

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 90° when it carries a discharge of $1.5 \text{ m}^3/\text{s}$ 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 S_w of a gradually varied flow is equal to the sum of the energy slope S and the slope due to velocity changed $(\alpha V^2/2g)/dx$.
- (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.