BTEC H.N. IN CONSTRUCTION & B.E. (CIV ENG)

Unit Ref No.: 32 F/601/1299

ENG GEOLOGY & SOIL MECHANICS

Edexcel Prog No.

Candidate's Name: ***(LARGE CAPITALS PLEASE)***			
Assessor's Name:	Angelo Filomeno	*Verifier's Name:*	--Phung Luu
Date Assignment brief Internally Verified & Released for distribution:	Verification completed--		
Issue Date:		*Due Date:*	**See Scheme of Work**

Assignments	*Summary of Available Outcomes:*
	LO1. Understand the common rock types, their mode of formation and uses within construction LO2. Be able to classify soil types from the determination of their basic soil properties LO3. Be able to establish the primary design parameters for soils LO4. Be able to analyse the results from common soil tests

Important Information:

Where there is evidence of plagiarism the assignment will be rejected and the candidate will not have an opportunity to re-submit the work. This will, inevitably, jeopardise your chances of completing the unit.

Work that is not handed in on time will not be assessed without an appropriate mitigating circumstances form.

Missing a Practical session will jeopardise your chance of achieving. It will be up to the student to organise alternative practical sessions.

Only the tasks relating to Pass criteria need to be completed successfully to achieve a Pass grade.

*Higher grades can be achieved by displaying higher grade characteristics across most of your work (see appropriate matrix that follows) Further some tasks are more likely to attract higher grades (as noted) and others **must** be completed to achieve higher grade. (as noted)*

FINAL SUMMARY OF ACHIEVEMENT – *(complete as soon as whole criteria met & enter on line)*

criteria	Date achieved	Assessors Signature and relevant comments:
P1		
P2		
P3		
P4		
M1		
M2		
M3		
D1		
D2		
D3		

Candidate's Signature signifying own work	*Date and verifier's Initials if candidate's work has been internally verified*
Dates of Submissions	

Submission to be as agreed with module tutor

The following tasks will enable you to demonstrate learning relevant to this topic, they cover practical, theory and research. You should always refer back to the requirement of the learning outcome criteria when writing up your tasks because your work needs to demonstrate that you can meet the requirement of these criteria. Higher grades can be achieved within the work produced by meeting the higher criteria stipulated in the higher grade matrix which follows.

In order to achieve a **Higher grade** the learner must::	**Indicative characteristics:** The learner's evidence shows (at least one of the characteristics below)	Available in task No:	Example of work required	Tutor to tick if evidence meets criteria
M1. Identify and apply strategies to find appropriate solutions	• effective judgements have been made • complex problems with more than one variable have been explored • an effective approach to study and research has been applied			
M2. Select/design and apply appropriate methods/ techniques	• relevant theories and techniques have been applied • a range of methods and techniques have been applied • a range of sources of information has been used • the selection of methods and techniques/sources has been justified • the design of methods/techniques has been justified • complex information/data has been synthesised and processed • appropriate learning methods/techniques have been applied			
M3. Present and communicate appropriate findings	• appropriate structure and approach has been used • coherent, logical development of principles/concepts for the intended audience • a range of methods of presentation have been used and technical language has been accurately used • communication has taken place in familiar and unfamiliar contexts • the communication is appropriate for familiar and unfamiliar audiences and appropriate media have been used			
D1. Use critical reflection to evaluate own work and justify valid conclusions	• conclusions have been arrived at through synthesis of ideas and have been justified • the validity of results has been evaluated using defined criteria • self criticism of approach has taken place • realistic improvements have been proposed against defined characteristics for success		*Justification of approach used and discussion of error reduction techniques*	
D2. Take responsibility for managing and organising activities	• autonomy/independence has been demonstrated • substantial activities, projects or investigations have been planned, managed and organised • activities have been managed • the unforeseen has been accommodated • the importance of interdependence has been recognised and achieved		*Maps and calculations has been completed without undue reliance on input from tutor.*	
D3. Demonstrate convergent/lateral/ creative thinking	• ideas have been generated and decisions taken • self evaluation has taken place • convergent and lateral thinking have been applied • problems have been solved • innovation and creative thought have been applied • receptiveness to new ideas is evident • effective thinking has taken place in unfamiliar contexts		.	

