



**BTECH**  
**(SEM V) THEORY EXAMINATION 2023-24**  
**GEOTECHNICAL ENGINEERING**

**TIME: 3 HRS****M.MARKS: 100**

**Note:** Attempt all Sections. If require any missing data; then choose suitably.

**SECTION A****1. Attempt all questions in brief.**

Q no.	Question	Marks	CO
a.	Discuss plasticity index and liquidity index.	2	1
b.	Write down the expressions for coefficient of uniformity and coefficient of curvature.	2	1
c.	What are the limitations of Darcy's law?	2	2
d.	Define the term quick sand condition.	2	2
e.	Discuss the factors affecting the time factor and degree of consolidation.	2	3
f.	What do you mean by soil compaction?	2	3
g.	What are the assumptions of Westergaard's theory?	2	4
h.	Write down the various tests for determining the shear strength of soil.	2	4
i.	Give the expression for stability number.	2	5
j.	Define slope. Where it is used?	2	5

**SECTION B****2. Attempt any three of the following:**

a.	A soil specimen has a water content of 15% and a wet unit weight of 25kN/m <sup>3</sup> . If the specific gravity of solids is 2.70, Determine the dry unit weight, void ratio, and degree of saturation, take $\gamma_w = 10\text{kN/m}^3$ .	10	1
b.	Describe Darcy's law and give its validity.	10	2
c.	Write a short note on: A. Normally consolidated soils and over consolidated soils. B. Coefficient of compressibility and coefficient of volume change. C. Compression index, swelling index and recompression index.	10	3
d.	In an in-situ vane shear test on saturated clay, a torque of 35 N-m was required to shear the soil. The diameter of the vane was 50 mm and length 100 mm. Calculate the undrained shear strength of the clay. The vane was then rotated rapidly to cause remoulding of the soil. The torque required to shear the soil in the remoulded state was 5 N m. Determine the sensitivity of the clay.	10	4
e.	What are the different types of slope failures? Explain with Diagrams.	10	5

**SECTION C****3. Attempt any one part of the following:**

a.	The mass specific gravity of a fully saturated specimen of clay having a water content of 30.5% is 1.96. On oven drying, the mass specific gravity drops to 1.60. calculate the specific gravity of clay.	10	1
b.	A partially saturated sample from a 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 the unit weight of the sample on saturation?	10	1

**4. Attempt any one part of the following:**

a.	A granular soil deposit has 10 m depth over an impermeable layer. The ground water table is at 5 m depth below ground surface. The soil is moist up to 2 m from water table with degree of saturation of 50 %. Plot the variation of total stress, pore water pressure and effective stress. Take $e = 0.6$ and $G = 2.67$ .	10	2
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b.	How would you determine seepage by using flow net?	10	2
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**5. Attempt any one part of the following:**

a.	What are various types of field compacting equipment's? Which types of rollers are suited for clayey and gravel soils? Also give specifications of such rollers.	10	3
b.	A saturated clay layer of 5 m thickness takes 1.5 years for 50 % primary consolidation, when drained on both sides. Its coefficient of volume change $m_v$ is $1.5 \times 10^{-3}$ m <sup>2</sup> /kN. Determine the coefficient of consolidation (in m <sup>2</sup> /yr.) and the coefficient of permeability (in m/yr.).	10	3

**6. Attempt any one part of the following:**

a.	A concentrated load of 30 kN acts on the surface of a homogeneous soil mass of large extent. Find the stress intensity at a depth of 8 m and (i) directly under the load; (ii) at a horizontal distance of 6 m.	10	4
b.	State the assumptions implied in the use of the Boussinesq's theory to determine the vertical stress in a soil. An elevated structure with a total weight of 10,000 kN is supported on a tower with 4 legs. The legs rest on piers located at the corners of a square 6 m on a side. What is the vertical stress increment due to this loading at a point 7 m beneath the Centre of the structure?	10	4

**7. Attempt any one part of the following:**

a.	A retaining wall with a smooth vertical back face has to retain a backfill of $c - \phi$ soil up to 6 m above ground level. The surface of the backfill is horizontal and it has the following properties: $\gamma = 1.9$ t/m <sup>3</sup> , $c = 1.7$ t/m <sup>2</sup> and $\phi = 15^\circ$ . i. Plot the distribution of active earth pressure on the wall. ii. Determine the magnitude and point of application of active thrust. iii. Determine the depth of the zone of tension cracks.	10	5
b.	How a slope is analyzed using Swedish Circle method? Derive an expression for the factor of safety.	10	5