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**Question Paper Code : 40745**

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018  
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 various geotechnical problems of laterite soils.
2. List out the materials that are used in practice for reclamation purposes.
3. Name two kinds of drainage methods that are used to improve the ground condition.
4. What are the limitations of open sump and ditches methods used for dewatering work ?
5. What is the basic mechanism involved in the insitu densification of cohesionless soil ?
6. Why should we need to accelerate the consolidation for densification of cohesive soil ? And give one example for it.
7. List out the various constraining factors on the use of reinforcement for ground strengthening work.
8. What are the factors controlling the hydraulic properties of geosynthetics ?
9. List out various advantages of compaction grouting.
10. What principles are to be followed in choosing the grout for ground improvement work ?



## PART – B

(5×16=80 Marks)

11. a) i) Classify the ground conditions which are having a potential to improve its characteristics and explain in details. (10)
- ii) What are the factors to be considered for selection of a best suitable ground improvement technique for stabilization of soils. (6)
- (OR)
- b) i) How do you choose an appropriate ground improvement techniques based on the particle size? Discuss in details. (8)
- ii) Discuss in details of various geotechnical problems involved in the use of black cotton soil ground for construction work. (8)
12. a) What are the various steps involved in the design of dewatering system to control ground water during any civil engineering construction? Discuss in details. (16)
- (OR)
- b) i) Classify the different types of drainage systems are used to prevent from the top surface ground water seeping into the existing structure and discuss in details. (8)
- ii) In order to estimate the seepage loss through the foundation of a cofferdam a flow net analysis was performed. The results of the flow net analysis gave a number of flow line  $N_f = 7.5$  and number of drops  $N_d = 12$ . The head of water lost during the seepage was 4.5 m. Assume the coefficient of permeability of the soil is  $k = 2.5 \times 10^{-4}$  m/min. Estimate the seepage loss per meter length of the coffer dam per day. The specific gravity  $G = 2.68$  and natural moisture content of the soil  $w_n = 45\%$ . Estimate the exit gradient if the average length of the last flow field is 0.9 m and also check whether any piping kind of the problem exit or not. (8)
13. a) i) List various types of vibro-compaction methods are used to densify saturated sandy soils and discuss any one of the method in details. (2+6=8)
- ii) It is proposed to treat the silty clay soil ground using stone columns having a diameter of 450 mm. The soil is having a cohesion value of  $c = 20$  kN/m<sup>2</sup>, specific gravity  $G = 2.70$  and natural moisture content  $W_n = 45\%$ . Estimate the required length of the stone column to support the total load of 250 kN on the stone column. Also, determine the spacing between the stone columns. Assume the final void ratio of the treated ground  $e = 0.65$ . Choose any suitable pattern for the design. (8)

(OR)



- b) i) What are the methods of preloading used to treat the cohesive soil ground and explain in details? (2+8=10)
- ii) List various factors have to be considered to achieve the performance by the preloading technique to stabilize clay soil ground and discuss. (6)
14. a) i) Classify two different types of geosynthetics are used in ground treatment work and discuss in details of raw materials used to produce two of it. (2+8=10)
- ii) Discuss in details of the role of geosynthetics in filtration and drainage work. (6)
- (OR)
- b) A 9 m high earth retaining wall reinforced with steel strip in a granular backfill having  $f = 30^\circ$ ,  $\gamma = 16.5$  kN/m<sup>3</sup>. The steel strip is having a width of 'w' = 75 mm, the vertical and horizontal spacing between the strip from c/c is 0.5 m and 1m respectively. The breaking strength of the steel strip  $F_y = 2.1 \times 10^5$  kN/m<sup>2</sup> and the relative friction angle  $\delta = 20^\circ$ . The foundation soil is having  $\phi = 30^\circ = 18.0$  kN/m<sup>3</sup>,  $\gamma = 18.0$  kN/m<sup>3</sup>,  $c = 35$  kN/m<sup>2</sup>,  $N_c = 30$ ,  $N_q = 18$  and  $N_\gamma = 22$ . 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 strip is to be 0.028 mm/year and life span of the structure to be 50 years. (16)
15. a) i) What are two different types of grouting materials used in ground treatment work and discuss each one of it in details. (8)
- ii) Briefly discuss in details of grouting is to be adopted for both in temporary and permanent works. (8)
- (OR)
- b) i) What is compaction grouting and explain in details of it? And write various advantages and disadvantages of this type grout method. (9)
- ii) Why should you need to monitor during the grouting process and explain in details of grout monitoring process? (2+5=7)