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B.TECH

(SEM IV) THEORY EXAMINATION 2017-18

HYDRAULICS & HYDRAULIC MACHINES

Time: 3 Hours ***Total Marks: 70***

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

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

a. Define Different types of flow.

b. Determine the maximum discharge through a rectangular open channel of area $8m^3$ with a bed slope of 1/2000. Assume manning's constant 0.022.

c. Define the velocity contour's in open channel flow.

d. What is the Back Water Curve?

e. Write the types of Surge.

f. What assumptions will take in Velocity Triangles?

g. Write the main Parts of Kaplan Turbines.

SECTION B

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

a. Uniform flow occurs at a depth of 1.5 m in a long rectangular channel 3 m wide and laid to a slope of 0.0009. If manning's n=0.015. Calculate (a) Maximum height of hump on the floor to produce critical depth (b) The width of contraction which will produce critical depth without increasing the upstream depth of flow.

b. In an open channel, the Froude number F remains constant at all depths. if the specific energy E is constant Show that

$$\frac{T}{B}=\left(\frac{E}{E-h}\right)^{\left(\frac{1+F^2}{2}\right)}$$

c. Prove that Hydraulically most efficient trapezoidal section is half of regular Hexagon.

d. Integrate the differential equation of G.V.F. for a Horizontal Channel to get the Profile equation as

$$x=\frac{h_c}{S_c}\left[\frac{\left(\frac{h}{h_c}\right)^{N-M+1}}{N-M+1}-\frac{\left(\frac{h}{h_c}\right)^{N+1}}{N+1}\right]+constt.$$

e. What is NPHS of centrifugal Pump? How it is related to cavitation in Pump?

SECTION C

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

(a) An open channel to be made of concrete is to be designed to carry 1.5m3/s at a slope of 0.00085. Find the most efficient cross section for (a) Rectangular section (b) Trapezoidal section (c) Semicircular section

(b) Define the following with formula (a) Kinetic Energy Correction factor (b) Momentum correction factor

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

(a) Using Basic differential equation of G.V.F. show that dh/dx is positive for S_1, M_3 and S_3 Profiles.

(b) How you will define Transitions between Sub Critical Flow And Super Critical Flow? Also draw the Diagram.

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

(a) A rectangular channel carrying a super critical stream is to be provided with a hydraulic jump type of energy dissipater. It is desired to have an energy loss of 5 m in hydraulic jump when inlet Froude's number is 8.5. What are the segment depths of this jump?

(b) Derive the relation between velocity and depths of flow where positive surges moving upward.

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

(a) In order to predict the performance of a large centrifugal pump, a scale model of one sixth size was made with following specifications. Power = 25 KW, H_{man} =7 mtr, N=1000rpm. If prototype works against 22m. Calculate its working speed, the power required to derive it and the ratio of flow rates handled by to pups.

(b) Define cavitation. And what precautions taken against Cavitation?

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

(a) A Pelton wheel is to be designed for the following specification. Shaft power =11722 KW, Head =380 mtr, speed =750rpm, η_o = 86% Jet diameter (d) not to exceed one-sixth of wheel diameter. Determine (i) The wheel Diameter (ii) Number of jet required (iii) Diameter of jet Take velocity ratio K_{v1}=0.985 and speed Ratio K_{u1}=0.45

(b) Define different types of efficiency of Hydraulic turbines.