

M.E. (Water Resources & Hydraulic Engineering) Examination, 2025
(2nd Semester)

RIVER HYDRAULICS & ENGINEERING

(Paper VIII)

Time : Three Hours

Full Marks : 100

Answer any *four* questions.

1. a) Differentiate between GVUF and RVUF with examples.
c) Derive the equations of continuity and motion for GVUF.
c) What do you mean by monoclinal wave?

4+18+3= 25

2. a) Derive the differential equation for a monoclinal rising wave.
b) What do you mean by positive and negative Riemann invariants in MOC?
c) Explain the characteristic grid method.
d) What do you mean by region of constant state?

11+4+7+3= 25

3. a) In the case of positive surge moving downstream, derive the relation between celerity and pre-surge velocity in terms of pre-surge and post-surge flow depths.
b) In a river, the depth and velocity of flow are 0.9 m and 1.25 m/s, respectively. Due to tidal action, a tidal bore of height 1.2 m is observed to travel upstream. Estimate the height and speed of the bore and the velocity of the river after the passage of the bore.
c) Give an example of negative surge moving upstream with a neat sketch.
d) In the case of a simple wave region, prove the following relationship

$$\frac{dx}{dt} = 3C_c + U_o - 2C_o$$

10+7+3+5 = 25

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4. a) Derive and explain the Kleitz Seddon Law.
- b) What are gabions? Write down the advantages and disadvantages of gabions?
- c) An observer measures the flow depth in a 50 m wide rectangular river inclined at a bed slope of 3×10^{-3} with a Mannings coefficient of 0.03. Initially, the flow depth is 1.0 m, and the water level changes at a rate of 1 m/h. Calculate (i) the initial discharge at a distance of 1 km upstream, (ii) relative magnitude of the acceleration terms in the St. Venant equation and (iii) determine whether the flood wave attenuates as it propagates downstream.

$$4+10+11 = 25$$

5. a) How rivers can be classified according to their geology?
- b) What do you mean by river morphology?
- c) What are the characteristics of meandering?
- d) What is meant by meander change? Explain
- e) What are the major types of rectification works carried out in rivers?
- f) What is a Vane dyke. Explain with diagram

$$4+3+6+4+3+5 = 25$$

6. a) Describe in details the sudden injection and constant rate injection - dilution method of stream flow measurement.
- b) What is Riprap revetment and what are the advantages Riprap revetment?
- c) What is Cellular Concrete Mattresses Block revetment and what are the advantages and disadvantages of Cellular Concrete Mattresses Block revetment? Mention the common reasons for failure.
- d) What is Dyanamic revetment and what are the advantages of Dyanamic revetment?

$$8+4+9+4 = 25$$