

**B.E. CONSTRUCTION ENGINEERING FOURTH YEAR FIRST**  
**SEMESTER EXAM 2024**

**SUBJECT: ADVANCED FOUNDATION TECHNIQUE (HONS.)**

**PART - I ( 50 Marks)**

Use separate answerscripts.

Full Marks :100

	No. of Questions	Answer any TWO questions.	Marks														
CO5	Q1.a)	Which tests are carried out to determine the shear strength of soil? Explain giving suitable example.	05														
	Q1.b)	Distinguish between CU and CD test. State which type of soil are suitable for these tests?	05														
	Q1.c)	For a saturated clay soil, the following are the results of some CD triaxial tests at failure:  <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Test no.</th> <th><math>\bar{\sigma}_3'</math></th> <th><math>\bar{\sigma}_1'</math></th> </tr> </thead> <tbody> <tr> <td>1</td> <td>240.8</td> <td>599.2</td> </tr> <tr> <td>2</td> <td>374.5</td> <td>885.5</td> </tr> <tr> <td>3</td> <td>462</td> <td>1078</td> </tr> <tr> <td>4</td> <td>793</td> <td>1727</td> </tr> </tbody> </table> Draw a $p'$ vs. $q'$ diagram. From that, determine $c$ and $\phi$ of the soil.	Test no.	$\bar{\sigma}_3'$	$\bar{\sigma}_1'$	1	240.8	599.2	2	374.5	885.5	3	462	1078	4	793	1727
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1	240.8	599.2															
2	374.5	885.5															
3	462	1078															
4	793	1727															
CO5	Q2.a)	Which code is followed for liquefaction analysis?	2														
	Q2.b)	State and explain the various steps followed for liquefaction analysis as per this code.	8														
	Q2.c)	At a site, an earthquake of magnitude 7.5 occurred. Results of soil exploration revealed that the bulk density of the top layer upto the depth of 4 m was $18.65 \text{ kN/m}^3$ and the water table existed at a depth of 1.0 m from the ground surface. Field $N_v$ value at a depth of 2.5 m was observed to be 7. Assuming $C_{60} = 1.05$ , $r_d = 1 - 0.000765z$	15														

[ Turn over

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		and $\frac{a_{max}}{g} = 0.36$ , calculate $CSR_{eq}$ at a depth of 2.5 m. Apply the necessary corrections only for hammer energy and overburden on SPT value.	
CO2	Q.3(a)	What are the design guidelines for stone columns? Explain giving suitable sketches.	10
	Q.3(b)	A stone column foundation work is proposed to be conducted for ground improvement work in Haldia for supporting storage tanks of 80m diameter and height 14m. Check the suitability of 800 mm dia. stone columns on a square grid arrangement for this work. The subsoil consists of 10m thick soft clay layer sandwiched between the top desiccated layer and bottom stiff layer. The top desiccated layer extends upto 2.5m below ground level. The storage tank will be water tested to its full depth and will be placed on 1m thick sand layer. Show checks against bearing capacity and settlement. Consider the undrained shear strength of the soft clay layer as 35 kN/m <sup>2</sup> . Assume any suitable data not provided.	15

**B. E. CONSTRUCTION ENGINEERING 4<sup>TH</sup> YEAR 1<sup>ST</sup> SEMESTER – 2024****SUBJECT: ADVANCE FOUNDATION TECHNIQUE**

