

(3 Hours)

Max. Marks: 80

**N.B:**

1. Question No. **ONE** is compulsory
2. Out of remaining questions attempt any **Three** questions.
3. In all four questions to be attempted.
4. Figures on the right hand side indicate full marks.
5. Assume suitable data, if required.

- Q.1 a) Explain in brief, (Any Five) 20
- a) Newton's law of viscosity
  - b) Centre of buoyancy and ii) Metacentric height
  - c) i) Steady and Unsteady flow ii) Uniform and Non-Uniform flow
  - d) i) Stream function and Velocity Potential function.
  - e) Desirable properties of hydraulic fluid.
  - f) Differences between Hydraulic and Pneumatic system.
  - g) Check Valve and its application.
- Q.2 a) Derive Bernoulli's equation and state the assumptions made. 08
- b) State the conditions for stability of Submerged and Floating bodies. 06
- c) Dynamic viscosity of oil used for lubrication between a shaft and a sleeve is 6 Poise. The shaft is of diameter 0.4 m and rotates at 190 rpm. Calculate the power lost in the bearing for a sleeve length of 0.09 m. Thickness of oil is 1.5 mm. 06
- Q.3 a) Explain the working of Meter-in and Meter-out circuit with the help of neat sketch and also state their advantages, disadvantages and limitations. 08
- b) Derive an expression for total pressure and centre of pressure for a fully submerged inclined surface. 08
- c) Calculate the total hydrostatic force and location of centre of pressure for a circular plate of 2.5 m diameter immersed vertically in water with its top edge 1.5 m below the oil surface (Sp. Gr.=0.9). 04
- Q.4 a) Explain the principle of operation and working of regenerative and sequencing hydraulic circuit with neat sketch. 10
- b) Derive Hagen-Poiseuille equation for laminar flow through circular pipe 10
- Q.5 a) Explain the working of the valves given below with neat sketches. 08
- i. Pressure relief valve
  - ii. Sequence valve
- b) With the help of neat sketch explain the working of balance vane pump. 08
- c) An oil of specific gravity 0.8 is flowing through a venturimeter having 04

inlet diameter 20 cm and throat diameter 10 cm. The oil ( $S_o = 0.8$ )-mercury differential manometer shows a reading of 25 cm. Calculate the discharge of oil through the horizontal venturimeter. Take  $C_d = 0.98$ .

- Q.6 a) Write ISO symbol for following (Any Five) 10
- i. Flow control valve
  - ii. Bidirectional variable displacement motor
  - iii. Pressure switch
  - iv. Pressure relief valve
  - v. Fixed displacement hydraulic pump
  - vi. Double acting cylinder
- b) An existing pipe line 800 m long consists of four sizes namely, 30 cm for 175 m, 25 cm dia for the next 200 m, 20 cm dia for the next 250 m and 15 cm for the remaining length. Neglecting minor losses, find the diameter of the uniform pipe of 800 m. Length to replace the compound pipe. 05
- c) Calculate the loss of head in a pipe having a diameter of 15 cm and a length of 2 km. It carries oil of specific gravity 0.85 and viscosity of 6 Stokes at the rate of 30.48 lps (Assume laminar flow). 05

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