University of Technology
Building and Construction Eng. Dept.
Final Exam 2013/2014

Subject: Computer Application — **Class: 4th**
Branch: Water and Dams Eng. — **Time: 1.5 Hour**
Examiner: Assist. Prof. Dr. Mahmoud Saleh, — **Date : 2/6/2014**

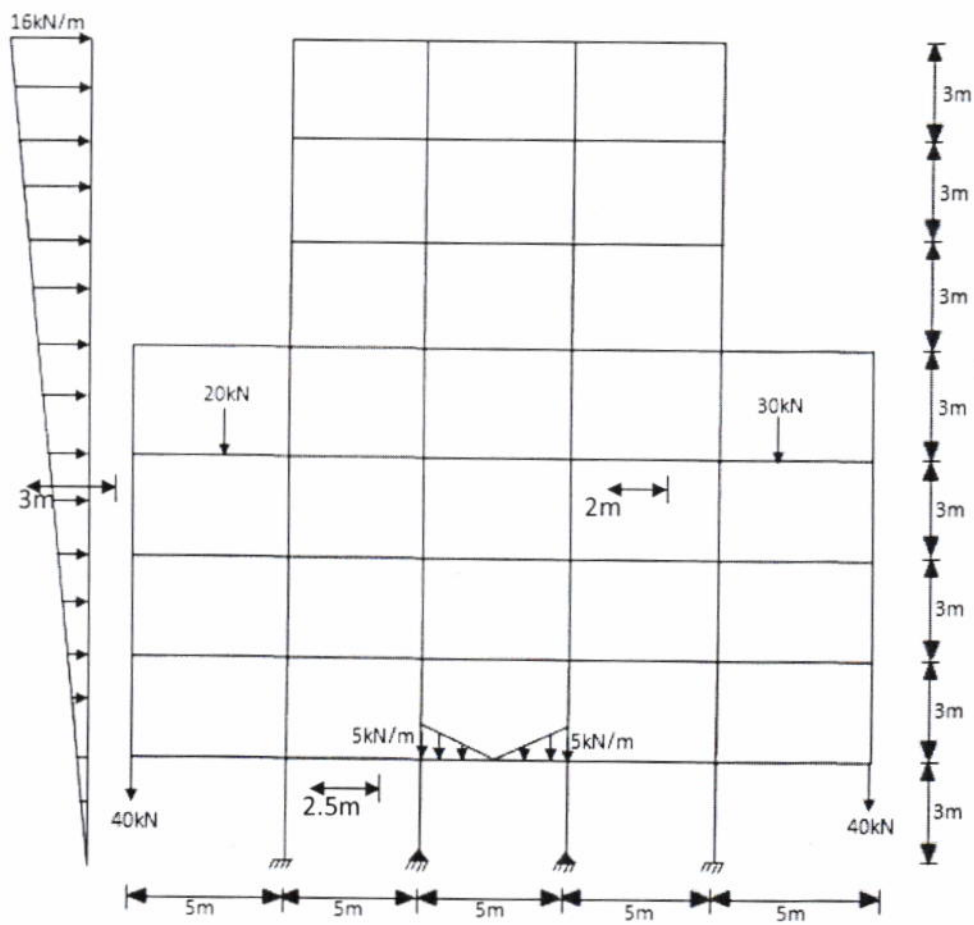
Part A: STAAD Pro and Auto Cad.

15 - 18

Q1: Using the concept of **auto-generation method** of STAAD Pro software, sketch and construct the idealization numbering of joints and members **concrete structure** shown below (All dimensions unit in meters). Edit the **analysis** commands of the structural members under the effects of following loading conditions:

i. Self weight with **F**actor **S**afety (F.S.=1.4)
ii. Roof super imposed dead load 4 kN/m with (F.S.=1.3)
iii. Floor super imposed dead load 3 kN/m with (F.S.=1.2)
iv. External loads (as shown below) with (F.S.=1.7)

Notes: Ec = 3300 kip/in^2, column section (60 * 40 cm), beam size (T-section) [flange bf = 80cm, tf=20cm], [web H = 80cm, bw = 30cm].



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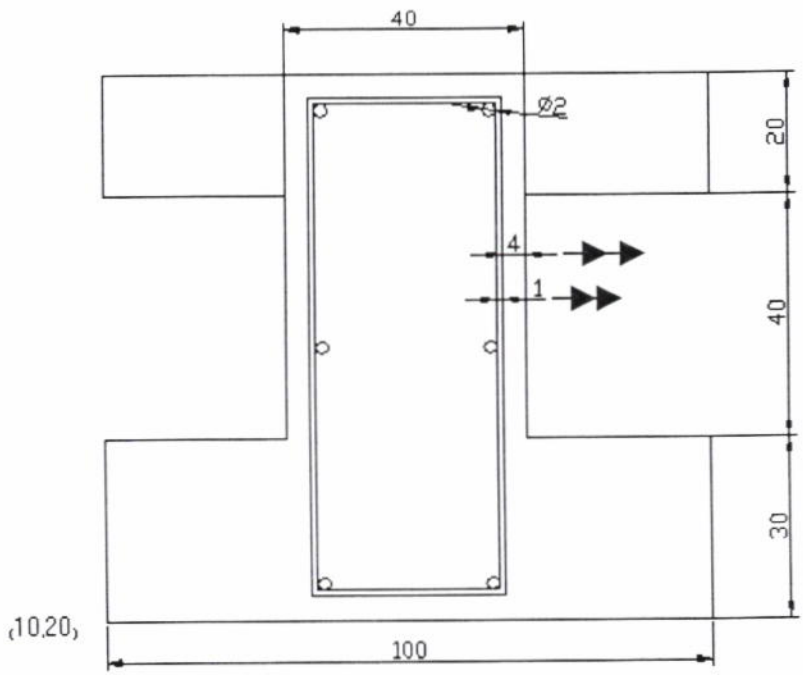
Q2: (Answer A or B)

A: Draw the following figure in board its' sides are (150×150 cm). If you know the figure is far away 10cm Horizontally and 20cm Vertically from original point(0,0). Concrete cover is equal to 4cm. Assume any dimension not found.



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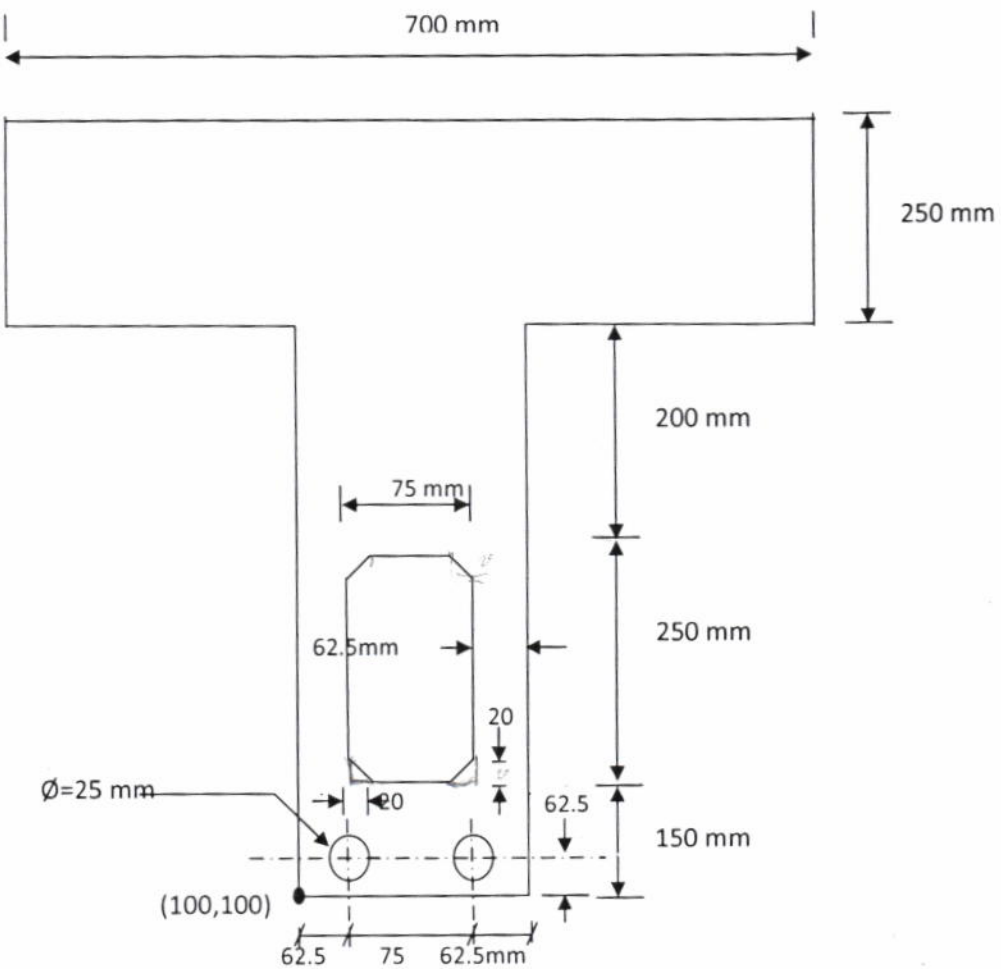
5-10

