G.R. No.

Paper Code– V 239-114 (ESE)

DECEMBER 2019 ENDSEM
S. Y. B.TECH. (Civil) (SEMESTER – III)
COURSE NAME: Introduction to Fluid Mechanics
COURSE CODE: CVUA21184

(PATTERN 2018)

Time: [2 Hours]   [Max. Marks: 50]

(*) Instructions to candidates:
1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Use of scientific calculator is allowed.
4) Assume suitable data where ever required.

Q.1)   Attempt any **one**
   a)   The velocity distribution over a flat plate is given by $= \frac{2}{3}y - y^2$. Determine
        the shear stress at y = 0 and y = 0.15 m above the surface of the plate. Take   [4]
        μ=10 poise
   b)   Derive equation for capillary rise   [4]

Q.2)   Attempt any **one**
   a)   Find 'h' if pressure in pipe B is 2000 Pa
                                             above pressure in pipe A   [4]
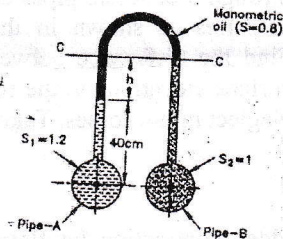
   b)   A circular plate of diameter 1.2 m is placed vertically in water in such a way
        that the centre of the plate is 2.5 m below the free surface of water.   [4]
        Determine the total pressure and position of centre of pressure

Q.3)   Attempt any **one**
   a)   Derive 3 D continuity equation for steady laminar incompressible flow of
        fluid in Cartesian coordinate system   [6]
   b)   V= (6+2xy+t²)i-(xy²+10t)j+25k. What is the acceleration of a particle at (3,
        0, 2) at time t=1.5?   [6]

Q.4)   Attempt any **one**
   a)   A Venturimeter is used for measurement of discharge of water in a   [10]
        horizontal pipeline. If the ratio of inlet to that of the throat is 2:1, inlet
        diameter is 300m, the difference of pressure head between the inlet and the
        throat is 3 m of water and loss of head between inlet and throat is one eighth
        of the throat velocity head. Calculate the discharge in the pipe
   b)   Derive equation for discharge through an orificemeter   [10]

Q.5)   Attempt any **one**
   a)   Starting with equation for average velocity derive Hagen Poiseullie equation   [7]
        for steady laminar flow through circular pipe

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Crude oil of dynamic viscosity 1.5 poise and RD 0.9 flows through a 20 mm [6] diameter vertical pipe. The pressure gauges fixed 20 m apart as shown in the figure show 600 kPa and 200 kPa respectively. Find the direction of flow and rate of flow through the pipe
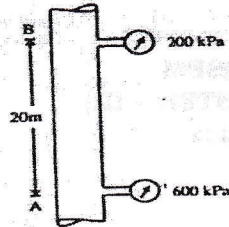

b) Calculate the displacement thickness and momentum thickness in terms of [7] nominal thickness for the following velocity distribution

$$\frac{u}{U} = 2\frac{y}{\delta} - 2\left(\frac{y}{\delta}\right)^3 + \left(\frac{y}{\delta}\right)^4$$

A 2 m wide and 5 m long plate is moving in air with a velocity of 2 m/s [6] parallel to its length. Density of air is 1.2 kg/m^3 and viscosity is 1.8 x 10^{-4} poise. Determine drag force on one face of the plate assuming that (i) boundary layer is laminar over the complete plate (ii) boundary layer is turbulent from the very beginning and over full plate

Q.6) Attempt any **one**

a) Derive Darcy Weisbach equation for calculating loss of head due to friction 7 in flow through pipes
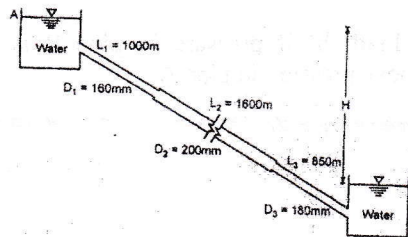
Water flows at a rate of 0.12 m^3/s from reservoir A to reservoir B 6 through 3 concrete pipes connected in series as shown in the figure. Find the difference between water surface elevations in the reservoirs. Neglect minor losses. Take f = 0.02

b)

Derive equation for head loss due to sudden contraction for flow through [7] pipe

Following details refer to system of 3 pipes connected in parallel. Calculate [6] the discharge through all the pipes if the discharge through pipe 1 is 150 lit/s

Pipe	L(m)	D (mm)	f
1	300	250	0.02
2	250	200	0.025
3	450	150	0.03

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