VISCOUS FLUID FLOW

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PRE-REQUISITES : No specific pre-requisite. Fundamental knowledge of Fluid Mechanics should be sufficient.

INTENDED AUDIENCE : Postgraduate and undergraduate students of Mechanical Engineering and
similar branches; Faculty members associated with Mechanical Engineering; Practicing engineers associated with fluid and thermal industries.

INDUSTRIES APPLICABLE TO : BHEL, NTPC, Eaton

COURSE OUTLINE :
Viscous fluid flow covers the fundamentals of fluid mechanics from an advanced point of view. This course focusses largely on viscous flows in the incompressible regime. This course will cover the derivation of Navier-Stokes equations, exact solutions for simplified configurations, creeping flows , Stokes's first and second problems, laminar boundary layers, wall-bounded and free-shear boundaries and hydrodynamic stability with an introduction to turbulence. The course will give the audience physical insights through the use of mathematical tools for solving real-flow problems. The course will help students, faculty members, and researchers in the field to get in-depth understanding of concepts in viscous fluid flow.

ABOUT INSTRUCTOR :
Prof. Amaresh Dalal is currently Professor in the Department of Mechanical Engineering of the Indian Institute of Technology Guwahati. He received his Ph.D. degree from Indian Institute of Technology Kanpur in 2009 and he was Post-doctoral Research Associate at Purdue University from Sep 2008 -Dec 2009. He has research interests in the area of Computational Fluid Dynamics and Heat Transfer, Finite Volume Methods and Unstructured Grid Techniques, Multiphase Flows. He received Prof KN Seetharamu Medal and Prize for the Best Young Researcher in Heat Transfer-2017 from Indian Society of Heat and Mass Transfer.

COURSE PLAN :

Week 1**:** Introduction

Week 2**:** Steady One-dimensional Rectilinear Flows

Week 3**:** Steady Axisymmetric Flows

Week 4**:** Transient One-dimensional Unidirectional Flows

Week 5**:** Steady, Two-dimensional Rectilinear Flows

Week 6**:** Lubrication Theory

Week 7**:** Laminar Boundary Layers - I

Week 8**:** Laminar Boundary Layers - II

Week 9**:** Laminar Free Shear Flows

Week 10**:** Stability Theory

Week 11**:** Turbulent Flows - I

Week 12**:** Turbulent Flows - II