CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

16 MAY 2019 (p.m.)

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FILL IN ALL THE INFORMATION REQUESTED CLEARLY IN CAPITAL LETTERS.

TEST CODE | 0 | 1 | 3 | 7 | 0 | 0 | 2 | 0 |

SUBJECT INDUSTRIAL TECHNOLOGY
OPTION A – ELECTRICAL AND ELECTRONIC TECHNOLOGY – Paper 02

034

PROFICIENCY TECHNICAL

REGISTRATION NUMBER | | | | | | | | | | |

SCHOOL/CENTRE NUMBER					

NAME OF SCHOOL/CENTRE

A006

CANDIDATE'S FULL NAME (FIRST, MIDDLE, LAST)

DATE OF BIRTH | D | D | M | M | Y | Y | Y | Y |

SIGNATURE _____

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FORM TP 2019081

TEST CODE 01370020

MAY/JUNE 2019

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

INDUSTRIAL TECHNOLOGY

OPTION A – ELECTRICAL AND ELECTRONIC TECHNOLOGY

Paper 02 – Technical Proficiency

2 hours 10 minutes

034

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of FIVE compulsory questions.
2. Use sketches where necessary to support your answers.
3. Write your answers in the spaces provided in this booklet.
4. Do NOT write in the margins.
5. You may use a silent, non-programmable calculator to answer questions.
6. This paper contains metric dimensions only. You should work your answers in the metric system.
7. You are advised to take some time to read through the paper and plan your answers.
8. If you need to rewrite any answer and there is not enough space to do so on the original page, you must use the extra lined page(s) provided at the back of this booklet. **Remember to draw a line through your original answer.**
9. **If you use the extra page(s) you MUST write the question number clearly in the box provided at the top of the extra page(s) and, where relevant, include the question part beside the answer.**

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

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1. (a) In the space provided, sketch and label a carbon-film fixed resistor that has FOUR colour-coded bands. On your sketch, identify the name of EACH of the bands.

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(6 marks)

(b) Three fixed resistors, $R_1 = R_2 = R_3$, are of equal value, 50 Ω. The resistors are connected to form a series-parallel circuit, with two resistors in parallel with each other and in series with the third resistor. A 15 V_{DC} source is connected across this resistive network.

(i) In the space provided, sketch and label the series-parallel circuit.

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(4 marks)

(ii) Calculate the total resistance (R_T) of the circuit in (b) (i).

(2 marks)

(iii) Determine the amount of current (I) passing through ONE of the resistors in parallel.

(3 marks)

(iv) Determine the value of the voltage drop across the resistor in series.

(3 marks)

Total 18 marks

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2. Figure 1 shows a typical single-line (one-line) diagram for the electrical power distribution to a small manufacturing plant, labelled A–F.

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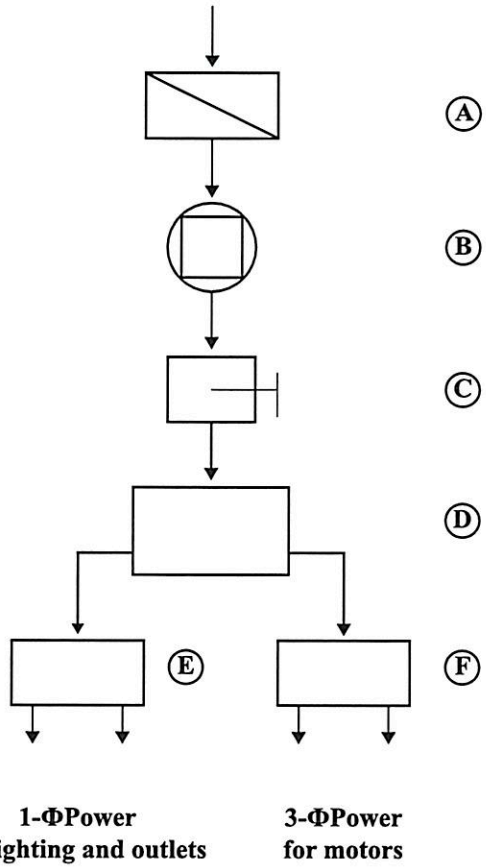


Figure 1. Typical single-line diagram for the electrical power distribution to a small manufacturing plant

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(a) Identify EACH of the components labelled A, B, C, D, E, and F in Figure 1.

A .....

B .....

C .....

D .....

E .....

F .....

(6 marks)

(b) Make a neat sketch of EACH of the following:

(i) A DC pulsating portion of a sinusoidal voltage waveform

(2 marks)

(ii) An AC sinusoidal voltage waveform, identifying the peak-to-peak value of the voltage waveform

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(4 marks)

(c) If the positive peak value of a sinusoidal voltage waveform is 100 V,

(i) calculate the value of its RMS voltage

(2 marks)

(ii) indicate the value of the RMS voltage on your graph in (b) (ii) **(1 mark)**

(iii) calculate the value of the average voltage for this waveform

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(2 marks)

(iv) indicate the value of the average voltage on your graph in (b) (ii). **(1 mark)**

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Total 18 marks

NOTHING HAS BEEN OMITTED.

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3. (a) Define the term 'apparent power'.

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(2 marks)

(b) (i) Using a simple sketch, show how the secondary windings of a centre-tapped isolation-type transformer can provide a dual-voltage supply. Assume the voltages to be 110V and 220V.

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(3 marks)

(ii) Using a simple sketch, show how an autotransformer may be connected as a

- step-up transformer

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(2 marks)

- variable output transformer.

(1 mark)

(c) A single-phase, step-up power transformer is rated at $V_{primary}$ = 110 V_{rms} and $V_{secondary}$ = 220 V_{rms}. The transformer has 100 turns on its primary side and a power-rating of 55 VA.

