CARIBBEAN EXAMINATIONS COUNCIL

CAPE® ELECTRICAL AND ELECTRONIC ENGINEERING TECHNOLOGY UNIT 1



Subject Report

May–June 2026

CARIBBEAN EXAMINATIONS COUNCIL

REPORT ON CANDIDATES' WORK IN THE CARIBBEAN ADVANCED PROFICIENCY EXAMINATION®

MAY–JUNE 2026

ELECTRICAL AND ELECTRONIC ENGINEERING TECHNOLOGY
UNIT 1

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INTRODUCTION

This guide is based on the 2026 CAPE Electrical and Electronic Engineering Technology Unit 1 examination. The examination comprises two units, each consisting of Paper 01 (multiple-choice items) and Paper 02 (essay-type questions). Unit 1, *Fundamentals of Electricity and Electronics*, comprises the following modules.

- Module 1 — Occupational Safety, Health and Environmental Practices
- Module 2 — Electrical and Electronic-related Studies
- Module 3 — Introduction to Circuit Technology and Devices

In 2026, the number of candidates entered for the examination remained small. There were 110 entries, compared with 115 in 2025 and 129 in 2024. Of the 110 candidates who registered for Unit 1, 103 sat the examination.

There was a slight increase in the percentage of candidates attaining acceptable grades (Grades I–V). In 2026, 94.94 per cent of candidates achieved Grades I–V, compared with 91.92 per cent in 2025 and 83.48 per cent in 2024.

Improvements were observed across all modules, both in the percentage mean scores and in the performance of candidates attaining Grades I–V, when compared with 2025 and 2024. The overall percentage mean also increased over the same period.

PAPER 01 — MULTIPLE CHOICE

This paper consisted of 45 multiple choice items. Each of the three modules comprised 15 items worth one mark each. It was designed to provide adequate coverage of the syllabus, as the items were drawn from all sections.

The mean score was 56.96 out of 90 (63.29 per cent), compared with 46.46 out of 90 (51.62 per cent) in 2025 and 48.98 out of 90 (54.43 per cent) in 2024. The highest score attained was 86, an increase from 76 in both 2024 and 2023.

Overall, candidates performed considerably better on Paper 01 than in the two preceding years, as reflected in the higher mean score and percentage mean.

PAPER 02 — STRUCTURED ESSAY

This paper consisted of six essay questions, two questions drawn from each of the three modules. Each question was worth 20 marks and candidates were required to answer all questions. The paper was worth a total of 120 marks.

The mean score was 37.62 out of 120 (31.34 per cent), representing an improvement over the mean scores of 36.66 out of 120 (30.55 per cent) in 2025 and 28.03 out of 120 (23.36 per cent) in 2024. The highest score attained was 81. While this was lower than the maximum score of 102 recorded in 2025, it exceeded the maximum score of 68 recorded in 2024.

Module 1 — Occupational Safety, Health and Environmental Practices

Question 1

Part (a) was generally well done. Most candidates correctly defined the term *hazard* as *any condition that can result in injury, illness, death or damage to equipment and property.*

In Part (b), candidates were required to identify one electrical hazard present in the given scenario based on three specified categories. Most candidates correctly identified the material and substance hazards; however, some candidates experienced difficulty identifying the situational hazard. Examples of the hazards identified in the scenario were.

- Material Hazard — damaged extension cord
- Situational hazard — overloaded power strip
- Substance hazard — presence of water near electrical equipment

For Part (c), most candidates correctly stated the sequence of steps required to replace a socket outlet. However, only two candidates mentioned the lockout/tagout procedure. A few candidates misinterpreted the term *risk* and responded by outlining methods of risk identification rather than the required procedure. The correct steps for replacing a socket outlet included the following.

- Isolate the source from the defective socket outlet.
- Apply lockout/tagout to the panel.
- Use a voltmeter to test the connection at the outlet to ensure that the circuit is deenergized.
- Use a properly insulated screwdriver to disconnect the cable from the socket outlet.

In Part (d), most candidates identified factors that affect the severity of an electric shock. However, some candidates failed to explain how these factors contribute to increased severity.

In Part (e), most candidates correctly identified *poor grounding* as a cause of the electric shock. However, only a few candidates recognized that the most likely cause was *live wire touching the frame*. Some candidates incorrectly attributed the shock to 'large current flow through the toaster circuit'. An expected response was that

> The technician did not reconnect the ground wire in the socket outlet or there was a break in the wire connected to the toaster, therefore the toaster's frame was not connected to the earthing system and a live wire was making contact with the metal frame of the toaster. The electricity flowed through the frame and into the body of the person in contact with the frame instead of through the earthing system.

In Part (f), most candidates recognized that fluorescent tubes constitute a hazard; however, many of them suggested incorrect disposal methods, such as ‘burning’, ‘breaking’ or ‘binning’.

Some candidates were able to describe the correct disposal procedures for old/defective fluorescent tubes by giving responses such as the following.

> Wrap the tubes securely in bubble wrap and place them in a cardboard box before **t**aking the package to an approved hazardous waste site for disposal. Doing so would prevent breakage or exposure to the hazardous contents of the tubes while ensuring safe and environmentally responsible disposal.

Recommendations

To improve candidates' performance, teachers should do the following recommendations.

- Use case studies of real-life scenarios to highlight to students the differences between the different types of hazards.
- Use real-world accident reports to illustrate to students the severity of electric shock.
- Emphasize lockout/tag out procedures and the importance of using proper tools when working on electrical circuits through laboratory exercises.
- Reinforce the concepts of grounding and insulation through practical exercises and simulations. Thorough coverage of the processes for disposing of electrical and electronic waste is also recommended.

Question 2

Part (a) (i) was generally well done. Most candidates successfully stated the purpose of occupational safety and health (OHS) legislation and regulations, which showed that they understood the role of OHS laws in protecting workers and promoting safe workplaces. Most candidates provided correct answers. They gave responses such as *the purpose of the occupational safety and health acts or legislation is to protect the health, safety and welfare of workers and others in the workplace.*

Most candidates also performed well on Part (a) (ii), as they were able to correctly identify two OHS organizations. However, a few of them incorrectly listed 'JS 21' as an organization. JS21 is a standard and not an organization. Examples of acceptable OHS organizations include the following.

- British Standards Institute (BSI)
- International Electrotechnical Commission (IEC)
- Institute of Electrical and Electronic Engineers (IEEE)
- International Standards Organization (ISO)
- Bureau of Standards

Part (b) (i) proved to be more challenging. Only a few candidates correctly identified at least two possible injuries that could result from failing to use the appropriate protective equipment. Examples of expected responses included the following.

- Hard hat — If Paulo does not wear a hard hat, his head will not be protected from falling objects, impacts with stationary objects, or electrical shock and he will be at risk of serious head trauma.
- Earmuffs — If Paulo is not wearing earmuffs, his ears will not be protected from the high noise levels in the plant. He will be at risk of hearing loss over time and increased stress and fatigue.
- Face shield — If Paulo does not wear a face shield, his face and eyes will be exposed to flying objects, chemical splashes and the high temperatures of arc flashes. This can result in him being burned or receiving permanent injury such as loss of sight.
- Safety shoes — By not wearing safety shoes, Paulo's feet will not be protected from slippery surfaces, punctures, electrical shock or the impact of falling objects. He is also at risk of falling, getting his toes crushed or receiving other foot injuries.

For Part (b) (ii), most candidates were able to identify at least three procedures for treating a victim of electrical burn. However, many of them failed to present the procedures in the correct sequence. Some candidates incorrectly suggested seeking assistance after treatment rather than doing so immediately following the incident. Other candidates were unfamiliar with the appropriate dressing for burns. An expected response included the following procedure.

- Switch off the power or safely isolate the person from the source.
- Call for help immediately.
- Check for breathing and a pulse. If neither is present, start CPR immediately.

- Cool the burn with running water.
- Cover the burn with dry, sterile nonadhesive dressing.

Part (c) presented some difficulty for candidates particularly when outlining the major difference between electrical burns and arc burns. A common misconception was that electrical burns occur beneath the skin, whereas arc burns occur only on the surface of the skin. Candidates who earned full marks correctly stated that *an electrical burn occurs when a person comes into direct contact with electric current. However, an arc burn results from the intense heat when electricity arcs through the air even without direct contact.*

Recommendations

To improve candidates' performance, teachers should do the following.

- Encourage students to connect theoretical concepts with practical workplace scenarios in order to promote deeper understanding of the concepts.
- Provide a clear list of recognized OHS organizations to help students distinguish between OSH standards and OHS organizations.
- Use case studies or role-play activities to illustrate to students the consequences of not wearing PPE. Outline all the possible situations and associated injuries that can occur if someone fails to wear the respective PPE. Create visual aids showing injuries linked to missing protective equipment.
- Teach students about the emergency response procedures in a clear, step-by-step sequence. Incorporate first-aid demonstrations and practical drills to highlight the importance of immediate medical assistance. Provide clear guidance on appropriate burn dressings
- Use comparative charts to highlight to students the differences in cause, appearance and severity of tissue damage from electrical burns versus arc burns.

