CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

12 MAY 2022 (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 |

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FORM TP 2022084

TEST CODE 01370020

MAY/JUNE 2022

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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(2 marks)

(ii) Sketch the shape and direction of the magnetic fields that exist between the ends of two bar magnets, if the magnetic poles are

- identical to each other

(2 marks)

- opposite to each other.

(2 marks)

(b) Two wire-wound resistors, R_1 and R_2, with EQUAL ohmic resistance are placed in PARALLEL across a 20 V_{DC} source. A total current (I_T) of 2 A is flowing in the circuit.

(i) Sketch and label the circuit configuration.

(1 mark)

(ii) Determine the ohmic resistance value of the fixed resisitor, R_1.

(3 marks)

(iii) Determine the maximum power (Pmax) that is dissipated across EACH resistor.

(2 marks)

a resistive circuit to safely measure EACH of the following q...

Note: Be sure to indicate clearly the polarity and power requirments, where applicable, for EACH connection.

(i) DC voltage drop of a resisitor

(2 marks)

(ii) Total DC current in a circuit

(2 marks)

(iii) Resistance of a resistor

(2 marks)

Total 18 marks

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NOTHING HAS BEEN OMITTED.

diagram.

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(6 marks)

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(b) Table 1 shows the components in six typical stages, labelled a–f, that are found in an electrical generation, transmission and distribution system. The a–f stages are NOT listed in the correct order.

TABLE 1: STAGES OF AN ELECTRICAL GENERATION, TRANSMISSION AND DISTRIBUTION SYSTEM

Stage	System Component
a.	Distribution lines
b.	Power plant
c.	Transmission lines
d.	Pole transformer
e.	Step-up transformer
f.	Step-down transformer

(i) Using a neatly labelled **block** diagram, draw and identify the correct order of EACH given stage of such an electrical system.

(6 marks)

of that stage.

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(6 marks)

Total 18 marks

3. (a) Define EACH of the following electrical terms and state the unit of measurement for EACH.

(i) True power

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(ii) Apparent power

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(iii) Power factor

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(6 marks)

the three types of electrical power.

(2 marks)

(c) An AC motor requires 500 units of apparent power to operate, while dissipating 400 units of true power.

(i) With the aid of a labelled phasor diagram (not drawn to scale), calculate how much energy is wattless (reactive) power.

(2 marks)

(ii) Determine the power factor of the motor.

(2 marks)

(d) (i) With the aid of a simple sketch, explain how a single-phase isolation-type power transformer is able to transfer electrical energy from its primary circuit to its secondary circuit without an electrical connection.

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(4 marks)

and a secondary winding (N_s) of 50 turns. If the transformer is to provide 20 V_{rms}, calculate the number of turns that must exist on the primary (N_p) side of the transformer.

(2 marks)

Total 18 marks

4. There are two basic types of alarm systems, the series-connected system and the parallel-connected system.

(a) (i) State TWO reasons for installing a burglar alarm system in a residence.

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(2 marks)

(ii) State the type of call-point (push-button) switches that EACH of the basic types of alarm systems utilize.

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(2 marks)

(iii) Explain why a burglar alarm system is usually fitted with a latching facility.

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(2 marks)

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(4 marks)

(v) Sketch and label a basic circuit (wiring) diagram for EACH type of alarm system identified in (a) (ii).

(6 marks)

(b) State TWO ways in which the wiring of a BURGLAR alarm system differs from that of a FIRE alarm system.

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(2 marks)

Total 18 marks

GO ON TO THE NEXT PAGE

5. (a) (i) Identify the TWO most common materials that are used to manufacture semiconductor diodes.

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(2 marks)

(ii) Identify the TWO states in which a semiconductor diode may be biased by a DC voltage source.

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(2 marks)

(iii) A semiconductor diode is often referred to as being equivalent to a single-pole, single-throw (SPST) switch. With the aid of a simple sketch, explain the condition(s) under which this statement may be considered true for an IDEAL semiconductor diode.

(6 marks)

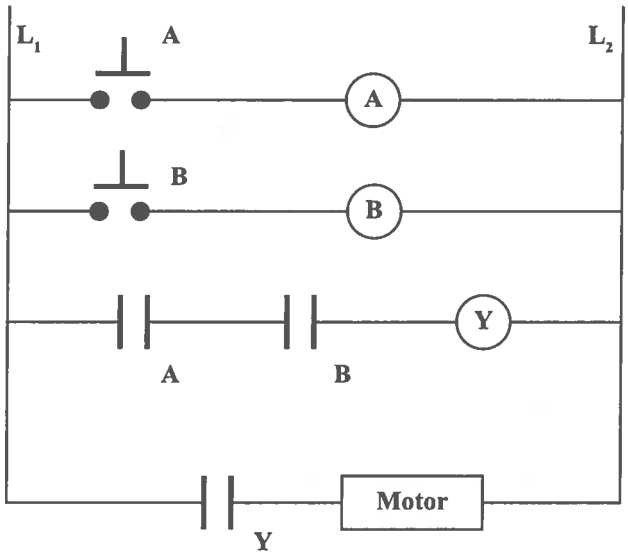


Figure 1. Relay logic diagram

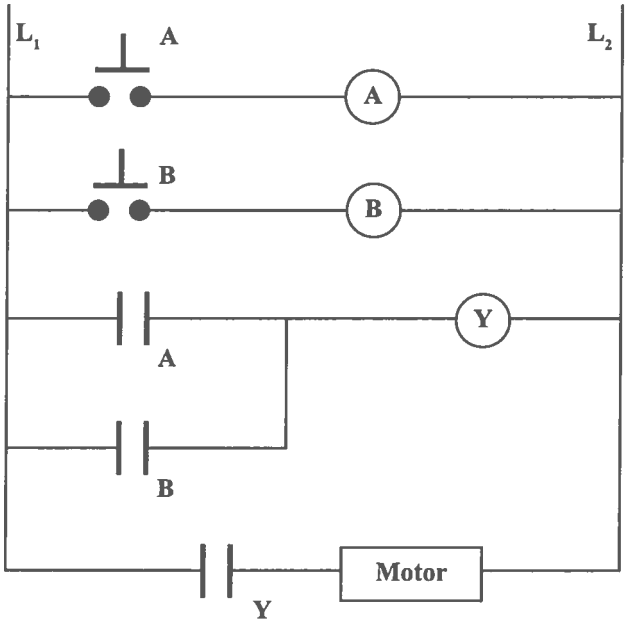


Figure 2. Relay logic diagram

(i) Identify the type of logic control circuit shown in Figure 1.

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(1 mark)

(ii) Identify the type of logic control circuit shown in Figure 2.

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(1 mark)

(iii) Sketch, using a standard digital logic symbol, an equivalent logic circuit for the relay logic control circuit shown in Figure 1. Indicate the inputs and the output of the logic gate.

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(3 marks)

logic gate.

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(3 marks)

Total 18 marks

END OF TEST

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

EXTRA SPACE

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Question No. ☐

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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: _____