Paper Code: CE-403 **Roll No.** | | | | | | | | | | |

B.Tech.
(SEM IV) EVEN SEMESTER EXAMINATION, 2015-16
HYDRAULICS & HYDRAULIC MACHINES

[Time: 3 hrs.] **[Max. Marks: 100]**

Note: Attempt any two parts in each question. All questions are compulsory and carry equal marks. Make suitable assumptions wherever data is (or seems to be) missing.

1. Attempt any two parts of the following:- [**10x2=20]**

(a) Prove from the basic principles of specific energy (E) that the critical specific energy (E_c) for a triangular channel is always 1.25 times the critical depth (Y_c).

(b) A 3.0 m wide horizontal rectangular channel is narrowed to a width of 1.5 m to cause critical flow in the contracted section. If the depth of flow in the contracted section is 0.8 m, calculate the discharge in the channel. Also compute the possible depths of flow and corresponding Froude numbers in the 3.0 m wide section.

(c) Describe any one procedure for estimating the first hydraulic exponent (M) with practical limits of accuracy.

2. Attempt any two parts of the following:- [**10x2=20]**

(a) Derive the condition for the hydraulically efficient triangular channel section. Find the hydraulic radius (R) for such a channel .

(b) A flow of 10.0 m^3/s is to be passed in a rectangular channel with the depth of flow equal to one third of its width. The channel is lined with smooth concrete (n= 0.014). Calculate the channel dimensions and its longitudinal slope necessary to carry the above discharge with a mean velocity of 2.5 m/s.

(c) Show that for a deep and narrow rectangular channel section, as B/y → 0, N → 2.0 based on the assumption that the second hydraulic exponent N could be calculated approximately as,

$$N = \frac{2y}{3}\left(\frac{5T}{A} - \frac{2}{P}\frac{dP}{dy}\right)$$

3. Attempt any two parts of the following:- **[10x2=20]**

(a) In a very long, wide rectangular channel the discharge intensity is 3.0 m^3/s/metre width. The bed slope of the channel is 0.004 and Manning's n = 0.015. At a certain section in this channel the depth of flow is observed to be 0.90 m. What type of GVF profile occurs in the neighbourhood of this section?

(b) A rectangular channel 4.0 m wide has a Manning's coefficient of 0.025. For a discharge of 6.0 m^3/s, identify the possible types of GVF profiles produced in the following break in grades:

(i) S_{01} = 0.0004 to S_{02} = 0.015
(ii) S_{01} = 0.005 to S_{02} = 0.0004

(c) Detail out the conceptual differences in procedure for computing the GVF profiles in open channels by Direct-step Method and Standard-step Method.

4. Attempt any two parts of the following:- [**10x2=20]**

(a) A hydraulic jump in a rectangular channel has the Froude number at the beginning of the jump $F_1 = 5$. Find the Froude number F_2 at the end of the jump.

(b) A hydraulic jump is occurring in a horizontal, frictionless,triangular channel with sequent depths as Y_1 and Y_2. Show that the pre-jump Froude number, F_1can be determined by the following expression

$$F_1^2 = \frac{2m^2(m^3-1)}{3(m^2-1)}, \quad \text{where } m = Y_2/Y_1$$

(c) Detailed out an appropriate procedure for finding the sequent depths in a hydraulic jump formed in non-rectangular channels.

5. Attempt any two parts of the following:- [**10x2=20]**

(a) What do you understand by Centrifugal Pump and what are different parts of a Centrifugal Pump? Explain these parts and their need in brief with the help of neat sketches.

(b) Give various classifications of Hydraulic Turbines. A Pelton wheel has a mean bucket speed pf 10 m/s with a jet of water flowing at the rate of 700 lit/s under a head of 30 m. The buckets deflect the jet through an angle of 160 º.Calculate the Power given by the water to the runner and the hydraulic efficiency of the turbine. Assume co-efficient of velocity as 0.98.

(c) Write short notes on any **four** of the followings: -
(i) Draft Tube and its types
(ii) Layout of a Hydro-electric Power Plant
(iii) Characteristics curves of turbines.
(iv) Mechanical Efficiency of Turbine
(v) Cavitation
(vi) Axial Flow Reaction Turbine