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B. TECH
(SEM IV) THEORY EXAMINATION 2017-18
HYDRAULIC AND HYDRAULIC MACHINE

Time: 3 Hours ***Total Marks: 100***

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

SECTION A

1. Attempt *all* questions in brief. 2 x 10 = 20

a. Differentiate between steady and unsteady.
b. Explain prismatic channel in brief.
c. Define critical depth.
d. Explain conveyance of channel.
e. Define the term hydraulic radius.
f. Why CDL is above NDL in case of mild slope?
g. Define celerity of wave.
h. Explain open channel surge.
i. What is break in grade?
j. Draw GVF profile when flow changes from mild to steep.

SECTION B

2. Attempt any *three* of the following: 10 x 3 = 30

a. Show that the pressure distribution in curvilinear flow in vertical plane, an additional pressure will be imposed on the hydrostatic pressure distribution.
b. While measuring the discharge in a small stream; it was found that the depth of flow increases at the rate of 0.10 m/h. If the discharge at the section was 25 m3 /s and the surface width of the stream was 20 m, estimate the discharge at section 1 km upstream.
c. Deduce basic equation of continuity for spatially varied open channel flow.
d. What is compound channel? How would you calculate the total discharge of compound channel? Explain with example.
e. A rectangular channel 2.5 m wide has a specific energy of 1.50 m when carrying a discharge of 6.48 m3 /s. Calculate the alternate depths and corresponding Froude numbers

SECTION C

3. Attempt any *one* part of the following: 10 x 1 = 10

(a) What is hydraulic jump? Why momentum equation is used in analysis of hydraulic jump? Deduce the relation between alternate depth of hydraulic jump and Froude Number.
(b) Determine the length of the back-water curve caused by an afflux 2.0 m in a rectangular channel of width 40 m and depth 2.5 m. The slope of bed is given as 1 in 11000. Take Manning's N = 0.03

4. Attempt any *one* part of the following: 10 x 1 = 10

(a) Determine the normal depth in a triangular channel with apex angle 900 when it carries a discharge of 1.5 m3 /s at a slope of 0.0001. Take Manning's n as 0.015.

(b) Derive the condition for the trapezoid channel of best section. Show that the hydraulic mean depth for such channel is one half of the depth of flow.

5. Attempt any *one* part of the following: 10 x 1 = 10

(a) Show that the water surface slope Sw of a gradually varied flow is equal to the sum of the energy slope S and the slope due to velocity changed (αV2 /2g)/dx.

(b) A natural channel with 50 m width and 1.50 m deep has an average bed slope of 0.0005. Estimate the length of the GVF profile produced by a low weir which raises the water surface just upstream of it by 0.75 m. Assume n = 0.035.

6. Attempt any *one* part of the following: 10 x 1 = 10

(a) Draw a typical curve of specific energy and depth relationship and discuss.

(b) Derive chezy equation along with assumptions.

7. Attempt any *one* part of the following: 10 x 1 = 10

(a) The specific speed of the high-speed Francis turbine is 200. Total power generated in the hydro-electric power station is 2000 kW and the head of water available is 18 m and the turbines are to run at 250 rpm. Determine numbers of turbines that are required in the power station.

(b) What are the three main characteristics of a water turbine? Define unit power, unit discharge and unit speed. Also sketch constant head curves for Pelton wheel.