(i) Calculate the maximum rated primary current ($I_{primary}$) of the transformer.

(2 marks)

(ii) If the transformer is now connected to a 110 V_{rms} source as a single- phase step-down transformer, calculate the new maximum rated secondary current ($I_{secondary}$).

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(2 marks)

(d) At a given frequency, a series AC circuit has an inductive reactance (X_L) of 40 Ω, a capacitive reactance (X_C) of 80 Ω, and a resistance (R) of 30 Ω. Calculate the

(i) total impedance (Z_T) of the circuit.

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(4 marks)

(ii) magnitude of the phase-angle of the circuit.

(2 marks)

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Total 18 marks

4. (a) Describe EACH of the following:

(i) A one-way switch

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(2 marks)

(ii) A two-way switch

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(2 marks)

(iii) An intermediate switch

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(2 marks)

(iv) Using a simple sketch, show how an electrician should wire a circuit to control EACH of the following:

- ONE load from TWO locations

(3 marks)

- ONE load from THREE locations

(3 marks)

(b) Figure 2 shows the circuit diagram of a single-stroke bell circuit.

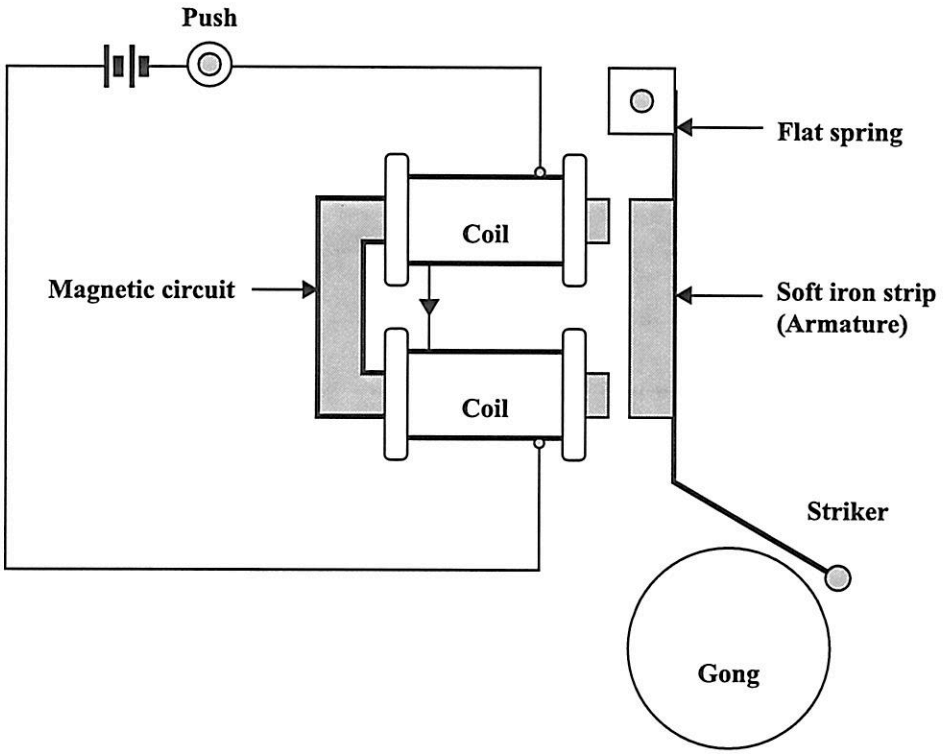


Figure 2. Circuit diagram of a single-stroke bell circuit

Outline the steps in the operation of the single-stroke bell circuit.

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(6 marks)

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Total 18 marks

5. (a) Make a neat sketch of the current–voltage characteristics graph for EACH of the following:

(i) An ideal diode

(2 marks)

(ii) A practical diode

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(2 marks)

(b) Describe the operation of a practical diode when it is

(i) forward biased

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(2 marks)

(ii) reverse biased

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(2 marks)

(c) Using simple sketches to support your answer, outline how an ohmmeter may be used to determine if an unknown transistor is a P-N-P or an N-P-N type.

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(6 marks)

(d) A given transistor has a collector current (I_C) rating of 2.5 mA when its base current (I_B) is 40 μA.

Determine

(i) the emitter current (I_E) rating of this transistor

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(2 marks)

(ii) the common-emitter current gain (β) of the transistor.

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(2 marks)

Total 18 marks

END OF TEST

EXTRA SPACE

If you use this extra page, you MUST write the question number clearly in the box provided.

Question No. ☐

EXTRA SPACE

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Question No. ☐

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CANDIDATE'S RECEIPT

INSTRUCTIONS TO CANDIDATE:

1. **Fill in all the information requested clearly in capital letters.**

TEST CODE: | 0 | 1 | 3 | 7 | 0 | 0 | 2 | 0 |

SUBJECT: INDUSTRIAL TECHNOLOGY
OPTION A – ELECTRICAL AND ELECTRONIC TECHNOLOGY – Paper 02

PROFICIENCY: TECHNICAL

REGISTRATION NUMBER: | | | | | | | | | | |

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FULL NAME: _____
(BLOCK LETTERS)

Signature: _____

Date: _____

2. **Ensure that this slip is detached by the Supervisor or Invigilator and given to you when you hand in this booklet.**

3. **Keep it in a safe place until you have received your results.**

INSTRUCTION TO SUPERVISOR/INVIGILATOR:

Sign the declaration below, detach this slip and hand it to the candidate as his/her receipt for this booklet collected by you.

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I hereby acknowledge receipt of the candidate's booklet for the examination stated above.

Signature: _____
Supervisor/Invigilator

Date: _____