

Roll No.

24066

B. Tech 3rd Sem. Civil Engg.

(Branch – XI)

Examination – December, 2011

FLUID MECHANICS – I

Paper : CE-205-F

Time : Three hours]

[Maximum Marks : 100

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : (i) Attempt any *five* full questions choosing at least *one* question from each Section.

(ii) Assume any missing data suitably if required.

SECTION – A

1. (a) State Newton's law of Viscosity and write the difference between Newtonian and non Newtonian fluid. 2 + 3 = 5
- (b) Derive an equation for the capillary rise of water in a glass tube immersed in it. 5

- (c) A 150 mm diameter vertical cylinder rotates concentrically inside another cylinder of diameter 151 mm. both the cylinder are 250mm in height. The space between the cylinders is filled with a liquid of viscosity 10 poise. Determine the torque required to rotate the inner cylinder at 100 rpm. 10
2. (a) Define the following :
- (i) Steady flow and unsteady flow. 3
 - (ii) Uniform flow and non uniform flow. 3
- (b) Write the continuity equation for :
- (i) One dimensional flow. 2
 - (ii) Three dimensional flow. 2
- (c) The stream function for a *two* dimensional flow is given by $\psi = 2xy$.
- (i) Calculate the velocity components in x and y directions at a point $P(2, 3)$ 4
 - (ii) Find the velocity potential function ϕ . 6

SECTION – B

3. (a) Explain with neat sketches of the following :
- (i) Simple manometer 3
 - (ii) U tube manometer 3
 - (iii) Single column manometer 4
- (b) A differential manometer is connected at the two points A and B of two pipes. Point A is carrying a liquid of specific gravity 1.5 and point B is carrying a liquid of specific gravity 0.9. A is above B. The differential manometer contains mercury and the mercury level in the left limb is higher than the mercury level in the right limb. Point A

is 5.0 m above mercury level in the left limb and B is 3.0 m below the point A. The pressures at A and B are $1 \times 10^5 \text{ N/m}^2$ and $1.8 \times 10^5 \text{ N/m}^2$ respectively. Find the difference in mercury level in the manometer. Specific gravity of mercury = 13.6. 10

4. (a) Derive Bernoulli's equation from general energy equation. 10
 (b) State and explain Buckingham's Π -theorem. 10

SECTION – C

5. (a) Derive Euler's equation of motion and deduce Bernoulli's equation from it. 7 + 3 = 10
 (b) A venturi meter has its axis vertical, the inlet and throat diameters being 150 mm and 75 mm respectively. The throat is 225 mm above inlet and coefficient discharge (C_d) = 0.96. Petrol of specific gravity 0.78 flows up through the meter at a rate of $0.029 \text{ m}^3/\text{s}$. Find the pressure difference between the inlet and the throat. 10
6. (a) Write a brief note about classification of orifices, mouthpieces, notches and weirs. 12
 (b) In an experiment on 90° V-notch the flow is connected in a vertical cylinder tank 0.9m diameter. It is found that the depth of water in the tank increases by 0.65m in 16.8s when the head over the notch is 0.2 m. determine the coefficient of discharge of the notch. 8

SECTION – D

7. (a) Write a note on boundary layer along a long thin flat plate and its characteristics. 10
- (b) Explain the methods of controlling boundary layer. 10
8. (a) Explain Rayleigh's method and Buckingham's theorem method for dimensional analysis. 10
- (b) A spillway 7.2m high and 150m long discharges $2150 \text{ m}^3/\text{s}$ under a head of 4m. If a 1 : 16 model of the spillway is to be constructed, find the model dimensions, head over the model and the model discharge. 10
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