****Last Date of Submission ……..** **Section CE43**

Babu Banarasi Das -National Institute of Technology & Management, Lucknow

B. Tech Final Year (Seventh Semester) 2018-19

Department of Civil Engineering

OPEN CHANNEL FLOW(NCE-043)

Assignment: I (Unit 1)

NOTE-ATTEMPT ALL PARTS

1. Differentiate b/w the following-
   - i- Uniform and non-uniform flow
   - ii- Steady and unsteady flow
   - iii- GVF&RVF
   - iv- Rigid and Mobile boundary channel
   - v- Prismatic and non-prismatic channel.

2. What is velocity distribution in an open channel flow?Explain with figure.
3. What is Continuity equation in an open channel flow?
4. What is Chezy's formula? How is it derived? Show that Chezy's coefficient C = where R is the hydraulic radius and n is Manning's roughness coefficient.
5. State the conditions under which the rectangular, triangular and trapezoidal sections of an open channel will be most economical. Derive these conditions.
6. What do you mean by term specific energy?Draw specific energy curve and explain it also derive Supercriticle,Subcriticle and critical flow condition.
7. A rectangular channel is 3m wide and conveys a discharge of $15m^3/s$ at a depth of 1.9m.It is proposed to reduce the width of the channel at a hydraulic structure.Assuming the transition to be horizontal and the flow to be frictionless determine the water surface elevations upstren and downstream of the constriction when the constricted width is (a)2.5m (b)2m.
8. Determine the normal depth in triangular cahnnel with apex angle 90 degree ,when it carries a discharge of $1.5m^3/s$ at manning's n=0.016.
9. Water is flowing at a critical depth at a section in a triangular shaped channel ,with side slope of 0.5H:1V with its apex positioning upward .If the critical depth is 1.6m amd base width is 3m ,estimate the discharge in the channel and specific energy at the critical depth section.
10. While measuring a discharge in small stream it was found thar the depth of flow increase at the rate of 0.10m/h .If the discharge at that section was $25m^3/s$ and the surface width of stream was 20m ,estimate the discharge at section 1km. upstream.

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B. Tech Final Year (Seventh Semester) 2018-19

Department of Civil Engineering

OPEN CHANNEL FLOW(NCE-043)

Assignment: II (Unit 2)

NOTE-ATTEMPT ALL PARTS

1- Using the Manning equation obtain the condition for velocity to remain constant for various normal depths for a channel with constant S and n.

2- Show that the gradually flow equation is reduced to uniform flow formula if dy/dx = 0.

3- Show that the water surface slope S_w of a gradually varied flow is equal to the sum of energy slope S and the slope

$$\frac{d}{dx}\left(\frac{V^2}{2g}\right)$$

due to velocity change α .

4. (b) Show that the differential equation of gradually varied flow in a rectangular channel of variable width B can be expressed as :

$$\frac{dy}{dx}=\frac{S_0-S_f+\left(\frac{Q^2 y}{gA^3}\frac{dB}{dx}\right)}{1-\frac{Q^2 B}{gA^3}}$$; with all usual notations.

5. Discuss the classification of flow profiles.
6. In a very long trapezoidal channel with bed width B=3.0m ,side slope m=1.5,Mannings n=0.016,Longitudinal slope S_o=0.0004,the normal depth is measured as 1.20m.Determine the type of GVF profile existing at a section x,in this channel when the depth of flow at X is (i)0.5m (ii)0.8m (iii)1.50m.
7. Sketch the possible GVF profiles in the following serial arrangement of channels .The flow is from left to right:
   (a) Steep-horizontal-mild slope.
   (b) Steep-steeper-mild-milder slope
8. In a rectangular channel two reaches A and B in series,with reach A being upstream of Reach B,have the following characteristics:

REACH	WIDTH(M)	DISCHARGE(m^3/s)	Slope	N
A	**3.5**	**10.0**	**0.0004**	**0.020**
B	**3.0**	**10.0**	**0.0160**	**0.015**

9. A 3.0m wide rectangular channel has a longitudinal slope of 150mm/km and mannings n=0.02.When the discharge in the channel is 0.85m^3/s,estimate the slope of the water surface in the channel(relative to the channel) at a point where the depth of flow is 0.75m.
10. (a) A rectangular channel has B=20 m,n=0.020 and S_0=0.0004 if the normal depth is 1.0m,a depth of 0.8m in a Gvf in this channel is the part of which type of profile.
    (c) Derive the expression for finding the length of backwater curve.

