THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

CANDIDATES' ITEM RESPONSE ANALYSIS R EPORT ON THE CERTIFICATE OF SECONDARY EDUCATION EXAMINATION (CSEE) 2023

ELECTRICAL DRAUGHTING

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082 ELECTRICAL DRAUGHTING

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FOREWORD

This report presents Candidates' Items Response Analysis (CIRA) on Form Four National Examination in Electrical Draughting subject which was conducted in November 2023. The report aims to provide an analytical feedback to all educational stakeholders on the factors that contributed to the candidates' performance in Electrical Draughting subject.

The Form Four National Examination is a summative evaluation which intends to measure the knowledge, skills and competences acquired by the students in four years of instructional period of ordinary level of secondary education. The report therefore, provides feedback that teachers, students and other educational stakeholders can use to improve teaching and learning process. This analysis justifies the candidates' performance in the Electrical Draughting subject. The candidates who attained high scores demonstrated their ability to understand the requirement of the questions, their knowledge, skills and competence in technical drawing and their mastery of the subject matter. However, candidates who scored low marks faced difficulties in responding to the questions due to their insufficient knowledge of the tested concepts, insufficient technical drawing skills, unconversant with electrical symbols used in schematic diagrams to represent various components accurately, and lack of enough knowledge and skills in various topics.

The National Examinations Council of Tanzania (NECTA) expects that the feedback provided in this report will enable teachers and other education stakeholders to take proper measures to improve teaching and learning process in Electrical Draughting subject. Consequently, prospective candidates will acquire knowledge, skills and competence indicated in the syllabus for better performance in future.

The Council appreciates the contribution of all those who prepared this report.

Dr. Said Ally Mohamed
EXECUTIVE SECRETARY

1.0 INTRODUCTION

This report presents the analysis of the items response of the candidates who sat for the Certificate of Secondary Education Examination (CSEE) 2023 in Electrical Draughting subject.

The paper comprised of sections A, B and C with a total of eight (8) questions. Section A consisted of one (01) multiple choice question with 10 items, (i) to (x) and each item carried 1 mark, to make a total of 10 marks. Section B consisted of six (6) short answer questions. The candidates were required to answer all questions in this section. Each question carried 10 marks, making a total of 60 marks. Section C consisted of one (1) compulsory structured question, weighing 30 marks.

A total of 247 (88.53%) out of 279 (100%) registered candidates sat for Electrical Draughting paper in the year 2023. Among them, 215 (87.04%) passed while 32 (12.96%) failed.

The analysis of the candidate's performance on each question is categorized into three grade ranges as shown in Table 1.

Table 1: **Categories of the Grade Ranges of the Candidates' Performance**

Range in %	0 – 29	30 – 64	65 – 100
Remark on performance	Weak	Average	Good

The report offers a detailed analysis of the candidates' response indicating the specific areas of strengths and weaknesses for a particular question. Graphs, charts and samples of good and weak responses from the candidates' scripts have been presented to prove such responses. Red, Yellow and Green colours are used to represent weak, average and good performance respectively.

Finally, the report provides recommendations for the improvement of candidates' performance in the future.

2.0 THE ANALYSIS OF THE CANDIDATES' RESPONSES TO EACH QUESTION

This part analyses the performance of the candidates in each sections namely A, B, and C. It presents strengths and weaknesses of the candidates as they responded to each question.

2.1 SECTION A: OBJECTIVE QUESTIONS

This section consisted of one (01) multiple choice question with 10 items, (i) to (x) and each item carried 1 mark, to make a total of 10 marks.

2.1.1 Question 1: Multiple Choice Items

The question was constructed from the following topics: *Introduction to Electrical Draughting*, *International Organization for Standardization (ISO) Sheet Layout and Sketching*, *Domestic Wiring System*, and *Electrical Diagrams*. The candidates were required to choose the correct answer from the given alternatives (A to E) and write its letter beside the item number in the answer booklet provided.

A total of 247 (88.53%) out of 279 registered candidates attempted this question. Among them, 11 (4.45%) scored from 0 to 2 marks; 125 (50.61%) scored from 3 to 6 marks and 111 (44.94%) scored from 7 to 10 marks. Figure 1 illustrates the students' performance in this question.

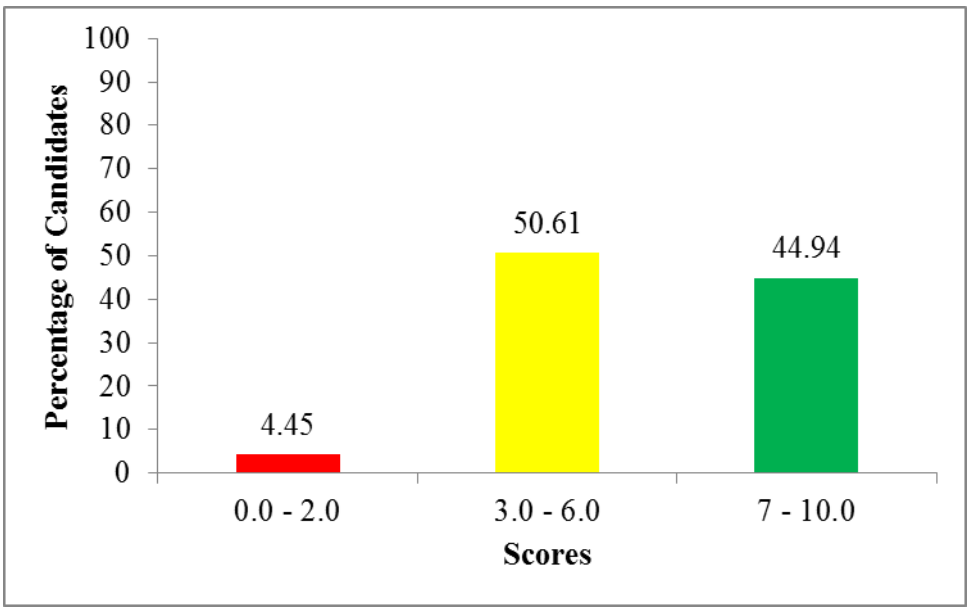


Figure 1: *The Candidates' Performance in Question 1*

The performance of the candidates on this question was good, since 236 (95.55%) of the candidates who attempted the question scored average and above marks. However, the analysis reveals that, most of the candidates had insufficient knowledge on the basics of *Electrical Draughting*. Despite the good performance on this question, 11(4.45%) of the candidates had weak performance. These candidates failed to choose the correct answers in almost all items. This indicates that they had inadequate knowledge of the subject contents covered by these items. The following part analyses candidates' responses to (i) to (x).

Item (i) was constructed from the topic of *Introduction to Electrical Draughting.* The question assessed the candidates' understanding on pencil types and their suitability for specific tasks. The question was as follows:

A draughtsman could not start sketching because he did not have suitable pencil. Which type of pencil would you recommend for his task?
A 2B B A4 C HB D A3 E 5HB

In this case, the draughtsman needs a suitable pencil to start sketching and therefore, the correct response was C, *HB* and most of the candidates opted for this alternative. These candidates had acquired enough knowledge about types of pencils and their uses. For those who opted for alternative A, *2B* failed to recognize that this type of pencil is a relatively soft pencil, which produces darker lines resulting in a drawing lacking precision. Few candidates who chose option E, *5HB* were attracted to the letters HB which are commonly used to categorize types of pencils. They did not realize that this type of pencil is suitable for general writing and artistic drawings. Others opted for B, *A4* and *D, A3.* These candidates opted randomly; might have misunderstood the question or misinterpreted the options provided. Actually, A4 and A3 are standards for paper sizes and not pencil types.

Item (ii) was constructed form the topic of *International Organization for Standardization (ISO) Sheet Layout and Sketching*. It intended to measure the candidate's understanding on basic geometry concepts and their ability to select the appropriate drawing instrument for different tasks. Specifically, it required the candidates to identify a single drawing

instrument capable of performing all the given tasks effectively. The question was as follows:

You are required to use a single drawing instrument to measure and draw a horizontal line, a vertical line, a parallel line, a perpendicular line and an angle. Which instrument will be suitable for your work?

A Ruler B Compass C Tee square D Protector E Set square

Most of candidates performed well on this question by selecting the correct answer which was E, *Set square*. This implies that they had enough knowledge on the basic drawing instruments for different tasks particularly set square which is also known as a triangle ruler or drafting triangle. Therefore, it fulfils all the requirements specified in the question. Those who opted for A, *Ruler* they might have misinterpreted the question, assuming that a ruler could serve for all tasks without considering the necessity for a single instrument that can perform all specified tasks. Similarly, those who opted for alternative B, *Compass, C, Tee Square,* and D, *Protector*; might have not familiar with the functions and limitations of these drawing instruments. This lack of knowledge could lead them to select instruments that are unsuitable for the tasks specified in the question. These candidates were supposed to understand that, a *compass* is primarily used for drawing circles and arcs of specific radii, a *Tee Square* (T-square) is a drafting tool used mainly for drawing horizontal lines, and a *protector* (Drafting Triangle) is used to draw lines at precise angles, typically 45, 60, or 90 degrees.

Item (iii) was set from the topic of *Introduction to Electrical Draughting.* It intended to measure the candidate's understanding of the procedures involved in drawing a line parallel to a given straight line passing through a given point using a set square. The question was:

You are given the procedures (1-4) which will help you to draw a next line parallel to a given straight line which is passing through a given point by using a set square.

1. *Place other set square as a base.*
2. *Draw the line through a point.*
3. *Hold the second set square firmly and slide the first, till its arranged edge is along the point.*
4. *Arrange the edge of set square coinciding with given line.*

Which sequence of procedure will you follow to accomplish the given task?

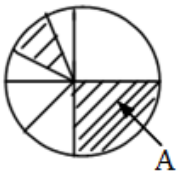
A	*1, 3, 4, 2*	*B*	*4, 1, 3, 2*	*C*	*2, 1, 3, 3*
D	*4, 1, 2, 3*	*E*	*2, 3, 1, 4*		

A few candidates chose the correct response B, *4, 1, 3, 2*. These candidates demonstrated to have knowledge and understanding of task requirements. Therefore, they were able to put in sequence the given procedures correctly.

For those candidates who opted for A: *1, 3, 4, 2* might have mistakenly thought that placing the set square as a base (Step 1) should come before drawing the line through the point (Step 2). They might have assumed that the sequence should start with setting up the set square before performing the action. Conversely, those who chose incorrect responses C: *2, 1, 3, 3; D: 4, 1, 2, 3* and *E: 2, 3, 1, 4* could be due to a lack of knowledge about *Introduction to Electrical Draughting* especially the procedures involved in drawing a line parallel to a given straight line passing through a given point using a set square. Hence, provided incorrect sequence of steps outlined in the instructions.

Item (iv) was set from the topic of *Introduction to Electrical Draughting.* It was intended to measure the candidates' understanding of basic geometric concepts related to circles. The question was set as follows:

Identify the name of a part of the circle which is labelled by latter A as shown in the following figure.



A	*Diameter*	*B*	*Radius*	*C*	*Sector*
D	*Circumference*	*E*	*Quadrant*		

The correct answer was alternative *E, Quadrant.* Candidates who chose the correct alternative had adequate knowledge of parts of the circle. They did understand that, the term "quadrant" specifically refers to a quarter of the circle, not the entire circumference. However, those who chose alternative *A, Diameter* did not understand that in relation to a circle, the diameter is a

straight line segment that passes through the center of the circle and whose endpoints lie on the circle itself. It essentially bisects the circle into two equal halves. It is not specifically what is labelled by letter A in the figure. Those who chose option B, *Radius* were guessed the answer as they were familiar with the term radius because it is in the basic concepts of circles. Similarly, some candidates chose alternative C, *Sector* under the assumption that the area labelled 'A' represents a sector of the circle. However, the term "sector" refers to a portion of the circle enclosed by two radii and an arc between them. Actually, a sector and quadrant (the correct answer) are both concepts related to circles, and they share some similarities. So, while all quadrants are sectors, not all sectors are quadrants. Sectors can have various sizes and central angles, while quadrants are specifically defined by their central angle of 90 degrees and their division of the circle into four equal parts. On the other hand, those who chose option D, *Circumference* lacked knowledge of essential concepts in circle geometry. They could not realize that circumference of a circle is the distance around the boundary of the circle itself. The candidates were supposed to understand that one-fourth of the circle's boundary as observed in the given figure is a quadrant.

