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

**PAPER ID : 33116** Roll No.

# B. Tech. Examination 2021-22

## (Even Semester)

## HYDRAULICS & HYDRAULICS MACHINE

*Time : Three Hours]* *[Maximum Marks : 60*

**Note :–** (i) Attempt all questions.

(ii) Assume suitable data if missing.

## SECTION–A

1. Attempt all parts of the following : 8×1=8

(a) What is the effect of slope on the pressure distribution trapezoidal section when side slopes are not known?

(b) Write down the conditions of most efficient channel.

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(c) For critical flow over a hump $Z_c = E_1 - \frac{3}{2} y_c$, If $E_1 = 1.5$m and $y_c = 0.22$ m. What is $Z_c$?

(d) Differentiate between Noteches & Wiers.

(e) A river 100 m wide and 3m deep has an average bed slope of 0.0005 calculate critical depth. Assume n = 0.035.

(f) Give the classification of hydraulic jump.

(g) How are hydroturbine classified?

(h) Write a brief notes on the cavitation problem in axial-flow turbines.

## SECTION – B

2. Attempt any two parts of the following : 2×6=12

(a) What flows at 12.5 cumec in a channel 2m wide at a velocity of 1.25 m/sec. Calculate the specific energy head. Find also the critical depth, critical velocity.

(b) Derive the condition for the trapezoidal channel of best section. show that the hydraulic mean depth for such a channel is one-half the depth of flow.

(c) Discuss the assumptions of gradually varied flow. What are the limitations of gradually varied flow? Prove that dynamic equation of gradually varied flow is given by :

$$\frac{dy}{dx} = \frac{S_0 - S_f}{1 - \frac{Q^2 T}{g A^3}}$$

(d) What is Turbine? Discuss the classification of turbine. Write the short note on heads of turbine.

## SECTION – C

**Note :–** Attempt all questions from this section.

$10 \times 4 = 40$

3. Attempt any two parts of the following :

(a) What do you understand by "open channel flow"? Describe different types of flow in channels. Discuss its applications.

(b) A sluice gate in a 2.0 m wide horizontal rectangular channel is discharging freely as shown in figure. If the depths a small distance upstream ($y_1$) and down-stream ($y_2$) are 2.5 m and 0.20 m respectively. Estimate the discharge in teh channel by neglecting energy losses at the gate.

(c) A rectangular channel has a width of 2.0 m and carriers a discharge of 4.8 $m^3$/sec with a depth of 1.6 m at a certain section a small smooth hump with a flat top and of height 0.1 m is proposed to be built. Calculate the likely change in the water surface neglect the energy loss.

4. Attempt any two parts of the following :

(a) A trapezoidal channel is 10 m wide and has a side slope of 1.5 horizontal : 1 vertical The bed slope is 0.0003. The channel is lined with smooth concrete of n = 0.012. Compute the mean velocity and discharge for a depth of flow of 3.0 m.

(b) Show that a hydraulically efficient triangular channel section has $Re = y_e \mid 2\sqrt{2}$.

(c) State Manning's equation. Derive Chezy's formula for uniform flow through an open channel.

5. Attempt any two parts of the following :

(a) What do you mean by Hydraulic jump? Explain under what conditions a hydraulic jump can

occur? Obtain an expression for the depth after the hydraulic jump and loss of head due to the jump.

(b) In a hydraulic jump occuring in a rectangular channel of 3m width, the discharge is 7.8 $m^3$/sec and the depth before the jump is 0.28m. Estimate :

(i) Sequent depth

(ii) The energy loss in the jump

(c) Discuss flow classification and its surface profile in "G. V. F". Using basic differential equation, show that $dB/dX$ is positive for $S_1$, $M_3$ and $S_3$ profiles.

6. Attempt any two parts of the following :

(a) What are the advantages of centrifugal pumps over displacement pumps? Discuss the various components of centrifugal pump.

(b) A turbine is to operate under a head of 25m at a speed of 300 rpm. The discharge is 12 $m^3$/sec. Assuming an efficiency of 0.85, calculate the power developed. What would be the specific

speed, power, discharge and rotational speed at a head of 15 m?

(c) Describe briefly the governing operation of a Pelton turbine.

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