

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

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Exam : Mid-Semester Examination 8th Sem. (Summer): AY 2022 - 2023
Course Number : CEE 4847 Full Marks: 75
Course Title : Sub-surface Soil Investigation and In-Situ Testing Time: 1.5 Hours

Answer all the questions. Programmable calculators are not allowed. The symbols have their usual meanings. Marks of each question and the corresponding CO and PO are written in brackets. Assume reasonable values for any data not given.

1. (a) What are the main objectives of sub-soil exploration? Discuss briefly. (06)
(CO1, PO1)
- (b) Discuss the key findings of the following steps of preliminary investigation. (06)
i) Reconnaissance (CO1, PO1)
ii) Study of maps
- (c) Explain the factors to be considered in selecting a site for the trial pit method of sub-soil explorations. (06)
(CO1, PO1)
- (d) Consider a rectangular plot of 55m × 40m in size. A 10-storied building with a raft foundation is expected to be constructed. The foundation depth from the ground surface is 3m and the setback is 5m from all sides of the building. Fix the number of boreholes and depth of exploration according to BNBC 2020. Draw the borehole layout plan and show the boreholes' locations if the site is within the Dhaka City Corporation area. Consider that the sub-soil condition of the site is erratic. (07)
(CO1, PO1)
2. (a) Write the advantages and limitations of the vane shear test. (05)
(CO1, PO1)
- (b) Describe with the help of neat sketches the components of a CPT probe. (05)
(CO1, PO1)
- (c) "CPT causes passive failure of soil while advancing" – explain this statement briefly. (06)
(CO1, PO1)
- (d) Using the following CPT data determine the ultimate bearing capacity of a 1.5m long hollow auger bored RCC pile of 1.0m diameter according to Bustamante and Gianeselli's (1982) method. (09)
(CO2, PO2)

Depth from the ground surface	Cone resistance, q_c (MPa)	Soil type
1.5 m	0.35	Clay
3.0 m	0.40	
4.5 m	0.80	
6.0 m	0.75	
7.5 m	1.50	
9.0 m	2.50	Sand
10.5 m	3.20	
12.0 m	4.75	

Depth from the ground surface	Cone resistance, q_c (MPa)	Soil type
13.5 m	6.45	Sand
15.0 m	9.50	
16.5 m	10.55	
18.0 m	17.80	
19.5 m	23.10	
21.0 m	17.40	
22.5 m	13.35	
24.0 m	17.65	

3. (a) Why does it is necessary to make corrections to the field SPT value? Explain different types of corrections for SPT applicable to sandy soil. (08)
(CO1, PO1)

Or

Explain the various causes of SPT corrections. Discuss the step-by-step procedure of SPT corrections.

- (b) How does caving occur during sub-soil exploration? Explain a suitable method of borehole stabilization for a site having caving soil. (08)
(CO1, PO1)

Or

When does the core recovery become low for a good-quality rock layer? Explain the key factors affecting core recovery.

- (c) Given the following SPT data. Determine the length of a bored pile according to the AASHTO method to carry a net applied load of 500 kN. Consider the factor of safety equal to 2.50 and the pile diameter equal to 0.5m. (09)
(CO2, PO2)

Depth (m)	1.5	3.0	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15.0	16.5	18.0	19.5	21.0
SPT (N)	2	3	2	5	7	11	21	27	24	35	42	29	37	48
Soil Type	Clay	Clay	Clay	Clay	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand

Or

- Given the following SPT data. Determine the length of a driven pile for a factor of safety of 3.50 if the net applied load on the pile is 600 kN. Consider the diameter of the pile equal to 0.5m. Follow the BNBC 2020 recommended method. (09)
(CO2, PO2)

Depth (m)	1.5	3.0	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15.0	16.5	18.0	19.5	21.0
SPT (N_{60})	2	3	2	5	7	11	21	27	24	35	42	29	37	48
Soil Type	Clay	Clay	Clay	Clay	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand