Mansoura University		Irrig. And Hydr. Engineering Dept.	Faculty of Engineering
		Total Marks: 100 Marks	

Course Title: **Design of Irrigation Works (I)**	Course Code: **IRH8211**	Year: **3rd Civil**
Date: 15 **January 2013 (First term)**	Allowed time: **4 hrs**	No. of Pages: **(3)**

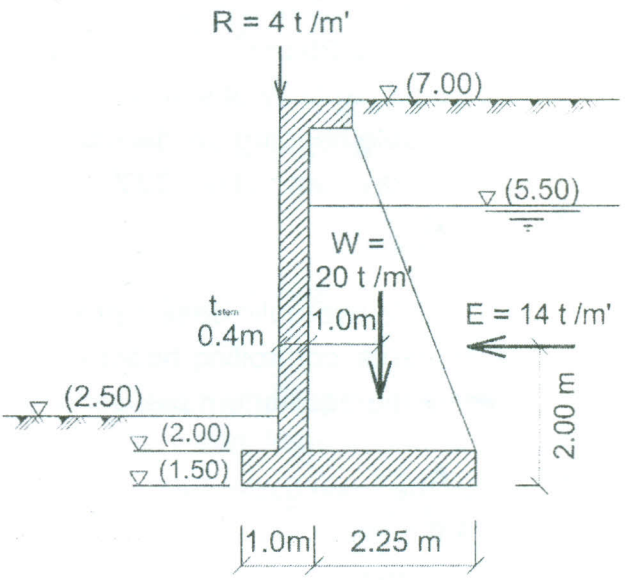
Remarks:

- Answer the following questions.
- All answers should be supported by clear, net and well proportional sketches.
- Any missing data may be reasonably assumed.

Question (1) [18 marks]

The opposite figure shows a reinforced concrete counterfort abutment. When the allowable bearing capacity of soil is **1.60 kg/cm²** and the sliding coefficient μ **= 0.60**, **it (E includes water pressure) is required to:**

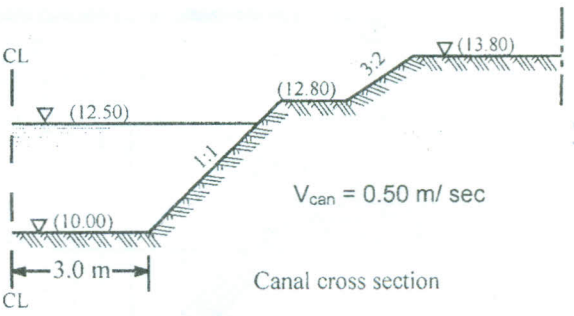
1. Check stability of the wall against sliding, overturning and stresses. **(6 marks)**
2. Calculate the reinforcements of vertical slab, base slab and web. **(6 marks)**
3. Sketch clearly detailing reinforcement of the wall. **(6 marks)**



Question (2) [17 marks]

At the crossing of a roadway 10.0 ms width and (14.25)m level with a canal showing in figure, a R.C box type culvert is required to be constructed at this crossing according to the following data:

- Maximum allowable heading up = 10 cm
- Manning Coeff. for concrete= 0.02



It is required to:

1) Design the culvert hydraulically **(open channel hydraulic system)**. **(5 marks)**

2) Calculate different loads acting on the culvert for all possible cases of loading. **(6 marks)**

3) Draw to proportional scale a fully dimensioned **Sectional Elevation** from center line of a vent. **(6 marks)**

Question (3) [30 marks]

3-a) Discuss classification of bridges according to structural form with net and clear sketches? **(4 marks)**

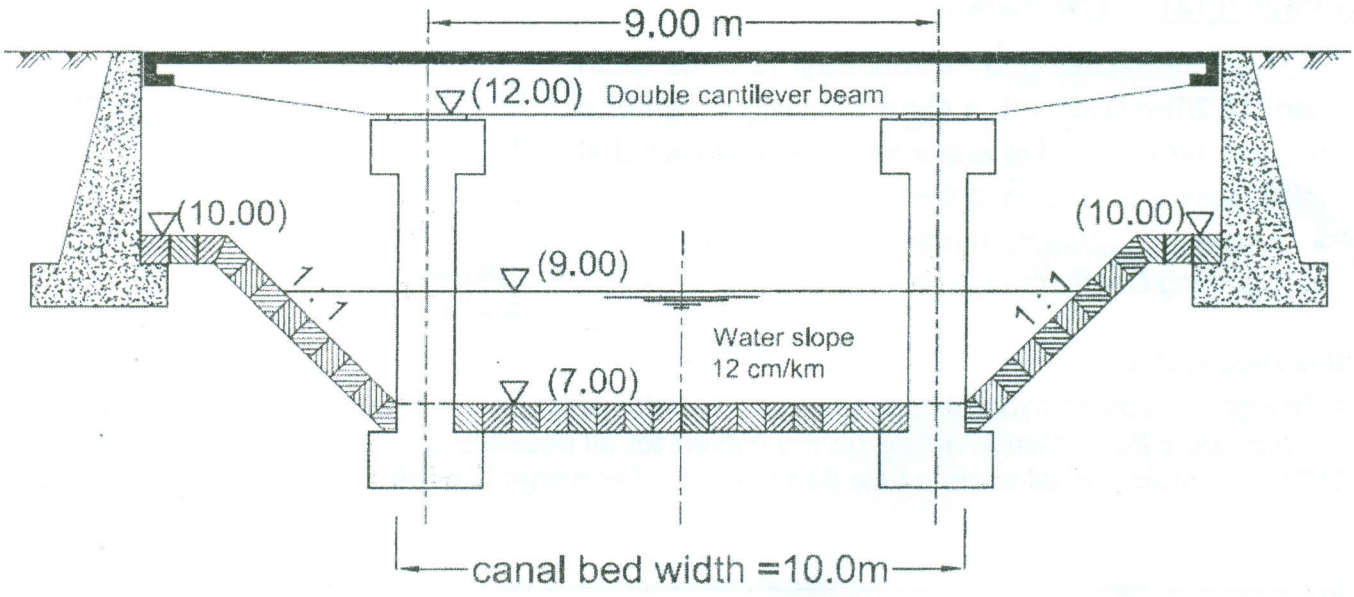
3-b) Explain briefly the four components of bridge scour, and note how to determine the total scour depth? **(4 marks)**

