

**FEDERAL UNIVERSITY OF TECHNOLOGY, OWERRI**  
**SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY (SEET)**  
**DEPARTMENT OF CIVIL ENGINEERING**  
**HARMATTAN SEMESTER** **2018/2019 SESSION**  
**COURSE: CIE431-SOIL MECHANICS II**  
**INSTRUCTION: ANSWER TWO QUESTIONS FROM EACH SECTION**  
**TIME: 3 HOURS**

**SECTION A**

**Q1. a)** Write down the soil and loading conditions that the results of the following triaxial tests apply:

- i) Unconsolidated undrained test.
- ii) Drained test.

**b)** Write down the shear strength parameter that cannot be obtained from the following field tests:

- i) Field Vane Shear test.
- ii) Unconfined Compression test.

**c)** Define the following:

- i) Critical Density
- ii) Critical Void ratio
- iii) Ultimate Strength

**Q2. a)** Explain the term 'Sensitivity of Clays' and relate it to the accuracy of efforts in obtaining undisturbed samples from the soil (site).

**b)** Explain the following:

- i) Overburden Pressure.
- ii) Effective Overburden.
- iii) Preconsolidation Pressure.
- iv) Over-consolidation Ratio.

**c)** Describe/illustrate the behaviour of a normally consolidated clay specimen during the consolidation stage of a triaxial test.

**Q3. a)** Write down the shapes of loaded area (foundation) and the kind of load distribution that apply to the following methods of obtaining/calculating the vertical stress at any depth  $z$  below a foundation.

i) Boussinesq's formulae. ii) Fadum's charts. iii) Newmark's chart.

**b)** How will you determine the vertical stress at a depth of 5m below a pile carrying a load of 60KN?

**c)** Write down the laboratory and field tests you can use to obtain the modulus of elasticity  $E_s$  of a soil for use in determining immediate elastic settlements of the soil.

**d)** Write the equation for determining the immediate elastic settlements of a flexible footing on a layered soil.

**e)** Explain the terms contained in the equation in 3(d) above.

**SECTION B**

**Q4. a)** List five clay minerals and briefly explain each.

**b)** Differentiate between the following:

- i) Cohesive and Cohesionless soils
- ii) Chemical and Mechanical stabilisation
- iii) Soil compaction and soil consolidation

**c)** Determine the permeability of the soil in mm/s if the following data were obtained from a falling head permeameter test on an undisturbed soil sample: