



Rheology of Fluids

CBE 5775

Credit Hours:

3.00 - 3.00

Course Levels:

Undergraduate (1000-5000 level)

Graduate (5000-8000 level)

Course Components:

Lecture

Course Description:

Principles of rheology, including the characterization of non-Newtonian materials, rheological equations of state, viscometric flows, measurements, and applications to the flow of industrial materials.

Prerequisites and Co-requisites:

Prereq: 2420 (420), or permission of instructor.

Course Goals / Objectives:

- Understand the definitions of tensors used to describe the state of stress, strain, and strain rate on a material element
 - Be familiar with the types of constitutive equations used to describe the behavior of Newtonian liquids, elastic solids, and viscoelastic liquids
 - Master the application of the mass and momentum balance coupled with a proper constitutive equation to solve engineering problems
 - Be generally familiar with experimental techniques used for rheological characterization of liquids and solids
 - Be exposed to the rheological behavior of rubbers, polymers, suspensions, emulsions, and foams
 - Be generally familiar with terminology used in the field of rheology
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Course Topics:

- Elastic solids, stress tensors, principal stresses, finite deformation tensor, finger deformation tensor, neo-Hookean solids
 - Equations of motion, boundary conditions, velocity gradient tensor, rate of strain tensor, definition of shear and extensional flows
 - Viscous liquids, constitutive models for general viscous fluids and plastic behavior
 - Linear viscoelasticity, Maxwell model, stress relaxation, creep, and sinusoidal oscillation
 - Nonlinear viscoelasticity, Deborah number, differential and integral constitutive equations
 - Shear rheometry: drag flows and pressure driven flows
 - Extensional rheometry
 - Rheo-optical measurements
 - Rheology of suspensions, emulsions, and foams
 - Rheology of polymeric liquids (polymer melts and solutions)
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Designation:

Elective