(c)   Briefly describe:

    (i)   A reduced-voltage three-phase motor starter that does not use a transformer

(2 marks)

    (ii)   A non-reduced voltage three-phase motor starter   **(2 marks)**

(d)   (i)   Describe the effect of single-phasing on the operation of a three-phase motor.

(2 marks)

    (ii)   Describe how an operator of a three-phase electric motor can be protected from electric shock.   **(2 marks)**

Total 20 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

11.   Figure 13 shows the electric circuit of an auto-transformer three-phase electric motor starter.
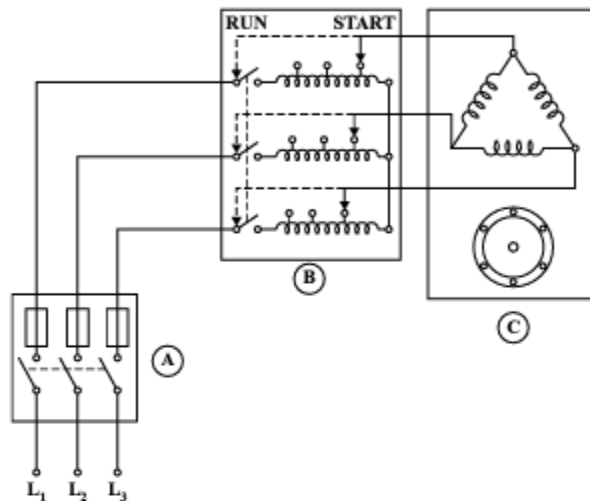

Figure 13. Three-phase auto-transformer motor

(a)   (i)   Name the circuit components of the motor starter identified by EACH of the letters
                (A) and (B) in Figure 13.

                                                                                    (2 marks)

        (ii)   State the function of EACH of the components of the motor circuit identified by
                the letters (A), (B) and (C).   **(6 marks)**

(b)   Briefly describe EACH of the following terms when used in connection with three-phase
        motors:

        (i)   Synchronous speed   **(1 mark)**

        (ii)   Slip   **(1 mark)**

        (iii)   Single-phasing   **(1 mark)**

        (iv)   Star connection   **(1 mark)**

(b)   A capacitance of 10 μf is connected in series with a 5Ω resistor across a 500V, 50Hz supply.

    (i)   Draw the circuit diagram and a phasor diagram showing the relationship between the voltages and current in the circuit.   **(4 marks)**

    (ii)   Calculate the

        a)   capacitive reactance of the capacitance   **(2 marks)**

        b)   impedance of the circuit   **(2 marks)**

        c)   current in the circuit   **(2 marks)**

        d)   power factor of the circuit.   **(2 marks)**

Total 20 marks

SECTION C

Candidates MUST answer ONE question from this section.

Each question is worth TWENTY marks.

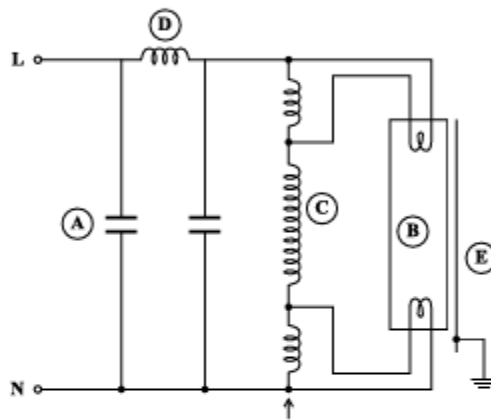10. Figure 12 shows the circuit diagram of a quick-start fluorescent lamp.

Figure 12. Circuit diagram of a quick-start fluorescent lamp

(a) (i) Name the circuit components identified by EACH of the letters (A) and (B).

(2 marks)

(ii) Name the circuit components identified by EACH of the letters (C), (D) and (E) and state the function of EACH.

(6 marks)

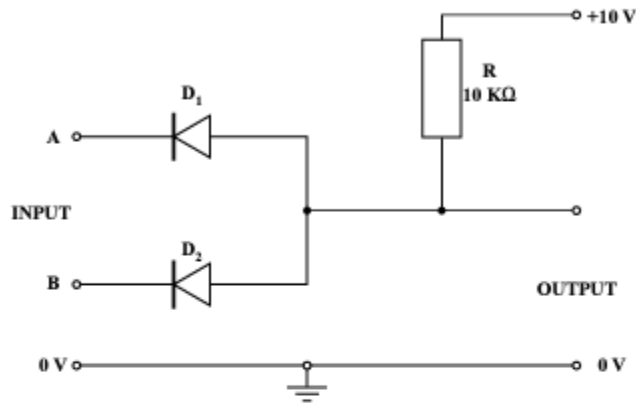(c)   Figure 11 shows a diode-resistor logic (DRL) circuit for a two-input AND-gate.

Figure 11. Diode-resistor logic circuit for AND gate

(i)   Briefly describe the operation of the logic gate when

a)   Logic 0 is applied to both inputs   **(1 mark)**

b)   Logic 1 is applied to input A and logic 0 is applied to input B   **(1 mark)**

c)   Logic 1 is applied to input B and logic 0 is applied to input A   **(1 mark)**

d)   Logic 1 is applied to both inputs A and B.   **(1 mark)**

(ii)   Construct a truth table that shows the logic output for EACH of the FOUR states of input logic mentioned in (c) (i).   **(4 marks)**

(iii) Sketch an electric circuit connection of two single-pole, single-throw switches (SPST) and a filament lamp that can be used to show the operation of the two-input AND logic gate.   **(2 marks)**

Total 20 marks

GO ON TO THE NEXT PAGE

9.   Figure 10 shows the basic elements of a personal computer system.

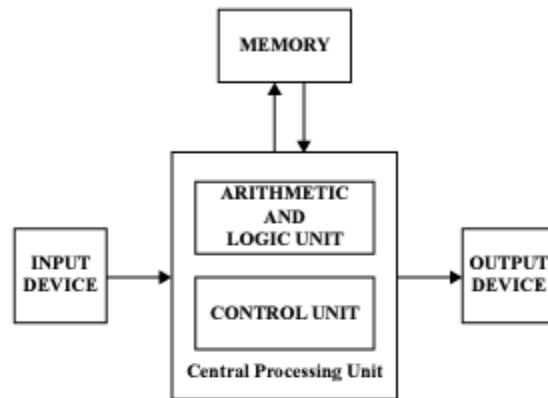**Figure 10. Basic computer system**

(a)   State the names of

      (i)   TWO input devices   **(2 marks)**

      (ii)   TWO output devices   **(2 marks)**

      (iii) TWO types of memory.   **(2 marks)**

(b)   (i)   What type of communication is used to transfer information between the computer components?   **(2 marks)**

      (ii)   What is the name of the form of communication that transfers information between the computer components?   **(2 marks)**

(b) TR_1 and TR_2 are pnp silicon transistors.

Calculate the

    (i) TR_1 base voltage   **(2 marks)**

    (ii) TR_1 emitter voltage   **(2 marks)**

    (iii) TR_1 emitter current   **(2 marks)**

    (iv)   voltage drop across R_3 **(2 marks)**

    (v) TR_1 collector voltage.   **(2 marks)**

Total 20 marks

8. Figure 9 shows a two-stage R.C. coupled a.f. transistor amplifier in which transistors TR_1 and TR_2 are biased for class A operation.
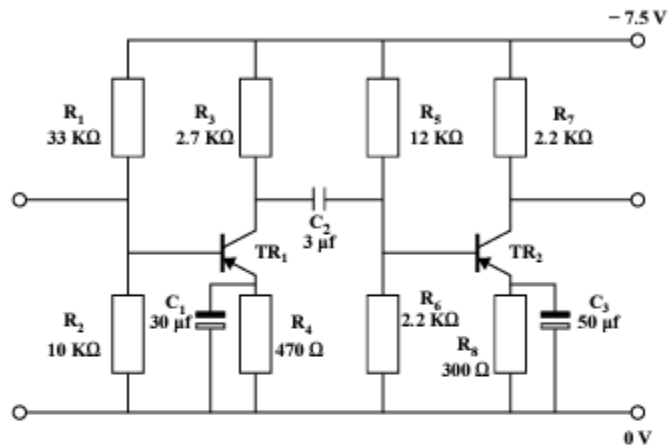

Figure 9. Two-stage R.C. transistor amplifier

(a) (i)   State the part of the characteristic curve at which the transistors operate.

(2 marks)

(ii) Name the resistors which are used to bias the base voltages for EACH of TR_1 and TR_2.

(4 marks)

(iii) What is the purpose of capacitor C_2 in the amplifier circuit?

(2 marks)

(iv) Name the type of capacitors which are used for C_1 and C_3 in the amplifier circuit.

(2 marks)

(b)   (i)   Briefly describe the cause of a short-circuit in an electrical installation.

                                                                    (2 marks)

     (ii)   State TWO effects of a short-circuit in an electrical installation.   **(2 marks)**

     (iii)   Briefly describe how a fuse operates in an electrical installation.   **(2 marks)**

     (iv)   Define EACH of the following terms used in connection with fuses.

         a)   Current rating   **(1 mark)**

         b)   Fusing current   **(1 mark)**

(c)   State the formula for calculating fusing factor.   **(2 marks)**

                                                            Total 20 marks

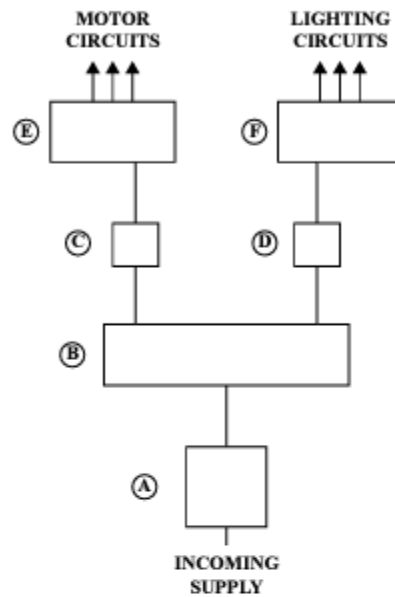7. Figure 8 shows an industrial electrical installation.

Figure 8. Industrial electrical installation

(a) (i)   Identify the type of a.c. supply system which provides power to the small industrial installation in Figure 8.   **(2 marks)**

    (ii) In your answer booklet, write the letters Ⓐ, Ⓑ, Ⓒ, Ⓓ, Ⓔ and Ⓕ on separate lines.

          Next to EACH letter, write the name of the part of the electrical installation identified by that letter in Figure 8.   **(6 marks)**

    (iii) Briefly describe EACH type of a.c. supply that supplies electric power to the motor circuits and the lighting circuits in Figure 8.   **(2 marks)**

(a)   Give ONE name for the type of single-phase electric motor shown in

    (i)   Figure 6   **(1 mark)**

    (ii)   Figure 7.   **(1 mark)**

(b)   On separate lines in your answer booklet write the letters (A), (B), (C) and (D) with reference to Figure 6, and (E), (F), (G) and (H) with reference to Figure 7.

Next to EACH letter, name the part of the motor identified by that letter in the diagrams of the motors.   **(8 marks)**

(c)   (i)   Explain briefly the difference in the rating of the starting windings in the two motors shown in Figure 6 and Figure 7.   **(4 marks)**

    (ii)   Explain briefly the functions of the components (F) and (G) in Figure 7.   **(4 marks)**

    (iii)   Explain briefly a method that can be used to reverse the direction of rotation of a single-phase a.c. motor.   **(2 marks)**

Total 20 marks

SECTION B

Candidates MUST attempt THREE questions from this section.

Each question is worth TWENTY marks.
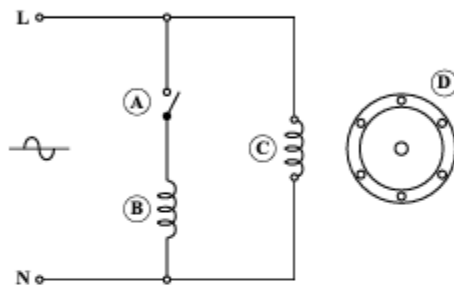
6.   Figures 6 and 7 show single-phase electric motors.

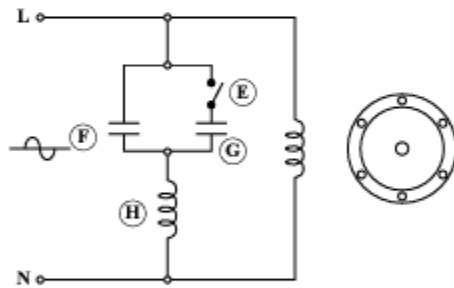**Figure 6. Single-phase electric motor**

Figure 7. Single-phase electric motor

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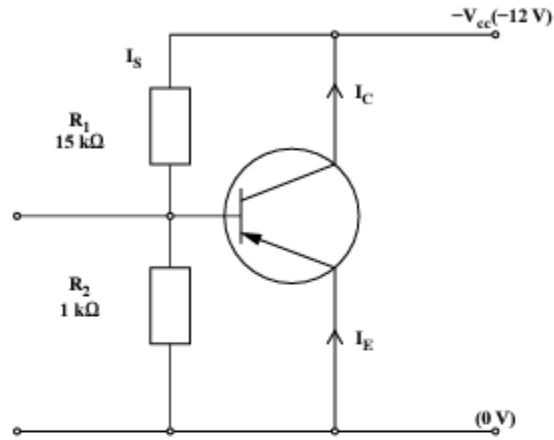(c)   Figure 5 shows the d.c. biasing connection for a pnp transistor.

Figure 5. D.C. biasing connection for pnp transistor

Calculate the

(i)   standing current, I_x **(2 marks)**

(ii)   base voltage, V_B.   **(2 marks)**

Total 8 marks

5.   Figure 4 shows bias voltages for an npn transistor.
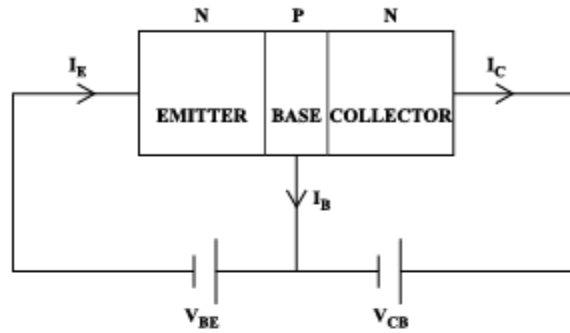

Figure 4. Bias voltages for npn transistor

(a)   Identify from Figure 4

    (i)   the type of the base-emitter junction bias   **(1 mark)**

    (ii)   the type of the collector-base junction bias.   **(1 mark)**

(b)   State the approximate amount of the emitter current

    (i)   that flows through the base terminal   **(1 mark)**

    (ii)   that flows through the collector terminal.   **(1 mark)**
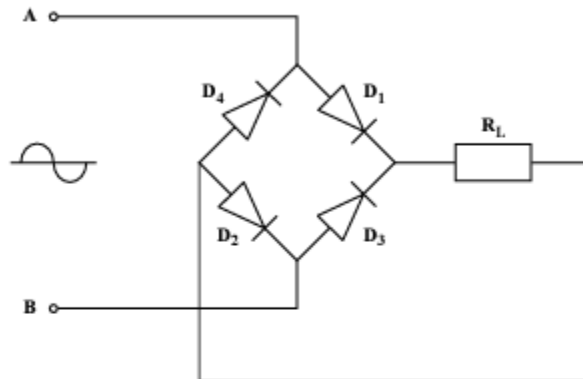
4.   Figure 3 shows a full-wave bridge rectifier circuit.

Figure 3. Full-wave rectifier circuit

(a)   (i)   Identify, using the labels,

a)   the diodes which are forward biased when A is positive relative to B

(1 mark)

b)   the diodes which are forward biased when B is positive relative to A.

(1 mark)

(ii)   Draw the output waveform when

a)   A is positive with respect to B   **(1 mark)**

b)   B is positive with respect to A.   **(1 mark)**

(b)   Explain briefly

(i)   the effect that a reverse bias has on the pn junction   **(2 marks)**

(ii)   the effect that a forward bias has on the pn junction.   **(2 marks)**

Total 8 marks

GO ON TO THE NEXT PAGE

3.   (a)   List TWO types of EACH of the following:

   (i)   Single-phase transformers   **(2 marks)**

   (ii)   Laminated core types used to construct transformers   **(2 marks)**

   (b)   A step-down power transformer, with iron losses of 55W and copper losses of 20W, supplies a full load current of 10A to a resistive load, from a secondary voltage of 100V.

   Calculate the

   (i)   total power loss in the transformer   **(1 mark)**

   (ii)   transformer efficiency at full load.   **(3 marks)**

                                                                                                Total 8 marks

2. (a) List FOUR methods that can be used to charge secondary batteries. **(4 marks)**

    (b) Figure 2 shows four lead-acid cells connected in parallel. Each cell has an e.m.f. of 2V and an internal resistance of 0.8Ω. The battery supplies a load of 0.8Ω.
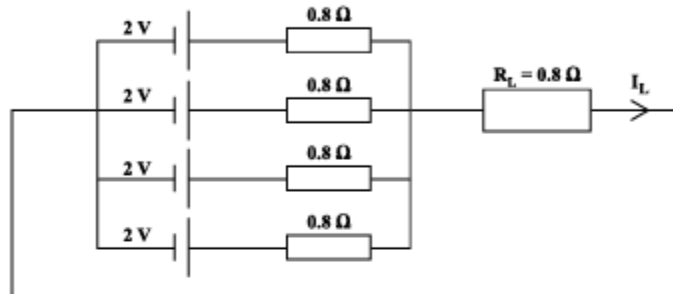

Figure 2. Lead-acid cells

Calculate the:

    (i)   Total internal resistance of the cells   **(1 mark)**

    (ii) Total circuit resistance   **(1 mark)**

    (iii) Total circuit current (I_L)   **(1 mark)**

    (iv) Terminal voltage of the battery   **(1 mark)**

                                                              Total 8 marks

Candidates MUST answer NINE questions, ALL FIVE from Section A, THREE from Section B and ONE from Section C.

