

Time Allowed: 3 Hours

Answer the following questions. Any missing data can be reasonably assumed
Illustrate your answer with neat sketches.

Question (I):

- (a) State the governing equations of unsteady varied flow in open channels. From these equations discuss the different types of flow.
- (b) From the Saint- Venant equations explain how could you construct a numerical model based on the method of characteristics? Discuss the stability of this kind of model..
- (c) illustrate with neat sketches the course of events resulting from a dam failure if the downstream of it is dry.
- (d) Water flows at a uniform flow of 1.5 m depth and velocity of 0.9 m /sec in a channel of rectangular section into a large estuary. The water level at the mouth falls at a rate of 0.3 m / hr for 3 hours. Neglecting bed slope and resistance, determine how long it takes for the river to fall 0.6 m at a section 1.6 km from the mouth? At this time , how far upstream will the river just be starting to fall ?

Question (II):

- (a) Estimate the specific weight (dry) of deposited sediment that is always submerged. The sediment is 25 % sand, 35 % silt, and 40 % clay by weight. Calculate how the specific weight of the deposited material varies with time and find the volume occupied by 400 tons of first year and tenth year deposited sediment.
- (b) Find the probable life of a reservoir with an initial capacity of 40,000 acre-ft and he average annual inflow is 80,000 acre-ft and the average annual sediment inflow is 250,000 .Assume specific weight of 70 pcf for the sediment deposits. The useful life of reservoir will terminate when 80 % of the initial capacity is filled with sediment

Question (III):

- (a) What do you understand by the term bed load of sediment transport? Numerous bed load equations have been presented but some of them look very similar, discuss this statement.
- (b) A certain canal has the following hydraulic data :average water slope equal to $10 \cdot 10^{-4}$, average depth = 6.0 m uniform over the entire width, mean width = 150 m, mean velocity = 1.5 m /sec, $d_{50} = 0.01$ m and the critical shear stress is $1.1 \text{ Kg} / \text{m}^2$. What is the rate of bed load of sediment transport, using equation given by:
(i) Einstein, (ii) Schoklitsch, and (iii) Kaliniske.
Comment on your results

Best Wishes