Outcome: LO1 Understand the common rock types, their mode of formation and uses within construction				
THIS IS A "MUST" To achieve a **PASS** the learner must provide sufficient evidence to demonstrate achievement of all the assessment criteria below.	THESE TASKS HELP YOU PRODUCE THE EVIDENCE: Completing the tasks below will help you meet the criteria for a Pass.	THIS IS AN AID TO ASSESSMENT: This is an indication of topics to be covered	related tasks	Tutor tick if met & comments
LO_1.1. examine modes of formation, engineering descriptions and classifications of common rock types **LO_1.2.** describe the common rock forming minerals and their susceptibility to weathering **LO_1.3.** evaluate the common usage of rock and un-cemented sediments for construction	**Assignment 1:** **Geological formation, classification & nomenclature and usage.** ***Submit/present on:***	*Classification of common rocks*: engineering description of rocks to current codes of practice		
		Mode of formation: petrographic classification of igneous rocks; common stable and unstable minerals; diverse nature of sedimentary rocks; grades of metamorphism		
	In groups of two prepare a seminar paper showing the various stages in the formation of rocks, soils and to what engineering purposes these rocks may be put to. Present this paper to a class of your peers. (Presentation to last 15-20 minutes) Submit the paper, presentation slides and an electronic copy after the presentation. Ensure you cover the aspects indicated in the learning outcome column to the left. The aspects indicated in the column on the right will be used as an aid to assessing your work. *(i.e. mention these aspects in your seminar)*	*Rock and un-cemented sediments for construction use*: common usage of geological materials for construction; characteristics of the main rock and soil deposits which make them suitable/unsuitable for construction use; differences between rock mass and rock material in construction; type and nature of rock discontinuities; characteristics of discontinuities which influence the engineering performance of rock materials		

Outcome: LO2 Be able to classify soil types from the determination of their basic soil properties

THIS IS A "MUST"	THIS IS TO HELP YOU COMPLETE THE ASSIGNMENT	THIS IS AN AID TO ASSESSMENT:	Tutor tick if met
To achieve a **PASS** the learner must provide sufficient evidence to demonstrate achievement of all the assessment criteria below.	Completing the tasks below will help you meet the criteria for a Pass. **Assignment 2: Soil types.** ***Submit/present on:***	*This is an indication of topics to be covered*	& comments

LO_2.1.

produce soil descriptions for in-situ and sampled materials

LO_2.2.

classify soils

LO_2.3.

determine basic soil properties

LO_2.4.

produce calculations and graphs relating to basic soil properties

(a) From experience based in your work place produce a soil description from the results of a trial pit or other excavation OR if you do not have access to excavations, produce a soil description from analysis of a borehole report (*ensure you use technical terms*)

(b) The results of a dry sieve test are as follows:

Sieve size (mm)	14.0	10.0	6.3	5.0	3.35	2.0	1.18	0.6	0.425	3.0	0.212	0.063
Mass Retained (g)	0	3.50	7.60	7.00	14.30	21.10	56.70	73.40	22.20	26.90	18.40	17.50

The mass passing the 0.063 mm sieve was 8.5g and the initial dried mass of the sample was 292.4g.

Plot the grading curve for the soil and determine:

(i) the effective size (D_{10})

(ii) the uniformity coefficient (C_u)

(c) Classify the soil in accordance with the British Soils Classification System.

(d) Describe the three-phase model of a soil.

Soil description and classification: differences between description and classification; classification tests to current codes of practice; liquidity and consistency indices for fine grained soils

Fundamental soil properties: particulate nature of soils; three-phase and two-phase states, calculations for soil density, moisture content, void ratio and degree of saturation;

(e) A soil sample, 10^{-3} m^3 in volume, has a mass of 1.73 kg in its natural state and Its degree of saturation is 61.6%. After oven drying at 105°C the mass of the sample was found to be 1.44 kg.

Find:-
(i) the particle specific gravity
(ii) the natural moisture content
(iii) the void ratio
(iv) the bulk density, and
(v) the dry density.

(f) Explain the importance of moisture content in the context of soil compaction.

(g) In a standard compaction test carried out on a sandy clay soil the following results were obtained:

Bulk Density (kg/m^3)	2019	2085	2111	2118	2099
Moisture Content (%)	12.8	14.2	15.6	16.8	17.8

(i) Plot a graph of dry density against moisture content and hence find the maximum dry density and the optimum moisture content.

(ii) Given that the particle specific gravity is 2.72 plot the 0% and 5% air voids lines and hence determine the air voids content corresponding to maximum dry density.

(h) Explain the significance of each of the following in the context of a soil as an engineering medium:

(i) shrinkage limit
(ii) liquid limit, and
(iii) plasticity index.

