



PROGRAM : NATIONAL DIPLOMA
ENGINEERING: CIVIL

SUBJECT : **SOIL MECHANICS 2A**

CODE : **CEGA211**

DATE : WINTER EXAMINATION 2019
01 JUNE 2019

DURATION : (X-PAPER) 08:30 – 10:30

WEIGHT : 40 :60

FULL MARKS : 70

TOTAL MARKS : 70

EXAMINER : PROF GC FANOURAKIS

MODERATOR : MR F THAIMO 2251A

NUMBER OF PAGES : 9 PAGES

INSTRUCTIONS

THIS PAPER CONSISTS OF TWO SECTIONS, SECTION A (MULTIPLE CHOICE) AND SECTION B. ANSWER ALL THE QUESTIONS IN BOTH SECTIONS.

THE QUESTIONS IN SECTION A MUST BE HANDED IN TOGETHER WITH THE MULTIPLE CHOICE ANSWER SHEET (PAGE 9) AND YOUR EXAMINATION SCRIPT.

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

SECTION A – MULTIPLE CHOICE

1. The moisture content of a soil, whose data is given below, is:

Mass of wet soil + container = 250 g

Mass of dry soil + container = 170 g

Mass of container = 27 g

- a) 5,59 %
- b) 4,71 %
- c) 55,9 %
- d) 47,1 %

(3)

2. Given the following data, determine the dry density of the soil.

Mass (M) = 73 g

Mass of solids (M_s) = 59 g

Volume (V) = 25 ml

- a) 2,28 g/ml
- b) 2,8 g/ml
- c) 0,52 g/ml
- d) None of the above

(2)

3. A saturated soil has 0 % Air Voids Content:

- a) True
- b) False

(1)

4. Nelson Mandela Bay, in the Eastern Cape, would have an N-value:

- a) Equal to 5
- b) Less than 5
- c) More than 5
- d) None of the above

(1)

5. The size that forms the boundary between silt and clay is:

- a) 2 mm
- b) 0,2 mm
- c) 0,6 mm
- d) 0,06 mm

(1)

6. The largest size clay particle is:

- a) 0,2 mm
- b) 0,02 mm
- c) 0,002 mm
- d) 0,0002 mm

(1)

7. The volume of voids divided by the volume of a soil, expressed as a percentage, is the:

- a) Void ratio
- b) Volume of voids
- c) Porosity
- d) Volume of solids

(1)

8. A soil has a Mass (M) of 21.2 kg, Mass of solids (M_s) of 18.9 kg and a Specific Gravity (G_s) of 2.7. The volume of solids (V_s) is:

- a) 0,007 m³
- b) 0,008 m³
- c) 0,0009 m³
- d) None of the above

(3)

9. The hydrometer used in TMH 1 Method A6 is a:

- a) Specific Gravity Hydrometer
- b) Bouyoucos Hydrometer
- c) General Purpose Hydrometer
- d) None of the above

(1)

10. The Liquit Limit of a soil can be determined by means of:

- a) The Casagrande Device
- b) The Cone Penetrometer
- c) Both a) and b) above
- d) None of the above

(1)

11. $D_{30}^2/D_{10} \times D_{60}$ is the:

- a) Coefficient of Particle Size Distribution
- b) Coefficient of Curvature
- c) Coefficient of Uniformity
- d) None of the above

(1)

12. As a rough guide, the Plasticity Index is:

- a) 2 to 3 times Plastic Limit
- b) 5 to 10 times Plastic Limit
- c) 5 to 10 times Linear Shrinkage
- d) 2 to 3 times Linear Shrinkage

(1)

13. The number of blows imparted to each layer in the moulds, during the mod AASHTO test is:

- a) 20
- b) 25
- c) 55
- d) None of the above

(1)

14. The height that the hammer falls during the mod AASHTO test is:

- a) 0,4572 m
- b) 0,352 m
- c) 0,5 m
- d) None of the above

(1)

15. The following roller is most suitable for compacting deep fill layers and collapsing soils:

- a) Smooth wheel roller
- b) Grid roller
- c) Pneumatic rubber tyre roller
- d) Impact roller

(1)

