Printed Pages—4 **ECE403**

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

PAPER ID : 0026 **Roll No.**

B. Tech.

(SEM. IV) THEORY EXAMINATION 2011-12

HYDRAULICS & HYDRAULIC MACHINES

Time : 3 Hours *Total Marks : 100*

Note : Attempt ***all*** questions. Each question carries equal marks.

1. Attempt any ***four*** of the following : **(4×5=20)**

   (a) Differentiate between : Steady and Unsteady flow, Uniform and non uniform flow.

   (b) Discuss velocity distribution in an open channel.

   (c) Show that the pressure distribution in curvilinear flow in vertical plane, an additional pressure will be imposed on the hydrostatic pressure distribution.

   (d) Deduce basic equation of continuity for unsteady, open channel flow.

   (e) Estimate the force in terms of y_1 and y_2 on sluice gate shown in fig. 1.

(f) The velocity distribution in a rectangular channel of width B and flow y_0 was approximated $v = k_1\sqrt{y}$ in which k_1 is constant. Calculate the average velocity for the cross section and correction coefficient α and β.

2. Attempt any ***four*** of the following : **(4×5=20)**

(a) Draw a typical curve of specific energy and depth relationship and discuss.

(b) What are critical energy and critical depth ? Also discuss subcritical and supercritical flow conditions.

(c) Determine the normal depth in a triangular channel with apex angle 900 when it carries a discharge of 1.5 m^3/s at a slope of 0.0001. Take Manning's n as 0.015.

(d) Prove that for triangular channel of side slopes m horizontal; 1 vertical, the Froude number if given by

$$F = \frac{V}{\sqrt{gy}}.$$

(e) Derive the condition for the rectangular channel of best section. Show that the hydraulic mean depth for such channel is one half of the depth of flow.

(f) What is compound channel ? How would you calculate the total discharge of compound channel ? Explain with example.

3. Attempt any ***two*** of the following : **(2×10=20)**

(a) Show that the water surface slope S_w of a gradually varied flow is equal to the sum of the energy slope S and the slope due to velocity change $d(\alpha V^2/2g)/dx$.

(b) Sketch the Gradually Varied Flow (GVF) profile produced for the all three types of channel given below in Fig. 2.

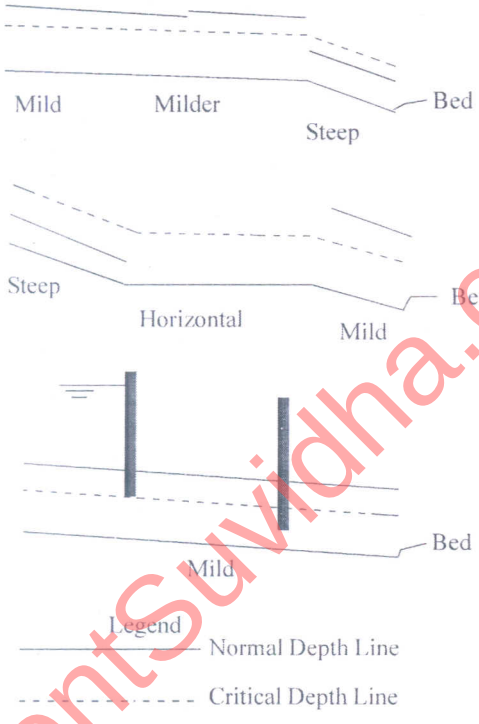

Fig. 2

(c) A natural channel with 50 m width and 1.50 m deep has an average bed slope of 0.0005. Estimate the length of the GVF profile produced by a low weir which raises the water surface just upstream of it by 0.75 m. Assume n = 0.035.

4. Attempt any *two* of the following : **(2×10=20)**

(a) What is hydraulic jump ? Discuss the application of hydraulic jump. Classify the hydraulic jump according to Frodue Number.

(b) Determine the length of the back water curve caused by an afflux 2.0 m in a rectangular channel of width 40 m and depth 2.5 m. The slope of bed is given as 1 in 11000. Take Manning's N = 0.03.

(c) Show that Froude numbers F_1 and F_2 in a hydraulic jump occurring in a rectangular channel are related by :

$$F_2^2 = \frac{8F_1^2}{(-1+\sqrt{1+8F_1^2})^3}.$$

5. Attempt any *two* of the following : **(2×10=20)**

(a) Prove that the work done per second per unit weight of water in a reaction turbine is given as :

$$= \frac{1}{g}(V_{w1}u_1 \pm V_{w2}u_2)$$

Where :

V_{w1} and V_{w2} = Velocities of whirl at inlet and outlet

u_1 and u_2 = Peripheral velocities at inlet and outlet.

(b) Define the specific speed of turbine. Derive an expression for the specific speed. What is the significance of the specific speed ?

(c) Explain with the help of a neat sketch, the principle and working of the following hydraulic device :

(i) Hydraulic Lift

(ii) Hydraulic Crane

(iii) Hydraulic Coupling

(iv) Hydraulic torque converter.