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

Total No. of Pages : 03

Total No. of Questions : 18

B.Tech. (CE) (2018 Batch) (Sem.–3)

FLUID MECHANICS

Subject Code : BTCE-303-18

M.Code : 76372

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

Write briefly :

1. Water is flowing through a vertical pipe. At a certain location the diameter of the pipe is doubled. How the water pressure will vary from a point just u/s and d/s of the section where the diameter is changed?

2. What do you understand by non uniform flow? Is steady non uniform flow possible in an open channel?

3. Explain stable equilibrium of a body.

4. Express pressure intensity of 9 kg/cm2 into equivalent water head.

5. What do you understand by boundary layer?

6. What is the dimensional formula of a kinematic viscosity in F, L and T system of units?

7. Differentiate between streamline and streak line.

8. What is specific energy? Give its units.

9. What are the conditions required for the formation of hydraulic jump in a channel with respect to type of flow and Froude number?

10. What do you understand by critical flow and sub critical flow?

SECTION-B

11. The height of a water tank is 8m. A 4m × 2m wide rectangular gate is fitted at the bottom of this tank vertically with 4 m side vertical and is hinged at point which is 0.2 m below the centre of gravity of the gate. The total depth of water is 6 m. What horizontal force must be applied at the bottom of the gate to keep the gate closed?

12. A cylindrical tank 0.8 m high and 0.6 m diameter is filled completely with water. If it is rotated at a speed of 12 radians/s, how many litres of water will be spilled? Also determine the speed at which the water surface will just touch the top rim and the centre bottom of tank.

13. A pipe of 500 m long has a slope of 1 in 125 and tapers from 1.2 m diameter at high end to 0.6 m at low end. The water flows through the pipe at $1 m^3/s$. If the pressure at the low end is $0.8 kg/cm^2$, find the pressure at the high end of the pipe. The total loss in the pipe may be taken as 1% of velocity head difference at the two ends.

14. As shown in figure, pipe M contains a liquid having specific gravity 1.55 under a pressure of $1.2 kg/cm^2$ and pipe N contains another fluid having specific gravity 0.85. If the pressure in the pipe N is $1.8 kg/cm^2$ and the manometric fluid is mercury, find the difference x between the level of mercury.

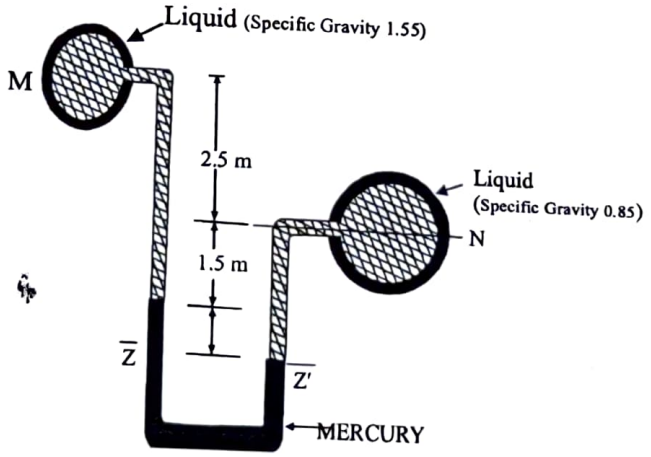

FIG.1

15. The velocity components in a two dimensional flow field for an incompressible fluid are expressed as :

$$u = \frac{y^3}{3} + 2x - x^2 y, \qquad v = xy^2 - 2y - \frac{x^3}{3}$$

Show that these represent a possible case of irrotational flow. Also find out an expression for stream function.

SECTION-C

16. A pipeline ABC is 200 m long. It is laid on an upward slope of 1 in 50. The length of portion AB is 90 m and its diameter is 0.16 m. At B the pipe section suddenly enlarges to 0.32 m diameter and remains so for the remainder of its length. A flow of 3 m^3/minute is pumped into the pipe at the lower end A and is discharged at the upper end C into a closed tank. The pressure intensity at end A is 140 kN/m^2. Sketch the hydraulic grade line and total energy line. Also find the pressure at the discharge end C. Take f = 0.02.

17. a. Show that at critical state of flow $\frac{Q^3}{g} = \frac{A^3}{T}$, where the symbols have their usual meaning.

    b. In a hydraulic jump occurring in a rectangular channel of 3 m width, the initial depth is 0.28 m for a discharge of 7.8 m^3/s. Estimate the sequent depth and the energy loss in the jump.

18. a. Show by method of dimensional analysis that the resistance R to the motion of a sphere of diameter D moving with uniform velocity V through a fluid having density ρ and viscosity μ may be expressed as $R = \rho D^2 V^2 f\left(\frac{\mu}{\rho VD}\right)$

    b. Differentiate between open channel flow and pipe flow.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.