PVP 20

Code: 20CE3301

II B.Tech - I Semester – Regular Examinations - FEBRUARY 2022

MECHANICS OF FLUIDS
(CIVIL ENGINEERING)

Duration: 3 hours Max. Marks: 70

Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.
2. All parts of Question must be answered in one place.

UNIT – I

1. a) Define surface tension and explain its cause. 7 M
   b) The velocity distribution u in m/s over a plate is given in terms of distance y in m above the plate by $u = (2/3)y - y^2$. Find the shear stress at $y = 0$ and $y = 0.15$ m when viscosity of the fluid is given as 9 poise. 7 M

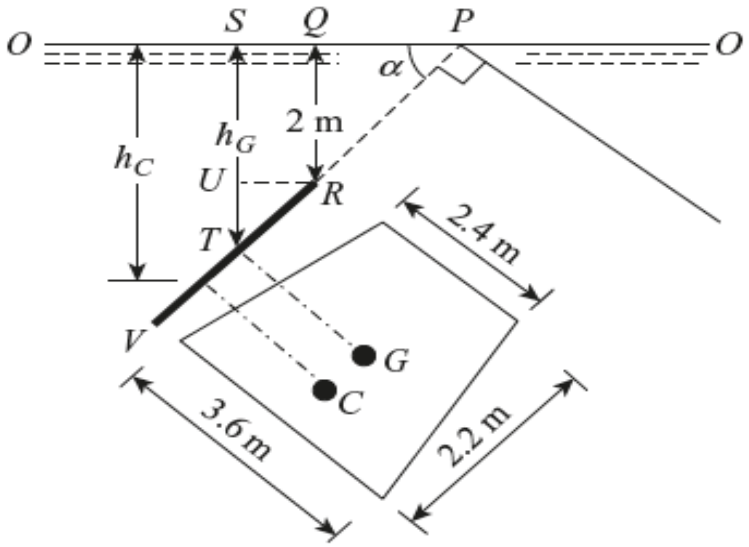
OR

2. a) What do you mean by piezometer? Also give its applications and limitations. 7 M
   b) Briefly explain the constructional and working details of a Bourdon pressure gauge with a neat sketch. 7 M

UNIT – II

3. a) Differentiate between steady & unsteady flow, uniform & non –uniform flow. 6 M
   b) A trapezoidal plate of height 2.2m and sides of 2.4m and 3.6m is immersed in water at an inclination of 30° to the free surface of the water. The depth of top edge of the plate is at 2m from the free surface. Determine

the hydrostatic force on the given plate and the centre of pressure. 8 M



OR

4. a) What are the methods of describing fluid flow? Explain. 6 M

b) If a fluid flow is given by $V = 2x^3i + 3x^2yj$, then determine whether (i) the flow is steady or unsteady (ii) flow is two-dimensional or three-dimensional? Also determine the velocity, local acceleration and convective acceleration at a point (1, 2, 3) in the field. 8 M

UNIT-III

5. a) Give the assumptions, limitations and practical applications of Bernoulli's equation. 6 M

b) A horizontal water pipe fitted with a 90° bend reducer. The pressure at the inlet is 210kPa where its cross-sectional area is $0.012m^2$. If at the exit section, the velocity is 15m/s, the area is $0.0024m^2$ and the pressure is atmospheric, then determine the resultant force exerted on the bend and its direction. 8 M

OR

6. a) What do you mean by boundary layer separation? What is the effect of pressure gradient on boundary layer separation? 7 M

   b) The velocity distribution in the boundary layer is $(u/U) = (1.5y)/\delta - y^2/(2\delta^2)$, where δ is the boundary layer thickness. Determine (i) the ratio of displacement thickness to boundary layer thickness and (ii) ratio of momentum thickness to boundary layer thickness. 7 M

UNIT – IV

7. a) Obtain expression for the difference of pressure head for a given length of the laminar flow between two parallel fixed plates. 7 M

   b) Oil flows between two parallel fixed plates of width 17.5cm kept at a distance of 7.5cm apart. If the drop of pressure in a length of 1.25m is 4kPa and the dynamic viscosity of oil is 1.5N-s/m^2, then determine the discharge of oil in liters per second between the plates. 7 M

OR

8. a) Define major and minor energy losses in pipes. 7 M

   b) A piping system consists of three pipes arrange in series, the length of pipes are 1000m, 750m, 500m and diameters 700mm, 500mm, 400mm, respectively.

   (i) Transform the system to an equivalent 420mm diameter pipe.

   (ii) Determine an equivalent diameter for the pipe of 2500m long. 7 M

UNIT – V

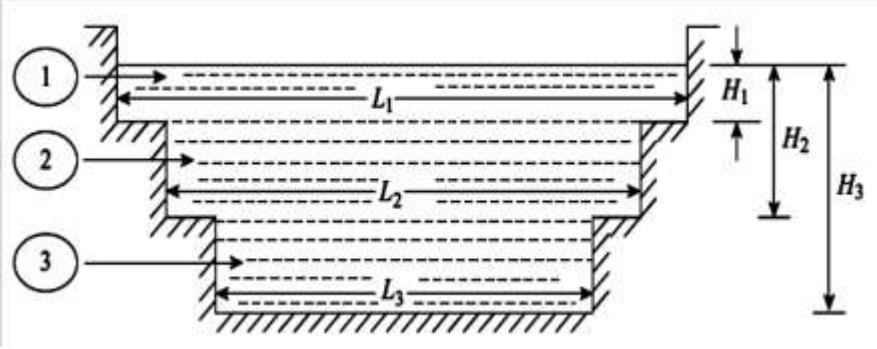
9. a) What is a pitot tube and how will you determine the velocity at any point with the help of it? Also state how it is different than pitot-static tube? 7 M

   b) A horizontal venturimeter with inlet diameter 200mm and throat diameter 100mm is used to measure the discharge. If the pressure at the inlet and vacuum pressure at the throat is 180kPa and 0.35mHg, respectively and the coefficient of meter is 0.98, then determine its discharge. 7 M

OR

10. a) Obtain an expression for discharge over a triangular notch in terms of head of water over its crest. Also mention the advantages of a triangular notch over a rectangular notch. 7 M

    b) Determine the discharge over a stepped rectangular notch as shown in Figure, when L_1 = 0.9m, H_1= 0.4m, L_2 = 0.6m, H_2 = 0.7m, L_3 = 0.3m and H_3= 0.9m. Take the coefficient of discharge for the entire rectangular notch as 0.62.



7 M