Q2:B: using AutoCAD program draw the following figure on board its sides(1000×1000mm) ,if you know the lower left side of figure is far100 mm horizontally and 100 vertically, from original point.



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Part B: HEC-RAS.

Note: Answer only **four** questions.

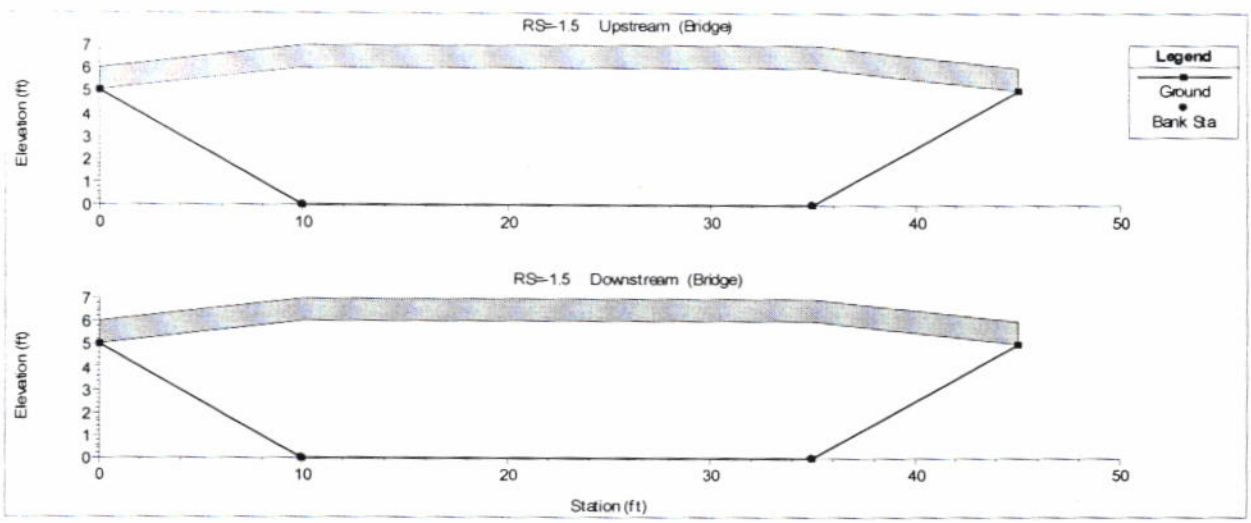
Q1:A: Explain (with necessary drawings and equations) the theoretical basis of the HEC-RAS for steady one – dimensional flow calculations.

Q1:B: What are the basic kinds of similarity? Give the main relations that explain each kind.

Q2: A: Fill the blanks in (1) and (2 or 3) of the followings:

1- In HEC-RAS model the water surface profiles for the steady flow are computed by solving.....equation which is....., while for unsteady flow by solving.....equation which is..... and .....equation which is ..... and the .....approach is used to solve these equations.
2- Steady flow data that required to perform water surface profile consists of ....., ... and.....
3- The location of boundary conditions for subcritical flow is at....., while for supercritical flow is at..... and for mixed flow is at.....

Q2: B: Fill the bridge – deck/road way menu with the necessary data to represent the bridge deck shown below.



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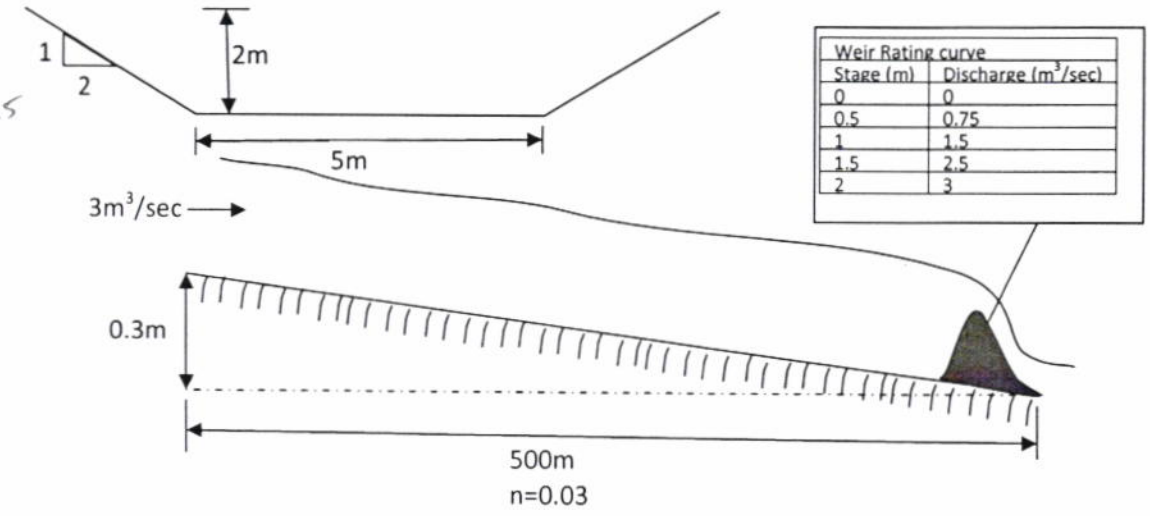
Q3: Draw a scheme representing the steps required for entering steady flow data and boundary conditions to simulate the flow in a river for three profiles with discharge 20, 40, and 60m^3/sec. the corresponding boundary condition of these discharges is a known water surface elevation 1, 1.5, 2 m. a. m. s. l. (Draw the necessary main menu).

Q4: Explain, with necessary sketch, the main stapes for preparing and running a hydraulic model to simulate the flow in a trapezoidal channel of a cross section, longitudinal profile, flow data and boundary condition as shown below.



Q5: Write the geometric data of the hydraulic structure shown in figure (1) in the menus (A) and (B). The distance between upstream cross-section and deck is 25m, Deck width in direction of flow 10m, gate length 2m, gate width 3m, weir coefficient is 2.18, U.S and D.S embankment side slope is 0.5 and the weir is broad crested weir.

