Printed Pages: 6 NCE-403

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

Paper ID : 100411 Roll No. | | | | | | | | | |

B.TECH.

Theory Examination (Semester-IV) 2015-16

HYDRAULICS & HYDRAULIC MACHINES

Time : 3 Hours *Max. Marks : 100*

Section-A

Attempt all parts. All parts carry equal marks.

Q.1. Write answer of each part in short. **(2×10=20)**

(a) Define open channel flow with example.

(b) Describe specific energy?

(c) State the relation between Manning's constant and Chezy's constant

(d) Sketch the velocity distribution in rectangular and triangular channels.

(e) Classify the surface profiles in channels

(f) .List the assumption made in the derivation of dynamic equation of gradually varied flow.

(g) Hydraulic jump is sometimes used as energy dissipator at the toe of the spillway of a dam. why?

(h) What is meant by Cavitations?

(i) Define celerity of the surge

(j) Give the range of specific speed values of Kaplan. Francis turbine and peltonwheels.

Section-B

Q.2. Attempt any 5 questions from this section. (10×5=50)

(a) Classify the following open-channel flow situations:

(a) Flow from a sluice gate

(b) Flow in a main irrigation canal

(c) A river during flood

(b) Show that in rectangular channel maximum discharges occurs when the flow is critical for a given value of specific energy.

(c) Derive an expression for the discharge through a channel by Chezy's Formula.

(d) The width of a horizontal rectangular channel is reduced from 3.5 m to 2.5 m and the floor is raised by 0.25 m in elevation at a given section. At the upstream section, the depth of flow is 2.0 m and the kinetic energy correction factor α is 1.15. If the drop in the water surface elevation at the contraction is 0.20 m, calculate the discharge if (a) the energy loss is neglected, and (b) the energy loss is one-tenth of the upstream velocity head. [The kinetic energy correction factor at the contracted section may be assumed to beunity].

(e) What is critical depth in open-channel flow? For a given average flow velocity, how is it determined?

(f) A trapezoidal channel B = 3.0 m, m = 1.50, n = 0.025 and S_0 = 0.00050 takes off froma reservoir with free inlet. The reservoir elevation is 7.0 m above the channel bed at theinlet. Calculate the discharge in the channel by neglecting entrance losses.

(g) Explain the terms :

(i) Uniform Flow in a open channel

(ii) Reaction turbine

(h) A spillway discharges a flood flow at a rate of 7.75 m3/ s per metre width. At the downstream horizontal apron the depth of flow was found to be 0.50 m. What tail water depth is needed to form a hydraulic jump? If a jump is formed, find its (a) type, (b) length, (c) head loss, (d) energy loss as a percentage of the initial energy, and (e) profile.

Section-C

Note: Attempt any 2 questions from this section. (15x2=30)

Q.3. (a) Draw neat sketches of various shapes of draft tubes. (5)

(b) In a pelton wheel has a mean bucket speed of 10 m/s. with a jet of water flowing at the rate of 0.7 m^3/s and a head of 30 m. If the buckets deflects the jet through an angle of 160° calculate the power given by water to the runner and hydraulic efficiency of the turbine. Assume the coefficient of velocity 0.98 (10)

Q.4. (a) A compound channel is symmetrical in cross section and has the following geometric properties. Main channel: Trapezoidal cross section, Bottom width = 15.0 m. Side slopes = 1.5 H : IV, Bank full depth = 3.0 m, Manning's coefficient = 0.03, Longitudinal slope = 0.0009 Flood plains: Width = 75 m, Side slope - 1.5 H : IV, Manning's coefficient = 0.05, Longitudinal slope = 0.0009. Compute the uniform flow discharge for a flow with total depth of 4.2 m by using DCM with either (i) diagonal interface, or (ii) vertical interface procedures. (12)

(b) A triangular channel with an apex angle of 75° carries a flow of 1.2 m^3/s at a depth of 0.80 m. If the bed slope is 0.009, find the roughness coefficient of the channel. (03)

Q.5. (a) There are three main categories of dynamic pumps. List and define them. (06)

(b) A centrifugal pump is running at 1000 r.p.m. The outlet vane angle of the impeller is 45° and velocity of flow at outlet is 2.5 m/s. The discharge through the pump is 2001it/s when the pump is working against a total head of 20m. If the manometric efficiency of the pump is 80%. Determine

(i) Diameter of the impeller (outside diameter)

(ii) Width of the impeller at outlet. (09)

Not

Q.3