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Question Paper Code : 80191

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Seventh Semester

Civil Engineering

CE 6012 – GROUND IMPROVEMENT TECHNIQUES

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Identify the various role of ground improvement in foundation engineering.
2. What are the geotechnical problems involved in black cotton soils?
3. Name the suitable ground condition in which the vacuum dewatering method is more effective and justify your answer.
4. Why is blanket drains? Name any few field applications of it.
5. What are the basic concepts of the insitu densification of cohesive soil?
6. Estimate the suitability number of the backfill used in vibroflotation work is having D_{50} = 1.5 mm, D_{20} = 0.5 mm and D_{10} = 0.08 mm and rate the backfill for the work.
7. What is the basis of using earth reinforcement to improve the ground characteristics?
8. Illustrate the role of geotextiles in separation and filtration work.
9. List any two types of grouts used for ground treatment and give one example for each.
10. Distinguish the conventional penetration grouting from the compaction grouting.

PART B — (5 × 16 = 80 marks)

11. (a) Discuss in details of various factors which contribute for alteration of ground characteristics after formation. (16)

Or

(b) (i) What are an alternative approaches that can be adopted if unsuitable ground conditions encountered at the desired site of a proposed structure? Explain in details. (8)

(ii) Discuss in details of various factors that need to be considered for the selection of an appropriate ground improvement technique to treat insitu soils. (8)

12. (a) (i) Describe in details of the dewatering scheme of electro-osmosis method and write the merits and demerits of this method. (5 + 3 = 8)

(ii) A fully penetrating well was sunk through a horizontal stratum of sand 15 m thick and underlain by a clay stratum. The radius of influence of water flow was at a horizontal distances of 40 m from the pumping well and radius of the well was 80 mm. The initial position of the water table was 2.0 m below the ground level. The water level in the well was 5.0 m from the ground surface. The coefficient of Permeability of the sand 'k' = 3.81×10^{-4} m/sec. Estimate the quantity of discharge from the well at a steady state pumping rate of litres/hour. If the total quantity of water to be pumped out from an excavation area is 0.65 m^3/sec, determine the total number of wells required to pump out water from the excavation area. Also, determine the spacing between two wells. (8)

Or

(b) (i) Write any two civil constructions in which the role of filter material is significant and explain in details of the general requirements of these filter materials. (6)

(ii) List various steps involved in the design of dewatering system to control ground water during any civil engineering construction and briefly discuss. (10)

13. (a) (i) What are the conditions to be satisfied for successful adoption of preloading method? Discuss various advantages of using this method? (4 + 4 = 8)

(ii) It is proposed to treat the clay ground using stone columns having a diameter of 400 mm. The soil is having a cohesion c = 25 kN/m^2, specific gravity G = 2.70 and natural moisture content W_n= 30%. The angle of internal friction of stone used for the treatment $\phi = 35°$. Estimate the allowable bearing capacity of a stone column and spacing between the stone columns. Assume the final void ratio of the treated ground e = 0.6 and a factor of safety of 2. Choose any suitable pattern for the design. (8)

Or

(b) (i) A new building construction is proposed to build on a layer of 10 m thick clay underlain by an impermeable stratum. Due to insufficient capacity of clay soil, it is to be getting – treated before construction by using preloading with a load of 80 kN/m^2. Further, to accelerate the consolidation process, sand drains of 400 mm diameter are proposed to install in a square pattern at a spacing of 2.5 m c/c. The clay soil is having the properties of c_v = 4.9 m^2/year, c_h = 8.3 m^2/year and $m_v = 2.9 \times 10^{-4}$ m^2/kN. Determine the total settlement due to consolidation by preloading. Also, estimate the settlement that can be expected on the clay stratum after 6 months of preloading with sand drains. Comment on possibility of the safe construction of the building after 6 months of consolidation. (4 + 4 + 2 = 10)

(ii) Name the soil in which the lime stabilization method is more suitable and explain in details. (6)

14. (a) (i) A retaining wall of 7 m high is reinforced with geotextile for the granular backfill having γ=18 kN/m^3 and ϕ = 34°. A woven slit film with warp direction having allowable strength of σ_G = 50 kN/m and δ = 26° is intended to be used for the construction. The factor of safety against both breaking $(FS_{(b)})$ and pull out $(FS_{(p)})$ is 1.5. For the design of wall, determine the vertical spacing (S_v), length (L_G) and lap length (L_l) of the geotextite. (10)

(ii) Describe the various applications of geosynthetics in ground engineering. (6)

Or

(b) A 8 m high earth retaining wall reinforced with steel strip in a granular backfill having ϕ = 30°, γ = 17.0 kN/m^3. The steel having width of the strip 'w' = 80 mm, the vertical and horizontal spacing between the strip from c/c is 0.5 m and 1 m respectively. The breaking strength of the steel strip 'f_y' = 2.8 × 10^5 kN/m^2 and the relative friction angle 'δ' = 20°. The foundation soil is having ϕ = 30°, γ = 18.5 kN/m^3, c = 40 kN/m^2, N_c = 30, N_q = 18 and N_γ = 22. Assume both the factor of safety against breaking and pull out is 3. Check for the internal and external stability of the wall. Assume the corrosion rate of the steel step strip to be 0.030 mm/year and life span of the structure to be 50 years. (16)

15. (a) (i) List two different types of grouting materials can be used for ground treatment and discuss in details of each type with examples. (10)

(ii) Briefly discuss in details of ground treatment using compaction grouting. (6)

Or

(b) What are the various injection methods used for stabilization of soils by grouting techniques and explain in details with suitable condition of it. (16)