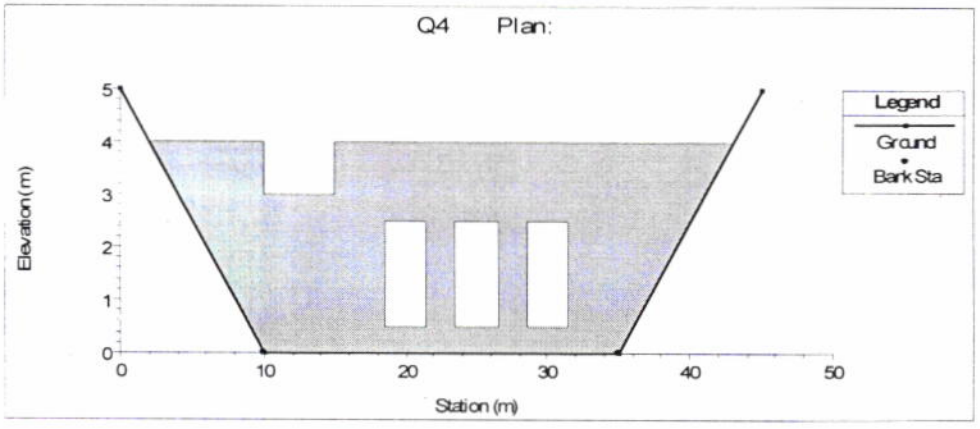


Figure (1): The Hydraulic structure

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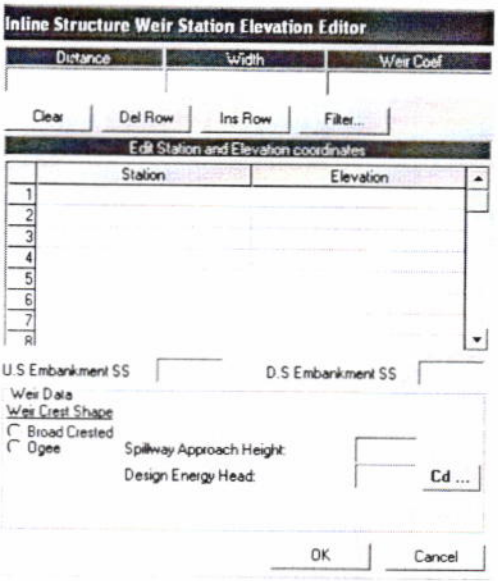
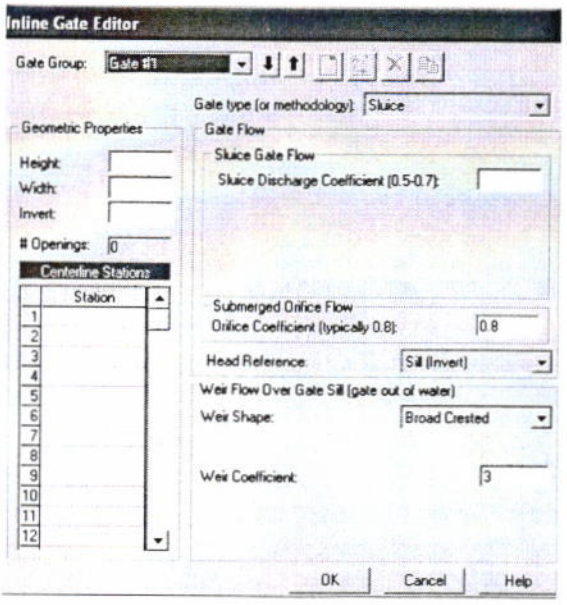


Menu A



Menu B

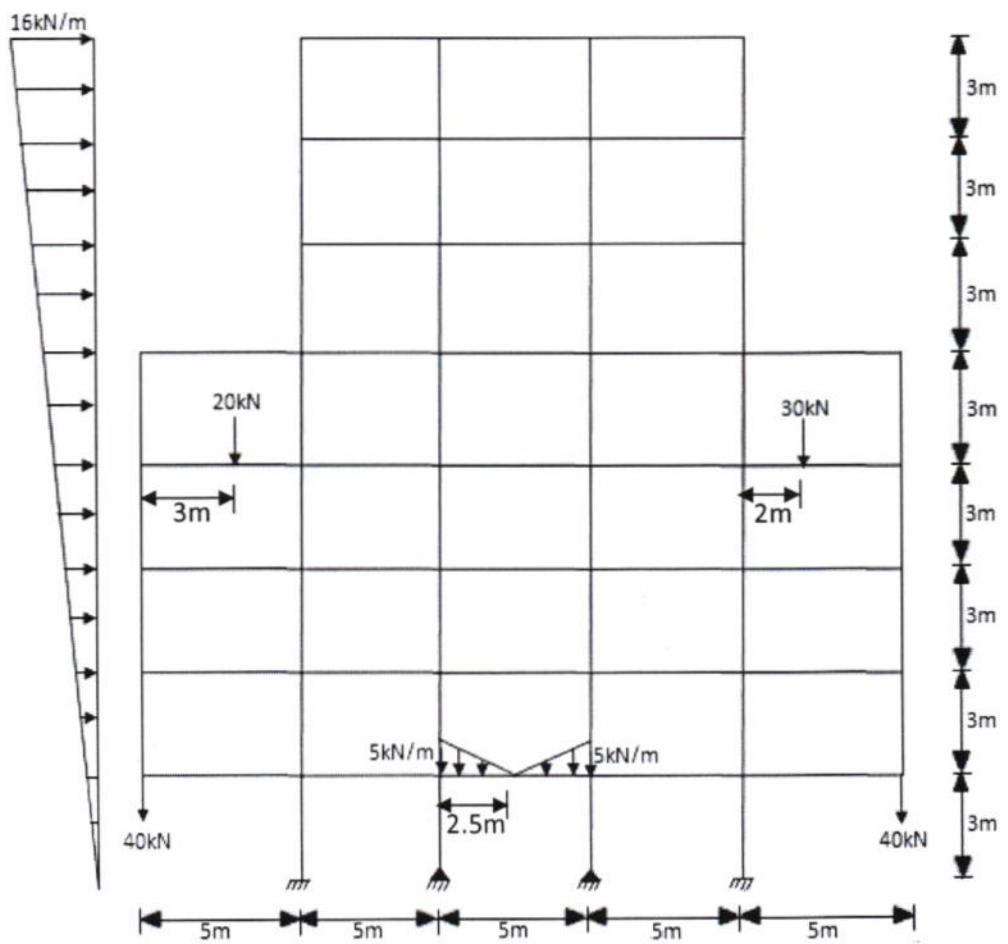
Good Luck

SET I 2013-2014 FINAL EXAM – DAMS

Q1) Using the concept of **auto-generation method** of STAAD Pro software, sketch and construct the idealization numbering of joints and members **concrete structure** shown below (All dimensions unit in meters). Edit the **analysis** commands of the structural members under the effects of following loading conditions:

