

(Following Paper ID and Roll No. to be filled in your Answer Book)

**PAPER ID : 0026**

Roll No.

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**B. Tech.**

**(SEMESTER-IV) THEORY EXAMINATION, 2011-12**  
**HYDRAULICS & HYDRAULIC MACHINES**

*Time : 3 Hours ]*

*[ Total Marks : 100*

- Note :**
- This question paper has **three** sections **A, B** and **C**.
  - Attempt all questions.
  - Marks and number of questions to be attempted from each section is mentioned before the section.
  - Assume missing data suitably. Illustrate the answers with suitable sketches.

**SECTION – A**

- This section has **ten** parts of short answer type questions. Attempt all parts. **10 × 2 = 20**
  - Differentiate between Steady and Unsteady flow, Uniform and non-uniform flow.
  - Discuss velocity distribution in an open channel.
  - Differentiate between Open Channel Flow and Pipe Flow.
  - Discuss the pressure distribution with respect to depth in an open channel.
  - What are Channel of First Kind and Channel of Second Kind ?
  - What is Compound Section ? Discuss methods of computations of total discharge in case of compound channel.
  - Describe the Chezy's and Manning's equations for uniform flow in open channels.
  - Deduce the condition for a most efficient channel section of trapezoidal shape.
  - Distinguish between GVF and RVF.
  - Discuss the necessary situations to form the hydraulic jump in an open channel.

**SECTION – B**

- Attempt any **five** parts of the following : **5 × 6 = 30**
  - What is specific energy ? Discuss its relation with depth.
  - What are subcritical and supercritical flow conditions ?
  - For a constant specific energy of 2.0 m, what maximum flow may occur in a rectangular channel of 3.0 m wide ?
  - What is Froude Number ? Discuss it's significance in open channel.
  - Derive the condition for the rectangular channel of best section. Show that the hydraulic mean depth for such channel is one half of the depth of flow.
  - Discuss the variation of discharge with depth of flow for a given specific energy.
  - Write a short note on cavitation phenomena in a pump.

### SECTION – C

Question No. 3 to 7 has **three** parts each. Attempt any **two** parts from each question.

5 × 10 = 50\*

3. (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 change  $d(\alpha V^2/2g)/dx$ .  
(b) Draw and discuss  $M_1$ ,  $M_3$ ,  $S_1$ ,  $S_2$  and  $S_3$  flow profile.  
(c) A natural channel with 35 m width and 1.25 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 0.60 m. Assume  $n = 0.035$ .
4. (a) What is hydraulic jump ? Deduce the relationship between sequent depths and Froude number for the same.  
(b) What are back water and celerity ? Prove that celerity  $C \approx \sqrt{gy}$ , where symbols have usual meanings.  
(c) Discuss the importance of hydraulic jump for dissipating the energy. Derive the formula of energy loss in hydraulic jump.
5. (a) The absolute velocity of water at inlet to a turbine is 12 m/s, the guide vane angle is being 20°. If the diameter of the wheel is 400 mm and its width is 100 mm, find the discharge of the turbine. Assume 8 percent of the circumferential area is blocked by thickness of the blades.  
(b) Define the specific speed of turbine. Derive an expression for the specific speed. What is the significance of the specific speed ?  
(c) A reciprocating pump has a suction head of 6 m and delivery head 15 m. It has bore of 150 mm and stroke of 250 mm and piston makes 60 double strokes in a minute. Calculate the force required to move piston during (a) suction stroke  
(b) during the delivery stroke.
6. (a) Evaluate all the salient elements of hydraulic jump on sloping beds.  
(b) Distinguish between deep and shallow water waves.  
(c) Describe the different types of roto-dynamic pumps.
7. (a) Describe the working of Francis Turbine with suitable sketch.  
(b) Explain the basis of performance of any turbine. Describe the various types of efficiency terms.  
(c) How will you describe the characteristic of a pump with the help of characteristic curves ?