UNIVERSITY OF LONDON

B.Sc. (ENGINEERING) EXAMINATION 1964

PART III

for Internal and External Students

(22) GEOLOGY AND SOIL MECHANICS

Monday 15 June: 2.30 to 5.30

Answer SIX questions only, THREE from Section A and THREE from Section B.

Section A

Use a separate answer-book and write 'Section A' on the cover.
Illustrate your answers by sketches where possible.

1. Write notes on four of the following:
(*a*) perched water tables, (*b*) hardness of water, (*c*) longshore drift, (*d*) suspension load of rivers, (*e*) boulder clay, (*f*) sand dunes, (*g*) landslips.

2. Describe the geological factors which should be taken into account in selecting sites for dams.

3. Write a short essay on faults, stressing, in particular, their possible significance to the civil engineer.

4. Give an account of the factors affecting the stability of hill slopes. Discuss how these are taken into consideration in the foundation of buildings and how the study of unstable structures in nature may be applied to problems of stability which are produced artificially.

5. Compare and contrast the properties that are sought in the selection of (*a*) building-stone (*b*) roadstone (*c*) aggregate for concrete.

Turn over

RP 64/127/28/350

Section B

Answer THREE questions.
Use a separate answer-book and write 'Section B' on the cover.

6. A foundation slab rests on a bed of compact sand which extends to a depth of 15 ft below the bottom of the slab. Under the sand there is a stratum of saturated clay 20 ft thick, which in turn rests on impermeable rock.
The initial effective overburden pressure at the top of the clay layer is 0·6 tonf/ft^2 and the additional pressure due to the weight of the structure is 0·8 tonf/ft^2 and 0·1 tonf/ft^2 at the top and bottom of the clay stratum respectively. The variation of pressure due to the applied load across the clay layer is linear. Ground water level is within the sand bed. The average density of the clay layer is 120 lb/ft^3, and the following results were obtained from an oedometer test:

Effective pressure tonf/ft^2	Void ratio e
0·5	0·93
1·0	0·91
2·0	0·88
4·0	0·85

Estimate the final settlement of the structure due to consolidation of the clay stratum.

7. A layer of soft saturated clay (γ = 100 lb/ft^3) 15 ft thick overlies a sand layer. The clay is in equilibrium under its own weight and ground water level is at the surface. The water level in the sand is reduced, by pumping to atmospheric pressure and this condition is maintained until equilibrium is again achieved.
Calculate and draw diagrams showing the distribution of pore water pressure and vertical effective stress through the clay layer before and after pumping. Sketch in the distribution of these quantities at a few intermediate times. Assume that there is sufficient rainfall to prevent capillary tensions forming at the surface of the clay.
If no rainfall occurs, how will the distribution of pore water pressure during and after pumping be modified?

8. The borehole records A and B shown in Figure 1 are typical of those submitted to a consulting engineer following a site investigation for a building 50 ft long and 35 ft wide. Some time after the erection of the building the front wall of the building moved horizontally 4 in and settled vertically 5 in. What are your comments and observations on these borings?

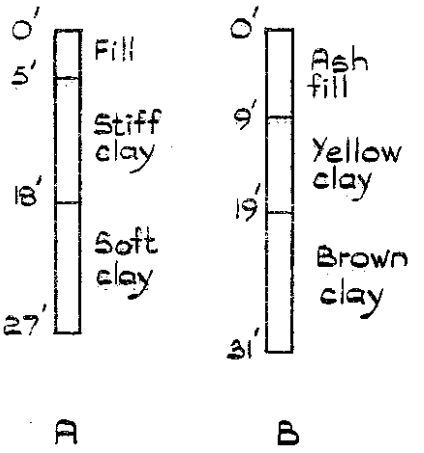

Figure 1

9. Explain what is meant by:
(*a*) a normally consolidated clay stratum,
(*b*) an overconsolidated clay stratum.
Is it possible for a normally consolidated stratum to be overlain by an overconsolidated stratum? Give reasons for your answer. Sketch curves showing typical variations with depth in (*a*) a normally consolidated clay stratum and (*b*) in an overconsolidated clay stratum, of the following quantities:
(*i*) water content,
(*ii*) undrained shear strength,
(*iii*) coefficient of compressibility.
Assume that the Atterberg limits of the clay do not vary with depth.

10. A retaining wall 20 ft high, with earth face vertical, supports cohesionless soil of dry density 100 lb/ft^3, angle of internal friction 30° and void ratio 0·70. The surface of the soil is horizontal and level with the top of the wall.
Neglecting wall friction determine the total earth thrust on the wall per linear foot
(*a*) when the soil is dry, and
(*b*) when owing to inadequate drainage the soil is water-logged up to a level 5 ft below the surface.
Find also at what heights above the base of the wall the thrusts act.

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