SE MECHANICAL (2008 Course)
202043 Fluid Mechanics

Max. Marks : 100 **Time: 03 Hrs.**

1. **Solve three questions from each section**
2. **Answers to two sections should be written in separate answer books**
3. **Figures to the right indicate maximum marks**
4. **Assume suitable data if required**
5. **Non-Programmable scientific calculator is allowed**

Section –I

Q.1. a) Define the following terms: 08

i) Specific Weight and Mass Density
ii) Adhesion and Cohesion
iii) Surface tension and Capillarity
iv) Dynamic Viscosity and Kinematic Viscosity

b) A dash pot 10 cm diameter and 20.5 cm long slides vertically down in a 10.05 cm dimeter cylinder. The oil filling the annular space has a viscosity of 0.80 poise. Find the speed with which rhe piston slides down if load on the piston is 20 N. 10

OR

Q. 1. a) Explain in brief the following terms: 08

i) Steady and Unsteady flow
ii) Uniform and non-uniform flow
iii) Laminar and turbulent flow
iv) Rotational and Irrotational flow

b) A two dimensional flow is described by the velocity components: $u= 5x^3$ and $v = -15x^2y$. Evaluate the stream function , velocity and acceleration at point P(1,2). 10

Q.2 a) Explain the concept of absolute, gauge and vacuum pressures. What is a pressure head? How pressure can be expressed in terms of height of liquid column? 06

b) A circular opening, 3 m in diameter in the vertical side of a water tank is closed by a circular disc of same dimeter, which can rorate about a horizontal diameter. If the head of water above the horizontal diameter is 4 m, Calculate – 10

i) Force on the disc and
ii) Torque required to maintain the disc in vertical position.

OR

Q. 2 a) Explain the following terms: 06

i) Pressure at a point
ii) Total Pressure
iii) Centre of Pressure
iv) Pressure on a surface

b) A wooden block of specific gravity 0.75, width 15 cm, Depth 30 cm, and length 150 cm floats horizontally on the surface of sea water with specific weight 10 kN. Calculate the volume of water displaced, depth of immersion and centre of buoyancy. Also find the metacentric height of the wooden block. 10

Q.3 a) State and explain the Navier – Stoke's Equation and Euler equation of motion along a stream line. 08

b) Explain the working of Orifice meter 08

OR

Q. 3 a) State and explain Bernaulli's equation. 08

b) Explain the working of Venturirmter 08

Section –II

Q.4 a) State and explain Hagen Poiseuille equation for laminar flow in cicular pipes 06

b) A container full of oil has a horizontal parallel crack in its end wall which is 300 mm wide and 50 mm thick in the direction of flow. The pressure difference between two faces of the crack is 10kPa and the crack forms a gap of 0.4 mm between the parallel surfaces. If specific gravity and viscosity of oil is 0.85 and 1.7 poise respectively, Calculate – 12

i) Volume of oil leakage per hour through the crack
ii) Maximum leakage velocity
iii)shear stress and velocity gradient at the boundary

OR

Q 4 a) State and explain Buckingham pi theorem 08

b) What are dimensionless numbers? What is their significance? Briefly explain - Reynold number and Mach number 10

Q.5 a) State and explain Darcy- Weisbach equation. 08

b) Two sharp ended pipes of diameters 50 mm and 100 mm respectively, each of length 100 m are connected in parallel between two reservoirs which have a difference of level of 10 m . If coefficient of fiction for each pipe is 4f = 0.3, calculate the rate of flow for each pipe and also the diameter of a single pipe 100 m long which would have same discharge if it were substituted for the original two pipes. 10

OR

Q 5 a) Explain the concept of Hydraulic Gadient and total energy lines. 04

b) What are major and minor losses in pipes? Explain 06

c) Explain in brief 'Moody diagram'. 06

Q 6 a) Explain Prandtl mixing length concept in turbulent flow 10

b) What is CFD Methodology? Explain. 06

OR

Q.6 a) Explain the Seperation of Boundary Layer and methods of its controlling. 08

b) Briefly explain the development of lift on Aerofoil. 08