MANSOURAH UNIVERSITY
FACULTY OF ENGINEERING
IRRIGATION AND HYDERALUIC DEPT.

4th YEAR CIVIL ENGINEERING
JANUARY, 2011
TIME ALLOWED: 4 HOURS

DESIGN OF IRRIGATION WORKS (II)

N.B. 1- All Sketches should be clear, neat and well proportioned.
2- Any missing data may be reasonably assumed.
3- Maximum mark of exam = 100.

QUESTION (I): (25 Marks)

i) Show by a sketch how the weirs can be used for decreasing the slope of water surface in canal.

ii) Compare between the weirs and regulators.

iii) Sketch the longitudinal section elevation of a stepped weir and show general equation of the thickness of the floor.

iv) A *weir* has to be built on a main lined canal according to the following data:

	U.S. Weir	D.S. Weir
High Water Level	(15.00)	(14.70)
Low Water Level	(14.70)	(14.40)
Bed Level	(11.00)	(11.00)
Bed Width	8.00 m	8.00 m

Canal side slopes= 3:2

Max. Canal discharge = 50.0 m^3/sec.

Min. Canal discharge = 40.0 m^3/sec.

Bligh value= 15

It is required to:

a) Define the weir type.

b) Crest level and Crest length.

c) Draw uplift diagram.

d) Calculate the floor thickness.

e) Draw a neat sketch showing the longitudinal section elevation of the weir.

QUESTION (II): (30 Marks)

An *Intermediate Regulator* has to be built on a canal with the following data:

	U.S Regulator	D.S. Regulator
High Water Level	(10.00)	(09.00)
Low Water Level	(09.50)	(08.50)
Canal Bed Level	(06.00)	(05.00)
Side Slope	3:2	3:2

Maximum discharge = 95 m^3/sec.

Mean Velocity in Canal = 0.70 m/sec.

Width of bridge above regulator = 12.00 m

Bligh's Coefficient = 12.

It is required to:

a) Name the different type pf regulators.

b) Determine the number of vents if the span of vent is 5.00 m.

c) Design the floor of the regulator showing the Uplift diagram and the floor thickness.

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d) Calculate the stresses at the base of the pier for case of maximum bending moment about the pier centerline in the transverse direction (M_x), consider a uniformly distributed live load of 1.50 t/m^2 and the dead load of the bridge is to be 1.00 t/m^2.

e) Draw to a reasonable scale a plan and longitudinal section through a regulator vent. ***Show all main dimensions.***

QUESTION (III): (25 Marks)

i) Sketch the different cases of the bridge location with respect to the lock chamber and compare between them..

ii) *A Symmetrical Lock* has to be built according to the following data:

	U.S. Lock	D.S. Lock
Water Level	(9.50)	(8.50)
Bed Level	(5.50)	(5.50)

Lock Chamber = 160 x 17 m.

Angle between gates = 135 ^{0}.

Level of upper pivot = (10.00).

The time of filling or emptying the chamber of the lock is 12 minutes.

It is required to:

a) Design the side culvert.

b) Calculate the Thrust Force at upper pivot for the gate of the lock for the case of *"During Operation"*.

c) Select the empirical dimensions of the lock parts and draw a plan.

QUESTION (IV): (25 Marks)

i) Site conditions and rock foundations play an important role in determining dam type and cost. Discuss the suitability of the concrete dams for site conditions.

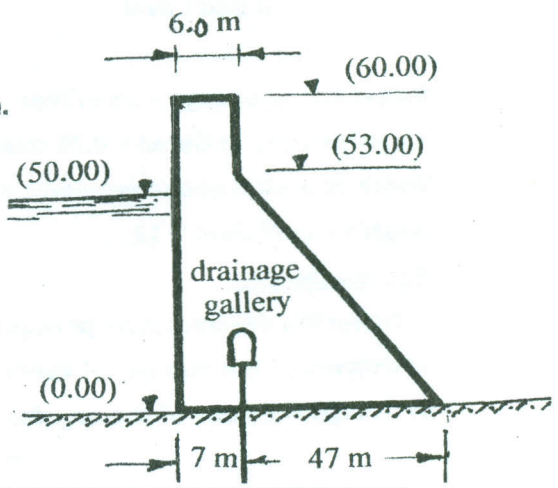
ii) Discuss the effect of the concrete dam frequency in relation to the frequency of earthquakes?

iii) Discuses the function of control galleries in dams and the precautions you would suggest to minimize the uplift below the dam body.

iv) The figure shows a non-overflow cross-section of a gravity dam. It is required to calculate the stresses of the resultant forces acting on the dam base.

