

Time: 3 Hours

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. Explain the following term 05
- i) Surface tension
 - ii) Mass density
 - iii) Viscosity
 - iv) Capillarity
 - v) Vapour pressure
- b. Define Buoyancy and explain Archimede's principle, 05
- c. Write a short note on flow net with its uses. 05
- d. Write a note on Mach number and its significance 05
- e. Derive Bernoulli's equation for compressible flow. 05

- Q.2 a. A hydraulic press has a ram of 20cm diameter and a plunger of 3 cm diameter. It is used for lifting a weight of 30 KN. Find the force required at the plunger. 05
- b. An oil of specific gravity 0.8 is flowing through a venturi meter having inlet diameter 20cm and throat diameter 10 cm. The oil- mercury differential manometer shows a reading of 25 cm. Calculate the discharge of oil through the horizontal venturi meter. Take $C_d = 0.98$. 05
- c. Derive expression for time of emptying a circular horizontal tank. 10

- Q.3 a. Find the kinematic viscosity of an oil having density 981Kg/m^3 . The shear stress at a point in oil is 0.2452N/m^2 and velocity gradient at that point is 0.2 per second. 05
- b. A sharp crested rectangular weir of 1m height extends across a rectangular channel of 3 m width. If the head of water over the weir is 0.45m, Calculate the discharge, consider velocity of approach and assume $C_d = 0.623$. 10
- c. Write a short note on Stagnation properties. 05

- Q.4 a. Explain analytical method for Meta-centric height. 10
b. Write in detail about the types of flow. 05
c. Explain propagation of pressure waves in detail. 05
- Q.5 a. A closed tank partially filled with water up to a height of 0.9m having an orifice of diameter 15 mm at the bottom of the tank. The air is pumped into the upper part of the tank. Determine the pressure required for a discharge of 1.5 liters/ sec through the orifice. Take $C_d=0.62$ 10
b. Determine the velocity of a bullet if the Mach angle is 30° . Given the temperature of the air is 22°C . ($k=1.4$ and $R=287 \text{ J/Kg K}$) 10
- Q.6 a. Write a short note on 10
i) Piezometer
ii) U-tube Manometer
iii) Single Column Manometer
b. The velocity vector in a fluid flow is given by, $V=4x^3i-10x^2yj+2tk$ Find the velocity and acceleration of a fluid particle at (2, 1, 3) at time $t = 1$. 10
