

B.TECH.
(SEM V) THEORY EXAMINATION 2022-23
OPEN CHANNEL FLOW

Time: 3 Hours

Total Marks: 100

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief.

2 x 10 = 20

- (a) Define specific force.
- (b) What do you understand by adverse slope?
- (c) Write the formula for relation between water surface slopes and channel.
- (d) Draw the neat sketch S_3 profile.
- (e) What do you understand by length of jump?
- (f) Define sills.
- (g) Give the classification of spatially varied flow.
- (h) Define bottom racks
- (i) Define spiral flow.
- (j) What do you understand by constrictions?

SECTION B

2. Attempt any *three* of the following:

10x3=30

- (a) Differentiate between normal depth and critical depth in open channel flow.
- (b) A rectangular channel 7.5 m wide has a uniform depth flow 2.0 m and has a bed slope of 1 in 3000. If due to weir constructed at a downstream end of the channel, water surface is raised by 0.75 m, determine the water surface slope with respect to horizontal at the section. Assume Manning's $n=0.02$
- (c) Hydraulic jump is formed in a 5m wide rectangular channel carrying a discharge of $20\text{m}^3/\text{s}$. The pre jump depth is 0.5 m. Find the post jump depth, post jump Froude no, and energy loss in the jump.
- (d) Write the assumptions for differential equation spatially varied flow with increasing discharge.
- (e) With neat sketches, classify the culvert flow with outlet unsubmerged conditions.

SECTION C

3. Attempt any *one* part of the following:

10 x 1 = 10

- (a) A Concrete lined trapezoidal channel with uniform flow carries a discharge of 30 cumecs. The basic width is 5 m and the side slopes are equal 1:2 (V:H). Manning's n can be taken as 0.015 and the bed slope $=0.001$. What is normal depth of flow?
- (b) For a trapezoidal channel of most economical section, prove that: (i) half of top width = Length of one of the sloping side (ii) Hydraulic mean depth = $(1/2) \times$ Depth of flow

4. Attempt any *one* part of the following:

10 x 1 = 10

- (a) Explain the standard fourth order Runge-Kutta method to solve the basic differential equation of gradually varied flow.
- (b) Explain with neat sketch computation of gradually varied flow for the graphical method.

5. Attempt any *one* part of the following:

10 x 1 = 10

- (a) Explain with the neat sketch positive surge moving downstream? Also find the expression for this.
- (b) A hydraulic jump takes place in a horizontal triangular channel having the side's slope of 1.5H: 1V. The depth before and after jump are 0.4 m and 1.5 m respectively. Estimate the flow rate and Froude no. at the beginning and End of the jump.

6. Attempt any *one* part of the following:

10 x 1 = 10

- (a) A rectangular channel 2.0 m wide carries a discharge of $3.5 \text{ m}^3/\text{s}$ at a Froude number of 0.30. A 2 m long parallel longitudinal bars bottom rack having $E=0.2$ is provided at a section. Super critical flow is known to occur over the rock. Estimated the discharge diverted out.
- (b) A side channel spillway channel is 100 m long and its rectangular is cross-section with $b= 5.0 \text{ m}$, $n=0.020$, $\beta=1.30$ and $S_o =0.15$. If the lateral inflow rate is $1.75 \text{ m}^3/\text{s/m}$, find the critical depth and its location.

7. Attempt any *one* part of the following:

10 x 1 = 10

- (a) For practical purposes, how many types culvert flow and also draw the neat sketch their types with profile.1
- (b) Write for a simple analysis of flow characteristics which conditions are assumed. Also find the expression for over all coefficient of discharge.