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Total No. of Questions : 09

B.Tech. (CE-2011 Batch) (Sem.–4th)

FLUID MECHANICS-II

Subject Code : BTCE-404

Paper ID : [A1174]

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

1. **Write short notes on :**

   a) In a uniform laminar flow through a pipe what will be the ratio of maximum velocity to average velocity?

   b) Define momentum thickness.

   c) Draw the velocity diagram for the laminar flow in a pipe.

   d) Define sequent depth.

   e) Write the equation for velocity distribution in a rough pipe having turbulent flow.

   f) Define Froude number.

   g) Under what condition a channel section is considered to be the most economical section?

   h) Define specific energy.

   i) Classify the hydraulic jump based on the Froude number.

   j) Draw a neat sketch of S_2 type of profile.

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SECTION-B

2. Using the basic differential equation of Gradually Varied Flow, show that dy/dx is positive for M_3 and S_3 profiles.

3. Water flows at a uniform depth of 2 m in a trapezoidal channel having a bottom width of 6 m and side slopes of 2H: 1V. If it has to carry a discharge of 65 m^3/sec, calculate the bottom slope required to be provided. Use Manning's $n = 0.025$.

4. How will you classify hydrodynamic smooth and rough boundaries in a pipe?

5. Water flows at a steady mean velocity of 1.5 m/sec through a 50 mm diameter pipe sloping upwards at 45° to the horizontal. At section 1, some distance downstream of the inlet, the pressure is 700 kPa and at section 2, 30 m further from the section 1 along the pipe, the pressure is 762 kPa. Determine the average shear stress at the wall of the pipe.

6. What are the causes which result in separation of the boundary layer?

SECTION-C

7. (a) A 3.0 m wide rectangular channel has a flow of 3.60 m^3/sec with a velocity of 0.8 m/sec. If a sudden release of additional flow at the upstream end of the channel causes the depth to rise by 50 percent, determine the absolute velocity of the resulting surge and also calculate the new flow rate.

   (b) A hydraulic jump in a rectangular channel has the Froude number at the beginning of the jump $F_1 = 5$. Calculate the Froude number F_2 at the end of the jump.

8. State and discuss the assumption made in the derivation of the equation for gradually varied flow. Also derive the basic differential equation for gradually varied flow.

9. Determine the displacement thickness and momentum thickness for the velocity profile given by :

$$\frac{u}{u_0} = \sin(\pi\delta / 2)$$

where u_0 is the free stream velocity.