THIRD SEMESTER **B.Tech. (Civil)**

SUPPLEMENTARY EXAMINATION **FEBRUARY-2019**

CE-205 FLUID MECHANICS

Time: 3:00 Hours ***Max. Marks: 40***

Note : Answer any ***FIVE*** questions.

Assume suitable missing data, if any.

1. (a) A U- tube is made up of two capillaries of bores 1.0mm and 2.2mm, respectively. The tube is held vertically with zero contact angles. It is partially filled with liquid of surface tension 0.06N/m. If the estimated difference in the level of two menisci is 15mm, determine the mass density of the liquid. (2)

(b) How does viscosity of a fluid vary with temperature? (1)

(c) A triangular plate of 1m base and 1.5m altitude is immersed in water with its base near to free surface. The plane of the plate is immersed in such a way that it makes an angle of 30° to the free surface of water and the base is parallel to and at a depth of 2 m from the water surface. Find the total pressure on the plate and the position of the centre of pressure. (5)

2. (a) Explain with neat sketch the working of pressure gauge (2)

(b) The barometric pressure at sea level is 760 mm of mercury while on a mountain top it is found to be 735mm. If the specific weight of air is assumed constant at 11.8 N/m^2, calculate the height of the mountain. (2)

(c) A velocity filed is given by $u = 3y^2$, $v = 2x$ and $w = 0$ in arbitrary units. Is this flow steady or unsteady? Is it two-dimensional or three-dimensional? At (x, y, z) = (2, 1, 0,) Compute (a) Velocity (b) local acceleration and (c) convective acceleration. (4)

3. (a) What is meant by stability of a floating body? Explain the stability of a floating body with reference to its metacentric height. (2)

(b) State the limitations of the Bernoulli's theorem (2)

(c) A crude oil of specific gravity 0.9 flows through a horizontal pipe 100 mm in diameter and 10 m long and 1000 kg of oil is collected in 5 mins. If the pressure difference at the two ends is 14.715 KN/m^2, Calculate the viscosity of the oil. (4)

4(a) A pipe 300m long has a slope of 1 in 100 and tapers from 1m diameter at the high end to 0.5 m at the low end. Quantity of water flowing is 0.09 cumecs. If the pressure at the high end is 68.670 KN/m^2, find the pressure at the lower end. (3)

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(b) What is repeating variables? How are they selected for dimensional analysis? (2)

(c) The pressure difference Δp in a pipe of diameter d and length l due to turbulent flow depends upon the velocity v of the fluid, density ρ of the fluid, viscosity μ of the fluid and roughness k. Using Buckingham's π- theorem or otherwise obtain an expression for Δp. (3)

5(a) Explain with the help of sketch

(a) Hydraulic gradient line
(b) Pipes in parallel
(c) Equivalent pipe
(d) Pipes in series (2)

(b) For a laminar steady flow, prove that pressure gradient in the direction of motion is equal to the shear gradient normal to the direction of motion. (2)

(c) An oil of viscosity of 10 poise and specific gravity 0.6 flows through a horizontal pipe of 30mm diameter. If the pressure drop in 50 m length of the pipe is 3000KN/m^2, determine the

(a) Rate of flow of oil in cumecs
(b) Centre line velocity
(c) Total frictional drag over 50 m length of the pipe
(d) Power requirement to maintain the flow
(e) Velocity gradient at the pipe wall. (4)

6(a) In a FM Lab, a pipe 60 m long and 0.15 m diameter is used to find the coefficient of friction. The supply head is arranged at 2.6 m above the centre of pipe. The discharge through the pipe in one of the trials is measured to be 0.032 cumecs. What will be the value of coefficient of friction when

(a) taking all losses

(b) neglecting all losses except friction. (2)

(b) Why resultant pressure on a curved submerged surface is determined by finding horizontal and vertical forces on the curved surface? Why is the same method not adopted for plane inclined surface that is submerged in a liquid? (2)

(c) A pipe line PQR 200m long is laid on an upward slope of 1 in 50. The length of a portion PQ is 100m and its diameter is 0.20m. At Q the pipe section enlarges to 0.40 m diameter and remains so up to R for a length of 100m. A flow of 80 L is pumped into the pipe at the lower end P and is discharged at the upper end R into a closed tank. The pressure of water at P is 137.34 KN/m^2. Find the pressure at R and draw H.G. L and T.E.L. Take f = 0.005. (4)