CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

13 MAY 2021 (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

PROFICIENCY TECHNICAL

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

SCHOOL/CENTRE NUMBER

NAME OF SCHOOL/CENTRE

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 2021083

TEST CODE 01370020

MAY/JUNE 2021

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

INDUSTRIAL TECHNOLOGY

OPTION A – ELECTRICAL AND ELECTRONIC TECHNOLOGY

Paper 02 – Technical Proficiency

2 hours 10 minutes

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.**

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

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1. (a) A transducer converts energy from one form to another form.

(i) State ONE example of a transducer that converts electrical energy to

heat energy.....

light energy.....

chemical energy.....

mechanical energy.....

(4 marks)

(ii) Sketch the electrical/electronic symbol of any TWO transducers stated in (a) (i).

(2 marks)

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(b) The carbon–zinc (leclanché) battery is a popular type of primary cell. A consumer purchases a new carbon–zinc battery at a local store. The consumer discovers that the battery has no charge.

(i) Suggest TWO reasons why the new battery has no charge.

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(2 marks)

(ii) Outline TWO ways of preventing the carbon–zinc battery from losing its charge.

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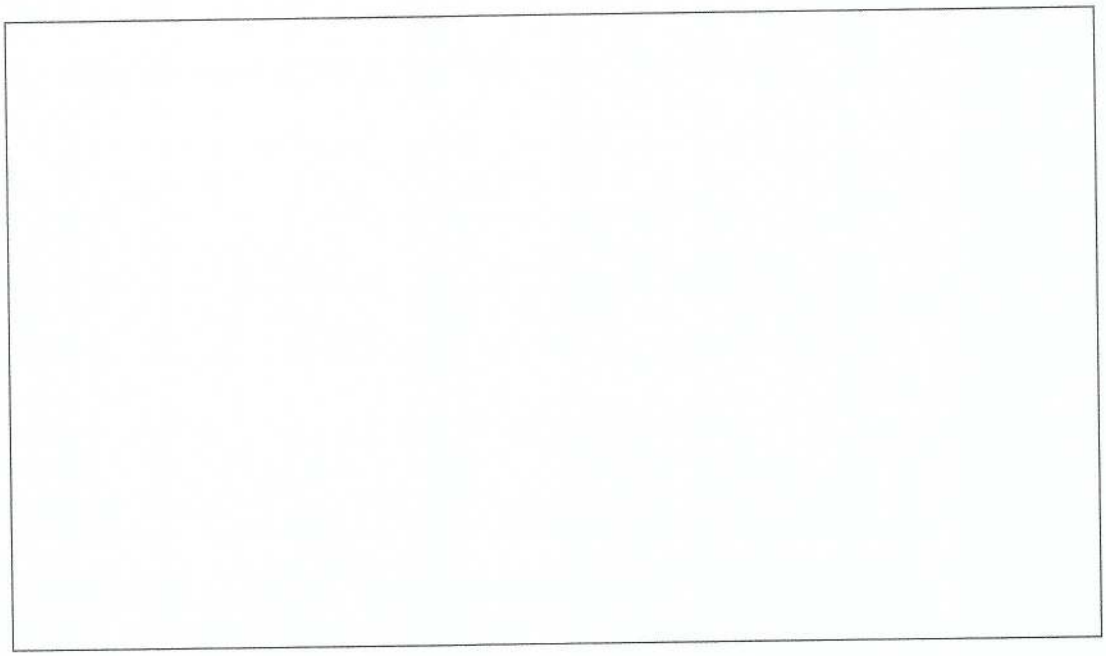
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(4 marks)

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(c) With the aid of a labelled diagram, describe how a hydrometer is used to check the condition of a lead–acid cell.



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(6 marks)

Total 18 marks

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2. (a) In the spaces provided, draw a standard electrical/electronic symbol of the components listed.

(i) DC voltmeter	(ii) Zener diode	(iii) Electric bell
(iv) J-K flip-flop	(v) AC motor	(vi) Double-pole single-throw switch

(6 marks)

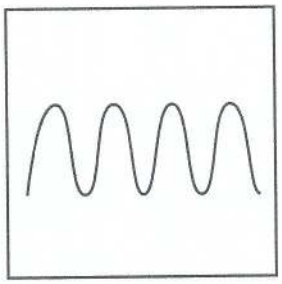
(b) A modulator combines a radio frequency carrier signal with an audio frequency signal to transmit information over a long distance.

In the spaces below, sketch the output signal of a modulator that varies

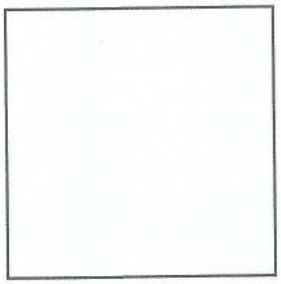
(i) the frequency of the carrier signal

(ii) the amplitude of the carrier signal.

