



IDEAL FLUID FLOWS USING COMPLEX ANALYSIS

PROF. AMIT GUPTA

Department of Mechanical Engineering
IIT Delhi

PRE-REQUISITES : Basic course on fluid mechanics

INTENDED AUDIENCE : Senior undergraduate and post-graduate students

COURSE OUTLINE :

The course is meant to impart competence in modelling engineering problems using principles of ideal or potential fluid flows, obtaining analytical solutions and deducing engineering design parameters. The course will focus on the use of complex analysis and highlight it as a classical and a much easier approach to obtain solutions using flow superposition.

ABOUT INSTRUCTOR :

Prof. Amit Gupta is currently working as a Professor and holds the NTPC Chair position in the Department of Mechanical Engineering, IIT Delhi. Prior to joining IIT Delhi, he worked as post-doctoral research fellow at the GM/UM Advanced Battery Coalition for Drivetrains (ABCD), University of Michigan (UM), Ann Arbor. He received his M.S. and Ph.D. at the University of Central Florida (UCF) in 2007 and 2009 respectively, and B.Tech. from IIT Delhi in 2004. His research is directed towards Energy Storage, Microfluidics and Flapping Wing Aerodynamics

COURSE PLAN :

Week 1: Introduction to ideal flows, velocity potential and stream function, complex variables and analytic functions, Complex potential and velocity.

Week 2: Use of complex potentials in developing elementary flows-uniform flow, source and sink, vortex flow, flow in a sector, flow around a sharp edge, Superposition of complex potentials for flow due to a doublet.

Week 3: Use of superposition to obtain flow around a cylinder without and with circulation, source and uniform flow, calculation of force for flow around a circular cylinder with circulation.

Week 4: Generalized derivation for forces on a 2D body, first theorem of Blasius, KuttaZhukhovsky law, Conformal transformations.