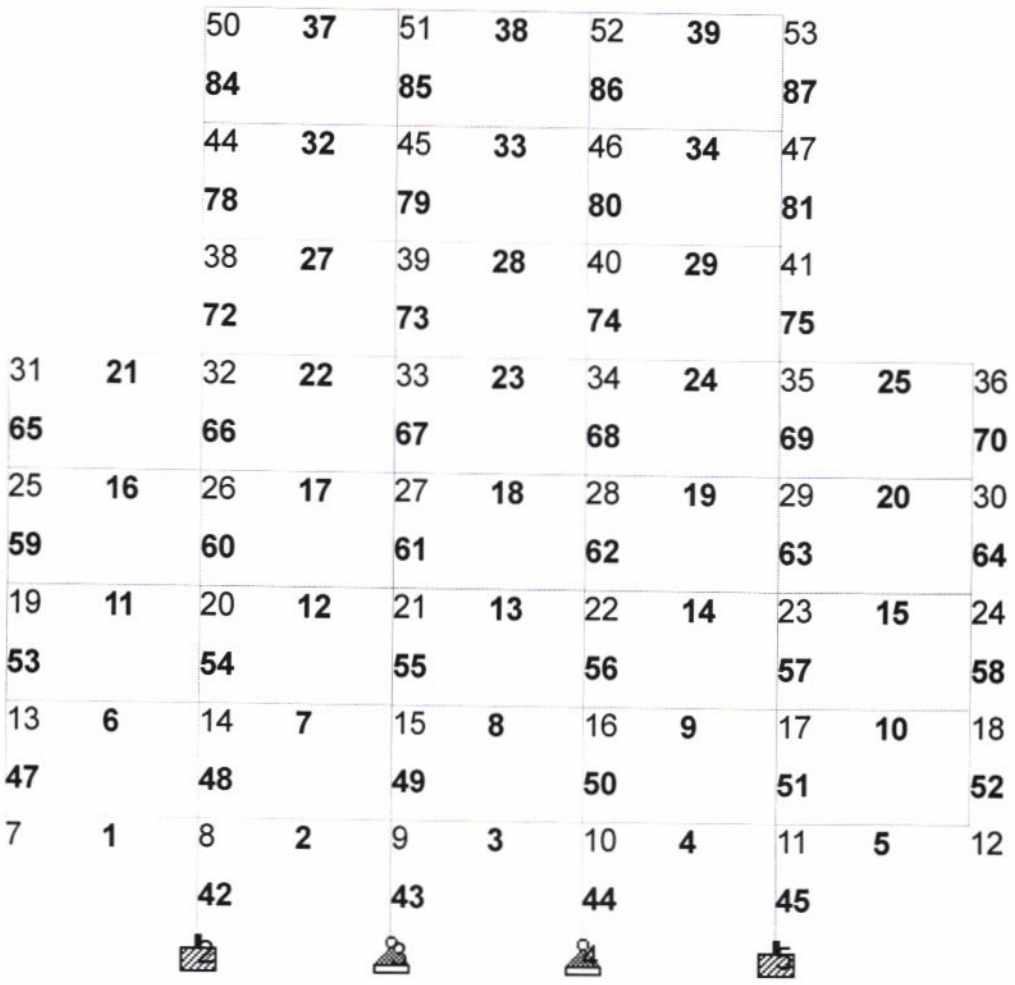
i. Self weight with **F**actor **S**afety (F.S.=1.4)
ii. Roof super imposed dead load 4 kN/m with (F.S.=1.3)
iii. Floor super imposed dead load 3 kN/m with (F.S.=1.2)
iv. External loads (as shown below) with (F.S.=1.7)

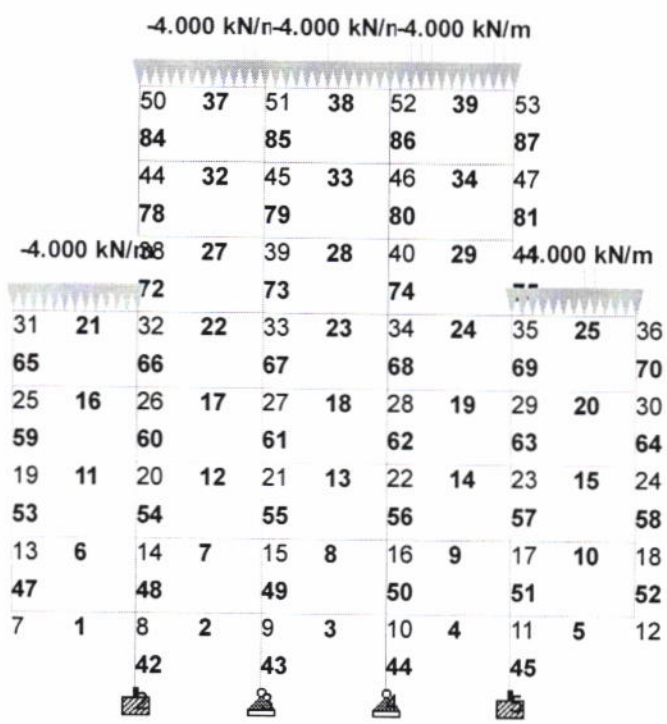
Notes: Ec = 3300 kip/in^2, column section (60 * 40 cm), beam size (T-section) [flange bf = 80cm, tf=20cm], [web H = 80cm, bw = 30cm].



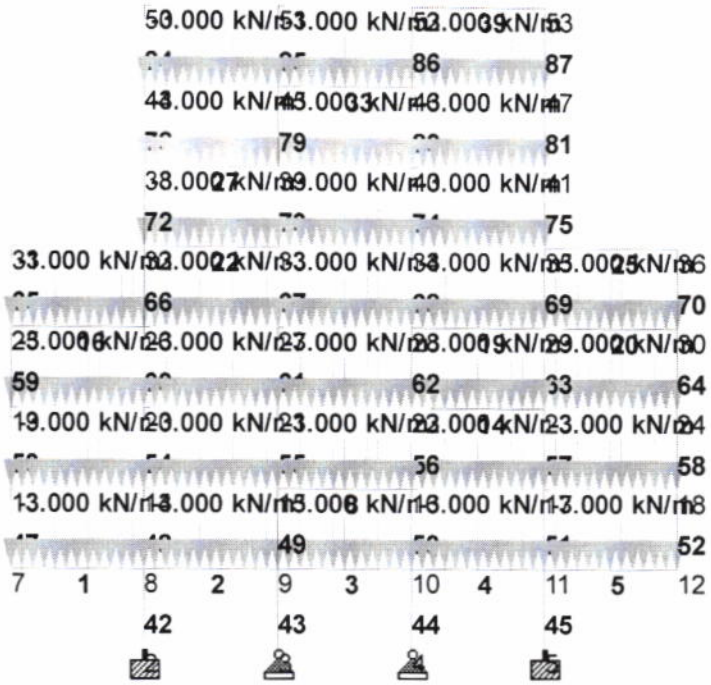
Answer of Question #1:

```
STAAD PLANE
uni met kn
joi coo
1 0 0 0 6 25 0 0
r 8 0 3 0
meminc
1 7 8 5
r 7 5 6
41 1 7 46
r 7 6 6
delmem 26 31 36 30 35 40 71 77 83 76 82 88 41 46
sup
2 5 fix
3 4 pin
Uni kip in
const
denconc all
E 3300 all
poiconc all
unimetkn
mem prop
47 to 70 42 to 45 72 to 75 78 to 81 84 to 87 prisyd 0.6 zd 0.4
1 to 25 27 to 29 32 to 34 37 to 39 prisyd 0.8 yb 0.6 zd 0.8 zb 0.3
loading 1 Gravity Load
self
Loading 2 Roof S.I.D.L
mem load
21 25 37 to 39 unigy -4
loading 3 Floor S.I.D.L
mem load
1 to 20 22 to 24 27 to 29 32 to 34 unigy -3
loading 4 L.L.
joi load
7 12 fy -40
mem load
16 con gy -20 3
20 con gy -30 2
mem load
3 trap gy -5 0 0 2.5
3 trap gy 0 -5 2.5 5
42 trap gx 0 2
47 trap  gx 2 4
53 trap  gx 4 6
59 trap  gx 6 8
65 trap  gx 8 10
72 trap  gx 10 12
78 trap  gx 12 14
84 trap  gx 14 16
load comb 5 Combination Load
1 1.4 2 1.3 3 1.2 4 1.7
perform analysis
FINISH
```


