COMMANDER (handwritten)

KWASU
Skills & Integrity

2015/2016 HARMATTAN SEMESTER EXAMINATIONS
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
GET 201: APPLIED ELECTRICITY I

SATURDAY, NOVEMBER 28, 2015

EXAMINATION TIME: 08:30A.M – 11.00AM   TIME ALLOWED: $2\frac{1}{2}$ HOURS

INSTRUCTIONS: Answer any TWO questions in each section. Each section is to be answered on separate booklet.

(YOU ARE REQUIRED TO FILL IN YOUR PARTICULARS HERE AND ON THE ANSWER BOOKLET)

MATRICULATION NUMBER: —15D/67CE/162——

· COLLEGE: --

DEPARTMENT: --

DEGREE PROGRAMME: --

PLEASE TURN OVER ONLY WHEN INSTRUCTED TO START BY THE INVIGILATOR

1. (a.) State Kirchhoff's Voltage and current laws.

(2 Marks)

(b.) Briefly explain the term *permittivity of free space*, which is represented as ϵ_0. (3 Marks)

(c.) Determine the current in 8Ω resistor in Figure Q1 below, using (i) Thevenin's theorem and (ii) Norton's theorem

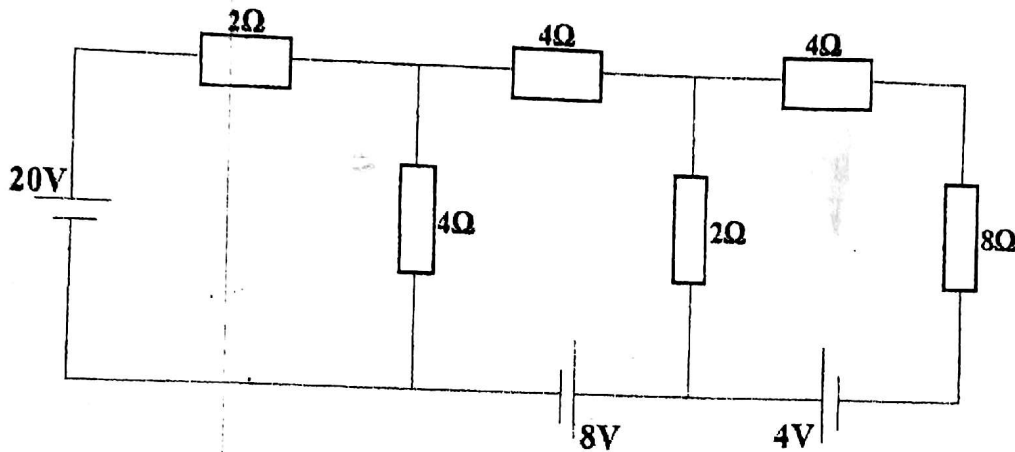

Fig.Q1   (10 Marks)

2. (a.) An insulant is called a _____

(2 Marks)

(b.) Define the *time constant* of a circuit that includes a resistor and capacitor connected in series.

(2 Marks)

(c.) A capacitor in Figure Q2 below consists of two metal plates, each 600 × 600 mm, spaced 10 mm apart. The space between the metal plates is filled with a glass plate 8 mm thick and a layer of paper 2 mm thick. The relative permittivities of the glass and paper are 8 and 2 respectively. Calculate

(i.) the capacitance, neglecting any fringing flux, and   (4 Marks)

(ii.) the electric field strength in each dielectric in kilovolts per millimetre due to a p.d. of 10kV between the metal plates.   (7 Marks)
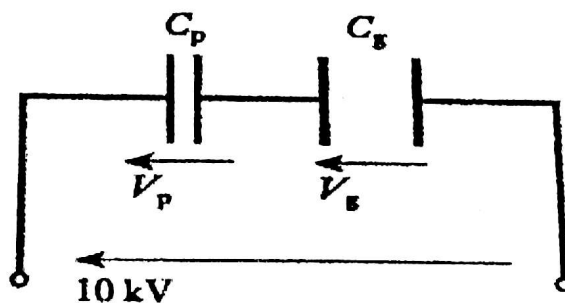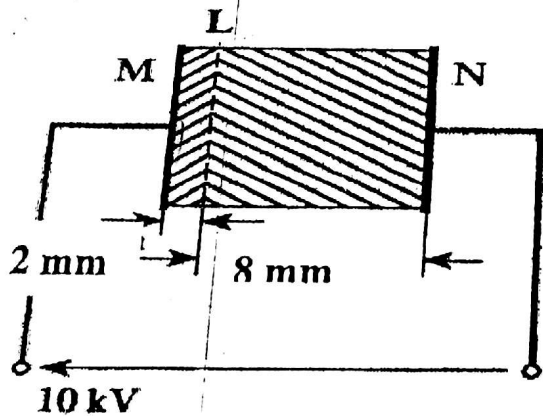