Item (v) was set from the topic of *International Organization for Standardization (ISO) Sheet Layout and Sketching.* It intended to test the candidates understanding on geometric concepts, specifically types of angles. The question was as follows:

Suppose you are required to construct an object with an angle inclined at less than a right angle. What name is given to such angle?
A Acute angle B Obtuse angle C Elevation angle
D Inclination angle E Reflection angle

The correct response was A, *Acute angle*. The candidates who selected this option had adequate knowledge on the concepts of types of angles. These candidates realized that an acute angle is an angle that measures less than 90 degrees. It is smaller than a right angle but larger than a zero-degree angle (a straight angle). The candidates who chose B, *Obtuse angle; C, Elevation angle;* D, *Inclination angle;* and E, *Reflection angle* seemed to have an idea of concepts regarding types of angles as all these options are related to angles but they do not accurately describe an angle inclined at less than a right angle, which is specifically referred to as an acute angle.

Item (vi) was constructed from the topic of *Domestic Wiring System.* It intended to assess the candidate's ability to understand the different types of projection methods used in technical drafting and design. The question was as follows:

You are given a task to evaluate a figure of a certain object and you found that the depth of an object is not visible. In which projection was the figure drawn?

A Oblique projection *B Isometric projection* *C Third angle projection*
D Orthographic projection *E First angle projection*

The correct answer was D, *Orthographic projection.* The candidates who chose this alternative were aware that, in orthographic projection, the object is represented using multiple 2D plane views (such as front, top, and side views), each showing one dimension of the object and the depth information is not typically visible.

A few candidates who selected alternative A, *Oblique projection,* failed to understand that in oblique projection, depth is typically visible, so if the depth is not visible in the figure then an oblique projection is not a correct choice. The candidates who selected alternative B, *Isometric projection,* confused with some feature of the correct answer D, *Orthographic projections* as both isometric and orthographic projections are methods used to represent three-dimensional objects on a two-dimensional surface. They could not realize that an isometric projection provides a more direct visual representation of depth in each view, while orthographic projection relies on multiple views to convey depth indirectly through the combination of these views. Those who selected alternative C, *Third angle projection;* and *E, First angle projection,* seem to have just guessed the answers. These candidates were required to understand that, *Third angle projection* and *First angle projection* are the methods commonly used in technical drawing, where the object is placed in a specific orientation relative to three perpendicular planes. However, the absence of depth information was not indicative of a specific projection method like third angle or first angle projection, making it an incorrect choice. The candidates' incorrect responses imply that, they either lacked knowledge about orthographic projection or confused about the characteristics of different projection methods.

Item (vii) was set from the topic of *Introduction to Electrical Draughting*. It intended to measure the candidates' knowledge and understanding on different types of diagrams commonly used in electrical engineering works. The question was as follows:

A site worker is required to draw a diagram of an electrical installation which indicates the location of components in a building. What type of the diagram is required to be drawn?

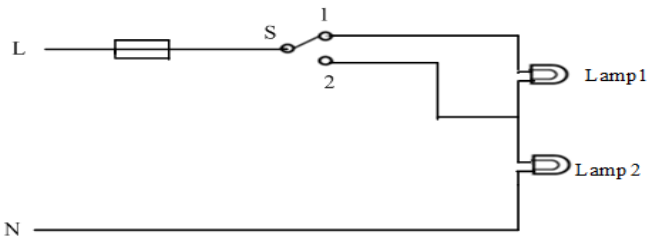
A Layout Diagram *B Circuit Diagram* *C Block Diagram*
D Wiring Diagram *E One-line Diagram*

Most of the candidates selected alternative A, *Layout Diagram,* which was the correct answer. These candidates had adequate knowledge of different types of electrical diagrams. They understood that, a layout diagram typically shows the physical arrangement of components within a system or structure.

A few candidates selected alternative B, *Circuit Diagram,* these did not understand that a circuit diagram illustrates the connections between electrical components using symbols. It provides a detailed representation of the electrical circuitry but may not necessarily indicate the physical location of components within a building. Candidates might select this option by assuming that the question refers to the electrical connections rather than physical locations. Others selected alternatives C, *Block Diagram;* D, *Wiring Diagram* and E, *One-line Diagram* because they had insufficient knowledge of types of electric diagrams and their uses. They failed to understand that, a *block diagram* provides an overview of a system by showing its major components and their interconnections. Also a *wiring diagram* illustrates the physical connections between components, such as switches, outlets, and fixtures, within a building's electrical system. It provides detailed information about the wiring layout. Conversely, a *one-line diagram* provides a simplified representation of an electrical system using single lines to represent conductors and components. It does illustrate the connections between them in a straightforward manner. These diagrams do not typically indicate the specific location of components within a building.

Item (viii) was constructed from the topic of *Lighting Scheme*. It assessed the candidates' ability to interpret electric circuit configurations and the behaviour of lamps in response to switches being placed in different positions. The question was set as follows:

Study the following figure and state the circuit condition for lamps 1 and 2 when switch "S" is placed at position 2.



A *Lamp 1 will be on* *B Lamp 2 will be on* ***C*** *Both lamps will be on*
D Lamp 2 will be off *E Both lamps will be off*

The correct answer was B, *Lamp 2 will be on*, and most of the candidates correctly selected this option. These candidates understood that Lamp 2 will be connected to the power source when the switch is at position 2. Some of the candidates wrongly opted for alternatives A, *Lamp 1 will be on* as they assumed that Lamp 1 is directly connected to the power source regardless of the switch position. Others opted for alternatives C, *Both lamps will be on* and E, *Both lamps will be off*, because they lacked knowledge about electrical circuit configuration, assuming that both lamps have complete circuit to the power source.

Item (ix) was constructed from the topic of *International Organization for Standardization (ISO) Sheet Layout and Sketching*. It intended to test the candidates' skills on graphical representation and drafting conventions, particularly the selection of line types for different purposes. The question was as follows:

Suppose you are given a task to draw a border for a drawing sheet preparation. Which line will you use for a visible outline?

A Continuous thin line. *B Short dashed line* *C Long chain line.*
D Continuous thick line *E Long dotted lines.*

Most of the candidates correctly selected alternative D, *Continuous thick line*. These candidates understood that a continuous thick line is used for drawing borders for a visible outline to make them more visually distinct. Those who chose alternative A, *Continuous thin line* could not recognize that thin lines are more commonly used in drafting for precise delineation but not for vivid outlines. On the other hand, the candidates who selected

alternatives B, *Short dashed line*; C, *Long chain line*; and E, *Long dotted lines* had misconception that dashed lines are commonly used for outlines. However, dashed lines are typically reserved for representing hidden or non-visible features in technical drawings, such as hidden edges or features obscured from view. Long chain lines are suitable for drawing borders or outlines. However, chain lines are typically used for representing centerlines, dimension lines, or other specific purposes in technical drawings, rather than outlining visible features. Also, dotted lines are commonly used for outlining visible features. However, dotted lines are typically utilized for representing auxiliary views, construction lines, or other reference elements in technical drawings, rather than for outlining visible boundaries.

Item (x) was set from the topic of *Introduction to Electrical Draughting* and aimed to assess the candidates' ability to understand geometric concepts, particularly angles, and their classifications. The question was constructed as follows:

A reflex angle is formed when two lines meet. At which angle does it occur?

A When an angle is less than 90^0.
B When an angle is greater than 180^0.
C When an angle is greater than 90^0.
D When an angle is less than 1800.
E When an angle is equal to 1800.

Most of the candidates correctly selected alternative B, *When an angle is greater than 180^0*. These candidates understood that a reflex angle occurs when two lines meet and form an angle greater than 180° but less than 360°. Those who chose alternative A, *When an angle is less than 90^0*, were incorrect because an angle less than 90° is called an acute angle, not a reflex angle. This demonstrates the candidates' misunderstanding of angle classification. In contrast, the students who selected alternative *C, When an angle is greater than 90^0*, were wrong because an angle greater than 90° but less than 180° is called an obtuse angle, not a reflex angle. Those who selected alternative D, *When an angle is less than 1800*, and E, *When an angle is equal to 1800* did not realize that in geometry, angles are typically measured within one full rotation (360 degrees). When an angle exceeds 360 degrees, it has completed multiple full rotations and some

additional degrees beyond that. Therefore, an angle of 1800 degrees is not considered a reflex angle because reflex angles fall between 180 and 360 degrees, encompassing one full rotation and less than another. An angle of 1800 degrees exceeds the range of a reflex angle.

2.2 SECTION B: SHORT ANSWER QUESTIONS

This section was comprised of six (6) short answer questions from the topics of *Domestic Wiring System*, *Electrical Diagrams* and *Lighting Scheme*. Each question carried 10 marks, giving a total of **60** marks. The analysis of candidates' response to each question in this section is as follows:

2.2.1 Question 2: Electrical Diagrams

The question intended to evaluate the candidates' understanding of basic circuit design and their ability to translate a given scenario into a practical electrical circuit diagram. The question was as follows:

A certain office building has two managers' rooms and one room for the office attendant. An alarm circuit for a manager to call an attendant is to be installed with the two push button switches, each placed in each manager's room. Construct the circuit diagram of the system.

A total of 279 (100%) candidates registered for Electrical Draugting paper, out of whom, 247 (88.53%) candidates attempted this question and their scores were as follows: 145 (58.70%) candidates scored from 0 to 2.5 marks; 66 (26.73%) scored from 3 to 6 marks and 36 (14.57%) candidates scored from 6.5 to 10 marks. The performance of the candidates on this question was average since 102 (41.30%) of them passed. Figure 2 summarizes the candidates' performance.

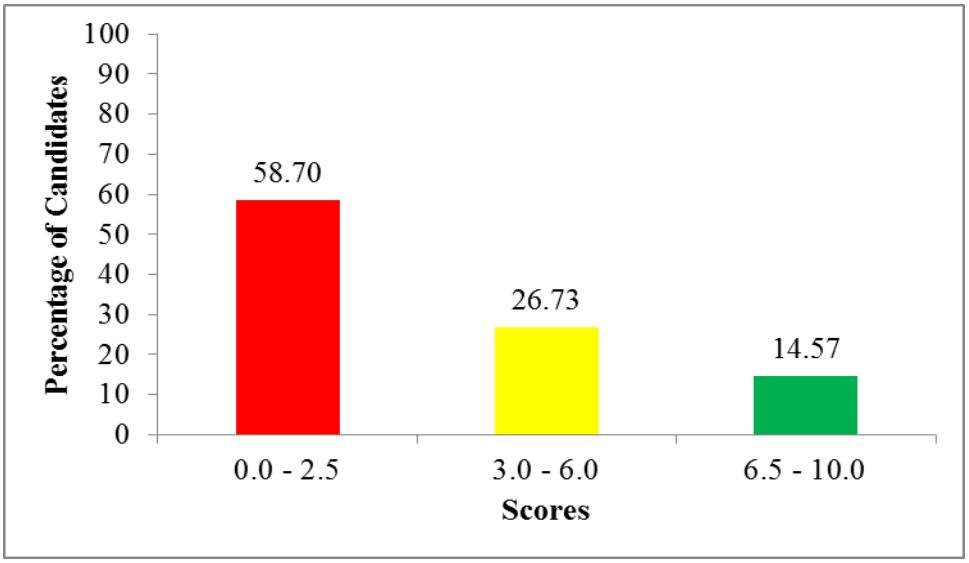
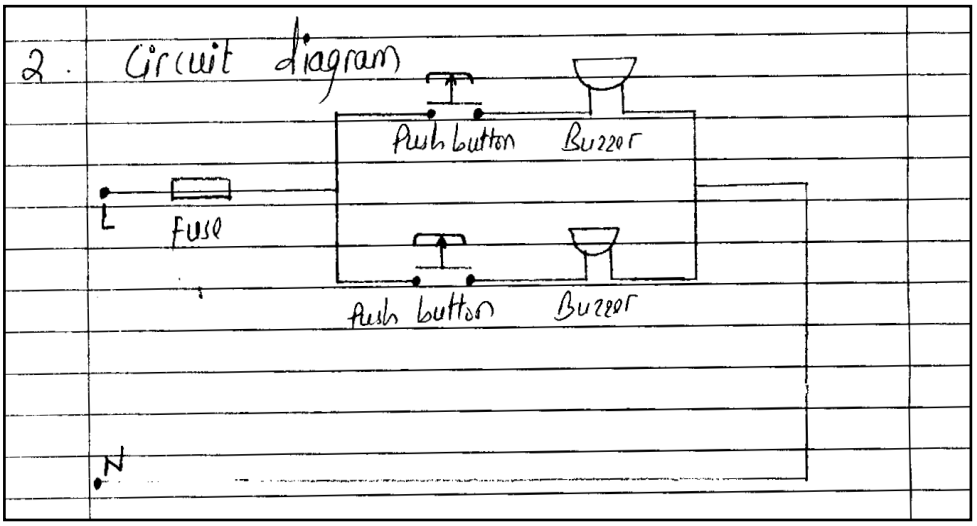