SECTION A

Candidates MUST answer ALL FIVE questions in this section.

EACH question is worth EIGHT marks.

1. (a) State FOUR factors that affect the resistance of a conductor.   **(4 marks)**

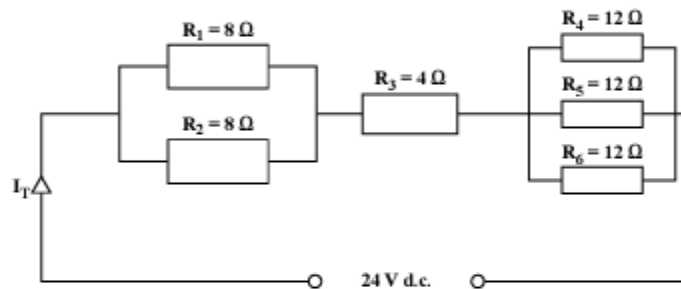   (b) Figure 1 shows the circuit diagram of six resistors connected in a series parallel combination.

Figure 1. Circuit diagram

Calculate the:

(i)   Equivalent resistance of R_1 and R_2 **(1 mark)**

(ii)   Equivalent resistance of R_4, R_5 and R_6 **(1 mark)**

(iii) Total resistance (R_T) in the circuit   **(1 mark)**

(iv)   Total current (I_T) in the circuit   **(1 mark)**

Total 8 marks

CARIBBEAN EXAMINATIONS COUNCIL

**CARIBBEAN SECONDARY EDUCATION CERTIFICATE®
EXAMINATION**

ELECTRICAL AND ELECTRONIC TECHNOLOGY

Paper 02 – Technical Proficiency

2 hours 40 minutes

14 MAY 2013 (p.m.)

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of THREE sections. Candidates MUST answer NINE questions.

   SECTION A: You must answer ALL FIVE COMPULSORY questions from this section.

   SECTION B: You must answer THREE questions from this section.

   SECTION C: You must answer ONE question from this section.

2. You are advised to take some time to read through the paper and plan your answers.

3. All working must be CLEARLY shown.

4. Use sketches where necessary to support your answers.

5. You may use a silent, non-programmable calculator to answer questions.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

(c)   Briefly describe:

    (i)   A reduced-voltage three-phase motor starter that does not use a transformer

(2 marks)

    (ii)   A non-reduced voltage three-phase motor starter   **(2 marks)**

(d)   (i)   Describe the effect of single-phasing on the operation of a three-phase motor.

(2 marks)

    (ii)   Describe how an operator of a three-phase electric motor can be protected from electric shock.   **(2 marks)**

Total 20 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

11. Figure 13 shows the electric circuit of an auto-transformer three-phase electric motor starter.
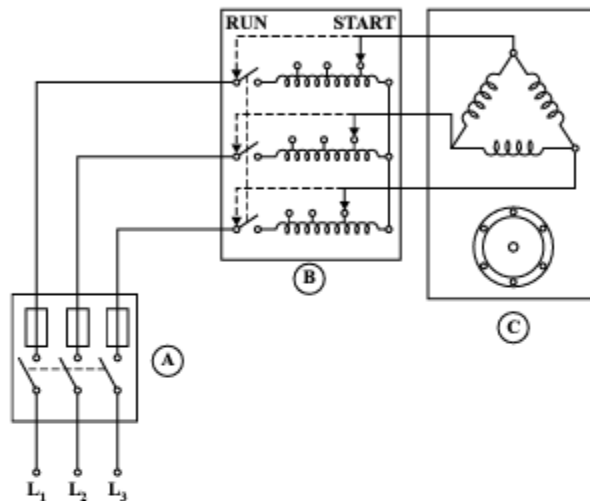

Figure 13. Three-phase auto-transformer motor

(a) (i) Name the circuit components of the motor starter identified by EACH of the letters (A) and (B) in Figure 13.

(2 marks)

(ii) State the function of EACH of the components of the motor circuit identified by the letters (A), (B) and (C). (6 marks)

(b) Briefly describe EACH of the following terms when used in connection with three-phase motors:

(i) Synchronous speed (1 mark)

(ii) Slip (1 mark)

(iii) Single-phasing (1 mark)

(iv) Star connection (1 mark)

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(b)   A capacitance of 10 µf is connected in series with a 5Ω resistor across a 500V, 50Hz supply.

   (i)   Draw the circuit diagram and a phasor diagram showing the relationship between
          the voltages and current in the circuit.   **(4 marks)**

   (ii)   Calculate the

          a)   capacitive reactance of the capacitance   **(2 marks)**

          b)   impedance of the circuit   **(2 marks)**

          c)   current in the circuit   **(2 marks)**

          d)   power factor of the circuit.   **(2 marks)**

                                                                                  Total 20 marks

SECTION C

Candidates MUST answer ONE question from this section.

Each question is worth TWENTY marks.

10.   Figure 12 shows the circuit diagram of a quick-start fluorescent lamp.
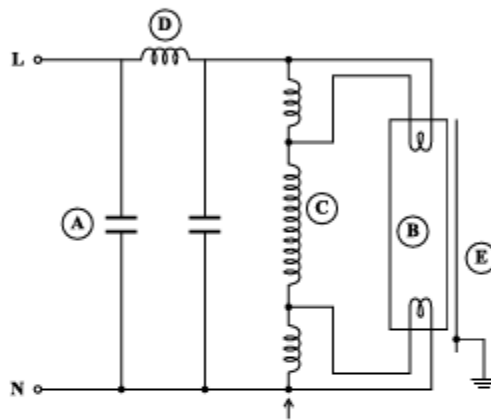

Figure 12. Circuit diagram of a quick-start fluorescent lamp

(a)   (i)   Name the circuit components identified by EACH of the letters (A) and (B).

(2 marks)

(ii)   Name the circuit components identified by EACH of the letters (C), (D) and (E) and state the function of EACH.

(6 marks)

GO ON TO THE NEXT PAGE

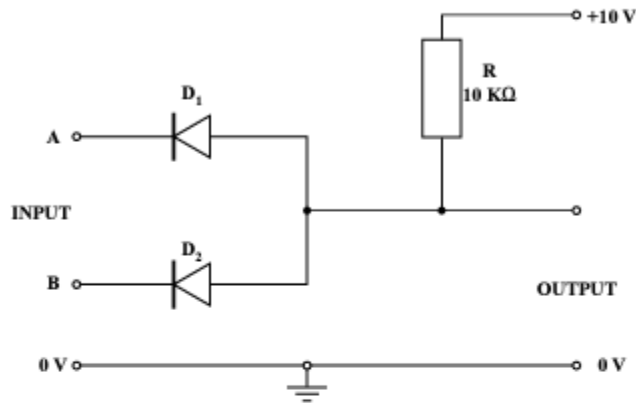(c) Figure 11 shows a diode-resistor logic (DRL) circuit for a two-input AND-gate.

Figure 11. Diode-resistor logic circuit for AND gate

(i) Briefly describe the operation of the logic gate when

    a) Logic 0 is applied to both inputs   **(1 mark)**

    b) Logic 1 is applied to input A and logic 0 is applied to input B   **(1 mark)**

    c) Logic 1 is applied to input B and logic 0 is applied to input A   **(1 mark)**

    d) Logic 1 is applied to both inputs A and B.   **(1 mark)**

(ii) Construct a truth table that shows the logic output for EACH of the FOUR states of input logic mentioned in (c) (i).   **(4 marks)**

(iii) Sketch an electric circuit connection of two single-pole, single-throw switches (SPST) and a filament lamp that can be used to show the operation of the two-input AND logic gate.   **(2 marks)**

Total 20 marks

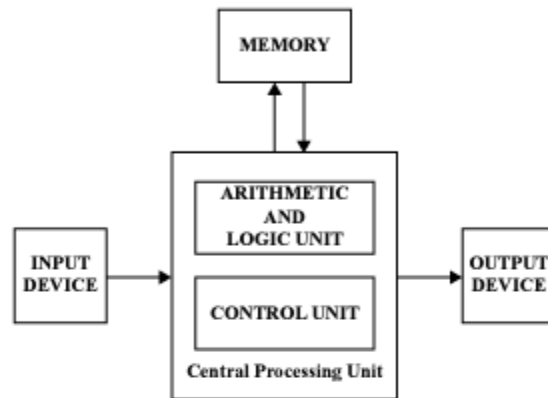9.   Figure 10 shows the basic elements of a personal computer system.

Figure 10. Basic computer system

(a)   State the names of

      (i)   TWO input devices   **(2 marks)**

      (ii)   TWO output devices   **(2 marks)**

      (iii)   TWO types of memory.   **(2 marks)**

(b)   (i)   What type of communication is used to transfer information between the computer
               components?   **(2 marks)**

      (ii)   What is the name of the form of communication that transfers information between
               the computer components?   **(2 marks)**

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(b) TR_1 and TR_2 are pnp silicon transistors.

Calculate the

(i)	TR_1 base voltage	**(2 marks)**
(ii)	TR_1 emitter voltage	**(2 marks)**
(iii)	TR_1 emitter current	**(2 marks)**
(iv)	voltage drop across R_3	**(2 marks)**
(v)	TR_1 collector voltage.	**(2 marks)**

Total 20 marks

8. Figure 9 shows a two-stage R.C. coupled a.f. transistor amplifier in which transistors TR$_1$ and TR$_2$ are biased for class A operation.

Figure 9. Two-stage R.C. transistor amplifier

(a)   (i)   State the part of the characteristic curve at which the transistors operate.

(2 marks)

(ii)   Name the resistors which are used to bias the base voltages for EACH of TR$_1$ and TR$_2$.

(4 marks)

(iii)   What is the purpose of capacitor C$_2$ in the amplifier circuit?   **(2 marks)**

(iv)   Name the type of capacitors which are used for C$_1$ and C$_3$ in the amplifier circuit.

(2 marks)

(b)   (i)   Briefly describe the cause of a short-circuit in an electrical installation.

(2 marks)

          (ii)   State TWO effects of a short-circuit in an electrical installation.   **(2 marks)**

          (iii)   Briefly describe how a fuse operates in an electrical installation.   **(2 marks)**

          (iv)   Define EACH of the following terms used in connection with fuses.

                a)   Current rating   **(1 mark)**

                b)   Fusing current   **(1 mark)**

(c)   State the formula for calculating fusing factor.   **(2 marks)**

Total 20 marks

7. Figure 8 shows an industrial electrical installation.

MOTOR
CIRCUITS

LIGHTING
CIRCUITS

Ⓔ
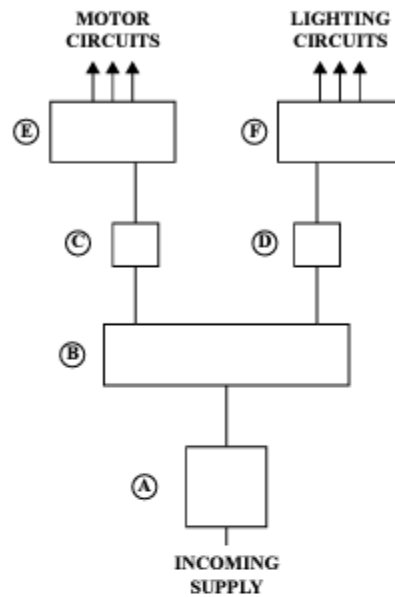
Ⓕ

Ⓒ

Ⓓ

Ⓑ

Ⓐ

INCOMING
SUPPLY

Figure 8. Industrial electrical installation

(a)   (i)   Identify the type of a.c. supply system which provides power to the small industrial installation in Figure 8.   **(2 marks)**

     (ii)   In your answer booklet, write the letters Ⓐ, Ⓑ, Ⓒ, Ⓓ, Ⓔ and Ⓕ on separate lines.

           Next to EACH letter, write the name of the part of the electrical installation identified by that letter in Figure 8.   **(6 marks)**

     (iii)   Briefly describe EACH type of a.c. supply that supplies electric power to the motor circuits and the lighting circuits in Figure 8.   **(2 marks)**

(a)   Give ONE name for the type of single-phase electric motor shown in

    (i)   Figure 6   **(1 mark)**

    (ii)   Figure 7.   **(1 mark)**

(b)   On separate lines in your answer booklet write the letters Ⓐ, Ⓑ, Ⓒ and Ⓓ with reference to Figure 6, and Ⓔ, Ⓕ, Ⓖ and Ⓗ with reference to Figure 7.

    Next to EACH letter, name the part of the motor identified by that letter in the diagrams of the motors.   **(8 marks)**

(c)   (i)   Explain briefly the difference in the rating of the starting windings in the two motors shown in Figure 6 and Figure 7.   **(4 marks)**

    (ii)   Explain briefly the functions of the components Ⓕ and Ⓖ in Figure 7.

                                                             (4 marks)

    (iii)   Explain briefly a method that can be used to reverse the direction of rotation of a single-phase a.c. motor.   **(2 marks)**

Total 20 marks

SECTION B

Candidates MUST attempt THREE questions from this section.

Each question is worth TWENTY marks.

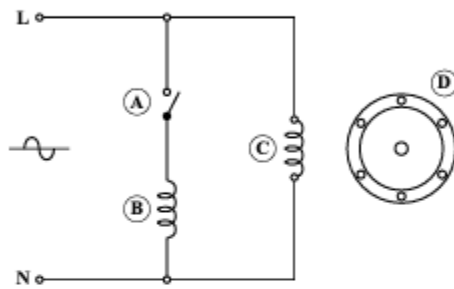6. Figures 6 and 7 show single-phase electric motors.

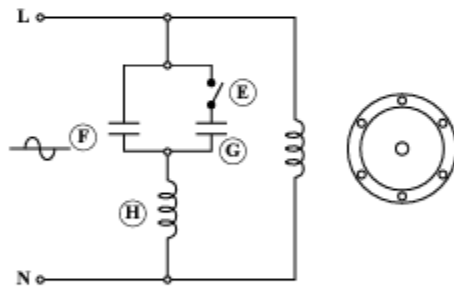**Figure 6. Single-phase electric motor**

Figure 7. Single-phase electric motor

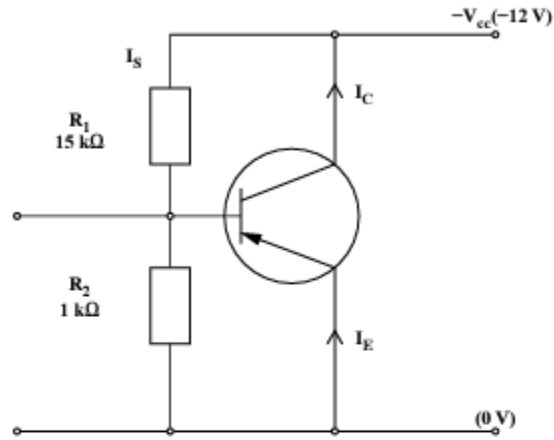(c)   Figure 5 shows the d.c. biasing connection for a pnp transistor.

Figure 5. D.C. biasing connection for pnp transistor

Calculate the

(i)   standing current, I_x **(2 marks)**

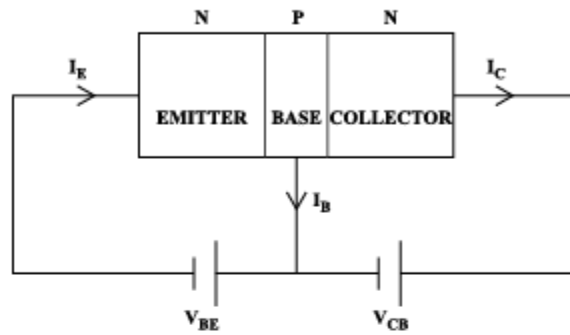(ii)   base voltage, V_B.   **(2 marks)**

                                                                                    Total 8 marks

5. Figure 4 shows bias voltages for an npn transistor.

Figure 4. Bias voltages for npn transistor

(a) Identify from Figure 4

    (i)   the type of the base-emitter junction bias   **(1 mark)**

    (ii)   the type of the collector-base junction bias.   **(1 mark)**

(b) State the approximate amount of the emitter current

    (i)   that flows through the base terminal   **(1 mark)**

    (ii)   that flows through the collector terminal.   **(1 mark)**

4. Figure 3 shows a full-wave bridge rectifier circuit.

Figure 3. Full-wave rectifier circuit

(a) (i) Identify, using the labels,

a) the diodes which are forward biased when A is positive relative to B

(1 mark)

b) the diodes which are forward biased when B is positive relative to A.

(1 mark)

(ii) Draw the output waveform when

a) A is positive with respect to B **(1 mark)**

b) B is positive with respect to A. **(1 mark)**

(b) Explain briefly

(i) the effect that a reverse bias has on the pn junction **(2 marks)**

(ii) the effect that a forward bias has on the pn junction. **(2 marks)**

Total 8 marks

3. (a) List TWO types of EACH of the following:

    (i) Single-phase transformers **(2 marks)**

    (ii) Laminated core types used to construct transformers **(2 marks)**

    (b) A step-down power transformer, with iron losses of 55W and copper losses of 20W, supplies a full load current of 10A to a resistive load, from a secondary voltage of 100V.

