

(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 be unity].
- (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 from a reservoir with free inlet. The reservoir elevation is 7.0 m above the channel bed at the inlet. Calculate the discharge in the channel by neglecting entrance losses.

(g) Explain the terms :

(i) Uniform Flow in an open channel

(ii) Reaction turbine

(h) A spillway discharges a flood flow at a rate of $7.75 \text{ m}^3/\text{s}$ 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)

(4)

(b) In a Pelton wheel has a mean bucket speed of 10 m/s . with a jet of water flowing at the rate of $0.7 \text{ m}^3/\text{s}$ and a head of 30 m . If the buckets deflect 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 = $1.5 \text{ H} : 1 \text{ V}$, Bank full depth = 3.0 m , Manning's coefficient = 0.03 , Longitudinal slope = 0.0009 Flood plains: Width = 75 m , Side slope = $1.5 \text{ H} : 1 \text{ V}$, 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 $1.2 \text{ m}^3/\text{s}$ at a depth of 0.80 m . If the bed slope is 0.009 , find the roughness coefficient of the channel.
(03)

(5)

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 200lit/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)