Figure 2: *The Candidates' Performance in Question 2*

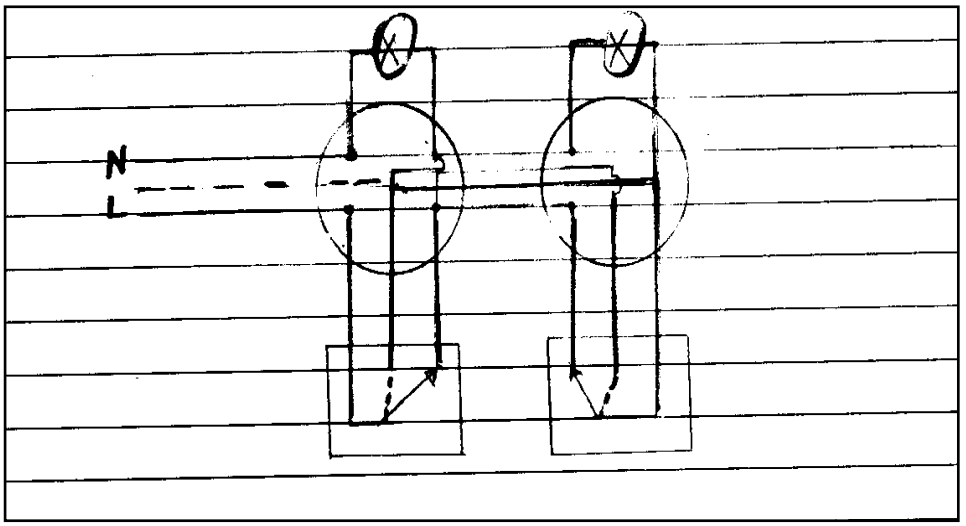
The analysis of responses shows that, average number of the candidates managed to construct the circuit diagram for the given scenario. They demonstrated their ability to design a circuit that includes push-button switches, indicating devices (such as lights or buzzers) and wiring connections to enable communication between the managers' rooms and the office attendant's room. This implies that the candidates had sufficient knowledge of *Electrical Diagrams*. Extracts 2.1 is a sample of a good response from one of the candidates.



Extract 2.1: A sample of the correct responses to Question 2

In Extract 2.1, the candidate successfully drew the circuit diagram by using appropriate symbols. This ensures that the candidate was able to convey the idea in a clear and relevant manner according to the question requirements. This indicates that the candidate appeared to possess a fundamental understanding of electrical systems and how various components interact.

Furthermore, the analysis of responses shows that, 58.70 percent of the candidates had weak performance. They lacked understanding of basic circuit principles: Some candidates might not have sufficient knowledge of how electrical circuits work, making it difficult for them to conceptualize and design a functional circuit for the given scenario. For example, one of the candidates drew two large dots and labeled them as Switch 1 and 2. Then, he/she connected the dots with several lines and indicated L (Live) and N (Neutral) to represent the circuit which was asked for. Likewise, one candidate among them only drew the vertical lines which doesn't relate to the required response. This implies that the candidates had insufficient knowledge of *Electrical Diagrams*. Extract 2.2 is an example to illustrate poor responses to Question 2.



Extract 2.2: A sample of incorrect responses to Question 2

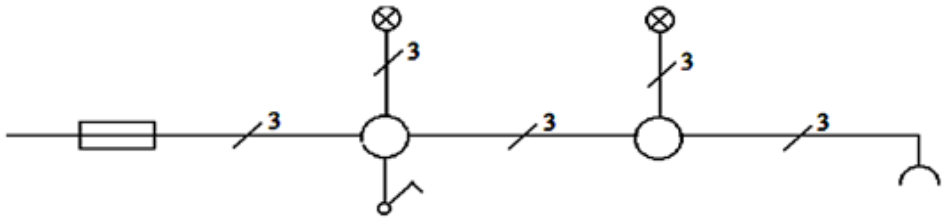
In Extract 2.2, the candidate lacked a clear understanding of the components and connections involved in the electrical circuit because he/she drew a wiring diagram instead of a circuit diagram. The candidate was supposed to understand that a *circuit diagram* is a type of schematic diagram that represents an electrical circuit by using standardized symbols

and conventions, while, a wiring diagram typically focuses on the physical layout of wires and connections, often used in installations. Actually, the candidate had limited knowledge on how to represent components with appropriate symbols in circuit diagrams.

2.2.2 Question 3: Domestic Wiring System

The question intended to evaluate the candidates' capability to accurately represent an installation plan into a schematic form by using standardized symbols and convention. The question was as follows:

The following Figure presents an installation plan of a room. Convert it into a schematic diagram.



A total of 247 (88.53%) out of 279 candidates who registered for this paper attempted this question, and their scores were as follows**:** 52 (21.05%) scored from 0 to 2 marks, 87 (35.23%) scored from 3 to 6 marks, and 108 (43.72%) scored from 6.5 to 10 marks. Figure 3 summarizes the candidates' performance in this question

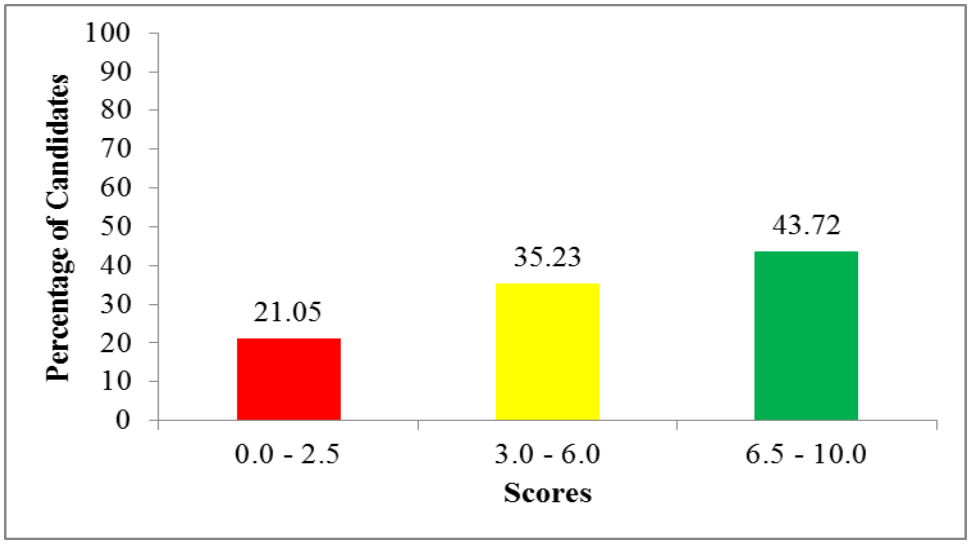
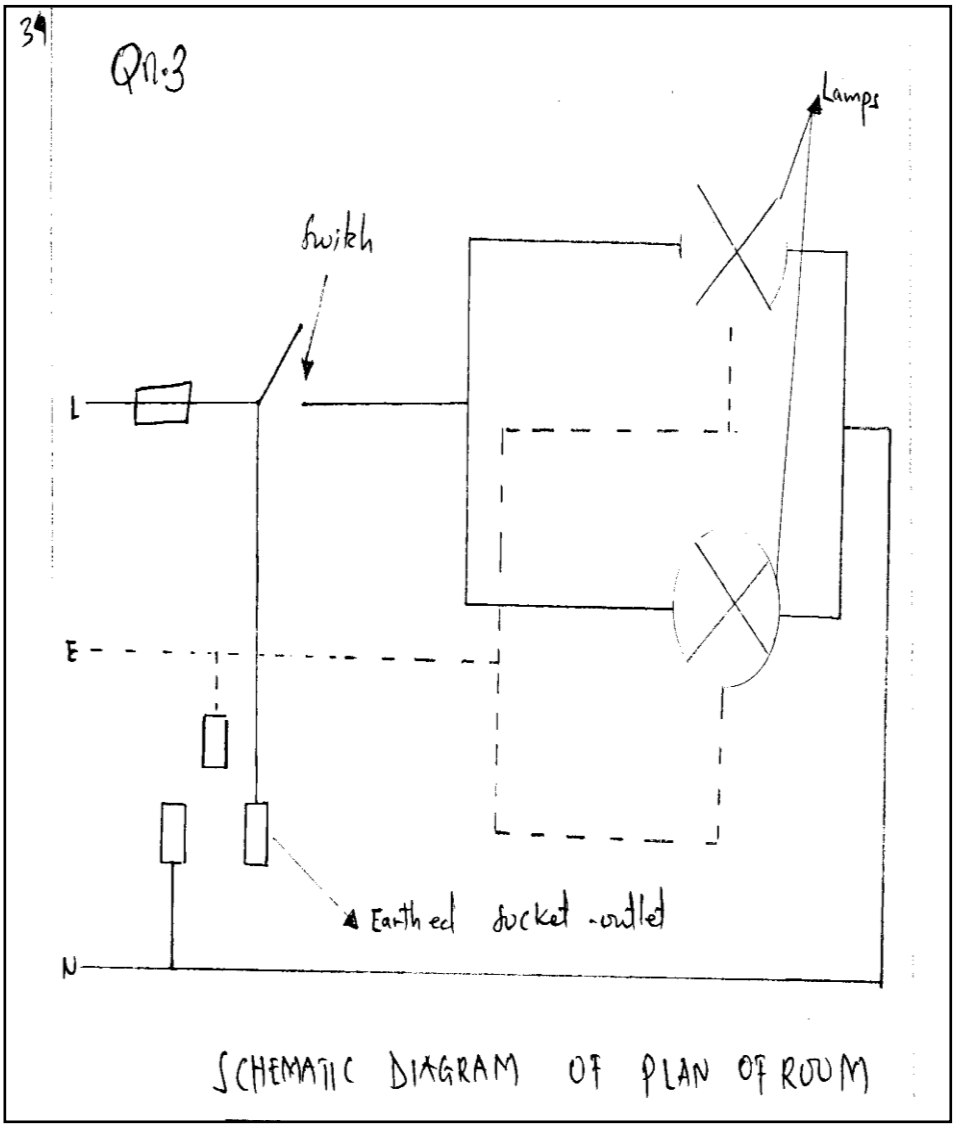


Figure 3: *The Candidates' Performance in Question 3*

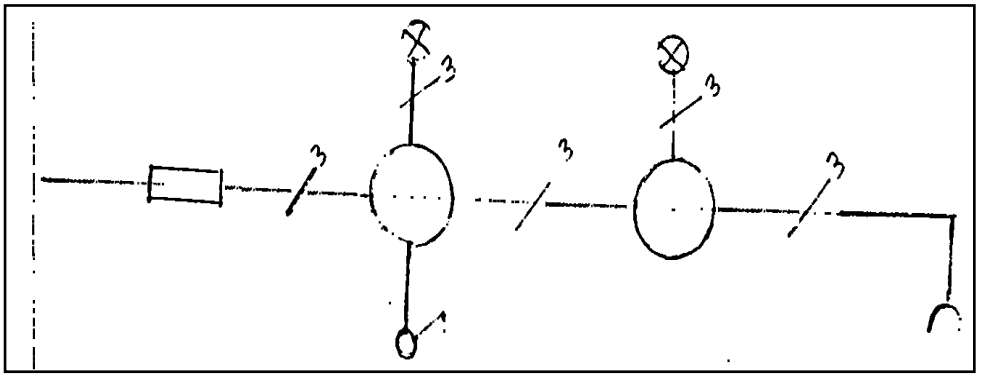
Figure 3 shows that the general performance of the candidates in this question was good since 195 (78.95%) of them scored 3 to 10 marks. The analysis of responses reveals that, among the candidates who performed well, 6 (2.43%) scored 10 marks. They managed to correctly interpret the given figure, hence, converted it into a schematic diagram. This implies that the candidates had sufficient knowledge on the topic *Domestic Wiring System*. Extracts 3.1 is a sample of a good response from one of the candidates who correctly responded to the question.



