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

PAPER ID : 2691 Roll No. | | | | | | | | | | |

B.Tech.

(SEM. VII) ODD SEMESTER THEORY EXAMINATION 2013-14

OPEN CHANNEL FLOW

Time : 3 Hours *Total Marks : 100*

Note :- Attempt **all** questions. All questions carry equal marks. Assume any suitable data, if missing.

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

   (a) Differentiate briefly :

   (i) *Uniform flow and non-uniform flow*

   (ii) *GVF and RVF*

   (iii) *Steady flow and unsteady flow.*

   (b) Show that the triangular channel section is most efficient when the central angle is 30°.

   (c) Determine the normal depth in triangular channel with apex angle 90°, when it carries the discharge of 1.5 m^3/s at Manning's coefficient equals to 0.016.

   (d) State the conditions under which uniform and non-uniform flows are produced.

   (e) For a trapezoidal channel of most economical section, prove that :

   (i) *Half of top width = Length of one of the sloping sides*

   (ii) *Hydraulic mean depth = (1/2) × Depth of flow.*

(f) What is a specific energy curve ? Draw specific energy curve, and then derive expressions for critical depth and critical velocity.

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

(a) Classify and characterize the various water surface profiles obtained in a steady gradually varied flow in a prismatic channel under different slopes.

(b) Explain the standard fourth order Runge-Kutta method to solve the basic differential equation of gradually varied flow.

(c) Discuss the graphical integration method in detail for working out water surface profile in an open channel flow.

(d) Prove that the slope of free surface in gradually varied flow in open channel flow is given by :

$$\frac{dy}{dx} = \frac{S_O - S_f}{1 - \frac{Q^2 y}{gA^3}}$$

(e) List the assumptions made in the derivation of dynamic equation of gradually varied flow.

(f) Explain briefly the transitions of subcritical and supercritical flow.

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

(a) Discuss about the 'hydraulic jump' along with their various uses. Describe with their neat sketches the various types of hydraulic jumps on the basis of Froude number. 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 an energy loss of 5.0 m in the jump when the inlet Froude number is 8.5, determine the sequent depths.

(b) Explain broad crested weir, with the help of its neat sketch. Classify the flow over a broad crested weir with an upstream sharp corner on the basis of H_1/B_w value. A sharp crested suppressed weir is 1.5 m long. Calculate the height of the weir required to pass a flow of 0.75 m^3/s, while maintaining an upstream depth of flow of 1.50 m.

(c) What do you mean by the rapidly-varied transient phenomenon in an open channel flow ? Show the open channel positive and negative surge moving upstream and downstream. Also prove a relation $V_w = V_1 \pm \sqrt{\frac{1}{2} g \frac{y_2}{y_1}(y_1 + y_2)}$ in a rectangular channel for the positive surge moving down stream.

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

(a) What is the basic principle of spatially varied flow ? Also classify the SVF. How the discharge is estimated through a side weir ?

(b) Derive the basic differential equation governing the motion in the SVF with decreasing discharge. Write down the assumptions made in deriving the equation.

(c) Write the name of various numerical methods for profile computation in SVF with lateral inflow. Explain in detail the 'Modified Hinds Method' used for profile computation in SVF.

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

(a) If a culvert is to be built across a subcritical stream, from the consideration of mechanics of flow, what factors govern the shape of the bridge piers, span and shape of abutments ? Which of these factors will be different in supercritical flow ?

(b) Discuss in detail the design considerations for subcritical and supercritical flows.

(c) How will the flow take place in channel of non -linear alignment and non-prismatic sections ? Discuss in detail.