DEPARTMENT OF CIVIL ENGINEERING, IIT DELHI

CVL702—GROUND IMPROVEMENT AND GEOSYNTHETICS

Minor–II	Date: 24.03.18
Duration: 60 Minutes	Max. Marks: 30

Note: 1. Answer all questions
2. Answer should be concise
3. Include neat sketch wherever necessary
4. Assume suitable data, if required

1. (a) List the types of grouting and explain their principle of working. **[4]**

   (b) Write a short note on groutability of soils for different types of grouts. **[2]**

   (c) Write a short note on deep soil mixing. **[2]**

   (d) How is the magnitude of preloading/surcharge decided while designing PVDs? **[2]**

2. A chimney is to be supported by a circular raft foundation. The working load on the raft is 12000 kN. The raft foundation is of 12 m diameter and to be laid on clay stratum. The clay bed is likely to settle about 500 mm under working loads. Stone columns having finished diameter of 750 mm were installed in a square pattern (@ c/c spacing of 2 m) up to a depth of 9 m below the depth of raft foundation. The soft clay has an average undrained cohesion of 15 kPa. The stone aggregates has angle of shearing resistance of 38°. Determine the following:

   (a) Safe load carrying capacity of single column as per IS code and number of columns. **[7]**

   (b) Check the adequacy of the number of columns to control the raft settlement to 150 mm, assuming the stress concentration ratio is 0.7. **[3]**

3. (a) Distinguish between *Sand drain* and *Geosynthetic strip drain*. **[2]**

   (b) Does preloading with drain contribute additional improvement, compared to simple preloading? Explain. **[2]**

   (c) A site consists of 12 m of silty clay on which a railway embankment is to be constructed. Consolidation tests indicated a value of c_v = 0.525 mm²/sec and c_h=2 c_v. Determine the time needed for 90% consolidation with band drains under radial drainage, neglecting vertical drainage. The properties of drain and soil are given below: **[6]**

   Equivalent drain diameter = 150 mm; smear diameter = 180 mm
   C/c spacing of drain in equilateral triangular pattern = 600 mm
   Horizontal permeability of soil = 2.5×10^{-7} cm/sec
   Horizontal permeability of smear zone of soil = 1.5×10^{-5} cm/sec
   Vertical permeability of drain material = 1.5×10^{-5} cm/sec
   Assume the bottom of drain is closed. q_w is the specific discharge capacity of drain.

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FORMULAE/CHARTS

$$\beta = \frac{S_i}{S} = \frac{1}{1+(n-1)a_s}$$

$$U_{rz} = 1 - \exp^{\frac{-8T_r}{\alpha_s}}$$

$$\alpha_s = \ln\frac{n}{m} + \frac{k_c}{k_c'}\ln m - \frac{3}{4} + \pi z(2L-z)\frac{k_c}{q_w}$$