

SE Civil - III 'e'

2.12.23

(3Hours)

Max Marks=80

Note 1. Question 1 is compulsory

2. Attempt any 4 out of six questions

3. Assume any suitable data where ever required

Q.1 Attempt any four

- a. Define co-efficient of contraction, co-efficient of velocity, co-efficient of discharge. 05
- b. A projectile is travelling in air having pressure and temperature as 10.1043 N/cm^2 and -10°C at a speed of 1500 km/hour . Find Mach number and the Mach angle. Take $k=1.4$ and $R=287 \text{ J/kg}^\circ\text{K}$ 05
- c. Explain types of fluid flow. 05
- d. Define following terms: 05
- Bulk modulus
 - Surface tension
 - Specific weight
 - Specific gravity
 - Mass density
- e. Short note : condition of stability of floating and submerged bodies 05

- Q.2 a. What is meta centre? Derive an expression for the meta-centric height of a floating body by analytical method. 10
- b. What is viscosity? A plate 0.025 mm distant from a fixed plate, moves at 60 cm/s and requires a force of 2 N per unit area i.e., 2 N/m^2 to maintain this speed. Determine the fluid viscosity between the plates. 10

- Q.3 a. Water flows over a rectangular weir 1 m wide at a depth of 150 mm and afterwards passes through a triangular right-angled weir. Taking C_d for the rectangular and triangular weir as 0.62 and 0.59 respectively, find the depth over the triangular weir. 10
- b. An orifice meter with orifice diameter 10 cm is inserted in a pipe of 20 cm diameter. The pressure gauge fitted upstream and downstream of the orifice meter gives reading of 19.62 N/cm^2 and 9.81 N/cm^2 respectively. Co-efficient of discharge for the orifice meter is given as 0.60 . Find the discharge of water through pipe. 10

- Q.4 a. State and prove Pascal's law. 10
- b. A rectangular plane surface 2 m wide and 3 m deep lies in water in such a way that its plane makes an angle of 30° with the free surface of water. Determine the total pressure and position of centre of pressure when the upper edge is 1.5 m below the free water surface. 10

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- Q.5 a. The velocity components in a two-dimensional flow field for an incompressible fluid are as follow: $u = y^3 + 6x - 3x^2y$ and $v = 3xy^2 - 6y - x^3$. Obtain expression for stream function Ψ . 10
- b. Find the mach number when an aeroplane is flying at 1100 km/hour through still air having a pressure of 7 N/cm² and temperature -50 C. wind velocity may be taken as zero. Take $R = 287.14$ J/kg K. Calculate the pressure, temperature, and density of air at stagnation point on the nose of the plane. Take $k = 1.4$. 10
- Q.6 a. A horizontal venturimeter with inlet and throat diameters 30 cm and 15 cm respectively is used to measure the flow rate of water. The reading of differential manometer connected to the inlet and the throat is 20 cm of mercury. Determine the rate of flow. Take $C_d = 0.98$. 10
- b. What is Euler's equation of motion? Derive Bernoulli's equation from Euler's equation. state the assumption made and limitation of Bernoulli's equation. 10
