Roll No. | | | | | | | | | | |

B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL / MAY 2019

COMMON TO CIVIL AND AGRICULTURAL AND IRRIGATION ENGINEERING

Third Semester

CE 8351 - FLUID MECHANICS

(Regulation 2012)

Time : 3 Hours | Answer ALL Questions | Max. Marks 100

PART-A (10 x 2 = 20 Marks)

1. What is surface tension in fluids?
2. What is Newtonian fluid and give few examples.
3. Define system and control volume.
4. What is streamline?
5. Distinguish between distorted and undistorted model.
6. Write the forces involved in different dimensionless numbers.
7. What is Moody diagram?
8. What do you mean by eddy and vena contracta in pipe flow?
9. Define boundary layer.
10. What is steady molecular diffusion?

Part – B (5 x 16 = 80 marks)

11. (i) Derive Von Karman momentum integral equation. (10)
(ii) Discuss the phenomenon of boundary layer separation in a diverging flow. (6)

12. a) (i) The pipe of 30 cm in diameter carries the water under the head of 30 m with a velocity of 4 m/s. If the pipe turns through 30° to the horizontal anticlockwise, find out the magnitude and direction of the resultant force at the bend. (8)
(ii) The velocity distribution for the flow of a Newtonian fluid between two wide, parallel plates is given by the equation $u = \frac{3V}{2}\left[1 - \left(\frac{y}{h}\right)^2\right]$ where V is the mean velocity, y is the vertical distance from centre of the pipe. The fluid has a viscosity of 1.92 Ns/m^2. When V=0.6 m/s and h=0.5 cm. determine: (a) the shearing stress acting on the bottom wall, and (b) the shearing stress acting on a plane parallel to the walls and passing through the centreline (midplane) (8)

(OR)

b) The gates of a lock are 5 m wide and 5 m high and, when closed, include an angle of 120°. Each gate is held on two hinges, one placed at the top and the other at the bottom of the gate. If the water levels are 4.5 m and 3 m on the upstream and downstream sides respectively, determine the magnitude of the forces on the hinges due to the water pressure. (16)

13. a) (i) Derive Euler's equation of motion along a stream line and obtain Bernoulli's equation by its integration. Also write its assumptions. (10)

(ii) The velocity components in a fluid flow given by $u = 2xy$ and $v = a^2 + x^2 - y^2$, show that the flow is possible. Obtain the relevant stream function. (6)

(OR)

b) A pipe carrying water has a 30 cm x 15 cm venturimeter (Figure-13.b) which is positioned inclined at 30° to the horizontal. The flow is upwards. The distance between the pressure tapping in the direction of flow is 45 cm in and the C_d = 0.98. A differential U-tube manometer with mercury as manometric fluid is connected to the inlet and to the throat and shows a differential column height of 30 cm. (i) Calculate the discharge in the pipe and (ii) if the pressure in the inlet section is 50 kPa, determine the pressure at the throat. (16)

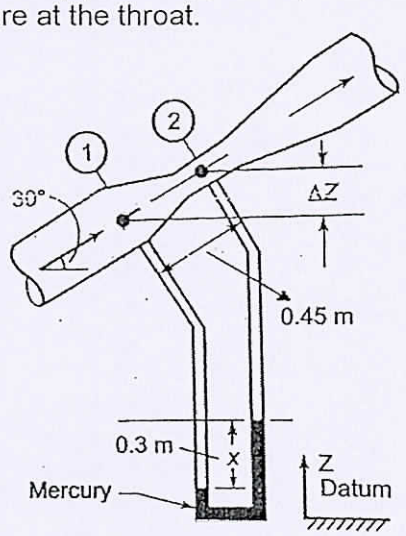

Figure-13.b

14. a) The frictional pressure loss per unit length of the pipe (Δp/L) is dependent on density of the fluid ρ, diameter of the pipe d, velocity of flow v, viscosity of the flowing fluid μ and roughness of the pipe ε. By using dimensional analysis technique and Buckingham π theorem, prove the loss pressure head is $h_f = \frac{4flv^2}{2gd}$. (16)

(OR)

b) (i) A model 1/10 of prototype of a flying boat is towed in freshwater. The prototype moving in a sea water of density 1030 kg/m^3 with a speed of 72 km/hr. Find the corresponding speed of the model. Also find out the resistance due to waves on model if the wave resistance experienced by prototype is 750 N. (10)

(ii) Explain the similarities in Model Studies (6)

15. a) Derive an expression for steady laminar flow in circular pipes and prove that the $U_{max}/V=2$, and head loss between two sections is 32 ν V L/(g D^2), where ν is kinematics viscosity. Draw the necessary sketches. (16)

(OR)

b) Two reservoirs with a difference in water surface elevation of 10 m are connected by a pipeline ABC which consists of two pipes of AB and BC joined in series. Pipe AB is 10 cm in diameter and 20 m long and has a value of friction factor f = 0.02. Pipe BC is of 16 cm diameter, 25 m long and has f = 0.018. (i) Calculate the discharge and (ii) Determine the difference in reservoir elevations necessary to have a discharge of 15 liters/s. Include all losses for both the cases. (16)