RDR/2KNT/OT – 10070

B. E. Third Semester (Civil Engineering) / SoE – 2018 Examination

Course Code : CV 2205 **Course Name : Fluid Mechanics**

Time : 3 Hours] [Max. Marks : 60

Instructions to Candidates :—

(1) All questions are compulsory.
(2) All questions carry marks as indicated.
(3) Due credit will be given to neatness and adequate dimensions.
(4) Assume suitable data wherever necessary.
(5) Illustrate your answers wherever necessary with the help of neat sketches.

1. Answer the following :—

(A1) Explain surface Tension and derive the expression of capillarity. 4 (CO 1)

(A2) A shaft of 30 mm diameter and a mass of 10 kg slides vertically in a sleeve with a velocity of 3 m/s. The gap between the shaft and sleeve is 0·1 mm which is filled with oil. Calculate the viscosity of oil, if the length of shaft is 500 mm. 4 (CO 1)

(A3) Define Ideal and real types of fluids and give example of each. 2 (CO 1)

OR

(B1) Calculate the capillary rise in a glass tube of 2 mm diameter when immersed in water. Value of surface tension for water at 20 ^{0}C in contact with air is 0·085 N/m. What will be the percent change in value of capillary rise if diameter of glass tube is 4 mm ? 4 (CO 1)

(B2) State Newton's Law of Viscosity ; Give the classification of fluid based on the above Law. 4 (CO 1)

(B3) Define Dynamic viscosity and Kinematic viscosity with their S.I. units. 2 (CO 1)

2. Answer the following :—

(A1) Define – Atmospheric pressure, Absolute pressure, Gauge pressure. Give relation between them and show it on sketch. 4 (CO 1)

(A2) An U – tube differential manometer connected two pressure pipes A and B. Pipe A contains, carbon tetra chloride having a sp. gravity of 1·6 under a pressure of 13·5 KN/m^2 and pipe B contains oil of sp. gravity of 0·9 under a pressure of 20·5 KN/m^2. Pipe A is 2·5 m above pipe B. Find the difference in mercury level between two limbs as fluid filling the U – tube. Assume that the level of mercury connecting pipe A is in level with the centre of pipe B. 4 (CO 1)

(A3) Define Manometer and give its classification. 2 (CO 1)

OR

(B1) State and prove Pascal's Law along with neat sketches. 4 (CO 1)

(B2) An U – tube containing mercury has its right limb opened to atmosphere. The left limb is full of water and connected to a pipe containing water under pressure, the center of which is in level with the free surface of mercury. Find the pressure of water in the pipe above atmospheres if the difference of level of mercury in the limbs is 6 cm. 4 (CO 1)

(B3) Define Manometer and Mechanical Gauges. 2 (CO 1)

3. Answer the following :—

(A1) Derive an expression for the depth of centre of pressure from free surface of liquid of an inclined plane surface submerged in liquid. 4 (CO 1)

(A2) A circular plate 6·0 m diameter is immersed in water in such a way that its greatest and least depth below the free surface are 6 m and 3 m respectively. Determine the total pressure on one face of the plate and position of the centre of pressure. 4 (CO 1)

(A3) Define :

(i) Steady and Unsteady Flow.

(ii) Uniform and Non – Uniform Flow. 2 (CO 1)

OR

(B1) Derive an expression for the force exerted on a submerged vertical plane surface by the static liquid and locate the position of centre of pressure. 4 (CO 1)

(B2) Calculate Total force and locate centre of pressure for an immersed triangular plane 2 m base and 3 m height immersed in oil of specific gravity 0·9 in inclined position such that depth of vertex is 1 m and depth of base 3·5 m. 4 (CO 1)

(B3) Define Laminar and Turbulent Flow. 2 (CO 1)

4. Answer the following :—

(A1) Show that Streamlines and Equipotential lines intersect each other orthogonally. 4 (CO 1, 2)

(A2) In a two–dimensional incompressible flow, the fluid velocity components are given by $u = x - 4y$ and $v = -y - 4x$.
Show that velocity potential exists. Find also the stream function. 4 (CO 1, 2)

(A3) Define : Streamline and Path Line. 2 (CO 2)

OR

(B1) Derive Continuity equation in Cartesian Co–ordinate system for steady flow of an incompressible fluid. 4 (CO 1, 2)

(B2) The velocity vector in a fluid flow is given by $V = (yz + t)\,i - (xz - t)\,j + (xy)\,k$. Find the acceleration of fluid particle at (2, 3, 4) and at time $t = 2$. 4 (CO 1, 2)

(B3) Write a short note on flow net. 2 (CO 2)

5. Answer the following :—

(A1) Derive Euler's equation of fluid motion. 4 (CO 1, 3)

(A2) Derive expression for discharge through Venturimeter. 4 (CO 1, 3)

(A3) State Bernoulli's theorem for steady flow of an incompressible fluid. 2 (CO 1, 3)

OR

(B1) A pipeline having a length of 7 m between section A (diameter 200 mm) and section B (diameter 450 mm) is inclined at an angle of 20 degree upwards with horizontal with section A at lower level. If the velocity of flow of water is 1·8 m/s at section A upwards and loss between two sections is 5 cm, determine the difference of pressures between the two sections. 4 (CO 1, 3)

(B2) A Venturimeter is used to measure the flow of liquid of specific gravity 0·785 in a pipeline, the throat area ratio is 5. If the difference in mercury level in the gauge is 7·5 cm. Calculate the flow in lit/hr., if the pipe diameter is 40 cm with Cd as 0·97. 4 (CO 1, 3)

(B3) Define Kinetic Energy and Momentum correction factor. 2 (CO 3)

6. Answer the following :—

(A1) Derive the expression $Cd = Cc \times Cv$ and write std. values for sharp edge circular orifice. 4 (CO 1, 3)

(A2) A large tank has a rectangular sharp – edged orifice 1·2 m broad and 0·75 m deep, the top edge of which is 0·6 m below the level of water in the tank. Find the quantity of water flowing through the orifice in cumec, if the coefficient of discharge is 0·63. 4 (CO 1, 3)

(A3) Define 'vena – contracta', write a note on it. 2 (CO 3)

OR

(B1) Distinguish between :—

(i) External mouthpiece and internal mouthpiece.

(ii) Mouthpiece running free and mouthpiece running full. 4 (CO 3)

(B2) A 50 mm diameter orifice in a vertical side of the tank discharge water. The water surface at the tank is at constant level of 2·0 m above the centre of orifice. If the head loss in the orifice is 0·2 m and the coefficient of contraction is 0·63, determine coefficient of discharge, coefficient of velocity and discharge through the orifice. 4 (CO 1, 3)

(B3) Define any two Hydraulic coefficients of orifice. 2 (CO 3)