



**PROGRAM** : NATIONAL DIPLOMA  
*ENGINEERING: CIVIL*

**SUBJECT** : **SOIL MECHANICS 2A**

**CODE** : **CEGA211**

**DATE** : WINTER SSA EXAMINATION 2014  
14 JULY 2014

**DURATION** : (X-PAPER) 08:00 – 10:00

**WEIGHT** : 40 :60

**FULL MARKS** : 70

**TOTAL MARKS** : 70

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**EXAMINER** : PROF GC FANOURAKIS

**MODERATOR** : MR F THAIMO 2251A

**NUMBER OF PAGES** : 3 PAGES AND 1 ANNEXURE

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**INSTRUCTIONS**

ANSWER ALL THE QUESTIONS.

NON-PROGRAMMABLE SCIENTIFIC CALCULATORS MAY BE USED. THE USE OF ALPHA-NUMERIC CALCULATORS IS PROHIBITED.

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**QUESTION 1**

Discuss the problems associated with dolomitic soils.

[5]

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**QUESTION 2**

Working from basic definitions, derive an equation for the bulk density of a soil in terms of its particle relative density, degree of saturation, void ratio and density of water.

[17]

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**QUESTION 3**

Discuss the similarities and differences between the AASHTO and USCS classification systems.

[12]

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**QUESTION 4**

The particle size distribution of a soil indicates 30 % gravel, 20 % sand and 33 % silt. Using Annexure A determine the textural classification of this soil.

[7]

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**QUESTION 5**

With regards to soil profiling, what do the letters MCCSSO stand for?

[6]

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**QUESTION 6**

A 3 km long and 7 m wide road is to be constructed. The 150 mm thick selected subgrade will be compacted to 93 % of the mod AASHTO maximum dry density, at the optimum moisture content. The soil to be used for this layer will be taken from a borrow pit, where it has an *in-situ* bulk density and natural moisture content of  $1820 \text{ kg/m}^3$  and 7.5 %, respectively.

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If the mod AASHTO maximum dry density of the soil is  $1950 \text{ kg/m}^3$  and the optimum moisture content is 7 %, determine the volume of soil that must be excavated from the borrow pit to construct this road layer.

[6]

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### **QUESTION 7**

The results of a number of laboratory CBR tests conducted on a soil from a particular source are given below. Using these results, determine the design CBR of this material in accordance with the Asphalt Institute Manual MS-1 method.

Laboratory CBR values: 4, 4, 5, 5, 8, 8, 3 and 7.

[5]

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### **QUESTION 8**

By means of a sketch, indicate the components of the standard hand held Dynamic Cone Penetrometer (DCP). Include details of dimensions and masses.

[6]

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### **QUESTION 9**

By means of sketches, illustrate the following forms of groundwater.

- Perched groundwater
- Artesian water

[6]

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**TOTAL: 70**

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# ANNEXURE A

## TEXTURAL CLASSIFICATION

(Applies to soil passing the 2 mm sieve)