Time : Three Hours

Full Marks : 100

**Part II ( 50 Marks)**

Question No.		Marks
	<b>Answer question (Q1), question (Q2) and any two from question (Q3), question (Q4) and question (Q5).</b>	
Q1.	Write a shot note on lime stabilization.	10
Q2a.	How one can identify that a soil at a site is expansive or not? How to assess the swelling pressure of an expansive soil?	05
Q2b.	What do zone understand by soil stabilization ? What are the different purposes of soil stabilization ?	05
Q3.	<p>A four storied building with basement is to be constructed at a site. The subsoil condition is presented below.</p> <p style="text-align: center;"> <math>\frac{C_c}{1 + e_0} = 0.13</math>      8.00m  <math>\frac{C_c}{1 + e_0} = 0.16</math>      16.00  <math>\frac{C_c}{1 + e_0} = 0.09</math>      20.00 </p> <p style="text-align: center;">Sand layer</p> <p>The plan area of the basement is 20.0m x 30.0m. The total load on the building from super structure is 30,000kN. Consider another 25% extra load from the basement.</p> <p>What will be the critical depth of excavation ? Assume <math>N_c = 6</math></p> <p>What will be the depth of foundation in case of a floating foundation?</p>	15

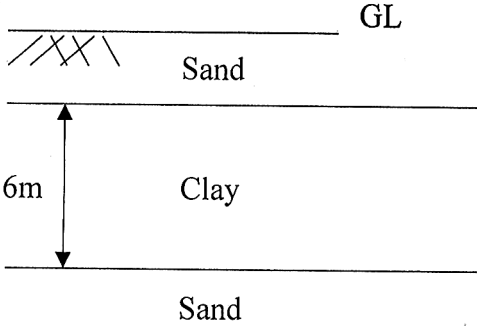
**B. E. CONSTRUCTION ENGINEERING 4<sup>TH</sup> YEAR 1<sup>ST</sup> SEMESTER – 2024**

**SUBJECT: ADVANCE FOUNDATION TECHNIQUE**

Time : Three Hours

Full Marks : 100

**Part II ( 50 Marks)**

Question No.		Marks															
	Calculate the settlements and check for bearing capacity if the depth of foundation is 3.00m below ground level ? Assume (a) Water table at 1.0m below ground level (b) $\mu=0.5$ , Influence Factor $I = 1.20$ , Depth factor = 0.97																
Q4.	<p>During construction of a highway bridge the average permanent load on the clay layer is expected to increase by about 115kN/m<sup>2</sup>. The average effective overburden pressure at the middle of the clay layer is 210 kN/m<sup>2</sup>.</p> <div style="text-align: center;">  </div> <p>Assume <math>c_c = 0.28</math>, <math>e_0=0.9</math> and <math>c_v=0.36\text{m}^2/\text{month}</math>.                      The clay is normally consolidated.                      Determine</p> <ol style="list-style-type: none"> <li>The total primary consolidation settlement of the bridge without pre-compression.</li> <li>The surcharge needed to eliminate the entire primary consolidation settlement in nine months by pre-compression.</li> </ol> <table border="1" data-bbox="359 1646 1332 1881"> <thead> <tr> <th><math>T_v</math></th> <th>U%</th> <th><math>U_{(f+s)}</math></th> <th><math>\frac{\sigma_f}{\sigma'_0}</math></th> <th><math>\frac{\sigma_s}{\sigma_f}</math></th> </tr> </thead> <tbody> <tr> <td>0.30</td> <td>40%</td> <td>45</td> <td>0.548</td> <td>2</td> </tr> <tr> <td>0.40</td> <td>52%</td> <td>50</td> <td>0.548</td> <td>15</td> </tr> </tbody> </table> <p><math>\sigma_f</math> = Foundation pressure  <math>\sigma'_0</math> = Effective overburden pressure  <math>\sigma_s</math> = Surcharge pressure</p>	$T_v$	U%	$U_{(f+s)}$	$\frac{\sigma_f}{\sigma'_0}$	$\frac{\sigma_s}{\sigma_f}$	0.30	40%	45	0.548	2	0.40	52%	50	0.548	15	15
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Q5.	<ol style="list-style-type: none"> <li>What is Geo-synthetics ?</li> <li>What are the different uses of Geo-synthetics?</li> <li>What are the different type of Geo-synthetics ?</li> </ol>	03 06 06															