

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination November 2018
B. Tech. in Civil Engineering, Semester V

Roll No.....

CE 508 : Geotechnical Engineering

Time: 3 hours

Max. Marks: 80

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1A Objective type multiple choice questions (10 questions @ 1 mark) 10

- i. The sedimentation analysis is done with the help of _____
 - a) Hydrometer and Pipette
 - b) Sieve
 - c) All of the mentioned
 - d) None of the mentioned
- ii. The minimum water content at which the soil just begins to crumble when rolled into threads 3 mm in diameter, is known
 - (a) liquid limit
 - (b) plastic limit
 - (c) shrinkage limit
 - (d) permeability limit
- iii. Sedimentation Analysis is based on _____ Law
- iv. The effective size of particles of soil is denoted by
 - (a) D_{10}
 - (b) D_{20}
 - (c) D_{30}
 - (d) D_{60}
- v. The condition to achieve laminar flow of fluid through soils is $Re > 1$. (True/False)
The quantity of seepage of water through soils is proportional to
- vi.
 - (a) coefficient of permeability of soil
 - (b) total head loss through the soil
 - (c) neither (a) nor (b)
 - (d) both (a) and (b)
- vii. Void ratio and water content decreases during consolidation (True/False)
- viii. Submerged unit weight is based on _____ Principle.
- ix. Ultimate/final/total consolidation settlement is dependent on number of drainage paths (True/False)
- x. In general, variable head method is used to find the permeability of coarse grained soils and constant head method for fine grained soils. (True/False)

Q.2 Short answer type questions (4 questions @ 2.5 marks) 10

- i. A soil sample contains volume of air equal to 1/5th of total volume and the Volume of water is 1/4th of total volume. Determine its void ratio and porosity.
- ii. The dry density of a sand with porosity of 0.387 is 1600 kg/m³. Find the void

- ratio of the soil and the specific gravity of the soil solids.
- iii. For conducting a standard Proctor compaction test, weight of hammer, height of fall, number of layers, number of blows per layer are ,..... ,..... , respectively.
- iv. With the above data (Q. No. iii), find the compaction energy in the standard Proctor test? Given the volume of mould to be 1000 cc. _____

Q.3A Explain the classification of soil. What are the various methods? Briefly state them. 05

Q.3B Derive an equation, for determining soil permeability using variable head permeability test. 05

Q.4A Derive an equation for quicksand condition and also explain optimum moisture content in compaction. 05

Q.4B Explain the standard proctor test and modified proctor test with the help of compaction curve also show the zero air void line and what are the factors affecting compaction? 05

Q.5A A core cutter 12.6 cm in height and 10.2 cm in diameter weighs 1071 gm when empty. It is used to determine the in-situ unit weight of an embankment. The weight of core cutter full of soil is 2970 gm. if the water content is 6%, what are the in-situ dry weight and porosity? 05

(ii) If the embankment gets fully saturated due to heavy rains what will be the increase in water content and bulk unit weight, if no volume change occurs? The specific gravity of soil solids is 2.69.

Q.5B A dry soil has a void ratio of 0.65 and its grain specific gravity is = 2.80. 05

(i) What is its unit weight?

(ii) Water is added to the sample so that its degree of saturation is 60% without any change in void ratio. Determine the water content and unit weight.

(iii) The sample is next placed below water. Determine the true unit weight (not considering buoyancy) if the degree of saturation is 95% and 100% respectively

Q.6A A falling head permeameter accommodates a soil sample 6 cm high and 50 cm² in cross-sectional area. The permeability of the sample is expected to be 1×10^4 cm/sec. If it is desired that the head in the stand pipe should fall from 30 cm to 10 cm in 40 minutes. Determine the size of stand pipe which should be used. 05

Q.6B A 75 mm diameter clay specimen was consolidated in an oedometer under 200 kPa. At the end of consolidation, the void ratio is 0.863 and the specimen thickness is 18.51 mm. When a stress increment of 200 kPa was added to the current vertical stress of 200 kPa, the specimen consolidated to a thickness of 17.56 mm. Find the coefficient of volume compressibility and compression index of the clay. 05

OR

Q.6B A 3 m thick layer of saturated clay in the field under a surcharge loading will achieve 90% consolidation in 75 days in double drainage conditions. Find the coefficient of consolidation of the clay. 05

- Q.7 The following data were recorded for a constant head permeability test. 10
- Internal diameter of permeameter = 100 mm
 - Height of the soil sample = 150 mm
 - Rate of upward flow = 540 ml/min
 - Head loss over the length of the sample = 360 mm
 - Porosity of the soil sample = 40 %
 - Room temperature = 21°
- Calculate the coefficient of permeability, Darcy velocity, and seepage velocity.

- Q.8 You are checking the field compaction of a landfill liner. The laboratory sent you the following information for the standard Proctor compaction curve: 10

Dry Unit Weight (PCF)	Water Content (%)
104	14
105.5	14
106	18
105	20
103.5	22
102	24

Maximum dry unit weight = 106 PCF optimum water content = 18% The specification calls for a minimum relative compaction of 95% of the maximum dry unit weight obtained from the standard Proctor. The specification also calls for the water content during compaction to be 0 to 3% wet of optimum. You were the QA/QC officer on site. You dig a hole that is 1/30 ft³ in the compacted soil layer and extract the soil from the hole. The soil from the hole weighs 4.2 lbs wet and 3.4 lbs dry.

- (a) Determine the dry unit weight in the field.
- (b) What is the water content

OR

- Q.8 A 5 m thick sand underlain by 10 m thick clay. The water table is at 2 m below the ground level. Due to capillary action the soil is saturated up-to the ground surface. The water content in sand and clay layer are 20% and 25% respectively. The specific gravity of soil solids are 2.65 and 2.7 for sand and clay respectively. Determine the total stress, effective stress and pore water pressure at (i) the ground level, (ii) water table, (iii) top of clay layer, (iv) mid of clay layer, (v) bottom of clay layer. 10