Solve as much as you can, any missing data can be reasonably assumed, and follow steps of solution using neat sketches.

QUESTION (1)... (16 Marks)

A-) Explain with sketches:

1- The distribution of seepage velocity and hydraulic gradient at exit surface. (2 marks)

2- Explain with sketches the function of weirs in irrigation works. .... (3 marks)

B-) A standing wave weir is to be constructed at the downstream of head regulator for measuring the discharge with minimum drop in water surface according to the following data:

Maximum water discharge= 18 m³/s   ,   Water level U.S the weir= (20.00)

Bed level U.S the weir= (17.50)   ,   Berm level U.S the weir= (20.50)

Bed width of canal= 8.0 m   ,   Side slopes from bed to berm= 1:1

Road level U.S the weir= (22.00)   , C_B=14.0

$$Q=2.05 \, B \, H^{1.6}$$

It's required to :-

1- Make a complete hydraulic design of the weir. .... (4 marks)

2- Give the full dimensions of the floor according to scouring and percolation. (4 marks)

3- Check the floor thickness against uplift pressure..(3 marks)

QUESTION (2).. (18 Marks)

A-) Mention the advantages of regulators on weirs..(2 marks)

B-) Explain with sketches the effect of the pier shape on the head loss..............(2 marks)

C-) An intermediate regulator is to be constructed across branch canal according to the following data:

The maximum discharge passing through the regulator= 30 m³/s

The cross section of the main canal D.S the regulator is shown in figure(1)

It's required to :-

1- Make a complete hydraulic design of the regulator. .... (4 marks)

2- Give empirical dimensions for the floor (length and thickness), Piers, and the retaining walls..(2 marks)

3- Draw PLAN H.E.R, SEC. ELEVATION, and SEC. SIDE VIEW..................(8 marks)

QUESTION (3).. (18 Marks)

A-) Explain with sketches the different cases of the bridge position to the lock chamber showing the advantages and disadvantages of each case. ....(3 marks)

B-) It's required to construct a symmetrical isolated lock according to the following data:

	U.S Lock	D.S Lock
High water levels=	(15.00)	(14.20)
Low water levels=	(14.00)	(13.20)

Bed level= (10.00)   , berm level=(16.00)

Minimum water depth for safe navigation is 3.0 m

Time required for filling or emptying the lock chamber is 15.0 min.

Dimensions of lock= 80x16

It's required to :-

1- Give all empirical dimensions for all elements of lock.................................. (3 marks)

2- Make a hydraulic design for the side culvert....................................... (3 marks)

3- Design the thrust wall according to all possible case of loading..................... (6 marks)

4- Design the landing wall according to the critical case of loading................... (3 marks)

QUESTION (4).. (18 Marks)

A-) Explain with sketches the classification of dams according to materials? (2 marks)

B-) Define with sketches the reservoir storage zones? ....(2 marks)

C-) What are the design requirements of Earth Dams? .... (2 marks)

D-) Consider the case of full reservoir with horizontal earthquake (α=0.12) condition for the shown Gravity Dam in figure (2) :

γ_m=2.30 t/m^3 , μ=0.70   ,   q=13.0 kg/cm^2 *(Dimensions and levels are in ms)*

Determine :-

1- Factor of safety against Overturning. .... (2 marks)

2- Factor of safety against Sliding. .... (2 marks)

3- The Shear friction factor. .... (2 marks)

4- The vertical Normal Stress. .... (2 marks)

5- The Major principal stress. .... (2 marks)

6- The Intensity of shear. .... (2 marks)
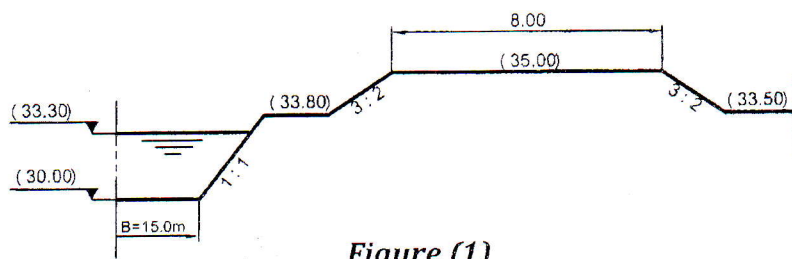
Figure (1)
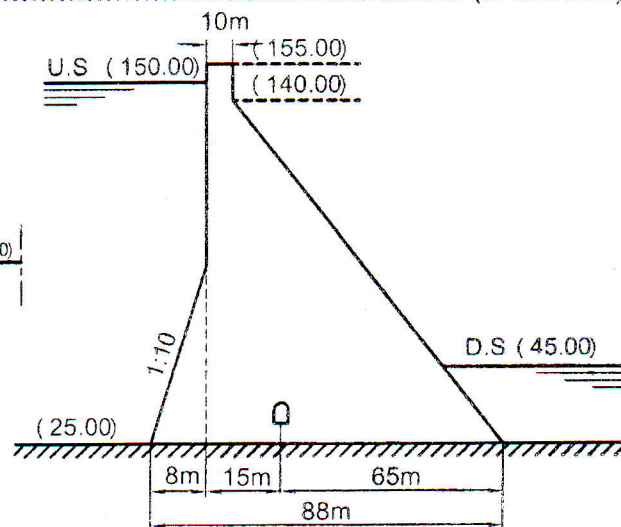
Figure (2)

With our best wishes

Prof. Mohamed Sobeih