Total No. of printed pages = 7

CE 131604

Roll No. of candidate | | | | | | | | | | |

2017

B. Tech. 6th Semester End-Term Examination

GEOTECHNICAL ENGINEERING - I

Full Marks – 100 Pass Marks – 35 Time – Three hours

The figures in the margin indicate full marks for the questions.

1. Answer in short any *ten* questions from the following : 3×10=30

   (i) Deduce the relation between void ratio, water content, specific gravity and degree of saturation.

   (ii) What do you mean by index properties of soil ?

   (iii) Explain Atterberg Limits with a suitable plot of water content and volume of soil mass.

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(iv) Discuss few effective methods of field compaction for compacting cohesionless soil deposit.

(v) Define OCR in term of normally consolidated, over consolidated and under consolidated soil.

(vi) What is a flow net ? List out the properties and uses of a flow net.

(vii) Write down the expression for critical hydraulic gradient for quick sand condition.

(viii) Explain briefly Mohr-Coulomb failure criteria equation.

(ix) What are the basic modes of failure in a slope ?

(x) A soil sample with specific gravity of solids 2.70 has a mass specific gravity of 1.84. Assuming the soil to be perfectly dry, determine the void ratio.

(xi) The in situ void ratio of a granular soil deposit is 0.50. The maximum and minimum void ratios of the soil were determined to be 0.75 and 0.35 respectively. Determine the relative density.

(xii) A long natural slope of cohesionless soil is inclined at 12^{o} to the horizontal. Taking $\phi = 30°$, determine the factor of safety of the slope.

2. Answer any *eight* questions from the following : 8×5=40

(i) What do you mean residual soil and transported soil ? Classify transported soil on the basis of transporting agency and method of deposition.

(ii) Justify the typical inverted V shape compaction curve for pure sand.

(iii) Explain the various factors affecting compaction.

(iv) A 1000 cc core cutter weighing 946.80 g was used to find out the in situ unit weight of an embankment. The weight of core cutter filled with soil was noted to be 2770.60 g. Laboratory tests on the sample indicated water content of 10.45% and specific gravity of solids as 2.65. Determine the bulk unit weight, dry unit weight, void ratio and degree of saturation of the sample.

(v) Discuss the compression behaviour of granular soil and fine grained soil with the aid of necessary plots.

(vi) Explain the mechanism of consolidation with the help of spring analogy.

(vii) Sketch the plasticity chart used for classifying fine grained soil in IS Soil Classification system. Give the group symbols for the following soils :

(a) Liquid limit = 40%, Plastic limit = 22%

(b) Liquid limit = 20%, Plastic limit = 14%.

(viii) An unconfined compression test was conducted on an undisturbed clay sample. The sample had a diameter of 37.5 mm and was 80 mm long. The load at failure measured by the proving ring was 28 N and the axial deformation of the sample at failure was 13mm. Determine the unconfined compressive strength and the undrained shear strength of the clay.

(ix) Explain the factors affecting permeability of soil.

(x) A stratified soil deposit consists of four layers of equal thickness. The co-efficient of permeability of the 2nd, 3rd and 4th layers are respectively one-third, half and twice of the co-efficient of permeability of the top layer. Compute the average permeabilities of the deposit, parallel and perpendicular to the direction of the stratification in terms of the permeability of the top layer.

3. Answer any *three* questions from the following : 3×10=30

(i) An oven dry sample of volume 250 cc weighs 430g. If the specific gravity of solid is 2.7, what is the water content when the soil becomes fully saturated without any change in its volume ? What will be the water content which will fully saturate the sample and also cause an increase in volume equal to 10% of the original dry volume ? Use phase diagrams.

(ii) A clay soil, tested in a consolidometer, showed a decrease in void ratio from 1.2 to 1.1, when the pressure was increased from 0.25 to 0.50 kgf/cm^2, calculate the co-efficient

of compressibility and the co-efficient of volume compressibility. If the co-efficient of consolidation determined in the test for the given stress increment was 10 m^2/year, calculate the co-efficient of permeability in cm/s. If the sample tested at site was taken from a clay layer 3m in thickness, determine the consolidation settlement resulting from the given stress increment.

(iii) In a falling head permeameter test the initial head is 40cm. The head drops by 5cm in 10 minutes. Calculate the time required to run the test for the final head to be at 20cm. If the sample is 6cm in height and 50cm^2 in cross-sectional area, calculate the co-efficient of permeability, taking area of stand pipe to be 0.5 cm^2.

(iv) (a) Discuss the different components of total settlement.

(b) Representative samples of a layer of silty clay 5m thick, were tested in a consolidometer and the following results are obtained :

Initial void ratio = 0.90

Recompression index = 0.03

Compression index = 0.27

Estimate the consolidation settlement if the present average over burden stress of the layer is 70kN/m^2 and increase in average stress in the layer is 80kN/m^2.

(v) Explain elaborately the stress-strain and volume change behaviour of sands from drained test.