CBEMS120A MOMENTUM TRANSFER

Catalog Data: **CBEMS120A Momentum Transfer (Credit Units: 4) F.** Macroscopic and differential mass balances; macroscopic and differential linear and angular momentum balances, mechanical energy balances; Ideal fluids, Newtonian and non-Newtonian fluids and turbulence. Applications to chemical processes. Prerequisites: CBEMS40A, Mathematics 3D. (Design units: 1)

Textbook: Munson, Bruce R., Young, Donald F., & Okiishi, Theodore H., *Fundamentals of Fluid Mechanics,* 4th edition, John Wiley & Sons.

References:

Coordinator: Vasan Venugopalan

Course Objectives: To design and control chemical processes, a chemical engineer must understand the principles of fluid flow. This course is an introduction to the basic concepts fluid statics and dynamics. The course builds on concepts introduced in chemical engineering calculations (ChE 40) and thermodynamics (ChE60), as well as calculus and differential equations.

Course Outcomes: Students will be able to:
Apply the principles of hydrostatics to read a manometer or calculate forces and moments applied to a submerged body.
Apply mass, momentum and energy conservation to fluid system.
Apply the Navier-Stokes equations to determine the velocity distributions of simple laminar flows.
Apply the principles of dimensional analysis to identify the dimensionless group of variable governing the fluid flow in a given situation.
Apply the principles involved in internal flow to determine head loss involved in laminar and turbulent flows through pipes and pipe fittings.
Analyze boundary layer flows.
Determine drag coefficients associated with objects traveling through air or water.

Prerequisites By Topic: Chemical Engineering Thermodynamics, and Ordinary Differential Equations.

Lecture Topics:
Fluid Properties
Conservation Laws for Closed Systems
Thermodynamics Review and Fluid Statics
Conservation of Mass for Open Systems
Conservation of Momentum for Open Systems
Conservation of Energy for Open Systems
Differential View of Fluid Motion
Differential Form of Conservation Laws
Dimensional Analysis
Analytic Solutions for Laminar Flows
Boundary Layers
External Flows

Internal Flows
Inviscid Flows
Conservation of Angular Momentum
Rotating Fluids and Turbomachinery

Class Schedule: Each class meets 4 hours per week for 10 weeks.

Computer Usage: Computer literacy and basic skills are required for performing analysis using special software for pipe system design.

Laboratory Projects:

Professional Component: Contributes toward the Chemical Engineering Topics Courses and Major Design experience.

Relationship to Program Outcomes: ChE: This course relates to Program Outcomes 1, 3, 5, 10, 11, and 13 as stated at: http://www.eng.uci.edu/dept/objective_chemical
MSE: This course relates to Program Outcomes 1 and 5 as stated at: http://www.eng.uci.edu/dept/objective_materials_science

Design Content Description:

Approach:

Lectures:

Laboratory Portion:

Grading Criteria:

Weekly homework:	15%
Computer project:	5%
Midterm exams (2):	50%
Final quiz:	30%
	100%

Estimated ABET Category Content:

Mathematics and Basic Science: 0 credit units or 0%
Engineering Science: 3 credit units or 75%
Engineering Design: 1 credit units or 25%

Prepared by: Vasan Venugopalan **Date:** July 2005

CEP Approved: Fall 2001