B.E. Fourth Semester (Civil Engineering) (CGS)

10182 : Fluid Mechanics - I : 4 CE 02

P. Pages : 3

Time : Three Hours

* 0 5 3 7 *

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Max. Marks : 80

Notes : 1. Answer **three** question from Section A and **three** question from Section B.
2. Assume suitable data wherever necessary.
3. Illustrate your answer necessary with the help of neat sketches.
4. Use of scientific calculator is allowed.
5. Use of pen Blue/Black ink/refill only for writing the answer book.

SECTION – A

1. a) Define the term absolute and Gauge pressure. **7**
Calculate the Gauge and absolute pressure within.

i) A droplet of water 0.45 cm in dimeter.

ii) A Jet of water 0.35 cm in diameter.

Assume surface tension of water in contact with air as 0.072 N/m and the atmospheric pressure as 10.1043×10^4 N/m^2.

b) State Newton's law of viscosity. How fluids are classified on the basis of viscosity? **6**
Explain why the viscosity of a liquid decreases with increase in temperature.

OR

2. a) Show that the rate of increase of pressure in vertical down ward direction must be equal to specific weight of the fluid at that point. **7**

b) A U-tube is made up of two capillaries of bore 1mm and 2mm respectively. The tube is held vertically and is partially filled with liquid of surface tension 0.05 N/m and Zero contact angle. Calculate the mass density of the liquid if the estimated difference in the level of two menisci is 12.5 mm. **6**

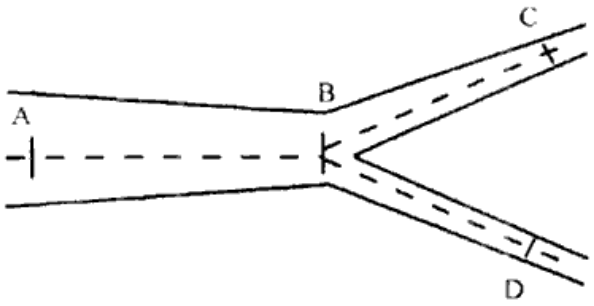
3. a) A circular plate of diameter 3 m is immersed in a liquid of specific gravity 1-2, in such a way that its greatest and least depths below the free surface are 3-5m and 1.5m respectively. Determine the total pressure and position of the centre of pressure. **7**

b) The stream function for a two dimensional flow is given by $\psi = 2xy$, Calculate the velocity at the point P (2,3). Find the velocity potential function ϕ. **7**

OR

4. a) Define metacentre and metacentric height. Explain stability of floating bodies with suitable sketches. **7**

b) A pipe AB branches in to two pipes BC and BD as shown in figure. 7



The pipe has diameter of 45cm at a, 30cm at B, 20cm at C and 15cm at D.
Determine the discharge at A if the velocity at A is 2 M/s. Also determine the velocities at B and D if the velocity at C is 4 M/s.

5. a) Derive Euler's equation of motion, by considering flow along a stream line. 7

b) 250 Lit/ sec of water is flowing in a pipe having a diameter of 300 mm. If the pipe is bent by 135°, find the magnitude and direction of the resultant force on the bend. The pressure of water flowing is 400 kN/m^2. 6

OR

6. a) Derive Bernoulli's equation from Euler's equation of motion. State assumptions mode in the derivation of Bernoulli's equation. 6

b) A pipe line carrying an oil (Sp. gr. 0.87) changes in diameter from 200mm diameter at position '1' to 500mm diameter at position '2' which is 4m at a higher level. If the pressures at position '1' and '2' are 100 kN/m^2 and 60 kN/m^2 respectively and the discharge is 0.2 m^3/s, determine. 7
i) Loss of head, and
ii) Direction of flow.

SECTION – B

7. a) A Venturimeter with 150 mm diameter at inlet and 100 mm at throat is laid with its axis horizontal and is used for measuring the flow of oil of Sp. gr. 0.9. The oil mercury differential manometer shows a Gauge difference of 200 mm. Calculate the discharge. Assume the coefficient of meter as 0.98. 6

b) Define the following terms. 2
i) Suppressed weir.
ii) Contracted weir with suitable sketches.

c) Derive expression for discharge applicable to a rectangular notch/weir. 6

OR

8. a) Explain the orifice coefficients: 6

i) Coefficient of contraction (C_c).
ii) Coefficient of velocity (C_v).
iii) Coefficient of discharge (C_d) hence show that $C_d = C_c \times C_v$.

b) A suppressed weir is constructed across a channel of 0.77m width with head of 0.39m and the crest 0.60m above the bed of channel. Estimate the discharge over it. Consider the velocity of approach and assume $C_d = 0.62\dot{5}$. **6**

c) State advantages of triangular notch/ weir over rectangular notch/weir. **2**

9. a) Define energy thickness, momentum thickness and Displacement thickness along a flat plate. **6**

b) A crude oil of viscosity 0.9 poise and specific gravity 0.8 is flowing through a horizontal circular pipe of diameter 8cm and of length 15m. Calculate the difference of pressure at the two ends of the pipe if 50 kg of the oil is collected in a tank in 15 seconds. **7**

OR

10. a) Prove that the ratio of maximum velocity to average velocity for a laminar flow through horizontal circular pipe is 2.0. **6**

b) The velocity distribution in the boundary layer is given by $\frac{U}{\upsilon} = \frac{y}{\delta}$ where U is the velocity at a distance Y from the plate and $U = \upsilon$ at $y = \delta, \delta$ being boundary layer thickness. Find **7**

i) The displacement thickness.
ii) The momentum thickness.
iii) The energy thickness.

11. a) Explain in brief the various types of drag. Explain briefly about the coefficient of drag and lift. **6**

b) A pipe of diameter 50 mm is 6m long and velocity of flow of water in the pipe is 2.4 m/s. What loss of head and the corresponding power would be saved if the central 2m length of pipe was replaced by 75 mm diameter pipe, if the change of section being sudden? Take F = 0.04 for pipes of both diameters. **7**

12. a) A piping system consists of three pipes arranged in series. The lengths of pipes are 1200m, 750m, and 600m and diameters 750 mm, 600mm and 450mm respectively. **6**

i) Transform the system to an equivalent 450 mm diameter pipe and.
ii) Determine the equivalent diameter for the pipe, 2550 m long.

b) Explain in brief about different types of minor energy losses in pipes with suitable equations. **7**

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