Fig. Q2

3. (a.) Figure Q3a below shows that the capacitor charge and discharged through a resistor, prove that the instantaneous charging current will be $i = I e^{-t/RC}$.

Where I is the initial value of current, C is the capacitor, R is the resistor and t is the time taken.
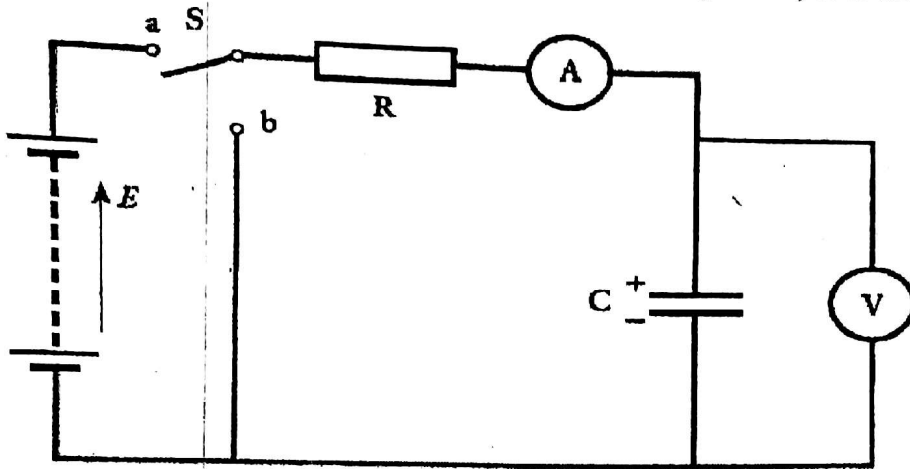

Fig. Q3a   (5 Marks)

(b.) Calculate the current in each resistor of the network shown in Figure Q3b below using Kirchhoff's current law and Kirchhoff's voltage law.
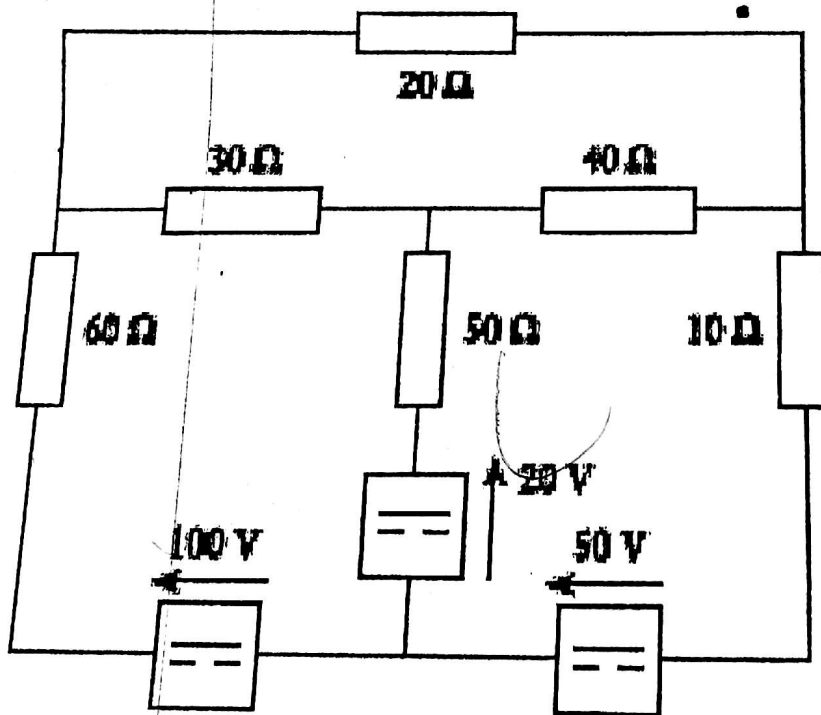

