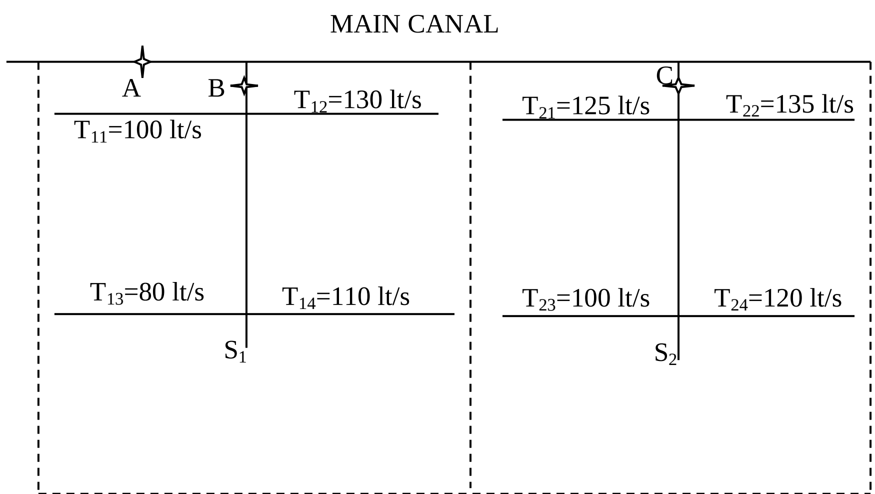
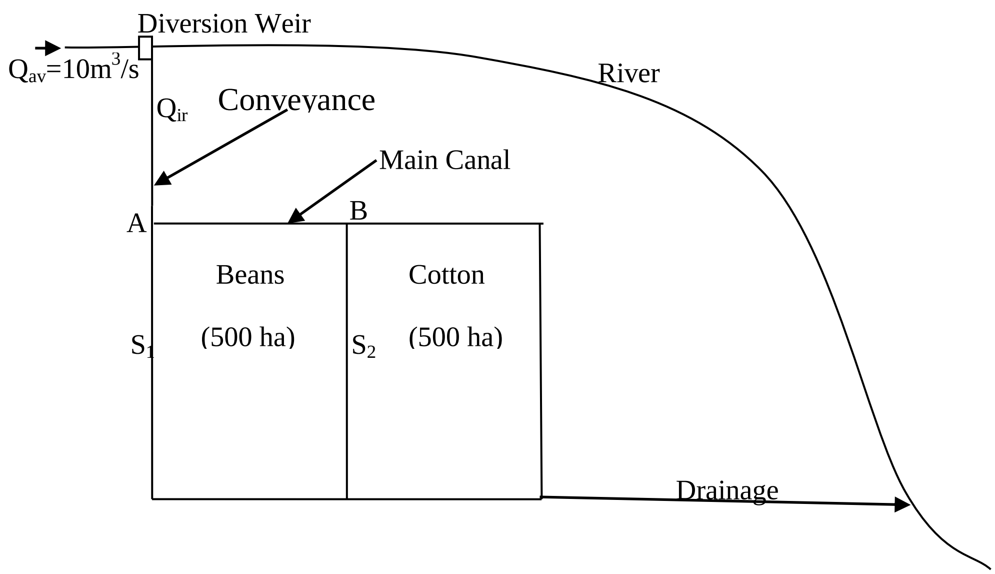
CE420 IRRIGATION AND DRAINAGE

HOMEWORK # 4

1) Based on the following information given in the figure below,
   a) Determine the most suitable rotation pattern among 2x2, 2x3, 2x4, 3x3 and 3x4. (Indicate which areas will be receiving water according to rotation defined)
   b) Determine the capacities (discharges) of canals at point A, B and C based on the rotation pattern you determined.

