

Roll No. 

Total No. of Pages : 02

Total No. of Questions : 09

B.Tech. (CE) (2011 Onwards) (Sem.-5)

**GEOTECHNICAL ENGINEERING**

Subject Code : BTCE-502

Paper ID : [A2079]

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTION TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.
4. Notations used carry usual meanings.

**SECTION-A****1. Fill in the Blanks / Write short notes on :**

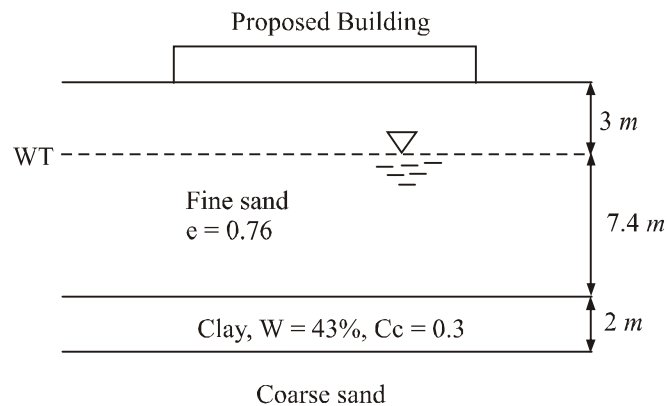
- a) A soil has a bulk density of  $1.80 \text{ g/cm}^3$  at water content of 5%. If the void ratio remains constant then the bulk density for a water content of 10% will be ..... (Fill in the blank)
- b) Given :  $D_{10} = 0.1 \text{ mm}$ ,  $D_{30} = 0.41 \text{ mm}$ ,  $D_{60} = 0.62 \text{ mm}$   
Write down soil classification as per 1498-1970.
- c) If  $w = 40\%$ ,  $G = 2.71$ ; then calculate  
 $\gamma_{\text{sat}}$  and  $\gamma_{\text{dry}}$  in  $\text{kN/m}^3$ .
- d) Give complete name of soil groups : SM, GW-GM.
- e) In a wet soil mass, air occupies one-sixth of its volume and water occupies one-third of its volume. The void ratio of the soil is ..... (Fill in the blank)
- f) Draw a typical consolidation curve for laboratory consolidation test on undisturbed soil samples.
- g) Distinguish between seepage and discharge velocities through soil.
- h) Draw typical stress-strain curves for sandy soils.
- i) The factor of safety of an infinite slope in a sand deposit is 1.732. If the angle of shearing resistance is  $30^\circ$ , the safe slope is ..... (Fill in the blank)
- j) Stokes law does not hold good if the size of particles is less than ..... (Fill in the blank)

### SECTION-B

2. What inclination is required where a filling 12 m high is to be constructed having a factor of safety of 1.25? The soil has  $c = 20 \text{ kN/m}^2$ ,  $\phi = 15^\circ$ ,  $\gamma = 17.0 \text{ kN/m}^3$ . The stability number for  $\phi_m = 12^\circ$  is equal to 0.063 when the slope is  $30^\circ$  and 0.098 when the slope is  $45^\circ$ .
3. A cohesive soil has unit weight of  $19.2 \text{ kN/m}^3$ , unit cohesion  $12 \text{ kN/m}^2$  and  $\Phi = 10$  degree. Calculate the critical depth of vertical excavation that can be made without any lateral support.
4. Enumerate the advantages and limitations of tri-axial shear strength tests.
5. An embankment for a highway is to be constructed from a soil compacted to a dry unit weight of  $18 \text{ kN/m}^3$ . The soil has to be trucked to the site from a borrow pit. The bulk unit weight of soil in the borrow pit is  $17 \text{ kN/m}^3$  and its natural water content is 50%. Calculate the volume of the soil from the borrow pit required for one cubic meter of embankment. ( $G = 2.7$ )
6. Give the structure and characteristics of montmorillonite clay minerals.

### SECTION-C

7. Estimate the primary consolidation settlement of the clay layer shown in the below Figure. The proposed building will impose a vertical increase of stress  $140 \text{ kPa}$  at the middle of clay layer. Assume the soil above WT as saturated. Take  $G = 2.7$ .



**Fig.**

8. The Atterberg limits of a clayey soil are as  $LL = 52\%$ ,  $PL = 30\%$  and  $SL = 18\%$ . If the specimen of this soil shrinks from a volume of  $39.5 \text{ cc}$  at  $LL$  to a volume of  $24.2 \text{ cc}$  at  $SL$ , Find specific gravity of the soil.
9. Write short notes on the followings :
  - a) Zero air-void line and its significance.
  - b) Logarithmic time fitting method.