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Name of Examination : **Winter 2020** - (Preview)

Course Code & Course Name : **CE303 - Geotechnical Engineering**

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Maximum Marks : **60**

Duration : **3 Hrs**

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Instructions:

1. All questions are compulsory.
2. Illustrate your answer with suitable figures/sketches wherever necessary.
3. Assume suitable additional data; if required.
4. Use of logarithmic table, drawing instruments and non programmable calculators is allowed.
5. Figures to the right indicate full marks.

- 1) a) A soil has specific gravity of solids of 2.65, void ratio of 67% and water content of 12 %. Determine the volume of water required to be added to 100 m³ of soil for its full saturation [04]

OR

A sample of fully saturated soil has a water content of 25% and bulk unit weight of 20 kN/m³. Determine dry density, void ratio and Specific Gravity of soil solids. What would be the bulk unit weight of the same soil at same void ratio but at a degree of saturation of 80%.

- b) The results of a liquid limit test are given below: [05]

N	48	38	29	20	14
w %	32.1	35.9	40.7	46.1	52.8

Plot the results and determine liquid limit of soil. If the plastic limit of the same soil is 23%, determine the Plasticity Index and comment on soil type.

- c) List the major soil deposits in India and explain briefly characteristics of any two of them. [03]

- 2) a) Following results were obtained from a standard compaction test on a soil sample: [06]

Water content (%)	0.12	0.14	0.16	0.18	0.20	0.22
Mass of wet soil (kg)	1.68	1.85	1.91	1.87	1.85	1.83

The volume of mould used was 950 ml. Make necessary calculations and plot the compaction curve and obtain maximum dry density and optimum moisture content.

OR

Define compaction. Briefly explain the standard compaction test. How the Heavy compaction test differs from it? Draw a neat sketch showing typical compaction curves in both the tests.

- b) List the types of laboratory test to determine the permeability of soils and state the suitability of each. Also draw neat sketches of schematic arrangements for apparatus in these tests and derive the expression for determination of permeability in each test. [06]

- 3) a) A cylindrical soil specimen of saturated clay, 4.0 cm in diameter and 8.0 cm in length is tested in an unconfined compression tester. The specimen fails under an axial load of 240 N. The change in the length of specimen at failure was 0.78 cm. Draw the Mohr's circle and determine the shear strength of the clay. [04]

OR

Describe briefly with the help of neat sketch the vane shear test conducted on soil sample. How shear strength of soil is determined in this type of test.

- b) A series of direct shear tests was conducted and following results were obtained: [04]

Sample no.	Normal stress (kN/m ²)	Shear stress (kN/m ²)
1	15	18
2	30	25
3	45	32

Determine the shear strength parameters of soil.

- c) Define 'Consolidation'. In a consolidation Test, when the load was changed from 50 kN/m² to 100 kN/m², the void ratio changed from 0.70 to 0.65. determine the coefficient of volume change and compression Index. [04]

OR

Define following terms:

- i) Consolidation
- ii) Compression Index
- iii) Coefficient of compressibility
- iv) Coefficient of volume change

- 4) a) Draw neat sketches showing variation of vertical stress, due to a point load 'Q' at the surface, on a [04]

1. Horizontal plane at depth 'z' from surface
2. Vertical plane at distance 'r' from axis of loading

Also indicate the values and locations of maximum stresses in each case.

- b) i). Define 'Contact pressure'. Draw neat sketches showing contact pressure distribution beneath a footing for different types of soil. [02]

- ii). Define 'Isobar' and 'Pressure bulb' with the help of neat sketches. State their significance. [02]

- c) Explain briefly 'Stabilization'. State its purposes. List the various methods of stabilization and state suitability of each. [04]

- 5) a) A stability analysis is carried out by Swedish circle method for a 30° inclined slope and the sliding mass was divided into six slices, each of width 2.0 m. Following results were obtained : [06]

Slice No.	1	2	3	4	5	6
Average ordinate (m)	0.9	2.4	3.6	4.5	4.0	1.80
α (degrees)	0	9	19	29	42	55

Radius of slip circle = 12 m and Central angle = 71° . The properties of soil are as follows:

Unit weight = 20 kN/m^3 , $c = 20 \text{ kN/m}^2$, $\phi = 30^\circ$

Determine the factor of safety of slope

- b) A retaining wall 9.0 m high retains a backfill of soil consisting of two different layers of soil. The upper layer consists of soil of depth 4.0 m and having properties: $\phi = 28^\circ$, unit weight = 18.0 kN/cum . The lower layer of soil is having thickness of 5.0 m and having properties: $\phi = 32^\circ$, saturated unit weight = 20.0 kN/cum . GWT exists at the interface of the two layers. Determine the active earth pressure on the retaining wall. [06]

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