50 37 51 38 52 39 53
84 85 86 87
44 32 45 33 46 34 47
78 79 80 81
38 27 39 28 40 29 41
72 73 74 75
31 21 32 22 33 23 34 24 35 25 36
65 66 67 68 69 70
25 16 26 17 27 18 28 19 29 20 30
59 60 61 62 63 64
19 11 20 12 21 13 22 14 23 15 24
53 54 55 56 57 58
13 6 14 7 15 8 16 9 17 10 18
47 48 49 50 51 52
7 1 8 2 9 3 10 4 11 5 12
42 43 44 45


-4.000 kN/m -4.000 kN/m -4.000 kN/m
-4.000 kN/m
44.000 kN/m
50 37 51 38 52 39 53
84 85 86 87
44 32 45 33 46 34 47
78 79 80 81
38 27 39 28 40 29
72 73 74
31 21 32 22 33 23 34 24 35 25 36
65 66 67 68 69 70
25 16 26 17 27 18 28 19 29 20 30
59 60 61 62 63 64
19 11 20 12 21 13 22 14 23 15 24
53 54 55 56 57 58
13 6 14 7 15 8 16 9 17 10 18
47 48 49 50 51 52
7 1 8 2 9 3 10 4 11 5 12
42 43 44 45

Load 2


50.000 kN/m
53.000 kN/m
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53
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87
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46.000 kN/m
79
81
38.000 kN/m
40.000 kN/m
72
75
33.000 kN/m
34.000 kN/m
66
69
70
28.000 kN/m
29.000 kN/m
59
62
64
19.000 kN/m
23.000 kN/m
56
58
13.000 kN/m
16.000 kN/m
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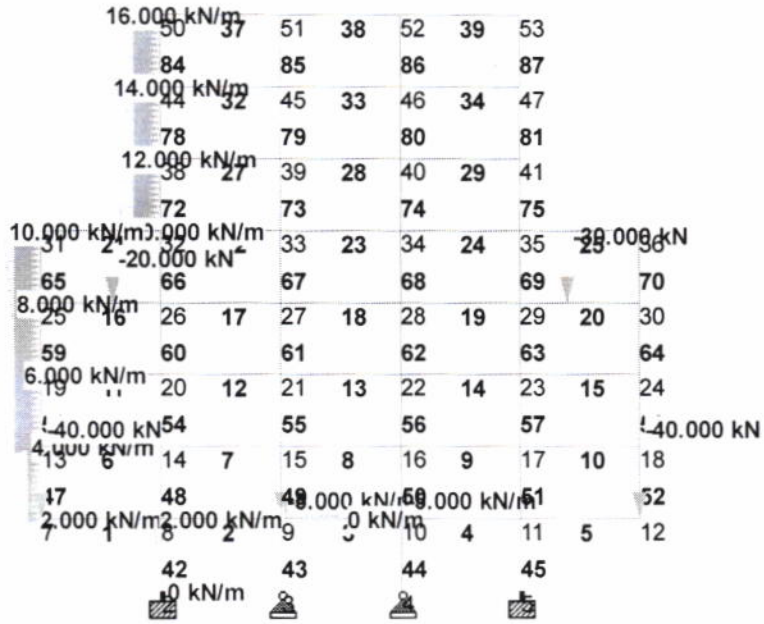
Load 3


16.000 kN/m
14.000 kN/m
12.000 kN/m
10.000 kN/m
-20.000 kN
-20.000 kN
8.000 kN/m
6.000 kN/m
-40.000 kN
-40.000 kN
4.000 kN/m
2.000 kN/m
2.000 kN/m
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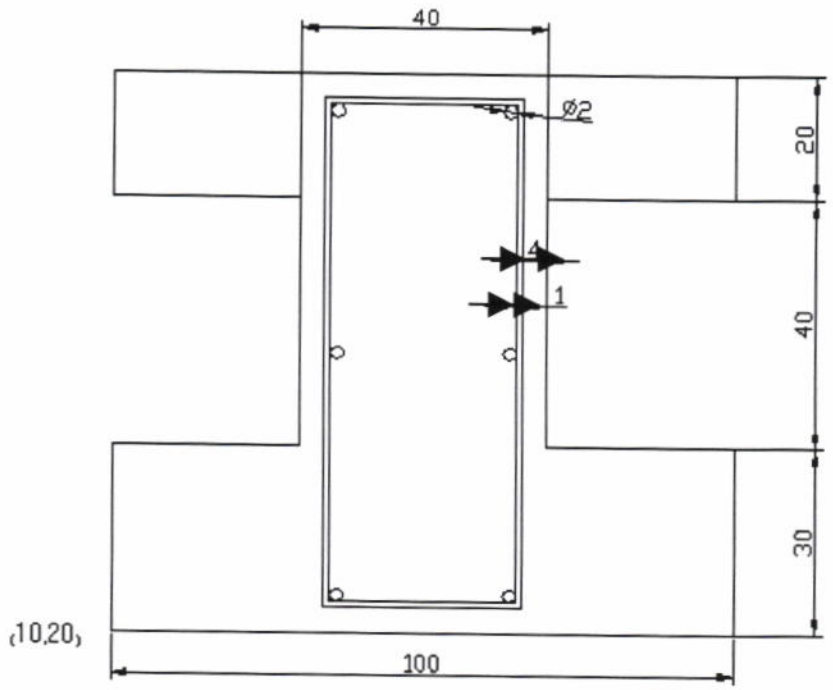
Load 4

Draw the following figure in board its' sides are (150×150 cm). If you know the figure is far away 10cm Horizontally and 20cm Vertically from original point(0,0). Concrete cover is equal to 4cm. Assume any dimension not found.



Absolute coordinate system

Command:L
Specify first point:10,20
Specify next Point:110,20
:110,50
:80,50
:80,90
:110,90
:110,110
:10,110
:10,90
:40,90
:40,50
:10,50
:10,20

Command: Rec
Specify first corner point:44,24
Specify other corner Point:76,106

Command: Rec
Specify first corner point:45,25
Specify other corner Point:75,105

Command : C
Specify center point for circle:46,26
Specify radius of circle:1

Command : C
Specify center point for circle:74,26
Specify radius of circle:1

Command : C
Specify center point for circle:46,70
Specify radius of circle:1

Command : C
Specify center point for circle:74,70
Specify radius of circle:1

Command : C
Specify center point for circle:46,104
Specify radius of circle:1

Command : C
Specify center point for circle:74,104
Specify radius of circle:1

Relative coordinate system

Command:L
Specify first point:10,20
Specify next Point:@100,0
:@0,30
:@-30,0
:@0,40
:@30,0
:@0,20
:@-100,0
:@0,-20
:@30,0
:@0,-40
:@-30,0
:@0,-30

