T2/2012 **SEV222: Hydraulics and Hydrology**

Assignment 2

Submission due date: Wednesday, 19th September for both on and off campus students

Notes:

(i) All calculation steps should be clearly shown in your answers

(ii) ***No electronic submissions*** will be accepted

Answer all questions

1. Determine the maximum depth in a 5-m wide rectangular channel if the flow is to be supercritical with a flow rate of $Q = 40\ m^3/s$.
   What is the critical slope corresponding to the above flow rate? ($n = 0.011$)

2. A flow of 28 m^3s^{-1} occurs in an earth-lined canal having a base width of 3 m, side slopes of 1(vertical) to 2 (horizontal) and the Manning's n value of 0.022. Calculate the critical depth and critical slope.

3.
   a. A hydraulic jump occurs in a rectangular open channel. The water depths before and after the jump are 0.6 m and 1.5 m, respectively. Calculate the critical depth.

   b. A hydraulic jump occurs in a rectangular channel 3 m wide having a discharge of 9 m^3s^{-1}. The approach depth is 0.75 m. What is the downstream depth, and what fraction of the upstream energy is dissipated in the jump?

4. Water enters a very wide rectangular channel (Manning's $n = 0.0149$) at a velocity of 12.2 ms^{-1} and a depth of 0.61 m. An H3 curve forms downstream and the water jumps to a depth of 2.4 m some distance downstream. Find the distance downstream to the location of the hydraulic jump.

5. A long wide rectangular channel carries a steady flow rate of 35 m^2s^{-1} (flow per unit width) and passes through an abrupt change in slope from 0.005 (upstream of the change) to 0.003 (downstream). Manning's n for the channel is 0.013. Is there a hydraulic jump in the channel and if so where? Describe the water surface profiles at the various parts of the channel.

6. Question from Hydrology section

Note:

(i) The numerical values for the variables in the questions are based on your ID number and you must use the appropriate values for answering the questions. ***Failure to do so will result in no marks being awarded to those questions.***

The following variable is used in the questions: ***R***

If the last two digits of your ID is greater than or equal to 45 then R = the last two digits

If the last two digits of your ID is less than 45, then R = 45 + the last two digits

Example: If the ID =230675467, then R = 67

If the ID = 230675134, then R = 45 + 34 = 79

Note that your R value can only be between 45 and 99 (both inclusive)

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6 (a)

Assuming that the following flood data follows a Gumbel distribution, plot the data on a Gumbel probability scale and fit a linear trend to your plot. Determine the Flood magnitude of ARI (return period) equal to ***R*** years from your fitted linear trend and compare with that from the equation; ($x = \beta + \alpha.y$)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Peak flow in m3/s	85.5	240.8	186.8	160.9	126.6	140.7	418.7	16.5	98.0	29.2

2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
100.7	18.4	175.4	314.9	22.2	262.2	131.7	13.7	11.7	3.2	142.8

$$AEP = (m - 0.4)/(N + 0.2)$$
$$y = -\ln[-\ln(1 - AEP)]$$

$$\alpha = S.\sqrt{6}/\pi$$
$$\beta = \bar{x} - 0.5772\alpha$$
$$x = \beta + \alpha.y$$

6 (b)

Flood peaks of a river for 5-yr and 100-yr return periods are given as (100 + ***R***) and (400 + ***R***) m^3/s respectively:

i. Calculate mean ($\overline{X}$) and standard deviation (S) of the river floods assuming that Gumbel distribution fits the data
ii. Using Normal distribution calculate 50 and 100 year return period flood peaks,
iii. Calculate 50 and 100 year return period flood peaks using 2-parameter Log-Normal distribution. The mean ($\overline{Y}$), standard deviation (S_y) and skewness coefficient (g_y) of the logarithms (base 10) of the annual flood peaks are given as follows:

   $\overline{Y}$ = 2 + ***R/1000***, S_y = 0.4 + ***R/1000*** , g_y= -(***R /100***)

iv. For statistics of the log transformed data in (iii), calculate flood peak for 50 and 100 year return periods using the Log-Pearson distribution