

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note: Attempt five questions in all, selecting one question each from section A, B, C and D. Section-E is compulsory.

Section A

1. (a) Differentiate between Newtonian and Non-Newtonian fluids with examples. (6)
 - (b) The right limb of a simple U-tube manometer containing mercury is open to the atmosphere while the left limb is connected to a pipe in which a fluid of sp. gr. 0.9 is flowing. The centre of the pipe is 12 cm below the level of mercury in the right limb. Find the pressure of fluid in the pipe if the difference of mercury level in the two limbs is 20 cm. (6)
 2. (a) Define capillarity and derive the expression for the capillary rise in a tube. (6)
 - (b) Discuss the Variation of Viscosity with temperature for both liquid and gases in detail with neat sketches. (6)
- Section B**
3. (a) What are velocity potential function and stream function? Derive the continuity equation in Cartesian coordinates. (6)

(b) Differentiate between:

- steady and unsteady flow,
 - uniform and non-uniform flow
 - laminar and turbulent flow
- (6)

4. (a) Explain any 3 in brief -

- streamline - path line
 - streak line - stream tube.
- (6)

(b) A 25 cm diameter pipe carries oil of sp. gr. 0.9 at a velocity of 3 m/s. At another section the diameter is 20 cm. Find the velocity at this section and mass rate of flow of oil. (6)

Section C

5. (a) Derive Bernoulli's equation and state its limitations. (6)
- (b) A 30 cm x 15 cm venturi meter is inserted in a vertical pipe carrying water, flowing in the upward direction. A differential mercury manometer connected to the inlet and throat gives a reading of 20 cm. Find the discharge. Take $C_d = 0.98$. (6)
6. (a) What is the Momentum Principle? Derive the equation for force exerted by a fluid jet on a fixed plate. (6)
- (b) Find the velocity of the flow of an oil through a pipe, when the difference of mercury level in a differential U-tube manometer connected to the two tapplings of the pitot-tube is 100 mm. Take co-efficient of pitot-tube 0.98 and sp. gr. of oil = 0.8. (6)

Section D

7. (a) Explain Hydraulic gradient line and Total energy Line with a neat sketch. (6)
- (b) How can power be transferred through pipe? Explain with neat sketch. (6)
8. (a) Derive the expression for discharge over a Cipolletti weir and compare it with a rectangular notch. (6)
- (b) Explain the equivalent pipe theory. Also explain water Hammer Phenomenon. (3 + 3 = 6)

Section E (Compulsory)

9. Answer the following short questions:
- (a) Differentiate between absolute pressure, gauge pressure, and vacuum pressure.
- (b) Define Newton's law of viscosity, H.G.L and T.E.L
- (c) Key differences between hydraulic gradient line (HGL) and total energy line (TEL). Explain the practical applications of these lines.
- (d) What is the significance of Reynolds number in fluid flow?
- (e) Define hydraulic coefficients of an orifice.
- (f) What is the water hammer phenomenon? Explain its effects. (6×2 = 12)