

**FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA**  
**SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION**  
**DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY EDUCATION**  
**SECOND SEMESTER EXAMINATION 2019/2020 SESSION**

**Course Code: ITE 225. Course Title: Electrostatic and Electromagnetism**

**Instruction: Answer three questions only. Time: 2 hours**

1a. State the two laws of Electrostatics

1b. State 5 applications of Electrostatics

1c. Two aluminum balls A and B have their centres separated by 50cm. If the charge on each ball is  $6.5 \times 10^{-7} \text{C}$ , what is the mutual force of repulsion between them? The radii of the balls are negligible compare to the distance of separation. What will be the magnitude of force if the two balls are placed in water? (Dielectric constant of water = 80)

2a. What is Electrostatic?

2b. Mention 5 properties of Electromagnetic Line of Force

2c. A ceramic capacitor has an effective plate area of  $4 \text{cm}^2$  separated by 0.1 mm of ceramic of relative permittivity 100. Calculate the capacitance of the capacitor in picofarads. (b) If the capacitor above is given a charge of  $1.2 \mu\text{C}$  what will be the pd between the plates?

3a. Mention and explain the factors that affect capacitance of capacitor

3b. Define the following terms as they relate to capacitor

(i). Capacitance

(i). Breakdown voltage

(ii). Tolerance

3c. Capacitances of  $3 \mu\text{F}$ ,  $6 \mu\text{F}$  and  $12 \mu\text{F}$  are connected in series across a 350 V supply. Calculate (a) the equivalent circuit capacitance, (b) the charge on each capacitor and (c) the pd across each capacitor.

4a. Mention 5 methods of maintaining permanent magnets

4b. Explain the following terms and state their unit of measurement where applicable

i. Permanent magnet ii. Magnetic flux iii. Magnetic neutral axis iv. Magnetomotive force.

v. magnetic field strength.

4c. The maximum working flux density of a lifting electromagnet is 1.8 T and the effective area of a pole face is circular in cross-section. If the total magnetic flux produced is 353mWb, determine the radius of the pole face.

5a. State Faraday's Laws of Electromagnetic Induction

5b. In a tabular form, state 5 similarities and 5 differences between magnetic circuit and electric circuits

5c. An electromagnetic contactor has a magnetic circuit length of 250mm and a uniform cross-sectional area of  $400 \text{mm}^2$ . Calculate the number of ampere-turns required to produce a flux of  $500 \mu\text{wb}$ . Given that the relative permeability of the material under this condition is 2500