

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular), Nov 2017

B. Tech in Civil Engineering, Semester VII

Roll No.....

CE735: Ground Improvement Techniques (Elective-IV)

Time: 3 hours

Max. Marks: 100

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.

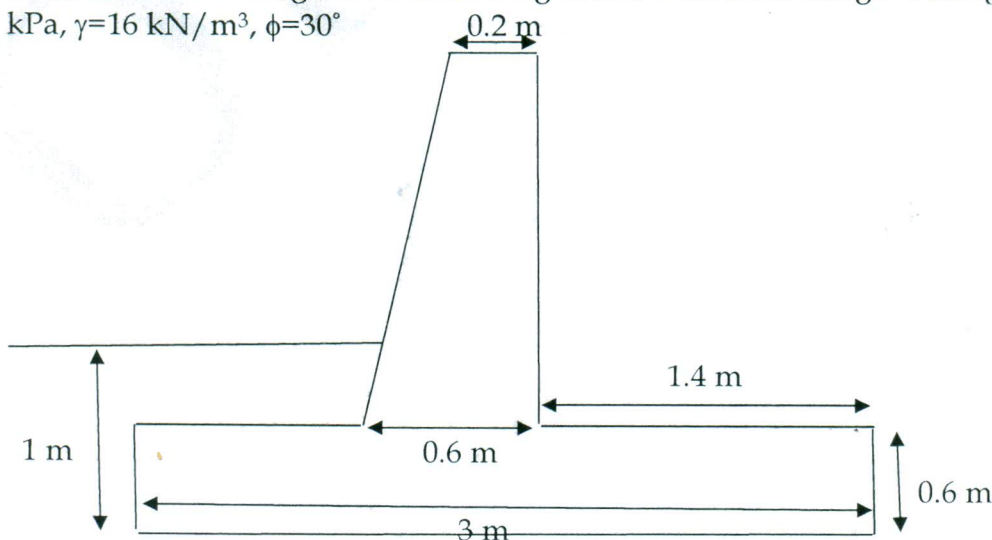
Q.1A Objective type multiple choice questions (5 questions @ 1 mark) 05

- i. Comparing two clay specimens compacted according to standard Proctor procedure to the same dry density, but at water contents above and below optimum, we find:
 - (a) The wetter soil is likely to have a flocculated rather than a dispersed soil structure
 - (b) The wetter specimen will have higher unsoaked strength.
 - (c) The wetter specimen will have a higher stress-strain modulus
 - (d) The wetter specimen will have lower swelling potential
- ii. Economical use of vibratory rollers usually involves
 - (a) 1 pass (b) 1 to 3 passes (c) 4 to 6 passes (d) 8 to 12 passes
- iii. The ratio of the energy input in the modified compaction test over the energy input in the standard compaction test is
 - (a) 1:1.1 (b) 1.1:1 (c) 1.5:1 (d) 4.5:1
- iv. Sandy and silty soils which benefit most from deep vibration have standard penetration resistance N in the range of
 - (a) 5 to 10 (b) 10 to 20 (c) 20 to 50 (d) >50
- v. Stone columns are said to be possible and beneficial in thin layers of cohesive soil with an undrained cohesion of
 - (a) < 10 kPa (b) 10 to 20 kPa (c) 20 to 60 kPa (d) > 200 kPa

Q.2 Short answer type questions (6 questions @ 2.5 marks) 15

- i. What are the different methods of ground improvement techniques applicable to various soil types?
- ii. Explain the classification of ground improvement methods as per IS:13094-1992
- iii. A 4 m thick horizontal clay layer lies below 5 m of sand and above impermeable bed rock. Calculate the settlement under a 100 kPa surcharge of large extent. Soil properties and stresses at the midpoint of the clay layer are as follows:
Initial effective stress = 70 kPa, Initial void ratio = 1.8, compression index = 0.8
- iv. What is the difference between liquefaction and sand boiling/quick sand condition?

- v. Mention the mitigation ways to liquefiable soil environment.
- vi. A 3 m thick clay layer in the field under a given surcharge will undergo 7 cm of total primary consolidation. If the first 4 cm of settlement takes 90 days, calculate the time required for the first 2 cm of settlement.
- Q.3A A 280 m³ mass of saturated soil had a void ratio of 0.92 and specific gravity of 2.68. A pre-loading was then applied over this soil, due to which the soil was compressed and some of the water was squeezed out. The final void ratio of soil was 0.71. 05
- Compute the initial and final water content of the soil,
 - Compute the volume of water squeezed out of the clay and the final volume of the soil, and
- Q.3B In the above problem, if the compression was one-dimensional in vertical and horizontal stretch of soil mass was 7 m × 4 m, compute the settlement of pre-load over the soil. 05
- Q.4A Stone columns are provided in a layer of clay soil. The following properties are given below: $C_u = 3 \text{ t/m}^2$, Spacing = 1.6 m, Diameter of stone column = 800 mm, Find the SBC of treated soil considering triangular and rectangular pattern. 05
- Q.4B A retaining wall 8 m high retains cohesionless soil having friction angle of 35°. Determine the displacement developed in the retaining wall for achieving active earth pressure condition whose strain level is 0.5%. 05
- Q.5A What is an unsaturated soil? Explain its effect on effective stress, shear strength and bearing capacity of a soil. 05
- Q.5B Explain the applications of Geotextiles in detail. 05
- Q.6A Draw the pressure diagram behind the cantilever sheet pile wall supported with struts and wales for clay, dense sand and loose sand. Explain the components of the wall diagrammatically. 10
- OR
- Q.6A Determine the FoS against overturning at toe, with a surcharge loading of 10 kPa, $\gamma = 16 \text{ kN/m}^3$, $\phi = 30^\circ$ 10



Q.7A How to improve the soft soils and expansive clays through chemical/lime stabilization. Explain in detail. 10

Q.8A Explain stabilization of soil with lime column in detail. 10

Q.8B Determine the FoS against sliding of a retaining wall having total height 6 m. The total vertical load on the base is 190 kN/m run of the wall. Take angle of wall friction at the base as 20° and angle of internal friction as 30° . Assume depth of foundation below ground level as 1.5 m. Take unit weight as 17.5 kN/m^3 . 10

Q.9A Determine the depth of embedment of a cantilever sheet pile wall below the dredge line to support a backfill for a height of 4m above the dredge line. The properties of the soil are $c = 0$ towards the backfill and $c = 10 \text{ kPa}$ on the other side below the dredge line. Take $\gamma = 17 \text{ kN/m}^3$ towards the backfill and 20 kN/m^3 on the other side below the dredge line. Take Factor of Safety against overturning to be 2.0. 10

OR

Q.9B An embankment is proposed to be constructed over a layer of clay 10 m thick, underlain by an impermeable stratum. The embankment is 3 m high and the fill soil has a unit weight of 20 kN/m^3 . The clay has the following properties: $c_h=8 \text{ m}^2/\text{year}$, $c_v=4.5 \text{ m}^2/\text{year}$, $m_v=2.7 \times 10^{-4} \text{ m}^2/\text{kN}$.

Sand drains of 400 mm diameter are proposed to be installed in a square pattern, at a spacing of 3 m centre to centre. Determine the magnitude of settlement that can be expected due to consolidation of the clay layer after 6 months of effective embankment loading.