Reg. No. : | | | | | | | | | | | | |

Question Paper Code : X20289

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
AND APRIL/MAY 2021
Third Semester
Civil Engineering
CE 6303 – MECHANICS OF FLUIDS
(Common to Environmental Engineering)
(Regulations 2013)
(Also Common to PTCE 6303 – Mechanics of Fluids for B.E. (Part-Time) – Second Semester – Civil Engineering – Regulations 2014)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions.

PART – A **(10×2=20 Marks)**

1. Determine the specific gravity of a fluid having viscosity 0.005 Ns/m^2 and kinematic viscosity 0.035×10^{-4} m^2/s.

2. State the concept of pressure measurement used in mechanical gauges.

3. Distinguish between uniform and non-uniform flows.

4. Write the expression for the resultant force acting between two sections of the pipe in terms of discharge using impulse-momentum principle.

5. What is hydraulic gradient line and total energy line ?

6. What is Moody's diagram and its importance in pipe flow ?

7. Define boundary layer thickness.

8. Give the classification of boundary layer flow based on the Reynolds number.

9. What is meant by dimensionally homogeneous equation ?

10. Distinguish between undistorted and distorted models.

PART – B **(5×13=65 Marks)**

11. a) A sliding fit cylindrical body of diameter 399 mm, length 200 mm and mass 3.5 kg drops vertically down inside a hollow cylinder of 400 mm internal diameter at a constant velocity of 0.05 m/s. Calculate the viscosity of oil filled in the space between the cylinders. **(13)**

(OR)

b) Find the total pressure and position of centre of pressure on a triangular plate of base 2 m and height 3 m which is immersed in water in such a way that the plane of the plate makes an angle of 60° with the free surface of the water. The base of the plate is parallel to water surface and at a depth of 2.5 m from water surface. **(13)**

12. a) If for a two-dimensional potential flow, the velocity potential function is given by $\Phi = x(2y - 1)$, determine the velocity at the point P(2, 3). Determine also the value of stream function at the point P. **(13)**

(OR)

b) An oil of specific gravity 0.8 is flowing through a horizontal venturimeter having a inlet diameter 200 mm and throat diameter 100 mm. The oil-mercury differential manometer shows a reading of 250 mm, calculate the discharge of oil through the venturimeter. Take $C_d = 0.98$. **(13)**

13. a) A crude oil of viscosity 0.97 poise and relative density 0.9 is flowing through a horizontal circular pipe of diameter 100 mm and of length 10 cm, calculate the difference of pressure at the two ends of the pipe, if 100 kg of the oil is collected in a tank in 30 seconds. **(13)**

(OR)

b) Determine the rate of flow of water through a pipe a of diameter 20 cm and length 50 m when one end of the pipe is connected to tank and other end of the pipe is open to the atmosphere. The pipe is horizontal and the height of water in the tank is 4m above the center of the pipe . Consider all minor losses and take f = 0.009. **(13)**

14. a) A plate of 600 mm length and 400 mm wide is immersed in a fluid of specific gravity 0.9 and kinematic viscosity of (v) = 10^{-4} m^2/s the fluid is moving with the velocity of 6m/s. Determine :

i) Boundary layer thickness **(4)**

ii) Shear stress at the end of the plate and **(4)**

iii) Drag force on one of the sides of the plate. **(5)**

(OR)

b) Briefly explain the following terms;
   i) Displacement thickness **(4)**
   ii) Momentum thickness **(4)**
   iii) Energy thickness. **(5)**

15. a) A partially submerged body is towed in water. The resistance R to its motion depends on the density ρ, the viscosity μ of water, length *l* of the body, velocity v of the body and acceleration due to gravity g. Using Buckingham's π method of dimensional analysis, express R in terms of dimensionless parameters.

(OR)

b) Show that the time period of a pendulum $t = 2\pi \sqrt{L/g}$ using Rayleigh's method of dimensional analysis and brief the three types of similitude between model and its prototype.

PART – C **(1×15=15 Marks)**

16. a) With basic assumptions derive the Bernoulli's Equation from the Euler's Equation.

(OR)

b) Using Buckingham π method of dimensional analysis obtain an expression for the drag force R on a partially submerged body moving with a relative velocity V in a fluid, the other variables being the linear dimension L, height of surface roughness K, fluid density ρ and the gravitational acceleration g.

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