



VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE  
[Central Technological Institute, Maharashtra state]  
Matunga, Mumbai-400019

SEMESTER EXAMINATION      **MAY 2014**      DATE OF EXAM: **6/05/14**  
SEMESTER & COURSE      **IV SYBTECH-(CIVIL)**      Time :- **1.30 to 4.30 pm**  
TIME ALLOWED      **3HRS**  
SUBJECT(Code):      **SOIL MECHANICS (0225)**      MAX MARKS : 100

Instructions:

2. All questions are compulsory.
  3. Figures to the right indicate full marks.
  4. Assume suitable data if necessary. Do not change unit
  5. Illustrate your answers with neat sketches wherever necessary.
- Q.1
- a) Write One Dimensional Terzaghi's Equation. Explain each term with assumptions. 5
  - b) Evaluate shear strength of soil deposit ( $\gamma = 20 \text{ kN/m}^3$ ,  $c = 10 \text{ kPa}$ ) at 5 m below GL. 5  
The sample failed at an angle  $60^\circ$  with horizontal. The GWL is 2 m below GL.
  - c) Show that stream lines and equipotential lines are orthogonal. 5
  - d) Can gravelly deposits undergo quick condition? 5
- Q.2
- a) A soil has liquid limit of 50% and plasticity index of 20%. When the soil at its Liquid limit was dried, the percentage decrease in volume was 40% of its dry volume. When it was dried from plastic limit, the percentage decrease in volume was 20% of dry volume. Determine the shrinkage limit and shrinkage ratio. 8
  - b) Draw effective pressure diagram for soil deposits 10 m thick. The GWL is located at 5m. A 20 kPa load is placed on the ground surface. A capillary zone is located above GWL and extended upto GL. The soil deposit properties are  $\gamma = 18 \text{ kN/m}^3$ ,  $\gamma_d$  as  $9 \text{ kN/m}^3$ ,  $\gamma_{\text{sat}}$  of  $20 \text{ kN/m}^3$ . Also evaluate effective force. 8
  - c) Draw Cassagrande's Plasticity chart. What are boundary conditions based on chart. 4
- Q.3
- a) A soil sample of 6 cm in height and c/s area of  $100 \text{ cm}^2$  was subjected to permeability test. In a time interval of 5 min, head drops from 60 cm to 20 cm. If c/s area of stand pipe is  $2 \text{ cm}^2$ , compute coefficient of permeability of sample in cm/s. If same sample is subjected to constant head of 18 cm, evaluate the total quantity of water in ml that will be collected after flowing through the sample in same time interval. 8
  - b) Write Laplace equation of flow in two dimensions. Write application of flow net. 8
  - c) How do you plot zero air void line. Discuss effect of amount and type of compaction on dry density. 4
- Q.4
- a) Evaluate consolidation settlement of 5m deposit subjected to square footing 4 m in size load of 20 kPa. The consolidation test result shows that change in void ratio from 0.6 to 0.7 under effective stresses of 20 to 50 kPa. Evaluate time of settlement after 70% consolidation if  $C_v = 5 \times 10^{-04} \text{ cm}^2/\text{s}$ . 8
  - b) Write drainage conditions with practical applications. Compare Direct shear test and Triaxial test with respect to plane of failure and control over pore water pressure. 8
  - c) Briefly explain with sketch the method of evaluation of pre-consolidation pressure. 4

- Q5 a) The results of CU test are shown in following table. Evaluate effective shear parameters 8

Confining pressure, kPa	50	100	150
Deviator stress, kPa	76	132	186
Excess p.w.p., kPa	35	59	83

- b) Explain theoretical curve given by Terzaghi for evaluation of coefficient of consolidation. Also explain Cassagrande's graphical method for evaluation of  $C_v$ . 8
- c) Briefly write about correction applied to SPT test, OR 4  
Draw Coloumb's failure envelope. How do you obtained principal stresses and their orientation from given point on failure envelope for Direct shear test.





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*Re-exam.*

SEMESTER EXAMINATION **MAY 2014** DATE OF EXAM **24/05/14**  
 SEMESTER & COURSE **IV SYBTECH-(CIVIL)** **1:30 - 4:30**  
 TIME ALLOWED **3HRS**  
 SUBJECT(Code): **SOIL MECHANICS (0225)** MAX MARKS : 100

Instructions:

2. All questions are compulsory.
3. Figures to the right indicate full marks.
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- Q.1 a) Write compressibility parameters that are used to evaluate settlement. Draw necessary graphs with expression. 4  
 b) Write application of flow net. 4  
 c) Write expression and figure for evaluating coefficient of permeability at field for confined aquifer. 4  
 d) Write expression for coefficient of permeability using Poiseuille equation. List factors affecting permeability. 4  
 e) Write particle size according to IS-1948 (1970) for Gravel, Coarse sand, Medium sand, Silt and Clay. 4

- Q.2 a) A sample of soil with liquid limit of 72.8 % was found to have a liquidity index of 1.21 and water content of 81.3 %. What are its plastic limit and plasticity index? Comment on consistency of soil. 8  
 b) A partially saturated sample from borrow pit has a Natural Moisture Content of 15% and bulk unit weight of 1.9 g/cc. The specific gravity of solids is 2.70. Determine the degree of saturation and void ratio. What will be saturated unit weight? Draw phase diagrams showing all volume and weight components. 8  
 c) Discuss quick sand condition. Discuss quick failure condition of clay. 4

- Q.3 a) Write <sup>characteristics</sup> application of flow net. 4  
 b) In a modified compaction test following results are obtained. Use volume of mould as per IS 2720. 8

Weight of compacted soil (gm)	1940	2096	2220	2176	2108
Moisture content %	7.22	10.30	12.94	16.37	19.29

- c) Derive the relation  $i = \frac{G - 1}{1 + e}$  in quick sand condition. Why fine sand is prone to quick condition. 8
- Q.4 a) The clay layer of 8 m thickness with single drainage settles by 120 mm in 2 years. The coefficient of consolidation for this clay was found to be  $6 \times 10^{-03} \text{ cm/s}^2$ . Calculate the likely ultimate consolidation settlement and find out how long it will take to undergo 90% of this settlement 8  
 b) Derive the relation between principal stresses. Simplify it for UCS test. 4  
 c) Explain theoretical curve given by Terzaghi for evaluation of coefficient of consolidation. Also explain Taylor's graphical method for evaluation of  $C_v$ . 8

- Q5 a) The results of box shear test are shown in following table. Evaluate effective shear parameters. Determine principal stress and orientation of planes at point (110 kN, 195 kN) on failure envelope. 8

Normal Load (N)	110	225	340
Shear Force at Failure (N)	95	195	294

- b) Write properties of flow net. Simplify it for UCS test *clayey sm* 8