SECTION B: ELECTRICAL PRINCIPLES

Answer at lease TWO questions from this section.

5. (a) Define the following electrical quantities stating the units used in each case :

    (i) current;

    (ii) power.
    (4 marks)

    (b) Three resistors of 10, 12 and "X" ohms are connected in parallel across a current source of 8 A. If the "X" resistor draws 2.5 A, determine its resistance. (6 marks)

    (c) The power drawn by a resistive copper coil of 100 V and 20° C is 220 W. If the temperature coefficient of resistance of copper is 0.00393, determine the power consumed by the coil at 115 V and 100° C. (4 marks)

    (d) Figure 1 shows a resistive network circuit. Using Kirchoff's law, determine the current flowing through the 2 ohm resistor. (6 marks)
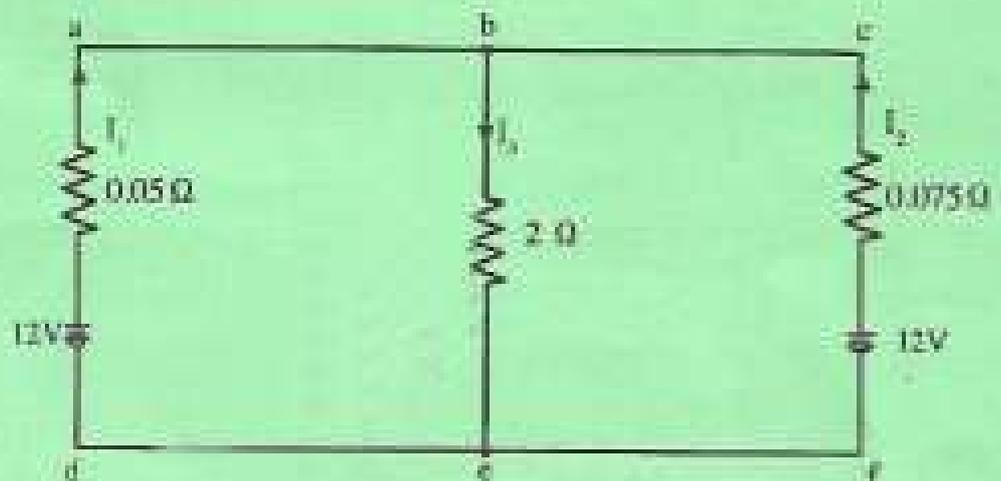

Fig. 1

6. (a) State two areas of application of

    (i) series wound motor;

    (ii) shunt wound motor.
    (4 marks)

    (b) A coil having a resistance of 4 Ω and inductance of 9.55 mH is connected across a 240 V, 50 Hz supply. Determine the:

    (i) reluctance of the coil;

    (ii) impedance of the circuit;

    (iii) current flowing through the coil;

    (iv) phase angle between supply voltage and current. (12 marks)

APPLIED SCIENCE AND
ELECTRICAL PRINCIPLES
June/July 2017
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

CRAFT CERTIFICATE IN MOTOR VEHICLE TECHNOLOGY

MODULE I

APPLIED SCIENCE AND ELECTRICAL PRINCIPLES

3 hours

INSTRUCTIONS TO CANDIDATES

You should have a Scientific calculator for this examination.
The paper consists of TWO sections; A and B.
*Answer FIVE questions in the answer booklet provided by choosing at least TWO questions
from each section.*
All questions carry equal marks.
Maximum marks for each part of the question are indicated.
Candidates should answer all questions in English.
Take:

$\mu_o = 4\pi \times 10^{-7} \, H/M$

$\varepsilon_o = 8.85 \times 10^{-12} \, F/m$

$g = 9.81 \, m/s^2$

This paper consists of 5 printed pages.

Candidates should check the question paper to ascertain that
all the pages are printed as indicated and that no questions are missing.

Turn over

3. (a) Define the following terms:

   (i) latent heat of vaporization;
   (ii) relative density;
   (iii) pressure.

   (3 marks)

   (b) (i) State Archimedes's principle.

   (ii) A body weighs 2.76 kN in air and 1.925 kN when completely immersed in water of density 1000 kg/m³. Determine:

   (I) the volume of the body;
   (II) the velocity of the body;
   (III) the relative density of the body.

   (12 marks)

   (c) With the aid of a diagram, explain the principle of operation of a simple barometer.

   (5 marks)

4. (a) Define the following terms as used in lenses:

   (i) focal point;
   (ii) focal length.

   (2 marks)

   (b) (i) State two laws of reflection.

   (ii) A converging lens of focal point 20 cm is placed 37 cm in front of the screen. Determine the position of the object if its image is to appear on screen.

   (6 marks)

   (c) (i) State three properties of images formed by plane mirrors.

   (ii) Differentiate between converging lense and diverging lense.

   (iii) With the aid of a diagram, explain the principle of refraction of light.

   (12 marks)

Answer at least TWO questions from this section.

1. (a) Define the following terms

    (i) energy;

    (ii) work.   (2 marks)

  (b) (i) State the law of conservation of energy.

      (ii) A car of mass 800 kg is climbing an incline of 10° to the horizontal. If the car moves a distance of 30 m up the incline, determine the potential energy.

                                              (7 marks)

  (c) (i) A machine raises a load of 150 kg through a distance of 1.8 m. The effort applied to the machine is 250 N and moves a distance of 14 m. Determine the:

          (I) mechanical advantage;

          (II) velocity ratio;

          (III) efficiency of the machine.

                                              (7 marks)

      (ii) State **four** sources of electrostatic charges.   (4 marks)

2. (a) Define the following terms:

    (i) mixture;

    (ii) element.   (2 marks)

  (b) (i) State **four** properties of Acids.

      (ii) Explain **three** differences between covalent compounds and ionic compounds.

                                            (10 marks)

  (c) (i) Define the term hybridization.   (2 marks)

      (ii) Differentiate between physical properties and chemical properties of matter.

                                            (6 marks)

(c)   State the two types of bipolar junction transistors and draw the symbols used for each
       type.   (4 marks)

7. (a)   Define the following terms as used in electrostatics:

           (i)   capacitance;
           (ii)   electric flux density.

                                                                                    (4 marks)

    (b)   Three capacitors of 6 μF, 10 μF and 15 μF are connected in series across a 200 V
           supply. If the capacitors are disconnected and reconnected in parallel, determine the:

           (i)   total charge when connected in series and in parallel;

           (ii)   energy stored by the capacitors when connected in parallel.

                                                                                    (12 marks)

    (c)   State the electrical equivalent of the following magnetic circuit quantities:

           (i)   magneto-motive force;
           (ii)   flux;
           (iii)   reluctance;
           (iv)   permeability.

                                                                                    (4 marks)

8. (a)   State two types of filters used in power supplies.   (2 marks)

    (b)   List two applications of:

           (i)   Light Emitting Diodes (LEDs);
           (ii)   Silicon Controlled Rectifiers (SCRs).

                                                                                    (4 marks)

    (c)   An ideal transformer connected to a 240 V mains supplies a 12 V, 150 W load.
           Determine the:

           (i)   transformer turns ratio;
           (ii)   current taken from the supply.

                                                                                    (6 marks)

    (d)   With the aid of a B-H curve, explain the following terms:

           (i)   residual magnetism;

           (ii)   magnetic saturation.

                                                                                    (8 marks)

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