

(Three Hours)

80 Marks

N.B. (I) Question No 1 is compulsory

(ii) Attempt any Three questions out of Five questions

(iii) Illustrate with figures whenever necessary

(iv) Assume suitable data if necessary and state it clearly

1 Solve any Four

[20]

- What are different types of fluids?
- What do you mean by velocity potential function and stream function?
- Define the terms (i) source (ii) sink (iii) Doublet
- What do you mean by velocity of approach? What will be discharge through rectangular notch if velocity of approach is considered?
- Calculate the pressure intensity due to depth of 0.5 m of (i) water (ii) mercury (iii) an oil of specific gravity 0.85
- What are different types of fluid flows?

2 (a) (i) For having a blood sample a fine glass of capillary of diameter 2 mm was held on freshly punctured finger tip. Estimate in ML the volume of blood sample so drawn. Take surface tension as 5×10^{-2} N/m and its contact angle with glass as zero degree. Take density of blood as 1060 kg/m^3

[5]

2 (a) (ii) A 2 cm wide gap between two vertical plane surfaces is filled with an oil of specific gravity 0.85 and of dynamic viscosity 2.5 N.s/m^2 . A metal plate $1.25 \text{ m} \times 1.25 \text{ m} \times 0.2 \text{ cm}$ thick and weighing 30 N is placed midway in the gap. Find the force required if plate is to be lifted with a constant velocity of 0.12 m/s

[10]

2 (a) (iii) State and prove the Pascal's Law.

[5]

3 (a) A vertical gate 6 m long and 2 m wide is hinged at 0.15 m below the centre of gravity of gate. The total depth of water is 14 m. What horizontal force is required at the bottom of gate to keep it closed?

[10]

3 (b) Explain why a 3 m cylindrical buoy 4.2 m long and weighing 4.1 tonnes can not float in water?

[10]

4 (a) A closed cylindrical vessel of length 50 cm and diameter 30 cm contains water up to a height of 80 cm. The cylinder is rotated at a speed of 250 rpm about its vertical axis. Find the height of paraboloid formed.

[10]

4 (b) Obtain an expression for continuity equation for a three dimensional flow. [10]

5 (a) A 150 mm x 75 mm venturimeter with a coefficient of discharge 0.98 is to be replaced by an orifice meter having a coefficient of discharge 0.6. If both the meters are to give same mercury manometer reading for a discharge of 100 lit/s and the inlet diameter is to remain 150 mm, what would be the diameter of orifice ? [10]

5 (b) A pipe line carrying oil of specific gravity of 0.8 changes in diameter from 300 mm at position 1 to 600 mm diameter at position 2 which is 5 meters at a higher level. If the pressures at positions 1 and 2 are 100 KN/m² and 60 KN/m² respectively and discharge is 300 litres/sec, determine [10]

(i) Loss of head

(ii) Direction of flow

6 (a) (i) The maximum flow through a rectangular channel is 2.2 m deep and 3 m wide is 1.8m³/s. Find the maximum height at which the crest of the weir may be installed so that water will not overflow the side of the channel. Take $C_d = 0.62$ [5]

6 (a) (ii) Prove that an error of 1 % in the measurement of head will produce an error of 2.5 % in the measurement of discharge over a triangular notch. [5]

6 (b) (i) A tank 1 m x 1m in area has a 20 mm diameter orifice at its bottom. Initially the depth of water is 4 m. Find time taken for the water surface to drop by 1 m. [5]

6 (b) (ii) Give the classification of mouthpieces [5]
