U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

May 2023 Semester End Main Examinations

Programme: B.E. **Semester: III**
Branch: Civil Engineering **Duration: 3 hrs.**
Course Code: 22CV3PCFME **Max Marks: 100**
Course: Fluid Mechanics **Date: 15.05.2023**

Instructions:

1. **Answer 5 full questions choosing one full question from Units 1 and 4**
2. **Answer all parts of the questions together**
3. **Assume missing data suitably**

UNIT - I

1 a) Derive the expression for the rise of liquid in a small diameter tube partially submerged in the liquid. **05**

b) Equation of the velocity profile of a fluid over a plate is $v = 2y^{2/3}$; in which v is the velocity in m/s at a distance y meters above the plate. Determine the shear stress at $y = 0$ and $y = 0.075$ m. Given, dynamic viscosity of the fluid = 0.835 N.s/m^2. **07**

c) An inverted U-tube manometer is used to measure the pressure difference between the points *m* and *n* shown in Fig. 1. If fluid *A* is water and fluid *B* is oil of specific gravity 0.85, compute the pressure difference between *m* and *n*. Given $Z = 0.7$ m and $y = 1.5$ m. **08**

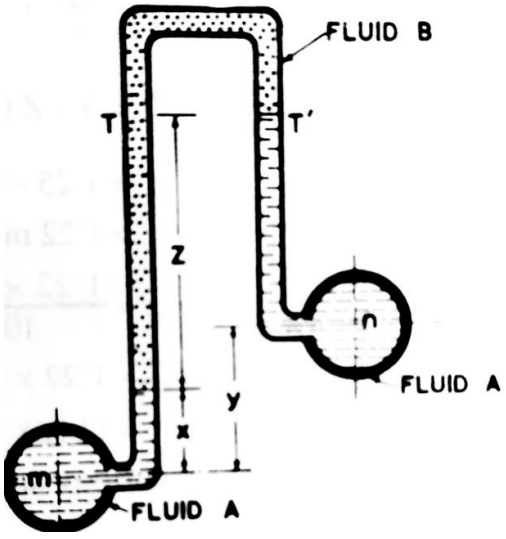

Fig. 1

OR

2 a) Determine the diameter of a droplet of water, if the pressure inside is to be 0.0018 kg(f)/cm^2 greater than the outside. Given the value of surface tension of water in contact with air at 20^{o}C as 0.0075 kg(f)/m. **05**

b) For a compound manometer shown in Fig.2, determine the gauge pressure at *C* if the manometric fluid is mercury. Elevation of various points above the datum (zero scale) are shown in the figure. **07**

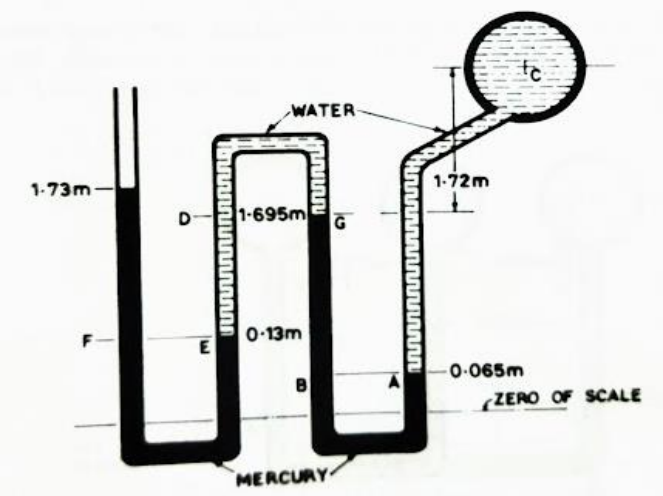

Fig.2

c) With a neat sketch, show that the pressure at any point in a static fluid has the same magnitude in all directions. **08**

