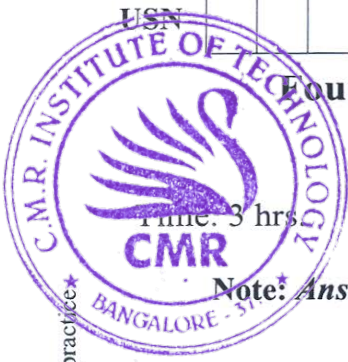


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## Fourth Semester B.E. Degree Examination, Jan./Feb. 2023 Basic Geotechnical Engineering

Max. Marks: 100

**Note:** Answer any FIVE full questions, choosing ONE full question from each module.

### Module-1

- 1 a. Draw phase diagrams for soil mass and define the following : i) Percent Air voids  
ii) Degree of saturation    iii) Water content    iv) Saturated unit weight. (07 Marks)
- b. Obtain a relation between saturated unit weight, specific gravity and voids ratio in the form  

$$\gamma_{Sat} = \frac{(G + e)\gamma_w}{1 + e}$$
 (05 Marks)
- c. The wet weight and oven dried weight of soil sample are 166.80 gms and 140 gms respectively. Diameter of sample is 3.81cm and length is 7.62cm. If specific gravity of soil is 2.70, find i) Water content    ii) Dry density    iii) Voids ratio  
iv) Degree of saturation. (08 Marks)

**OR**

- 2 a. List objectives of soil classification. Draw plasticity chart of IS soil classification system. (06 Marks)
- b. Define the following with necessary equation : i) Consistency Index    ii) Liquidity Index  
iii) Activity of clay    iv) Shrinkage limit. (08 Marks)
- c. The natural dry unit weight of soil is 17.50 kN/m<sup>3</sup>. If its maximum and minimum dry unit weights are 18.5kN/m<sup>3</sup> and 16.00 kN/m<sup>3</sup>, find relative density of soil. Take G = 2.65. (06 Marks)

### Module-2

- 3 a. Explain the following with neat figures : i) Single grained structure    ii) Honey comb structure    iii) Flocculant and Dispersed structure. (06 Marks)
- b. Explain Electrical diffuse double-layer and primary valency bonds. (06 Marks)
- c. A soil sample proposed to be used for Earthen bund construction is found to have bulk unit weight of 19.20 kN/m<sup>3</sup> corresponding to a moisture content of 18%. Find void ratio and degree of saturation of compacted fill if specific gravity of soil is 2.70. (08 Marks)

**OR**

- 4 a. Draw neat sketch and explain the structure of Kaolinite and Montmorillonite clay minerals. (06 Marks)
- b. Explain the following :  
i) Modified proctor test    ii) Proctor needle for field moisture control. (04 Marks)
- c. Following observations are available from a standard Proctor Test. Plot the graph showing Dry density – Water content relationship. Also draw Zero Air voids line. Take G = 2.72. Volume of mould is 944cm<sup>3</sup>. (10 Marks)

Item	①	②	③	④	⑤	⑥	⑦
Wet weight of soil (gms)	1772	1837	1860	1871	1906	1865	1850
Moisture content (%)	17.50	19.00	20.00	20.80	21.80	22.40	24.20

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8 = 50, will be treated as malpractice.

**Module-3**

- 5 a. Write Darcy's Law and explain its validity for flow of fluids through soil mass. (05 Marks)  
 b. Explain characteristics of flow nets. (05 Marks)  
 c. In a falling head permeability test, the diameter of length of sample used are 60mm and 150mm respectively. Diameter of stand pipe is 20mm. Initial head of water is 45cm. head drops by 15cms in two minutes time interval. Find co-efficient of permeability in mtr/day. (10 Marks)

**OR**

- 6 a. Define Total, Effective and Neutral stresses and write the relation between them. (04 Marks)  
 b. Explain with necessary sketch the method of locating phreatic line in a homogeneous Earthen Dam with horizontal filter. (07 Marks)  
 c. Explain the following : i) Discharge velocity and seepage velocity  
 ii) Flow nets applications in hydraulic analysis of structures. (09 Marks)

**Module-4**

- 7 a. Draw graph of effective pressure Vs Voids ratio for a consolidation test on soil sample and explain the following : i) Virgin compression curve ii) Recompression curve  
 iii) Expansion curve. (08 Marks)  
 b. A fully saturated clayey strata of 6 mtr thick is sandwiched between sandy layer at top and hard rock at bottom. Voids ratio under a vertical pressure of  $150\text{kN/m}^2$  is 1.95. Compression index of soil is 0.28 and co-efficient of permeability is  $3.50 \times 10^{-6}$  mtr/sec. Find  
 i) Change in voids ratio and settlement of strata due to increase in pressure to  $210\text{kN/m}^2$ .  
 ii) Time required for 50% degree of consolidation. Time factor  $T_v$  for 50% consolidation is 0.197. (12 Marks)

**OR**

- 8 a. Explain Mass – Spring Analogy of consolidation of soil. (07 Marks)  
 b. Explain Logarithm of Time fitting method for finding co-efficient of consolidation of soil samples. (06 Marks)  
 c. A Consolidation test performed on a clay specimen yielded following results :  
 Vertical stress applied =  $1.40\text{ kg/cm}^2$  ; Voids ratio achieved = 0.50  
 Compression Index = 0.30.  
 If vertical stress is increased to  $2.00\text{ kg/cm}^2$ , find the voids ratio of specimen. Also find settlement of clay strata of 4 mtr thick. (07 Marks)

**Module-5**

- 9 a. Explain Mohr – Coulomb failure criterion for shear strength of soils. (05 Marks)  
 b. List advantages and disadvantages of Direct Shear Test and Triaxial Shear Tests. (08 Marks)  
 c. A saturated soil specimen failed at an axial stress of  $150\text{ kN/m}^2$  in an unconfined compression test. The inclination of failure plane with horizontal measured to be  $52^\circ$  Find shear parameters of soil. (07 Marks)

**OR**

- 10 a. Explain different drainage conditions adopted in evaluating shear strength of soils. (06 Marks)  
 b. Define Thixotropy and Sensitivity of soils. (04 Marks)  
 c. The C and  $\phi$  of soil sample from triaxial shear test found to be  $89\text{kN/m}^2$  and  $22^\circ$  respectively. The cell pressure maintained was  $280\text{ kN/m}^2$ . Find deviator stress and failure. (10 Marks)

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