HANYANG UNIVERSITY

2019 HISS Syllabus

(Fluid Mechanics)

Professor:	**Balaram Kundu**
E-mail:	bkundu@mech.net.in
Home Univ.:	Jadavpur University
Dept.:	Mechanical Engineering

Description:	This course will provide students with an introduction to principal concepts and methods of fluid mechanics for both compressible and incompressible fluid flow. Topics will be covered in the course include pressure, hydrostatics, and buoyancy; open systems and control volume analysis; mass conservation and momentum conservation for moving fluids; viscous fluid flows and flow through nozzles; stagnation properties and normal shock; flow through a constant area duct with friction; boundary layers; lift and drag on objects; etc. Students will work to formulate the models necessary to study, analyze, and design fluid systems through the application of these concepts, and to develop the problem-solving skills essential to engineering practice of fluid mechanics in practical applications.

Objective:	a) Understanding basic laws, principles and phenomena in the area of fluid mechanics, b) To introduce the Navier Stokes equation and demonstrate its use in simple flows, c) To establish approaches for the analysis of compressible flow in different applications with consideration of an actual flow, d) To solve elementary problems in fluid mechanics, and e) To apply the acquired knowledge and skills in professional and specialist courses.
Preparations:	**Pre-requisites:** Basic knowledge of Physics and Mathematics. **Text Books:** 1. Introduction to Fluid Mechanics by Robert W. Fox & Alan T. McDonald, 2. Fluid Mechanics by F. M. White, 3. Mechanics of Fluids by B.S. Massey, 4. Fluid Mechanics by Pijush K. Kundu & Ira M. Cohen

Schedule:	Week 1	Basic concepts of fluid mechanics. Lagrangian and Eulerian approach, types of fluid flow; streamlines, streakline and pathline; acceleration of fluid flow; deformation and conservation of mass of fluid element; angular deformation of a fluid element, vorticity & stream function; Euler's equation; Bernoulli's equation
	Week 2	Reynolds Transport Theorem-conservation of mass, conservation of linear momentum; Navier's equation of motion, derivation of Navier-Stokes equation; fully developed flow between two parallel plates; Couette flow; introduction to turbulence; Prandtl's mixing length; turbulent Prandtl number; velocity distribution in turbulent flow; Reynolds averaged Navier Stokes equation.
	Week 3	I ntroduction to boundary layer; scaling and order of magnitude analysis; flow over a fat plate: Blasius equation; momentum integral method for boundary layer analysis; approximate solution of the momentum integral equation; displacement and momentum thickness; boundary layer separation; potential flow; lift and drag forces.
	Week 4	Introduction to compressible flows; significance of Mach number; stagnation properties; isentropic and actual flow through variable area ducts; normal shock; converging nozzle; converging-diverging nozzle; effect of back pressure on velocity and pressure distribution in nozzles; chocked flow; adiabatic flow with friction in a constant area duct.

Evaluation:	Midterm (%)	Final (%)	Attendance (%)	Assignments (%)	Participation (%)	Etc. (%)
	30	40	5	20	5	00