Code: 13A01705 **R13**

B.Tech IV Year I Semester (R13) Supplementary Examinations June 2018

GROUND IMPROVEMENT TECHNIQUES

(Civil Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) What are the main functions of dewatering systems to improve the geotechnical characteristics of a ground?
(b) What are the various methods of grouting?
(c) What are the requirements of drains should be satisfy?
(d) How is a rammed stone column installed?
(e) What are the methods adopted in construction of stabilized roads?
(f) How is stabilization of soil achieved by cement?
(g) Write a brief note on geo-synthetics as reinforcement.
(h) How does the use of a geo-synthetic as a filter differ from that of drainage?
(i) Improvement of expansive soils using fly ash-Explain.
(j) What is expansive soil? Give one example.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) Explain in brief the various steps for designing a dewatering system.

(b) Two rows of sheet piles are driven to a depth of 4.4 m blow the sand deposit to form a cofferdam. Excavation is then carried out within the coffer dam up to a depth of 3.3 m below the water table level by keeping the area free from water by pumping. The flow net analysis gave $n_f = 6$ and $n_d = 11$ and width of flow channel at -bottom of the excavation is 0.65 m. The sand deposit is having $k = 3 \times 10^{-3} cm/sec$ and underlain by an impermeable stratum at a depth of 6 m below the sand deposit. What is the quantity of flow into the cofferdam per hour per meter length of the sheet pile walls? Is there any danger of quick condition developing at bottom of the excavation? Assume specific gravity and void ratio of the sandy soil is 2.68 and 1.01 respectively.

OR

3 (a) How the dewatering is carried out during construction? Explain in detail.

(b) Explain the vacuum dewatering system with a neat sketch.

UNIT – II

4 (a) Explain in brief about the installation and working of a vibro-replacement stone column.

(b) Explain in detail about the method of pre-loading. How do vertical drains improve the functioning of pre-loading technique?

OR

5 (a) Write in detail the principle, operation and applications of vibro-compaction method of ground improvement.

(b) Estimate the load capacity of a stone column installed in soft clay having the undrained cohesion of $c_u = 18\ kN/m^2$ and measured effective radial stress is $40\ kN/m^2$. Assume the angle of internal friction of stone is $38°$ and a factor of safety of 2.

UNIT – III

6 (a) Write a detailed note on: (i) Portland cement stabilization. (ii) Bituminous stabilization.

(b) What are the different methods of mechanical stabilization? Write the various classes of chemicals used in stabilization of soil.

OR

7 Wick drains have been used to stabilize a saturated clay ground and drains are arranged in square pattern. Estimate the times required for 50%, 70% and 90% consolidation of a saturated clayey soil at various square spacing's and also estimate the appropriate spacing between the drains. The wick drains measure 100 mm x 4 mm and the soil has a horizontal coefficient of consolidation, $c_h = 6.5 \times 10^{-6}\ m^2/min.$

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UNIT – IV

8 (a) A 10 m high retaining wall with galvanized steel-strip reinforcement in a granular backfill has to be constructed.

$\phi_1' = 36^0$

Granular backfill: $\gamma_1 = 16.5\frac{kN}{m^3}$

$\phi_2' = 28^0$

Foundation soil: $\gamma_2 = 17.3\frac{kN}{m^3}$

$c_2' = 50\frac{kN}{m^2}$

Galvanized steel-strip reinforcement:
Width of strip,
$w = 75mm$

$S_V = 0.6m \ center-to-center$

$S_H = 1m \ center-to-center$

$f_y = 24000\frac{kN}{m^2}$

$\phi_\mu' = 20^0$

Required $FS_{(B)} = 3$

Required $FS_{(P)} = 3$

Check for the internal and external stability of the wall. Assume the corrosion rate of the galvanized steel strip to be 0.025 mm/year and life span of the structure to be 50 years.

(b) How do geo-synthetics function as a filter? How does it differ in its function for drainage? Explain in detail with sketches.

OR

9 (a) Consider a geo-textile reinforced soil retaining wall with the following details:
Height of retaining wall, $H = 8m$

For granular backfill:

Total unit weight, $\gamma_b = 17\frac{kN}{m^3}$

Angle of internal friction, $\phi_b' = 35^0$

Allowable tensile strength of geo-textile reinforcement, $\sigma_{all} = 20\frac{kN}{m}$

Factor of safety against geotextile rupture $=1.5$
Factor of safety against geotextile pull-out = 1.5
Calculate the spacing and length of geo-textile layers and the lap length at depths $z = 2m, 4m \ and \ 8m$ from the top of the wall.

(b) With neat sketches, explain in detail the various applications of reinforced earth for ground improvement.

UNIT – V

10 (a) How expansive soils can lead to foundation problems?

(b) What are the different applications of under-reamed piles?

OR

11 (a) What are the signs of soil expansion and shrinkage?

(b) What are the design aspects of under-reamed piles?

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