Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER-1 (NEW) EXAMINATION – WINTER 2016

Subject Code: 2714306 **Date:06/01/2017**

Subject Name: Soil Improvement Technology

Time: 2:30 pm to 5:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1		Enlist the various methods of soil improvement based on IS: 13094. Discuss the various considerations for establishing need for soil improvement. Explain the principle, suitability, advantages and limitations of various methods based on precompression and reinforcement.	**14**
Q.2	**(a)**	What do you mean by soil stabilization? Which index and engineering properties are taken into consideration during selection of soil stabilization? Which points are kept in mind while selection of proper method for soil stabilization?	**07**
	(b)	Define grouting. Classify in detail fine grouts and coarse grouts. Discuss the various criteria's for penetrability of fine grouts.	**07**
		OR	
	(b)	Discuss the characteristics of cement based grouts. Explain neat cement, cement with bentonite, cement with chemical admixtures based grouts in detail.	**07**
Q.3	**(a)**	Explain the mechanism and construction methodology of each method mentioned below and discuss (**any one**) in detail with neat sketches, formulas/equations and plots: i) Vibro Compaction ii) CNS iii) Electrokinetic Injections	**07**
	(b)	An highway embankment is proposed to be constructed over a layer of clay 10m thick, underlain by an impermeable stratum. The embankment is 3.5 m high and the fill soil has unit weight of 20.6 kN/m^3. The coefficient of consolidation due to horizontal drainage is 7.1m^2/year and coefficient of consolidation due to vertical drainage is 4.1 m^2/year. Sand drains of 500mm diameter are proposed to be installed in a square pattern at a spacing of 3m c/c. Determine the magnitude of settlement that can be expected due to consolidation of the clay layer after 5 months of effective embankment loading?	**07**
		OR	
Q.3	**(a)**	Discuss (**any two**)in detail with reference to soil-cement mixtures from the following with neat sketches, formulas/equations and plots: i) Compressive strength, modulus of elasticity, plasticity index ii) Degree of pulverization, moisture content, density iii) Soil Amendments and additives.	**07**
	(b)	Following are the details for the backfill material used in a Vibroflotation project: D_{10} = 0.38mm, D_{20} = 0.54mm, D_{50} = 1.44mm.	**07**

Determine the suitability number, S_N. What would be its rating as a backfill?

Q.4 **(a)** For which type of soil condition lime stabilization is recommended and why? Discuss the various stages of reactions taking place in lime stabilization. Support your answer with one small case study. **07**

(b) Enlist various methods employed in stage grouting. Explain the down stage without and with packer with neat sketch. **07**

OR

Q.4 **(a)** Discuss soil-cement mix design in detail for both major projects and minor projects. Support your answer with flowcharts. **07**

(b) Explain in detail bituminous stabilization. Under which soil conditions they are preferred? Classify the various bituminous stabilized mixtures with their applicability. **07**

Q.5 Enlist the various physical and rheological properties needed for grout mix design. How they are determined? Explain the determination of each property in detail with neat sketch. Justify its importance in grout mix design. **14**

OR

Q.5 **(a)** Attempt **<u>any one</u>**: **07**

(i) A silicate grouting is to be done at a place where the permeability of the alluvium to be grouted is 1.25×10^{-3} cm/sec and the porosity of the alluvium is 36% at an injection pressure of $6 kg/cm^2$. The internal radius of the grout pipe is 2.5cm. The properties of the grouts: density of grout 1.18gm/cc, ratio of viscosity of grout to that of water 2.5 and gelling time of the grout 45min. Compute the radius of the grout front at the gel time of the grout in the formation.

(ii) Discuss in detail frame work approach and equivalent weight approach of grout mix design.

(iii) Compute the flow rate $\boldsymbol{q}$ for an injection pressure equivalent to 100m of water-head, if an injection hole has a diameter of 40mm and 0.5m length of hole is exposed at any one time, if its $\mathbf{k}_G = 10^{-5}$ m/sec corresponding to a clean fine sand.

(b) Under which circumstances chemical grouts are preferred? Which physical properties are needed to be evaluated for chemical grouts? Also enlist various chemical grouts. Discuss any one chemical grout in detail. **07**

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