

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B.Sc. Engineering (Civil)

Course Title: Open Channel Flow
Time: 3 Hrs

Course Code: CE 361
Full Marks: 90

[There are six (8) questions. Answer any five (6)]

- 1 (a) Define Specific Energy and Total Energy. (4)
(b) Write down the various uniform flow formulae. (6)
(c) For a trapezoidal channel with $b = 6$ m and $s = 2$, compute the critical depth and velocity if $Q = 50$ m³/s. (5)
- 2 (a) Define 'hydraulic jump' and 'Regime' approach of an open channel. (4)
(b) Classify the hydraulic jumps based on Froude number. (4)
(c) A horizontal trapezoidal channel with $b = 6$ m and $s = 2$ carries a discharge of 120 m³/s. If the upstream depth of flow is 1 m, compute the downstream depth that will create a hydraulic jump. (7)
- 3 (a) Define Sequent depth and establish the sequent depth formula for a horizontal rectangular channel. (7)
(b) A concrete lined channel is to carry a discharge of 100 m³/s and laid on a slope of 1 in 2500. The side slope of the channel is 1:1 and the value of $n = 0.012$. Determine the section dimensions if the permissible velocity is 2 m/s. (6)
(c) Define lining. (2)
- 4 (a) What is flow measurement device? What are the criteria on which the choice of construction material depends? (5)
(b) Derive the discharge formula for broad crested weir for free flow condition. (7)
(c) A rectangular broad crested weir spanning the full width of a rectangular channel 2 m wide. Compute the discharge over the weir under an upstream head of 0.75 m. The coefficient of discharge C_d is 0.67. (3)
- 5 (a) Design a stable channel by using the Lacey's theory. The channel is to carry 10 m³/s through 1 mm diameter sand. (6)
(b) What are the differences between sharp crested and broad crested weirs? (3)
(c) Obtain the relationship among Chezy's C , Darcy-Weishbach friction factor f and Manning's n . (6)
- 6 (a) Draw a schematic diagram of a Parshall flume. What are the advantages of flumes over the weirs? (3)
(b) Water flows in a horizontal rectangular channel 6 m wide and at a depth of 0.52 m and a velocity of 15.2 m/s. Check whether hydraulic jump forms in this channel or not. If forms, determine, (i) type of jump, (ii) downstream depth needed to form jump, and (iii) relative height of jump and (iv) length of jump. (8)
(c) What are the various factors affecting the Manning's roughness coefficient, n ? (4)
- 7 (a) Define Normal depth and Conveyance of an open channel. (4)
(b) For a rectangular channel with bottom width $b = 6$ m, $n = 0.025$ and bottom slope $S_0 = 0.0025$, compute the normal depth and velocity if $Q = 20$ m³/s. (6)
(c) What are the conditions for establishing uniform flow in an open channel? (5)
- 8 (a) Write down design steps for a lined trapezoidal channel with appropriate figure. (5)
(b) Draw a schematic diagram of a broad crested weir and state the conditions to be satisfied to exist the hydrostatic pressure distribution. (4)
(c) The sides of a laboratory flume are made of glass ($n = 0.01$) and the bottom is made of wood ($n = 0.015$). The flume is rectangular with $b = 1$ m and is laid on a slope of 0.001. Compute the discharge in the flume if normal depth, $h_n = 0.04$ m. (6)