DEPARTMENT OF CIVIL ENGINEERING, IIT DELHI

CVL702— GROUND IMPROVEMENT AND GEOSYNTHETICS

Minor–I | **Date: 05.02.18**

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 various factors based on which the choice of suitable ground modification method is made. **[2]**

   (b) Distinguish between Smooth steel/tyre rollers and sheep foot rollers. **[2]**

   (c) Draw and explain the effect of number of passes and plasticity on maximum dry density likely to be achieved. **[2]**

   (d) Explain type of triaxial tests and stress paths required to simulate different field compaction processes. **[2]**

2. (a) What are the major differences in behaviour of sands and clays when modified using dynamic compaction? **[2]**

   (b) How safety of nearby structures is assessed against vibrations caused by dynamic compaction? (write briefly) **[2]**

   (c) What are the mechanisms by which vibro-compaction improves the ground condition? Explain. **[2]**

3. A site predominantly consisting silty sand layers is prone to liquefaction up to a depth of 10 m from GL. Based on engineering judgment, it is decided to adopt dynamic compaction to mitigate liquefaction. The available crane can lift the hammer upto a height of 8 m only. Considering the soil as pervious, determine the weight of the tamper **[3]**

4. (a) What is free discharge height in the dewatering through wells? Explain its typical variation with zone of influence of dewatering. **[3]**

   (b) What is the principle of electro-osmosis? With the help of near sketch, describe how electro-osmotic permeability is measured. **[3]**

5. An underground fuel storage tank is to be constructed up to a depth of 5 m, for a petrol pump station in East Delhi. The plan size of an excavation for construction of this tank is 9 m × 12 m. The soil at the site predominantly consists of fine sand with traces of silt, having an average permeability of 8×10^{-3} cm/sec. This layer has a thickness of 12 m from surface and followed by an impermeable silty clay layer. The water table is at surface. For maintaining the water level of 1.5 m below the excavation depth, determine the following, for L = 20 m, using standard design approach: **[7]**

   (i) Number of wells (assume the well of radius 100 mm is drilled upto the impermeable layer)

   (ii) Draw the layout of location of bore wells and Check the adequacy of assumed h_0.

   (iii) Calculate the pump capacity required.

----------X----------

Note: Formulae are given in next page (P.T.O).

FORMULAE

$$Q = \frac{\pi k (h^2 - h_w^2)}{\ln(L/r)}$$

$$Q = \frac{\pi k (T^2 - (h_w + t)^2)\alpha}{\ln(L/r)}$$

$$\alpha = \sqrt{\frac{h}{t}}\left[\sqrt[4]{\frac{2T - h}{T}}\right]$$

$$Q = \frac{\pi k (h^2 - y^2)}{\ln L - (1/n)\ln x_1 x_2 x_3 \ldots x_n)}$$

$$Q = \frac{\pi k (h^2 - y^2)}{\ln(L/a)}$$

$$Q_i = 2\pi r h_w k i_e$$

$$i_{e\max} = \frac{1}{15\sqrt{k}}$$

$$N = \frac{Q h \gamma_w}{\eta}$$

$$Q = 2.22 F_a \frac{a}{\sqrt{s}}$$