    Calculate the

    (i) total power loss in the transformer **(1 mark)**

    (ii) transformer efficiency at full load. **(3 marks)**

    Total 8 marks

2. (a) List FOUR methods that can be used to charge secondary batteries.   **(4 marks)**

    (b) Figure 2 shows four lead-acid cells connected in parallel. Each cell has an e.m.f. of 2V and an internal resistance of 0.8Ω. The battery supplies a load of 0.8Ω.
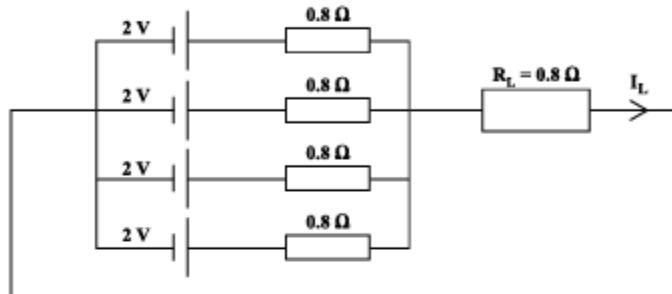

Figure 2. Lead-acid cells

Calculate the:

    (i) Total internal resistance of the cells   **(1 mark)**

    (ii) Total circuit resistance   **(1 mark)**

    (iii) Total circuit current (I_L)   **(1 mark)**

    (iv) Terminal voltage of the battery   **(1 mark)**

Total 8 marks

- 2 -

Candidates MUST answer NINE questions, ALL FIVE from Section A, THREE from Section B and ONE from Section C.

SECTION A

Candidates MUST answer ALL FIVE questions in this section.

EACH question is worth EIGHT marks.

1. (a) State FOUR factors that affect the resistance of a conductor. **(4 marks)**

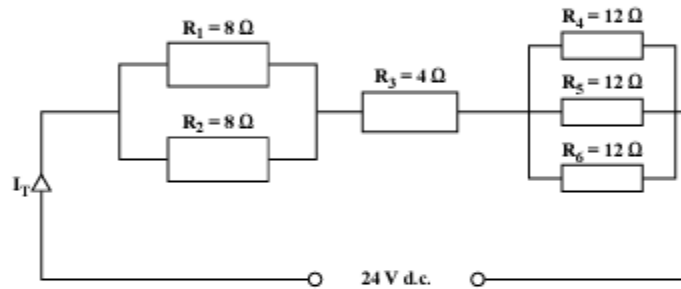   (b) Figure 1 shows the circuit diagram of six resistors connected in a series parallel combination.

Figure 1. Circuit diagram

Calculate the:

   (i) Equivalent resistance of R_1 and R_2 **(1 mark)**

   (ii) Equivalent resistance of R_4, R_5 and R_6 **(1 mark)**

   (iii) Total resistance (R_T) in the circuit **(1 mark)**

   (iv) Total current (I_T) in the circuit **(1 mark)**

Total 8 marks

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

ELECTRICAL AND ELECTRONIC TECHNOLOGY

Paper 02 – Technical Proficiency

2 hours 40 minutes

14 MAY 2013 (p.m.)

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of THREE sections. Candidates MUST answer NINE questions.

   SECTION A: You must answer ALL FIVE COMPULSORY questions from this section.

   SECTION B: You must answer THREE questions from this section.

   SECTION C: You must answer ONE question from this section.

2. You are advised to take some time to read through the paper and plan your answers.

3. All working must be CLEARLY shown.

4. Use sketches where necessary to support your answers.

5. You may use a silent, non-programmable calculator to answer questions.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

(d)   Figure 15 shows the connection of the electrical components labelled 1 to 5 in a domestic electrical installation.
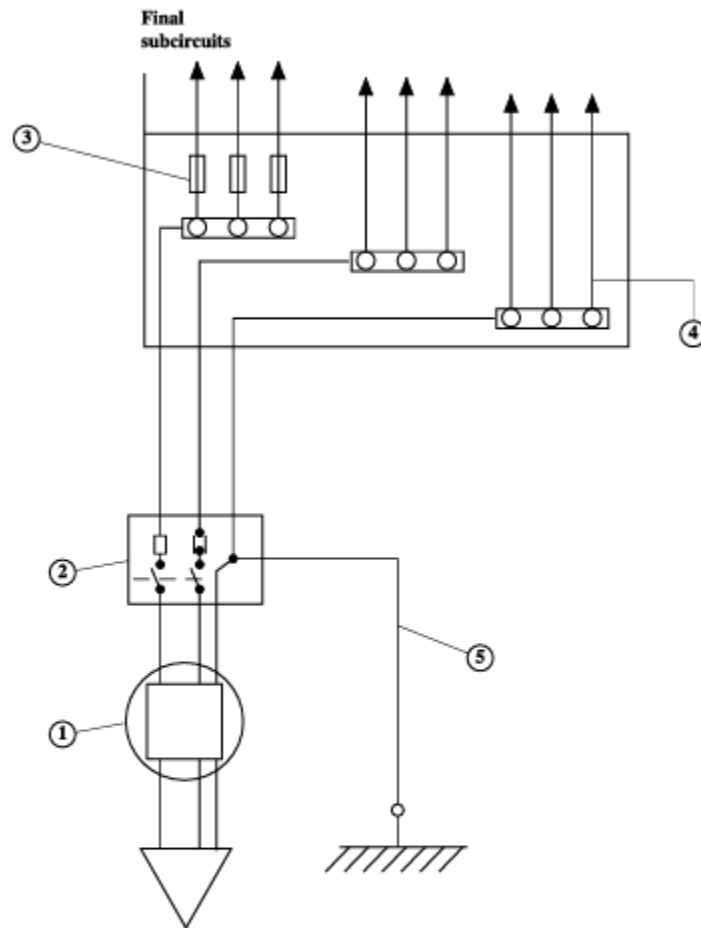

Figure 15

(i)   In your answer booklet, write any FOUR of the numbers ①, ②, ③, ④ and ⑤ and beside EACH selected number, write the name of the electrical component(s) it identifies.   **(4 marks)**

(ii)   Briefly explain the function performed by EACH of the components labelled ①, ②, ③, ④ and ⑤ in the installation.   **(10 marks)**

Total 20 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

11. (a) Name TWO tests that are performed on a new installation to verify the electrical soundness of the installation.   **(2 marks)**

     (b) Identify TWO measuring instruments that are used to perform electrical tests on a new installation.   **(2 marks)**

     (c) Name TWO ways in which users of portable electric equipment are protected from electric shock.   **(2 marks)**

(d)   Figure 14 shows a direct-on-line motor starter. Its parts are labelled by the numbers 1, 2, 3, 4, 5 and 6.
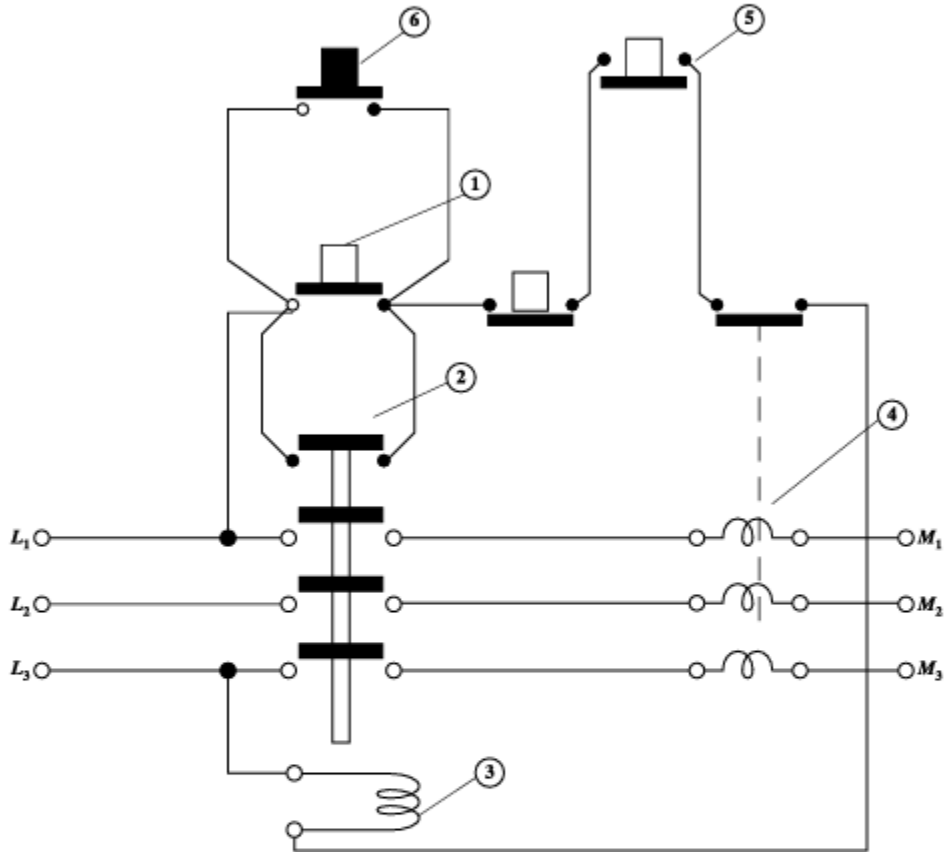

Figure 14

(i)   In your answer booklet list the numbers ①, ②, ③, ④, ⑤ and ⑥. Beside EACH number write the name of that part of the starter indicated.   **(6 marks)**

(ii)   Briefly explain how EACH part of the starter numbered ②, ③ and ④ operates.

(6 marks)

Total 20 marks

SECTION C

Candidates MUST answer ONE question from this section.

Each question is worth 20 marks.

10. (a) Give TWO methods used to effect a reduced voltage at the terminals of a 3-phase motor at starting. **(2 marks)**

    (b) Give the name of EACH type of connection shown in Figure 13 (a) and Figure 13 (b), using labels.
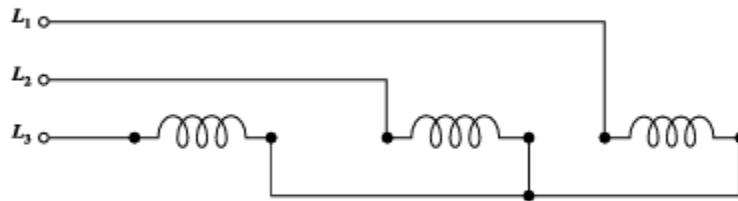
Figure 13 (a)
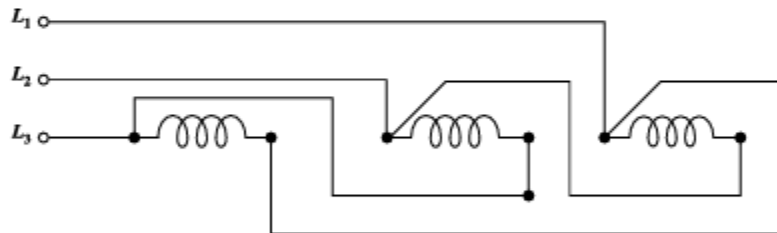
(2 marks)

Figure 13 (b)

    (c) Briefly explain how a STAR-DELTA motor starter connects the winding in a 3-phase motor to obtain a reduced voltage at START, and the rated voltage on RUN. **(4 marks)**

9. (a) Name TWO factors that affect the resistance of an electrical cable used in an electrical installation. **(2 marks)**

    (b) Name TWO materials that have a

        (i) positive temperature coefficient **(2 marks)**

        (ii) negative temperature coefficient. **(2 marks)**

    (c) Figure 12 shows five resistors connected in a series-parallel combination across a 20 V d.c. supply.
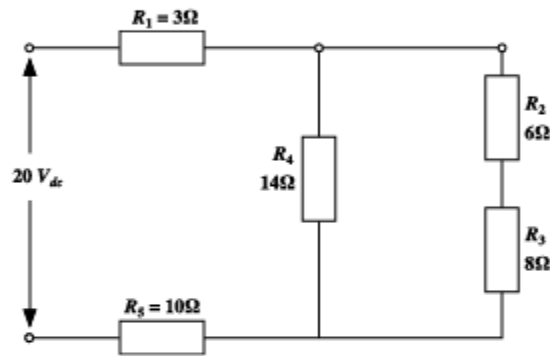

Figure 12

    Calculate the

        (i) equivalent resistance of the parallel combination (R_2, R_3 and R_4) **(3 marks)**

        (ii) total resistance of the circuit **(3 marks)**

        (iii) total current **(3 marks)**

        (iv) total power dissipated. **(3 marks)**

    (d) Sketch the series equivalent circuit of Figure 12. **(2 marks)**

Total 20 marks

GO ON TO THE NEXT PAGE

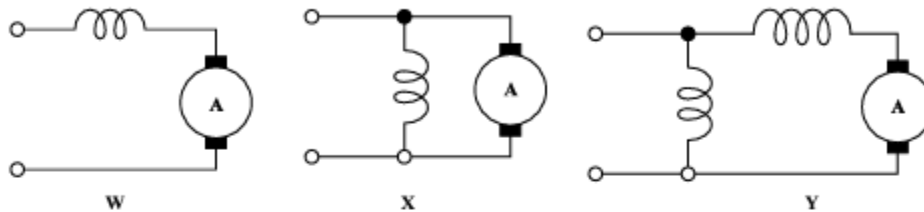**8.** **(a)** Figure 10 shows three d.c. motor connections labelled W, X and Y.

Figure 10

Write down any TWO of the letters W, X and Y and give the name of the connection by EACH letter. **(2 marks)**

(b) Figure 11 below shows a motor circuit. Its parts are labelled 1, 2, 3 and 4.
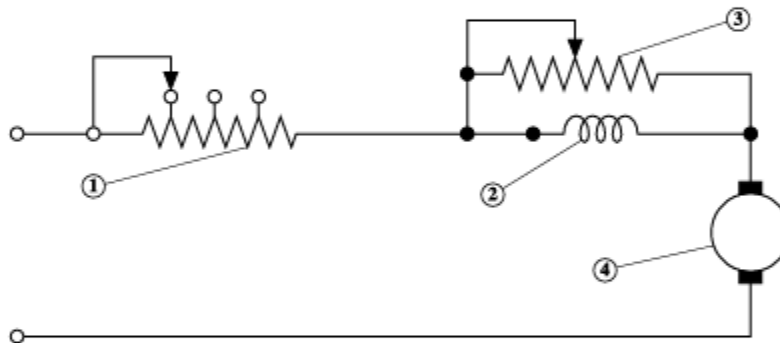

Figure 11

In your answer booklet write the numbers ①, ②, ③ and ④. Beside EACH number, write the name of the part of the motor indicated. **(4 marks)**

(c) A d.c. motor with a terminal voltage of 100 V has an armature resistance of 0.2 ohm, and an armature current of 20 A. Calculate the

   (i)   armature volt drop   **(3 marks)**

   (ii)   back e.m.f.   **(3 marks)**

   (iii) power loss in the armature   **(3 marks)**

   (iv)   power supplied to the motor   **(2 marks)**

   (v)   electrical energy when the motor is in use for 20 hours.   **(3 marks)**

Total 20 marks

GO ON TO THE NEXT PAGE
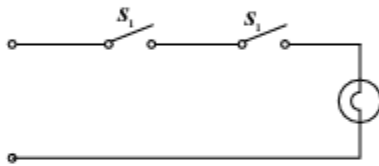
7. (a)   Figure 6 and Figure 7 both show logic gates.

Figure 6   **Figure 7**

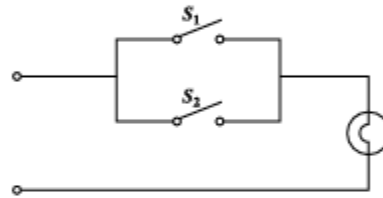   (i)   Give the name of the gate in Figure 6.   **(1 mark)**

   (ii)   Give the name of the gate in Figure 7.   **(1 mark)**

   (b)   Figure 8 and Figure 9 show the electrical equivalents of two logic circuits, labelled P and Q.

P   Q

Figure 8   **Figure 9**

   (i)   Name the logic equivalent for EACH figure, using the labels.   **(2 marks)**

   (ii)   Develop truth tables for EACH logic equivalent circuit identified in Figure 6 and Figure 7 using the labels.   **(14 marks)**

   (iii) Name TWO electronic devices that perform switching functions in logic circuits.
                                                                  (2 marks)

                                              Total 20 marks
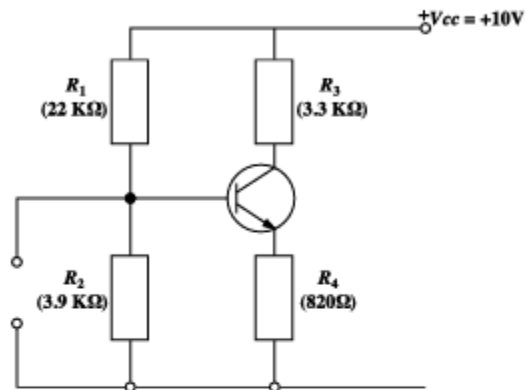
(c)   Figure 5 shows an NPN transistor amplifier.

Figure 5

Assuming the transistor to be silicon, and $I_E = I_C$, calculate the

(i)   current through the potential dividier   **(3 marks)**

(ii)   base voltage (V_B)   **(3 marks)**

(iii)   emitter voltage (V_E)   **(3 marks)**

(iv)   emitter current (I_E)   **(3 marks)**

(v)   collector voltage (V_C).   **(2 marks)**

Total 20 marks

(b)   Figure 4 shows the family of curves for a transistor.
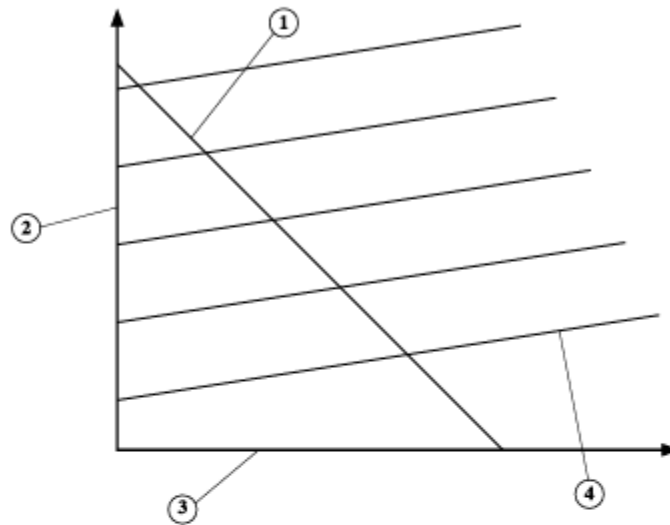

Figure 4

In your answer booklet write the numbers ① , ② , ③ and ④. Next to EACH number,

name the characteristic represented in the diagram.   **(4 marks)**

SECTION B

Candidates MUST attempt THREE questions from this section.

