Geankoplis 3.6 – 3.7, 3.8B  Velocity Distribution for Flow Between Coaxial Cylinders, Example 3.8-5 |
| 25 Wednesday | Example 3.8-6 Rotating Liquid in a Cylindrical Container  2.9B Shell Momentum Balances for Laminar Flow in a pipe (also see Example 3.8-3) C&S8.1 Laminar Flow of a Newtonian Fluid in a Horizontal Pipe  Example 3.8-4 Laminar Flow in a Cylindrical Annulus  2.9C Shell Momentum Balance for Falling Film  C&S8.3 Vertical Laminar Flow of a Liquid Film – Newtonian fluid  3.5H Non-Newtonian laminar flow in a horizontal pipe: power law  C&S8.4 Laminar Flow of Non-Newtonian Fluids in a Horizontal Pipe |
| **February**  1 Wednesday | Examples of Shell Momentum Balances applied to new geometries Unsteady-State for a wall suddenly set in motion, Coating of a Wire, Radial Flow Between Parallel Disks, Parallel disk viscometer |
| 8 Wednesday | Heat Transport  Heat transfer in pipes Chapter 4.5B laminar & 4.5C turbulent & 4.5H Log Mean Temperature Difference:  C&S9.8 Single-Pass Heat Exchanger with Convective Heat Transfer on Tue Side  Heat loss from liquid flowing in a pipe with condensing steam on the surface. C&S9.9 Double-Pipe Heat Exchanger  C&S 9.10 Heat Losses from an Un-insulated Tank Due to Convection 365 |
| 15 Wednesday | **Exam 1 Momentum Transport**  **Chapter 4 Principles of Steady-State Heat Transfer** C&S9.1 One-Dimensional Heat Transfer Through a Multilayered Wall  C&S9.3 Radial Heat Transfer by Conduction with Convection at Boundaries 344  Overall Heat Transfer Coefficients in Heat Exchangers Section 4.9  C&S9.4 Energy Loss from an Insulated Pipe |
| 22 Wednesday | C&S9.2 Heat Conduction in a Wire With Electrical Heat Source and Insulation 338 |
| **March** 1 Wednesday | 4.13C Extended Surface or Finned Exchangers C&S9.5 Heat Loss Through Pipe Flanges 347  C&S9.6 Heat Transfer from a Horizontal Cylinder Attached to a Heated Wall 352  C&S9.7 Heat Transfer from a Triangular Fin Chapter 5: Principles of Unsteady-State Heat Transfer  Chapter 5 Unsteady-State Heat Transfer  5.2 Simplified Cases for Negligible Internal Resistance  5.3 Unsteady-State Conduction  C&S 9.11 Unsteady-State Radiation to a Thin Plate 368  C&S 9.12 Unsteady-State Conduction within a Semi-Infinite Slab 370  C&S 9.13 Cooling of a Solid Sphere in a Finite Water Bath 373  C&S 9.14 Unsteady-State Conduction in Two Dimensions 378 |
| 8 Wednesday | **Chapter 6 Principles of Mass Transfer** Empirical Correlation of Diffusion: Eugen Fick’s 1855 experiments: NaCl in water  Unimolecular Diffusion  Review of material balances; Intro to diffusion  Measurement of Diffusivity using a Stefan Tube (Example 6.2-3)  C&S 10.1 One-Dimensional Binary Mass Transfer in a Stefan tube  6.2D Diffusion Through a Varying Cross-Sectional Area  C&S 10.3 Slow Sublimation of a Solid Sphere |
| March 13-17 | **Spring Break** |
| 22 Wednesday | **Chapter 7: Convective mass transfer**  7.3 Mass Transfer Coefficients for Various Geometries  7.3D Flow inside pipes  7.3E Flow inside packed beds  C&S 10.2 Mass Transfer in a Packed Bed with Known Mass Transfer Coefficient  Mass Transfer of a lozenge C&S 10.4 Controlled Drug Delivery by Dissolution of Pill Coating  Bubble Columns  7.4 Mass Transfer in Stirred Tanks  **Exam 2 Heat Transport** |
| 29 Wednesday | 7.5 Molecular Diffusion Plus Convection and Chemical Reaction  Diffusion and Chemical reaction at a boundary  Diffusion with Instantaneous surface reaction: Vapor Deposition on a Solid, Shrinking Core Model (Catalyst Regeneration/Coal Combustion)  Diffusion with slow surface reaction  Diffusion and homogeneous reaction in a phase  C&S6.5 Shooting Method for Solving Two-Point Boundary Value Problems 218 Diff&rxn  C&S10.5 Diffusion with Simultaneous Reaction in Isothermal Catalyst Particles 400  C&S10.6 General Effectiveness Factor Calculations for First-Order Reactions 404  C&S10.7 Simultaneous Diffusion and Reversible Reaction in a Catalytic Layer 406 |
| **April** 5 Wednesday | Multicomponent Diffusion: C&S 10.8 Stefan-Maxwell Equations for multicomponent molecular diffusion of gases  C&S10.10 Multicomponent Diffusion in a Porous Layer Covering a Catalyst 419  C&S10.11 Second-Order Reaction with Diffusion in Liquid Film 421  **Chapter 7: Unsteady state mass transfer**  C&S 10.13 Unsteady-State Mass Transfer in a Slab  C&S 10.14 Unsteady-State Diffusion and Reaction in a Semi-Infinite Slab 434 |
| 12 Wednesday | **Problems related to Chapter 8 Evaporation and Chapter 9 Drying** 9.10A Through-Circulation Drying in Packed Beds  9.10C & 9.10D Material and Heat Balances for Continuous Dryers |
| **14 Friday** | **Good Friday: No Classes** |
| 19 Wednesday | **Chapter 10**: 10.6E Rate Based Model of Absorption Column  Mass transfer coefficients in absorption processes  Solution using POLYMATH for 10.6F dilute  Minimum solvent flows for tray tower design Solution using POLYMATH for 10.6F dilute and with G and L allowed to vary  Solution using POLYMATH for 10.7 concentrated mixtures in packed towers h=HOGNOG  Gas Absorption with Chemical Reaction  **Chapter 12 Liquid-Liquid and Fluid-Solid Separation Processes**  12.1 & 12.2 Adsorption, 12.5 Extraction, 12.8 Leaching, 12.11 Crystallization |
| 26 Wednesday | **Review for Final** |
| **May** May 2-8 | Comprehensive Final  Tuesday-Monday, May 2-8 (includes Saturday May 6) |
|  | Go out and design some reactors! |

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