

4E1209

Roll No. \_\_\_\_\_

**4E1209**

**B. Tech. IV-Sem. (Back) Exam., Oct.-Nov. - 2020**

**Civil Engineering**

**4CE4 – 06 Hydraulic Engineering**

**Time: 2 Hours**

**Maximum Marks: 82  
Min. Passing Marks: 29**

*Instructions to Candidates:*

*Attempt all ten questions from Part A, four questions out of seven questions from Part B and two questions out of five from Part C.*

*Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.*

*Use of following supporting material is permitted during examination.  
(Mentioned in form No. 205)*

1. NIL

2. NIL

**PART – A**

**(Answer should be given up to 25 words only)**

**[10×2=20]**

**All questions are compulsory**

- Q.1 Define cavitation.
- Q.2 Define energy correction factor.
- Q.3 What is a rain gauge?
- Q.4 Define channel alignment.
- Q.5 Determine the dimensions of kinematic viscosity.
- Q.6 What is dynamic similarity?
- Q.7 Define gradually varied flow.
- Q.8 Define specific energy of flow.
- Q.9 What is Weber's number?
- Q.10 What is the working principle of a centrifugal pump?

**PART – B**

**(Analytical/Problem solving questions)**

**[4×8=32]**

**Attempt any four questions**

- Q.1 Determine the distance from the centre of the pipe, at which the local velocity is equal to the average velocity for turbulent flow in pipes.
- Q.2 The resisting force R of a supersonic plane during flight can be considered as dependent upon the length of the aircraft l, velocity V, air viscosity  $\mu$ , air density  $\rho$  & bulk modulus of air K. Express the functional relationship between these variables & resisting force by dimensional analysis.
- Q.3 Air is flowing over a smooth plate with a velocity of 10 m/sec. the length of the plate is 1.2m & width is 0.8m. If laminar boundary layer exists up to a value of  $Re = 2 \times 10^5$ , find the maximum distance from the leading edge upto which laminar boundary layer exists. Find the maximum thickness of laminar boundary layer, if the velocity profile is given by,  $\frac{u}{U} = 2 \left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$ . Take kinematic viscosity for air = 0.15 stokes.
- Q.4 A jet of water of diameter 50mm strikes a fixed plate in such a way that the angle between plate and jet is  $30^\circ$ . The force exerted in the direction of the jet is 1471.5 Newton. Determine the rate of flow of water. <https://www.rtuonline.com>
- Q.5 Explain the term draft tube along with its principle.
- Q.6 Explain the term 'aquifer' along with its types.
- Q.7. Discuss all the cross-sectional parts of a channel along with a neat sketch.

**PART – C**

**(Descriptive/Analytical/Problem Solving/Design Questions)** [2×15=30]

**Attempt any two questions**

- Q.1 State Buckingham's  $\pi$  - theorem. What do you mean by repeating variables & how are these selected in dimensional analysis.
- Q.2 Prove that the loss of energy head in a hydraulic jump is equal to  $\frac{(d_2 - d_1)^3}{4d_1d_2}$  where  $d_1$  &  $d_2$  are conjugate depths.
- Q.3 Derive the following conditions for most economical trapezoidal channel –
- Half of top width is equal to one of the sloping sides of the channel.
  - Hydraulic mean depth must be equal to half the depth of flow.
- Q.4 Explain Lacey's Regime theory, along with the important terms involved. Also discuss its drawbacks.
- Q.5 Explain the steps involved in converting a flood hydrograph to a unit hydrograph.

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