Extract 3.1: A sample of the correct responses to Question 3

In Extract 3.1, the candidate managed to convert an installation plan of a room into a schematic diagram. He/she was able to accurately draw the diagram using the correct circuit symbols. This suggests that the candidate had a good level of skill and competence in schematic diagram construction.

Despite the good response from most of the candidates 195 (78.95%), minority of them 52 (21.05%) responded poorly as they failed to interpret the given figure and convert it into a schematic diagram. This implies that they had limited knowledge in the topic of *Domestic Wiring System*s. It was observed that, one of the candidates drew the wiring floor plan (also known as a wiring diagram) which was not the requirement of the question. The candidate confused between *a schematic diagram* and a *wiring diagram* as both diagrams represent electrical systems. However, the candidate was supposed to understand that, a *wiring diagram* focus on the physical layout and connections of electrical components within a system, whereas a *schematic diagram* emphasizes functional relationships and operation of electrical components within a system. It is probable that the candidate lacked the ability to accurately interpret and convert visual information into a schematic diagram. This indicates deficiency in understanding technical drawings, schematic representations, or both. Extract 3.2 is a sample of an incorrect response to the question.



Extract 3.2: A sample of incorrect responses to Question 3

Extract 3.2 shows that the candidate redrew the diagram given in the question and made it as the answer to that question. This is translated as lack of understanding and proficiency in the area of electrical diagrams representation.

2.2.3 Question 4: Lighting Scheme

The question intended to measure the candidate's knowledge and understanding of electrical symbols used in electrical diagrams. The question was as follows:

Draw the electrical symbols to represent the following electrical components:

(a) Intermediate switch.
(b) Earthed socket-outlet.
(c) Cable laid under plaster.
(d) Two-gang 1-way switch.
(e) Two-way switch.

The question was attempted by 247 (88.53%) of the 279 (100%) registered candidates. A total of 13 (4.26%) candidates scored from 0 to 2.5 marks and 83 (33.61%) scored from 3 to 6 marks. Moreover, 151 (61.13%) candidates scored from 6.5 to 10 marks. Figure 4 illustrates this performance.

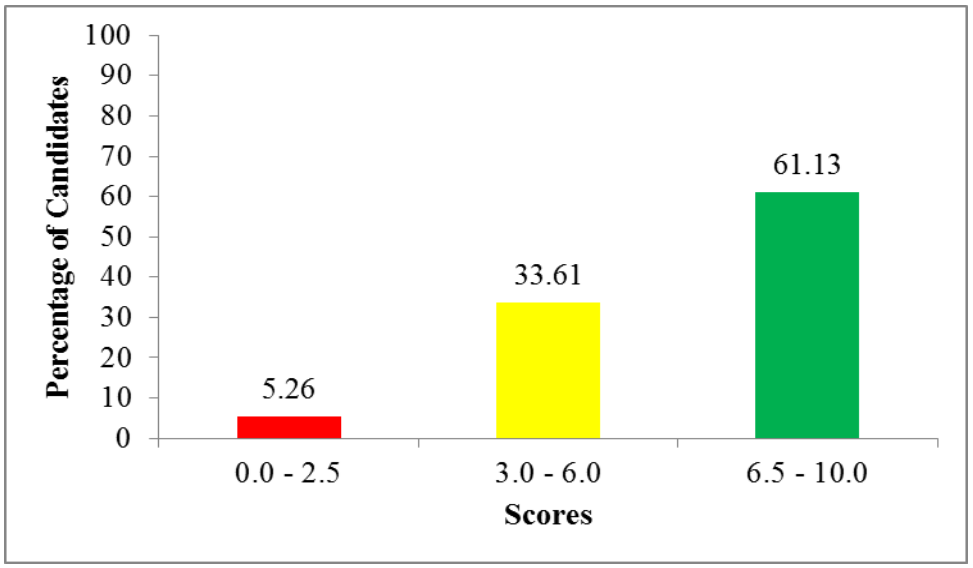
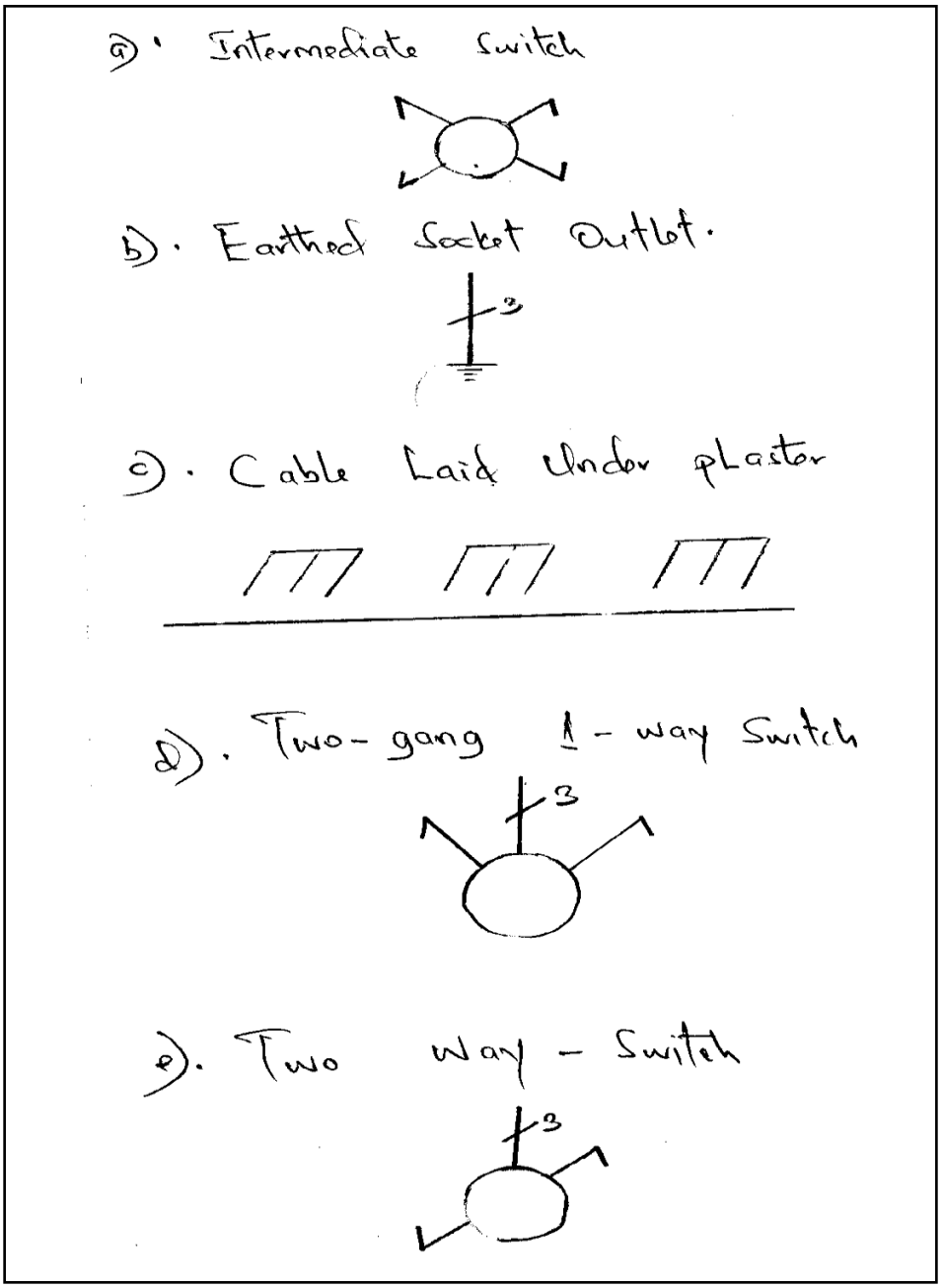


Figure 4: *The Candidates' Performance in Question 4*

Based on Figure 4, the candidates' performance in this question was good because 234 (94.74%) scored from 3 to 10 marks out of the 10 marks allocated to the question. The candidates who scored higher marks (6.5 - 10) had adequate knowledge of *Lighting Scheme*, and demonstrated good

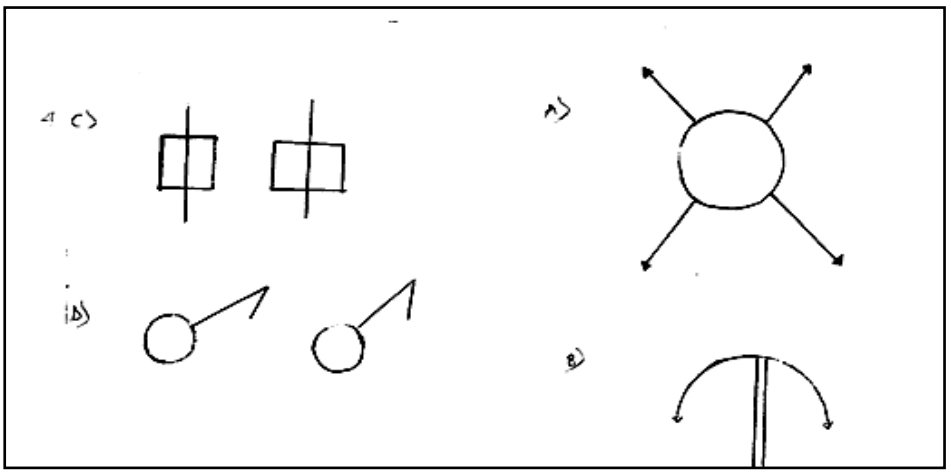
drawing skills. They were able to draw electrical symbols to accurately represent the given electrical components. Extract 4.1 is a sample of candidates' correct responses.



Extract 4.1: A sample of the correct responses to Question 4

In Extract 4.1, the candidate correctly provided the electrical symbols to represent the given electrical components. The candidate likely had sufficient understanding of commonly used electrical symbols and their representations in schematic diagrams.

Further analysis shows that, 13 (5.26%) candidates scored 2 marks or less as they failed to meet the requirements of the question. They lacked knowledge on the concept of *Lighting Scheme*. Some of them succeeded to draw the symbol of one component, while others failed completely to draw any. It is possible that the candidates failed due to the fact that, some symbols might look similar due to their shapes or basic elements. For instance, the symbols for different types of switches might share common features like lines and circles, making it easy to confuse them if they are not careful. For example, when responding to part (e), one of the candidates drew the symbol of *two gang 1-way switch* instead of *two-way switch.* This candidate was supposed to understand that although a "one-way switch" and a "two-way switch" both refer to types of electrical switches used to control the flow of electricity in a circuit, but they differ in their functionality and wiring configuration. In fact, a "two-gang 1-way switch" refers to a switch with two terminals (two-way functionality) within a single unit (1-gang), allowing control from two locations. This is different from a "one-way switch," which only has two terminals and controls the circuit from one location. Extract 4.2 illustrates a sample of incorrect responses from one of the candidates.



