



# GOVERNMENT COLLEGE OF ENGINEERING, JALGAON

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Name of Examination : **Summer 2021** - (Preview)

Course Code & Course Name : **CE251U - Fluid Mechanics**

Generated At : **19-04-2022 15:17:41**

Maximum Marks : **60**

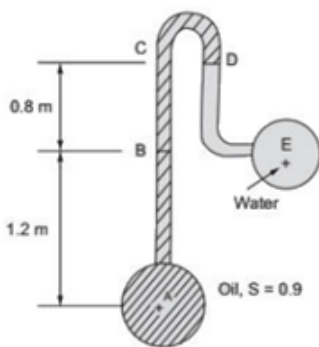
Duration : **3 Hrs**

[Edit](#) [Print](#) [View Answer Key](#) [Close](#) **Answer Key Submission Type:** Marking scheme with model answers and solutions of numerical

Instructions:

1. All questions are compulsory and solve any three from a, b, c and d.
2. Illustrate your answer with suitable figures/sketches wherever necessary.
3. Assume suitable additional data; if required.
4. Use of logarithmic table, drawing instruments and non programmable calculators is allowed.
5. Figures to the right indicate full marks.

- 1) a) Explain viscosity with derivation of its equation [5]  
 b) The pressure outside the droplet of water of diameter 0.04 mm is 10.52 N/cm<sup>2</sup> (atmospheric pressure). Calculate the pressure within the droplet if surface tension is given as 0.0725 N/m of water. [4]  
 c) An inverted U-tube manometer is fitted between two pipes as shown in Figure. Determine the pressure at E, if  $P_A = 40$  kPa (gauge) [5]



- d) A square aperture in the vertical side of a tank has one diagonal vertical and is completely covered by a plane plate hinged along one of the upper sides of the aperture. The diagonals of the aperture are 2 m long and the tank contains a liquid of specific gravity 1.15. The centre of aperture is 1.5 m below the free surface. Calculate the thrust exerted on the plate by the liquid and position of its centre of pressure. [5]
- 2) a) Explain the term buoyancy and centre of buoyancy [4]  
 b) A cylindrical buoy, diameter 1.5 m and 1.1 m high weighing 4.45 kN is floating in sea water with its axis vertical. Find the maximum permissible height above the top of the buoy, of the centre of gravity of a 450 N load which is placed centrally on top of the buoy. Take specific gravity of sea water as 1.025 [5]  
 c) Derive the equation of continuity in Cartesian coordinate for three dimensional flow. [5]  
 d) For a two dimensional flow  $\phi = 3xy$  and  $\psi = 1.5(x^2 - y^2)$  Determine the velocity components at the points (1, 3) and (3, 3). Also find the discharge passing between the streamlines passing through the points given above. [5]
- 3) a) A venturi meter has its axis vertical, the inlet and throat diameters being 150 mm and 75 mm respectively. The throat is 225 mm above inlet and  $C_d = 0.96$  Petrol of specific gravity 0.78 flows up through the meter at a rate of 0.029 m<sup>3</sup>/s. Find the pressure difference between the inlet and the throat. [5]  
 b) Explain the term kinetic energy correction factor. [5]  
 c) The drag force  $F$  on a smooth sphere is found to be affected by the velocity of flow,  $u$ , the diameter  $D$  of the sphere and the fluid properties density  $\rho$  and viscosity  $\mu$ . Using dimensional analysis obtain the dimensionless groups to correlate the parameters [5]  
 d) Explain the dimensionless number i) Reynolds's number ii) Weber number [5]
- 4) a) Derive the relation between shear and pressure gradient in laminar flow [5]  
 b) For Laminar flow of an oil having dynamic viscosity  $\mu = 1.766$  Pa.s in a 0.3 m diameter pipe, the velocity distribution is parabolic with a maximum point velocity of 3 m/s at the centre of the pipe. Calculate the shearing stresses at the pipe wall and within the fluid 50 mm from the pipe wall. [5]  
 c) A circular orifice of area  $6.45 \times 10^{-4}$  m<sup>2</sup> is provided in the vertical side of a large tank. The tank is suspended from a knife edge 1.53 m above the level of the orifice. When the head of water is 1.22 m the discharge is 1161.5 N/min and a turning moment of 14.421 N-m has to be applied to the knife edges to keep the tank vertical. Determine  $C_v$ ,  $C_d$  and  $C_c$  of the orifice. [5]  
 d) The maximum flow through a rectangular flume 1.8 m wide and 1.2 m deep is 1.65 m<sup>3</sup>/sec. It is proposed to install a suppressed sharp crested rectangular weir across the flume to measure flow. Find the maximum height at which the weir crest can be placed in order that water may not overflow the sides of the flume. Assume  $C_d = 0.6$  [5]

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