Reg. No. | | | | | | | | | | | | |

Question Paper Code : 57145

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2016

Third Semester

Civil Engineering

CE 6303 – MECHANICS OF FLUIDS

(Common to Environmental Engineering)

(Regulations 2013)

Time : Three Hours **Maximum : 100 Marks**

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. Define Centre of pressure.
2. Temperature rise, decreases viscosity in liquids but increases it in gases, why ?
3. Define flow net.
4. Distinguish between stream line and streak line.
5. What is hydraulic gradient line ? State its application.
6. List major and minor losses of flow in a pipe.
7. Define displacement thickness.
8. When a surface will be called as hydro dynamically smooth ?
9. State the disadvantages of Rayleigh's method in dimensional analysis.
10. What do you know by the term "Distorted models" ?

PART – B (5 × 16 = 80 Marks)

11. (a) (i) Differentiate

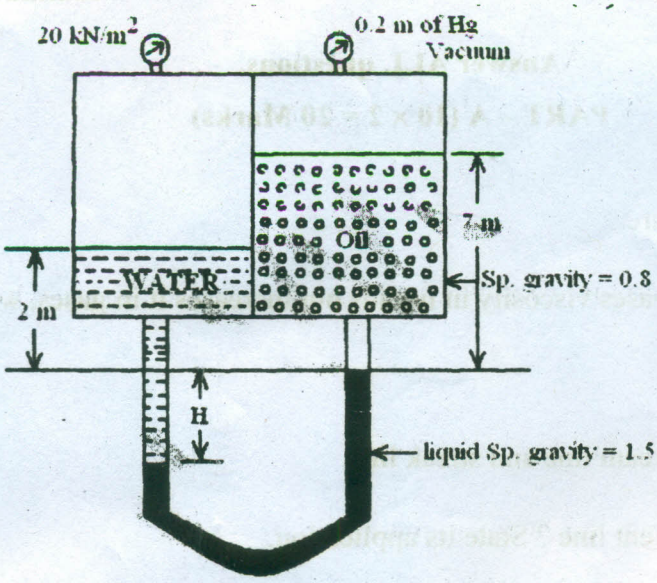
(1) Real fluids & Ideal fluids

(2) Newtonian & non Newtonian fluids. (4)

Through a narrow gap of height 6, a thin plate of large surface is pulled with a velocity U on one side of the plate, oil is of velocity μ_1, and on the other side of μ_2. Determine the position of the plate so that the shear force on two sides is equal. (4)

(ii) What is the difference between U – tube differential monometer and inverted U – tube differential manometer ? (2)

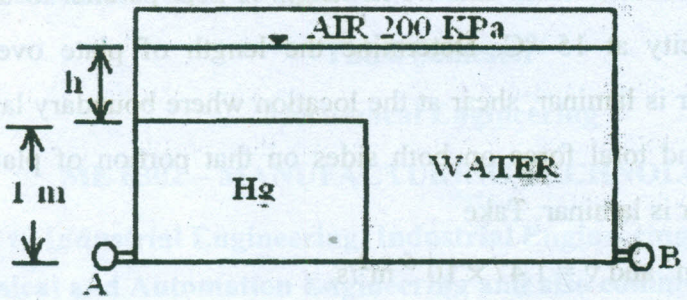
For The arrangement shown in figure, determine the height 'H' (6)



OR

(b) (i) A cylinder of 0.3m diameter rotates in annular sleeve of 0.31 m internal diameter. Both the cylinders are 0.3 m long. Determine the viscosity of the liquid which fills the space between the cylinder if a torque of 0.98 N.m is required to maintain an angular velocity of 2π rad/s. (8)

(ii) With a neat sketch of 'u' tube connected to a pipe under pressure, explain the procedure of writing manometric equation. (Assume the u tube manometer contain mercury on manometric liquid and open to atmosphere). Gauge 'A' attached at the bottom of a tank shown in figure reads 350 KPa (abs). What is the height 'h' of water ? What is the reading of gauge 'B' ? **(8)**



12. (a) Water flows through a pipe AB 1.2 m diameter at 3 m/s and then passes through a pipe BC 1.5 m diameter. At C, the pipe branches. Branch CD is 0.8 m in diameter and carries one-third of the flow in AB. The flow velocity in branch CE is 2.5 m/s. find the volume rate of flow in AB, the velocity in BC, the velocity in CD and the diameter of CE. **(16)**

OR

(b) State Bernoulli's theorem for steady flow of an incompressible fluid. Derive an expression for Bernoulli's equation from first principle and state the assumptions made for such a derivation. **(16)**

13. (a) A liquid flows through a short pipe which branches into two parallel pipes A and B each with a length of 50 m and with inside diameters of 25 mm and 50 mm, respectively. The ends of the pipes are connected together by another short pipe. Determine the flow through each pipe if they have a drop in elevation of 3 m. Assume a constant Fanning friction factor in both pipes of 0.005. **(16)**

OR

(b) Oil of mass density 800 kg/m^3 and dynamic viscosity 0.02 poise flows through 50 mm diameter pipe of length 500 m at the rate of 0.19 *l*/s. Determine (i) Reynolds number of flow, (ii) centreline velocity, (iii) pressure gradient, (iv) loss of pressure in 500 m length, (v) wall shear stress and (vi) power required to maintain the flow. **(16)**

14. (a) A fill plate of 2.0 m width and 4.0 m length is kept parallel to air flowing at 5.0 m/s velocity at 15 °C. Determine the length of plate over which the boundary layer is laminar, shear at the location where boundary layer ceases to be laminar, and total force on both sides on that portion of plate where the boundary layer is laminar. Take

$\rho = 1.208$ kg/m^3 and $\nu = 1.47 \times 10^{-5}$ m^2/s. **(16)**

OR

(b) A smooth rectangular plate of 1.0 m width and 20 m length, when towed through water at 20 °C lengthwise, experiences drag of 1440 N on both the sides. Determine (i) average drag coefficient, (ii) velocity of the plate, and (iii) boundary layer thickness at the edge of the plate. **(16)**

15. (a) Show by the Buckingham Π method of dimensional analysis, that the frictional pressure drop Δp_f for a fluid of density ρ and viscosity μ flowing with a velocity v through a circular pipe of inside diameter d, length L and surface roughness ε can be given by the dimensionless groups

$$\frac{\Delta p_f}{\rho v^2} = f\left(\frac{L}{d}, \frac{\varepsilon}{d}, \frac{\mu}{\rho v d}\right)$$ **(16)**

OR

(b) A river carrying a discharge of 3500 m^3/s has a depth of 2.25 m and width of 1500 m. From the point of view of availability of space the horizontal scale of 1:400 is chosen. Assuming slope scale to be unity, determine the depth and discharge scales for the model. **(16)**

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