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**VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS), HYDERABAD**

Accredited by NAAC with A++ Grade

**B.E. (Civil Engg.) VI-Semester Main & Backlog Examinations, June-2022****Soil Mechanics**

Time: 3 hours

Max. Marks: 60

Note: i) Answer all questions from **Part-A** and any **FIVE** from **Part-B**

ii) Students may avail normal/semilog graph sheets if required

**Part-A (10 × 2 = 20 Marks)**

Q. No.	Stem of the question	M	L	CO	PO
1.	Draw the structure of (i) Kaolinite and (ii) Montmorillonite clay minerals.	2	1	1	1
2.	Demonstrate computation of coefficient of uniformity and coefficient of curvature and classify the soil: Gravel = 20%, Sand = 78%, Fines = 2%, D10 = 1.28 mm, D30 = 2.80 mm, D60 = 4.99 mm.	2	2	1	1
3.	What is capillary action? In which type of soils can you observe a higher capillary rise – coarse grained or fine grained soil?	2	1	2	1
4.	What is quick sand condition?	2	1	2	1
5.	State the uses of Newmark's chart.	2	1	3	1
6.	A borrow pit has a dry density of 17 kN/m <sup>3</sup> . How many m <sup>3</sup> of dry soil will be required to construct an embankment of 100m <sup>3</sup> volume with a dry density of 16 kN/m <sup>3</sup> ?	2	2	3	1
7.	State the differences between compaction and consolidation.	2	1	4	1
8.	Define: (i) coefficient of consolidation, (ii) compression index	2	1	4	1
9.	What are Skempton's pore water pressure parameters?	2	1	5	1
10.	Name 3 types of triaxial tests. Which of these tests take maximum time to complete?	2	1	5	1
<b>Part-B (5 × 8 = 40 Marks)</b>					
11. a)	Outline the corrections required for hydrometer analysis and why?	3	2	1	1
b)	A sample of saturated soil has a water content of 25% and a bulk unit weight of 20 kN/m <sup>3</sup> . Demonstrate determination of dry unit weight, void ratio and specific gravity of solids.	5	2	1	1
12. a)	A soil profile consists of a surface layer of sand 3.5m thick (density = 16.5 kN/m <sup>3</sup> ), an intermediate layer of clay 3m thick (density = 19.5 kN/m <sup>3</sup> ) and the bottom layer of gravel 3.5 m thick (density = 19.25 kN/m <sup>3</sup> ). The water table is at the upper surface of the clay layer. Analyze and draw the effective stress at various levels immediately after placement of a surcharge load of 100 kN/m <sup>2</sup> on the ground surface.	5	4	2	1



b)	A constant head permeability test was run on a sand sample 30 cm in length and 20 cm <sup>2</sup> in area. When a loss of head was 60 cm, the quantity of water collected in 2 minutes was 250 ml. Demonstrate determination of coefficient of permeability for the given soil.	3	2	2	1														
13. a)	The following data were recorded while performing a compaction test:	6	3	3	1														
<table border="1"> <tbody> <tr> <td>Water content (%)</td> <td>7.7</td> <td>11.5</td> <td>14.6</td> <td>17.5</td> <td>19.5</td> <td>21.2</td> </tr> <tr> <td>Weight of wet soil W (N)</td> <td>16.67</td> <td>18.54</td> <td>19.92</td> <td>19.52</td> <td>19.23</td> <td>18.83</td> </tr> </tbody> </table>		Water content (%)	7.7	11.5	14.6	17.5	19.5	21.2	Weight of wet soil W (N)	16.67	18.54	19.92	19.52	19.23	18.83				
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Weight of wet soil W (N)	16.67	18.54	19.92	19.52	19.23	18.83													
If the volume of compaction mould is 950 cc, assuming $G = 2.65$ , draw the compaction curve and report MDD and OMC. Solve for the void ratio and degree of saturation corresponding to each water content.																			
b)	A concentrated load of 2000 kN is applied on the ground surface. Demonstrate determination of vertical stress at a point R which is at a depth of 6m but at a horizontal distance of 5m from the axis of the load.	2	2	3	1														
14. a)	A 3m thick clay layer beneath a building is overlain by a permeable stratum and is underlain by an impervious rock. The coefficient of consolidation of the clay was found to be 0.025 cm <sup>2</sup> /min. The final expected settlement for the layer is 8cm. (i) How much time will it take for 55% of total settlement to take place? (ii) Determine the time required for a settlement of 2.5 cm to occur. (iii) Compute the settlement that would occur in 1 year.	5	4	4	1														
b)	Analyze the terms using appropriate plots (i) normally consolidated soil, (ii) over-consolidated soil, (iii) over-consolidation ratio	3	4	4	1														
15. a)	Illustrate the disadvantages of direct shear test?	3	2	5	1														
b)	A saturated specimen of cohesionless sand was tested under isotropically consolidated drained conditions in a triaxial compression test apparatus and the sample failed at a deviatoric stress of 482 kN/m <sup>2</sup> . The angle of shearing resistance is 30°. Solve for the magnitudes of the principal stresses using graphical or analytical methods.  What would be the magnitudes of the deviator stress and the major principal stress at failure for another identical specimen of sand if it is tested under a cell pressure of 200 kN/m <sup>2</sup> ?	5	3	5	1														

16. a)	A dry sand with a specific gravity of 2.65 has a maximum density of 1.866 gm/cc and a minimum density of 1.577 gm/cc. Infer natural density of soil, such that, the filled up sand has a relative density of 40%.	4	2	1	1
b)	Explain factors affecting permeability of soil.	4	2	2	1
17.	Answer any <i>two</i> of the following:				
a)	2 columns A and B are situated 6m apart. Column A transfers a load of 500 kN and column B, a load of 250 kN. Show the resultant vertical stress on a horizontal plane 20m below the ground surface at points vertically below A.	4	2	3	1
b)	The laboratory consolidation data for an undisturbed clay sample are as follows: $e_1 = 1.00$ , effective $\sigma_1 = 85 \text{ kN/m}^2$ , $e_2 = 0.80$ , effective $\sigma_2 = 465 \text{ kN/m}^2$ . Solve for the void ratio for an effective $\sigma_3 = 600 \text{ kN/m}^2$ .	4	3	4	1
c)	A field vane testing instrument having height 100 mm and diameter 50 mm was inserted completely into a deposit of soft, saturated silty clay. Upon application of a rapidly increasing torque about the vane rod, the soil was found to fail when the torque reached 4.6 Nm. Assuming mobilization of undrained shear strength on all failure surfaces to be uniform and the resistance mobilized on the surface of the vane rod to be negligible, solve for undrained shear strength of the soil in $\text{kN/m}^2$ ?	4	3	5	1

M : Marks; L: Bloom's Taxonomy Level; CO; Course Outcome; PO: Programme Outcome

i)	Blooms Taxonomy Level – 1	20%
ii)	Blooms Taxonomy Level – 2	40%
iii)	Blooms Taxonomy Level – 3 & 4	40%

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