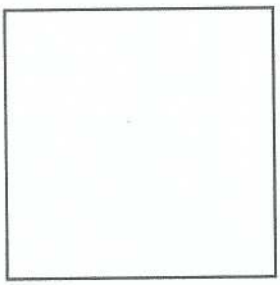
Frequency modulation



Carrier signal

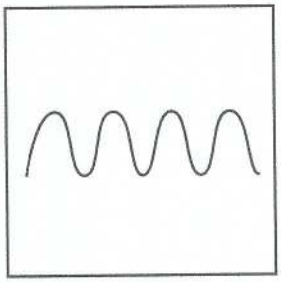


Information signal

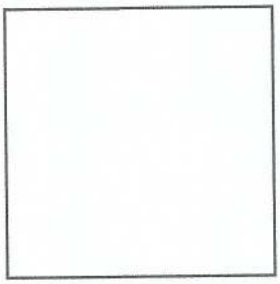


Frequency modulated signal

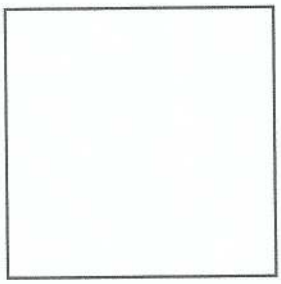
Amplitude modulation



Carrier signal



Information signal



Frequency modulated signal

(6 marks)

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(c) Figure 1 shows a pictorial diagram of an electronic circuit.

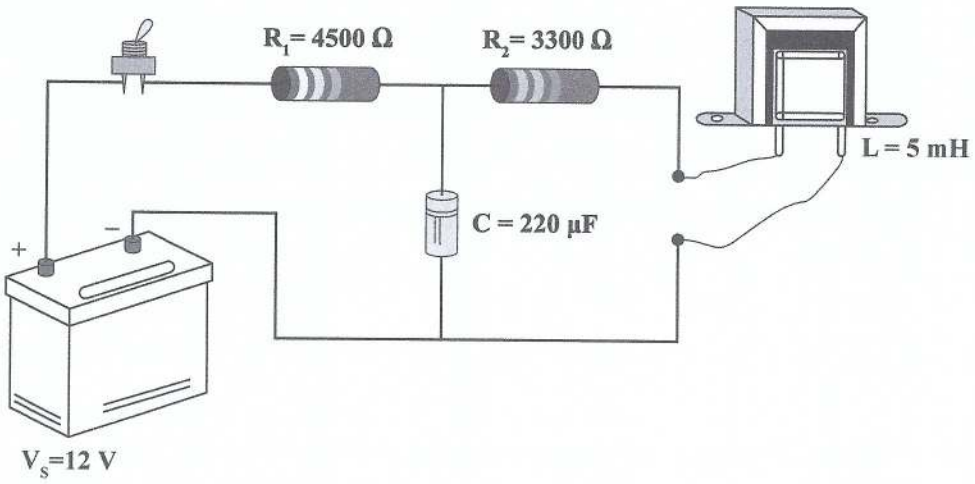


Figure 1. Electronic circuit

Draw, in the space below, a schematic diagram to represent the circuit shown in Figure 1.

(6 marks)

Total 18 marks

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3. (a) (i) Identify TWO non-renewable sources of energy used by power generating stations.

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(2 marks)

(ii) Identify TWO renewable sources of energy used to generate electricity.

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(2 marks)

(b) State TWO types of internal losses in a power transformer, other than eddy current losses.

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(2 marks)

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(c) (i) Describe how eddy current losses in a transformer may be minimized.

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(3 marks)

(ii) Draw a simple sketch to show how THREE single-phase power transformers may be connected to form a three-phase Star (WYE) transformer.

(3 marks)

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(d) For a given series RLC circuit, where R = 33 Ω, C = 10 μF, L = 50 mH, V = 75 V, and f = 200 Hz, calculate the

(i) impedance, Z_T, of the circuit

(4 marks)

(ii) phase angle, Θ, of the circuit.

(2 marks)

Total 18 marks

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4. (a) List THREE reasons for conducting EACH of the following tests and checks on a complete installation.

(i) Visual inspections

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(3 marks)

(ii) Continuity tests

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(3 marks)

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(b) (i) Outline the procedure for conducting a polarity test on a complete electrical installation that is NOT connected to an electrical supply system.

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(4 marks)

(ii) Outline ONE procedure for conducting a polarity test on a complete electrical installation that is connected to an electrical supply system.

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(2 marks)

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(c) With the aid of labelled diagrams, show the relationships between the

- phase (V_{pH}) and (V_L) voltages
- phase (I_{pH}) and line (I_L) currents in EACH of the following:

(i) Three-phase, three-wire delta-connected secondary winding of a power transformer

(3 marks)

(ii) Three-phase, three-wire, Star (WYE) connected secondary winding of a power transformer

(3 marks)

Total 18 marks

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5. (a) The p-n junctions of any transistor may be biased to operate in three modes (or regions).

(i) List EACH of the three modes of operation.

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(3 marks)

(ii) Identify the biasing criterion for EACH mode of operation listed in (a) (i).

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(3 marks)

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(b) (i) Sketch a simple common-base transistor configuration, labelling the input and output terminal points.

(4 marks)

(ii) Draw a simple sketch to show the phase relationship between the input voltage (V_i) and output voltage (V_o) of the common-emitter transistor configuration.

(2 marks)

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(c) The truth table for a TWO input logic gate system is shown below.

(i) Complete the truth table for the expression **(A·B) + (A+B)**.

A	B	A·B	A+B	(A·B) + (A+B)
0	0			
0	1			
1	0			
1	1			

(3 marks)

(ii) Sketch the **simplest** logic circuit diagram for the expression **(A·B) + (A+B)**.

(3 marks)

Total 18 marks

END OF TEST

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

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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: | | | | | | | | | | |

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.

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

Signature: _____
Supervisor/Invigilator

Date: _____