Extract 4.2: A sample of the incorrect response to Question 4

In Extract 4.2, the candidate drew diagrams that resembled some symbols used in electrical engineering drawings but were not correct. The candidate demonstrated partial understanding of the standard symbols used in electrical engineering.

2.2.4 Question 5: Electrical Diagrams

The question intended to assess the candidates' ability to develop a block diagram and their understanding on how electrical power is generated, transmitted, and distributed to consumer areas. The question was as follows:

Draw a labeled block diagram of TANESCO power supply for domestic premises.

The question was attempted by 247 (88.53%) out of 279 registered candidates. Candidates who scored from 0 to 2.5 marks were 129 (52.23%) out of whom, 66 (26.72%) scored 0. The candidates who scored from 3 to 6 marks were 82 (33.20%), whereas 36 (14.57%) scored from 6.5 to 10 marks. Further analysis reveals that 7 (2.51%) candidates scored all the 10 marks. Figure 5 summarizes the candidates' performance in question 5.

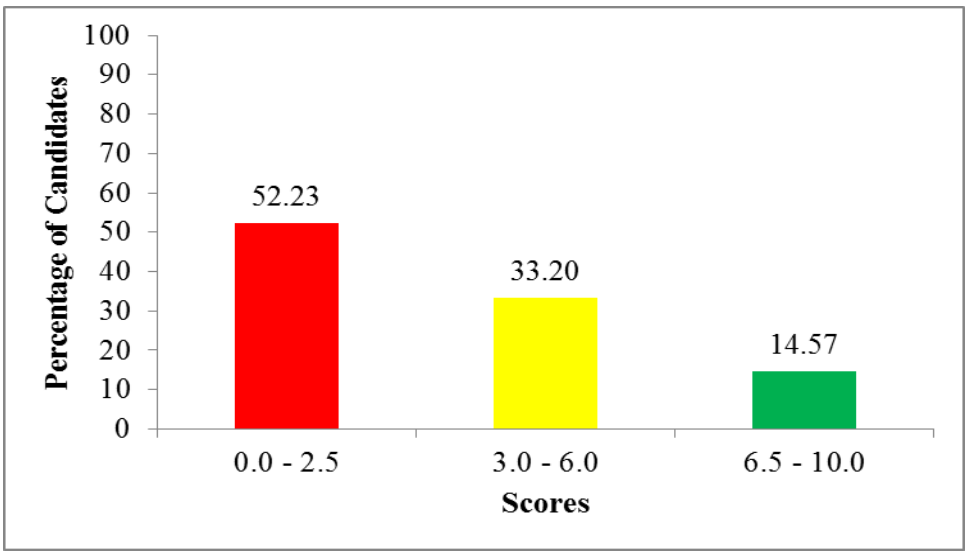
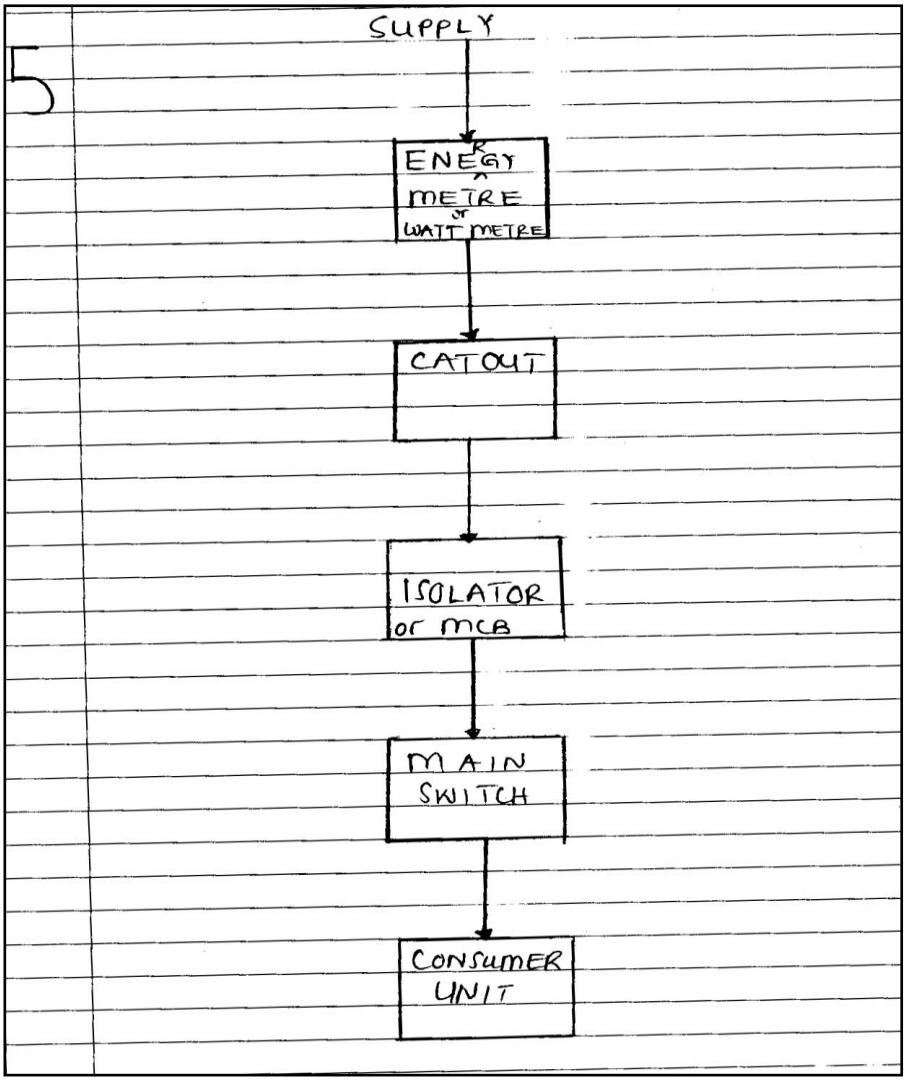


Figure 5: *The Candidates' Performance in Question 5*

Based on Figure 5, candidates' performance on this question was average because 118 (47.77%) scored from 3 to 10 marks out of the 10 marks

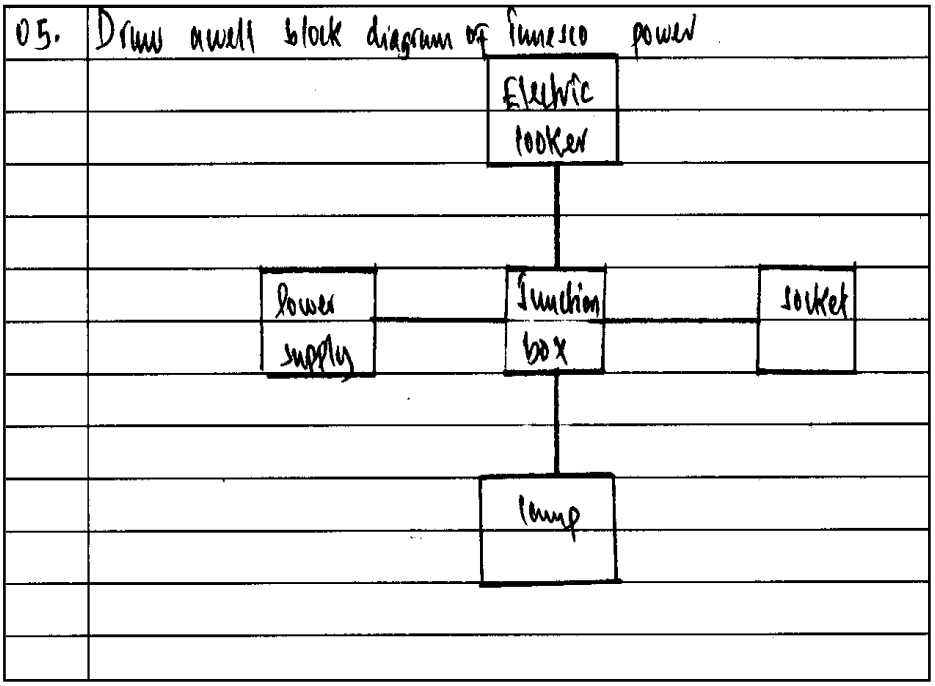
allocated to this question. These candidates had adequate knowledge of *Electrical Diagrams*, especially the structure and components of a typical electrical power supply system for domestic premises which include cut-out, power meter, circuit breaker and the main switch. Extract 5.1 is a sample of candidates' correct responses.



Extract 5.1: A sample of correct responses to Question 5

In Extract 5.1, the candidate correctly drew the block diagram of TANESCO power supply for domestic premises. He/she identified and accurately represented key components of the TANESCO power supply system which include power meter, cut out, circuit breaker, main switch and finally to consumers' unit.

On the other hand, candidates who scored low marks (0 to 2.5); most of them either completely failed to draw the block diagram as asked, or were able to draw it and identify only some of the parts/stages of the block diagram. For example, some candidates drew circuit diagrams showing electrical components and connections within a single device or system, rather than a block diagram showing the overall power supply *for* domestic premises. There was also a candidate who drew floor plan (wiring diagram) which indicates a visual representation of the electrical system's layout, including the placement of outlets, switches, lighting fixtures, and other electrical devices in the building. Extract 5.2 illustrates the candidates' incorrect responses.



Extract 5.2: A sample of incorrect responses to Question 5

In Extract 5.2, the candidate's block diagram illustrates the basic components and layout of the electrical wiring system within domestic premises, including power supply, distribution, and outlets for various appliances and lighting. However, it does not specifically represent the TANESCO power supply system which would involve elements such as power meter, cut out, circuit breaker, main switch and finally to consumers' sub circuit.

2.2.5 Question 6: Electrical Diagrams

The question intended to assess the candidates' understanding of electrical components, circuits, and systems, particularly in the context of motor control and starters. The question was as follows:

You are required to design the direct online starter of a three-phase motor which starts a motor from two different places with a pilot lamp. Draw the circuit diagram of your design.

This question was attempted by 247 (88.53%) out of 279 candidates who registered for this paper. Their scores were as follows: 128 (51.82%) students scored from 0 to 2.5 marks, 93 (37.65%) scored from 3 to 6 marks and 26 (10.54%) scored from 6.5 to 10 marks. Figure 6 illustrates the candidates' performance for this question.

