Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – WINTER • 2014

Subject code: 2714301 **Date: 07-01-2015**

Subject Name: Advanced Geotechnical Engineering

Time: 02:30 pm - 05:00 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 **(a)** Give different types of shear tests based on drainage conditions. Explain how the pore water pressure variation and volume change take place during tests. Also enumerate the field conditions which necessitate each of these tests. **07**

(b) A 7m high embankment is constructed with a soil whose effective shear strength parameters are c'= 62 kN/m^2, Ø'=22º and ɔ= 15.8 kN/m^2. The pore pressure parameters as determined from triaxial tests are A=0.39 and B=0.94. Find the shear strength of the soil at base of the embankment just after the fill has been raised from 7 to 10 m. Assume that the dissipation of pore pressure during this stage of construction is negligible and that the lateral pressure at any point is held at half the vertical pressure. **07**

Q.2 **(a)** What is the basis of the construction of the Newmarkôs influence chart? How is it used? **07**

(b) What do you understand by the ñstate of general plastic equilibriumò? Explain the concept of active and passive earth pressures with the help of Mohr circle and shear strength envelope. **07**

OR

(b) Describe sand drains. How are these designed? Discuss their uses. What is the effect of smear? **07**

Q.3 **(a)** Write detail note on óstress pathô **07**

(b) In a laboratory consolidometer test on a 20 mm thick sample of saturated clay taken from a site. 50 % consolidation point was reached in 10 mm. Estimate the time required for the clay layer of 5 m thickness at the site for 50 % consolidation if there is drainage only towards the top. Assume that the laboratory sample and the clay layer at the site are both subject to the same increases in stress. How much time is required for clay layer to reach 90 % consolidation? What is time required for the clay layer to reach 50 % consolidation if the layer has double drainage instead of single? **07**

Take T_{50} =0.197 and T_{90} =0.848

OR

Q.3 **(a)** A series of undrained shear box tests (area of box = 3600 mm^2) were carried out on a soil with the following results: **07**

Normal load (N)	Shear force at failure (N)
280	240
560	320
1080	460

(i) Determine the cohesion and angle of friction of the soil with respect to total stresses. (ii) If a 30 mm diameter, 72 mm long sample of the same soil was tested in a triaxial machine, with a cell pressure 300 kN/m^2 what would be the additional axial load at failure if the sample shortened by 6.3 mm ?
(iii) If a further sample of the soil was tested in an unconfined compression apparatus, at what value of compressive stress would failure be expected?

(b) What is the coefficient of consolidation? What is its use in the settlement analysis? How is it determined? **07**

Q.4 **(a)** Differentiate critically the classical earth pressure theories of Rankine and Coulomb. **07**

(b) A concentrated load of 40 kN acts on the surface of a soil. Determine the vertical stress increment at points directly beneath the load up to a depth of 5 m and draw a plot. Also plot the variation of vertical stress increment due to load on horizontal planes at depth 2 m on either side of centre. **07**

OR

Q.4 **(a)** A retaining wall 6 m high, with a smooth vertical back is pushed against a soil mass having cô = 40 kN/m^2 and ū = 15°; ɔ = 19 kN/m^3. What is the total Rankine passive pressure, if the horizontal soil surface carries a uniform load of 50 kN/m^2 ? What is the point of application of the resultant thrust? **07**

(b) Write and explain the Boussinesqôs equation for stress distribution in soil for (i) a point load and (ii) Line load. **07**

Q.5 **(a)** What is critical void ratio? How would you determine it in the laboratory? Also explain the conditions causing liquefaction of sand. **07**

(b) A sheet pile wall was driven across a river to a depth of 6 m below the river bed. It retains a head of water of 12.0 m. The soil below the river bed is silty sand and extends up to a depth of 12.0 m where it meets an impermeable stratum of clay. Flow net analysis gave *Nf* = 6 and *Nd* = 12. The hydraulic conductivity of the sub-soil is $k = 8 \times 10^{-5}$ m /min. The average uplift pressure head *ha* at the bottom of the pile is 3.5 m. The saturated unit weight of the soil $ɔ_{sat}$ = 19.5 kN/m^3. Determine: (a) The seepage loss per meter length of pile per day. (b) The factor of safety against heave on the downstream side of the pile. **07**

OR

Q.5 **(a)** Write note on properties and uses of a flow net in detail. **14**

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