Roll No. | | | | | | | | | | | | | Total No. of Pages : 02

Total No. of Questions : 09

B.Tech.(CE) (2011 onwards) (Sem.–4)

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

SECTION-A

1. Write briefly :

a) From the Navier-Stokes equation derive the equation of motion at very small Reynold's number.

b) What are the forces accounted for the Navier-Stokes equation?

c) Define turbulent intensity.

d) Name the four methods to control the separation of boundary layer.

e) Estimate the longitudinal slope of the channel with depth 2.0 m having the permissible shear stress of 1.96 N/m^2.

f) Write any two factors on which the Manning's roughness depends with reasons.

g) Write down the assumptions in the Chezy's equation.

h) What are the differences between a hydraulic jump and a surge?

i) Differentiate between open channel flow and closed conduit flow.

j) The boundary layer thickness at a distance of 1 m from the leading edge of a flat plate kept at zero angle of incidence to the direction of the flow is 0.1 cm. The velocity outside the boundary layer is 25 m/s. Find the boundary layer thickness at a distance of 4 m.

SECTION-B

2. Derive the equation for laminar flow through the horizontal circular pipe. 5

3. Compare the cost of pumping the same fluid at same discharge through pipes having 15 cm and 20 cm diameters. The absolute roughness of the pipe is 0.03 cm. Assume that the Reynold's number is sufficiently high so that viscous effect is negligible. 5

4. A gate is to be suddenly dropped into place closing a rectangular channel of 2 m deep and 3 m wide. The discharge in the channel is 5.5 m^3/s with a depth of flow is 1.3 m. Determine if the channel will overflow or not. Assuming the sides of the channel to be sufficiently high to prevent it from overflowing, what will be the velocity of the surge produced? 3+2

5. Discuss with reasons the changes in the water surface profiles in a channel over a local rise in the channel bed with the help of a specific energy curve. 5

6. Derive the conditions for most efficient trapezoidal channel. 5

SECTION-C

7. The velocity distribution within the boundary layer is given by :

   $\frac{u}{U_\infty} = \frac{3}{2}\left(\frac{y}{\delta}\right) - \frac{1}{2}\left(\frac{y}{\delta}\right)^3$; where, U_∞ is the free stream velocity, δ is the boundary layer thickness.

   Compute the ratio of displacement thickness of boundary layer to nominal boundary layer thickness.

8. What is specific energy? Draw and discuss the specific energy curve. Hence derive the condition for critical flow in a channel.

9. In a rectangular channel, the specific discharge is 1.62 $m^3/s/m$ and the loss of energy in the jump is 2.2 m. Determine two sequent depths.