PVP 19

Code: 19ME3403

II B.Tech - II Semester – Regular Examinations – AUGUST 2021

FLUID MECHANICS
(MECHANICAL ENGINEERING)

Duration: 3 hours Max. Marks: 70

Note: 1. This question paper contains two Parts A and B.
2. Part-A contains 5 short answer questions. Each Question carries 2 Marks.
3. Part-B contains 5 essay questions with an internal choice from each unit. Each question carries 12 marks.
4. All parts of Question paper must be answered in one place

PART – A

1. a) Define Dynamic viscosity and Kinematic viscosity.
   b) Explain Meta centric height.
   c) Explain Euler's equation.
   d) Differentiate between rectangular notch and triangular notch.
   e) Describe dynamic similarity.

PART – B

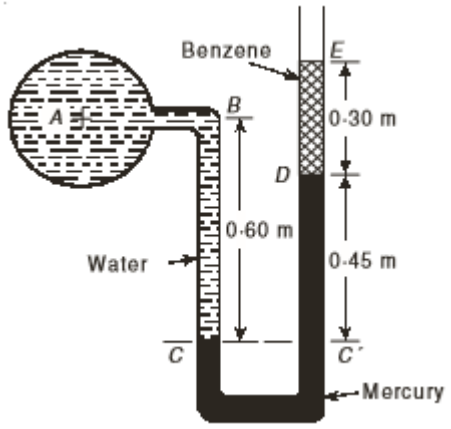
UNIT – I

2. a) Calculate the capillary effect in mm in a glass tube 3 mm in diameter when immersed in (a) water (b) mercury. Both the liquids are at 20°C and the values of the surface tensions for water and mercury at 20°C in contact with air are respectively 0.0736 N/m and 0.51 N/m. Contact angle for water = 0° and for mercury = 130°. 6 M

b) If the equation of a velocity profile over a plate is $v = 2y^{2/3}$; in which v is the velocity in m/s at a distance of y metres above the plate, determine the shear stress at y = 0 and y = 0.075 m. Given μ = 8.35 poise. 6 M

OR

3. a) The left leg of a U-tube mercury manometer is connected to a pipe-line conveying water, the level of mercury in the leg being 0.6 m below the center of pipe-line, and the right leg is open to atmosphere. The level of mercury in the right leg is 0.45 m above that in the left leg and the space above mercury in the right leg contains Benzene (specific gravity 0.88) to a height of 0.3 m. Find the pressure in the pipe. 6 M



b) Briefly explain the principle employed in the manometers used for the measurement of pressure. 6 M

UNIT – II

4. a) Derive the equation of center of pressure for vertical plane surfaces. 6 M

b) Determine the total pressure and center of pressure on an inclined surface with a neat sketch, assume that the angle of inclination is 45 degrees. 6 M

OR

5. a) Describe the stability of submerged and floating bodies. 6 M
   b) A solid cylinder of diameter 4.0m has a height of 4.0m. Find the meta-centric height of the cylinder if the specific gravity of the material of cylinder = 0.6 and it is floating in water with its axis vertical. State whether the equilibrium is stable or unstable. 6 M

UNIT-III

6. a) Derive the Bernoulli's equation from the principle of conservation of energy. 6 M
   b) A bend in pipeline conveying water gradually reduces from 0.6 m to 0.3 m diameter and deflects the flow through angle of 60°. At the larger end the gage pressure is 171.675 kN/m^2. Determine the magnitude and direction of the force exerted on the bend, (a) when there is no flow, (b) when the flow is 876 litres/s. 6 M

OR

7. a) Describe Reynold's experiment with a neat sketch. 6 M
   b) Water at a pressure of 294.3 kN/m^2 flows through a horizontal pipe of 100 mm diameter with a velocity of 2 m/s. If the diameter of the pipe gradually reduces to 50 mm what is the axial force on the pipe assuming no loss of energy. 6 M

UNIT – IV

8. a) Explain the working of an Orifice meter with a neat sketch. 6 M
   b) A venturi meter is to be fitted in a pipe 0.25 m diameter where the pressure head is 7.6 m of flowing liquid and the maximum flow is 8.1 m^3 per minute. Find the least 6 M

diameter of the throat to ensure that the pressure head does not become negative. Take K = 0.96.

OR

9. a) Derive the equation of force exerted by a fluid jet on a inclined vane. 6 M

   b) Derive the equation of discharge of rectangular notch. 6 M

UNIT – V

10. a) Find the form of the equation for discharge Q through a sharp-edged triangular notch assuming Q depends on the central angle α of the notch, head H, gravitational acceleration g and on the density ρ , viscosity μ and surface tension σ of the fluid. 6 M

    b) Describe the procedure of dimensional analysis by using Bucking Ham's pi theorem. 6 M

OR

11. a) List all the variables that may influence the motion of a moving body fully submerged in a fluid, and by dimensional analysis derive an expression for resistance of its motion. 6 M

    b) Assuming that the rate of discharge Q of a centrifugal pump is dependent upon the mass density ρ of fluid, pump speed N (rpm), the diameter of impeller D, the pressure p and the viscosity of fluid μ , show using the Buckingham's π -theorem that it can be represented by 6 M

$$Q = (ND^3)\phi\left[\left(\frac{gH}{N^2D^2}\right),\left(\frac{\upsilon}{ND^2}\right)\right]$$

where H = *head and* υ = *kinematic viscosity of the fluid.*