UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(TAKE HOME)
SEMESTER I
SESSION 2020/2021

COURSE NAME	:	SOIL MECHANICS AND FOUNDATION
COURSE CODE	:	BNP 20903
PROGRAMME CODE	:	BNB
EXAMINATION DATE	:	JANUARY / FEBRUARY 2021
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

Q1 (a) With a labelled sketch, demonstrate the failure mechanism of a strip footing in dense sand as per Terzaghi's Bearing Capacity Model.

(8 marks)

(b) Referring to the answer in **Q1(a)**, differentiate between 'general shear failure' and 'local shear failure' following the downward movement of the footing under load application. A load – displacement plot would be instructive.

(6 marks)

(c) Settlement analysis of pile groups differs based on the load-bearing mechanism, i.e. whether it is by end-bearing or by frictional resistance. Analyze the key features of both mechanisms with suitable sketches as per Fadum's Chart.

(6 marks)

(d) Calculate the active earth pressure distribution and total active force acting on a 6 m high gravity wall. Note that the water table behind the wall is 2 m below the surface of the sand (γ_b = 18 kN/m^3 and γ_{sat} = 21 kN/m^3). Take K_A = 1/3.

(5 marks)

Q2 (a) With a sketch, briefly analyze lateral load effects on the foundation of a power transmission line.

(6 marks)

(b) Examine the factors pertaining to groundwater level, existing nearby structures and near surface ground conditions for the adoption of deep foundation as a substructure.

(6 marks)

(c) Propose effective protection for the upstream and downstream slopes of an earth dam. Use a labelled sketch to aid in your explanation.

(6 marks)

(d) A 2.5 m wide foundation is to be placed at 2 m depth in a soil of $\gamma = 18$ kN/m^3, $c = 0$ and $\phi = 35^o$. The Bearing Capacity Factors are given as $N_q = 41$, $N_\gamma = 42$ and $N_c = 0$.

Also given. $q_{ult} = qN_q + 0.5\gamma BN_\gamma + cN_c$

(i) Determine the ultimate bearing capacity (q_{ult}) when GWT is at 10 m depth.

(2 marks)

(ii) Determine the ultimate bearing capacity (q_{ult}) when GWT is at ground surface.

(2 marks)

(iii) Comment on the effect of GWT on q_{ult}.

(3 marks)

Q3 (a) Problematic soils can cause difficulties in construction due to the soils' chemical composition and mineralogy. Give **TWO (2)** examples of problematic soils

(4 marks)

(b) Preloading is one of the most effective and economical approaches for improving poor grounds with large consolidation settlement upon loading. With the aid of a sketch, demonstrate how vertical drains and vacuum consolidation can enhance the effectiveness of preloading.

(7 marks)

(c) Vibro-flotation and vibro-replacement are widely used to stabilize loose granular soils. Outline how stabilisation is achieved with these methods.

(6 marks)

(d) Geosynthetics are materials made from various types of polymers. They are incorpoarted with geo-materials such as soils and rocks for stability improvement and deformation control.

(i) Describe the type of geosynthetics suitable for road, working platform and soft subgrade applications.

(2 marks)

(ii) Briefly explain the features that can ensure performance of the geosynthetics mentioned in **Q3(d)(i)**.

(2 marks)

(iii) Analyse **TWO (2)** benefits of soil reinforcement for ground improvement.

(4 marks)

Q4 (a) With a labelled sketch, examine the formation and propagation of a contaminant plume beneath an unlined waste dump.

(10 marks)

(b) Figure out the essentials of an engineered landfill, including key components such as liners and covers, gas and leachate collection systems, as well as post closure care.

(7 marks)

(c) Justify the use of pipelines for transporting slurry waste to the disposal site.

(3 marks)

(d) Assess the options for dealing with a dump site where waste was dumped in the past without adequate barriers, resulting in contaminants entering the surrounding soils and groundwater.

(5 marks)

-END OF QUESTIONS –