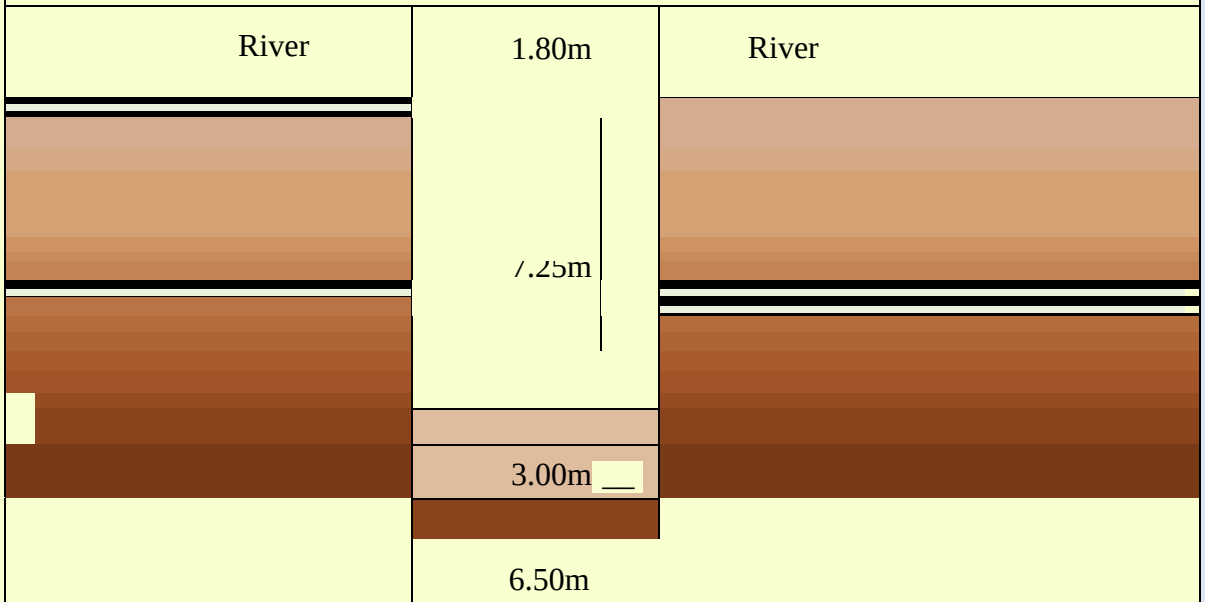
Use diagrams where appropriate.

characteristics of fine grained soil responsible for development of apparent cohesion

(i) The figure below shows the cross section of a long cofferdam into which the flow can be considered two-dimensional. The base of the soil stratum is at a considerable depth. The coefficient of permeability of the soil is 0.015m/s in every direction.

(i) By drawing only the right hand side of the cofferdam to a scale of 1:00 sketch the flow net (to the right of the centre-line only) for this situation.

(ii) Determine the total seepage into the cofferdam (per metre run) if the water level inside is maintained at excavated ground level.



Principles of effective stress: influence on the strength and deformation of soil, drained and undrained behaviour; influence of seepage on effective stress

Calculations and graphs: total stress, pore water pressure and effective stress for soil sequence under hydrostatic conditions

Outcome LO3 Be able to establish the primary design parameters for soils

THIS IS A "MUST" To achieve a **PASS** the learner must provide sufficient evidence to demonstrate achievement of all the assessment criteria below.	THIS IS TO HELP YOU COMPLETE THE ASSIGNMENT Completing the tasks below will help you meet the criteria for a Pass. **Assignment 3: Soil design parameters** ***Submit/present on:***	THIS IS AN AID TO ASSESSMENT: This is an indication of topics to be covered	
LO_3.1. explain the measurement of geotechnical design parameters **LO_3.2.** discuss the methods of ground investigation and/or in-situ sample acquisition and testing **LO_3.3.** carry out laboratory measurements on soils	**(a)** Explain the various methods used to obtain soil samples and discuss the in-situ tests that can be applied. Further, discuss the various stages involved in the analysis of a soil sample for the purpose of classification and obtaining soil properties which can be used in design work. **(b)** Describe a laboratory experiment you have performed as part of this course to Your answer should include reference to the following: (i) the procedure (ii) the treatment of the results (iii) a diagram of the apparatus used (iv) sources of error.	*Geotechnical design parameters: common methods for the determination of shear strength, compressibility and permeability to current codes of practice; potential limitations associated with the methods* *Ground investigation and in-situ sampling: current techniques for the acquisition of soil samples for laboratory testing; impact of sample quality on measured parameters; common methods of in-situ testing Laboratory measurements: eg density, moisture content, void ratio, degree of saturation, permeability, porosity, shear strength, liquid limit, chemical nature*	

