C **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 53105

B.E./B.Tech. DEGREE EXAMINATION, MAY 2018

Third Semester

Civil Engineering

15UCE305 - FLUID MECHANICS

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

PART A - (5x 1 = 5 Marks)

Answer All Questions

1. Property of a fluid by which molecules of different kinds of fluids are attracted to each other is called CO1- R

   (a) Adhesion (b) Cohesion (c) Viscosity (d) Compressibility

2. The range for co-efficient of discharge(C_d) for a Venturimeter is CO2- U

   (a) 0.6 to 0.7 (b) 0.7 to 0.8 (c) 0.8 to 0.9 (d) 0.95 to 0.99

3. The boundary layer separation takes place if CO3- R

   (a) pressure gradient is zero (b) pressure gradient is positive

   (c) pressure gradient is negative (d) none of the above

4. At a sudden expansion in a horizontal pipe CO4- R

   (a) Total energy line rises in the direction of flow

   (b) Velocity head increasing in the direction of flow

   (c) Hydraulic grade rises in the direction of flow

   (d) Total energy line is below the hydraulic grade line

5. The ratio of all corresponding linear dimension in the model and prototype are equal in — CO5- R

(a) Geometric similarity (b) Dynamic similarity

(c) Kinematic similarity (d) Model analysis

PART – B (5 x 3= 15Marks)

6. Define isothermal process. — CO1- App

7. The velocity potential function is given by $\phi=5(x^2- y^2)$. Calculate the velocity components at the point (4, 5). — CO2-App

8. Define momentum correction factor. — CO3- U

9. Find the head loss due to friction in a pipe of diameter300mm and length 50m, through which water is flowing at a velocity of 3m/s using Darcy formula. Take γ for water =0.01stoke. — CO4- App

10. State Buckingham's π theorem. Why this theorem is considered superior over the Rayleigh's method for dimensional analysis. — CO5- U

PART – C (5 x 16= 80Marks)

11. (a) Briefly explain the surface tension and calculate surface tension for soap bubble, water droplet and liquid jet. — CO1-App — (16)

Or

(b) The dynamic viscosity of an oil used for lubrication between a shafts and sleeves is 6 poise. The shaft is 0.5m diameter and rotates at speed a of 200rpm. Calculate power loss in the bearing for a sleeve length of 10mm thickness of oil film 1.5mm. — CO1 -App — (16)

12. (a) (i) A 30cm diameter pipe conveying water, branches into two pipes of diameters 20cm and 15cm respectively. If the average velocity in the 30cm diameter pipe is 2.5m/s, find the discharge in this pipe. Also determine the velocity in 15cm pipe if the average velocity in 20 cm diameter pipe is 2m/s. — CO2 -App — (10)

(ii) Enlist the types of fluid flow. — CO2 -U — (6)

Or

(b) (i) Derive Bernoulli's equation. CO2 -App (10)

(ii) An oil of specific gravity 0.8 is flowing through a Venturimeter having inlet diameter 20 cm and throat diameter 10 cm. The oil- mercury differential manometer shows a reading of 25 cm. Calculate the discharge of oil through the horizontal Venturimeter. Take C_d=0.98 CO2 -App (6)

13. (a) For the laminar boundary layer, the velocity distribution is given by $u/U = 2(y/\delta) - (y/\delta)^2$. Compute the displacement thickness, energy and momentum thickness. CO3- App (16)

Or

(b) For the following velocity profiles, determine whether the flow has separated or on the verge of separation or will attach with the surface: CO3- App (16)

(i) $\frac{u}{U} = \frac{3}{2}\left(\frac{y}{\delta}\right) - \frac{1}{2}\left(\frac{y}{\delta}\right)^3$

(ii) $\frac{u}{U} = 2\left(\frac{y}{\delta}\right)^2 - \left(\frac{y}{\delta}\right)^3$

(iii) $\frac{u}{U} = -2\left(\frac{y}{\delta}\right) + \left(\frac{y}{\delta}\right)^2$

14. (a) An oil of viscosity 0.1Ns/m^2 and relative density 0.9 is flowing through a circular pipe of diameter 50mm and of length 300m. The rate of flow of fluid through the pipe is 3.5 l/s. Find the pressure drop in a length of 300m and also the shear stress at the pipe wall. CO4-App (16)

Or

(b) A pipe line having diameter 30cm, length 3km carries water from P to R .The piezometric head of P and R are maintained that 100m and 80m. To increase a discharge of second pipe is added parallel to exist pipe P to R. The length of addition pipe is also 2km assume the friction factor f=0.04 for all pipe and ignore minor loss. What is increasing discharge of addition pipes as same diameter of 0.3m? CO4 -App (12)

(ii) Find the loss of head when a pipe of diameter 200mm is suddenly enlarged to a diameter of 400mm. The rate of flow of water through the pipe is 250l/s. CO4 -App (4)

15. (a) Using Buckingham's π theorem, show that the velocity through a circular orifice is given by $V=\sqrt{2GH}\ \phi\ (\frac{D}{H}, \frac{\mu}{\rho VH})$. Where, H-head causing flow, D-diameter of orifice, μ-coefficient of viscosity, G-acceleration due to gravity, ρ-mass density. CO5- Ana (16)

Or

(b) (i) Briefly discuss the important dimensionless numbers. CO5- Ana (8)

(ii) A 7.2m height and 15m long spillway discharges 94 m^3/s discharge under head of 2.03. If 1:9 scare model of this spillway is to be constructed, determine model dimensions, head over spillway model and model discharge. CO5- Ana (8)