UNIT - II

3 a) An opening in a dam is closed by a plate 1 m square which is hinged at the upper horizontal edge as shown in Fig. 3. The plate is inclined at an angle of 60^o to the horizontal and its top edge is 2 m below the water surface in the reservoir. If this plate is pulled by means of a chain attached to the centre of the lower edge, calculate the necessary pull *T* in the chain. The line of action of the chain makes an angle of 45^o with the plate. Weight of the plate is 1.962 kN. **10**

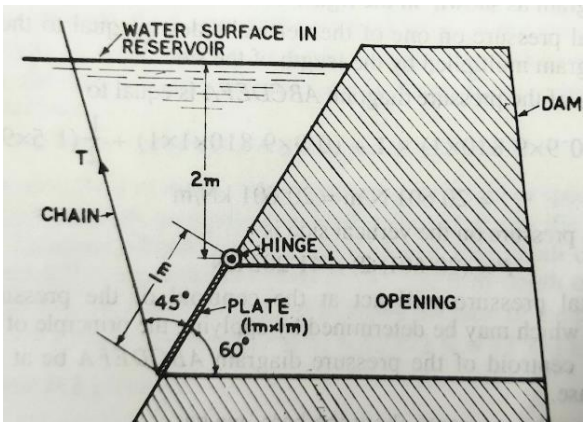

Fig.3

b) The vertical side of a reservoir has a rectangular opening 2.75 m long and 1.2 m high. It is closed by a plate using 4 bolts in placed at the corners of the opening. Determine the tension in the bolts if water stands to a height of 1.8 m above the top edge of the opening, which is horizontal. **10**

UNIT - III

4 a) Water flows through a pipe AB of 1.2 m diameter at 3 m/s and then passes through a pipe BC of 1.5 m diameter. At C, the pipe branches. Branch CD is 0.8 m diameter and carries one-third of the flow in AB. The flow velocity in branch CE is 2.5 m/s. Calculate the volume rate of flow in AB, the velocity in BC, velocity in CD, and diameter of CE. **10**

b) For a two-dimensional potential flow, the velocity potential is given by $\Phi = 4x.(3y-4)$. Determine the velocity at point (2,3). Determine also the stream function and its value at that point. **10**

UNIT - IV

5 a) A pitot static tube having a coefficient of 0.98 is used to measure the velocity of water in a pipe. The stagnation pressure recorded is 3 m and the static pressure is 2 m. Determine the velocity of water in the pipe. **05**

b) A pipe 300 m long has a slope of 1 in 100 and tapers from 1.2 m diameter at the high end to 0.6 m diameter at the low end. Quantity of water flowing is 5400 litres per minute. If the pressure at the high end is 68.67 kPa, determine the pressure at the lower end. Neglect the losses in the pipe. **07**

c) State the working principle of a venturimeter. Derive the expression for calculating discharge through a venturimeter connected to a horizontal pipe. **08**

OR

6 a) A jet of water issues from a sharp edged vertical orifice under a constant head of 0.51 m. At a certain point of the issuing jet, the horizontal and vertical coordinates measured from the vena-contracta are 0.406 m and 0.085 m respectively. If the coefficient of discharge for the orifice is 0.62, determine the coefficient of velocity and coefficient of contraction. **05**

b) A rectangular weir 6 m long is divided into 3 bays by two vertical posts each 0.3 m wide. Determine the discharge when the head is 0.45 m. Assume coefficient of discharge as 0.7. **07**

c) For a triangular weir, show that the discharge varies with $H^{5/2}$ where H is the head causing the flow. **08**

UNIT - V

7 a) Explain the concept of equivalent pipe. **05**

b) Discuss the minor losses in pipes. **07**

c) Population of a city is 800 000 and is to be supplied with water from a reservoir 6.4 km away. Water is to be supplied at the rate of 140 litres per head per day, and half the supply is to be delivered in 8 hrs. The full supply level of the reservoir is RL 180.000 and its lowest water level is RL 105.000. The delivery end of the main is at RL 22.50 and the head required there is 12 m. Determine the diameter of the pipe required for the water supply. Assume Darcy's friction factor f = 0.04. **08**

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