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KC-8119

B. E. (Sem. III) (Mech.) Examination

November / December – 2012

Fluid Mechanics

Time : **3** Hours] [Total Marks : **100**

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ **B. E. (SEM. 3) (MECH.)**

Name of the Subject :

☛ **FLUID MECHANICS**

☛ Subject Code No. : **8 1 1 9** ☛ Section No. (1, 2,.....) : **NIL**

Seat No. :

Student's Signature

(2) Attempt all questions.

(3) Figures to the right indicate full marks.

(4) Assume suitable data if necessary.

1 Attempt all question : **10**

(1) Define :

(a) Surface tension

(b) Capillarity

(2) Discuss effect of temperature on viscosity.

(3) Explain total pressure and centre of pressure.

(4) Differentiate uniform and non uniform flow.

(5) (a) The Numerical value of 1 bar = _____ Pa.

(i) 1 N/m^2 (ii) 1 MN/m^2

(iii) 1 N/mm^2 (iv) 1 kg/cm^2

(b) The intensity of pressure at bottom of liquid for, liquid vertical height h from free surface

(i) $p = \rho g h^2$ (ii) $p = gh$

(iii) $p = \rho g h$ (iv) $p = \frac{1}{2}\rho g h^2$

2 Attempt any **four** question : **20**

(1) Derive an expression for total pressure and centre of pressure for vertically immersed surface.

(2) Explain Archimedes principle

(3) Derive an expression for the measurement of velocity of flow at any point in a pipe by pitot tube.

(4) Give classification of fluid flow and define pathline, streamline and streak line.

(5) Differentiate

(i) Real fluid and ideal fluid

(ii) Steady flow and unsteady flow.

3 Solve any **four** example : **20**

(1) A plate 0.03 mm distance form a fixed plate, moves at 70 cm/s and requires a force of 3 N/m^2 to maintain this speed. Calculate the fluid viscosity between the plates.

(2) A U tube manometer measure the pressure difference between two points A and B in a liquid of density ρ_1. The U-tube contains mercury of density ρ_2. Calculate the difference of pressure between points A and B if the liquid contains at A is water. Take a = 1.5 m, b = 0.75 m and h = 0.5 m.

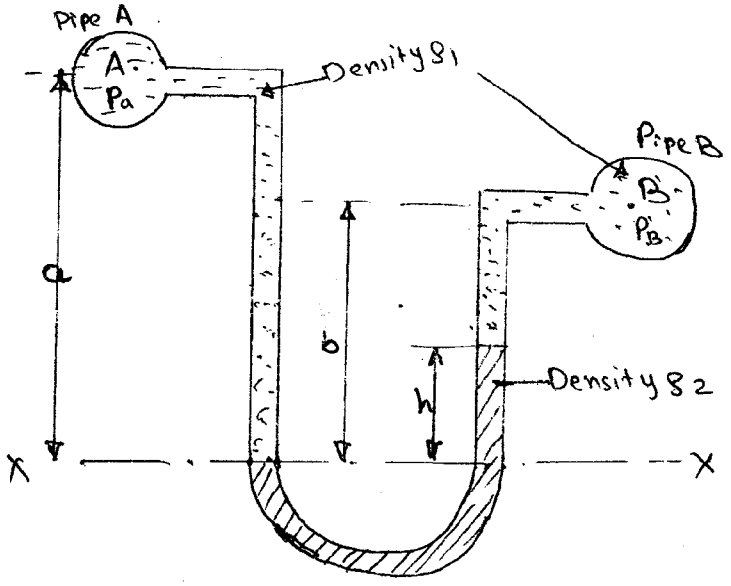

Fig.

(3) A circular lamina 125 cm in diameter is immersed in water so that the distance of its edge measured vertically below the free surface varies 60 cm to 150 cm. Find the total force due to water on one side of the lamina and vertical distance of the centre of pressure below the water surface.

(4) A jet of water 30 mm diameter nozzle leaves the nozzle tip with 14m/s and is directed vertically upwards. If the jet remains circular, calculate its diameter at a point 4m above the nozzle tip. Neglect any loss of energy.

(5) The water is flowing through a taper pipe of length 100 m having diameter 600 mm at the upper end and 300 mm at the lower end, at the rate of 50 litres/sec. The pipe has a slope of 1 in 30. Find the pressure at the lower end if the pressure at the higher level is 19.62×10^4 N/m^2 and lower end is 10 m above datum.

4 (a) Derive the equation of motion for vertex flow. **15**

(b) Find the expression for power P developed by a pump when P depends upon the head H, the discharge Q and specific weight V of the fluid.

5 (a) What is the methods of dimensional analysis ? Describe the Rayleig's's method for dimensional analysis. **15**

(b) The frictional torque T of a disc of diameter D rotating at a speed N in a fluid of viscosity μ and density q in a turbulent flow is given by,

$$T = D^5 N^2 q \phi \left[\frac{\mu}{D^2 N q} \right]$$

Prove this by the method of dimension.

OR

5 (a) What is undistorted and distorted model ? What are the advantages of using distorted model ? **15**

(b) Oil is flowing though a pipe of 0.25 m diameter having viscosity equal to 1.5 N-S/m^2 compute the shearing stress at the pipe wall and within the fluid 50 mm from the pipe wall, if the maximum velocity is 3 m/sec. at the centre of pipe. Take sp. gravity of oil = 0.85.

6 Attempt any four **20**

(1) Prove that the maximum velocity is twice the average velocity of the flow for viscous flow in a circular pipe.

(2) Describe various methods of determine co-efficient of viscosity of a liquid.

(3) Derive an expression for velocity distribution in terms of average velocity for

(a) Smooth pipe

(b) Rough pipes.

(4) Derive Darcy weisbach formulae for the loss of head due to friction in pipes.

(5) Derive the expression of velocity of sound wave in a fluid.

(6) Write a short notes on "Shock waves".