16. The amplitude of vibrating roller drums is approximately:

- a) 5 to 10 mm
- b) 0,7 to 1,8 mm
- c) 0,02 to 0,18 mm
- d) None of the above

(1)

17. The maximum lift thickness during compaction is generally:

- a) 0,03 m
- b) 0,3 m
- c) 3 m
- d) 30 m

(1)

18. The name of the method used where a nuclear density device is operated from the surface, without lowering the rod containing the nuclear source into the ground, is the:

- a) Backscatter method
- b) Direct transmission method
- c) Surface method
- d) None of the above

(1)

19. The Design CBR, according to the TRH 5 Method, of the following CBR values is approximately:

CBR values: 9, 5, 8, 6, 5, 7, 4, 7, 6, 7

- a) 8
- b) 7
- c) 6
- d) 5

(4)

20. The 8 kg hammer of the hand held DCP drops through a height of:

- a) 457 mm
- b) 575 mm
- c) 750 m
- d) None of the above

(1)

21. The subsurface zone above the groundwater table is known as:

- a) Aeration or vadose
- b) Soil water or soil belt
- c) Capillary fringe
- d) None of the above

(1)

22. It is possible to encounter more than one water table in a testpit:

- a) True
- b) False

(1)

TOTAL SECTION A : 30

SECTION B

QUESTION 1

A soil sample has dry and wet masses of 1325 kg and 1465 kg, respectively. The solid particles occupy a volume of $0,55 \text{ m}^3$ and the sample has a void ratio of 0,45. **Using first principles and basic definitions**, determine the soil's:

- 1.1 Moisture content
- 1.2 Bulk density
- 1.3 Dry density
- 1.4 Porosity
- 1.5 Moisture content when the soil is 87 % saturated.

[17]

QUESTION 2

The results of Atterberg Limit tests conducted on a soil sample are shown below.

Liquid Limit

	Sample 1	Sample 2	Sample 3
No of taps	14	23	36
Mass of tin and wet soil (g)	37.1	41.2	38.9
Mass of tin and dry soil (g)	33.2	36.3	34.3
Mass of tin (g)	18.3	19.2	18.5

Plastic Limit

	Sample 1	Sample 2
Mass of tin and wet soil (g)	38.6	38.7
Mass of tin and dry soil (g)	37.0	37.7
Mass of tin (g)	18.3	19.2

Calculate the soil's plasticity index.

[13]

QUESTION 3

A technician had to carry out a sand replacement test on a site. In the laboratory, prior to going to the site, he labelled 5 tins A, B, C, D and E. He placed 1,9 kg of dry density sand in tin A and 5,7 kg of dry density sand in tin B. The density of the density sand had previously been determined as 1470 kg/m^3 .

On site he assembled the apparatus according to the prescribed method and filled the lower half of the funnel with density sand from tin A. Excess density sand was returned to tin A. He then removed the funnel and carefully transferred the density sand from the ring to tin C.

When digging the hole, he placed the soil from it in tin D. On reaching the required depth, he replaced the funnel on the ring and filled the hole and the lower half of the funnel with density sand from tin B. Excess density sand was returned to tin B.

When he returned to the laboratory, he determined the masses of the contents of tins A, B, C and D as 0,43 kg, 2,42 kg, 1,45 kg and 2,3 kg, respectively.

After drying, the soil in tin D had a mass of 2,18 kg.

Calculate the soil's dry density and moisture content.

[10]

TOTAL SECTION B : 40

TOTAL : 70

MULTIPLE CHOICE ANSWER SHEET**NAME:****STUDENT No.**

CROSS THE LETTER OF THE CORRECT ANSWER ON THE GRID. DETACH THIS TABLE AND INCLUDE IT WITH YOUR SCRIPT.

Question	Answer			
1	a	b	c	d
2	a	b	c	d
3	a	b	c	d
4	a	b	c	d
5	a	b	c	d
6	a	b	c	d
7	a	b	c	d
8	a	b	c	d
9	a	b	c	d
10	a	b	c	d
11	a	b	c	d
12	a	b	c	d
13	a	b	c	d
14	a	b	c	d
15	a	b	c	d
16	a	b	c	d
17	a	b	c	d
18	a	b	c	d
19	a	b	c	d
20	a	b	c	d
21	a	b	c	d
22	a	b	c	d