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B.Tech
PCI3I103

3ʳᵈ Semester Regular/Back Examination 2017-18
Geotechnical Engineering
BRANCH: CIVIL
Time: 3 Hours
Max Marks: 100
Q.CODE: B1121
Answer Question No.1 and 2 which are compulsory and any four from the rest.
The figures in the right hand margin indicate marks.

Q1		**Answer the following questions:** *multiple type or dash fill up type*	**(2 x 10)**

a) 'Lacustrine soils' means………….

b) The void ratio of a soil sample will be between ………………. and …………..

c) Sodium oxalate is used as ………….. agent in the sedimentation analysis.

d) The pore water pressure in the capillary zone is …………

e) The seepage force j per unit volume is given by……………

f) When the average degree of consolidation U is less than 60%, the time factor T is given by …………….

g) The special case of a triaxial compression test with zero confining pressure is called ………………

h) The locus of a point at which the vertical stress intensity is the same value is called……………..

i) Relative or degree of compaction means…………………

j) Even after complete dissipation of excess pore pressure, a little more consolidation is possible. This is known as ………………

Q2   **Answer the following questions:** *Short answer type*   **(2 x 10)**

a) Name a few clay minerals.

b) The values of void ratio of a calcareous sand sample in the densest and loosest states are 0.23 and 0.89 respectively. If the in-situ void ratio is 0.46, what is the relative density?

c) What do you mean by 'slaking of clay'?

d) Differentiate between SM and CI soils.

e) Sketch a typical compaction curve for sand and explain 'bulking of sand' from this curve.

f) What do you mean by seepage force per unit volume? Write down its expression.

g) Sketch the normal stress distribution on a vertical line at a radial distance from the point load on the ground surface.

h) The liquid limit of a saturated normally consolidated soil is 50%. What will be the compression index of the soil for virgin compression curve?

i) In an unconfined compression test, how the failure load is related to cohesion of the soil tested?

j) Sketch various slope failures.

Q3 **a)** Discuss the IS soil classification system in brief. The particle size characteristics of a soil are given below in Table 1. The soil has a liquid limit of 31% and plastic limit of 24%. (i) Draw the grain size distribution curve. (ii) Find coefficient of gradation and uniformity coefficient. (iii) Determine the percentages of gravel, sand, silt and clay in the soil. (iv) Classify the soil according to Indian Standards.
Table 1   **(10)**

Size(mm)	% Finer
4.75	100
2	93
0.425	80
0.2	75
0.075	63
0.018	53
0.006	30
0.0036	25
0.002	18
0.001	06

b) A soil sample with porosity of 40% has degree of saturation of 50%. Taking specific gravity of soil solids as 2.66, compute dry, saturated, submerged and bulk unit weight of the sample. **(5)**

Q4 What are the major geotechnical field problems? Distinguish between black cotton soil and lateritic deposits from geotechnical angle. What are the major soil deposits in India? Discuss their characteristics. **(10)**
A sample of soil with a liquid limit of 72.8% was found to have a liquidity index of 1.21 and water content of 81.3%. What are its plastic limit and plasticity index?

(b) Define activity of a soil. Sketch and discuss the activity chart and the plasticity chart. **(5)**

Q5 a) The following are the results from a standard compaction test performed on a sample of soil. **(10)**

Water content (%)	4	7	10	15	20	25	30
Bulk density (gm/cc)	1.63	1.77	1.94	2.	2.12	2.12	1.98

Plot the water content-dry density curve and obtain the optimum water content and maximum dry density. Calculate the water content necessary to completely saturate the sample at its maximum dry density assuming no change in the volume.

b) Calculate the coefficient of permeability of a soil sample 6 cm in height and 50 cm^2 in cross sectional area, if 500 ml of water passed down in 9 minutes under an effective constant head of 52 cm. On oven drying, the test specimen weighed 5 N. Taking G = 2.67, calculate the seepage velocity of water during the test. **(5)**

Q6 (a) What are the characteristics of a flow net? Discuss how to construct a flow net for anisotropic soil. **(10)**
For a homogeneous earth dam 36 m high and 2 m free board, a flow net was constructed with five flow channels. The number of potential drops was 22. The dam has a horizontal filter at the base near the toe. The coefficient of permeability of soil was 11.2 X 10^{-2} mm/sec. Determine the anticipated seepage, if the length of dam is 100 m.

(b) A deposit of fine sand has a porosity of 42% and specific gravity of 2.64. The ground water table is 5 m below the ground surface and the sand layer is saturated by capillary water up to a height of 2 m due to the water table. The degree of saturation of the first 3 m of moist sand is 20%. Calculate the effective vertical stress at a depth of 10 m below the ground surface. **(5)**

Q7 **(a)** Enumerate various methods to determine the coefficient of consolidation. **(10)**
Discuss the square root of time fitting method.
The total anticipated settlement due to consolidation of a clay layer under a
certain pressure is 150 mm. If 50 mm of settlement has occurred in 10 months,
what is the expected settlement in 20 months?

(b) A saturated soil has a compression index of 0.25. Its void ratio at a stress of 10 **(5)**
kPa is 2.03 and its permeability is 3.5X10-7 mm/sec. Compute;
the change in void ratio if the stress is increased to 19 kPa
settlement if the soil stratum is 5 m thick.

Q8 **(a)** Write a brief critical note on 'Newmaark's Influence Chart'. **(10)**
A circular area on the surface of an elastic mass of great extent carries a
uniformly distributed load of 120 kN/m^2. The radius of the circle is 3 m.
Compute the intensity of vertical pressure at a point 5 m beneath the centre of
the circle

(b) What is the effect of pore pressure on strength of soils? How does pore **(5)**
pressure increase? How the effective stress path is influenced by such an
increase?

Q9 Write critical notes on the friction circle method of analyzing the stability of **(15)**
slopes.
An embankment is inclined at an angle of 35^0 and its height is 15 m. The angle
of shearing resistance is 15^0 and the cohesion intercept is 200 kN/m^2. The unit
weight of soil is 18.0 kN/m^2. The Taylor's stability number is 0.06, find the
factor of safety with respect to cohesion.