Command: Rec
Specify first corner point:44,24
Specify other corner Point:@32,82

Command: Rec
Specify first corner point:45,25
Specify other corner Point:@30,80

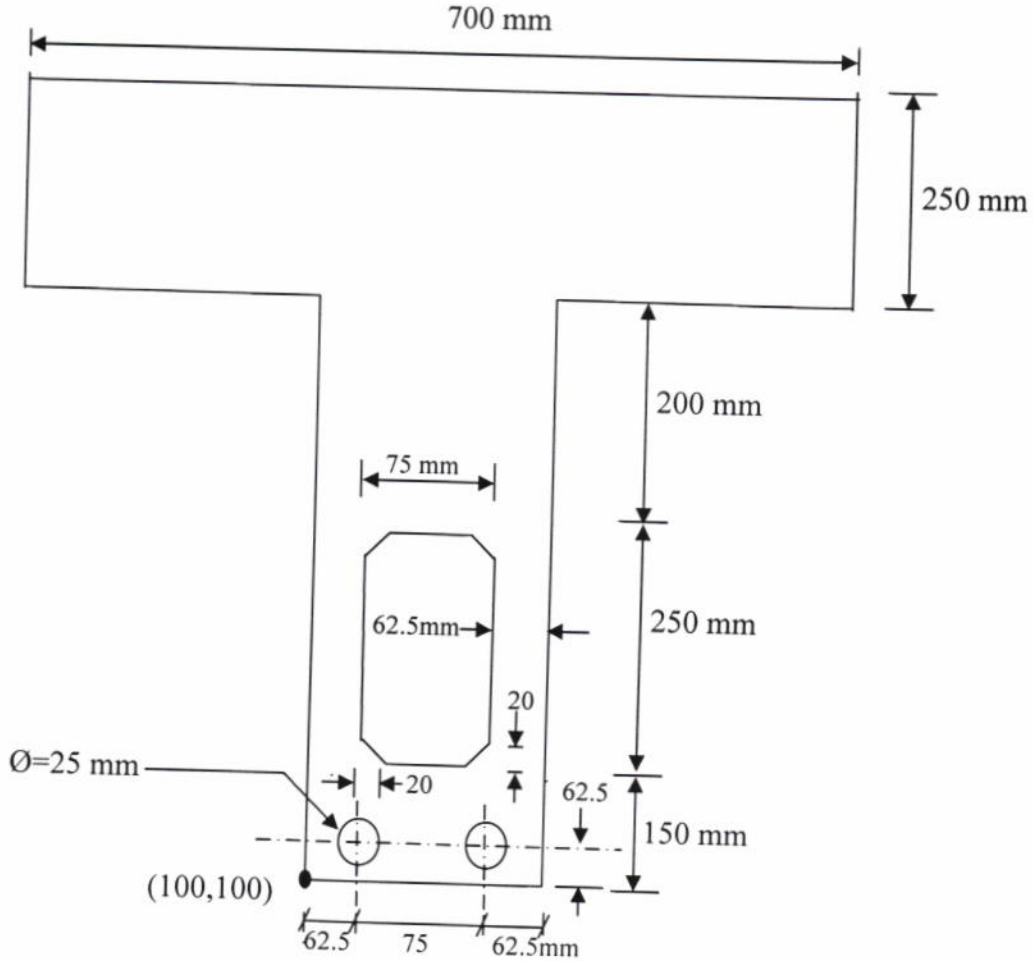
Relative Polar coordinate system

Command:L
Specify first point:10,20
Specify next Point:@100<0
:@30<90
:@30<180
:@40<90
:@30<0
:@20<90
:@100<180
:@20<270
:@30<0
:@40<270
:@30<180
:@30<270

Command: Rec
Specify first corner point:44,24
Specify other corner Point:@88.02<68.68

Command: Rec
Specify first corner point:45,25
Specify other corner Point:@85.44<69.44

using AutoCAD program draw the following figure on board its sides(1000×1000mm) ,if you know the lower left side of figure is far100 mm horizontally and 100 vertically, from original point.



1. *Solve using Absolute Coordinate System*

Command: Line (enter)
Specify first point:100,100
Specify next point: 300,100
: 300,700
: 550,700
: 550,950
: -150,950
: -150,700
: 100,700

Command: Rectangle
Specify first corner point: C
Specify first distance chamfer:20
Specify second distance chamfer:20
Specify first corner point: 162.5,250
Specify second corner point::237.5,500

Command: Circle
Specify center point of circle:162.5,162.5
Specify radius of circle: 12.5

Command: Circle
Specify center point of circle:237.5,162.5
Specify radius of circle: 12.5

2. *Solve using Relative Polar Coordinate System*

Command: Line (enter)
Specify first point:100,100
Specify next point: @200<0
: @600<90
: @250<0
: @250<90
: @700<180
: @250<270
: @250<0
: @600<270

Command: Rectangle
Specify first corner point: C
Specify first distance chamfer:20
Specify second distance chamfer:20
Specify first corner point: 162.5,250
Specify second corner point::@261<73.30

Command: Circle
Specify center point of circle:162.5,162.5
Specify radius of circle: 12.5

Command: Circle
Specify center point of circle:237.5,162.5
Specify radius of circle: 12.5

Solution:

Q1:A:

Water surface profiles are computed from one cross-section to the next by solving the energy equation. The energy equation is:

$$y_1 + \frac{\alpha_1 v_1^{\,2}}{2g} + z_1 = y_2 + \frac{\alpha_2 v_2^{\,2}}{2g} + z_2 + h_e \qquad \text{.....(1)}$$

where:

y_1, y_2 : depth of water at cross-section, m.

z_1, z_2: elevation of the main channel inverts, m.

v_1, v_2: Averaged velocity at the section, m/sec.

g: gravitational acceleration, m/sec^2.

h_e: head loss, m.

The head loss in a reach of length L may be calculated as:

$$h_e = L * \bar{S}_f + C\left[\frac{\alpha_1 v_1^{\,2}}{2g} + \frac{\alpha_2 v_2^{\,2}}{2g}\right] \qquad \text{.....(2)}$$

Where:

$\bar{S}_f$: Representative friction slope between the two sections.

C: Expansion or contraction loss coefficient

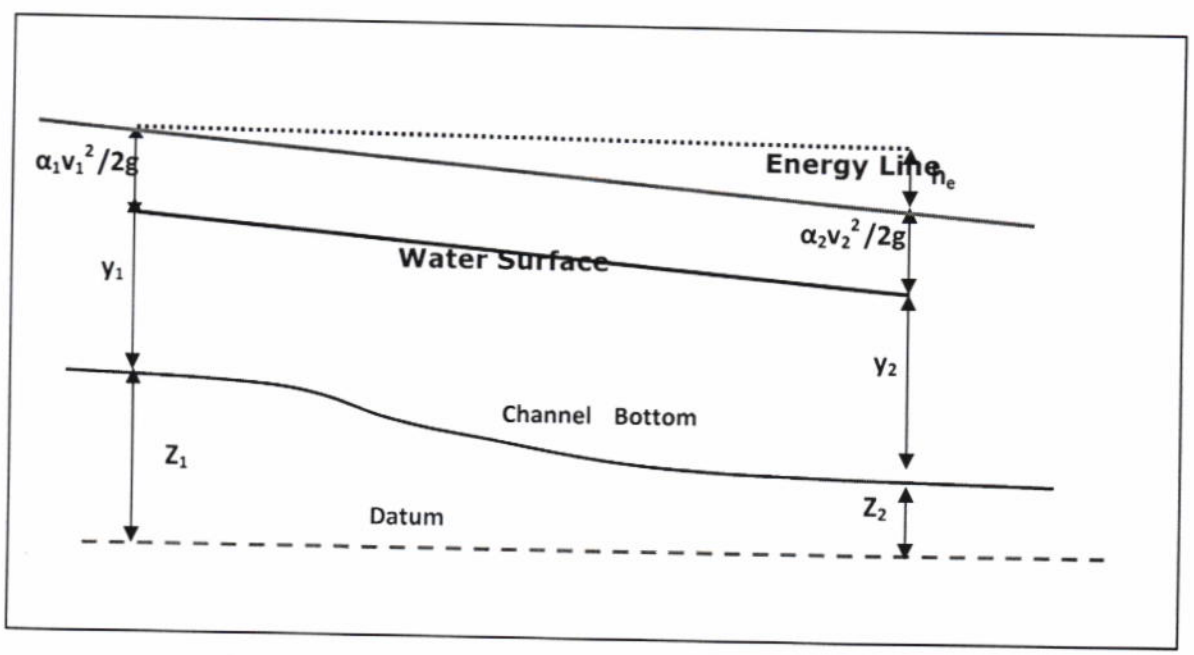


Figure (I-1). Longitudinal Section of Channel Reach

Q1:B: The basic kinds of similarity are:

