B.Tech. SEM -IV (Civil) 2014 Course (CBCS) : WINTER - 2018

SUBJECT: MECHANICS OF FLUIDS

Day: Thursday
Date: 15/11/2018

W-2018-2334

Time: 02.30 PM TO 05.30 PM
Max. Marks: 60

N.B.:

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Draw neat and labeled diagrams **WHEREVER** necessary.

Q.1 **a)** What is Newton's law of viscosity? **(05)**

b) A circular plate of 2.5m dia. is submerged vertically in water? Its top edge is at a distance of 2.5m from surface of water. Determine: **(05)**
i) The total pressure on one face of plate
ii) The position of center of pressure.

OR

Q.1 **a)** What is metacentric height? **(05)**

b) A square plate of side 2m is immersed in water in such a way that its top edge is at 2m and bottom edge is at 3m distance from water surface. Find total pressure on the plate and depth of center of pressure. **(05)**

Q.2 **a)** Explain the following: **(05)**
i) Steady flow ii) Uniform flow

b) For the following stream functions calculate velocity at (2, 2). **(05)**
i) $\psi = 3xy$ ii) $\psi = 3x^2y - y^3$

OR

Q.2 **a)** What is Velocity Potential Function and Stream Function? **(05)**

b) A pipe of 400 mm diameter branches into two pipes of diameter 200 mm and 250 mm respectively. If average velocity in 400 mm diameter pipe is 2m/s. Find: **(05)**
i) Discharge through 400 mm diameter pipe
ii) Velocity in 200 mm diameter pipe, if velocity in 250 mm diameter pipe is 1m/s.

Q.3 **a)** State Bernoulli's theorem with significance of various terms in it. **(05)**

b) Water is flowing through a tapering pipe having diameter 200 mm at section 1 and 150 mm at section 2. The discharge through the pipe is $0.01 m^3$/Sec. The section 1 is 2m above the datum and section 2 is 5m above the datum. Find intensity of pressure at section 2 if intensity of pressure at section 1 is $100 KN/m^2$. **(05)**

OR

Q.3 **a)** What is Total Energy Line and Hydraulic Gradient Line? **(05)**

b) A smooth inclined pipe of uniform diameter 200 mm is having pressure of 20kpa at section 1-1. At another section 2-2 having elevation of 5m above section 1-1., the pressure is 10kpa and velocity is 1m/s. Determine the direction of flow and head loss. Density of Water = $1000 Kg/m^3$. **(05)**

P. T. O.

Q.4 **a)** Explain Dimensional Homogeneity of an equation with suitable example. **(05)**

b) The Resisting force F on the airplane depends upon length of aircraft l , velocity v, air density ρ, air viscosity μ, bulk modulus of air K. Express functional relationship between these variables and resisting force using Buckingham's π Method. **(05)**

OR

Q.4 **a)** The efficiency η of a fan depends upon air density ρ, the dynamic viscosity of air μ , the angular velocity ω , the diameter D of the rotar, the discharge Q. Express η in terms of dimensionless parameters. **(05)**

b) State and explain Buckingham's π theorem. **(05)**

Q.5 **a)** What are characteristics of Laminar flow? **(05)**

b) A fluid of density 1200 kg/m^3 and viscosity 0.006N-s/m^2 is flowing through a pipe of diameter 0.5m. The rate of flow is 3m^3/s. Is this flow laminar or turbulent? **(05)**

OR

Q.5 **a)** What are method of controlling boundary layer separation? **(05)**

b) The velocity distribution in a boundary layer is $\frac{u}{U}=\frac{y}{\delta}$. **(05)**

Determine the displacement thickness and momentum thickness.

Q.6 **a)** Explain Prandtl's mixing length theory. **(05)**

b) The diameter of horizontal pipe which is 250 mm is suddenly enlarged to 500mm. The rate of flow through pipe is 0.25m^3/s. Find loss of head due to sudden enlargement. **(05)**

OR

Q.6 **a)** What are outcomes Nikurandse's Experiment? **(05)**

b) Derive expression for the hydraulic power transmission through pipes? **(05)**

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