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Babu Banarasi Das -National Institute of Technology & Management, Lucknow

B. Tech Final Year (Seventh Semester) 2018-19

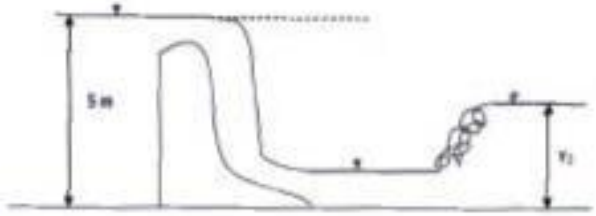
Department of Civil Engineering

OPEN CHANNEL FLOW(NCE-043)

Assignment: III (Unit 3)

NOTE-ATTEMPT ALL PARTS

1. 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
2. A spillway, as shown in figure 1, has a flow of 3 m3/s permeter of width occurring over it. What depth y_2 will exist downstream of the hydraulic jump ? Assume there is no energy loss over the spillway.



3. 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 $V_w = \sqrt{\frac{1}{2} g \frac{y_2}{y_1} (y_1 + y_2)}$ in a rectangular channel for the positive surge moving down stream.
4. Estimate the energy head loss through the jump.
5. A rectangular channel 2.0 m wide has a discharge of 0.35m^3/s .Find the height of rectangular weir spanning the full width of cahnnel that can be used to pass this discharge while maintain an upstream depth of 0.85 m.
6. In a hydraulic jump occurring in a rectangular channel of b3.0 m width the discharge is 7.8m^3/s and the depth before the jump is 0.028m.Estimate the sequent depth and Energy loss in the jump.
7. What are Surges?Classify them ?Derive the expression for C?
8. Classify hydraulic jump on the basis of Froud's number.
9. Derive the expression for sequent depth ratio ,energy loss.
10. A rectangular channel carries a flow with a velocity of 0.65m^3/s and depth of 1.40m.If the discharge is abruptly increased threefold by a sudden lifting of a gate on the upstream,estimate the velocity and the height of the resulting surge.

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Babu Banarasi Das -National Institute of Technology & Management, Lucknow

B. Tech Final Year (Seven Semester) 2018-19

Department of Civil Engineering

OPEN CHANNEL FLOW(NCE-043)

Assignment: IV (Unit4)

NOTE-ATTEMPT ALL PARTS

1. What is the basic principle of spatially varied flow?Also classify the SVF,how the discharge is estimated through side weir.
2. Derive the basic differential equation governing the motion in the SVF with decreasing discharge. Write down the assumptions made in deriving the equation.
3. 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.
4. What do you understand by bottom racks and classify it into different categories ? Discuss various types of flow that can occur over bottom racks and draw its profile also
5. Derive De Marchi equation.
6. A rectangular channel B=2.0m, n=0.014,is laid on a slope S_0=0.001.A side weir is required at a section such that it comes into operation when the discharge is 0.6m^3/s and diverts 0.15 m^3/s when the canal discharge is 0.9 m^3/s.Design the element of side weir.
7. A discharge of 11 m3/s is diverted through ports in the bottom of the channel between sections 1 and 2 as shown in fig 2. Neglecting head losses and assuming a horizontal channel, what depth of water is to be expected
8. A 1.5m wide rectangular channel conveys a discharge of 1.7m^3/s at a depth of 0.6 m.A uniformly discharging side weir with crest at 0.42 m above the bed at the comncement of the side weir is proposed to divert a flow of 0.3m^3/s laterally.Design the length of the side weir and other geometry of the channel at the weir.
9. Derive Mostkow equations for Bottom racks.
10. A 3.0 m wide rectangular channel can carry a discharge of 3.60 m^3/s at a normal depth of 1.2m.Design a side weir so that it pass all the flow in the canal when the discharge is 2.00m^3/s and wil divert 0.6m^3/s when the canal discharge is 3.60m^3/s.

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Babu Banarasi Das -National Institute of Technology & Management, Lucknow

B. Tech Final Year (Seventh Semester) 2018-19

Department of Civil Engineering

OPEN CHANNL FLOW(NCE-043)

Assignment: V (Unit 5)

NOTE-ATTEMPT ALL PARTS

1. 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 ?
2. Discuss in detail the design considerations for subcritical and supercritical flows.
3. How will the flow take place in channel of non -linear alignment and non-prismatic sections ? Discuss in detail.
4. A rectangular concrete conduit is to be used as a culvert on a slope of 0.02. The culvert is 15 m long and has a cross-section of 2.13 m × 2.13 m. If the tail water elevation is 1.8 m above the crown at the outlet, determine the head water elevation necessary to pass a 10 m_3/s discharge.Assume a square-edged entrance (K_e = 0.5).
5. Explain the factor affecting the culvert flow .
6. With neat sketches classify the culvert flow with outlet submerged condition.
7. A 5.0m wide rectangular canal carries a discharge of 10 cumecs at a depth of 1.25 m and has a mannings roughness cofficient of 0.015.It has a bend with center line radius of 30m and included angle of 45^0 .Find the superelevation.
8. What is superelevation ?Derive its expression.

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