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Fluid Mechanics
(123101 / 213101)

P. Pages : 3

Time : Three Hours **Max. Marks : 80**

Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Answer sheet 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.
5. Attempt **any two** sub questions from each question out of a, b, c.
6. Figure to the right indicate full marks.
7. Use of non programmable calculator is allowed.
8. Assume suitable data if necessary.

1. a) State and prove the Pascal's law. **8**

b) A Rectangular pontoon 10 m long, 7m broad and 2.5 m deep weights 686. 7KN it carries in its upper deek an empty boiler of 5m diameter weighting 588.6 KN. The centre of gravity of the boiler and the Pontoon are at their respectives centres along a vertical line. Find metacentric height weight density of sea water is 10.104 KN/m^3. **8**

c) A 15 cm diameter vertical cylinder rotates concentrically inside another cylinder of diameter 15.10 cm. Both cylinders are 25 cm high. The space between the cylinders is filled with a liquid whose viscosity is unknown. If a torque of 12 N-m is required to rotate the inner cylinder at 100 rpm, determine the viscosity of the fluid. **8**

2. a) Define the following and give one practical example for each. **8**

i) Laminar flow.

ii) Turbulent flow.

iii) Steady flow.

iv) Uniform flow.

b) The inlet and throat diameters of a horizontal venturimeter are 30 cm and 10 cm respectively. The Liquid flowing through the meter is water. The pressure intensity at inlet is 13.734 N/cm^2 while the vaccum pressure head at the throat is 37 cm of mercury. Find rate of flow. Assume that 4% of the differential head is lost between the inlet and throat. Find also the value of Cd for the venturimeter . **8**

c) State Bernoulli's theorem for steady flow of an incompressible fluid. Derive an expression for Bernoulli's theorem from first principle and state the assumptions made for such a derivation. **8**

3. a) An oil of viscosity 0.1 NS/cm^2 and relative density 0.9 is flowing through a circular pipe of diameter 50 mm and of length 300m. The rate of flow of fluid through the pipe is 3.5 litre/s. Find the pressure drop in a length of 300 m and shear stress at the pipe wall. **8**

b) A shaft having a diameter of 50 mm rotates centrally in a journal bearing having a diameter of 50.15 mm and length 100 mm. The angular space between the shaft and the bearing is filled with oil having viscosity of 0.9 poise. Determine the power absorbed in the bearing when the speed of rotation is 60 rpm. **8**

c) Define **8**

i) Laminer boundary layer.

ii) Turbulent boundary layer.

iii) Laminer sublayer.

iv) Boundary layer thickness.

4. a) Define **8**

i) Reynolde's number.

ii) Froude's number.

iii) Euler's number.

iv) Weber's number.

b) A pipe of diameter 20 cm and length 2000 m connects two reservoirs, having difference of water levels as 20 m. Determine the discharge through pipe. **8**

If additional pipe of diameter 20 cm and length 1200 m is attached to the last 1200 m length of the existing pipe, find the increase in discharge. Take f = 0.015 and neglect minor losses.

c) Prove that the head lost due to friction is equal to one Third of the total head at inlet for maximum power transmission through pipes. **8**

5. a) Define centrifugal pump. Explain the working of a single stage centrifugal pump with sketch. **8**

b) A three stage centrifugal pump has impellers 40 cm in diameter and 2 cm wide at outlet. The vanes are curved back at the outlet at 45º and reduce the circumferential area by 10%. The manometric efficiently is 90%. and the overall efficiency is 80%. Determine the head generated by the pump when running at 1000 rpm delivering 50 litres per second. What would be the shaft Power ? **8**

c) What is negative slip in a reciprocating pump ? Explain with neat sketch the function of air vessels in a reciprocating pump. **8**

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