Module 2 — Electrical and Electronic-related Studies

Question 3

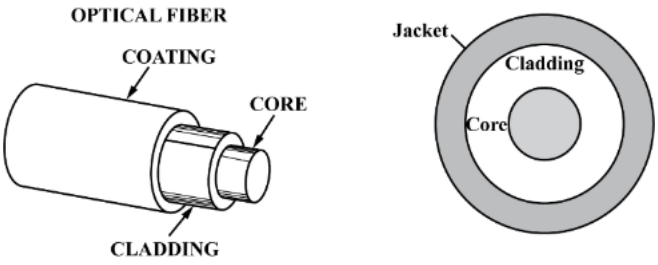
Part (a) (i) was generally well done. Most candidates correctly defined the term *microprocessor* as *a computer's central processing unit (CPU) implemented on a single integrated circuit chip.*

Part (a) (ii) proved more challenging**.** Only a minority of candidates correctly identified the parts of the microprocessor labelled A, B and C. Some candidates correctly stated the functions of the components but provided incorrect names, while others correctly identified the components but were unable to accurately state their functions. The expected labels and functions included the following.

- A — Control unit: determines the order in which instructions are executed or controls the flow of data
- B — Register: stores data or instructions for immediate use by the processor
- C — Memory unit: stores data and instructions for the CPU to access and process

Very few candidates were able to adequately explain how data is transmitted using fibre-optic technology in Part (b) (i). Some of them stated that *data is transmitted at the speed of light through the conductor*, while others provided responses that were unrelated to fibre-optic technology.

Candidates experienced considerable difficulty with Part (b) (ii). No candidate was able to correctly draw and label an optical fibre and identify its three main components. However, a few candidates correctly identified the core, while others identified the protective coating. An example of the expected drawing is shown below.



Some candidates performed satisfactorily on Part (b) (iii), correctly stating at least two advantages of optical fibre.

Recommendations

To improve candidates' performance, teachers should do the following.

- Provide opportunities for students to draw and label the different components of microprocessor architecture. Use flow diagrams to illustrate how the control unit coordinates input, processing

and output operations, and reinforce key concepts through the use of analogies. Provide hands-on exercises using assembly language or simple coding tasks to demonstrate register use. For memory, use visual aids to illustrate the memory hierarchy.

- Conduct focused lessons on the principles of data transmission in fibre-optic systems. Use videos, animations and demonstrations to show students how signals travel as pulses of light through glass or plastic fibres. Where possible, incorporate practical activities to strengthen students' understanding of the concept.
- More emphasis needs to be placed on fibre-optic technology. Provide step-by-step guidance on drawing and labelling optical fibre. Use visual aids and practice worksheets to reinforce to students how to label their diagrams correctly. Introduce peer-review exercises where students critique and correct each other’s diagrams.
- Assign short groups presentations in which students are expected to explain different advantages in detail, linking them to real-world applications. Use comparison charts between fibre-optic and copper cables to strengthen retention.

Question 4

Part (a) (i) proved challenging for most candidates, as they were unable to determine the peak-to-peak voltage from the oscilloscope trace showing the output voltage of Transformer X. An expected response was as follows.

Read from graph: 3.5 cm displacement in one direction
3.5 × 2 = 7 cm (both directions)
7 cm × 5 V/cm = 35 V

Candidates also experienced difficulty with Part (a) (ii), which required them to estimate the period of the waveform. An expected response was as follows.

$$T = 6.6 \times 2 = 13.2 \text{ ms}$$
OR
$$T = 6.7 \times 2 = 13.4 \text{ ms}$$

Candidates' performance on Part (a) (iii) was generally stronger. Most candidates correctly stated at least one electrical quantity commonly measured by a multimeter that cannot be measured by an oscilloscope. A fair number of candidates provided two correct responses, namely *current* and *resistance*.

Many candidates who attempted Part (b) failed to calculate the cross-sectional area of the conductor. They used the diameter instead of the cross-sectional area to calculate the magnetic flux and therefore did not get the final correct answer. An expected response is shown below.

$$r = \frac{0.01}{2} = 0.005 \text{ m}$$
$$\text{Cross sectional area of the solenoid } = \pi r^2$$
$$= 3.142(0.005)^2$$
$$= 78.53 \times 10^{-6} \text{ m}^2$$
$$\text{Magnetic Flux Density, B } = \frac{\Phi}{A}$$
$$= \frac{0.032 \times 10^{-3}\ Wb}{78.53 \times 10^{-6} m^2}$$
$$= 0.407 \text{ T}esla$$

In Part (c) (i), most candidates attempted to state Faraday's law but many of them did so incorrectly. Most candidates were also unable to relate the law to the zero-voltage reading presented in the scenario. Only a few candidates were able to use Faraday's Law of electromagnetic induction to explain the most likely cause of the zero-voltage reading. The following is the expected response.

