Section C

5. (a) Obtain an expression for continuity equation for a three-dimensional flow. **6**

   (b) A horizontal pipe line 50 m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 30 m of its length from the tank, the pipe is 140 mm diameter and its diameter is suddenly enlarged to 280 mm. The height of water level in the tank is 10 m above the center of the pipe. Considering all losses of head which occur, determine the rate of flow. Take $f = 0.01$ for both sections of the pipe. **6**

6. (a) Derive Bernoulli's equation from Euler's equation of motion. **6**

   (b) The difference in water surface levels in two tanks, which are connected by three pipes in series of length 350 m, 150 m and 200 m and of diameters 50 mm, 200 mm and 300 mm respectively, is 12 m. Determine the rate of water flow if coefficient of friction are 0.005, 0.0052 and 0.0048 respectively considering minor losses also. **6**

July-22-00229

B.Tech. EXAMINATION, 2022

Semester III (CBCS)

FLUID MECHANICS

ME-302

Time : 3 Hours   *Maximum Marks : 60*

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt *Five* questions in all, selecting *one* question from each Sections A, B, C and D. Q. No. **9** is compulsory. Non-programmable calculator is allowed.

Section A

1. (a) Define the following fluid properties : **6**
   - (i) Specific gravity
   - (ii) Viscosity
   - (iii) Surface tension.

(b) A circular plate of diameter 1.5 m is placed vertically in water in such a way that the center of plate is 2 m below the free surface of the water. Determine the total pressure and center of pressure for the plate. (Density of water = 1000 kg/m³). **6**

2. (a) What are the different types of fluids ? Explain with examples. **6**

(b) A uniform body of size 4 m long, 2 m wide and 1 m deep floats in water. What is the weight of the body if depth of immersion is 0.6 m ? Also calculate the meta-centric height. (Density of water = 1000 kg/m³) **6**

Section B

3. (a) Distinguish between the following types of fluids flows : **6**

(i) Steady and un-steady

(ii) Uniform and non-uniform

(iii) Laminar and turbulent.

(b) A horizontal venturimeter with inlet diameter 30 cm and throat diameter 15 cm is used to measure the flow of oil of specific gravity 0.8. The discharge of oil through venturimeter is 50 liters/sec. Find the reading of the oil-mercury differential manometer. Take Coefficient of discharge of venturimeter = 0.98. (Specific gravity of mercury = 13.6) **6**

4. (a) Explain the following terms : **6**

(i) Velocity potential function

(ii) Stream line

(iii) Stream function.

(b) A sub-marine moves horizontally in sea and has its axis 20 m below the surface of water. A pitot-static tube placed in front of the sub-marine and along its axis is connected to the two limbs of a U-tube manometer containing mercury. The difference of mercury level is found to be 20 cm. Find the speed of the sub-marine. Take specific gravity of mercury 13.6 and sea-water 1.026. **6**

(d) Cavitation

(e) Pressure

(f) Buoyancy

(g) Meta-center

(h) Streak line

(i) Bernoulli's equation for real fluids

(j) Difference between orifice and mouthpiece

(k) Laminar sub-layer

(l) Reynold's number.

Section D

7. (a) What are the different laws on which models are designed for dynamic similarity ? Where the they used ? 6

(b) What do you mean by separation of boundary layer ? What is the effect of pressure gradient on boundary layer separation ? 6

8. (a) State Buckingham's Pi theorem. What do you mean by repeating variables ? How are the repeating variables selected in dimensional analysis ? 6

(b) What are the different methods of preventing the separation of boundary layers ? 6

(Compulsory Question)

9. Explain the following briefly : 12×1=12

(a) Mass density

(b) Surface tension

(c) Bulk modulus of elasticity