

Roll No.

Total No. of Pages : 02

Total No. of Questions : 09

B.Tech.(CE) (Sem.-4)
Fluid Mechanics-II
 Subject Code : CE-204
 Paper ID : [A0607]

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTION 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 has to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students has to attempt any TWO questions.

SECTION-A**I. Write briefly :**

- a. Write the boundary conditions for Plane Poiseuille flow.
- b. Define nominal thickness of boundary layer.
- c. Calculate the nominal thickness of turbulent boundary layer over a flat plate at a distance 10 m from the leading edge, if the free stream velocity is 10 m/s and viscosity is $1 \times 10^{-6} \text{ m}^2/\text{s}$.
- d. Find out the drag force on a sphere of diameter 1 cm falling with uniform velocity of 1 cm/s in a fluid with viscosity 0.1 N-s/m².
- e. What is the concept behind Karman similarity hypothesis in a turbulent flow?
- f. Why the laminar flow separates much early than the turbulent flow?
- g. Define critical, subcritical and supercritical flow.
- h. Write names of four methods to calculate the length of water surface profile in a gradually varied flow.
- i. On what condition the hydraulic jumps take place?
- j. What is normal depth?

SECTION-B

2. Derive the equation for generalized Chezy equation.
3. A rough pipe of 50 cm diameter and roughness height 0.25 mm with a velocity of 4 m/s. The surface roughness is 0.25 mm. Determine whether the flow is laminar or turbulent. Find head loss due to friction.
4. A trapezoidal channel with side slope 1 horizontal to 2 vertical has a discharge of 30 cumec at an average velocity of 1.5 m/s. Find the minimum area of the concrete lining per meter length.
5. A rectangular channel of 2 m width has a discharge of 10 cumec. Find the height of the sudden rise of the channel bed. What upstream flow depth can be maintained?
6. Find out the energy loss expression for a channel flow.

SECTION-C

7. The velocity distribution in the boundary layer over a spillway is in the following form :

$$\frac{u}{U_\infty} = \left(\frac{y}{\delta} \right)^{0.5}$$

The free stream velocity (U_∞) at a section where the boundary layer thickness of 5 cm is estimated. The discharge is 5 m³/s per meter length of the spillway. Find the boundary layer thickness, energy thickness, and the loss coefficient.

8. A sluice across a channel 6 m wide has a discharge of 10 cumec. Calculate the flow rate when the upstream water level has been raised locally to form a hydraulic jump. Find the force on the concrete block if the depth of the water is 1.5 m.
9. Discuss the various flow profiles in a channel with horizontal slopes.