1- Geometric Similarity:

Length ratio, $L_R = \frac{L_P}{L_m}$ where P=prototype m= model

Area ratio, $A_R = \frac{A_P}{A_m}$

2- Kinematic Similarity :

$$V_R = \frac{V_{1p}}{V_{1m}} = \frac{V_{2p}}{V_{2m}} \quad , \quad a_R = \frac{a_{1p}}{a_{1m}} = \frac{a_{2p}}{a_{2m}} \quad , \quad Q_R = A_R V_R = L_R^2 V_R \quad , \quad T_R = \frac{L_R}{V_R}$$

$$a_R = \frac{L_R}{L_R^2} = \frac{V_R^2}{L_R}$$

3- Dynamic similarity:

$$\tau_R = \frac{\tau_P}{\tau_m} \quad , \quad P_R = \frac{P_P}{P_m} \quad , \quad F_R = \frac{F_P}{F_m} = P_R A_R = P_R L_R^2 \quad , \quad P_R = \tau_R A_R = \tau_R L_R^2$$

Q2: A:

1- Energy equation, $y_1 + \frac{\alpha_1 V_1^2}{2g} + z_1 = y_2 + \frac{\alpha_2 V_2^2}{2g} + z_2 + h_e$

Continuity equation, $\frac{\partial A}{\partial t} + \frac{\partial Q}{\partial x} - q_L = 0$

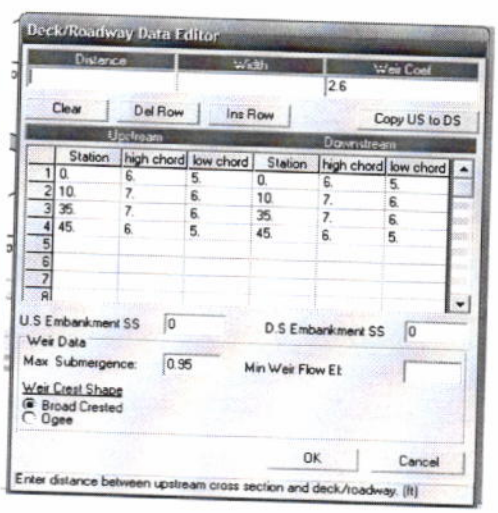
and momentum equation $\frac{\partial Q}{\partial t} + \frac{\partial QV}{\partial x} - gA(\frac{\partial z}{\partial x} + S_f) = 0$

the finite- difference approach is used to solve these equations.

2- Flow regime, boundary conditions and peak discharge

3- Downstream, Upstream , Upstream and downstream

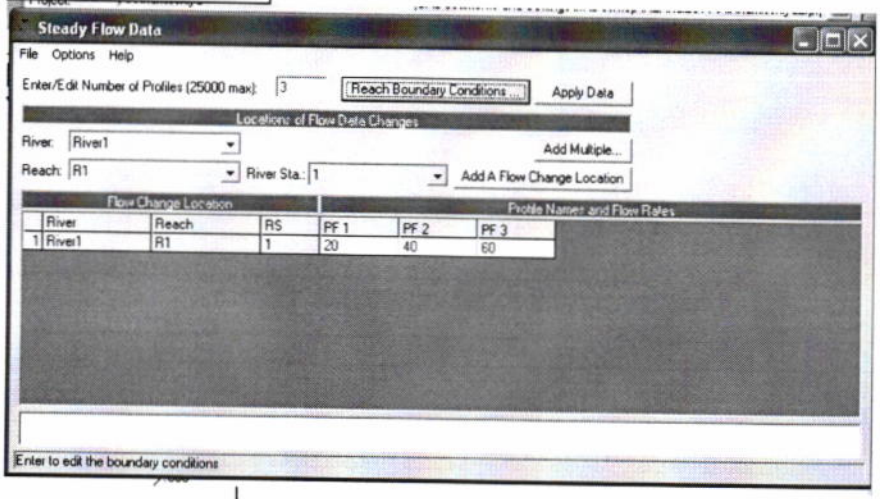
Q2: B:



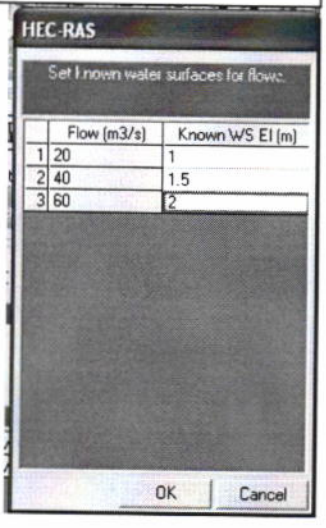
Q3:

Edit

Steady flow Data

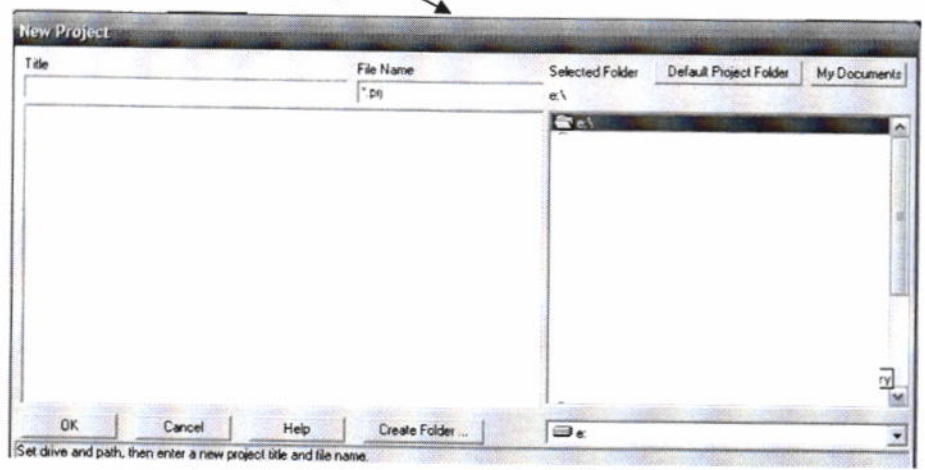


Reach boundary conditions / Known water surface elevation



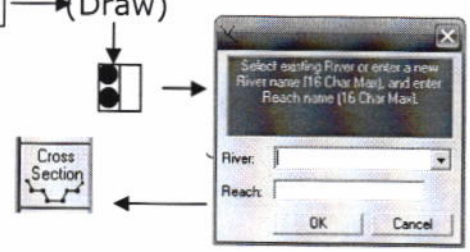
Q4:

1- Starting a new project: File → New project



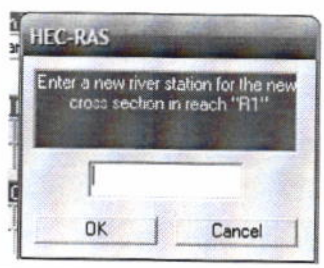
2- Entering Geometric Data : Edit → Geometric data → River Reach

add new river reach → Draw the river reach → (Draw)

