

**NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY**

FACULTY OF HEALTH, APPLIED SCIENCES AND NATURAL RESOURCES

DEPARTMENT OF NATURAL AND APPLIED SCIENCES

QUALIFICATION: BACHELOR OF SCIENCE	
QUALIFICATION CODE: 07BOSC	LEVEL: 6
COURSE CODE: EAM601S	COURSE NAME: ELECTRICITY AND MAGNETISM
SESSION: JULY 2022	PAPER: THEORY
DURATION: 3 HOURS	MARKS: 100

SUPPLEMENTARY/SECOND OPPORTUNITY EXAMINATION QUESTION PAPER	
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INSTRUCTIONS
<ol style="list-style-type: none">1. Write all your answers in the answer booklet provided.2. Read the whole question before answering.3. Begin each question on a new page.

PERMISSIBLE MATERIALS

Scientific Calculator

THIS QUESTIONS PAPER CONSISTS OF 7 PAGES (Including this front page)

SECTION A

QUESTION 1

[30]

Short Answer Question Types: Each question in this section carries two marks

- 1.1 Gold leaf electroscope consists of the following except; (2)
- a. insulating plug b. brass disc c. earth metal case
 - d. constantan wire.
- 1.2 On a conductor, the greatest concentration of charges is at. (2)
- a. the conducting surface b. the insulating stand c. the sharpest point
 - d. inside the conductor.
- 1.3 The concentration of charge on a conductor is such that its strength is $6\mu C$ and the surface area is $3\mu m$. What is its surface density? (2)
- a. $3.0 C/m$ b. $2.0 C/m$ c. $0.5 C/m$ d. $2.5 C/m$
- 1.4 The mathematical statement of coulomb's law is that; (2)
- a. $F \propto \frac{q_1q_2}{r}$ b. $F = \frac{q_1q_2}{r^2}$ c. $F = \frac{q_1q_2}{4\pi\epsilon_0 r}$ d. $F = \frac{q_1q_2}{4\pi\epsilon_0 r^2}$
- 1.5 The following factors affect capacitors except; (2)
- a. separation, d between the capacitors b. area of the capacitors
 - c. resistivity of the capacitors d. nature of the separating medium.
- 1.6 The parallel plates of an air-filled capacitor are everywhere 1.0 mm apart. What must the plate area be if the capacitor is to be 1.0 F? (2)
- a. $1.1 \times 10^8 m^2$ b. $1.2 \times 10^8 m^2$ c. $1.3 \times 10^8 m^2$ d. $1.4 \times 10^8 m^2$

- 1.7 A work of 30J is done in transferring 5 mC of charge from a point B to a point A in an electric field. Calculate the potential difference between A and B. (2)
a. 60 V b. 6000 V c. 600 V d. 6 V
- 1.8 The instrument used in the measurement of current is (2)
a. voltmeter b. wheatstone bridge c. potentiometer d. ammeter
- 1.9 The space around a magnet where magnetic influence is felt is called _____. (2)
a. magnetic field b. magnetic strength c. magnetic space
b. magnetic region
- 1.10 Magnetic lines of force can be trace using one of the following; (2)
a. magnetic flux b. magnetometer c. magnetic filling d. iron filling
- 1.11 Which of the following is a magnetic material (2)
a. mood b. Iron c. rubber d. glass
- 1.12 All the followings are properties of magnetic lines of force except. (2)
a. line of force do not intercept
b. lines of force are imaginary lines
c. lines of force are perpendicular to each other
d. lines of force are uniformly spaced in a uniform magnetic field.
- 1.13 All the followings are example of ferromagnetic substances except; (2)
a. iron b. steel c. nickel d. aluminum
- 1.14 The S.I unit of magnetic flux density is; (2)
a. weber b. tesla c. henry d. farad

- 1.15 The ability of one coil to induce current in the nearby coil by the phenomenon of induction when the current in the first coil changes is called. (2)
- a. self-induction b. mutual induction c. electromagnetic induction d. induction.

SECTION B

QUESTION 2

[15]

- 2.1 Define electromotive force. (2)
- 2.2 What did you understand by the term electric potential energy? (2)
- 2.3 Derive the equation for electric field at a point near a large charge plane. (3)
- 2.4 An electron is placed at the center of a large metal plate, which carries a negative charge and is accelerated towards nearby position plate at $2.0 \times 10^{15} \text{ m.s}^{-2}$. Both plates have charge densities of same size. What is the value? (8)

QUESTION 3

[15]

- 3.1 Define the capacitance of a capacitor. (2)
- 3.2 State three applications of capacitors in an electrical circuit. (3)
- 3.3 Derive a formula for the energy W stored in a charged capacitor of capacitance C carrying a charge Q on either plate. (5)
- 3.4 A meter sphere mounted on an insulating rod carries a charge of 6nC when its potential is 200 V higher than its surroundings. What is the capacitor formed by the sphere and its surroundings? (5)

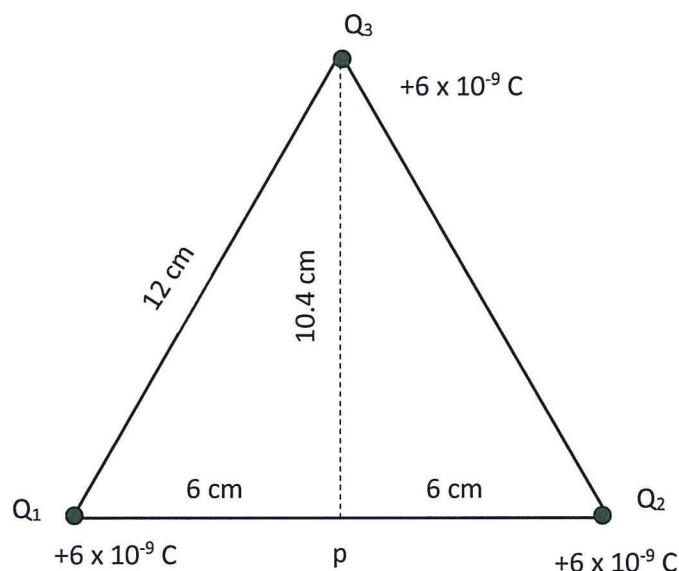
QUESTION 4**[15]**

4.1 Define the electronvolt. (2)

4.2 State Ohm's law of electricity (3)

4.3 List any three laws of resistance in parallel. (3)

4.4 Three equal charges of $+6 \text{ nC}$ are located at the corners of an equilateral triangle whose sides are 12 cm long, as shown below. Find the potential at the center of the triangle. (7)

**QUESTION 5****[15]**

5.1 State Faraday's second law of electromagnetic induction. (2)

5.2 What are the factors affecting the strength of an induced current? (3)

(i) The number of turns in the coil.

- (ii) The strength of the magnet.
- (iii) The speed with which the magnet is plunged in the coil.

5.3 Write down the equation for Biot-Savart's law and define the various parameters. (4)

5.3 Briefly explain the following magnetic properties.

- (i) Paramagnetic Substance. (3)
- (ii) Diamagnetic Substance. (3)

QUESTION 6 [10]

6.1 Define the following terms: (2)

- (i) Reactance
- (ii) Impedance.

6.2 What do you understand by the term resonance frequency in an ac circuit? (3)

6.3 An ac voltage of amplitude 2.0 V is connected to an RLC series circuit. If the (5)

resistance in the circuit is 5.0Ω and the inductance and capacitance are 3.0 mH and $0.05 \mu\text{F}$ respectively, calculate:

- (i) The resonance frequency
- (ii) The maximum ac current at resonance.

END!