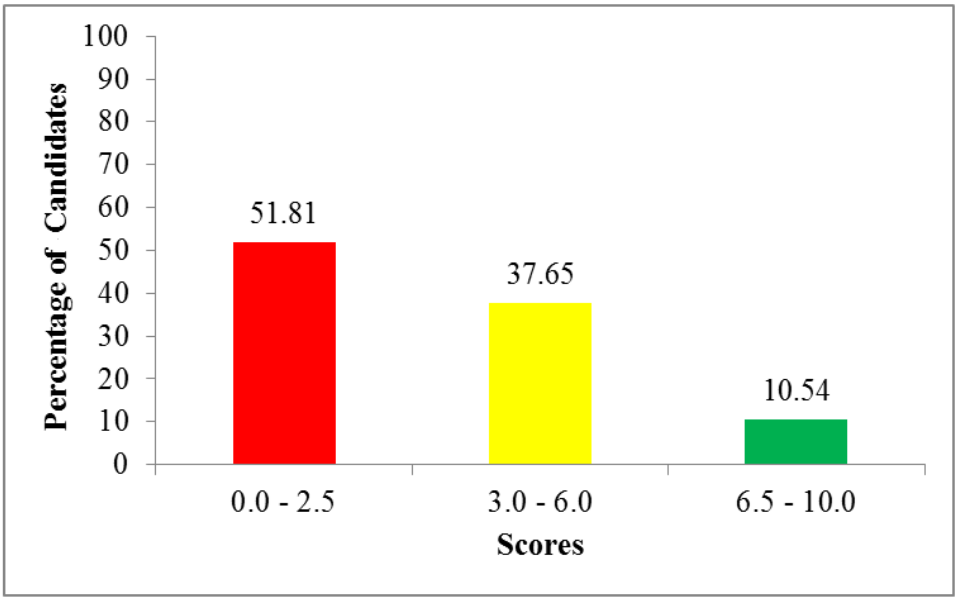
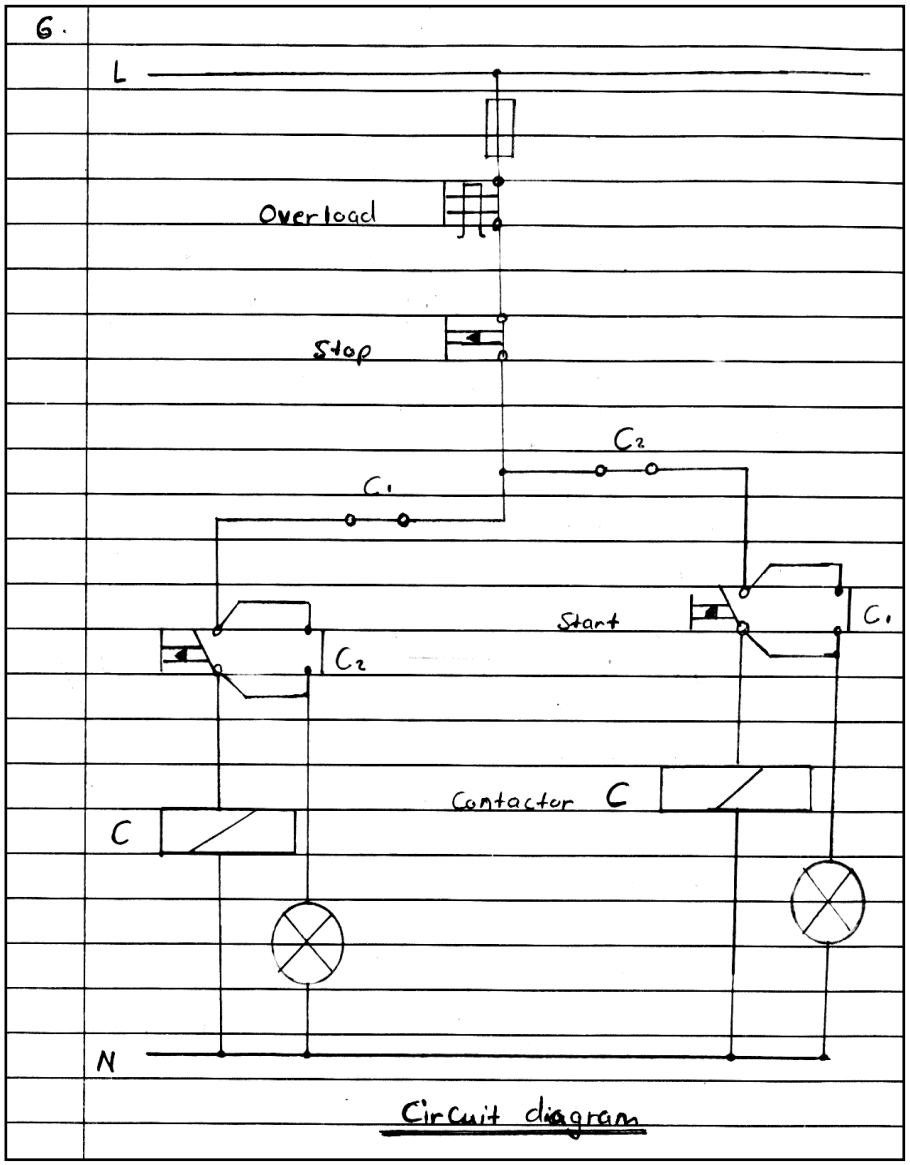


Figure 6: *The Candidates' Performance in Question 6*

Figure 6 shows that the general performance on this question was average because 119 (48.19%) of the candidates scored from 3.0 to 10.0 marks. This indicates that the candidates had sufficient knowledge about three phase motor control and the direct online starters. They acquired a general understanding of how electrical systems work, including control systems for motors such as direct online starters. Hence, managed to draw a direct online starter of a three-phase motor which can start a motor from two

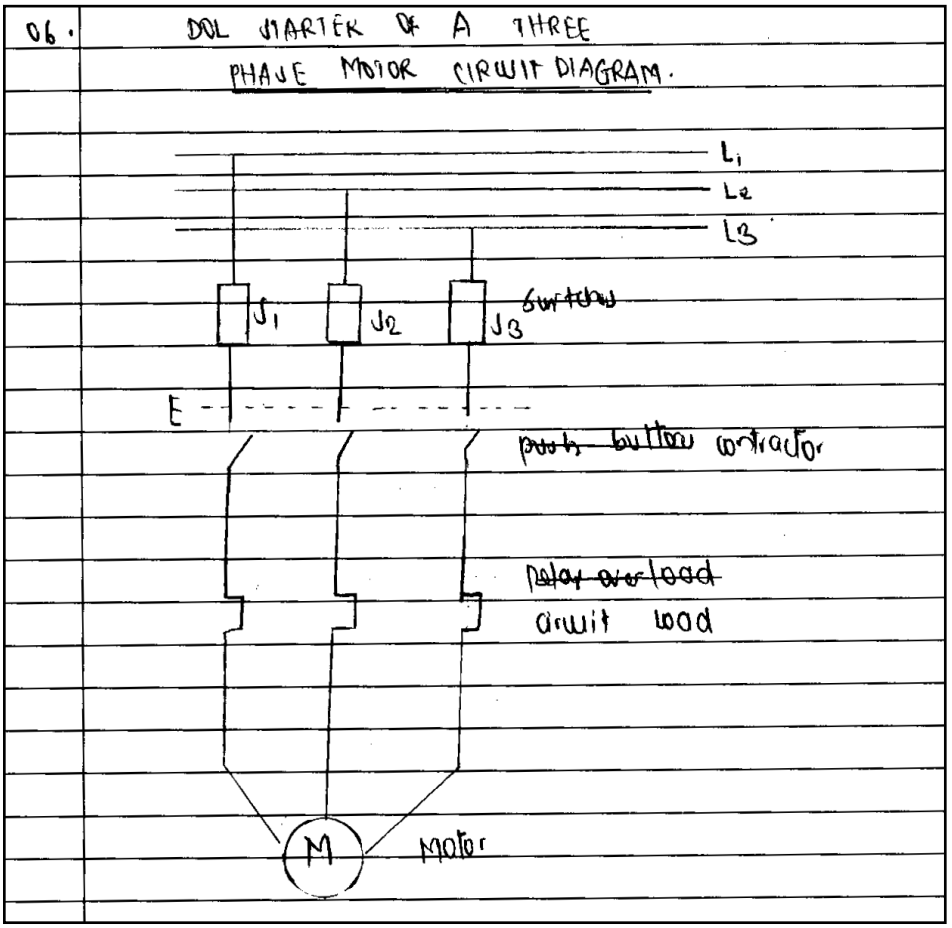
different places with a pilot lamp. Extract 6.1 is a sample of the correct responses to this question.



Extract 6.1: A sample of correct responses to Question 6

In Extract 6.1, the candidate correctly drew circuit diagram of a direct online starter of a three-phase motor which starts a motor from two different places with a pilot lamp. The candidate presented the circuit diagram in a clear and organized manner, with properly labeled components and connections.

Despite the good performance of the candidates on this question, 101 (36.20%) scored zero. These candidates either did not understand the demands of the question or they lacked knowledge of the tested concepts, thus provided incorrect responses. Some of them might have misinterpreted the question which led them to draw a circuit unrelated to motor control, such as a lighting circuit. Extract 6.2 is illustrative.



Extract 6.2: A sample of incorrect responses to Question 6

In Extract 6.2, the candidate drew the main circuit of direct online starter of a three-phase motor instead of a control circuit of a direct online starter of a three-phase motor. The candidate likely misunderstood the question requirements. Basically, the main circuit and the control circuit of a direct online starter for a three-phase motor are interrelated systems that work together to start, stop, and protect the motor. However, they serve different functions and contain distinct components.

2.2.6 Question 7: Electrical Diagrams

This question intended to measure the candidates' understanding of electrical circuit design, particularly in the context of lighting circuits and switch control arrangements. The question was as follows;

A customer has planned to install lighting circuit with three lamps for security purpose. The circuit is designed to use two 1-way-one-gang switches and three 2-way switches each controlling its separate lamp. All lamps of the circuit are to be controlled by any of the 1-way-one-gang switches to act as a master switch. If one of the 1-way-one-gang switches is ON, then any three 2-way switches can control its lamp by keeping it ON/OFF. If all 1-way-one gang switches are OFF, none of the three 2-way switches can control its lamps, and if all 1-way-one-gang switches are ON the lamps remain ON all the time. Construct the circuit diagram from the given information to fulfill the customer's requirements.

This question was attempted by 247 (88.53%) out of 279 registered candidates. Out of whom 147 (59.51%) scored from 0 to 2.5 marks; 68 (27.53 %) scored from 3 to 6 marks; and 32 (12.96%) scored from 6.5 to 10 marks. Figure 7 summarizes the performance of the candidates on this question.

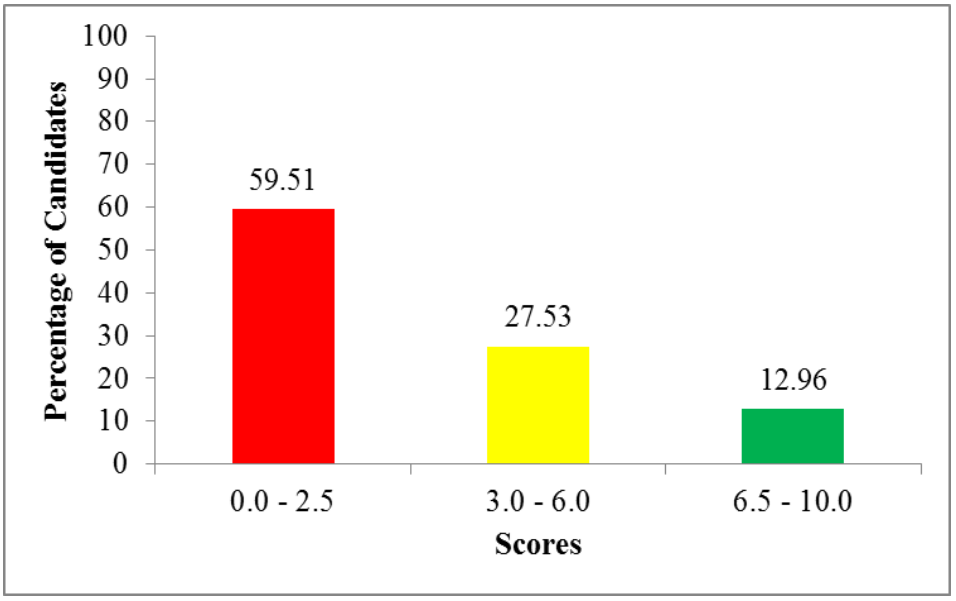
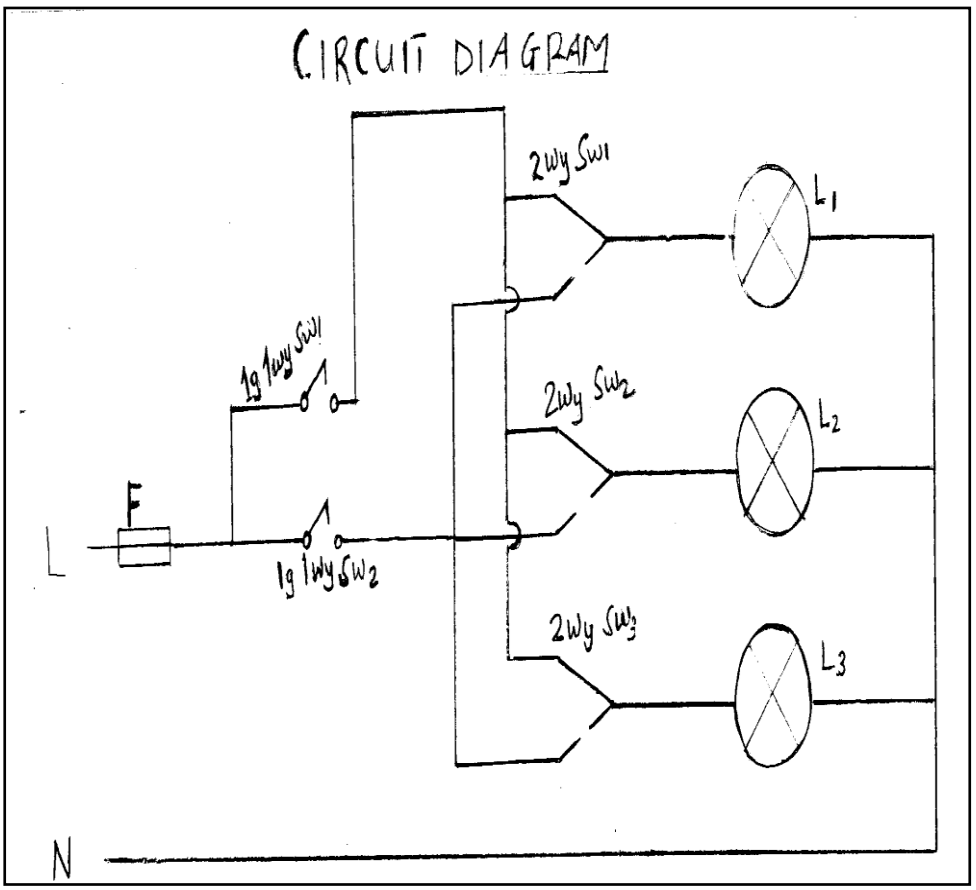


