3E1625

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B.Tech. III Semester (Main/Back) Examination - 2014

Civil Engg.

3CE5A Fluid Mechanics

Time : 3 Hours **Maximum Marks : 80**
Min. Passing Marks : 24

Instructions to Candidates:

*Attempt any **five** questions, selecting **one** question from each **unit**. All questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.)*

Unit - I

1. a) Define Newton's law of viscosity. Elaborate the difference between dynamic viscosity and kinematic viscosity of fluids. What is the effect of temperature change on the viscosity of liquids and gases? Give the reasons for it. **(8)**

   b) A U-tube is made of two capillaries of bore 4mm and 5mm respectively. The tube is held vertically and partially filled with liquid of mass density 1000 kg/m^3 and angle of contact 0 degree. Calculate the surface tension of the liquid if the difference in the menisci is 1.5mm **(8)**

OR

1. a) Derive expression for capillary rise of a fluid having surface tension σ and contact angle θ between:

   i) two concentric glass tubes of radii r_o and r_1

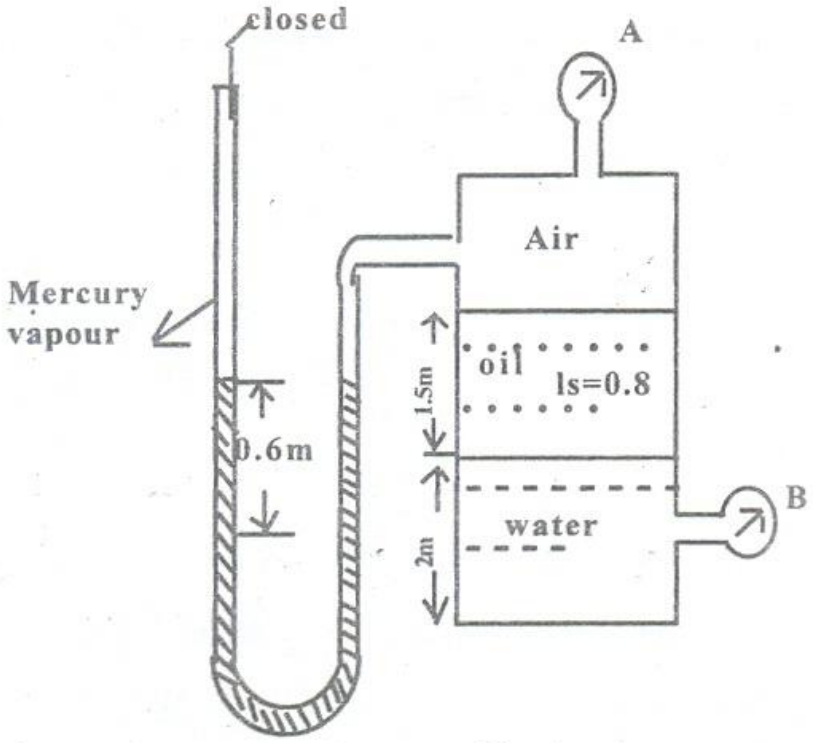
   ii) two vertical glass plates set parallel to each other and having a gap 't' between them.

   What will be capillary rise of water having $\sigma = 0.073 N/m^3$, $\theta = 0^o$ and distance between plates, t = 1mm **(8)**

b) A hydraulic lift used for lifting automobiles has 25cm diameter ram which slides in a 25.018cm diameter cylinder. The annular space being filled with oil having a kinematic viscosity of $3.7cm^2/sec$ and specific gravity 0.85. If the rate of travel of the ram is 15cm/sec, find the frictional resistance when 3.3m long ram is engaged in the cylinder. **(8)**

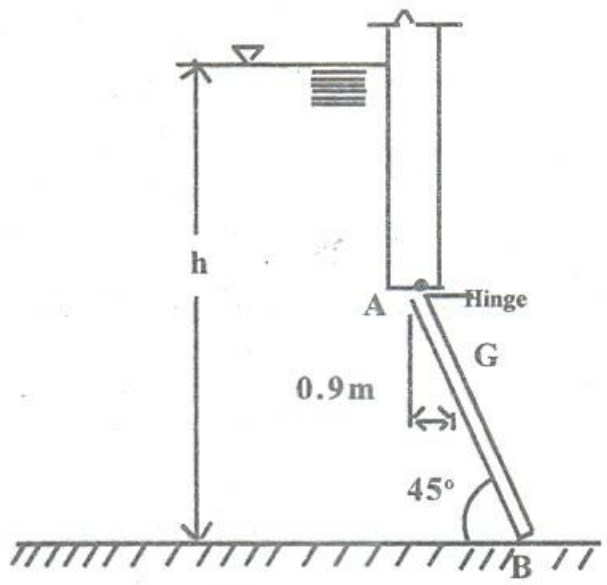
Unit - II

2. a)



