



# TRANSPORT PHENOMENA OF NON-NEWTONIAN FLUIDS

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**PRE-REQUISITES :** Fluid Mechanics, Heat Transfer, Mass Transfer

**INTENDED AUDIENCE :** Chemical Engineering, Biotechnology, Food Engineering, Mechanical Engineering

**COURSE OUTLINE :**

Non-Newtonian fluids are often encountered in our daily life as well as in many industries. Some of the daily-life applications include personal care products such as cosmetics, gels, pastes; food stuffs such as sandwich spreads, ketchup, chocolate, soups, etc. Some of the industrial applications include processing of many polymers, paints and detergents, degassing of polymeric melts and glasses, use of non-Newtonian polymers in enhanced oil recovery, non-Newtonian fluidized beds, wastewater treatment, production of polymeric alloys and ceramics via liquid routes, pharmaceutical products wherein the polymer thickening agents are used to enhance their stability for extended shelf-life, pulp and paper industries, etc. Because of aforementioned overwhelming applications, it is required for both undergraduate and postgraduate students to acquire enough academic experience related to the momentum, heat and mass transfer phenomena associated with non-Newtonian fluids. Thus, in this course, details of types and mathematical models of non-Newtonian fluids, and their momentum, heat and mass transport phenomena are discussed along with the corresponding boundary layer flows. Problems would be discussed on the cases of engineering applications where combined momentum and heat transfer, combined momentum and mass transfer, combined mass and heat transfer, combined heat and mass transport along with homogenous and/or heterogeneous reactions are involved simultaneously.

**ABOUT INSTRUCTOR :**

Prof. Nanda Kishore completed PhD from Indian Institute of Technology (IIT) Kanpur in 2008 and presently is a full professor in the Department of Chemical Engineering of IIT Guwahati, India. He was Brunel Research Fellow from Dec. 21, 2009 to March 31, 2011 at School of Engineering Sciences, University of Southampton, UK. He was a visiting researcher of Department of Chemical and Processing Engineering, University of Surrey, Guildford, United Kingdom from June 2016 to July 2016. He received Young Scientist Research Award in 2016 from DAE-BRNS; IEI Young Engineers Award for the year 2015; Young Scientist Research Grant from Science and Engineering Research Board of Department of Science and Technology, Government of India, 2013.

**COURSE PLAN :**

- Week 1 :** Introduction to Non-Newtonian Fluids
- Week 2 :** Rheology Measuring Instruments
- Week 3 :** Equations of Change
- Week 4 :** Momentum Transfer of Non-Newtonian Fluids
- Week 5 :** Momentum Transfer of Non-Newtonian Fluids
- Week 6 :** Flow of Non-Newtonian Fluids through Porous Media
- Week 7 :** Heat Transfer Phenomena of Non-Newtonian Fluids
- Week 8 :** Heat Transfer Phenomena of Non-Newtonian Fluids
- Week 9 :** Mass Transfer Phenomena of Non-Newtonian Fluids
- Week 10 :** Simultaneous Heat and Mass Transfer with Chemical Reactions
- Week 11 :** Mass Transfer Combined with Heat Transfer
- Week 12 :** Boundary Layer Flows of Non-Newtonian Fluids