ADVANCED FLUID MECHANICS

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PRE-REQUISITES : Basic knowledge of Mathematics and Fluid Mechanics

INTENDED AUDIENCE : Mechanical Engineering, Chemical Engineering, Civil Engineering, Aerospace Engineering, Mining Engineering, Atmospheric and Ocean Engineering, Physics

INDUSTRIES APPLICABLE TO : Oil Companies (IOCL, SHELL, BPCL and others), Automobile and Aviation companies (GE, AIRBUS, TATA Motors and others)

COURSE OUTLINE :

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.

ABOUT INSTRUCTOR :

Prof. 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”.

COURSE PLAN :

Week 1**:** Brief recapitulation of some preliminary concepts of Fluid Mechanics : Fluid Kinematics

Week 2**:** Brief recapitulation of some preliminary concepts of Fluid Mechanics: Dynamics of Inviscid Flows and Reynolds Transport Theorem

Week 3**:** Dynamics of viscous flows - Derivation of Navier-Stokes equation

Week 4**:** Some exact solutions of Navier-Stokes equation-Steady FlowsSome exact solutions of Navier-Stokes equation-Steady Flows

Week 5**:** Some exact solutions of Navier-Stokes equation – Steady Flows (contd) and Practical Applications

Week 6**:** Some exact solutions of Navier-Stokes equation-Unsteady Flows, Introduction to Turbulence

Week 7**:** Introduction to turbulence (contd.), Boundary Layer theory

Week 8**:** Boundary Layer theory (contd.)

Week 9**:** Boundary Layer theory (contd.), Potential flow and flow past immersed bodies

Week 10**:** Potential flow and flow past immersed bodies(contd.)

Week 11**:** Compressible flows

Week 12**:** Compressible flows (contd.)