**King Saud University CE 382 – Geotechnical Engineering (1)**

College of Engineering 1st Semester 1428-1429H

Civil Engineering Department Time: 2:30 Hours

**Question One (25 pts)**

A. Explain the following:

Specific gravity, degree of saturation, liquid limit and plastic limit.

B. Explain how to determine plastic limit for a given clay sample.

C. A sample of dry soil was uniformly mixed with 16% of water by weight and compacted in a cylindrical mold of 945 cm3. If the weight of sample in the mold is 1600g and the specific gravity of soil particles is 2.68, find the dry density, void ratio and degree of saturation.

D. In a liquid limit device, specimens of clay at water content of 46.6%, 52% and 54.2% require 74, 39, 21, and 13 blows respectively to close the standard groove. Data from three plastic limit determinations gave water contents of 22.6%, 22.9% and 22.8%.Find the liquid limit, plastic limit and plasticity index of the tested soil.

**Question Two (15 pts)**

1. If you have a soil and want to classify, list tests you must conduct.
2. Classify the soils (C, and D) shown in the Table below and soils (A, and B) shown in the figure using unified soil classification system and AASHTO soil classification system.

|  |  |  |
| --- | --- | --- |
| Soil | C | D |
| %passing sieve # 4 | 77.5 | 40 |
| %passing sieve # 10 | - | 30 |
| %passing sieve #200 | 9.5 | 15 |
| D10 (mm) | .20 | - |
| D30 (mm) | .73 | - |
| D60 (mm) | 3.35 | - |
| LL (%) | - | 35 |
| PL (%) | - | 22 |

**Question Three (25 pts)**

1. Explain the following:

a) The main advantages of subgrade soil compaction

b) The main factors influencing the compaction results

c) Relative compaction

d) List methods used for field density and moisture content determination

e) Standard versus modified compaction test.

1. Suppose you are asked to check earth work for a construction control job. Laboratory compaction data for the soil is given below (Gs = 2.67; volume of mold = 1000 cm3). Specification call for compacted densities to be at least 98% of MDD in the Lab and within ± 3% of the OMC. In the field, you used a balloon field density test; the volume of the soil excavated was 1162 cm3, and its weight 2253 gr wet and 1910 gr dry.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test number | 1 | 2 | 3 | 4 | 5 |
| water content of soil in mold (%)  | 12.5 | 15 | 17.8 | 20 | 22.2 |
| Weight of soil in mold (gr)  | 1634.0 | 1826.3 | 1890.4 | 1778.2 | 1595.6 |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

a) Plot compaction curve and find laboratory MDD and OMC.

b) Find field density and moisture content.

c) Specify limits of specification.

d) Would you accept the field compaction work?

e) What is the percent compaction in the field?

**Question Four (20 pts)**

1. Define or explain the following terms:

Soil permeability, Darcy’s law, Hydraulic gradient and factors that influence coefficient of permeability.

1. For a constant head laboratory test on sand, the following values are given:

Length of specimen = 200 mm

Diameter of specimen = 120 mm

Head difference = 400 mm

Volume of water collected in a period of 5 min = 10.18 cm3

Draw the above test arrangement and calculate the coefficient of permeability, k, of the soil in cm/sec.

**Question Five (15 pts)**

1. State two fundamental properties of a flow net.

B. For the flow net shown below in the Figure, find:

a) The quantity of flow per meter of dam in m3/day.

b) Water pressure at points A and B.

c) The uplift pressure acting on the base of the dam.