Each question is worth 20 marks.

6. (a) Figure 3 shows two transistors connected in an electronic circuit. They are labelled A and B.
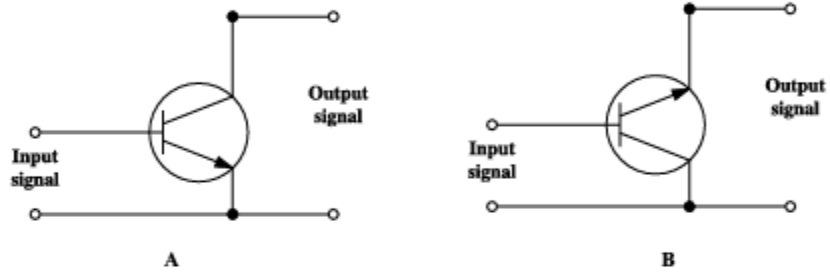

Figure 3

Give the name of EACH transistor connection, using the labels A and B. **(2 marks)**

4. (a) (i)   Name the process used to join P-type and N-type semiconductor materials.

                                                                              (1 mark)

        (ii) Name the area formed on either side of the junction formed in (a).   **(1 mark)**

    (b) Give the value of the potential barrier established at the P-N junction for

        (i)   germanium

        (ii) silicon semiconductor material.   **(2 marks)**

    (c) Explain briefly the operation of a semiconductor diode when it is

        (i)   forward biased   **(2 marks)**

        (ii) reverse biased.   **(2 marks)**

                                                                      Total 8 marks

5. (a) Name TWO electromotive forces that are induced in a double-wound transformer.

                                                                              (2 marks)

    (b) Name TWO materials that are used to insulate laminated iron stampings from each other
         in the construction of transformer cores.   **(2 marks)**

    (c) Explain briefly the increase in primary current that results from an increase in secondary
         current in a double-wound transformer.   **(4 marks)**
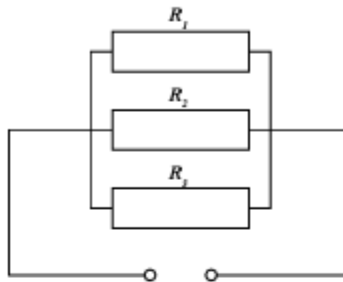
                                                                      Total 8 marks

Figure 2

Write the formula for total resistance in the circuit of

    (i)   Figure 1   **(1 mark)**

    (ii)   Figure 2.   **(1 mark)**

(c)   Sketch the circuit of a potential divider and briefly explain its operation.   **(4 marks)**

                                                                        Total 8 marks

3.   (a)   Name TWO types of energy that may be directly converted into electrical energy.

                                                                        (2 marks)

    (b)   State how secondary cells are connected in a battery to increase the

        (i)   terminal voltage   **(1 mark)**

        (ii)   current capacity.   **(1 mark)**

    (c)   (i)   Explain how polarization reduces the overall efficiency of cells.

        (ii)   Describe how the depolarizer **increases** the efficiency of a Leclanché primary cell.

                                                                           (4 marks)

                                                      Total 8 marks

Candidates MUST answer NINE questions, ALL FIVE from Section A, THREE from Section B and ONE from Section C.

SECTION A

Candidates MUST answer ALL FIVE questions in this section.

Each question is worth EIGHT marks.

1. (a) Name TWO types of electrical measuring instruments used in electrical circuits.

    (2 marks)

    (b) Give TWO methods that are used to dampen the oscillations of the pointer in an analog measuring instrument.

    (2 marks)

    (c) Sketch the connection diagram of a multirange (2 ranges) moving-coil instrument used as

    (i) an ammeter

    (2 marks)

    (ii) a voltmeter.

    (2 marks)

    Total 8 marks

2. (a) State how the current in a d.c. (direct current) circuit, is related to the

    (i) applied voltage

    (1 mark)

    (ii) electrical resistance.

    (1 mark)

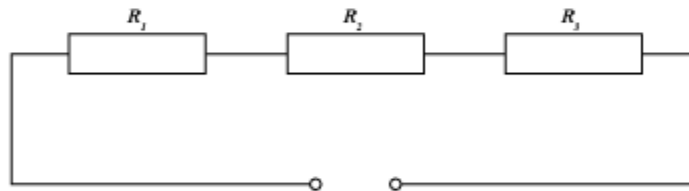   (b) Figure 1 and Figure 2 show three resistors connected in two circuit combinations.

Figure 1

CARIBBEAN EXAMINATIONS COUNCIL

SECONDARY EDUCATION CERTIFICATE
EXAMINATION

ELECTRICAL AND ELECTRONIC TECHNOLOGY

Paper 02 – Technical Proficiency

2 hours 40 minutes

10 MAY 2012 (p.m.)

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of THREE sections. Candidates MUST answer NINE questions.

    SECTION A: You must answer ALL FIVE COMPULSORY questions from this section.

    SECTION B: You must answer THREE questions from this section.

    SECTION C: You must answer ONE question from this section.

2. You are advised to take some time to read through the paper and plan your answers.

3. All working must be CLEARLY shown.

4. Use sketches where necessary to support your answers.

5. You may use a silent, electronic calculator.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

11. (a) Define EACH of the following terms:

     (i) Illumination (2 marks)

     (ii) Luminous flux (1 mark)

  (b) State the inverse square law for photometry. (3 marks)

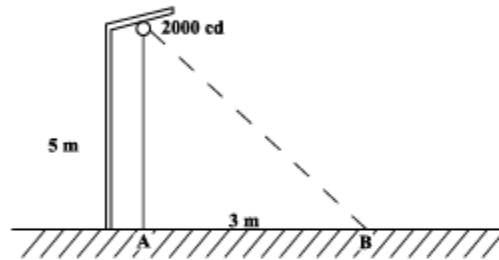 (c) Figure 6 shows a street lamp of 2000 cd which hangs 5 m above the ground.

Figure 6

Calculate the illumination

     (i) below the lamp at point A

     (ii) 3 m away from point A, at point B. (10 marks)

  (d) (i) Sketch a switch-start fluorescent lamp circuit using a choke. (2 marks)

     (ii) Explain the function of the choke in the circuit. (2 marks)
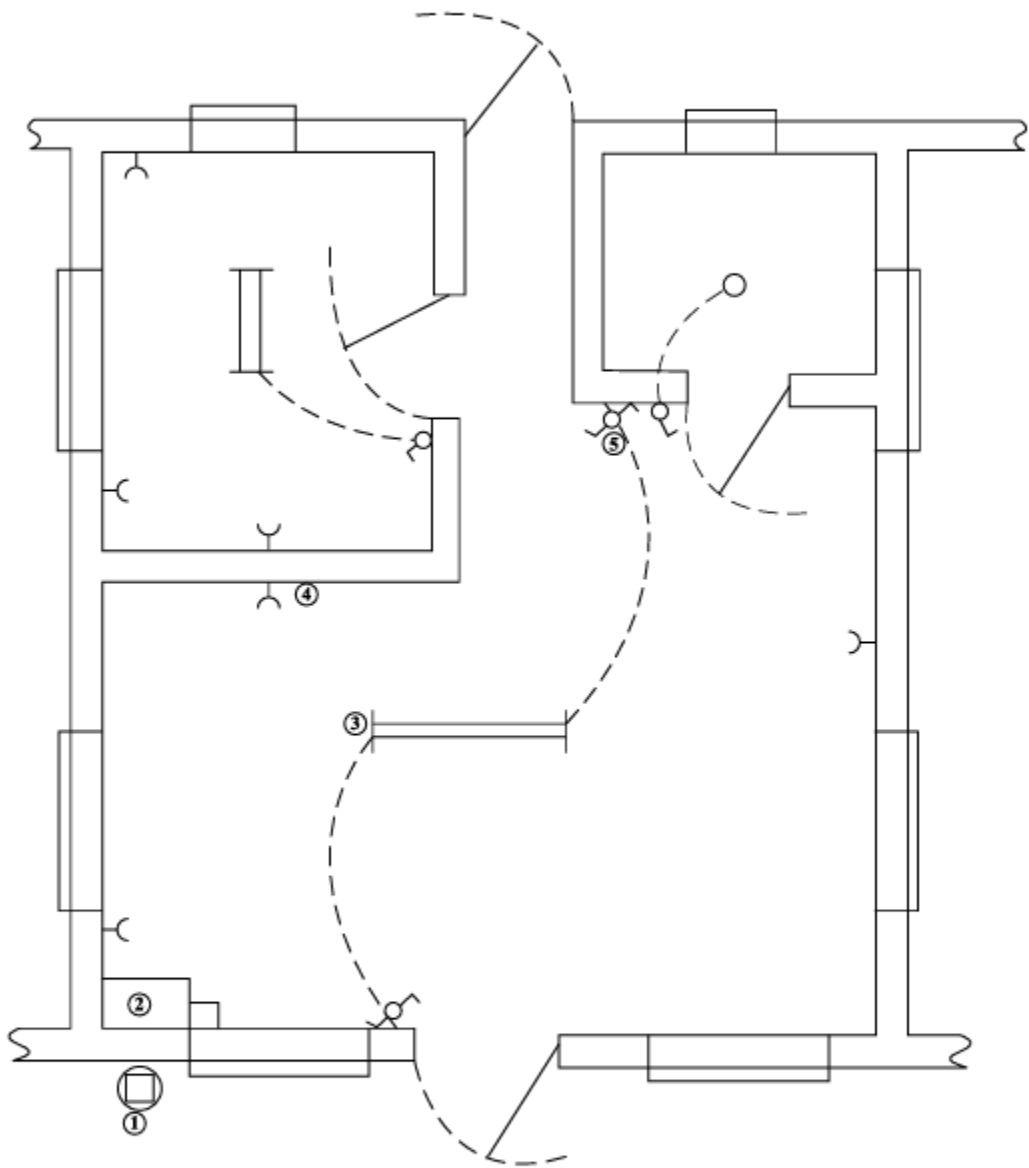
Total 20 marks

END OF TEST

Figure 5

SECTION C

Candidates MUST answer ONE question from this section.

Each question is worth TWENTY marks.

10. (a) Figure 5 on page 9 shows the electrical floor plan of a studio apartment with components

numbered ① – ⑤ . In your answer booklet write the numbers ①, ②, ③ ,④ and

⑤. Identify EACH of the corresponding components by writing the name of the part next

to the number.   (**5 marks**)

(b) Briefly explain the MAIN function of EACH electrical component identified in Part (a)
above.

(**5 marks**)

(c) State TWO electrical safety tests that must be conducted on all new installations **before** the
power supply is connected to the circuit.   (**2 marks**)

(d) State ONE electrical safety test that must be conducted on all new installations with the
power supply connected to the circuit.   (**1 mark**)

(e) Identify TWO test instruments that are used to test an electrical installation.   (**2 marks**)

(f) Outline the procedure for conducting insulation resistance tests between the conductors and
between the conductors and earth in a completed electrical installation.   (**5 marks**)

Total 20 marks

9.   (a)   With the help of a diagram, describe the principle of operation of the Wheatstone bridge.

(7 marks)

(b)   State ONE application of the Wheatstone bridge.   (1 mark)

(c)   State TWO safety precautions that should be observed when connecting a multimeter in an electrical circuit.   (2 marks)

(d)   A moving coil meter has a coil of resistance 10 ohms and requires a potential difference of 100 mV dc to give full scale deflection.

Calculate the value of

(i)   the series resistance required to enable the instrument to give full scale deflection of 240 V   (6 marks)

(ii)   the shunt resistance to convert the meter to an ammeter to read full scale deflection of 10 A.   (4 marks)

Total 20 marks

8. (a) (i) Name the TWO main parts of a three-phase motor. (**2 marks**)

    (ii) Define the term 'synchronous speed' for a squirrel-cage induction motor. (**2 marks**)

    (iii) A three-phase squirrel-cage induction motor is operating from a 110 V, 60 Hz supply. What is the synchronous speed of this motor? (**3 marks**)

    (iv) State TWO advantages of squirrel-cage induction motor. (**2 marks**)

    (v) Give ONE disadvantage of the use of the squirrel-cage motor. (**1 mark**)

    (vi) State TWO methods used to start three-phase squirrel-cage induction motors. (**2 marks**)

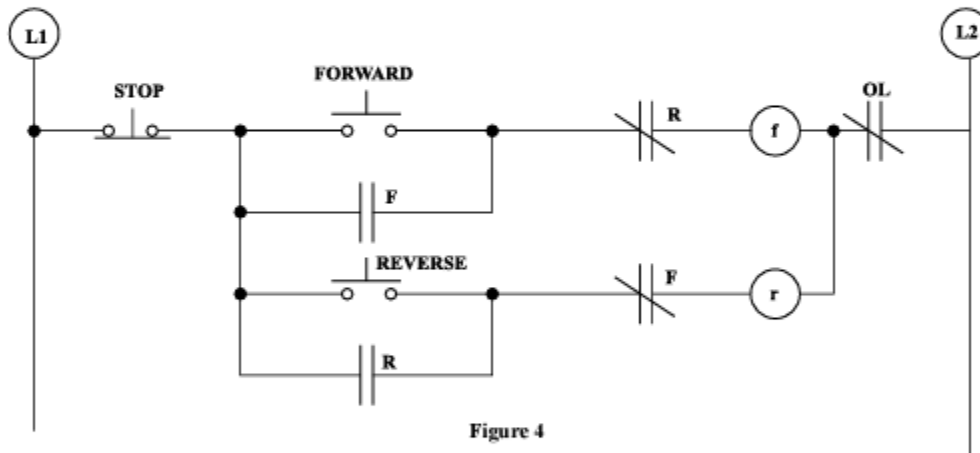(b) Figure 4 shows the line diagram of a motor-control circuit.

Figure 4

    (i) Identify THREE purposes of the motor-control circuit shown by the line-diagram in Figure 4. (**3 marks**)

    (ii) A motor is controlled by the circuit shown in Figure 4. If the motor is running in the FORWARD direction, what would happen to the lines of the three-phase supply when the reverse control circuit is activated. (**2 marks**)

    (iii) State THREE reasons why each of the three power lines in a three-phase motor connected through a motor-control circuit must be switched off. (**3 marks**)

Total 20 marks

7. (a) Draw the symbols of logic OR and NAND gates. Develop truth tables for these gates.

(10 marks)

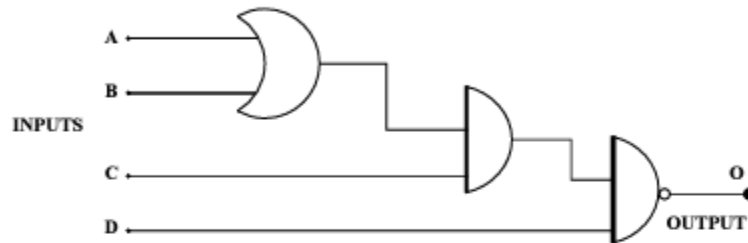(b) Derive a Boolean expression at the output O for the logic circuit shown in Figure 3.

Figure 3

(3 marks)

(c) Using logic gates, implement the expression given below:

$$(A + B) + (\overline{C D E}) + F G H$$

(3 marks)

(d) An apartment has two doors and two windows. These doors and windows are equipped with sensors consisting of switches which are open when any of the doors or windows are open.

Using an OR gate with four inputs, construct a circuit, such that the output of the OR gate is high when **any or all** of the windows and doors are open. **(4 marks)**

Total 20 marks

SECTION B

Candidates MUST attempt THREE questions from this section.

Each question is worth TWENTY marks.

6. (a) (i)   Define 'inductive reactance'.

    (ii) Write the formula for inductive reactance and explain EACH of the terms in the formula.   (3 marks)

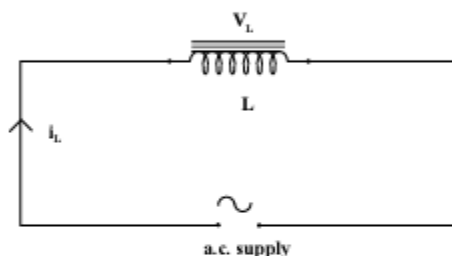   (b) An alternating voltage source is connected across an inductor L as shown in Figure 2.

Figure 2

    (i)   Use a wave diagram to show the phase relationship between the voltage V_L and the current i_L associated with the inductor.

    (ii) Illustrate the relationship between the current i_L and voltage V_L using a vector diagram.   (7 marks)

    (c) An a.c. supply of 110 V and 50 Hz is applied across an inductor of 0.5 H. Calculate the current I_L flowing through the inductor.   (5 marks)

    (d) Define the term 'e.m.f. of self inductance'. Give ONE application of e.m.f. of self induction in electronic circuits.   (5 marks)

Total 20 marks

3. (a) With the aid of simple diagrams, describe the main difference between a double wound step-up transformer and an auto-transformer. **(4 marks)**

   (b) A single-phase double wound transformer has 200 primary turns and 50 secondary turns. What will be the secondary voltage and the secondary current if the transformer has an a.c. input of 120 V at 1A? **(4 marks)**

   Total 8 marks

4. (a) State the main differences between a primary and a secondary cell. **(2 marks)**

   (b) Explain briefly the action of 'polarization' in a primary cell. **(2 marks)**

   (c) A commercial battery, with an open circuit voltage of 14.4 V, has a terminal voltage of 12.2 V when supplying a current of 20 A to a load. Calculate the internal resistance of the battery. **(4 marks)**

   Total 8 marks

5. (a) Sketch a p-n junction connected to a cell and a single pole switch under forward bias condition. Explain what happens when the circuit is closed. **(4 marks)**

   (b) State TWO characteristics of Class A power amplifier. **(2 marks)**

   (c) Which semiconductor device is used to replace relays and contactors in industrial control applications? **(2 marks)**

   Total 8 marks

Candidates MUST answer NINE questions, ALL FIVE from Section A, THREE from Section B and ONE from Section C.

