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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) % of air voids. (05 Marks)
- b. With usual notations derive the relationship: $S_e = W.G.$ (05 Marks)
- c. The volume of an undisturbed clay sample having a natural water content of 40% is $25.6 \times 10^{-6} \text{ m}^3$ 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 $100 \times 10^{-6} \text{ m}^3$ 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 500 cm^2 in area. The permeability of sample is expected to be $1 \times 10^{-4} \text{ cm/sec}$. 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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