**Q. P. Code: 27438**

**(3 hours)** **Total marks: 80**

**N.B.: (1) Question no.1 is compulsory.**

**(2) Attempt any 3 questions out of the remaining 5 questions.**

**(3) Assume data wherever necessary and clearly mention the assumptions made.**

**(4) Draw neat figures as required**.

**Q1** **Solve any four from the following** **20**

a Write a short note on back water curve and afflux.
b Classify and draw different surface profiles of a steep sloped open channel.
c Enlist the advantages of Lacey's theory over Kennedy's theory.
d Explain terminal velocity with suitable examples.
e Explain boundary layer separation with a neat sketch.

**Q2** a Prove that in a most economical trapezoidal channel section **10**
(i) Half of the top width = one of the sloping sides.
(ii) The best side slope is $60^0$ to the horizontal.

b. The triangular channel where depth of flow is 0.6 m and conveys a discharge of 0.285 $m^3/s$ between elevations 300 m and 297 m. The channel is required to be the most economical one. For normal flow, what should be the length of the channel between these sections? Take N= 0.021. **10**

**Q3** a Derive an expression for the dynamic equation of gradually varied flow. State the assumptions. **10**

b The loss of energy head in a hydraulic jump is 4.05 m. The Froude number just before the jump is 7.50. Find **10**
(i) Discharge per meter width of channel.
(ii) The depth before and after hydraulic jump.
(iii) Froude number after jump.
(iv) Percentage loss of energy head due to the jump.
(v) Length of the jump.

**P.T.O**

**Q4** a Design a regime channel for a discharge of 50 cumecs with a silt factor 1 using Lacey's theory. **10**

b Compare Kennedy's and Lacey's theories. What are the drawbacks of Lacey's theory? **10**

**Q5** a Water is flowing over a thin smooth plate of length 4 m and width 2 m at a velocity of 1.0 m/s. If the boundary layer flow changes from laminar to turbulent at a Reynold's number $5x10^5$, find (i) the distance from leading edge of the plate upto which boundary layer is laminar, (ii) the thickness of the boundary layer at the transition point and (iii) the drag force on one side of the plate. Take viscosity of water $\mu = 9.81x10^{-4}$ Ns/m$^2$. **10**

b Derive Von-Karman Momentum Integral equation. **10**

**Q6** a What is an airfoil? Explain airfoil terminologies with a neat sketch and prove that the co-efficient of lift on an airfoil is dependent on the angle of attack. **10**

b A kite 0.8m x 0.8m weighing 4.0 N assumes an angle of 12$^o$ to the horizontal. The string attached to the kite makes an angle of 45$^o$ to the horizontal. The pull on the string is 25 N, when the wind is flowing at a speed of 30 km/hour. Find the corresponding co-efficient of drag and lift. Density of air is given as 1.25 Kg/m$^3$. **10**

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