SECTION A

Candidates MUST answer ALL FIVE questions in this section.

Each question is worth EIGHT marks.

1. (a) State Ohm's Law and write the formula that represents Ohm's Law.   (2 marks)

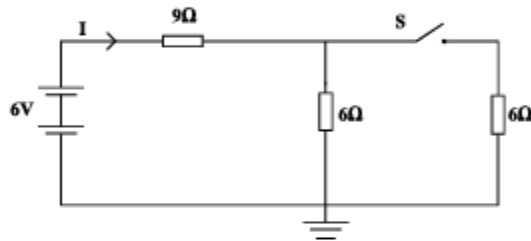   (b) Figure 1 shows a series parallel resistive circuit.

Figure 1

Calculate the

    (i)   total resistance when the switch S is closed   (1 mark)

    (ii) total resistance when the switch S is open   (1 mark)

    (iii) total current I when the switch S is closed   (1 mark)

    (iv) maximum power developed in the 9Ω resistor.   (3 marks)

Total 8 marks

2. (a) State the difference between the application software and the operating system software used in computers.   (2 marks)

    (b) Name TWO commercial software packages used to implement database applications.   (2 marks)

    (c) List ONE advantage and ONE disadvantage of networking computers in offices using a single server.   (2 marks)

    (d) State what is a RAM software and state the main function of RAM software in computers.   (2 marks)

Total 8 marks

FORM TP 2011068

TEST CODE **01317020**

MAY/JUNE 2011

CARIBBEAN EXAMINATIONS COUNCIL

SECONDARY EDUCATION CERTIFICATE
EXAMINATION

ELECTRICAL AND ELECTRONIC TECHNOLOGY

Paper 02 – Technical Proficiency

2½ hours

10 MAY 2011 (p.m.)

GENERAL INSTRUCTIONS

1. This paper consists of THREE sections. Candidates MUST answer NINE questions.

   SECTION A: You must answer ALL FIVE COMPULSORY questions from this section.

   SECTION B: You must answer THREE questions from this section.

   SECTION C: You must answer ONE question from this section.

2. In addition to the 2½ hours, candidates are allowed 10 minutes to read through the paper. Writing MAY begin during the 10-minute period.

3. All working must be CLEARLY shown.

4. Use sketches where necessary to support your answers.

5. Silent electronic calculators may be used.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

01317020/F 2011

(a) In your answer booklet, list the numbers ①, ②, ③, ④, ⑤, ⑥, ⑦, and ⑧ and name the electrical component identified by EACH number. **(8 marks)**

(b) Explain briefly the function of the components ⑥, ⑦ and ⑧ in providing protection from electrical shocks. **(4 marks)**

(c) Explain briefly the function of an electrical component that can be used in place of component ⑧ in the installation shown in Figure 6. **(4 marks)**

(d) Name and describe TWO electrical tests that are carried out on a new electrical installation. **(4 marks)**

Total 20 marks

11. (a) Name THREE output devices that can be used to output data from a personal computer. **(3 marks)**

(b) State the MAIN function of a modem connected to a personal computer. **(3 marks)**

(c) State TWO advantages and TWO disadvantages of networking computers in an office. **(4 marks)**

(d) Name ONE computer software programme which can be used to

(i) prepare an inventory of computer parts in a computer store **(2 marks)**

(ii) prepare schematic diagrams of electronic circuits. **(2 marks)**

(e) Explain briefly the function of an operating system in a personal computer. **(2 marks)**

(f) A student received an electrical shock in a computer lab. List TWO steps in order of priority that should be taken to assist the student. **(4 marks)**

Total 20 marks

END OF TEST

SECTION C

Candidates MUST answer ONE question from this section.

Each question is worth TWENTY marks.

10.   Figure 6 shows the components and connections in a single-filament lamp domestic installation.

EXPOSED METAL
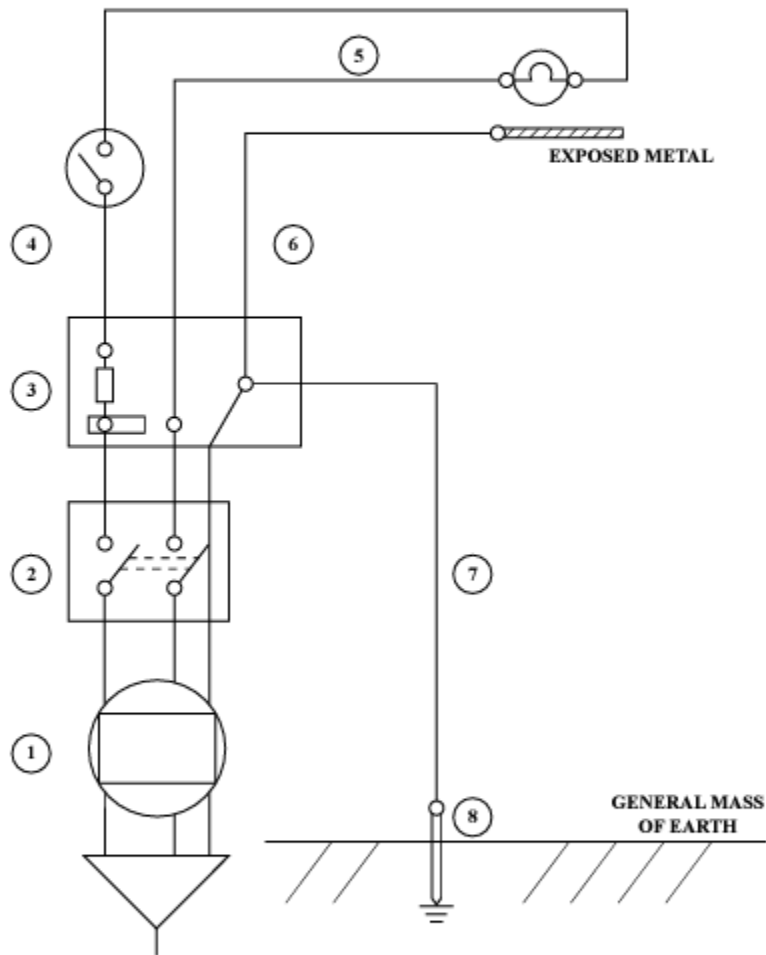
GENERAL MASS
OF EARTH

Figure 6

9. (a) Sketch the symbols of NAND and OR logic gates. **(2 marks)**

   (b) Construct the truth tables of NAND and OR gates. **(8 marks)**

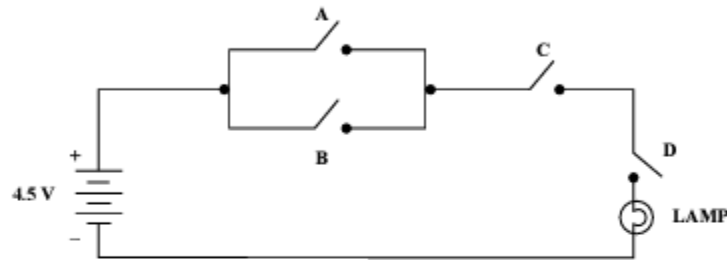   (c) A lamp circuit is shown in Figure 4.

Figure 4

For the lamp to be ON, state the OPEN and CLOSED positions of the switches:

   (i) A and B

   (ii) C and D **(4 marks)**

   (d) For Figure 4, name the logic gates which perform the same function as the switches:

   (i) A and B

   (ii) C and D **(2 marks)**

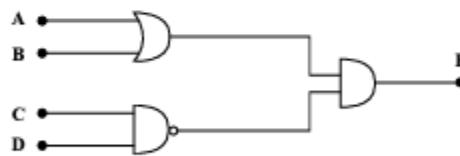   (e) Derive a boolean expression for the logic circuit shown in Figure 5 below.

Figure 5

(4 marks)

Total 20 marks

01317020/F 2010

8. (a) Figure 3 shows a schematic diagram of a d.c. power supply with a R-C filter circuit.
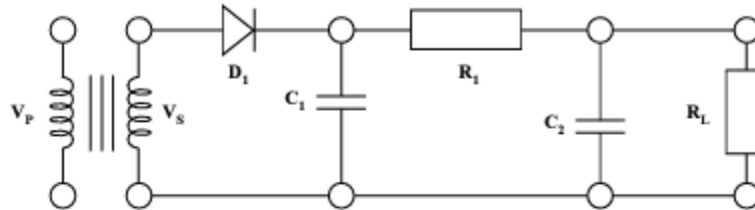

Figure 3

Given that

V_{RMS} at the secondary V_S = 36 volts

Full-load voltage across R_L, V_L = 36 volts

Full-load current through R_L, I_L = 10 mA

Calculate:

   (i) The voltages to which capacitor C_1 and C_2 will charge when the power supply is NOT supplying a load current **(4 marks)**

   (ii) The peak inverse voltage (PIV) that is developed across the diode D_1 **(4 marks)**

   (iii) The percentage regulation of the power supply when it provides 38 V at no load, and 36 V when supplying a full load current of 10 mA **(4 marks)**

  (b) Explain briefly the difference in the output of half wave and full wave rectifier circuits without filtering components. **(4 marks)**

  (c) Explain briefly the function of capacitor C_1 in the d.c. power supply circuit shown in Figure 3. What type of capacitor is used to perform this function? **(4 marks)**

Total 20 marks

7. (a) Figure 2 shows a short wound direct current machine.
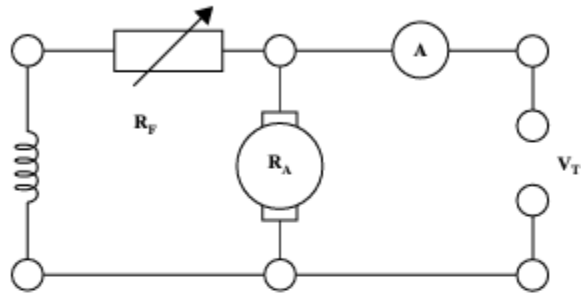
Figure 2

For the armature resistance $R_A = 0.2\ \Omega$ and terminal volts $V_T = 220$ V, calculate:

(i) The generated e.m.f. when the machine acts as a generator with the output current of 80 A **(4 marks)**

(ii) The generated e.m.f. when the machine acts as a motor with the input current of 60 A **(4 marks)**

(iii) The mechanical power, in watts, developed by the armature when the machine acts as a motor **(4 marks)**

(b) What is the function of a variable resistor placed in the starter circuit when the machine acts as a motor? **(4 marks)**

(c) Explain briefly the function of the field resistor (R_F) when the machine acts as a motor. **(4 marks)**

Total 20 marks

SECTION B

Candidates MUST attempt THREE questions from this section.

Each question is worth TWENTY marks.

6. (a) State Ohm's Law in words and formula form.   (2 marks)

    (b) Name TWO types of materials which are used as conductors of electricity.   (2 marks)

    (c) State TWO applications of resistors in electronic circuits.   (2 marks)

    (d) Give TWO reasons why domestic electric lamp circuits are connected in parallel.
                                                                                     (2 marks)

    (e) Figure 1 shows a series-parallel circuit.
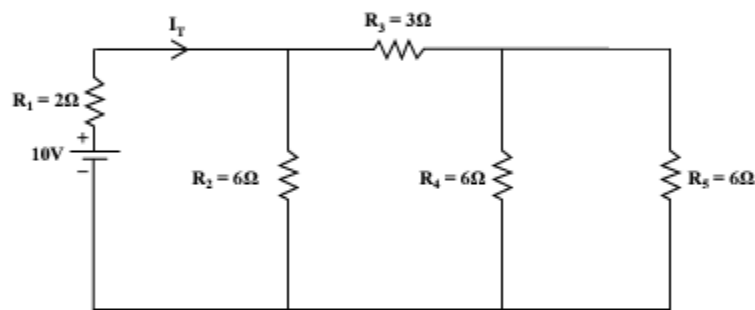
Figure 1

Calculate:

    (i)   The total resistance of the circuit, as seen from the source of emf.   (4 marks)

    (ii) The total current (I_T) flowing in the circuit   (2 marks)

    (iii) Power dissipated by the resistor R_2 (2 marks)

    (iv) Total current flowing in the circuit if R_3 is short circuited   (4 marks)

                                                                  Total 20 marks

4. (a) State the difference between a primary and a secondary cell.   **(2 marks)**

    (b) List TWO methods used to determine the discharge status of a lead acid battery.
    (4 marks)

    (c) Give ONE advantage and ONE disadvantage of the lead acid cell over the alkaline cell.
    (2 marks)

    Total 8 marks

5. (a) List TWO types of semi-conductor materials used in transistors.   **(2 marks)**

    (b) For a PN junction diode, using a d.c. power supply, show with the help of circuit diagrams, how a diode is

    (i) forward biased

    (ii) reverse biased.   **(4 marks)**

    (c) Name TWO applications of a thyristor in electrical circuits.   **(2 marks)**

    Total 8 marks

Candidates MUST answer NINE questions, ALL FIVE from Section A, THREE from Section B and ONE from Section C.

SECTION A

Candidates MUST answer ALL FIVE questions in this section.

Each question is worth EIGHT marks.

1. (a)   Name TWO types of e.m.f. that are induced in a double wound transformer.   **(2 marks)**

    (b)   Name TWO sources of energy losses in a double wound transformer.   **(2 marks)**

    (c)   (i)   State Faraday's Law of electromagnetic induction.   **(2 marks)**

          (ii)   State Lenz's Law.   **(2 marks)**

                                                                    Total 8 marks

2. (a)   Name TWO sources of energy that can be used in conjunction with steam turbines to produce electrical energy for commercial purposes.   **(2 marks)**

    (b)   Name TWO metals that are used to manufacture cables for high voltage transmission lines.   **(2 marks)**

    (c)   State TWO advantages of generating alternating voltage for transmission.   **(4 marks)**

                                                                    Total 8 marks

3. (a)   State TWO characteristics of a moving-iron instrument.   **(2 marks)**

    (b)   Name the types of scales used in the case of:

          (i)   Moving-coil instruments

          (ii)   Moving-iron instruments   **(2 marks)**

    (c)   Explain with the aid of diagrams how a moving-coil instrument can be converted to:

          (i)   An ammeter

          (ii)   A voltmeter   **(4 marks)**

                                                                    Total 8 marks

01317020/F 2010

FORM TP 2010063

TEST CODE **01317020**

MAY/JUNE 2010

C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L

SECONDARY EDUCATION CERTIFICATE
EXAMINATION

ELECTRICAL AND ELECTRONIC TECHNOLOGY

Paper 02 – Technical Proficiency

2½ hours

11 MAY 2010 (p.m.)

GENERAL INSTRUCTIONS:

1. This paper consists of THREE sections. Candidates MUST answer NINE questions.

    SECTION A: You must answer ALL FIVE COMPULSORY questions from this section.

    SECTION B: You must answer THREE questions from this section.

    SECTION C: You must answer ONE question from this section.

2. In addition to the 2½ hours, candidates are allowed 10 minutes to read through the paper. Writing MAY begin during the 10-minute period.

3. All working must be CLEARLY shown.

4. Use sketches where necessary to support your answers.

5. Silent electronic calculators may be used.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

11. (a) Explain briefly the following terms:

     (i) Illumination

     (ii) Luminous intensity   (4 marks)

  (b) State TWO advantages of incandescent lamps over gas-filled lamps.   (2 marks)

  (c) Explain why lamps in domestic electrical installations are connected in parallel.
                                                     (2 marks)

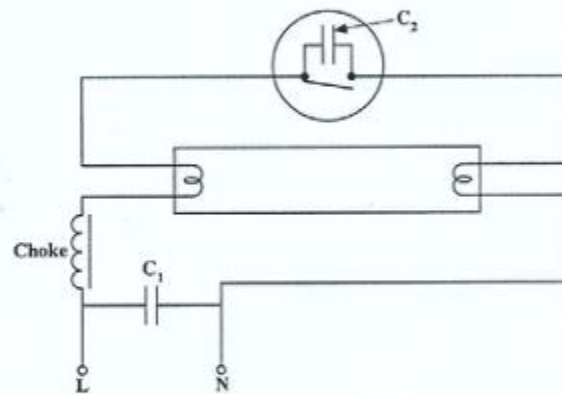 (d) Figure 7 shows a switch-start fluorescent circuit with glow type starter.

Figure 7

     (i) Explain briefly the function of the choke in the above circuit.   (2 marks)

     (ii) State the function of C_1 and C_2 in the above circuit.   (2 marks)

  (e) A customer requires two lamps to be controlled from two different locations along a corridor. Design a schematic diagram to satisfy the customer.   (6 marks)

  (f) Name TWO instruments you can use to test the circuit for (e) above, before it is energized.
                                                  (2 marks)

Total 20 marks

END OF TEST

(a)   Figure 6 shows the layout of a computer laboratory. In your answer booklet write the numbers ① , ② , ③ , ④ , ⑤ , ⑥ , ⑦ and ⑧ . Identify EACH of the corresponding parts by writing the name of the part next to the number.

(8 marks)

(b)   Name any TWO of the conductors in the earthing system of an electrical installation.

