El-Mansoura University
Faculty of Engineering
Irrigation and Hydraulics Department

Time Allowed: 4 hours
SEPTEMBER , 2013
Post-Graduate Studies Exam

Design of Large Irrigation Structures

Question I

A bench flume is used to convey canal water along a steep hillside according to the following data:

- At the U.S. and D.S. ends of the flume structure, the canal bed level = (19.00) and (18.80) m; respectively.
- The ~~total~~ length of the flume = 158.0 m.
- The roughness coefficient of the flume concrete (n) is 0.014. The ratio of the bed width to water depth = 1.00 approximately.
- The earth canal has the following hydraulic properties at each end of the flume:
  Water discharge Q = 2.8 m^3/sec, n = 0.025
  Water depth (d) = 1.00 m, side slopes = 3 : 2, bed width (b) = 4.00 m
- A broken back transition for the inlet and outlet will be used. Transition losses = 0.3 Δh_v and 0.5 Δh_v for inlet and outlet transitions, respectively.
- Assume that inlet and outlet transition lengths = 5,7 m., respectively.

It is required to

1. Design the flume section.
2. Draw a longitudinal section along the bench flume showing all water and bed levels.
3. Draw the total energy line along the flume.

Question II

a) Discuss the technical fundamentals of constructing a vertical grout curtain through an alluvial soil beneath an earth dam. Mention the main grouting materials and the precautions required to avoid injection problems.

b) Rock-fill dams may be constructed on fine sand foundations if the rocks are sluiced with fine sand or by using inverted filters. Discuss the statement and give examples referring to the construction of the High Aswan Dam Project.

c) Illustrate using sketches the methods that are used for constructing water-way tunnels and the techniques used for lining and grouting the tunnels.

Question III

An earth dam made of loamy soil is required to be designed according to the following data:

- Max./Min. U.S. water levels = (71.70) / (67.70) m
- wave height = 1.10 m
- D.S.W.L. =(61.50) m, Bed level = (60.00) m
- The dam is homogenous with an end rock toe. Assume the coefficient of filtration K=0.06 m/day.
- Road width = 6.0 m +2×1.0 m sidewalk. = 8.0m

It is required to

1. Draw the dam cross section showing all main levels and dimensions.
   - For loamy soil, U.S. side slopes = 3:1 and D.S. side slopes = 2~2.5:1
   - For the end rock toe, U.S. and D.S. side slopes = 3:2
2. Calculate the minimum cover of earth over the phreatic line and calculate the seepage discharge through the dam.

Examiner

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