

53:030 SOIL MECHANICS

Department of Civil & Environmental Engineering
The University of Iowa
Fall Semester 2002

Midterm Exam #1, 1 hour
4 questions, 100 points

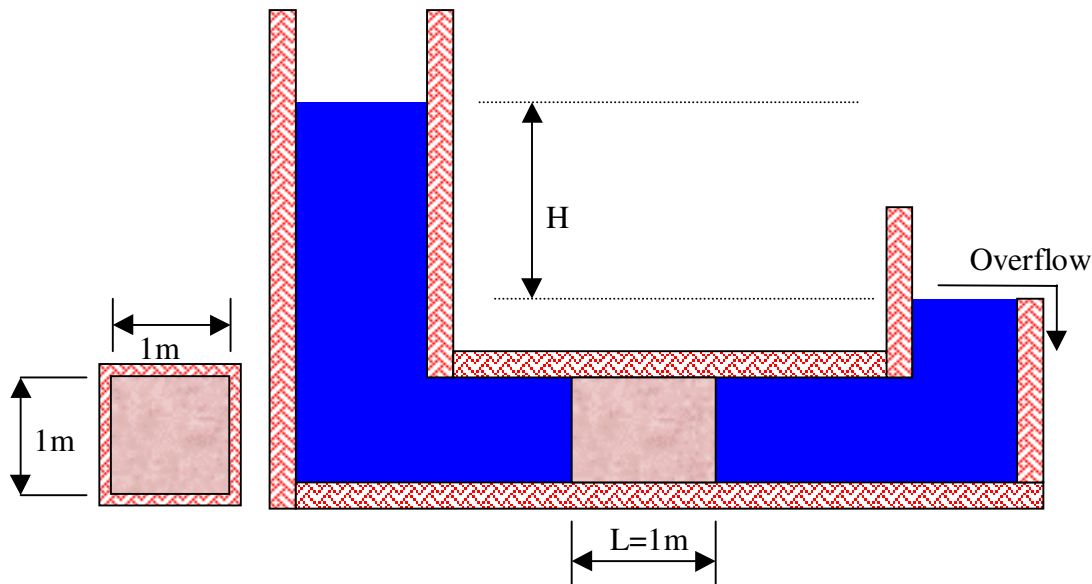
Question #1: (20 points)

A saturated soil completely filling a container of volume 0.05m^3 has a mass of 100 kg and water content of 25%. Compute G_s and e for the soil. Assume that $\rho_w = 1000\text{ kg/m}^3$.

Question #2: (25 points)

Consider seepage occurring in the soil layer within the U-tube below.

- What is the hydraulic gradient in the soil layer?
- What is the direction and magnitude of the seepage force exerted by the seeping pore fluid on the soil layer?
- If the maximum shear stress that can be developed between the soil and the U-tube is 25 kPa, how high large would H need to be to initiate slippage between the soil and the walls of the tube?



Question #3: (15 points)

- In a few sentences, discuss and explain what effective stresses in soils are.
- How are effective stresses related to pore pressures?
- In general when seepage is occurring in soil, how can one calculate the fluid pressure at specific locations in the soil?

Question #4: (40 points)

Consider seepage occurring around the levee shown below. For the soil: $e = 0.8$; $G_s = 2.7$; and $k = 10^{-6}$ m/second. Given the flownet, and the dimensions provided, compute the following:

- The volumetric flow rate beneath the structure per unit width in the out-of-plane direction;
- The fluid pressure at the tip of the sheet-pile cutoff.
- The factor of safety against heaving in the critical region;
- The dept of water on the upstream side of the levee that would induce liquefaction in the critical region.

To receive full credit, remember to show all of your work.

