

<b>3E1133</b>	Roll No. _____	Total No of Pages: <span style="border: 1px solid black; padding: 2px;">4</span>
	<b>3E1133</b> <b>B. Tech. III - Sem. (Main / Back) Exam., Dec. 2019</b> <b>PCC Civil Engineering</b> <b>3CE4 - 06 Fluid Mechanics</b>	

Time: 2 Hours

Maximum Marks: 80

*Instructions to Candidates:*

*Attempt all five questions from Part A, four questions out of six questions from Part B and two questions out of three from Part C.*

*Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.*

*Use of following supporting material is permitted during examination.  
(Mentioned in form No. 205)*

1. NIL

2. NIL

### PART - A

(Answer should be given up to 25 words only)

[5×2=10]

All questions are compulsory

Q1 Define Viscosity.

Q2 Define Buoyant Force?

Q3 Define stream line, Streak line and path line?

Q4 Define Hydraulic gradient line and Total Energy line.

Q5 Define the kinetic energy correction factor.

**PART – B**

**(Analytical/Problem solving questions)**

**[4×10=40]**

**Attempt any four questions**

- Q.1 A thin plate is placed between two flat surfaces  $h$  cm apart such that the viscosity of liquids on the top and bottom of the plates are  $\mu_1$  and  $\mu_2$ , respectively. Determine the position of the thin plate such that the viscous resistance to uniform motion of thin plate is minimum (Assume  $h$  to be very small).
- Q.2 Two tanks are filled with water of specific weight  $9.81 \text{ kN/m}^3$ . The bottom of tanks are connected to an inverted U tube containing oil weighing  $7.85 \text{ kN/m}^3$ . Find the difference in pressure between the two tanks when the manometer gives a reading of  $0.8\text{m}$ .

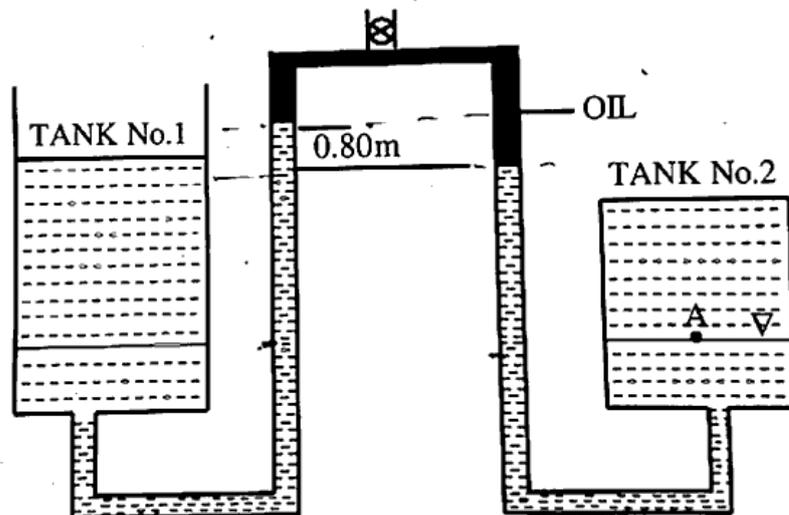


Fig. Q.2 (Part B)

Q.3 Two velocity components are given in the following cases, find the third component such that they satisfy the continuity equation.

(a)  $u = x^3 + y^3 + 2z^2$ ;  $v = -x^2y - yz - xy$

(b)  $u = \log(y^2 + z^2)$ ;  $v = \log(x^2 + z^2)$

(c)  $u = \frac{-2xyz}{x^2 + y^2}$ ;  $\omega = \frac{y}{(x^2 + y^2)}$

Q.4 State the assumptions made in Bernoulli's equation. Also derive the Bernoulli's equation.

Q.5 Derive the Darcy - Weisbach equation for head loss due to a flow in a pipe in terms of the friction factor  $f$ . For laminar flow, develop relations for the estimation of  $f$  and boundary shear stress in terms of flow parameters.

Q.6 Explain the following - <http://www.rtuonline.com>

- (a) Newtonian fluid
- (b) Bingham Plastic fluid
- (c) Pseudoplastic fluid
- (d) Dilatant fluid
- (e) Ideal fluid

Also plot  $\tau$  v/s  $\frac{du}{dy}$  for each of them.

where  $\tau \rightarrow$  shear stress

$\frac{du}{dy} \rightarrow$  Velocity gradient

**PART - C**

**(Descriptive/Analytical/Problem Solving/Design Questions)**

**[2×15=30]**

**Attempt any two questions**

Q.1 An open cylinder 30cm in diameter and 50cm high is filled with water and rotated about its axis. Calculate the amount of water spilled when the speed of rotation is-

(i) 180 rpm

(ii) 240 rpm

Q.2 Oil of relative density 0.9 and dynamic viscosity 2.5 poise is pumped through a 100 mm diameter, 500mm long pipe at a rate of 2 lps.

(i) Find the Reynolds number of the flow.

(ii) Calculate pressure received at the pump if the outlet end, which is free is at 20m above the pump level.

(iii) What should be the power inputs if the overall efficiency of the pump set is 65%.

Q.3 For the following flows, determine the components of rotation about the various axes.

(i)  $u = xy^3z$        $v = -y^2z^2$        $\omega = yz^2 - \frac{y^3z^2}{2}$

(ii)  $u = 3xy$        $v = \frac{3}{2}x - \frac{3}{2}y^2$

(iii)  $u = y^2$        $v = -3x$

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