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10CV35

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Fluid Mechanics

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Give reasons for the following:
   i) Viscosity of the fluid decreases with increase in temperature.
   ii) Shape of water droplet is spherical.
   iii) Capillary rise occurs when glass tube is immersed in water.
   iv) Specific gravity is dimensionless. **(04 Marks)**

   b. Derive an expression for capillary rise in a glass tube immersed in water. **(08 Marks)**

   c. The space between two square flat plates of 800mm side is filled with an oil film of 20mm thickness. Lower plate is stationary and upper plate moves at a speed of 3.2m/s when 50N force is applied. Calculate:
   i) Shear stress
   ii) Dynamic viscosity of oil in poise
   iii) Kinematic viscosity of oil if G = 0.90. **(08 Marks)**

2 a. Differentiate between:
   i) Pressure intensity and pressure head
   ii) Simple and differential manometers
   iii) Absolute and gauge pressure. **(06 Marks)**

   b. Draw the neat sketch of Bourdon pressure gauge and explain the working. **(06 Marks)**

   c. An U-tube differential manometer connects two pipes A and B. Pipe A contains CCl_4(G = 1.59) under 130kN/m^2 gauge pressure. Pipe B contains oil (G = 0.82) under 200kN/m^2 gauge pressure. Pipe A is 2.5m above pipe B. The manometer contains mercury. Calculate the difference in mercury levels. Draw neat sketch. The level of mercury connected to pipe A is in level with center of pipe B. **(08 Marks)**

3 a. Derive an expression for total pressure and center of pressure on a plane surface immersed vertically in water. **(08 Marks)**

   b. A gravity dam shown in Fig.Q.3(b) withhold water to a depth of 10m. Upstream face of dam is vertical for 7m depth and inclined at 20° with vertical for the remaining height as shown in figure. Determine the pressure force on vertical and inclined faces per unit length of dam. Also locate their respective center of pressures. **(12 Marks)**

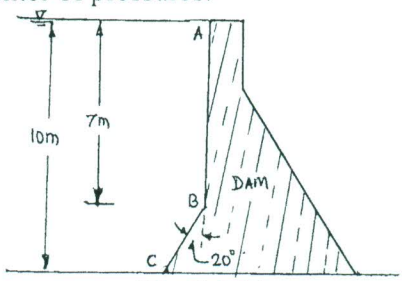

Fig.Q.3(b)

4 a. Define stream function and velocity potential function. Obtain Cauchy – Rieman equations. **(06 Marks)**

b. Derive continuation equation using stream tube. **(08 Marks)**

c. The velocity components for a 2D flow are u = xy and $v = x^2 - \frac{1}{2}y^2$. Check i) whether they represent the possible flow case; ii) Whether flow is irrotational. **(06 Marks)**

PART – B

5 a. List the assumptions made in deriving Bernoulli's equation. **(06 Marks)**

b. Crude oil of G = 0.84 flows through a pipe with a rate of 450 lps. The diameter of pipe and pressure in the pipe at one section are respectively 25cm and 55kPa and at section two are 50cm and 320kPa. Find the direction of flow through pipe and head loss. Pipe is horizontal. **(06 Marks)**

c. A 300mm diameter pipe carries water under a head of 20m with a velocity of 3.5m/s. If the axis of the pipe turns through 45°, find the magnitude and direction of resultant force on the bend. **(08 Marks)**

6 a. Derive Darcy-Weisbach equation for head loss due to friction in a pipe. **(07 Marks)**

b. The rate of flow through a horizontal pipe is 0.03 m^3/s. Length of pipe is 1km. Diameter of pipe for first half of length is 20cm and suddenly enlarges to 40cm for the remaining length. Find the difference in water surface elevation in the two reservoirs connected to either side of pipe. Take f = 0.01 in equation $fLV^2/2gD$. Consider minor losses. **(08 Marks)**

c. The water is flowing with a velocity of 1.25m/s in a pipe of 2km length and 250mm diameter. The valve at the end of pipe is closed in 27sec. Find the rise in pressure. Take C = 1400m/s. **(05 Marks)**

7 a. Explain the measurement of depth using: i) Staff gauge; ii) Float gauge; iii) Self-recording gauge. **(12 Marks)**

b. Derive the expression for the point velocity using pitot tube. **(08 Marks)**

8 a. Derive an expression for discharge over a rectangular notch. **(08 Marks)**

b. List the advantages of triangular notch over rectangular notch. **(04 Marks)**

c. A horizontal venturimeter with inlet diameter 20cm and throat 10cm is used to measure the flow of oil (G = 0.8). The discharge is 60*l*/s, find the reading of oil-mercury differential manometer. $C_d = 0.98$. **(08 Marks)**

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