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10CV54

Fifth Semester B.E. Degree Examination, Aug./Sept.2020
Geotechnical Engineering – I

Time: 3 hrs.

Max. Marks:100

Note: *Answer any FIVE full questions, selecting atleast TWO questions from each part.*

PART – A

1 a. Define: i) Void ratio; ii) Porosity; iii) Degree of saturation; iv) Water content; v) Dry unit weight; vi) Unit weight of soil solids; vii) Air content with the help of a three phase diagram; viii) %ge of air voids. **(05 Marks)**

b. With usual notations derive the relationship: Se = W.G. **(05 Marks)**

c. The volume of an undisturbed clay sample having a natural water content of 40% is 25.6×10^{-6} m^3 and its weight is 0.435N. Calculate the void ratio and degree of saturation of the sample, if specific gravity is 2.75. Solve by first principles. **(10 Marks)**

2 a. Define: i) Liquid limit; ii) Plastic limit; iii) Shrinkage limit; iv) Relative consistency; v) Toughness index; vi) Slenderness ratio. **(06 Marks)**

b. A 100×10^{-6} m^3 clay sample has a natural water content of 30%. Its shrinkage limit is 18%. If the sp.gr. of solids is 2.72, what will be the volume of sample at a water content of 15%? **(04 Marks)**

c. In a liquid limit test specimens of certain sample of clay following readings are obtained:

Water content (%)	31.93	27.62	25.51	23.30
No. of blows	5	16	23	42

The plastic limit of clay is 13% natural water content is 18%. Determine liquid limit, plasticity index, liquidity index, relative consistency, flow index and toughness index of soil. **(10 Marks)**

3 a. Explain the classification of fine grained soils as per Indian soil classification system. **(06 Marks)**

b. Define soil structure. Explain with neat sketches single grained and honey combed structures in soils. **(06 Marks)**

c. The following data refers to a sample of soil: **(08 Marks)**
Percentage passing 4.75mm I.S sieve = 64
Percentage passing 75 micron I.S sieve = 6
Coefficient of uniformity = 7.5
Coefficient of curvatures = 2.7
Plasticity index = 2.5
Classify the soil

4 a. Derive the relation between co-efficient of permeability and percolation with usual notations. **(07 Marks)**

b. Explain Quick – sand phenomena and list its importance during construction. **(05 Marks)**

c. A falling head permeater accommodates a soil sample of 6cm length and 500cm^2 in area. The permeability of sample is expected to be 1×10^{-4} cm/sec. Head of water in the standpipe falls from 30cm to 10cm in 40 minutes. Determine the size of the stand pipe which should be used. **(08 Marks)**

PART – B

5 a. Explain sensitivity and thixotropy of clayey soil. **(04 Marks)**

b. List the factors affecting shear strength of soil. **(04 Marks)**

c. A direct shear test results are obtained as follows :

Normal stress (kN/m^2) :	100	200	300
Shear stress (kN/m^2) :	130	185	240

Determine shear parameters graphically. Also draw Mohr's circle corresponding to second test result and report major and minor principal stresses. **(12 Marks)**

6 a. Obtain the value of compactive energy imported to the soil during Light compaction and Heavy compaction test. **(04 Marks)**

b. What are the objectives of Compaction? Discuss the factors affecting compaction. **(06 Marks)**

c. Following are the results obtained from a standard compaction test :

Water content, W(%)	13.5	20.2	25	35	45
Bulk unit weight , γ_b kN/m^3	16.3	19.4	18.8	18	17.2

Plot compaction curve and obtain maximum dry unit weight and OMC. Also plot 100% saturation line. Show specimen calculation. G = 2.65. **(10 Marks)**

7 a. Define the following terms : i) Compression index ii) Co-efficient of compressibility iii) Co-efficient of volume compressibility. **(06 Marks)**

b. Explain with a neat sketch, Casagrande's method of obtaining Pre – consolidation pressure. **(06 Marks)**

c. A saturated soil stratum 5m thick lies above an impervious stratum. It has a compression index of 0.25 and co-efficient of Permeability 3.2×10^{-3}mm/sec. If void ratio is 1.90 at a normal stress of 0.15N/mm^2. Compute i) void ratio due to increase in stress to 0.2N/mm^2 ii) settlement of soil stratum due to above increase in stress. **(08 Marks)**

8 a. List the merits and demerits of Triaxial shear test over Direct shear test. **(06 Marks)**

b. Explain the determination of co-efficient of consolidation by square root of time fitting method. **(06 Marks)**

c. In a direct shear test on a specimen of clean dry sand a normal stress of 200kN/m^2 was applied and failure occurred at a shear stress of 140kN/m^2. Determine i) Angle of shearing resistance ii) Principal stresses during failure iii) Direction of principal planes with respect to plane to shearing.

Draw a neat sketch of Mohr circle showing the directions of Major and Minor principal planes with reference to shearing. **(08 Marks)**

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