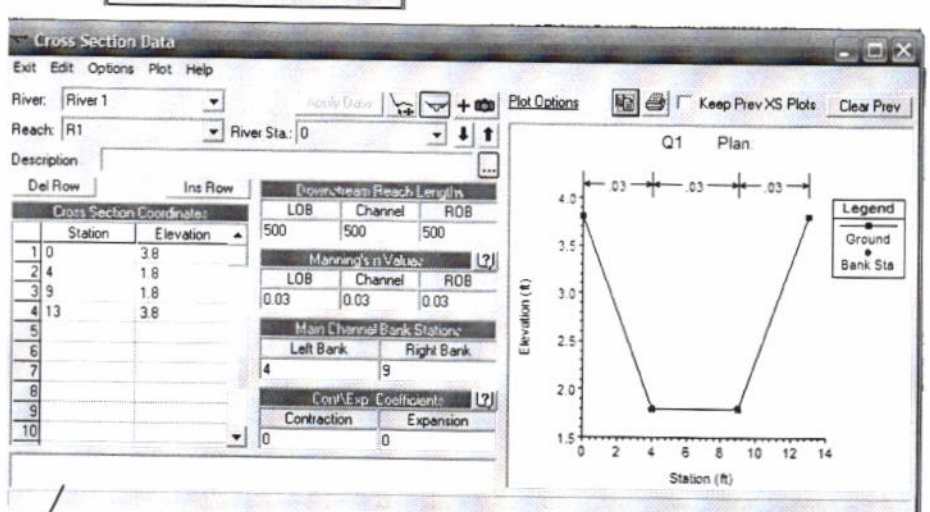


Cross Section → Edit cross section data → Option

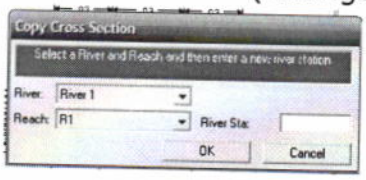
Add new cross



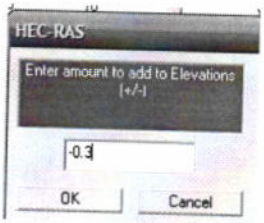
→ Enter cross section data



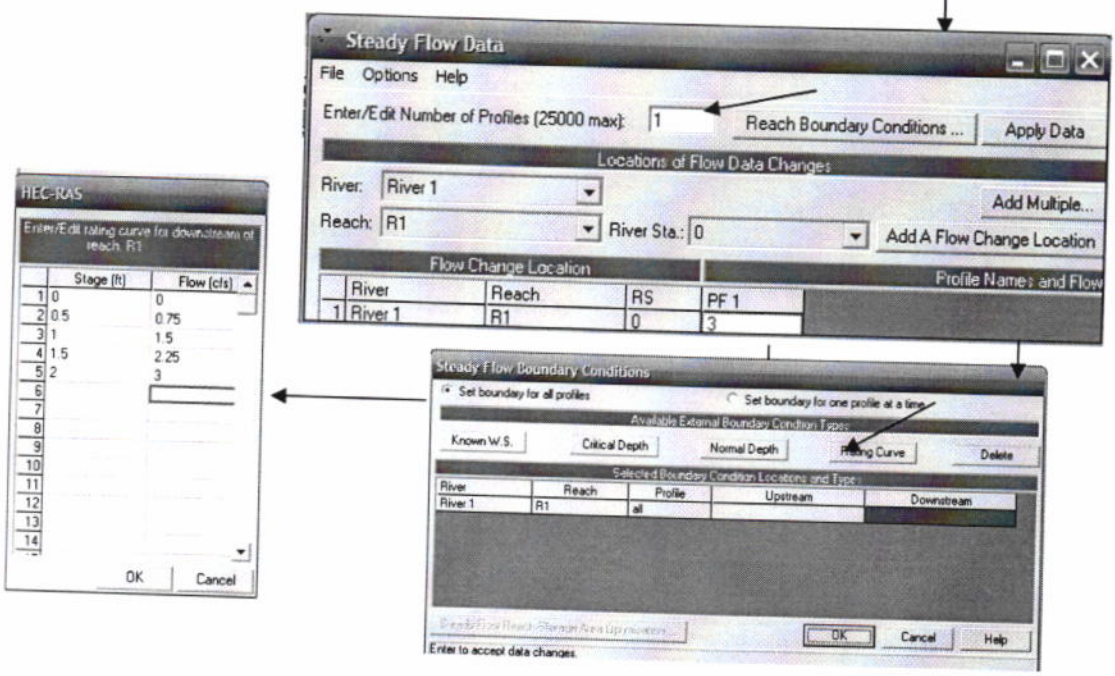
Option ---- copy current cross section -- (Change the LOB, Channel and ROB from 500 to 0



Option ---- adjust elevation



3- Enter flow data and boundary conditions: Edit--- steady flow data

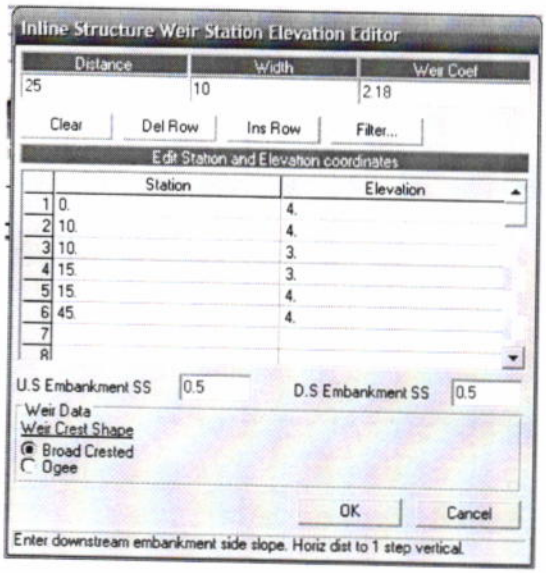


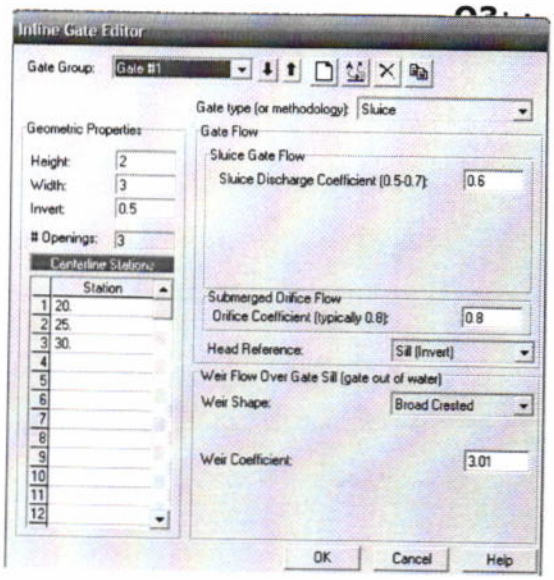
4- Performing the hydraulic calculations

Run---- steady flow data – Compute.

5- Viewing and printing results

Q5:


Inline Structure Weir Station Elevation Editor
Distance
Width
Weir Coef
25
10
2.18
Clear
Del Row
Ins Row
Filter...
Edit Station and Elevation coordinates
Station
Elevation
1 0. 4.
2 10. 4.
3 10. 3.
4 15. 3.
5 15. 4.
6 45. 4.
7
8
U.S Embankment SS
0.5
D.S Embankment SS
0.5
Weir Data
Weir Crest Shape
Broad Crested
Ogee
OK
Cancel
Enter downstream embankment side slope. Horiz dist to 1 step vertical.


Inline Gate Editor
Gate Group:
Gate #1
Gate type (or methodology):
Sluice
Geometric Properties
Height:
2
Width:
3
Invert:
0.5
Openings:
3
Centerline Stations
Station
1 20.
2 25.
3 30.
Gate Flow
Sluice Gate Flow
Sluice Discharge Coefficient (0.5-0.7):
0.6
Submerged Orifice Flow
Orifice Coefficient (typically 0.8):
0.8
Head Reference:
Sill (Invert)
Weir Flow Over Gate Sill (gate out of water)
Weir Shape:
Broad Crested
Weir Coefficient:
3.01
OK
Cancel
Help