Question #1: (15 points)

A moist soil packed into a volume of 0.1m³ has a dry mass of 150 kg and a water content of 10%. The average specific gravity of the grains comprising the soil is 2.60. Compute:

a. The dry density of the soil;
b. The moist density of the soil;
c. The void ratio;
d. The porosity;
e. The degree of saturation; and
f. The volume occupied by the water in the soil.

Question #2: (15 points)

A loose (Dr = 15%) layer of sandy soil has a thickness of approximately 10m. After being subjected to dynamic in-situ compaction, the relative density Dr of the soil has been increased to 75%. Calculate the change in thickness of the soil layer. [For the soil, e_min = 0.50 and e_max = 1.0].

Question #3: (20 points)

a. In a few sentences, discuss the significance of the three Atterberg Limits of fine-grained soils;
b. In a few sentences, explain the basic principles underlying measurement of soil grain-size distributions using hydrometers.
Question #4: (50 points)

Consider seepage occurring around the flow-retaining structure shown below. For the soil: e = 0.8; G_s = 2.7; and k = 10^{-6} m/second. The retaining structure is embedded 2.5m into the soil. Given the flownet, and the dimensions provided, compute the following:

a) The volumetric flow rate beneath the structure per unit width in the out-of-plane direction;
b) The factor of safety against heaving in the critical region;
c) The fluid pressure at point M along the base of the structure;
d) The vertical effective stress at point C; and
e) The approximate magnitude and direction of the seepage forces per unit volume at the tip of the sheetpile.

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