Printed Pages : 4

ECE403

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

PAPER ID : 100407

Roll No.

B. Tech.

(SEM. IV) THEORY EXAMINATION, 2014-15

HYDRAULICS & HYDRAULIC MACHINES

Time : **3** Hours] [Total Marks : **100**

Note : Attempt all questions. Additional data may be suitable assumed for the best answering the questions.

1 Attempt **any four** parts of the following: **5×4=20**

(a) Show that for critical flow in a circular conduit of diameter D

$$\frac{Q^2}{gD^5} = \frac{(\theta - \sin\theta \cos\theta)^3}{64\sin\theta}$$

Where 2θ is the angle subtended by the water surface at centre.

(b) Velocity distribution in an open channel is given

by $u = (1.0 + \frac{y}{y_0})$. Determine α and β.

(c) What is specific energy? Clearly explain critical, supercritical and subcritical flow conditions using specific energy diagram.

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(d) A rectangular channel 2.0 m wide has a specific energy of 1.50 m when carrying a discharge of 6.32 cumecs. Calculate alternate depths and corresponding Froude's number.

(e) Show that for a critical flow at a section the Froude's number is equal to unity.

(f) Water flows at a discharge of 4.8 cumecs and a depth of 1.60 m in an open channel of rectangular cross section and bed-width of 2.0 m. At a certain section a small, smooth hump with flat top and of height 0.51 m is proposed to be built. Estimate the water surface elevation on the hump and at a section upstream of the hump.

2 Attempt **any Two** parts of the following: 10×2=20

(a) Discuss briefly the factors affecting Manning's Roughness coefficient (n).

A rectangular channel of 2.5 m width and 0.00015 slope carries a discharge of 1.2 cumecs with Manning's n of 0.02. Determine the normal depth and average shear on the channel bed.

(b) Derive the standard Chezy's formula for uniform flow through an open channel.

(c) What do you mean by a hydraulically efficient channel? A power canal of trapezoidal section having side slope equal to 60° with the horizontal, has to be excavated through hard clay at least cost. Determine the width at the base and depth of flow, given discharge equal to 15 cumecs, bed slope 1:2000 and Manning's n= 0.015.

3   Attempt **any Two** parts of the following: **10×2=20**

(a)   Derive the dynamic equation of gradually varied flow in a channel using energy conservation concept. What are the various assumptions involved in the analysis. Also find the slope of water surface curve as an expression of conveyance and section factor of the channel.

(b)   A rectangular channel has two reaches A and B in series, with reach A being upstream of reach B, have the following characteristics.

Reach	Width (m)	Discharge (cumecs)	Slope	n
A	4.0	10.0	0.0002	0.020
B	3.0	10.0	0.00025	0.018

Sketch the resulting GVF profile due to the change in the channel characteristics as above.

(c)   A rectangular channel of width 2.0 m and 50 m long allows water to freefall. Channel is made up of glass (n=0.01) and bed slope is 1 in 1000. At channel entrance the depth is observed to be constant at 0.50 m. Find the length of GVF profile from the freefall brink to a section where the depth is 0.45 m. Use Direct-step method.

4   Attempt **any two** parts of the following: **10×2=20**

(a)   Derive the expression of sequent depth and energy loss for hydraulic jump in a sloping rectangular channel.

(b) What is specific force? A rectangular channel carrying a supercritical stream is to be provided with a hydraulic jump type of energy dissipater. If it is desired to have energy loss of 5.0 m in the jump when the inlet Froude number is 8.5. Determine the sequent depths.

(c) A rectangular channel 3.0 m wide has a flow of 3.60 cumecs with the velocity of 0.8 m/s. If the sudden release of additional flow at the u/s end of the channel causes the depth to raise by 50%, determine the absolute velocity of resulting surge and the net flow rate.

5   Attempt **any two** parts of the following: 10×2=20

(a) A pelton wheel has a mean bucket speed of 10 metres per second with a jet of water flowing at the rate of 700 litres/ sec under a head of 30 m. The buckets deffects the jet through an angle of 160°. Calculate the power given by the water to the runner and the hydraulic efficiency of the turbine. Assume coefficient of velocity as 0.98.

(b) Differentiate between

(i)   The Impulse and Reaction turbines

(ii)   The Kaplan and Propeller turbines

(c) A rotodynamic pump running at 1500 rpm discharges 120 litre/sec against a head of 25 m. If the diameter of the impeller is 250 mm and its width is 50 mm, find the vane angle at the outer periphery. The manometric efficiency of the pump is 75%.