3-c) The following figure represents a double cantilever reinforced concrete slab and T-girder bridge that will be constructed according to the following data:

Loading: Egyptian Code-Loading (20 ton lorry + U.L.L of 400 Kg/m^2).
Main Girder: Double cantilever beam
pier thickness = 1.50 m
Road width: 10 meters (8 m auto way m + 2 m sidewalks).
Canal side slopes, 1 : 1 and 3 : 2
Wearing Surface = 2.20 t/m^3, P.C. = 2.20 t/m^3, R.C. = 2.50 t/m^3
Allowable bearing capacity of soil: 1.8 kg/cm^2
Maximum allowable heading up: **10 cm**
Allowable waterway contraction: **30%**

Required:

1. Perform the hydraulic design process including waterway dimension, contraction requirements, controlling heading up. **(4 marks)**
2. Estimate the equilibrium pier scour depth (mean size diameter of soil particle is 0.80 mm). **(3 marks)**
3. Design the main girder, and sketch net and clear its reinforcements. **(6 marks)**
4. Check the maximum normal stresses on soil from the pier. **(4 marks)**
5. Draw to proportional scale a fully dimensioned **P.H.E.R** **(5marks)**



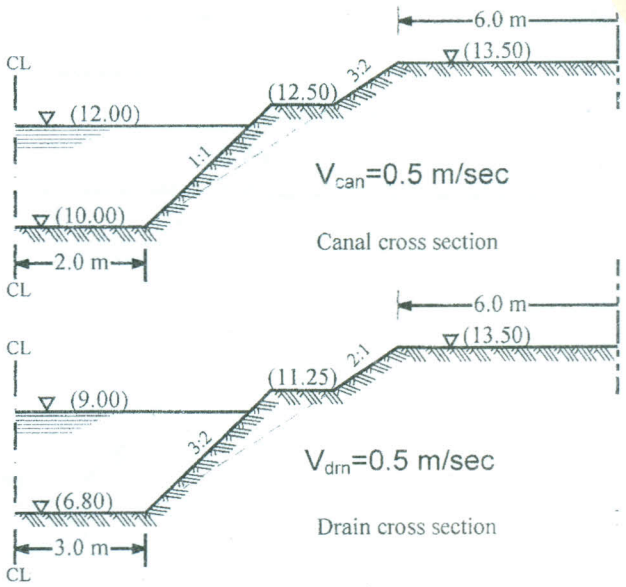
Question (4) [17 marks]

4.a) If the length of overhanging part of an aqueduct is 50 ms, where you suggest to support this part (you have two supports)? **(4 marks)**

4.b) With the aid of a longitudinal cross-section of a syphon, explain briefly the components of head lost. **(4 marks)**

4.c) Two steel pipes 1.75 diameter aqueduct is to be constructed at the intersection between the given drain and canal,

1. Design the aqueduct hydraulically. **(4 marks)**
2. Draw the U.S section elevation of the aqueduct. **(5marks)**



Question (5) [18 marks]

5.a) Show with clear and well finished sketches how can you control the canal water level in the following cases:

i). At the end of the canal **(2 marks)**

ii). If the flow of the canal pass through an aqueduct over a drain **(2 marks)**

iii). If the canal passes over an inverted box type syphon which pass a drain flow underneath the canal. **(2marks)**

5.b) At the end of canal, a Tail Escape is required to be constructed to escape the excess water from the canal to a branch drain provided that the water level in the canal does not exceed 20 cm. Following data are available.

diameter of orifice pipe =0.60m and internal diameter of well=1.50m. Length of last reach = 3.0 Km

	Canal	Drain
Bed width	3.0 m	4.0 m
Bed level	(9.50) m	(6.75) m
High water level	(11.00) m	(8.75) m
Berm level	(11.30) m	(10.80) m
Bank level	(12.30) m	(12.30) m
Bank width	6.0 m	8.0 m
Side slopes	1:1	3:2
Water surface slope	10 cm / Km	9 cm / Km

1. **Check** the design for the elements of the structure. **(6 marks)**
2. **Draw** fully dimensioned sketches for **Sectional Elevation** of the structure. **(6 marks)**

Good Luck

Course Examination Committee

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