(2 marks)

(c)   Describe how earthing of exposed metal in an electrical installation provides protection from electric shock.   (4 marks)

(d)   Briefly explain the purpose of the switch feed, the travellers, and switch wire in a two-way switch control of a filament lamp.   (4 marks)

(e)   Describe TWO advantages of using circuit breakers instead of fuses.   (2 marks)

Total 20 marks

SECTION C

Candidates MUST answer ONE question from this section.
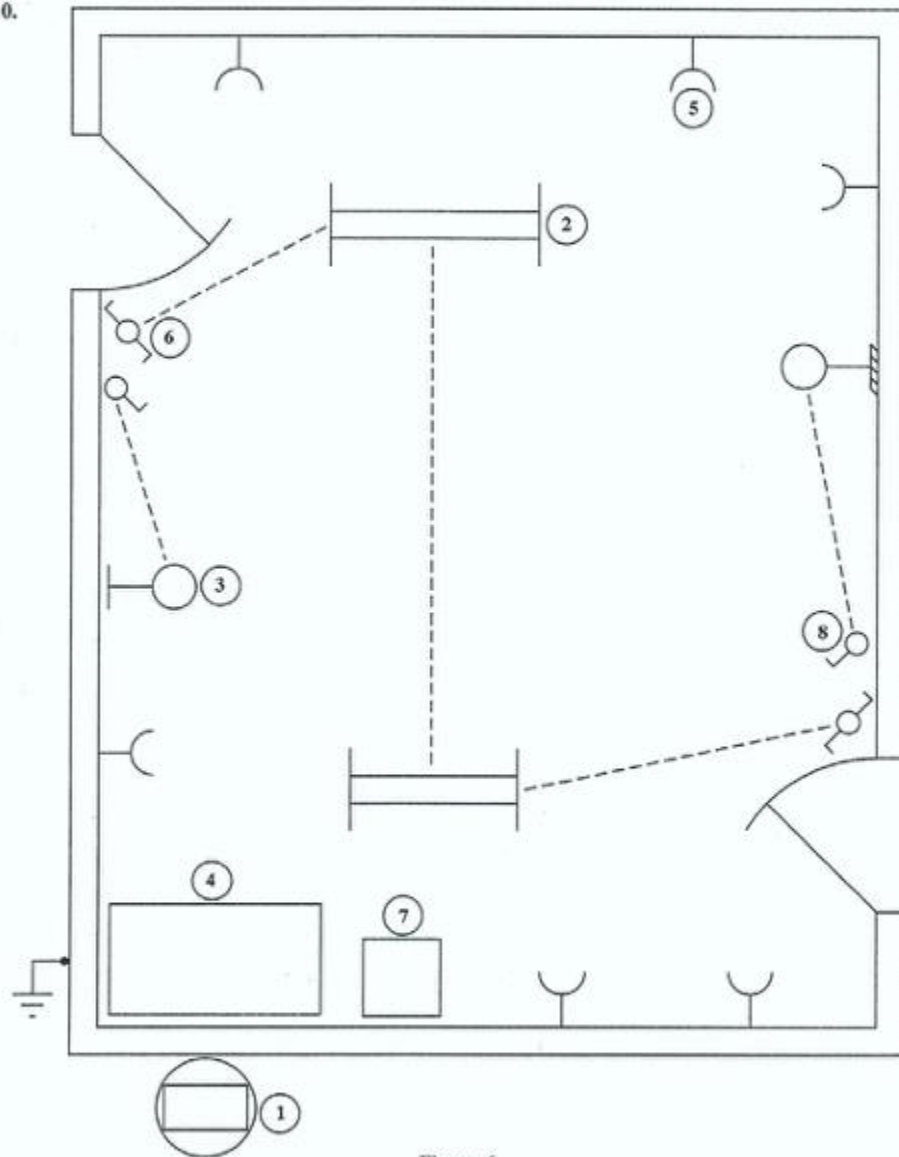Each question is worth TWENTY marks.
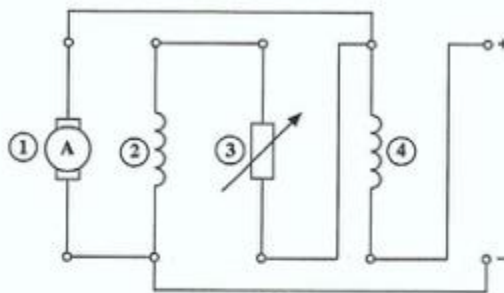
10.

Figure 6

GO ON TO THE NEXT PAGE

9.

Figure 5

(a) What are the functions of the variable resistor ③ and the compound field winding ④ in the compound motor shown in Figure 5?   (2 marks)

(b) Describe briefly the operation of the commutator associated with the armature of the compound motor shown in Figure 5.   (4 marks)

(c) State the TWO laws of electromagnetic induction which influence the magnitude and direction of the back e.m.f. in a compound motor.   (4 marks)

(d) A 230 Volt d.c. motor with negligible shunt winding current, and a series winding with 0.5 ohms resistance, and an armature with 0.1 ohm resistance takes 60 Amps from the supply voltage.

Calculate the

(i)   series windings voltage drop

(ii)   armature voltage drop

(iii) power loss in the motor windings

(iv) back e.m.f. generated in the armature of the motor   (8 marks)

(e) Explain briefly the sources of TWO major types of energy loss in a d.c. motor.

(2 marks)

Total 20 marks

7. (a) (i) Draw the symbols of logic AND and NOR gates. Develop a truth table for an AND gate using two inputs. (6 marks)

(ii) You are given two switches, S_1 and S_2, a relay and a d.c. power supply. Construct a circuit representing the function of an AND gate. Explain briefly the operation of the circuit. (2 marks)

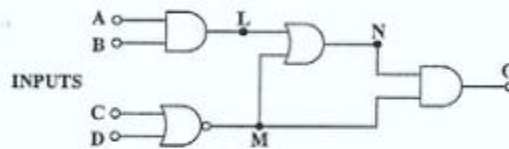(b) A logic circuit with inputs A, B, C, and D is shown in Figure 4.

Figure 4

Derive boolean expressions at the output points. (4 marks)

(c) (i) Name FOUR devices that can be used to output information from a personal computer. (4 marks)

(ii) State the difference between operating system software and application software in a microcomputer system. Name ONE example in EACH case. (4 marks)

Total 20 marks

8. (a) Explain briefly the difference between a primary and a secondary cell. (4 marks)

(b) State the expression for the internal resistance (r) of a cell in terms of its e.m.f. (E) and terminal voltage (V), for a load current (I). (2 marks)

(c) For a primary cell, explain briefly the terms:

(i) Polarization

(ii) Local action (4 marks)

(d) State TWO advantages of an alkaline cell over a lead-acid cell. (4 marks)

(e) The voltage at the terminals of a battery is 12 V when no load is connected, and 10 V when a load causing a current flow of 8 A is connected.

(i) Find the internal resistance of the battery. (3 marks)

(ii) What would be the terminal voltage when a load causing a current flow of 5 A is connected to the battery? (3 marks)

Total 20 marks

GO ON TO THE NEXT PAGE

SECTION B

**Candidates MUST answer THREE questions from this section.
Each question is worth TWENTY marks.**

6. (a) With the help of diagrams show and state how you will connect a p – n junction semiconductor diode to a d.c. supply to

    (i)   reverse bias the diode   (2 marks)

    (ii) forward bias the diode.   (2 marks)

    (b) Figure 3 shows the schematic of a transistor amplifier.
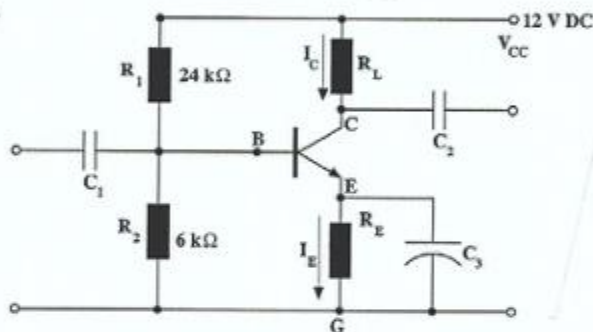
Figure 3

For $R_L = 4.7\ k\Omega$, $V_{BE} = 0.6\ V$, $V_{CE} = 5.5\ V$ and $I_C = I_E$, calculate the

    (i)   voltage V_{BG} (3 marks)

    (ii) voltage drop across the resistor R_E (2 marks)

    (iii) value of current I_C (3 marks)

    (iv) value of R_E (2 marks)

    (c) Explain briefly the functions of the capacitors C_1, C_2 and C_3.   (4 marks)

    (d) State the application of the circuit shown in Figure 3 in a radio receiver circuit.

                                                                        (2 marks)

Total 20 marks

4. (a) You are given a Volt/Amp meter. State how you will increase

   (i) the voltage range of the instrument   (2 marks)

   (ii) the current range of the instrument.   (2 marks)

   (b) (i) What type of meter shows readings on a linear scale?   (2 marks)

   (ii) What type of meter shows readings on a non-linear scale?   (2 marks)

   Total 8 marks

5. (a) Give ONE reason why a.c. is preferred over d.c. for transmitting voltages over long distances.   (2 marks)

   (b) Name TWO primary sources of energy used for the generation of electricity in commercial systems.   (2 marks)

   (c) (i) State TWO alternative sources of primary energy for generation of electricity.   (2 marks)

   (ii) Explain briefly the principle of conversion of ONE such alternative source.   (2 marks)

   Total 8 marks

2. (a) Name TWO factors which impact on the inductance of an inductor. (2 marks)

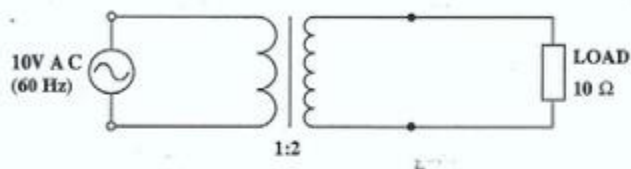   (b) Figure 2 shows the schematic diagram of a step up transformer.

Figure 2

The ratio of the primary to secondary windings is one to two. Assume that the transformer is 100% efficient.

Calculate the

    (i)   secondary voltage V_s (2 marks)

    (ii) primary current I_p (2 marks)

    (c) State ONE reason why transformer cores are laminated. (2 marks)

                                                                Total 8 marks

3. (a) What is the MAIN advantage of a full wave rectifier over a half wave rectifier in power supply circuits? (2 marks)

    (b) Name TWO components used to change pulsating d.c. to smooth d.c. in a power supply circuit. (2 marks)

    (c) Draw the schematic diagram of a full wave bridge rectifier. (4 marks)

                                                                Total 8 marks

Candidates MUST answer NINE questions, ALL FIVE from Section A, THREE from Section B and ONE from Section C.

SECTION A

Candidates MUST answer ALL FIVE questions in this section.
Each question is worth EIGHT marks.

1.   (a)   State Ohm's law.   **(2 marks)**
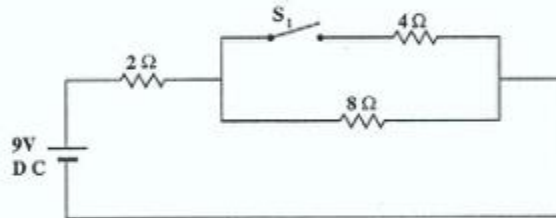
       (b)   Figure 1 shows a series parallel circuit

Figure 1

Calculate the

           (i)   total resistance when S_1 is closed.   **(1 mark)**

           (ii)   total resistance when S_1 is open.   **(1 mark)**

           (iii)   total current when S_1 is closed.   **(1 mark)**

           (iv)   power dissipated in the $2\ \Omega$ resistor when the switch S_1 is closed.

                                                                          (2 marks)

       (c)   Define temperature coefficient of resistance.   **(1 mark)**

                                                                 Total 8 marks

CARIBBEAN EXAMINATIONS COUNCIL

SECONDARY EDUCATION CERTIFICATE
EXAMINATION

ELECTRICAL AND ELECTRONIC TECHNOLOGY

Paper 02 – Technical Proficiency

$2\frac{1}{2}$ hours

(12 MAY 2009 (p.m.))

GENERAL INSTRUCTIONS

1. This paper consists of THREE sections. Candidates MUST answer NINE questions.

    SECTION A: You must answer ALL FIVE COMPULSORY questions from this section.

    SECTION B: You must answer THREE questions from this section.

    SECTION C: You must answer ONE question from this section.

2. In addition to the $2\frac{1}{2}$ hours, candidates are allowed 10 minutes to read through the paper. Writing MAY begin during the 10-minute period.

3. All working must be CLEARLY shown.

4. Use sketches where necessary to support your answers.

5. Silent electronic calculators may be used.

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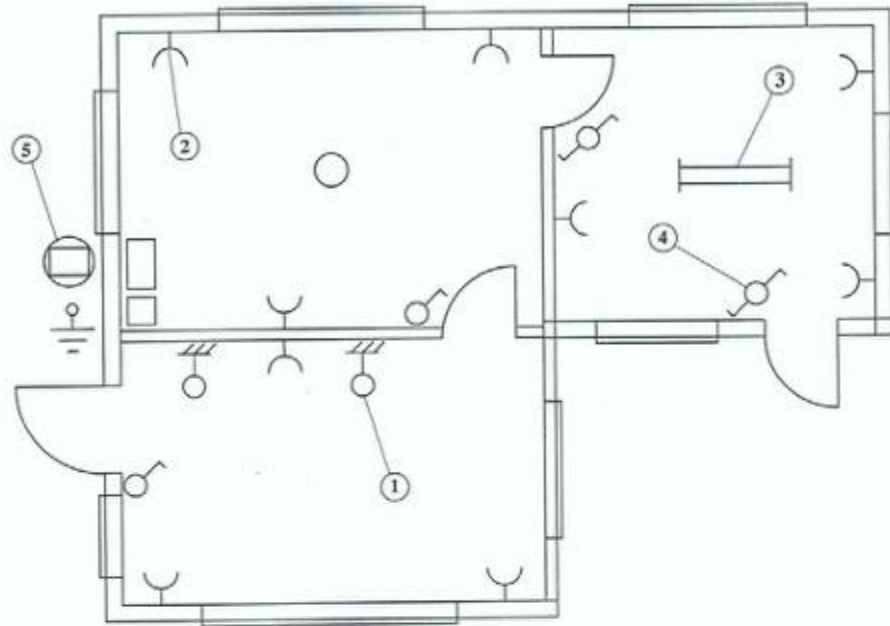
01317020/F 2009

11.

Figure V

Figure V shows the electrical floor plan of a building.

(a)   In your answer booklet write the numbers ① ② ③ ④ and ⑤ . Beside EACH number write the name of the electrical item shown in Figure V.   **(5 marks)**

(b)   Explain the MAIN function of EACH electrical item named in part (a) above.
    (10 marks)

(c)   Why are fluorescent lamps preferred to filament lamps in lighting circuits?
    (2 marks)

(d)   Which conductors connect exposed metal parts in an electrical installation to the general mass of earth or ground?   **(3 marks)**

Total 20 marks

END OF TEST

01317020/F 2008

SECTION C

**Candidates MUST answer ONE question from this section.
Each question is worth TWENTY marks.**

10.
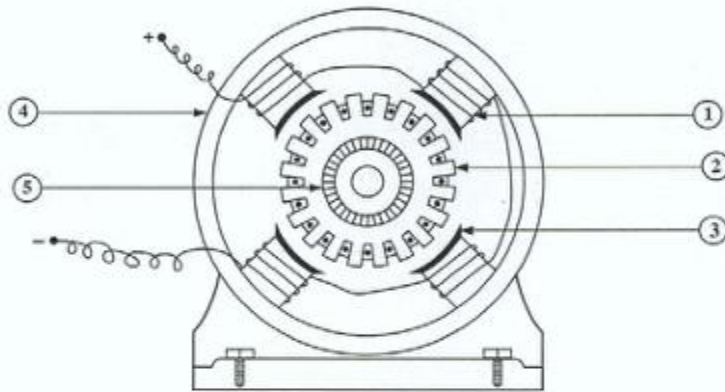
Figure IV

Figure IV shows the diagram of a four pole d.c. motor.

(a) In your answer booklet, write the numbers ①②③④ and ⑤. Beside EACH
number write the name of the corresponding part of the d.c. motor shown in Figure IV.
(5 marks)

(b) Explain the MAIN function of EACH part of the d.c. motor named in part (a) above.
(10 marks)

(c) Name THREE types of d.c. motors that are identified by the way the armature and field
windings are connected in the motor.
(3 marks)

(d) State TWO ways of achieving reversal of rotation in a d.c. motor.
(2 marks)

Total 20 marks

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9.

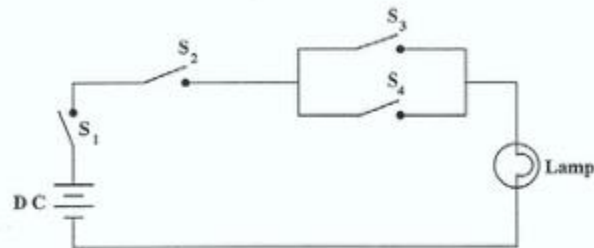**Figure II**

(a)   In Figure II, an electric lamp is controlled by the switches S_1, S_2, S_3 and S_4. For Figure II,

(i)   draw the equivalent logic circuit which can replace the four switches S_1, S_2, S_3 and S_4.   (6 marks)

(ii)   Using the three switches S_2, S_3 and S_4 as inputs and the electric lamp as an output, draw the truth table of the circuit.

Assume that the open state of the switches is represented by logic O, and the closed state is represented by logic 1, and the state of switch S_1 is logic 1 or it is closed.   (8 marks)
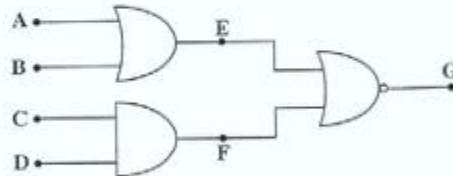
(b)

Figure III

A logic circuit is shown in Figure III. A, B, C, and D represent inputs to the circuit. Derive expressions for the outputs at the points E, F, and G.   (6 marks)

Total 20 marks

7. (a) State the difference between primary and secondary cells. (2 marks)

(b) State TWO safety precautions which should be observed when charging secondary cells. (2 marks)

(c) (i) Explain briefly the principle of operation of a lead-acid cell. (6 marks)

(ii) State the TWO MAIN indicators of a FULLY charged lead-acid cell. (4 marks)

(d) A 6 ohm resistor is connected across a lead-acid cell. The potential difference across the battery terminals is 20 V for the open-circuit, and 18 V when the circuit is closed.