According to Faraday's law of induced voltage, a voltage is induced in a conductor when there is a change in magnetic flux linking or cutting the conductor. If the conductor is moving and there is no voltage, then there is no magnetic flux hence no voltage would be induced and the output voltage would be zero.

Candidates also experienced difficulty with Part (c) (ii). Few of them identified the first step in troubleshooting the generator, which was to *check whether the battery was functioning properly.*

Although most candidates correctly stated Ohm's law in Part (d) (i), many of them were unable to apply it to the scenario presented. An expected response was that *the cable used to transfer power to the load has a resistance since it is copper. According to Ohm's law, this will result in a voltage drop in the cable due to the current flowing through it (V=I x R). If there is a voltage drop in the cable, then voltage transfer to the load will be less than the source voltage.*

Part (d) (ii) was not well done. Most candidates were unable to correctly determine the load voltage. An expected response was that *the voltage at the load is equal to the generator output voltage minus the voltage drop in the cable*.

Similarly, Part (d) (iii) presented a challenge for many candidates. Most of them did not correctly identify the most suitable conductor for voltage transfer. An expected response was *superconductors, since they have zero resistance and therefore do not produce a voltage drop.*

Recommendations

To improve candidates' performance, the following recommendations are offered.

- Place greater emphasis on teaching students about the uses of the oscilloscope, including the interpretation of waveforms. Students should also be taught the basic control settings. This can be done through simulation exercises.
- Encourage students to pay closer attention to the principles and applications of electromagnetic induction. Additional practice questions requiring the application of these laws in practical contexts should be incorporated into instruction.
- Provide students with opportunities to explore real-world applications of Ohm's Law.
- Reinforce foundational concepts across the electrical and electronic engineering curriculum through regular practice and application-based activities to strengthen students' analytical and problem-solving skills.

Module 3 — Introduction to Circuit Technology and Devices

Question 5

For Part (a) (i), most candidates were unable to state Thevenin's theorem correctly. In some instances, candidates provided no response. An expected response was that *Thevenin's theorem states that any active DC network can be simplified to an equivalent circuit consisting of a single voltage source in series with a single resistance*.

In Part (a) (ii), although many candidates attempted to state Kirchhoff's voltage law, responses were generally vague and incomplete. An expected response was that *the algebraic sum of the voltages around any closed loop in a circuit is always equal to zero*.

For Part (b) (i), most candidates experienced difficulty calculating the Thevenin resistance, as they were unable to correctly apply the reduction techniques required for analysing series-parallel resistor networks. An expected solution is shown below.

Setting all sources to zero $R_{th} = R_{MN}$

$$R_{th} = R4 + \frac{(R1 + R2) \text{ x } R3}{R1 + R2 + R3}$$

$$= 3 + \frac{(2 + 1) \text{ x } 3}{2 + 1 + 3}$$

$$= 4.5\ \Omega$$

In Part (b) (ii), most candidates were unable to calculate the Thevenin voltage, largely because they did not apply Kirchhoff's voltage law correctly. An expected solution is shown below.

With sources active Vth = VMN

Using the potential divider rule

$$V_{R3} = \frac{R3}{R1+R2+R3} \times 24$$

$$= \frac{3}{2+1+3} \times 24$$

$$= 12\text{V}$$

Using KVL: $V_{R3} - V_{MN} - 8 = 0$

Let $V_{MN} = V_{TH}$

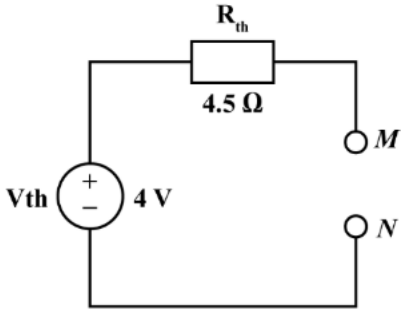
$V_{th} = V_{MN} = V_{R3} - 8$

$= 12 - 8 = 4\text{V}$

In Part (b) (iii), most candidates were unable to obtain the correct answer. Many of them simply divided their calculated value for the Thevenin voltage by the given load resistance. They did not use the sum of the Thevenin's resistance and load resistance in their calculation.

$$I_L = \frac{Vth}{(Rth + RL)}$$
$$= \frac{4}{(4.5+5)}$$
$$= 0.421 \text{ A}$$

For Part (c), most candidates were unable to draw the correct circuit. Although some of them recognized that the circuit should consist of a voltage source connected in series with a resistance, they were unable to correctly represent and label the Thevenin equivalent of the active DC network shown. The expected diagram is shown below.