Outcome LO4 Be able to analyse the results from common soil tests

THIS IS A "MUST" To achieve a **PASS** the learner must provide sufficient evidence to demonstrate achievement of all the assessment criteria below.	THIS IS TO HELP YOU COMPLETE THE ASSIGNMENT Completing the tasks below will help you meet the criteria for a Pass **Assignment 4: Analyse test results** ***Submit/present on:***	THIS IS AN AID TO ASSESSMENT: This is an indication of topics to be covered	tick if meets requirements
LO_4.1. evaluate laboratory data to determine shear strength parameters using current codes of practice **LO_4.2.** carry out permeability and one-dimensional consolidation tests	(a) Discuss the factors that affect the shear strength of a soil. (b) Undrained tests carried out on a 60mm x 60mm x 20mm specimen of sandy clay in a shear box gave the following results: Normal Load (N) 200 400 800 Shear Load at Failure (N) 194 244 345 (i) Determine the undrained values of cohesion (c) and angle of internal friction (Φ) for this soil. (ii) What value of shear strength would apply on a horizontal plane 8m below the surface in a soil having an average unit weight of 18.6kN/m^3, assuming the condition on site are similar to those of the test.	*Laboratory data: shear box tests; volumetric response to shear; unconsolidated undrained and consolidated undrained with pore pressure measurement triaxial tests; triaxial shear strength parameters by Mohr's Stress Circles and stress path methods* *Permeability tests: constant head and falling head permeometers; process results from field pumping tests (in terms of coefficient of permeability and radius of the cone of depression)*	

	(c) Explain why a knowledge of the in-situ permeability of a soil is important. (d) For an in-situ determination of soil permeability a well was sunk through a horizontal layer of sand, 14.4 m thick, which was resting on top of a stratum of clay. Two observation wells were sunk 16m and 34m, respectively, from the pumping well. The water table was initially 2.2 m below ground level. When water was pumped from the pumping well at a steady rate of 925×10^{-3} m^3/minute the drawdowns in the observation wells were found to be 2.47 m and 1.16 m respectively. Calculate the coefficient of permeability of the sand.	*One-dimensional consolidation test: oedometer tests for coefficient of volume compressibility*	

REFERAL

Work not meeting the minimum requirement for pass grade will be referred back to the learner who will have TWO weeks to rectify any shortcoming. Higher Grade can only be obtained at first attempt.

REFERENCE GUIDANCE:

M.J. Smith – *Soil Mechanics*- Godwin Study Guides 4th Ed(Longmans Scientific & technical - 1994)
Ian Smith –*Smith's Elements of Soil Mechanics* –8th Ed (Blackwell Publishing – 2006)
Blyth et al -- A geology for Engineers ---0 7131 2882 8
Lisle R. J.--- Geological structures & Maps ----0 7506 2588 0

IN ADDITION TO THIS ENSURE YOU MAKE USE OF ALL PRESENTATION SLIDES AND OTHER ELECTRONIC SOURCES AVAILABLE ON THE WEBSITE: www. angelofilomeno.com

SOILS FORMULAE

(With the usual notation)

1. Moisture Content = $\frac{\text{Mass of Water}}{\text{Mass of Solids}}$

2. Voids Ratio = $\frac{\text{Volume of Voids}}{\text{Volume of Solids}}$

3. $A_V = V_A / V$

4. $S_r = V_W / V_V$

5. $\rho_B = \rho_W \cdot \frac{G_S + e\,S_r}{1 + e}$

6. $mG_S = e.\,S_r$

7. Pressure at depth in a soil $= h \cdot \rho \cdot g$

8. $\rho_D = \rho_B / (1 + m)$

9. $\rho_D = \rho_W \,.\, G_S \,. \dfrac{}{1 + mG_S}$

10. $k = \dfrac{q}{\pi (h_2^2 - h_1^2)} .\log_e (r_2 / r_1)$

11. $\tau = \sigma_n \,.\, \tan \phi + c$

Where appropriate use the following data: $g = 10\ m/s^2$ and $\rho = 1000\ kg/m^3$