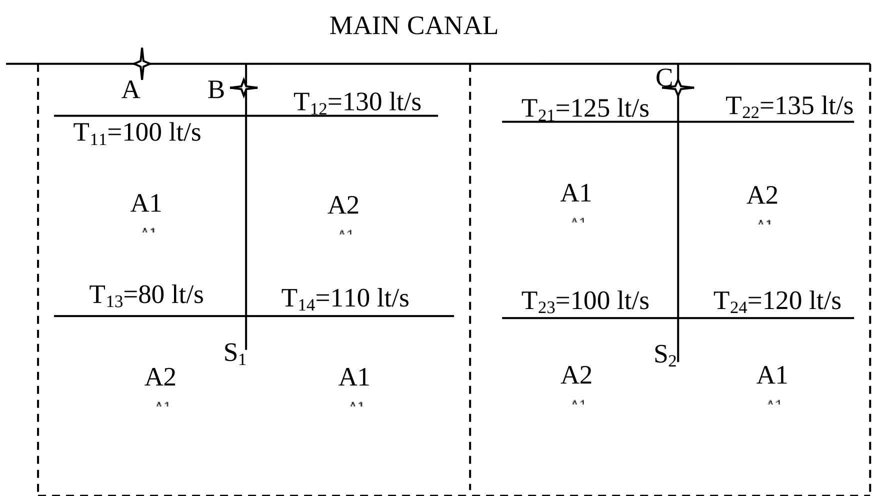


2) An irrigation project is planned for 1000 hectare area in semi-arid zone located in latitude 36^0 N. 50% of the area (500 hectare) will be used to grow cotton and the remaining 50% of the area (500 hectare) will be used to grow Beans. The maximum water requirements of the crops are estimated using the Blaney-Criddle method in July and August during which no precipitation was is observed. The temperature records of the area during this period indicate that the average temperatures in July and August are 32^0C and 36^0C respectively. The mean dry period discharge of a stream flowing near this field (See Figure below) is 10 m^3/s. Of this amount, Q_{ir} discharge is diverted to irrigate the area. Using the demand method and considering 60% efficiency,
   a) Determine the design irrigation discharge of the project area in July and August
   b) Determine the optimum section dimensions of the trapezoidal main canal at points A and B with, z=1.5, n=0.016 and S_0=0.00008. Consider the minimum velocity should not be less than 0.5 m/s. If the results do not match with the criterion what would you suggest about the parameters such as slope S_0 and recompute the dimensions of canals using new slope you suggested.
   c) Determine the optimum section dimensions of trapezoidal secondary canals S_1 and S_2 which delivers irrigation water for the first and second field. Take z =1.5 and n=0.016, and S_0=0.0005.



SOLUTION OF HW4

1a)



Rotation Pattern T= Nxn = 2x2 = 4 days ; T = Rotation Period
N = number of secondary canals
n = number of tertiaries on the secondary canal

<u>Areas receiving irrigation water according to the rotation pattern and rotation period</u>

Day	Secondary	Areas	Discharge (lt/s)
1	S_1	A1	210
2	S_1	A2	210
3	S_2	A1	245
4	S_2	A2	235

b)

POINT	Q (lt/s)
A	245
B	210
C	245

2a)

	JULY		AUGUST	
	Cotton	**Bean**	**Cotton**	**Bean**
k_1	0.65	0.65	0.65	0.65
k_2	1.0	0.70	1.3	1.65
k	0.65	0.455	0.845	1.073
t (^{0}C)	32		36	
P	9.99		9.47	
f	8.95		9.10	
u_c (mm/mo)	147.8	103.4	195.3	247.9
% A	0.5		0.5	
CIR	73.9	51.7	97.7	124
TDR = CIR/e	123.2	86.2	162.8	206.6
TDR (mm/mo)	209.4		369.4	
q_{max} (l/s/ha)	0.78		***1.38***	

q_{max}= 1.38 lt/s/ha

Using Demand method for 1000 ha irrigation field
A=1000 ha, q_{max}=1.38 lt/s/ha $\Rightarrow$ F= 1.19
Q_A = A x F x q_{max} = 1000 x 1.19 x 1.38 = 1642 lt/s = 1.64 m^3/s
Q_B = A x F x q_{max} = 500 x 1.26 x 1.38 = 869.4 lt/s = 0.87 m^3/s

b) Dimensions (y and b) of the main irrigation canal at Points A, and B.

POINT	S_0	n	Q	$AR^{2/3}=nQ/(S_0)^{1/2}$	Water Depth, y (m)	Bottom Width, b (m)	Velocity U (m/s)
A	0.00008	0.016	1.64	2.934	0.9	3.0	0.41
B	0.00008	0.016	0.87	1.556	0.95	1.0	0.4

Since average velocities at points A and B are lower than v_{min}=0.5 m/s criteria, for any pair of water depth (y) and bottom width for the given S_0 value, it is necessary to go through the trial&error process. So change (increase) S_0 value.

Let's take $S_0 = 0.0002$ and re do calculations.

POINT	**S_0**	**n**	**Q**	**$AR^{2/3}=nQ/(S_0)^{1/2}$**	**Water Depth, y (m)**	**Bottom Width, b (m)**	**Velocity U (m/s)**
A	0.0002	0.016	1.64	1.86	**0.85**	**2.0**	0.6
B	0.0002	0.016	0.87	0.98	**0.77**	**1.0**	0.53

c) Capacities of S_1 and S_2

POINT	**S_1**	**S_2**
q_{max} (lt/s/ha)	1.38	1.38
A (ha)	500	500
F	1.26	1.26
Q (m^3/s)	0.87	0.87

Slope of $S_1 = S_2 = 0.0005$

	Slope	**n**	**Q (m^3/s)**	**Section Factor $AR^{2/3}=nQ/(S_0)^{1/2}$**	**Water Depth, y (m)**	**Bottom Width, b (m)**	**Average Velocity U (m/s)**
S_1	0.0005	0.016	0.87	0.623	**0.67**	**0.8**	0.72
S_2	0.0005	0.016	0.87	0.623	**0.67**	**0.8**	0.72