Menoufia University
Faculty of Engineering
Civil Eng. Dept.

MINUFIYA UNIV.

Earthworks Engineering
Time allowed: 3.0 hours
Date: 4/6/ 2016

(الدراسات العليا- دبلومة)

N.B. any missing data can be reasonably assumed

Question (1):

a) Define and explain with neat sketches:

- Laplace's equation of continuity.

- Flow net in anisotropic material.

b) For the dam section shown in Fig. (1), determine the rate of seepage (given that $k_x = 9 \times 10^{-5}$ mm/sec and $k_y = 4.5 \times 10^{-5}$ mm/sec).

Question (2):

a) Show the following in details:

- The piping force.

- The piping in soil under an earth dams.

b) For the same dam section in Fig. (1), determine the rate of seepage if a vertical sheet pile with 6.0 m length found at 6.0 m from point (a).

Question (3):

a) Define and explain:

- Stabilization of the soil with lime.

- Stabilization of soil with granular bearing skeleton.

b) What is the importance of compaction in stabilization procedure of natural soil?

Question (4):

a) Explain the following:

- The effect of different factors which affected in stability of slopes in both cohesive and cohesionless soils.

- The effect of ground water table and crumble in stability of slopes.

b) Explain:

- The different methods for protection of soil slopes.

- Two methods of dewatering system and compare between them.

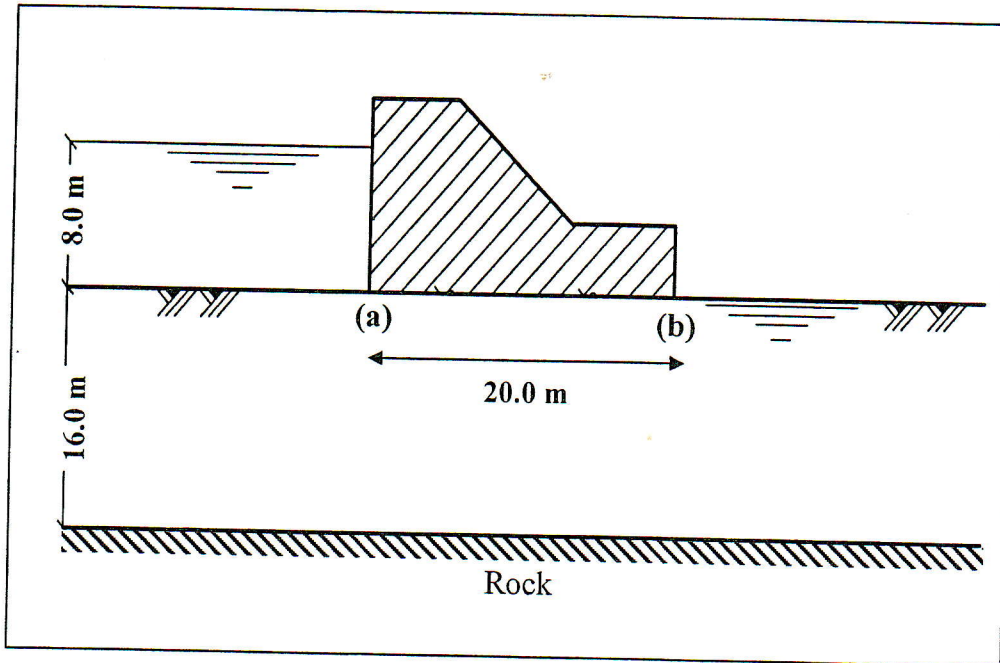**With my best wishes,**
Dr.Mohammed Abou Raia

Fig. (1)