Calculate the

(i) current in the circuit (2 marks)

(ii) internal resistance of the battery. (4 marks)

Total 20 marks

8. (a) Explain briefly the following terms:

(i) Luminous flux (2 marks)

(ii) Illumination (2 marks)

(b) A light source is suspended from a ceiling 5 m above a working table. The illumination on the working table at right angle to the light source is 250 Lux.

Calculate the

(i) luminous intensity of the light source (3 marks)

(ii) illumination at a point 3 m along the working table surface. (6 marks)

(c) Sketch the circuit diagram of a quick-start fluorescent lamp circuit. Describe briefly the operation of the circuit. (7 marks)

Total 20 marks

GO ON TO THE NEXT PAGE

SECTION B

Candidates MUST answer THREE questions from this section.
Each question is worth TWENTY marks.

6.   (a)   (i)   a)   State Ohm's Law.

   b)   Write down the mathematical relationship between the current (I), the
   voltage (V), and the resistance (R) of a circuit   (3 marks)

   (ii)   Explain briefly the term 'resistivity'.   (3 marks)

(b)   Figure I, shows a series parallel circuit
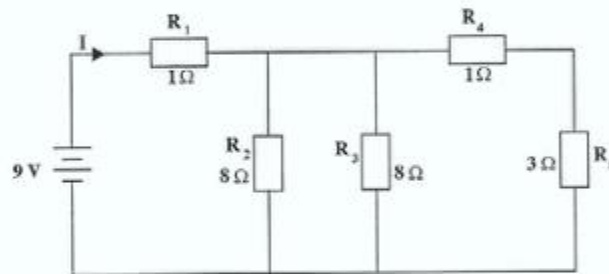

Figure I

Calculate the

   (i)   total resistance of the circuit.   (5 marks)

   (ii)   voltage drop across the resistor R_1.   (3 marks)

   (iii)   voltage drop across the resistor R_5.   (3 marks)

   (iv)   power dissipated by the resistor R_5.   (3 marks)

Total 20 marks

GO ON TO THE NEXT PAGE

4. (a) In the case of a parallel plate capacitor, state the impact on the capacitance of the capacitor if,

    (i) the area of the plates of the capacitor is increased.   (2 marks)

    (ii) the distance between the plates is decreased.   (2 marks)

  (b) Name THREE dielectric materials used in the construction of a capacitor.

    (3 marks)

  (c) State ONE application of capacitors in electronic circuits.   (1 mark)

Total 8 marks

5. (a) Name TWO input and TWO output devices in a computer system.   (4 marks)

  (b) Explain briefly the difference between ROM memory and RAM memory in a computer system.   (4 marks)

Total 8 marks

Candidates MUST answer NINE questions, ALL FIVE from Section A, THREE from Section B and ONE from Section C.

SECTION A

Candidates MUST answer ALL FIVE questions from this section.
Each question is worth EIGHT marks.

1.   (a)   Name THREE types of transistor configurations.   (3 marks)

     (b)   What type of transistor configuration will you select to design a high input impedance and low output impedance amplifier.   (2 marks)

     (c)   In a transistor amplifier circuit, for a base current of 50 μA, the collector current is 3 mA. Calculate the current gain of the amplifier circuit.   (3 marks)

                                                                              Total 8 marks

2.   (a)   Name TWO electromotive forces that are induced in the conductors of a double wound power transformer.   (2 marks)

     (b)   A step-down transformer with an input of 230 volts gives an output of 24 volts. The transformer has 800 turns of primary windings. Calculate the number of turns on the secondary windings.   (2 marks)

     (c)   What are the TWO MAIN losses present in an iron core transformer under load conditions?   (2 marks)

     (d)   A high voltage transmission line causes electrical energy from location A to be used at location B. What type of transformers are required at the two locations?   (2 marks)

                                                                              Total 8 marks

3.   (a)   State TWO methods of increasing the terminal volts of a d.c. generator.   (2 marks)

     (b)   Name the field windings of a compound wound d.c. generator.   (2 marks)

     (c)   State TWO methods used to excite the magnetic field of a d.c. generator.   (2 marks)

     (d)   State Lenz's Law of Electromagnetic Induction.   (2 marks)

                                                                              Total 8 marks

GO ON TO THE NEXT PAGE

CARIBBEAN EXAMINATIONS COUNCIL

SECONDARY EDUCATION CERTIFICATE
EXAMINATION

ELECTRICAL AND ELECTRONIC TECHNOLOGY

Paper 02 – Technical Proficiency

$2\frac{1}{2}$ *hours*

(13 MAY 2008 (p.m.))

GENERAL INSTRUCTIONS

1. This paper consists of THREE sections. Candidates MUST answer NINE questions.

    SECTION A: You must answer ALL FIVE COMPULSORY questions from this section.

    SECTION B: You must answer THREE questions from this section.

    SECTION C: You must answer ONE question from this section.

2. In addition to the $2\frac{1}{2}$ hours, candidates are allowed 10 minutes to read through the paper. Writing MAY begin during the 10-minute period.

3. All working must be CLEARLY shown.

4. Use sketches where necessary to support your answers.

5. Silent electronic calculators may be used.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

CARIBBEAN EXAMINATIONS COUNCIL

SECONDARY EDUCATION CERTIFICATE
EXAMINATION

ELECTRICAL AND ELECTRONIC TECHNOLOGY

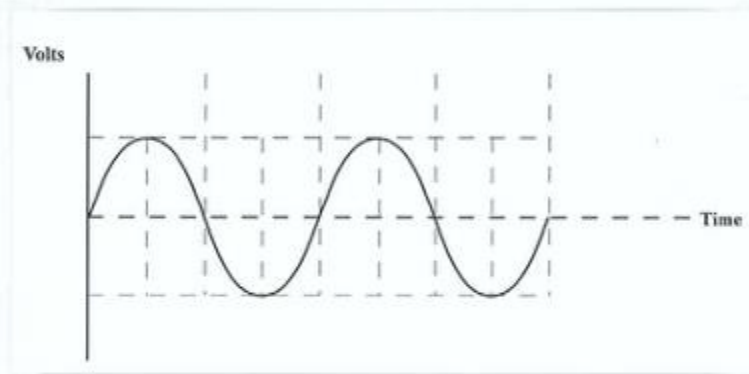Paper 02 – Technical Proficiency

Answer sheet for Question 3. (b)

Figure I

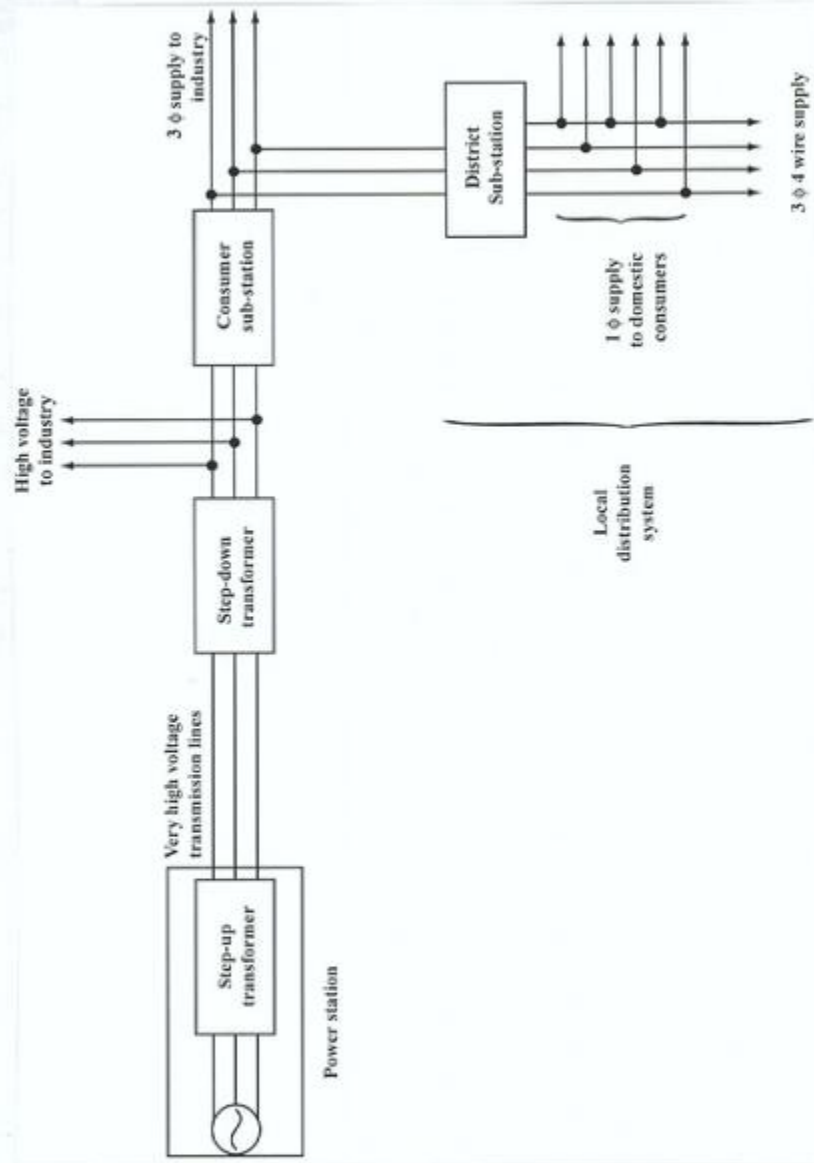TO BE ATTACHED TO YOUR ANSWER BOOKLET.

Figure VIII – A Typical National Power Distribution System

END OF TEST

11.   Figure VIII, on page 11, shows a typical Power Distribution System.

    (a)   Explain briefly the function of EACH of the following:

        (i)   Power Station   (4 marks)

        (ii)   Step Down Transformer   (2 marks)

        (iii)   Sub-stations   (2 marks)

    (b)   Name TWO sources of energy used for the generation of electricity for commercial purposes.   (2 marks)

    (c)   Give TWO reasons why a.c. is widely used for the distribution of electricity.
                                                                                         (2 marks)

    (d)   Give TWO reasons why domestic lighting circuits are connected in parallel.
                                                                                         (2 marks)

    (e)   State what is meant by the following:

        (i)   Short circuit   (3 marks)

        (ii)   Overload   (3 marks)

                                                                              Total 20 marks

SECTION C

Candidates MUST answer ONE question from this section.

Each question is worth TWENTY marks.

10. Figure VII shows a block diagram of a superheterodyne radio receiver.
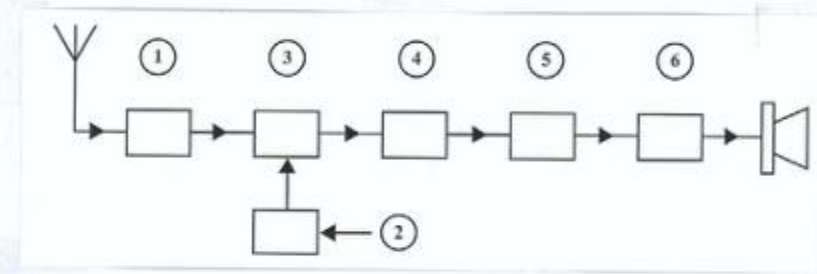

Figure VII

(a) In your answer booklet, write the numbers ①, ②, ③, ④, ⑤ and ⑥. Beside EACH number, write the name of the block of the receiver.   **(6 marks)**

(b) State the main function of EACH of the blocks labelled ① ② ③ ④.

    (8 marks)

(c) Calculate the wavelength for an electromagnetic wave with a frequency of 30 GHz.

    (6 marks)

Total 20 marks

9.   Figure VI shows the symbols of four logic gates.

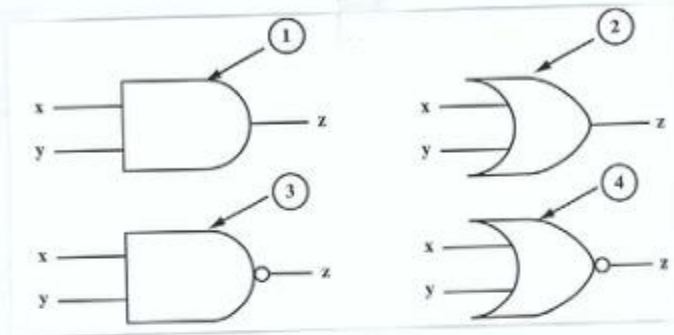**Figure VI**

(a)   In your answer booklet, write the numbers ① ② ③ ④ and beside EACH number, write the names of the logic gate indicated by the symbol.   **(4 marks)**

(b)   Construct truth tables to show the input and output states for the logic gates ① , ② , ③ and ④ .   **(10 marks)**

(c)   List FOUR types of application software used in personal computers.   **(4 marks)**

(d)   State the difference between hardware and software in any computer system.
                                                                (2 marks)

                                                        Total 20 marks

8. Figure V shows the internal connections of a measuring instrument.
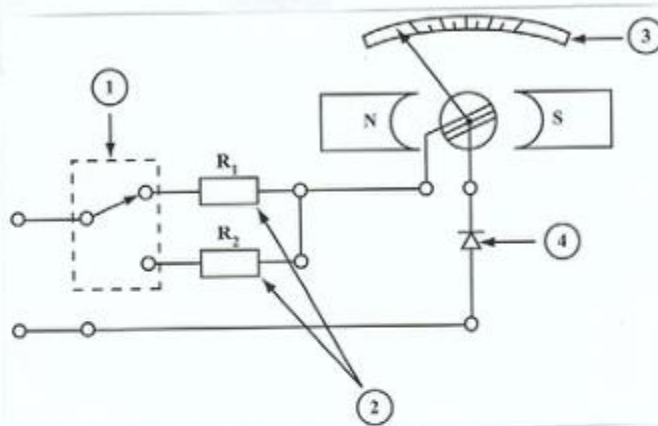

Figure V

(a) In your answer booklet, write the numbers ① ② ③ ④ and beside EACH number, write the name of the part of the instrument.   **(4 marks)**

(b) State the main function of EACH of the parts labelled ① ② ③ ④ .   **(8 marks)**

(c) You are given a measuring instrument, which has 1 mA Full Scale Deflection (FSD) at an internal resistance of 50 Ω. Use this instrument to construct a voltmeter with 10 V and 25 V ranges.

Calculate the values of the series resistor required for EACH voltage range.

(8 marks)

Total 20 marks

7.   (a)   Figure IV shows a common emitter amplifier.

$V_{BE} = 0.6$ V; $V_{CC} = 12$ V; $R_1 = 100$ kΩ; $R_2 = 20$ kΩ;

$R_L = 1$ kΩ; $R_E = 1.4$ kΩ; $\beta = 50$; and $I_B \approx I_C$.

Figure IV

Calculate:

(i)   voltage across R_2 (4 marks)

(ii)   voltage across R_E (2 marks)
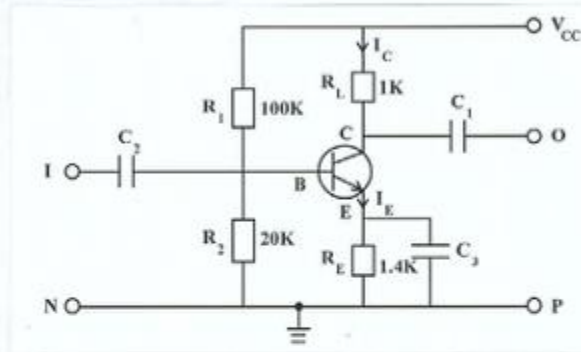
(iii) V_{CE} (6 marks)

(iv)   power dissipated by R_L (2 marks)

(b)   Name TWO methods of connecting a transistor in a circuit to form an amplifier.
                                                                                                         (2 marks)

(c)   Explain the function of C_3.   (2 marks)

(d)   Between which TWO terminals of the circuit would you apply an input signal?
                                                                                                         (2 marks)

Total 20 marks

SECTION B

Candidates MUST attempt THREE questions from this section.

Each question is worth TWENTY marks.

6. (a) A 80 µF capacitor draws a current of 1.0 A when 220 V a.c. is connected across it.

    Calculate:

    (i)   the frequency of the supply voltage   (5 marks)

    (ii) the value of resistance connected in series to reduce the current to 0.75 A at the
          same frequency   (7 marks)

    (iii) the phase angle of the RC series circuit.   (3 marks)

    (b) Make a neat sketch indicating the current and voltage relationship of the components in
         a RC series circuit.   (5 marks)

                                                                          Total 20 marks

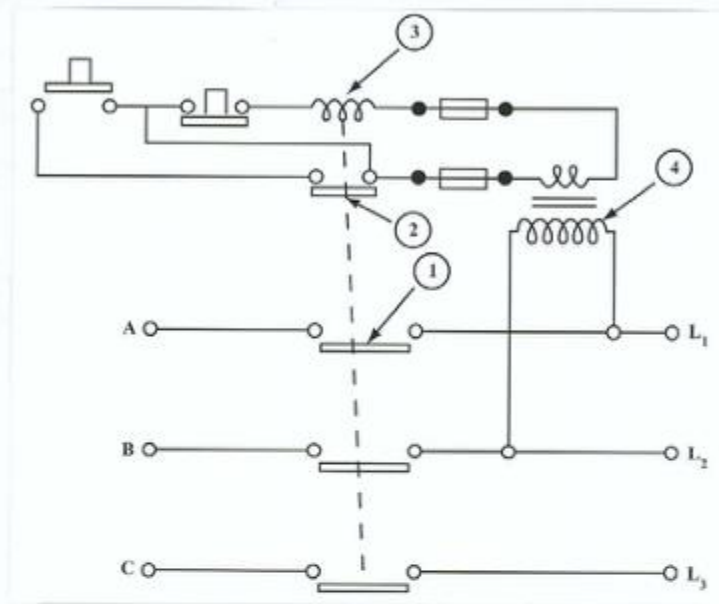5. Figure III shows the internal connections of a direct on-line motor starter.

