20.5.14

M. E. (Geotech. Engg.) 2nd Semester Examination, May 2014

GROUND IMPROVEMENT TECHNIQUES (CE-1033)

Time: 3 hours Full Marks: 100

Assume any data, if required reasonably

All questions carry equal marks

Answer Question Number **One** and any **FOUR** from the rest

1. Write short notes on any **FOUR** from the followings: 4@5 =20
   (a) Sand drain
   (b) Blasting
   (c) Vibroflotation
   (d) Compaction pile
   (e) Dynamic Compaction
   (f) Deep mixing

2. (a) Enumerate the design guidelines for rock bolting.
   (b) Explain the analysis of the rock bolting around a circular tunnel.
   (c) Discuss the advantages and disadvantages of rock bolting application.

   5+7+8=20

2. (a) Enumerate the applications and functions of grouting.
   (b) What are the general types of grout used in the field?
   (c) What quantity of cement is required for permeation grouting in gravel having void ratio of 0.65, if the grout mix has a water cement ratio of 6:1. Assuming that 60% of the void space gets filled with grout slurry.

   6+7+7 = 20

3. (a) Enumerate the possible application fields of stone column.
   (b) A tank is to be founded on a earth pad founded on stone column. Design the foundation system considering the following data:

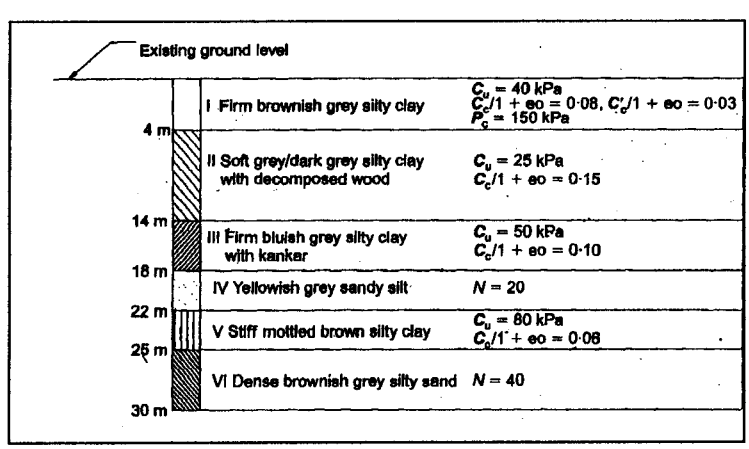
Diameter of the tank = 80 m, Load intensity from tank and earth pad = 140 kPa

The soil exploration report of the proposed site revealed that the soil profile consists of soft silty clay up to 8.0 m depth with undrained cohesion 20 kPa. Average bulk density of soil = 18.0 kN/m^3. The ground water table is located at 1.5 m below GL. Assume any suitable data required.

5+15 = 20

4. (a) Discuss the load transfer mechanism of timber pile.

   (b) Design the load carrying capacity of a timber pile with 300 mm butt diameter and 175 mm tip diameter. The Kolkata soil deposit given herewith may be considered in the computation work. Water table is located at 1.50 m below EGL. Assume any suitable data required.



contd.

5. (a) Enumerates the merits and demerits of vacuum preloading.
(b) During construction of a structure, the average permanent load on the clay layer is expected to increase by about 100 kN/m^2. The clay deposit is underlined and overlain by sandy strata. The average effective overburden pressure at middle of the clay layer is 200 kN/m^2. Thickness of the clay layer is 5.0 m, C_c = 0.25, e_0 = 0.8, C_v = 0.3 m^2/month. The clay is normally consolidated. PVDs of 100 mm wide and 3.5 mm thickness are to be installed. Design a suitable PVD system so that the 90 % of the primary consolidation settlement is achieved by 2.5 months with a surcharge being equal to the expected permanent load. Assume same value of coefficient of consolidation for radial drainage. Also assume that it is a no smear case with the following data.

F(n)	200	300	400	500	1000	2000	3000	4000	5000
n	11	13	14	16	21	28	34	38	41

5+15=20

6. (a) Field applications of geotextiles and their function.
(b) Enumerate the steps for
(i) Determination of length of reinforcement, (ii) largest tension in the strips,
and (iii) external stability related to design of reinforced earth retaining wall to be used for a fly over project in a National Highway.

5+15 = 20

8. (a) Enumerate the factors to be considered before selecting a suitable ground modification technique for a practical problem.
(b) Discuss the types of compaction equipment used in field compaction.
(c) Calculate the production rate (m^3 / h) for a roller with the following characteristics:

Drum width	=	2.5 m
Efficiency	=	80%
Speed	=	10 km/h
Layer thickness	=	0.40 m
Number of pass	=	6

6+6+8 = 20

9. (a) How the lift thickness of compacted soil and the number of passes of roller are decided in the field during construction of earthen embankment?
(b) Explain the possible mechanisms of compaction.
(c) For constructing an embankment, the soil is transported from a borrow area using a truck which can carry 6 m^3 of soil at a time. With the following details, determine the number of truck loads of soil to obtain 100 m3 of compacted earthfill and the volume of borrow pit.

Properties	Borrow area	Truck (loose)	Field (compacted)
Bulk density (kN/m^3)	16.6	11.5	18.2
Water content (%)	8	6	14

7+5+8=20

10. (a) How is the existence of swelling soil at a site be identified?
(b) State the methods of evaluating swelling pressure of such soils in laboratory.
(c) Enumerate the special types of foundations generally used in expansive soils.