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18CV33

## Third Semester B.E. Degree Examination, July/August 2021
Fluid Mechanics

Time: 3 hrs.

Max. Marks: 100

Note: *Answer any FIVE full questions.*

1 a. Differentiate between i) Liquids and gases ii) Real fluids and Ideal fluids iii) Specific weight and Specific volume of a fluid. **(06 Marks)**

b. One litre of crude oil weighs 9.6N. Calculate its specific weigh, density and specific gravity. **(06 Marks)**

c. Calculate the capillary rise in a glass tube of 3mm diameter when immersed vertically in i) Water and ii) Mercury. Take surface tensions for mercury and water as 0.0725N/m and 0.52 N/m respectively in contact with air , specific gravity of mercury taken as 13.6. **(08 Marks)**

2 a. Differentiate between i) Absolute and gauge pressure ii) Simple manometer and differential manometer iii) Peizometer and pressure gauges. **(06 Marks)**

b. An open tank contains water upto a depth of 1.5m and above it an oil of Sp.gr 0.8 for a depth of 2m. Find the pressure intensity i) at the interface of the two liquids ii) at the bottom of the tank. **(06 Marks)**

c. The water is flowing through two different pipe to which an inverted differential manometer having an oil Sp.gr 0.8 is connected. The pressure head in the pipe A is 2m of water. Find the pressure in the pipe B for the manometer readings as shown in Fig. Q2(c). **(08 Marks)**

Fig. Q2(c)
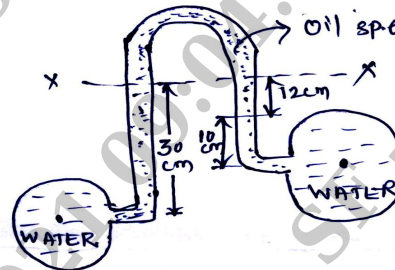
3 a. What do you understand by 'Total Pressure' and 'Centre of Pressure'? **(06 Marks)**

b. A circular opening, 3m diameter in a vertical side of a tank is closed by a disc of 3m diameter which can rotate about a horizontal diameter. Calculate i) the force on the disc ii) the torque required to maintain the disc in equilibrium in the vertical position when the head of water above the horizontal diameter is 6m. **(06 Marks)**

c. Find the horizontal and vertical components of the total force acting on a curved surface AB, which is the form of a quadrant of a circle of radius 2m as shown in Fig. Q3(c). Take the width of the gate is 2m. **(08 Marks)**

Fig. Q3(c)

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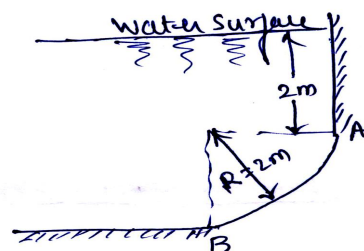
4 a. Define the terms : i) Velocity potential function   ii) Stream function.   **(06 Marks)**

   b. The velocity vector in a fluid flow is given by $V = 2x^3 i - 5x^2 yj + 4tK$. Find the velocity and acceleration of a fluid particle at $(1, 2, 3)$ at time $t = 1$.   **(06 Marks)**

   c. If for a two – dimensional potential flow, the velocity potential is given by $\phi = 4x(3y-4)$, determine the velocity at the point $(2,3)$. Determine also the value of stream function ψ at the point $(2, 3)$.   **(08 Marks)**

5 a. What is Euler's equation of motion? How will you obtain Bernoulli's equation from it?   **(06 Marks)**

   b. A pipe through which water is flowing, is having diameters 40cm and 20cm at the cross – section 1 and 2 respectively. The velocity of water at section 1 is given 5m/s. Find the velocity head at the section 1 and 2 and also rate of discharge.   **(06 Marks)**

   c. The water is flowing through a pipe having diameters 20cm and 10cm at section 1 and 2 respectively. The rate of flow through pipe is 35 litres/s. The section 1 is 6m above datum and section 2 is 4m above datum. If the pressure at section 1 is 39.24 N/cm^2. Find the intensity of pressure at section 2.   **(08 Marks)**