Figure 7: *The Candidates' Performance in Question 7*

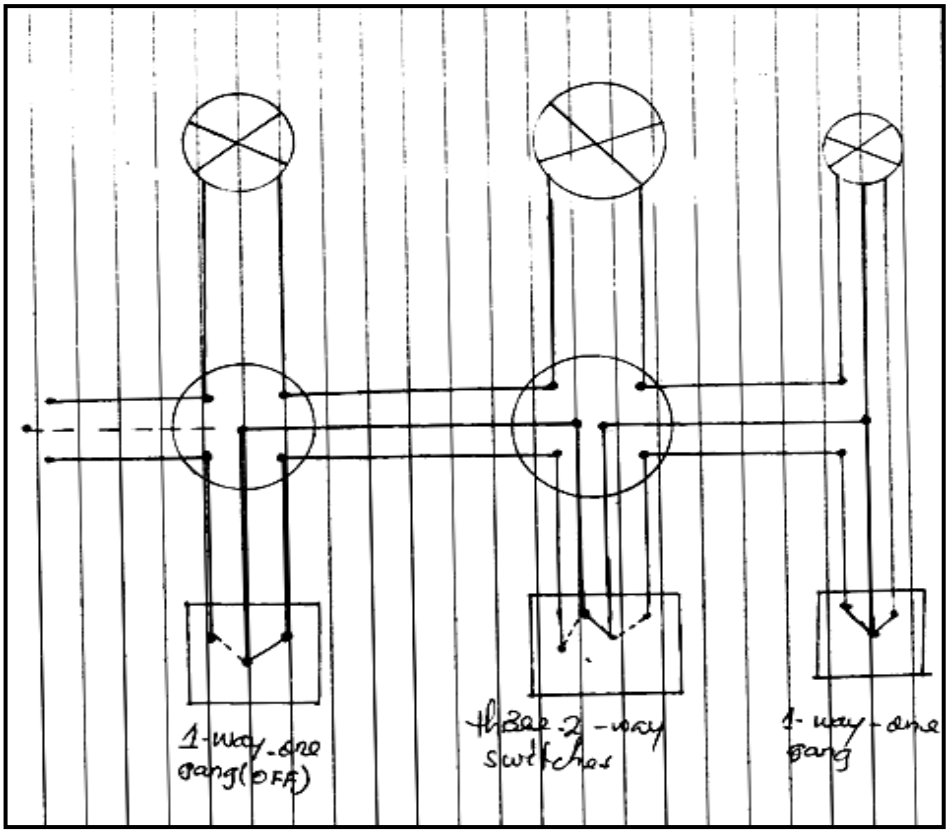
The trend in Figure 7 depicts that the performance of the candidates in this question was average since 100 (40.49%) candidates scored average and above. These candidates managed to correctly construct the circuit diagram from the given information to fulfill the customer's requirements. They demonstrated their ability to translate theoretical concepts into practical circuit design. Extract 7.1 illustrates a good response to the question.



Extract 7.1: A sample of correct responses to Question 7

In Extract 7.1, the candidate demonstrated knowledge of different types of switches particularly 1-way-one-gang and 2-way switches and their configurations to achieve the desired circuit diagram. Overall, the candidate's proficiency in understanding customer requirements, knowledge of switch types and configurations, ability to interpret and apply information, effective circuit design skills, attention to detail, and clarity in presentation which was likely contributed by good mastery of electrical diagrams.

Furthermore, the response analysis shows that among 147 (59.51%) of the candidates who performed poorly, 123 (49.80%) scored zero. These candidates lacked knowledge of *Electrical Drawing*, especially ability to distinguish the characteristics and uses of the switches. Some candidates attempted to develop the circuit diagram but did not perform well because they used incorrect symbols. For example, some candidates used "two-gang 1-way switch" instead of "1-way-one-gang switch" as requested. Additionally, some candidates drew diagrams that did not align with the requirements of the question. Extract 7.2 illustrates the candidates' incorrect responses to the question.



Extract 7.2: A sample of incorrect responses to Question 7

In Extract 7.2, the candidate incorrectly drew circuit diagram from the given information. He/she drew a diagram that resembled a wiring diagram instead of a circuit diagram. However, the switches labeled as "1-way one gang switch" and "2-way switch" were incorrectly connected.

2.3 SECTION C: STRUCTURED QUESTION

This section consisted **of one** (1) structured question, carrying **30** marks. All candidates were required to answer this question. The analysis of candidates' responses to the question is as follows:

2.3.1 Question 8: Lighting Scheme

The question assessed the candidates' understanding of circuit design principles, including wiring configurations, component connections, and electrical symbols. The question was as follows:

A lighting system of a certain industry is illuminated by a single tube fluorescent lamp, series double tube, and parallel double tube fluorescent lamps. For each tube arrangement, draw a well labeled circuit diagram.

A total of 247 (88.53%) out of 179 (100%) candidates attempted this question. Among them 145 (58.70%) scored from 0 to 8.5 marks, 47 (19.03%) scored from 9 to 18.5 marks, and 55 (22.27%) scored from 19 to 30 marks. Figure 8 summarizes the candidates' performance in this question.

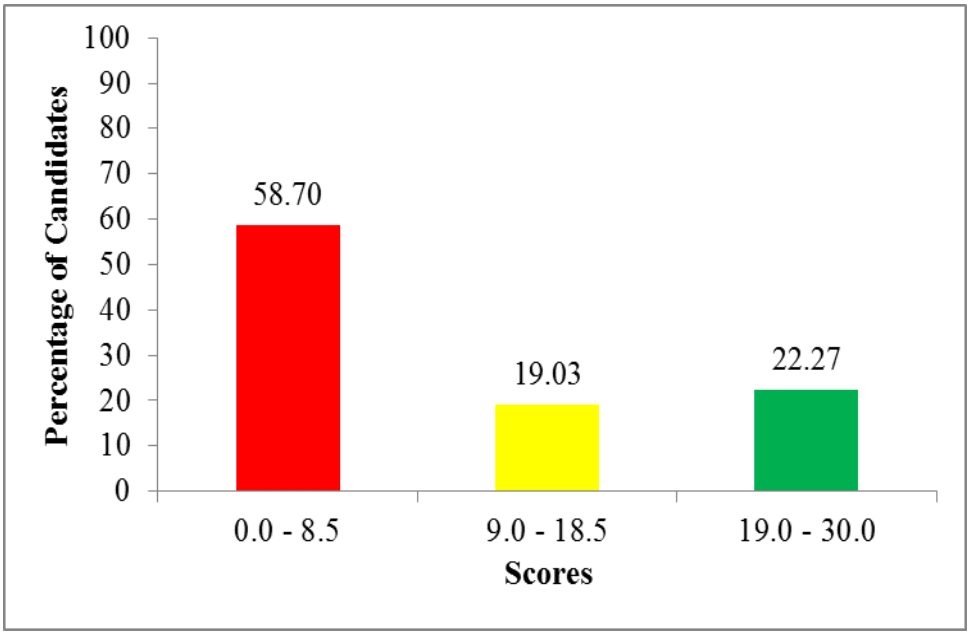
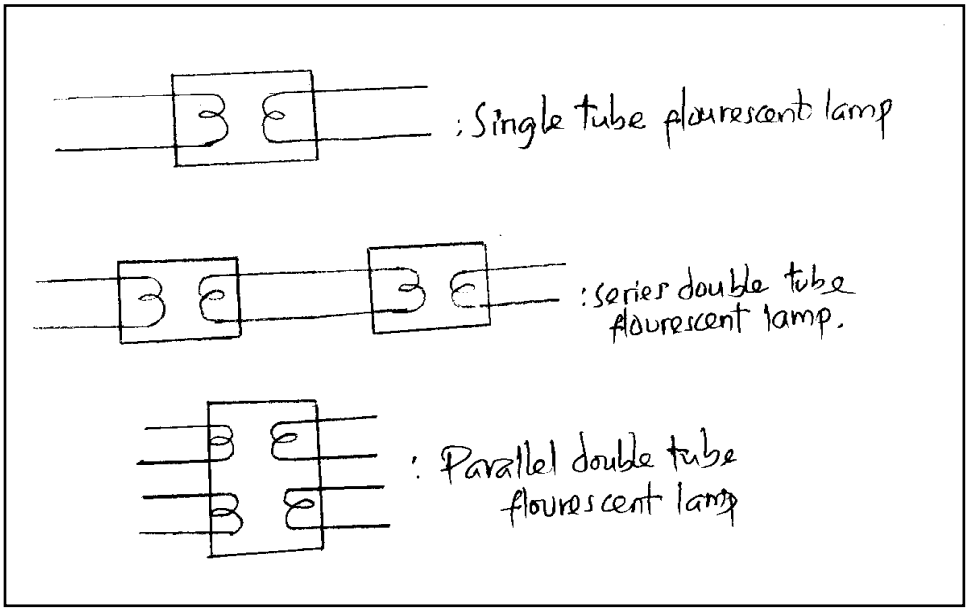


Figure 8: *The Candidates' Performance in Question 8*

Figure 8 illustrates that the performance in this question was average because 102 (41.30%) of the candidates who attempted this question scored above the marginal level of fail.

The analysis indicates that, 145 (58.70%) candidates had weak performance due to inadequate knowledge on the topic of *Lighting Scheme.* Generally, the candidates' weakness was observed when some of them confused the configurations of the fluorescent tubes. For example, some of them mistakenly drew a series configuration when a parallel configuration was required, or vice versa. There were candidates who attempted to draw the relevant circuit diagrams but incorrectly labeled the components within, such as misidentifying capacitors, electrodes, starter or other circuit components. Some candidates forgot to include necessary components in the circuit diagram, such as starters, choke and capacitor which are required for fluorescent tube operation. For example, one of the candidates drew a parallel-series circuit using only resistors and inductors instead of arranging fluorescent tubes for single tube, series double tube, and parallel double tube fluorescent lighting circuits. Extract 8.1 is a sample of incorrect responses to the question.

