

<b>PROFESSOR'S NAME</b>	Prof. Aditya Bandopadhyay
<b>DEPARTMENT</b>	Mechanical Engineering
<b>INSTITUTE</b>	IIT Kharagpur
<b>COURSE OUTLINE</b>	<p><b>Learning outcomes</b></p> <p>This is a first course in fluid mechanics and has a broad coverage of various concepts. The learning outcomes of the course may be itemized as following:</p> <ol style="list-style-type: none"> <li>Idea of a continuum and various fluid properties</li> <li>Fluid statics – application to atmospheric pressure, submerged bodies and their stability,</li> <li>Fluid kinematics – Lagrangian and Eulerian descriptions, streamline, streakline, pathline, strain and rotation rates,</li> <li>Conservation laws – Reynolds transport theorem, conservation of mass, momentum, energy,</li> <li>Inviscid flows – Euler equation, Bernoulli's equation, streamfunction, velocity potential, and complex potential,</li> <li>Dynamics of viscous flows, pipe flows, free surface flows, lubrication approximation, Stokes law for a sphere, Stokes 1<sup>st</sup> and 2<sup>nd</sup> problems</li> <li>Viscous flows through pipes,</li> <li>Boundary layer theory, Integral formulation and Blasius solution;</li> <li>Turbulence – Mean motion and fluctuations, Reynolds stress, Velocity distribution law;</li> <li>Euler turbomachinery equations, pumps,</li> </ol> <p><b>Course outline</b></p> <p>Fluids and idea of continuum; Properties of fluids and dimensional analysis;</p> <p>Fluid statics – manometry, forces on submerged body, buoyancy, stability of floating objects, rigid body motion and problems; Some essential mathematical tools;</p> <p>Kinematics - Particle and field description of motion, Streamline, streakline, and pathlines, Fluid deformation: Strain and rotation, Problems; Reynolds transport theorem;</p> <p>Conservation laws - Introduction and conservation of mass, Conservation of momentum and constitutive relationships, Non-inertial frame of reference, Conservation of energy, Problems;</p> <p>Inviscid flows - Euler's equation, Bernoulli's equation, Application of Bernoulli's equation, Streamfunction and velocity potential, Complex potential; Principles of similarity;</p> <p>Dynamics of viscous flows – Internal flows 1, Internal flows 2, Flows with a free surface, Low Reynolds number flows: Lubrication analysis, Low Reynolds number flows: Flow around a sphere, Problems;</p> <p>Stokes first and second problem; Viscous flows through pipes;</p>

		Boundary layer theory; Introduction to turbulence; Turbomachinery.	
<b>COURSE DETAILS</b>			
<b>S. No</b>	<b>Module ID/ Lecture ID</b>	<b>Lecture Title/Topic</b>	<b>Duration</b>
1	<b>M11-Mod1</b>	Fluids and idea of continuum	0:58:24
2	<b>M11-Mod2</b>	Properties of fluids and dimensional analysis	0:59:53
3	<b>M11-Mod3</b>	Fluid Statics - Manometry	0:59:05
4	<b>M11-Mod4</b>	Fluid Statics – Forces on submerged bodies	0:59:55
5	<b>M11-Mod5</b>	Fluid Statics – Buoyancy & Stability of floating bodies	0:59:25
6	<b>M11-Mod6</b>	Fluid Statics – Stability of floating bodies	0:59:53
7	<b>M11-Mod7</b>	Fluid Statics – Stability of floating bodies	1:00:00
8	<b>M11-Mod8</b>	Some mathematical preliminaries	1:00:00
9	<b>M11-Mod9</b>	Kinematics – Particle and Field description, Lagrangian and Eulerian descriptions	1:00:00

**References if Any:**