For the above arrangement, find gauge reading at A and B **(8)**

b) A rectangular sluice gate AB shown in the figure is 3m wide and 4.5m long hinged at A. It is kept closed by a weight fixed to the gate. The total weight of the gate and weight fixed to the gate is 515KN. The centre of gravity of the weight and gate is at G. Find the height of water h which will first cause the gate to open. **(8)**



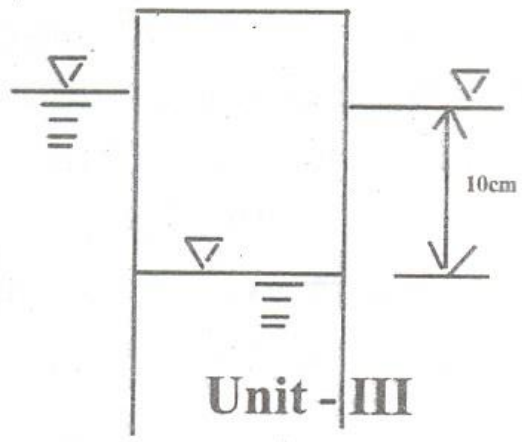
OR

2. a) What do you understand by stable, unstable and neutral equilibrium of a body. State the conditions of equilibrium of a floating body and a submerged body. **(6)**

b) A rectangular container having base area of $1.5m^2$ and length 0.9m is floating in water with the open end downwards as shown in the figure. If the difference in water levels inside and outside the container is 10cm, determine

i) the mass of the container and

ii) what force will be required to depress the bottom of the container to a depth of 10m in water if the trapped air has constant temperature?



(10)

Unit - III

3. a) An open tank contains water to a depth of 1.5m. The tank is put in an elevator which accelerates at 2.5m/s^2. Calculate the pressure force per meter length on one of the sides of the tank when

i) the acceleration is upwards and

ii) the acceleration is vertically downwards. **(6)**

b) The velocity components in a two-dimensional flow are given as

$$u = \frac{y^3}{3} - x^2 y + 2x \text{ and } v = xy^2 - \frac{x^3}{3} - 2y$$

Obtain the expressions for the stream function and the velocity potential. **(10)**

OR

3. a) What is a flownet? What are the methods of drawing flownet? Mention some applications of flownet **(6)**

b) A pipeline carrying oil (sp.gr. 0.8) changes in diameter from 30cm at position 'A' to 60cm at position 'B' which is 5m above 'A'. If the pressures at two positions are 100kN/m^2 and 60kN/m^2 respectively and the discharge through the Pipe is 300 lit/sec, determine-

i) loss of head and

ii) direction of flow **(10)**

Unit - IV

4. a) Describe with the help of neat diagram the construction and working of a prandtl Pitot tube **(8)**

b) A vertical pipeline carries oil of specific gravity 0.85. A 400mm×160mm venturimeter is provided in the pipeline and the difference of elevation of the throat section and the entrance of venturimeter is 500mm. The pressure difference between two section is 300mm of mercury given by a differential manometer. Determine the flow rate of oil and the pressure difference between entrance and throat section. Assume $C_d = 0.98$ **(8)**

OR

4. a) Derive expression for discharge through a triangular notch. **(8)**

b) A pipe bend of 400mm dia. at inlet and 200mm dia. at outlet turns the flow of water through 120° in a vertical plane. The flow through the bend is 200 lit/sec and the pressure at inlet is 100kN/m^2. The axis at the inlet is horizontal and the exit is 1.2m below the entrance. If the volume of bend is 0.18m^3, determine the force exerted on the bend. **(8)**

Unit - V

5. a) What is major loss and minor losses in pipes. **(4)**

b) A horizontal pipeline 40m long is connected to a water tank at one end and discharges freely into atmosphere at the other end. For the first 25m of its length from the tank, the pipe is 150mm diameter and its diameter is suddenly enlarged to 300mm. The height of water level in the tank is 8m above the centre of the pipe. Considering all losses

i) determine the rate of flow and

ii) draw the hydraulic gradient and energy gradient line. Take friction factor, $f = 0.04$ **(12)**

OR

5. a) Derive an expression for the power transmission through the pipe. Find also the condition for maximum transmission of power and corresponding efficiency of transmission. **(8)**

b) A pipeline carrying water has a diameter of 50cm and is 2km long. To increase the discharge another pipeline of same diameter is introduced parallel to the first pipe in the second half of its length. Find the increase in discharge if the total head loss in both the case is 15m. Assume friction factor, $f = 0.2$ for all pipes. **(8)**