

Paper Id: 100255

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B. TECH.
(SEM IV) THEORY EXAMINATION 2018-19
HYDRAULICS & HYDRAULIC MACHINES

Time: 3 Hours**Total Marks: 70****Note: 1.** Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt all questions in brief. 2 x 7 = 14

- a. State the relation between Manning's constant and Chezy's constant
- b. Explain GVF and RVF
- c. What are the classifications of flow profile
- d. Differentiate between most economical and most efficient channel
- e. Sketch the Velocity distribution in rectangular and triangular channels
- f. Define the terms: Speed ratio, Flow ratio and Jet ratio
- g. Give the range of specific speed values of Kaplan, Francis and Pelton wheel turbine

SECTION B

2. Attempt any three of the following: 7 x 3 = 21

- a. What is a draft tube? Write neat sketch, list the different types of draft tube.
- b. Derive the condition for most efficient Trapezoidal channel section for uniform flow.
- c. A rectangular channel carries water at the rate of 400 litres/sec when bed slope is 1 in 2000. Find the most economical dimensions of the channel if $C = 50$.
- d. Explain the specific energy concept and prove the critical flow condition for all type of channel.
- e. Differentiate between single stage and multistage pumps.

SECTION C

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

(a) A Centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000 rpm works against a total head of 40m. The velocity of the flow through the impeller is constant and is equal to 2.5m/s. The vanes are set back at an angle of 40° at outlet. If the outer diameter of the impeller is 500mm and width at outlet is 50mm, determine

- i. Vane angle at inlet
- ii. Work done by impeller on water per second
- iii. Manometric efficiency.

(b) What is reciprocating pump? Describe the principle and working of a reciprocating pump with a neat sketch

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

(a) Derive an expression for depth of hydraulic jump in terms of upstream Froude's number.

(b) A rectangular channel is 20m wide and carries discharge of 65m³/s. It is laid at a slope of 0.0001. At a certain section along the channel length, the depth of flow is 2.0m. How far will be the depth be 2.60m? Take $n = 0.02$.

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

(a) Prove that the discharge over a spillway is given by the relation,

$$Q = VD^2f \left[\frac{\sqrt{gD}}{V} \cdot \frac{H}{D} \right]$$

(b) A jet of water of 40mm diameter strikes a hinged square plate at its Centre, with a velocity of 20m/s. The plate is deflected through an angle of 30°. Find the weight of the plate. If the plate is not allowed to swing, what will be the force required at the lower edge of the plate to keep the plate in vertical position.

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

(a) What is cavitation? What is its effect on turbine? How it can be avoided in turbines

(b) A channel is 2m width at bottom; the length of each sloping side is 1.95m. The width of water surface is 5.5m. The flow depth is 1.2m and bed slope is 1 in 5280. What is the discharge per minute? Take value of $C = 34.6$.

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

(a) Sketch the GVF profiles produced on i. Steep Slope and ii. Critical Slope.

(b) A pipe of dia 15mm is required to transmit an oil of specific gravity 0.9 and viscosity 3×10^{-2} poise at 3000 lps. Tests were conducted on 150mm dia pipe using water at 20°C. Find Velocity and rate of flow of model if 'μ' water at 20°C, is 0.01 poise.