



**Fourth Semester B.E. Degree Examination, Feb./Mar.2022**  
**Basic Geotechnical Engineering**

Max. Marks: 100

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

**Module-1**

- 1 a. Explain the following mentioning necessary equations,
  - (i) Relative density
  - (ii) Activity of clay
  - (iii) Flow index. (06 Marks)
- b. With the help of phase diagram, obtain the relationship  $\gamma_d = \frac{G_{rw}}{1+e}$ . (05 Marks)
- c. A Moist soil sample has weight of 4.90 Newtons which reduces to 4.54 N after oven drying for 24 hrs. The volume of soil sample is 300 cm<sup>3</sup>. Specific gravity G = 2.70. Find voids ratio, porosity, water content and degree of saturation. (09 Marks)

**OR**

- 2 a. Define the following:
  - (i) Liquidity index.
  - (ii) Plasticity index.
  - (iii) Degree of saturation
  - (iv) Air content. (04 Marks)
- b. Write stoke's equation and discuss the corrections to Hydrometer reading. (06 Marks)
- c. A medium dense gravelly sand is found to have void ratio of 0.68 and 0.49 in loosest and densest states respectively. In Situ bulk unit weight is 19.36 KN/m<sup>3</sup> and water content is 18%. Specific gravity is 2.60. Find degree of saturation and Relative density of soil. (10 Marks)

**Module-2**

- 3 a. Explain the following with neat sketches,
  - (i) Flocculant and Dispersed structures. (08 Marks)
  - (ii) Montmorillonite and Illite clay minerals. (04 Marks)
- b. Explain Proctor needle method for field compaction control. (04 Marks)
- c. In a standard Proctor Test a maximum dry density of 18.65 KN/m<sup>3</sup> was achieved for a soil at an moisture content of 13.90%. Specific gravity of soil is 2.63. Find degree of saturation, percentage air voids and air content. Also find theoretical MDD at above water content. (08 Marks)

**OR**

- 4 a. Distinguish between Standard Proctor Test and modified Proctor Test. (04 Marks)
- b. Explain the following with neat figures:
  - (i) Single grained and Honey combed structures
  - (ii) Electrical double diffuse layer and adsorbed water. (06 Marks)
- c. The results of a laboratory proctor test are as below. Plot moisture content Vs dry density curve and find OMC and MDD. Also plot zero air voids curve. G = 2.68

Water content (%)	8.33	10.40	12.23	16.20	17.92	20.39
Bulk unit weight (KN/m <sup>3</sup> )	16.41	18.26	19.13	20.21	20.40	19.98

(10 Marks)

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. Explain characteristics of flow net and list its applications. (07 Marks)  
 b. Obtain an expression for average co-efficient of permeability when flow is perpendicular to bedding planes. (06 Marks)  
 c. Flow net is constructed for an earthen dam 180 m long with an effective water storage height of 25 mtrs. The co-efficient of permeability of soil is  $2.78 \times 10^{-4}$  cm/sec. Number of potential drops are 10, Number of flow channels = 4. Find seepage loss across the dam per day assuming dry downstream. (07 Marks)

OR

- 6 a. Discuss factor affecting co-efficient of permeability of soils. (06 Marks)  
 b. Explain with necessary sketches drawing of phreatic line in an earthen dam without toe filter. (06 Marks)  
 c. The diameter and height of soil specimen in a falling head permeability test are 9.5 cm and 14 cm respectively. Dia of stand pipe is 1.20 cms. During the test water level in stand pipe found to fall from 70 cm to 55 cm in 18 minutes. Find  
 (i) Co-efficient of permeability of soil.  
 (ii) Time in minutes required for water level to drop from 55 to 30 cm. (08 Marks)

**Module-4**

- 7 a. Define: (i) Compression Index (ii) Co-efficient of compressibility (iii) Co-efficient of volume change. (06 Marks)  
 b. Explain factors influencing time factor  $T_v$ . (04 Marks)  
 c. A clay strata of 9 m thick having drainage at Top and Bottom faces is having co-efficient of permeability is  $1.05 \times 10^{-9}$  mtr/sec, Voids ratio = 0.80 and Co-efficient of compressibility  $a_v = 0.003$  m<sup>2</sup>/kN. Time factor  $T_v = 0.20$ . Find time in days for achieving 50% degree of consolidation in soil strata. (10 Marks)

OR

- 8 a. Explain the following with necessary equations with respect to consolidation of soils:  
 (i) Drainage path  
 (ii) Consolidation settlement  
 (iii) Co-efficient of consolidation. (06 Marks)  
 b. Explain square root of time fitting method for determination of co-efficient of consolidation. (06 Marks)  
 c. An isolated footing is supported over a 8.00 mtr thick clay strata sandwiched between sand layers at top and bottom. A 20 mm thick undisturbed sample collected from the clay strata when tested in Lab under double drainage condition undergone 50% consolidation in 10 minutes. Calculate time required for 60% consolidation of soil strata under the footing.  $TV_{60} = 0.287$ ,  $TV_{50} = 0.197$  (08 Marks)

**Module-5**

- 9 a. List the disadvantages of direct shear test. (05 Marks)  
 b. With neat figure explain unconfined compressive strength test. (06 Marks)  
 c. The following observations are available from a triaxial shear test.

Specimen No.	Deviator Stress (KN/m <sup>2</sup> )	Cell pressure (KN/m <sup>2</sup> )
1	800	230
2	1200	380

Find shear parameter C and  $\phi$  analytically. Also find shear stress at failure if same soil when tested in direct shear test failed under a normal stress of 512 KN/m<sup>2</sup>. (09 Marks)

OR

- 10 a. Distinguish between the following:
- (i) Undrained test and Drained test.
  - (ii) Thixotropy and Sensitivity of soils. (05 Marks)
- b. A soil sample 4 cm dia and 7 cm high failed under an vertical compressive load of 0.60 KN in a unconfined compression test. The axial deformation of soil at failure was 8 mm. Calculate sensitivity of soil if unconfined compressive strength in remoulded state found to be 113 KN/m<sup>2</sup>. (09 Marks)
- c. Derive an equation to determine shear strength of soil by vane shear test, also state the suitability. (06 Marks)

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