RDR/ORT/2KNT – 10106/10141

B. E. Third Semester (Civil Engineering) / SoE – 2014 – 15 Examination

Course Code : CV 1205 / CV 205 **Course Name : Fluid Mechanics – I**

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 dimesions.
(4) Assume suitable data wherever necessary.
(5) Use of Logarithmic tables, non programmable calcualtor, Steam tables, Mollier's chart, Drawing instruments, Thermodynamic tables for moist air, Psychrometric charts and Refrigeration charts is permitted.

1. Solve the following :—

(A1) Draw the Rheological diagram and show different types of fluid thereon. 4(CO1)

(A2) The pressure outside the droplet of water of diameter 0.04 mm is $10.32\ N/cm^2$ (atm. pressure). Calculate absolute pressure within the droplet, if surface tension $\sigma = 0.0725\ N/m$ and derive the formula which is used. 4(CO1)

(A3) Find the expression for pressure inside the Liquid droplet. 2(CO1)

OR

Solve the following :—

(B1) A fluid of absolute viscosity 8 poise flows past a flat plate and has a velocity 100 cm / s at the vertex which is 20 cm from the plate surface. Make calculations for the velocity gradients and shear stress at points 5 cm , 10 cm 15 cm and 20 cm from the boundary. Assume a parabolic velocity distribution. 4(CO1)

(B2) Calculate the capillary rise in glass tube of 2 mm diameter when immersed in water. If value of surface tension for water at $20\ ^0C$ in contact with air is 0.072 N / m. What will be % change in capillarity if diameter of glass tube is 4 mm. 4(CO1)

(B3) Explain Newtons law of viscosity. 2(CO1)

2. Solve the following :—

(A1) Derive an expression for depth of centre of pressure for a vertical flat plate immersed in water. Use usual notations for the expression. 4(CO3)

(A2) A Trapezoidal 2.0 meter wide at the bottom and 1.0 meter deep has side slop 1 : 1.
Determine :

(I) Total pressure

(II) Center of pressure on the vertical gate closing the channel when it is full of water. 4(CO3)

(A3) Define Total Pressure and Center of pressure. 2(CO1)

OR

Solve the following :—

(B1) What will be the total pressure force and center of pressure on the surface of plane for the following cases :

(1) Horizontal plane surface submerged in liquid.

(2) Vertical plane surface submerged in liquid. 4(CO3)

(B2) A circular plate 2.0 mt. Diameter is immersed in water in such a way that its greatest and least depth below the free surface are 3 mt. and 1 mt. respectively. Determine the total pressure on one face of the plate and position of the centre of pressure. 4(CO3)

(B3) State "Pascal's Law". 2(CO1)

3. Solve the following :—

(A1) Derive the continuity equation for three Cartesian coordinate system. 4(CO2)

(A2) If potential function $\Phi = 6xy$ find stream function ψ and its value at point (1,2). 4(CO2)

(A3) Define Normal and tangential acceleration. 2(CO2)

OR

Solve the following :—

(B1) If $V = 4xi + 5yj$, Determine the equations of steam line at point (2 , 4). 4(CO2)

(B2) A two dimensional flow field is given by
$\Phi = 9\,xy$,

Determine stream function and its value at point (1 , 3) 4(CO2)

(B3) Define Steady and unsteady flow. 2(CO2)

4. Solve the following :—

(A1) Define kinetic energy correction factor, momentum correction factor and write its value for laminar flow and turbulent flow in pipe. 4(CO3)

(A2) Explain the principal on which pitot tube works and derive its expression. 4(CO3)

(A3) What is momentum equation ? 2(CO3)

OR

Solve the following :—

(B1) Explain :
Kinetic energy correction factor
Momentum correction factor. 4(CO3)

(B2) 450 lit / sec of water is flowing in a pipe having a dia of 310 mm. If the pipe is bend $125^{\mathbf{0}}$. Find the magnitude and direction of resultant force exerted by water on the bend, The pressure of the water flowing is 450 KN / $m^{\mathbf{2}}$. 4(CO3)

(B3) State Bernoulli's theorem. 2

5. Solve the following :—

(A1) Define mouth piece and give its classification with brief explanation. 4(CO3)

(A2) The diameter of throat and exit of convergent and divergent mouthpiece are 40 mm and 80 mm resp. It is fitted to vertical side of tank containing water. If the maximum vacuum pressure is 7.5 m of water. Find the maximum head of water. Take the atm. Pressure head 10.3 meter of water. 4(CO3)

(A3) Define coefficient of contraction and coefficient of velocity. 2(CO3)

OR

Solve the following :—

(B1) Define large rectangular orifice and Derive the expression for flow through large rectangular orifice. 4(CO3)

(B2) A tank has two identical orifices, each 5 cm in one of its vertical sides and is situated one above another. The upper orifice is 4 met. Below water surface and lower is 6 meter below water surface. The coefficient of contraction and coeff. of velocity are 0.64 and 0.98 for both the orifice Find :

(1) The combine rate of discharge from the two orifices.

(2) The distance of the point of intersection of the two jets from the vertical side. 4(CO3)

(B3) Define Mouthpiece running free and mouthpiece running full. 2(CO3)

6. Solve the following :—

(A1) Explain and derive the expression for Eulers and Froude numbers. 4(CO4)

(A2) The pressure drop '$\triangle$P' in a pipe of dia 'D' and length 'L' depends on mass density 'ρ', viscosity 'μ' of the flowing fluid, mean velocity 'V' of the flow and avg. height of roughness projection on the pipe surface 'k'. Obtain a dimensionless expression for '$\triangle$p'. 4(CO4)

(A3) State Buckingham π theorem. 2(CO4)

OR

Solve the following :—

(B1) Explain Rayleigh's method. By using Rayleigh's method, show that the power 'p' developed by pump depends on sp. weight 'γ', Discharge 'Q', and head 'H' is given by $P = \gamma QH$. 4(CO4)

(B2) Explain similitude and various types of similarities between model and prototype. 4(CO4)

(B3) Define model and prototype structure. 2(CO4)