METU Civil Engineering Department
CE363 Soil Mechanics
2011-2012 Fall Semester

HOMEWORK 1

Due on: Oct 17 Monday, 17:40

1) A moist soil sample has a volume of 22.3 cm^3 and weighs 39.7 g. The dry weight of the sample was determined to be 33 g. The value of G_s is 2.65. Determine:
    a) Void ratio
    b) Water content
    c) Porosity
    d) Degree of saturation of the sample
    e) What would be the total unit weight and water content if the soil were fully saturated at the same void ratio in its natural state?

2) A sand with a minimum void ratio of 0.48 and a maximum void ratio of 0.81 has a relative density of 65%. A 2 m thick stratum of this sand is densified and 12 cm settlement was observed at the end of densification. What is the relative density in the densified state? Assume that the sand layer is compressed in the vertical direction only, with no lateral strain.

3) The results of particle size analysis and, where appropriate, Atterberg limit tests on samples of four soils are given in the table below.

Particle size (mm)	Percentage smaller (%)			
	Soil A	Soil B	Soil C	Soil D
19	100	-	-	-
6.35	94	100	-	-
2	69	98	-	-
0.59	32	88	100	-
0.21	13	67	95	100
0.074	2	37	73	99
0.020	-	22	46	88
0.006	-	11	25	71
0.002	-	4	13	58

Liquid limit (%)	-	Non-plastic	32	78
Plastic limit (%)	-		24	31

    a) Plot the grain size distribution curve of each soil (use Excel or graphing softwares)
    b) Determine the percentages of gravel, sand and the fines in samples A and B.
    c) Determine $D_{10,}$ $D_{30,}$ D_{60}, C_u and C_c of soils A and B, and comment on their gradation.
    d) Classify each soil according to Unified Soil Classification System, give letter name.
    e) For soil D, if the natural water content is 55%, what is the consistency in its natural state. Determine also the plasticity index and liquidity index of soil D.

4) Soil has been compacted in an embankment at a bulk density of 2.15 Mg/m^3 and a water content of 12%. The value of G_s is 2.65. Calculate the dry density, void ratio, degree of saturation and air content.