Transport Phenomena I

CBE 2420

Credit Hours:
3.00 - 3.00

Course Levels:
Undergraduate (1000-5000 level)

Course Components:
Lecture

Course Description:
The transport of energy, mass and momentum is essential to the function of all non-living and living systems. This course will serve as an introduction to momentum transport (i.e., fluid mechanics), and will primarily focus on the basic mechanisms of momentum transport and its application to the analysis of real world flows.

Prerequisites and Co-requisites:
Prereq: 2200, and Math 2173 or 2177 or 2415, and enrollment in CBE, FABEng, or EngPhysics major; or Grad standing; or permission of instructor.

Course Goals / Objectives:
- On completion of this course, students should be able to Describe the modes of momentum transfer and be able to write the empirical laws governing each mode
- Understand the key physical properties governing momentum transfer
- Be able to set up shell balances and surface balances for momentum transfer problems
- Identify appropriate boundary conditions to solve the governing equations
- Understand the concept and application of key dimensionless numbers in transport
- Identify and apply the appropriate correlation to solve transport problems

Course Topics:
- Vector algebra, tensor algebra: addition and multiplication, dot product, heat flux vector, stress tensor
- Vector and tensor calculus: "del" operator, Divergence Theorem, Reynolds Transport Theorem
- Balance of Mass: deforming body, fixed volume of space, the Equation of Continuity
- Balance of Momentum: deforming body, fixed volume of space, the Cauchy Momentum Equations
- Constitutive equations; Navier Stokes equations
- Laminar flow problems
- Dimensional analysis based on the equations of motion: scale-up and the rational design of engineering experiments, friction factors for flow in conduits, laminar and turbulent flow
- Macroscopic balances and their uses
- Design of piping systems

Designation:
Elective
Required