Recommendations

Teachers are encouraged to provide more comprehensive coverage of topics related to the analysis of DC networks. Greater emphasis should be placed on the application of network laws and theorems through a variety of practice problems. Laboratory activities involving DC circuits are also recommended to allow students to compare theoretical calculations with measured values and to strengthen their understanding of circuit behaviour.

Question 6

For Part (a), most candidates were unable to correctly state a factor affecting the capacitance of a capacitor, with many incorrectly identifying voltage or current as the determining factor. An expected response was any one of the following.

- Permittivity of the dielectric
- Area of the plates
- Distance (separation) between the plates

In Part (b), most candidates were unable to correctly state the time required for a capacitor to become fully charged. Many candidates either omitted the answer or provided an incorrect value. The expected response was that *a capacitor is considered fully charged after approximately five time constants (5τ),* although *six time constants (6τ)* was also accepted.

For Part (c), some candidates correctly sketched the general shape of the capacitor charging curve. However, many candidates omitted important details such as the maximum voltage reached and the division of the horizontal axis into five time constants. Many candidates either left out this subpart completely or incorrectly sketched sinewaves and other unrelated curves.

Many candidates did not attempt Part (d) (i). However, among those who did, many candidates were able to determine the correct frequency. The expected response is shown below.

$$f = \frac{\omega}{2\pi}$$

from f=1/T

$$= \frac{120\pi}{2\pi}$$

$$= 60 \text{ Hz}$$

The calculation of the RMS current in Part (d) (ii) was also attempted by relatively few candidates. Nevertheless, many of those who responded obtained the correct answer. Such candidates gave the following response.

$$i_{rms} = \frac{i_{max}}{\sqrt{2}}$$

$$= \frac{10\sqrt{2}}{\sqrt{2}}$$

$$= 10 \text{ A}$$

For Part (d) (iii), many candidates did not attempt to provide a response. However, those who did obtained the correct power. The following is the correct response.

$$P = i_{rms}^2 R = 10^2 \times 5$$
$$= 500W$$

Part (d) (iv) was not attempted by many candidates and those who did attempt it often obtained incorrect answers because they failed to set their calculators to radian mode. The expected response is shown below.

$$i = 10\sqrt{2}\ \sin(\ 120\pi\ [0.1] - \frac{\pi}{6}\ )$$
$$\sin(37.2)$$
$$= 10\sqrt{2}\ \text{x}\ (-0.5)$$
$$= -7.07\ \text{A}$$

Part (e) (i) was not attempted by many candidates. Among those who attempted it, a common error was failing to convert the capacitance from microfarads to farads when calculating the capacitive reactance. The following is the expected response.

$$X_c = \frac{1}{2\pi fC}$$
$$= \frac{1}{2\pi(50)(200\ \text{x}\ 10^{-6})}$$
$$= 15.92\ \Omega$$

Very few candidates attempted Part (e) (ii). Most of the candidates who attempted it obtained an incorrect value for the impedance because they carried forward an incorrect value for the capacitive reactance. The correct response is shown below.

$$Z = \sqrt{R^2 + Xc^2}$$
$$= \sqrt{25^2 + 15.92^2}$$
$$= 29.64\ \Omega$$

Candidates' performance on Part (e) (iii) was similarly weak. Many candidates either did not attempt the subpart or incorrectly calculated the current by dividing the supply voltage by the resistance rather than the circuit impedance. The expected response is shown below.

$$I = \frac{V}{Z}$$
$$= \frac{120}{29.64}$$
$$= 4.05\ \text{A}$$

Recommendations

Teachers are advised to teach students about the topic of capacitor charging and discharging thoroughly and to encourage them to pay attention to fine details. Students should be given more practice questions involving AC circuit calculations. Lab exercises involving AC circuits are also recommended. In these exercises, students should be required to compare calculated and measured values.

GENERAL RECOMMENDATIONS

Responses from candidates for most questions were generally vague and incomplete. More thorough coverage of the syllabus content is therefore recommended, with greater emphasis on the application of concepts, problem-solving skills and technical accuracy. Where appropriate, the use of real-world scenarios, role-play activities, online videos, simulations and practical exercises should be used to reinforce the delivery of the content. More practice questions for students involving the analysis of DC and AC circuits are recommended.