



Answer the following questions- use neat sketches - assume any missing data.

**Question (1)** (30 marks)

- a. A canal whose bottom width is 20 ms., side slopes 2:1 passing a discharge of 200 m<sup>3</sup>/s. the normal water depth is 4.0 ms the canal is lined with concrete for which (1/n=80). Determine: (20 marks)
- 1) The grade of the canal in cm/km, (5 marks)
  - 2) If Q=100 instead of 200 m<sup>3</sup>/s, find the corresponding water depth, (5 marks)
  - 3) Calculate the discharge if s<sub>0</sub> is doubled, (5 marks)
  - 4) Calculate the discharge if n is doubled. (5 marks)
  - 5) A special sewer consists of a semicircular top and bottom of radius (r) joined by parallel vertical sides of length (r) so that the total height is (3r).....(10 marks)
  - 6) Show that for max. discharge the angle subtended by the water surface at the center of curvature of the upper semicircle is approximately 64°. (5 marks)
  - 7) If the upper surface is raised until it reached the top of the sewer, find the percentage decrease in flow. (5 marks)

**Question (2)** (20 marks)

If the velocity distribution for turbulent flow over rough open channel surfaces is represented by :

$$U = 5.75 U_* \log(30y/k),$$

It is required to :

- 1) Prove that:  $\epsilon = 14.2/C = 0.883(f)^{1/2} = 9.50 n^{R1/6} \rightarrow$  In which  $\epsilon = 2.5 U_*^2 / \nu$ ,  $\nu =$  mean velocity (5 marks)
- 8) Derive an expression for the mean velocity at a vertical section ( $v_m$ ) and give the height above the bed at which it occurs. (5 marks)
- 9) Compare the expressions you get in (2) with the mean of the velocities 0.20 and 0.80 of the water depth. (5 marks)
- 10) Show that  $\epsilon = U_{max} / V_m - 1$  (5 marks)

**Question (3)** (15 marks)

In a river of bed width of 600 ms. and bed slope of 7.5 cm/km. it is found that the bed material just begin to move when the discharge is 120 million m<sup>3</sup>/day. Assuming the mean velocity to vary with the water depth and slope according to the relation:  $V = 120 y_* s_*^{2/3}$ , find the bed slope at which the same tractive force on the bed would be produced with a discharge of 365 million m<sup>3</sup>/day.

**Question (4)** (35 marks)

- 1) A uniform flow of depth 1.50 ms occurs in a long rectangular channel of 20 ms. width, having a Manning's n of 0.012 and laid on a slope of 0.0016. Calculate the following; .....(15 marks)
  - a) The min. height of a hump which can be built in the floor of this channel a cross the flow to produce min. specific energy, Evaluate  $E_{min}$ . (5 marks)
  - b) The max. contraction which can produce by itself min. specific force, Evaluate  $F_{min}$ . (5 marks)
  - c) Compare between the two cases (a), (b) by stating two main differences. (5 marks)
- 2) A trapezoidal channel of bed width 10.0 ms. and side slopes of 1:1, conveys a discharge of 100 m<sup>3</sup>/s the water depth is 1.50ms determine; .....(20 marks)
  - a) Can a hydraulic jump take place, (5 marks)
  - b) The sequent depth, (5 marks)
  - c) The power corresponding to loss in kinetic energy through jump, and (5 marks)
  - d) The energy dissipated in H.P (5 marks)

*With our best wishes*

Question Number	Q1 A2	Q2 A5	Q4 A2	Q2 B1	Q3 B5	Q4 B2	Q2 C2	Q3 C1	Q4 C6
Skills	Knowledge & Understanding Skills			Intellectual Skills			Professional Skills		