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Family Name					
Given Name/s					
Student Number					
Teaching Period	Semester 1, 2019				

ENG311 – Geomechanics	DURATION	
	Reading Time:	10 minutes
	Writing Time:	120 minutes
INSTRUCTIONS TO CANDIDATES		
Answer all questions If necessary make appropriate assumptions and state the assumptions		
EXAM CONDITIONS		
<u>You may begin writing from the commencement of the examination session.</u> The reading time indicated above is provided as a guide only.		
This is a CLOSED BOOK examination		
Any non-programmable calculator is permitted		
No handwritten notes are permitted		
No dictionaries are permitted		
ADDITIONAL AUTHORISED MATERIALS	EXAMINATION MATERIALS TO BE SUPPLIED	
No additional printed material is permitted	1 x 16 Page Book	

**THIS EXAMINATION IS PRINTED
DOUBLE-SIDED.**

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Section A (Each question worth 4 marks)

Attempt all questions

1. Differentiate between Rankine theory of earth pressure and the Coulomb's theory of earth pressure.
2. Differentiate between active earth pressure and passive earth pressure.
3. Discuss the possible failure modes for rigid retaining walls.
4. What are the properties of soil, which contribute towards the Bearing capacity of soil?
5. What is the effect of tension crack on to stability of slope?
6. Briefly discuss Bishop's simplified method of slices.
7. When do we use pile foundations compared to shallow foundations?
8. Taylor's Stability number is defined as $N_S = \gamma h / c_{u, \text{mob}}$. Explain the usage of the number.
9. What are the different kind of stabilisation you can employ for ground improvement?
10. What is negative skin friction in relation to a pile?

Section B (Each question worth 15 marks)

Attempt all questions

1.

Series of samples from normally consolidated clay was subjected to consolidated undrained triaxial tests. Results as below.

Cell pressure kPa	Deviator pressure at failure kPa	Pore pressure at failure kPa
205	115	110
410	240	220
600	350	320

With the aid of Mohr, circles for effective stress find the value of ϕ .

2.

For a certain soil the cohesion is 67kN/m^2 , the unit weight is 20.40 kN/m^3 and the coefficients are $N_c = 5.14$, $N_q = 1$ and $N_\gamma = 0$. Calculate the net ultimate bearing capacity for a strip footing of width $B = 1.0\text{ m}$, at a depth $z = 6.0\text{m}$.

Considering shear failure only, calculate the safe load on a strip of wall footing 1 m wide, using a load factor of 3.0 .

3.

A retaining wall 7.25 m high with vertical earth face supports sandy soil of specific weight 17.5kN/m^3 angle of shearing resistance 35° , overlying saturated sandy clay of specific weight 19.2 kN/m^3 , angle of friction 30° , and cohesion 16.6 kN/m^2 . The ground water level is at the upper surface of the sandy clay. Make a sketch of the distribution of active pressure on the wall stating the principal values.

4.

a. Explain the principals involved in the design of a pile foundation.

b. Explain Cullman's graphic solution to determine the earth pressure.

Useful Formulae and Table:

$$K_a = (1 - \sin\phi) / (1 + \sin\phi)$$

$$K_p = (1 + \sin\phi) / (1 - \sin\phi)$$

$$K_o = 0.44 + 0.0042PI$$

$$N = \gamma H / c_{u.mob}$$

$$q_{ult} = 1.3cN_c + \gamma_1 D_f N_q + 0.4B\gamma_2 N_\gamma$$