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| Department of Mechanical Engineering | | | | | | | | |
| Course Code | Title of the course | | Program Core (PCR) / Electives (PEL) | Total Number of contact hours | | | | Credit |
| Lecture (L) | Tutorial (T) | Practical (P) | Total Hours |
| **MEC 303** | **Fluid Mechanics** | | PCR | **3** | **1** | **0** | **4** | **4** |
| Pre-requisites | | | Course Assessment methods (Continuous (CT) and end assessment (EA)) | | | | | |
| Nil | | | CT+EA | | | | | |
| Course Outcomes | | CO1: To understand the fundamental concepts of fluid mechanics  CO2: To formulate the fundamental equations in mathematical form to solve the fluid mechanics problems  CO3: To apply the conservation equations to analyse both viscous and inviscid flow. | | | | | | |
| CO1    CO2        CO3    CO2  CO2        CO1    CO3 | | I. Introduction: 04  Definition of fluid; Concept of continuum and Knudsen number; Concept of velocity, pressure and stress fields; Stress tensor; Fluid properties; Slip and no-slip; Compressibility and bulk modulus; Vapour pressure; Surface tension; Capillary rise and depression.  II. Kinematics of flow and flow measurements: 05  Definition of flow field; Lagrangian and Eulerian description of fluid motion; Substantial derivative; Pathline, streamsline, streakline, timeline and stream tube; Pure translation, rotation and linear and angular deformation of fluid element; angular velocity; vorticity and circulation; Free and forced vortex flows;  Reynold’s Transport Theorem; Integral form of conservation equations of fluid motion; Acceleration field. 05  Static, stagnation and dynamic pressures: Application of Bernoulli’s Equation (Venturi Meter,Orifice Meter, Pitot Tube, V-notch and Rectangular Weir). 03    III. Differential analysis of fluid motions: Differential control volume: 08  Conservation of mass; conservation of momentum; Stokes’s hypothesis; Navier-Stokes equation; Integral form of energy equation; Euler’s equation of motion of an ideal fluid; Euler’s equation along streamline and normal to stream line; Bernoulli’s Equation from Euler’s equation and from energy equation .  Exact solutions of NS equations for steady incompressible flow: plane Poiseuille flow, Couette Flow, falling film flow. 03  IV. Incompressible Flow through pipes and ducts: 06  Hagen-Poiseuille flow, Darcy Wesibach Equation, Major and minor losses, Surge control;  V. Boundary layer flows: 06  Boundary layer concepts; Prandtl’s boundary layer equations; Blasius Equation for flow over a flat plate; Momentum integral equations for boundary layers; Wall shear stress; Separation of boundary layers; Fluid flows about immersed bodies.  VI. Dimensional Analysis: 04  Measurement and dimension; Variables and functions; Dimensional homogeneity; Pi Theorem; Dimensionless parameters; Scaling rules, dimensionless numbers; Similitude; Similarity solutions and transformations; Geometric and dynamic similitude.  VII. Potential flow: 06  Irrotational flow; Velocity potential and stream function; Stream function for two-dimensional incompressible flow; Laplace equation; Method of solution; Complex potential for fundamental flows; Superposition of elementary flows; Flow about a half body; Uniform flow past a source and a sink, a doublet, and a cylinder with circulation; Aerofoil theory.  VIII. Compressible flow:    Propagation of sound wave; Types of flow regimes: Mach cone; Stagnation and critical states; 02  Isentropic flow of an ideal gas: area variation; Isentropic flow in converging and converging-diverging nozzle; normal shock. 04 | | | | | | |
| Text Books, and/or reference material | | **Text Books:**  1. Introduction to Fluid Mechanics: Fox &McDonald  2. Fluid Mechanics: Munson and Okiish  3. Fluid Mechanics: Robert Granger  4. Introduction To Fluid Mechanics And Fluid Machines: S. K. Som, G. Biswas and S. Chackraborty | | | | | | |
| **Reference Books:**   1. Fluid Mechanics: Frank M. White 2. Mechanics of Fluids: B. S. Massey | | | | | | |

Total Class hour= 14 X4=56

SCR-34 ; Marked BLUE

ANM-33 ; Marked RED

RNB-33 ; Marked Black