



Advanced Fluid Mechanics

Mechanical Engineering

Instructor Name: Prof. Suman Chakraborty

Institute: IIT Kharagpur

Department: Mechanical Engineering

About Instructor: Dr. Suman Chakraborty is a Professor in the Mechanical Engineering Department of the Indian Institute of Technology (IIT) Kharagpur, India, and Indian National Academy of Engineering Chair Professor. He is also currently the Head, School of Medical Science and Technology at IIT Kharagpur. He has offered a significant number of video courses through the NPTEL programme. These courses include: Introduction to Fluid Mechanics and Fluids Engineering, Computational Fluid Dynamics, and Microfluidics. He has also taught in an online programme (under NMEICT) titled “Talk to 10 Thousand Teachers”.

Pre Requisites: : Basic knowledge of Mathematics and Fluid Mechanics

Core/Elective: : Core

UG/PG: : Both

Industry Support : Oil Companies (IOCL, SHELL, BPCL and others), Automobile and Aviation companies (GE, AIRBUS, TATA Motors and others)

Course Intro: : This is an advanced course in Fluid Mechanics. The subject Fluid Mechanics has a wide scope and is of prime importance in several fields of engineering and science. Present course emphasizes the fundamental underlying fluid mechanical principles and application of those principles to solve real life problems. Special attention is given towards deriving all the governing equations starting from the fundamental principle. There is a well balanced coverage of physical concepts, mathematical operations along with examples and exercise problems of practical importance. After completion of the course, the students will have a strong fundamental understanding of the basic principles of Fluid Mechanics and will be able to apply the basic principles to analyze fluid mechanical systems.

COURSE PLAN

SL.NO	Week	Module Name
1	1	Brief recapitulation of some preliminary concepts of Fluid Mechanics : Fluid Kinematics
2	2	Brief recapitulation of some preliminary concepts of Fluid Mechanics: Dynamics of Inviscid Flows and Reynolds Transport Theorem
3	3	Dynamics of viscous flows - Derivation of Navier-Stokes equation
4	4	Some exact solutions of Navier-Stokes equation-Steady Flows Some exact solutions of Navier-Stokes equation-Steady Flows
5	5	Some exact solutions of Navier-Stokes equation “ Steady Flows (contd) and Practical Applications
6	6	Some exact solutions of Navier-Stokes equation-Unsteady Flows, Introduction to Turbulence



7	7	Introduction to turbulence (contd.), Boundary Layer theory
8	8	Boundary Layer theory (contd.)
9	9	Boundary Layer theory (contd.), Potential flow and flow past immersed bodies
10	10	Potential flow and flow past immersed bodies(contd.)
11	11	Compressible flows
12	12	Compressible flows (contd.)