The following conditions should be considered:

1- **Full reservoir and no tail water.**
2- **Horizontal earthquake acceleration acting upstream.**
3- **Horizontal seismic coefficient = 0.1g.**
4- **Vertical earthquake acceleration acting upwards.**
5- **Vertical seismic coefficient= 0.10g.**
6- **Consider uplift pressure.**
7- **Specific gravity of dam material = 2.35.**



Prof. Dr. Mahmoud Elgamal
and Exam Committee.

Elmansoura University — Fourth Year Civil Eng.
Faculty of Engineering — January, 2011
Irrigation & Hydraulics Department — Time Allowed: 4 Hours
Design of Irrigation Works (II) — نظام قديم

N. B. : 1) All sketches should be clear, neat, and well proportioned
2) Any missing data may be reasonably assumed

Question 1: (20 marks)

a) Discuss the different types of the weirs and how are the weirs classified with respect to their functions.

b) A Fayoum type weir is proposed to be constructed across a main canal with 10 ms width, side slopes 3:2, and discharge of 30.0 m^3/sec. The following data is available:
High U.S water level = 21.50 m
High D.S water level = 20.50 m
Bed level U.S the weir = 19.10 m
Bed level D.S the weir = 17.80 m
It is required to:
1) Make a complete hydraulic design for the weir.
2) Design the floor of the weir structure assuming Bligh's coefficient = 15.
3) Draw a sectional elevation of the structure showing all important dimensions and the precautions required to prevent the undermining of the soil tail erosion.

Question 2: (35 marks)

A regulator adjacent to an unsymmetrical lock has to be built on a main canal according to the following data:

	U. S. Regulator	D. S. Regulator
High Water Level	(22.70)	(21.90)
Low Water Level	(22.00)	(21.20)
Canal Bed Level	(18.40)	(18.40)
Side Slope	3 : 2	3 : 2

Max. discharge Q = 60.0 m^3/sec ; mean velocity in canal V = 0.65 m/sec ; width of bridge above regulator = 12.00 m ; Bligh's Coeff. = 12.0

It is required to:

a) Name the different types of regulators and steel gates (net sketches are required)
b) Determine the number of vents if the span of vent is S = 5.00 m.
c) Design the floor of the regulator showing the Uplift diagram and the floor thickness.
d) Calculate the stresses at the base of the pier for case of maximum bending moment about the pier centerline in the transverse direction (M_x), consider a uniformly distributed live load of 1.50 t/m^2 and the dead load of the bridge is to be 1. 0 t/m^2.
e) Draw to a reasonable scale a longitudinal section through a regulator vent, and cross section half earth removed. Show all main dimensions.

Question 3: (30 marks)

A symmetrical lock will be constructed on a main canal for navigable requirements. The following data are available.

	U. S.	D. S.
Water Level	(50.00)	(47.00)
Bed Level	(46.00)	(44.00)

Minimum depth of water in the lock chamber = 3.0 m.
Lock chamber dimensions (17.0 m x 120.0 m).
The upper pivot level of the lock gate is (50.00).
Angle between lock gates is 140^{o}.
The time of filling or emptying the chamber of the lock is 12 minutes.

It is required to:

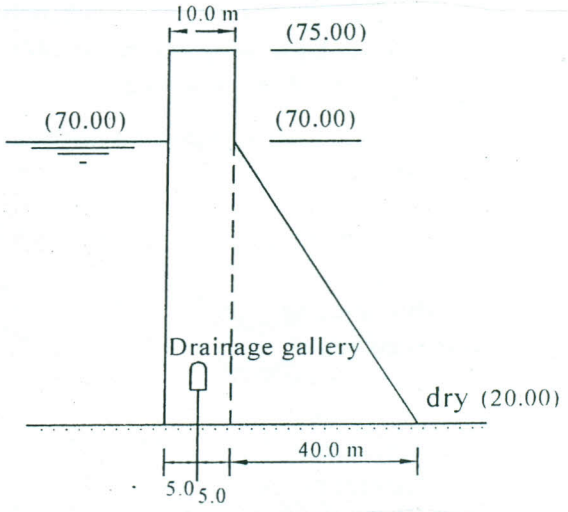
a) Design the side culvert.
b) Show how to design the thrust wall for the case of during operation.
c) Draw to a reasonable scale a plan of the lock.

Question 4: (25 marks)

a) Discuses the function of control galleries in dams and the precautions suggested to minimize the uplift below the dam body.
b) The figure shows a non-overflaw cross-section of a gravity dam. It is required to calculate the stresses of the resultant forces acting on the dam base.

The following conditions should be considered :

1- Full reservoir and no tail water.
2- Horizontal earthquake acceleration acting upstream with seismic coefficient = 0.12.
3- Vertical earthquake acceleration acting upwards with seismic coefficient = 0.12.
4- Consider uplift pressure.
5- Specific gravity of dam material = 2.30 t/m^3.



Best wishes

Prof. Dr. Mahmoud El-gamal
Dr. Khaled Abdel-Azeez
Exam Committee