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1788

Fluid Mechanics
(1110, 1100, 1090)

P. Pages : 3

Time : Three Hours

Max. Marks : 100

Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Answersheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. All questions are compulsory. Solve **any two** bits from each question.
5. Use of non-programmable calculator is allowed.
6. Figure to the right indicate full marks.
7. Assume suitable data if necessary.

1. a) Define :   **10**

     i) Viscosity.

     ii) Kinematic Viscosity.

     iii) Compressibility.

     iv) Surface Tension.

     v) Capillarity

     And also write down its units.

   b) A rectangular plate surface is 2m wide and 3m deep. It lies in vertical plane in water. Determine the total pressure and position of centre of pressure on the plane surface when its upper edge is horizontal and

     a) Coincides with water surface.

     b) 2.5m below the free water surface.   **10**

   c) What are the conditions of equilibrium of floating body and submerged body and explain them ?   **10**

2. a) Explain :   **10**

i)   Steady and unsteady flow

ii)   Uniform and Non uniform flow

iii) Laminar And Turbulent flow

iv) Compressible and Incompressible flow.

v)   Rotational and irrotational flow.

b) Obtain an expression for continuity equation for a three dimensional flow.   **10**

c) The inlet and throat diameters of horizontal venturimeter are 30cm and 10cm respectively. The liquid flowing through the meter is water. The pressure intensity at inlet is 13.734 N/cm^2 while the vacuum pressure head at throat is 37cm of Mercury. Find the rate of flow. Assume that 4% differential head is lost between the inlet and the throat. Find also the value of Cd for the Venturimeter.   **10**

3. a) Prove that the maximum velocity in a circular pipe for viscous flow is equal to two times the average velocity of the flow.   **10**

b) The radial clearance between a hydraulic plunger and the cylinder wall is 0.1mm, the length of plunger is 300mm and diameter 100mm. Find the velocity of leakage and the rate of leakage past the plunger at an instant when the difference of the pressure between the two ends of plunger is 9m of water. Take $\mu = 0.0127$ poise.   **10**

c) Determine the difference in the elevation between the water surfaces in the two tanks which are connected by horizontal pipe of diameter 300mm and length 400m. The rate of flow of water through the pipe is 300 lit/sec. Consider all losses and take f = 0.008.   **10**

4. a) A syphon of diameter 200mm connects two reservoirs whose water surface level differ by 40m. The total length of pipe is 8000m. The pipe crosses a ridge. The summit of ridge is 8m above the level of water in the upper reservoir. Determine the minimum depth of pipe below the summit of the ridge, if the absolute pressure head at the summit of syphon is not to fall below 3.0m of water. Take f = 0.006 and atmospheric pressure head = 10.3 m of water. The length of syphon from the upper reservoir to the summit is 500m. Find the discharge also.   **10**

b) Prove that condition for Maximum power transmission through pipe is

$h_f = H/3$ **10**

c) A pipe line of length 2000m is used for power transmission. If 110.3625kw power is to be transmitted through the pipe in which water having a pressure of 490.5 N/cm^2 at inlet is flowing. Find the diameter of the pipe corresponding to maximum efficiency of transmission Take f = 0.0065.   **10**

5. a) What is reciprocating pump. Describe the principle and working of reciprocating pump with neat sketch.   **10**

b) What is an Air Vessel ? Describe with neat sketch working and function of Air Vessel for reciprocating pumps.   **10**

c) Write down classification of Reciprocating pump. Explain slip, percentage slip and negative slip of Reciprocating pump.   **10**

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