6 a. What is a Pitot tube? How will you determine the velocity at any point with the help of pitot – tube?   **(06 Marks)**

   b. A 20×10cm veturimeter is provided in a vertical pipe line carrying oil of sq. gr 0.8, the flow being upwards. The difference in elevation of the throat section and entrance section of the venturimeter is 50cm. The differential U – tube mercury manometer shows a gauge deflection of 40cm. Calculate   i)   the discharge of oil   ii)   the pressure difference between the entrance section and the throat section. Take $C_d = 0.98$ and Sp. Gr of mercury as 13.6.   **(06 Marks)**

   c. A pitot – tube is inserted in a pipe of 300mm diameter. The static pressure in pipe is 100mm of mercury (vaccum). The stagnation pressure at the centre of the pipe recorded by the pitot tube is 0.981 N/cm^2. Calculate the rate of flow of water through pipe. If the mean velocity of flow is 0.85 times the central velocity. Take $CV = 0.98$.   **(08 Marks)**

7 a. Explain the classification of orifices and mouth pieces based in their shape , size and sharpness.   **(06 Marks)**

   b. The head of water over an orifice of diameter 100mm is 5m. The water coming out from orifice is collected in a circular tank of diameter 2m. The rise of water level in circular tank is 45m in 30 seconds. Also the co-ordinates of a certain point on the jet, measured from vena – contracta are 100cm horizontal and 5.2cm vertical. Find the hydraulic co-efficients C_d, C_v and C_c.   **(06 Marks)**

   c. A tank has two identical orifices on one of its vertical sides. The upper orifice is 3m below the water surface and lower one is 5m below the water surface. If the value of C_v for each orifice is 0.96, find the point of intersection of the two jets.   **(08 Marks)**

8 a. How are the weirs and notches classified?   **(06 Marks)**

   b. A right angled V – notch is inserted in the side of a tank of length 4m and width 2.5m. Initial height of water above the apex of the notch is 30cm. Find the height of water above the apex, if the time required to lower the head in tank from 30cm to final height is 3 minutes. Take $C_d = 0.6$.   **(06 Marks)**

   c. A Cipolletti weir of crest length 60cm discharges water. The head of water over the weir is 360mm. Find the discharge over the weir if the channel is 80cm wide and 50cm deep. Take $C_d = 0.6$ **(08 Marks)**

9 a. What do you understand by Total energy line , Hydraulic gradient line , Pipes in series , Pipes in parallel and Equivalent pipe? **(05 Marks)**

b. An oil of sp. gr. 0.9 and viscosity 0.06 poise is flowing through a pipe of diameter 200mm at the rate of 60 litres/s. Find the head loss due to friction for a 500m length of pipe. Find the power required to maintain this flow. **(07 Marks)**

c. The rate of flow of water through a horizontal pipe is $0.25 m^3$/s. The diameter of the pipe which is 200mm is suddenly enlarged to 400mm. The pressure intensity in the smaller pipe is $11.772 N/cm^2$. Determine i) Loss of head due to sudden enlargement ii) Pressure intensity in the large pipe iii) Power lost due to enlargement. **(08 Marks)**

10 a. Explain the phenomenon of water hammer. Obtain an expression for the rise of pressure when the flowing water in a pipe is brought to rest by closing the valve gradually. **(06 Marks)**

b. The water is flowing with a velocity of 1.5m/s in a pipe of length 2500m and of diameter 500mm. At the end of the pipe, a valve is provided. Find the rise in pressure of the valve is closed in 25 seconds. Take the value of C = 1460 m/s. **(06 Marks)**

c. A valve is provided at the end of a cast iron pipe of diameter 150mm and of thickness 10mm. The water is flowing through the pipe which is suddenly stopped by closing the valve. Find the maximum velocity of water, when the rise of pressure due to sudden closure of valve is $196.2 N/cm^2$. Take K for water as $19.62 \times 10^4 N/cm^2$ and E for cast iron pipe as $11.772 \times 10^6 N/cm^2$. **(08 Marks)**

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