Figure III

(a) In your answer booklet, write the numbers ① ② ③ ④ and beside EACH number, write the name of the part of the motor starter. **(4 marks)**

(b) State the main function of any TWO of the parts labelled ① ② ③ ④.

(4 marks)

Total 8 marks

(b) Figure I, provided on a separate sheet, is a sketch of the a.c. wave form. On that sketch indicate:

    (i)   Peak voltage   (1 mark)

    (ii)   One cycle   (1 mark)

    (iii)   Positive and negative polarity of the vertical axis   (2 marks)

Total 8 marks

4.   Figure II shows schematic symbols of two semiconductor devices, A and B.
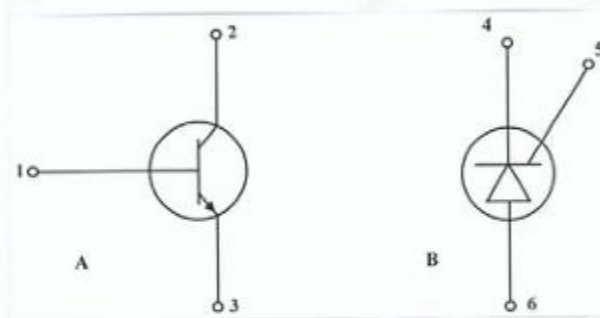

Figure II

(a)   Name EACH device.   (2 marks)

(b)   Identify TWO terminals on EACH device.   (2 marks)

(c)   Give ONE application of EACH device.   (4 marks)

Total 8 marks

Candidates MUST answer NINE questions, ALL FIVE from Section A, THREE from Section B and ONE from Section C.

SECTION A

Candidates MUST answer ALL FIVE questions in this section.

Each question is worth EIGHT marks.

1. (a) Name TWO materials that can be added to a pure semiconductor material to form N–type semiconductors. **(2 marks)**

    (b) (i) Name the area in the pn junction diode where ionization takes place.

    (1 mark)

    (ii) Name the process used to produce P or N type semiconductor materials.

    (1 mark)

    (c) With the aid of a diagram, show how four 1.5 V cells can be connected to provide a D.C. supply of 6 V. **(4 marks)**

    Total 8 marks

2. (a) Define the term 'resistivity' of a material. **(2 marks)**

    (b) Write an expression showing the relationship between the cross-sectional area (A) and the resistance (R) of a given conductor. **(2 marks)**

    (c) What is the resistance of 20 meters of copper wire with cross sectional area of 1.5 mm^2? (The Resistivity of copper is 1.59×10^{-8} Ω m) **(4 marks)**

    Total 8 marks

3. (a) Define the following terms:

    (i) Capacitance **(2 marks)**

    (ii) Inductance **(2 marks)**

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CARIBBEAN EXAMINATIONS COUNCIL

SECONDARY EDUCATION CERTIFICATE EXAMINATION

ELECTRICAL AND ELECTRONIC TECHNOLOGY

Paper 02 – Technical Proficiency

2½ hours

15 MAY 2007 (p.m.)

GENERAL INSTRUCTIONS:

1. This paper consists of THREE sections. Candidates MUST answer NINE questions.

    SECTION A: You must answer ALL FIVE COMPULSORY questions from this section.

    SECTION B: You must answer THREE questions from this section.

    SECTION C: You must answer ONE question from this section.

2. In addition to the 2½ hours, candidates are allowed 10 minutes to read through the paper. Writing MAY begin during the 10-minute period.

3. All working must be CLEARLY shown.

4. Use sketches where necessary to support your answers.

5. Silent electronic calculators may be used.

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11. Figure VII shows the schematic for a lead-lag circuit for operating a pair of fluorescent lamps.
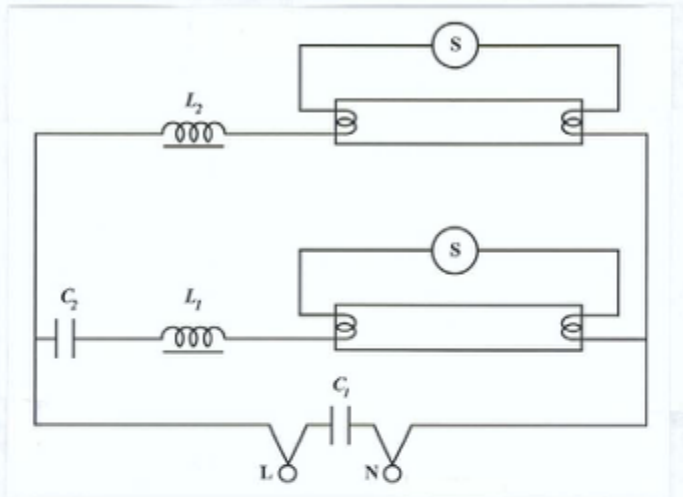

Figure VII

(a) Explain briefly the function of the choke in the operation of electric discharge lamps.

(2 marks)

(b) Explain briefly the term 'stroboscopic effect' with reference to electric discharge lighting in industrial settings.

(4 marks)

(c) Explain briefly the functions of capacitor C_1 and capacitor C_2 in the operation of the lead-lag fluorescent lamp circuit.

(4 marks)

(d) Name TWO gases used in the construction of electric discharge lamps.

(2 marks)

(e) Give TWO inductive components used in the construction of electric discharge lamps.

(4 marks)

(f) List TWO **major** advantages of using fluorescent lamps in industrial installations.

(4 marks)

Total 20 marks

END OF TEST

SECTION C

Candidates MUST answer ONE question from this section.

Each question is worth TWENTY marks.

10. (a) Name the network for computers which are interconnected

        (i)   in offices

        (ii) across the world.   **(2 marks)**

    (b) List TWO **major** advantages of networking computers in offices.   **(4 marks)**

    (c) Name FOUR input devices that can be used to input data to a computer system.
                                             (4 marks)

    (d) Name the type of computer software program that is dedicated to the following office processes:

        (i)   The preparation of customers' accounts

        (ii) Keeping up-do-date records of customer information

        (iii) Preparing letters and memoranda   **(6 marks)**

    (e) Explain the terms ROM and RAM.   **(4 marks)**

                                                 Total 20 marks

(e) Explain briefly the operation of a normally open alarm circuit connected in an OR control system logic arrangement.   (4 marks)
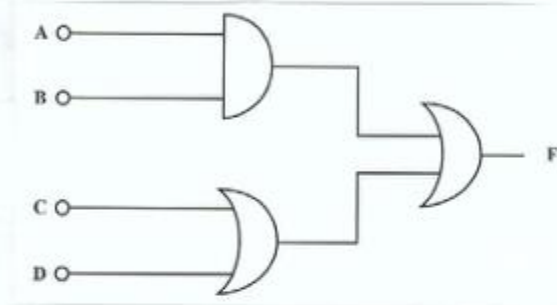
(f) Figure VI shows a logic arrangement.

Figure VI

Derive a boolean expression for the logic arrangement shown in Figure VI.

(2 marks)

Total 20 marks

9.   A single-phase, double wound transformer has a voltage ratio of 230V : 60V. A 2 kΩ resistive load is connected across the secondary winding. There are 600 turns on the secondary winding.

(a) Calculate

    (i)   the number of turns in the primary winding

    (ii)   the secondary power

    (iii) the primary current.   (10 marks)

(b) Explain briefly the copper losses in a transformer and their relationship to the transformer load.   (4 marks)

(c) Explain briefly the iron losses in a transformer and their relationship to the transformer load.

(4 marks)

(d) Explain the term 'electrostatic screening' in relation to a power transformer.

(2 marks)

Total 20 marks

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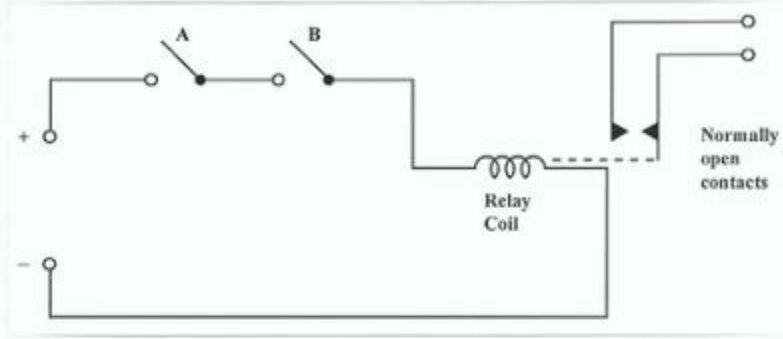8. (a) Figure V (a) and Figure V (b) show AND and OR control system logic arrangements.
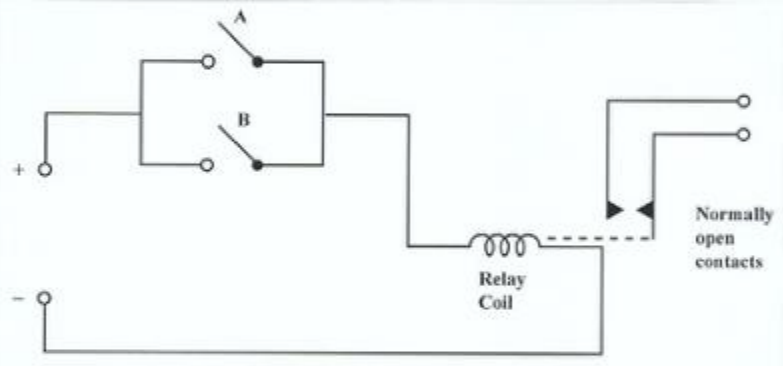

Figure V (a) - The AND ARRANGEMENT

Figure V (b) - The OR ARRANGEMENT

Give the logic state when switches A and B are in the following positions:

(i) Switch A and B are open

(ii) Switch A and B are closed   (2 marks)

(b) Construct a truth table that shows the output for any combination of states of switches A and B in the AND arrangement shown in Figure V (a).   (4 marks)

(c) Construct a truth table that shows the output for any combination of states of switches A and B in the OR arrangement shown in Figure V (b).   (4 marks)

(d) Explain briefly the operation of a normally closed alarm circuit connected in an AND control system logic arrangement.   (4 marks)

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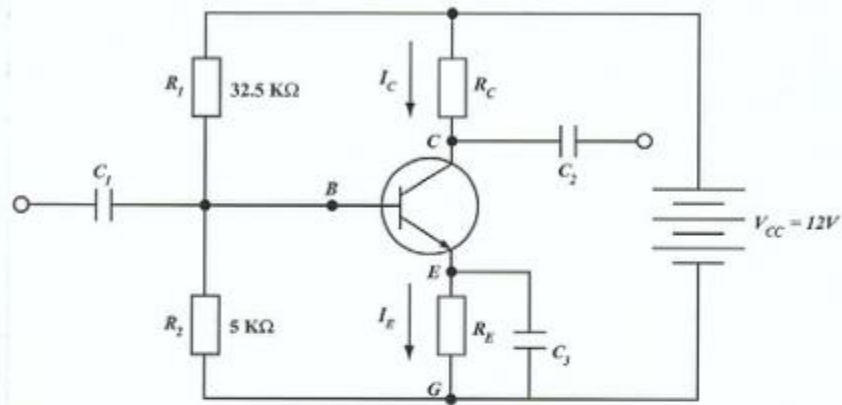7. (a) Figure IV shows the schematic of a transistor amplifier.

Figure IV

Given that $V_{CE} = 5V$, $V_{BE} = 0.6V$, $I_C = I_E = 1mA$, calculate the

(i) voltage drop between the points B and G

(ii) value of R_E

(iii) value of R_C. **(12 marks)**

(b) Explain briefly the terms 'amplitude modulation' and 'frequency modulation' in the transmission of radio signals. **(4 marks)**

(c) Explain briefly the term 'natural frequency' as applied to oscillations in a circuit containing capacitance and inductance connected in series. **(4 marks)**

Total 20 marks

SECTION B

Candidates MUST attempt THREE questions from this section.

Each question is worth TWENTY marks.

6. (a) Figure III shows the schematic of a normally open relay circuit.
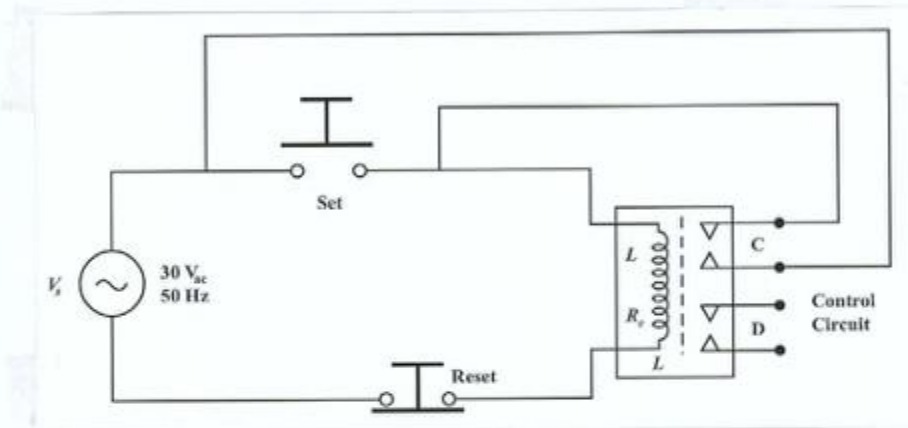

Figure III

Given that coil resistance, $R_c = 12$ Ohms, Inductance, $L = 0.1$ henry, and supply $V_s = 30$ Volts 50 Hertz, calculate the

     (i)   inductive reactance of the coil

     (ii)   impedance of the coil

     (iii) current in the coil

     (iv)   power

     (v)   power factor of the circuit.   **(10 marks)**

   (b) Explain briefly the protection provided to control the circuit by the relay circuit.
                                                                      (4 marks)

   (c) Explain briefly the function of contacts C and D.   **(4 marks)**

   (d) Name a passive electronic component that can reduce arcing at contact points C and D.
                                                                      (2 marks)

                                                                Total 20 marks

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5. (a)   State Ohm's Law and write the formula that represents Ohm's Law.   (2 marks)

    (b)   Figure II shows a resistive circuit.

Figure II

          Calculate the
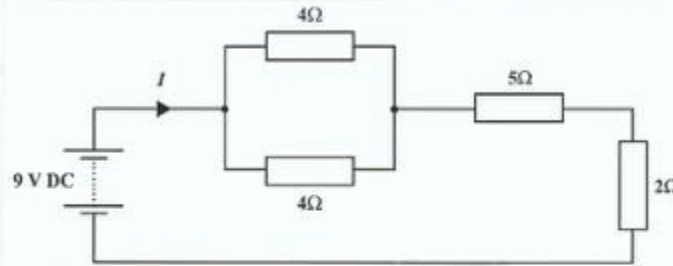
          (i)   total resistance

          (ii)   current, *I*.   (4 marks)

    (c)   Name TWO components that oppose the flow of alternating current in the running winding
          of a single-phase motor.   (2 marks)

                                                                    Total 8 marks

3. (a)   Give TWO specifications that must be considered in selecting a semiconductor diode for use in a half-wave rectifier circuit.   (2 marks)

    (b)   State the junction bias conditions that control the operation of a silicon transistor used as a switch in a logic circuit.   (2 marks)

    (c)   With reference to the transfer characteristic, explain the operation of the following categories of transistor amplifiers:

          (i)   Class A amplifiers

          (ii)   Class B amplifiers   (4 marks)

                                                                              Total 8 marks

4. (a)   Give TWO methods used to reduce the starting current in three-phase alternating current motor starters.   (2 marks)

    (b)   Name TWO effects of an electric current that are the basis for constructing over-current protection devices in three-phase motor starters.   (2 marks)

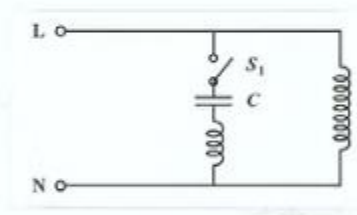   (c)   Figure I shows the schematic of a single-phase capacitor, start induction motor.

Figure I

Explain the function of the capacitor, C, and switch, S_1.   (4 marks)

                                                                              Total 8 marks

Candidates MUST answer NINE questions, ALL FIVE from Section A, THREE from Section B and ONE from Section C.

SECTION A

Candidates MUST answer ALL FIVE questions in this section.

Each question is worth EIGHT marks.

1. (a) State TWO operations required to change the output of an alternator to a steady d.c. value.
    (2 marks)

    (b) Name TWO instruments that are used to measure the state of charge of a lead acid battery.
    (2 marks)

    (c) Explain the energy conversions that take place in the following electric circuits in an automobile.

    (i) The starter circuit

    (ii) The battery charging circuit
    (4 marks)

    Total 8 marks

2. (a) Name TWO types of e.m.f.s that are induced in the windings of a double-wound power transformer in operation.
    (2 marks)

    (b) List TWO design features of the iron core of a power transformer that reduce the effects of eddy currents.
    (2 marks)

    (c) Explain the increase in the current in the primary winding of a double-wound power transformer when there is an increase in the secondary current.
    (4 marks)

    Total 8 marks

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CARIBBEAN EXAMINATIONS COUNCIL

SECONDARY EDUCATION CERTIFICATE
EXAMINATION

ELECTRICAL AND ELECTRONIC TECHNOLOGY

Paper 02 – Technical Proficiency

2½ hours

16 MAY 2006 (p.m.)

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