Fig. Q3b   (10 Mark

3

THE PENALTY FOR EXAMINATION MALPRACTICE IS DISMISSAL

SECTION B

4. (a.) Answer the following;

    i.   The reciprocal of **impedance** is called _____.

    ii.   _____ is a complementary measure that shows how much a circuit allows current to flow.

    iii.   What is a transducer?

                                    (4 marks)

(b.) A coil having a resistance of 7Ω and an inductance of 31.8mH is connected to 230V, 50Hz supply. Calculate; (i) The circuit current (ii) Phase angle (iii) Power factor (iv) Real power consumed (v) Apparent power

                                    (5 marks)

(c.) In a Wheatstone bridge PQRS, a galvanometer is connected between Q and S and a voltage source between P and R. An unknown resistor Rx is connected between P and Q. When the bridge is balanced, the resistance between Q and R is 200Ω, that between R and S is 10Ω and that between S and P is 150Ω. Draw the circuit and calculate the value of Rx. **(6 marks)**

5. (a.) Answer the following;

    i.   The symbol for **conductance** is _____.

    ii.   Write the expression for conductance in terms of resistance and reactance.

    iii.   Show the various inputs of a transducer and their relationship with the output on a simple diagram.

                                    (3 marks)

(b.) A 200V, 50Hz, inductive circuit takes a current of 10A, lagging 30°. Find;

(i.) The resistance (ii.) Reactance (iii.) Inductance of the coil (iv.) Real power

(v.) Reactive power

                                    (5 marks)

(c.) A Maxwell bridge circuit ABCD has the following arm impedances: AB, 250Ω resistance; BC, 15 μF capacitor in parallel with a 10 kΩ resistor; CD, 400Ω resistor; DA, unknown inductor having inductance L and resistance R. Draw the circuit, and determine the values of L and R assuming the bridge is balanced. **(7 marks)**

6. (a.) Answer the following;

    i.   If a circuit's total **admittance** <u>increases</u> while the source voltage is held constant, then the circuit's total **current** _____.

    ii.   State the use of AC bridges

    iii. Write what the following transducers measure.

Linear Voltage Displacement Transducer (LVDT)

Piezoelectric

Thermocouple

Tachometer

Potentiometer   **(7 marks)**

(b.) A capacitor of capacitance $79.5\mu F$ is connected in series with a non-inductive resistance of 30Ω across a $100V$, $50Hz$ supply. Find; (i.) Impedance (ii.) Current (iii.) Phase angle (iv.) Equation for the instantaneous value of current (v.) Apparent power   **(5 marks)**

(c.) For the a.c. bridge shown in Figure Q6c below, determine the values of the inductance and resistance of the coil when $R1 = R2 = 400\Omega$, $R3 = 5\ k\Omega$ and $C = 7.5\ \mu F$
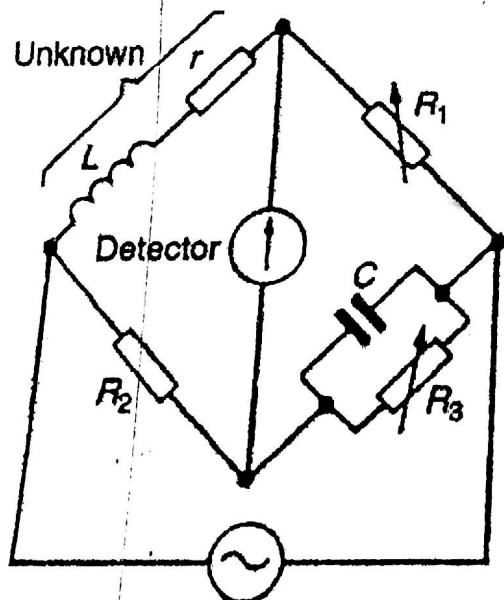

Fig. Q6c   **(3 marks)**