Tutorials on rating curve

Problem 1 (Discharge Calculation)

a) Find out the river discharge for given set of data as below, by all three methods, i.e., CWC, Mid-Section & Mean Section methods.

b) Compare the results obtained from each of them & state the reasons thereof.

	RDs in m	***Depth in m***	***Velocity in m/sec***
Left Bank	6	0	0
	10	1.0	0.3
	15	1.3	0.4
	20	1.4	0.5
	25	1.6	0.45
	30	1.9	0.6
	35	2.7	0.8
	40	2.3	0.6
	45	2.0	0.4
	50	1.3	0.3
	55	1.2	0.2
Right Bank	59	0	0

Problem 1 (Data Entry in SWDES)

RD-1 sheet attached

Problem 2 (Statistics in Hydrology)

It is observed that water level at a station 'A' indicates some relation with water levels recorded at two upstream sites. For the data given below, develop an equation using linear multiple regression method.

Station	A (main river)	B (on tributary)	C (on tributary)
	80.3	112.2	165.3
	80.5	112.2	165.8
	82.2	112.3	116.6
	84.3	113.3	167.2
	85.6	114.0	168.0
	85.7	114.1	168.4
	86.0	114.3	168.8
	86.3	114.3	169.3
	87.1	114.6	170.2

Problem 3 (Rating Curve)

a) A Set of Gauge & Discharge data of Site 'A' is given below. With the given data, pl perform following operations.

i.) Fit a rating curve
ii.) Find out Standard Deviation & Standard Error of Estimate
iii.) What is the value of Correlation Coefficient
iv.) Draw 95% Confidence Band line
v.) Draw Standard Error of Mean Relationship line

b) Carry out stability analysis of rating curve so drawn.

c) Do results obtained by you differ with others? If answer is in affirmative, what factor contributes to it?

Gauge	*Discharge(cusec)*	*Gauge*	*Discharge*
81.00	23418	81.13	25974
81.35	26069	81.40	26844
81.40	25704	81.47	26306
81.64	29028	81.67	24751
81.77	27829	81.69	29148
81.89	30053	81.80	29317
82.02	26479	81.87	29562
82.03	32181	80.07	29845
82.11	31292	82.30	33727
82.21	32811	83.48	43695
82.27	30500	82.75	33697
82.65	35306	84.03	51496

Problem-1

Mean section Method:-

$$q_i = \frac{(\bar{v}_i + \overline{v_{i-1}})}{2} * \frac{(d_i + d_{i-1})}{2}(w_i - w_{i-1})$$

Mid section Method:-

$$q_i = \frac{(\bar{v}_i.d_i + \bar{v}_{i-1}.d_{i-1})}{2} * (w_i - w_{i-1})$$

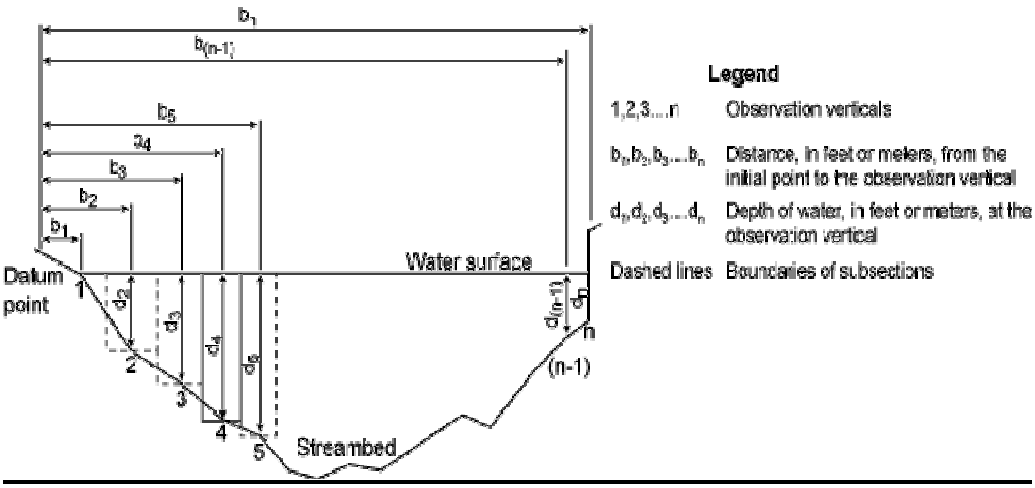
CWC method- Deduct end corrections for area and discharge.

Calculate sum of depth and sum of increase in bed width. Calculate depth*velocity. Calculate wetted perimeter, P =sum of increase in bed+ top width.

Area= $\sum(D) * Seg\ width - area\ correction\ at\ both\ ends$

$Q = \sum[(D * Vel) * Seg\ width - Q_{correction}]$

HMD=A/P, Vel=Q/A, calculate Manning's N.



Problem-2

Regression analysis

X1=a+bX2+cX3

∑X1=aN+b∑X2+c∑X3

∑X1X2=a∑X2+b∑X2^2+∑X2X3

∑X1X3=a∑X3+b∑X2X3+c∑X3^2

Problem3

Steps wise procedure for Exercise on rating curve

a) Arrange the stage in ascending order, so that judging the values will be easier.

b) Pick up ***two*** discharge data in such a way that $Q_1 * Q_3 = Q_2^2$.

c) Calculate G0 using the given formula.

$$\frac{Q_1}{Q_2} = \frac{Q_2}{Q_3}$$

$$G_0 = \frac{G_1 G_3 - G_2^{\,2}}{G_1 + G_3 - 2G_2}$$

d) Draw the rating curve using *Scatter* plot and find the trend line with equation plot on graph.

e) Calculate the ***Sd*** from excel function and also coefficient of correlation r^2.

f) Estimate Q_c from the curve using the equation.

g) Calculate ***Se*** using the formula

h) $$Se = \left[\frac{\sum (\ln Q - \ln Q_c)^2}{(N-2)} \right]^{0.5}$$

i) Calculate ***t*Se*** taking ***t*** as *1.96* as per normal distribution curve.(2 may be taken upto N>20)

j) Calculate terms for bands i.e., ***(Qc+/- t*Se).***

k) Calculate ***ln(G-G$_0$).*** Calculate the average value and calculate $2s_{mr}$.

l) $$2s_{mr} = \pm tSe \left[\left\{ \frac{1}{N} \right\} + \frac{[\ln(G-Go) - \overline{\ln(G-G_0)]^2}}{\sum [\ln(G-Go) - \overline{\ln(G-G_0)]^2}} \right]^{0.5} x100$$

m) Calculate Qc+/-2smr

n) Plot the values ***(Qc+/-t*Se)*** and ***(Qc+/-2smr)*** with ***(G-Go)*** and compare the result and interpret.