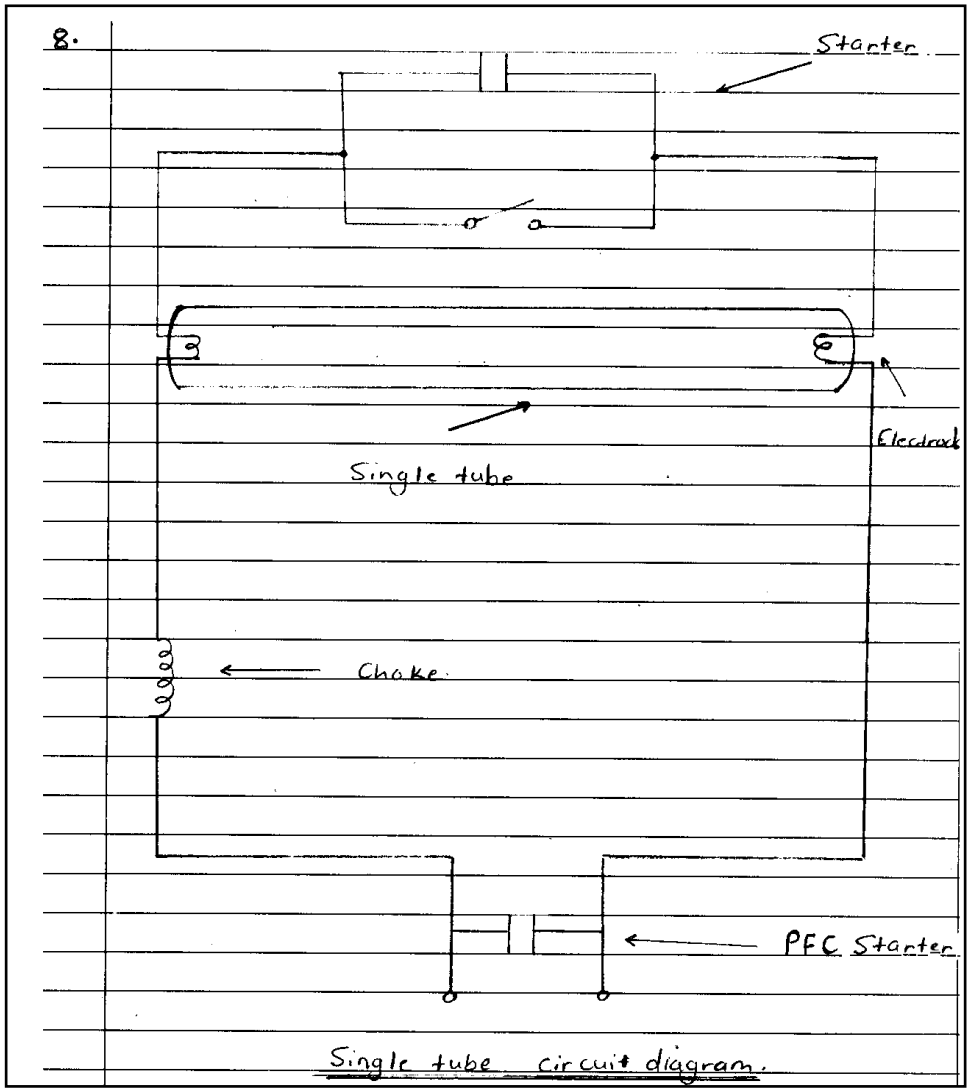


Extract 8.1: A sample of incorrect responses to Question 8

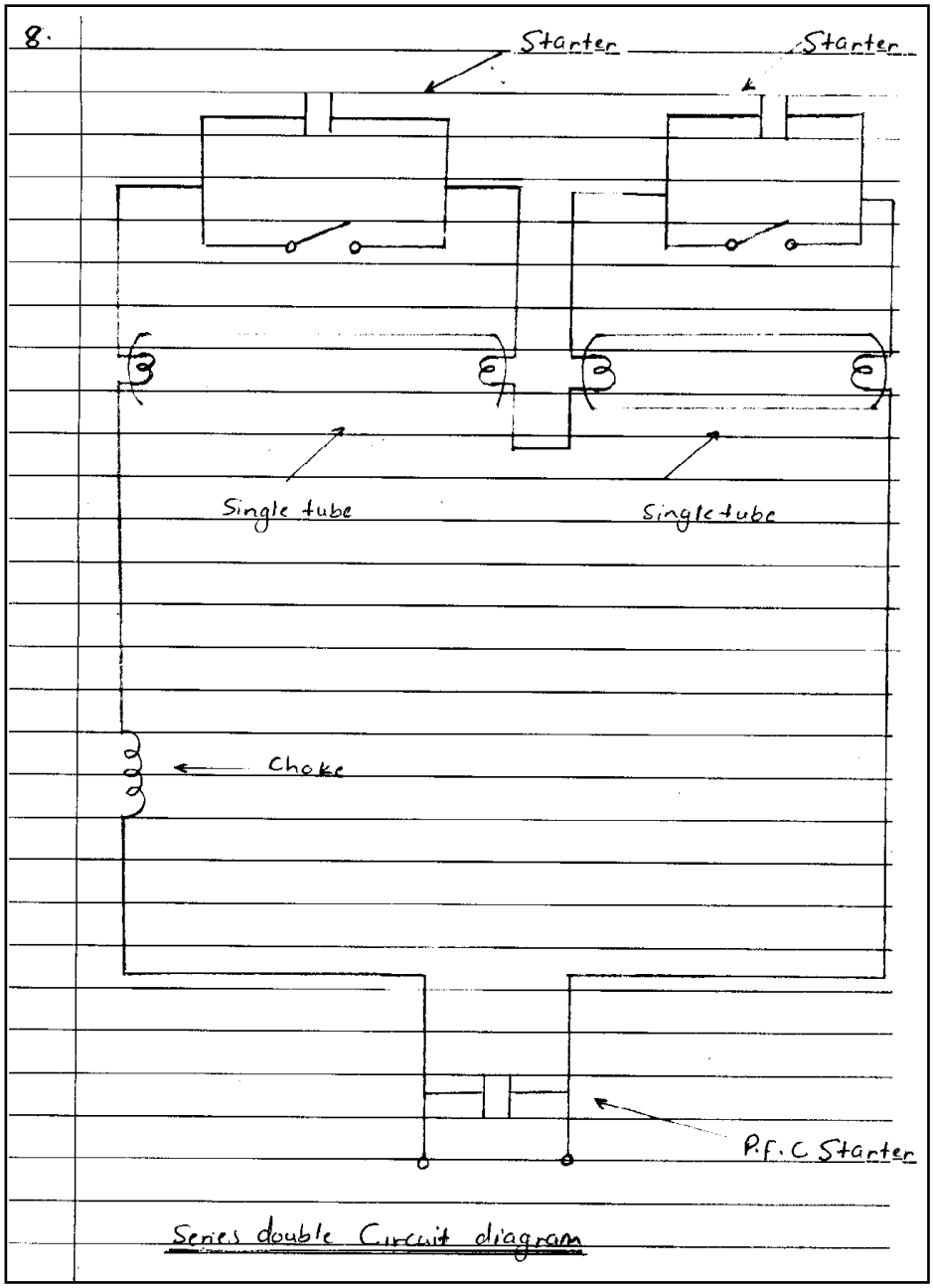
In Extract 8.1, the candidate used the fluorescent tube symbol without creating a circuit as required by the question. He/she used two symbols arranged in a series configuration and labeled them as series double tube.

Also he/she arranged another two symbols in a parallel configuration and labeled them as double parallel tube. These responses suggest that the candidate lacked understanding of *Lighting Scheme.*

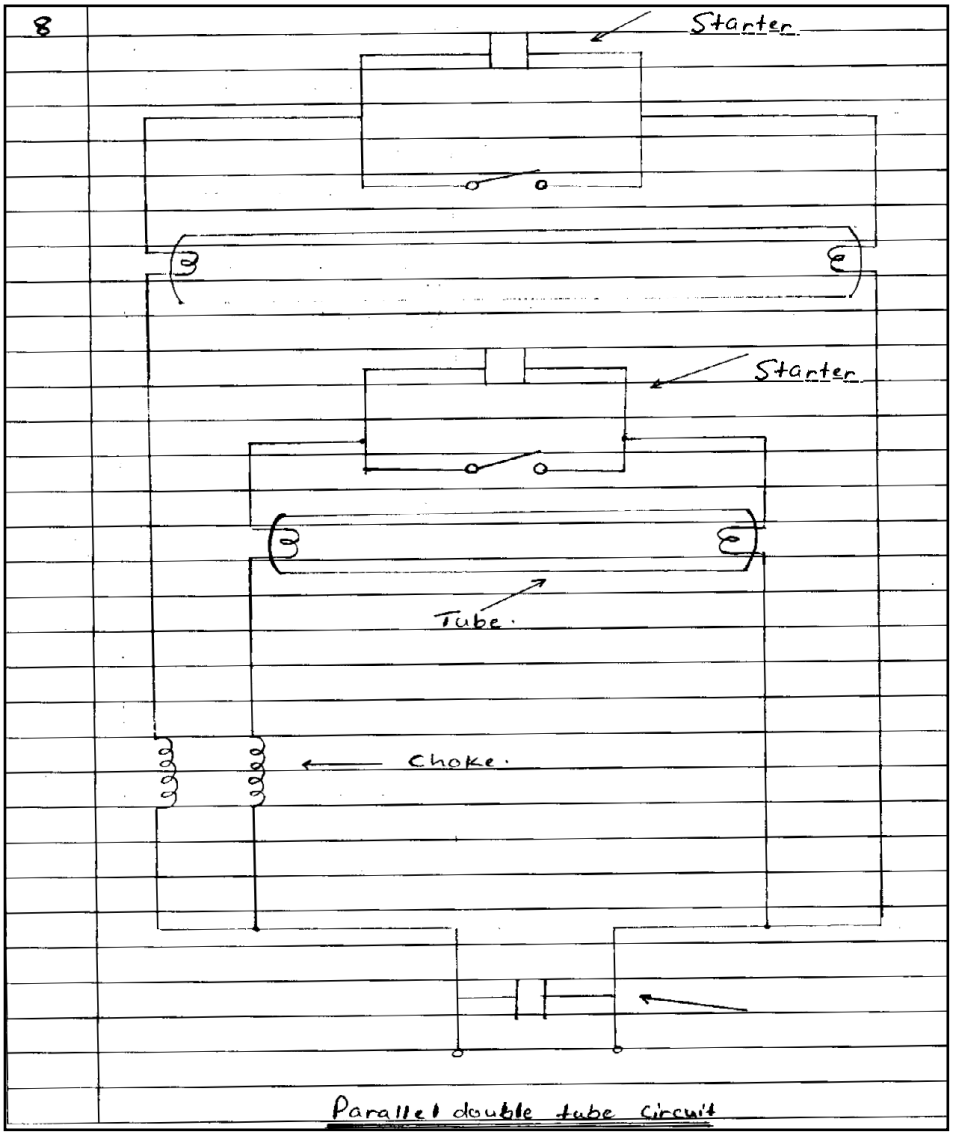
Despite the weak performance shown by most of the candidates, 55 (22.27%) revealed to have satisfactory knowledge on the concept of *Lighting Scheme*. Among them, 15 (6.07%) scored 30 marks allotted to the question. These candidates accurately interpreted the requirements of the question and created appropriate circuit diagrams for each tube arrangement. Extract 8.2 represents a sample of good responses to this question.



8.



Series double Circuit diagram



Extract 8.2: A sample of good responses to Question 8

In Extract 8.2, the candidate demonstrated good understanding of *Lighting Scheme*. He/she accurately interpreted the requirements of the question and drew appropriate circuit diagrams for each tube arrangement. The candidate diagrams were well-labeled with clear and accurate representations of components with appropriate circuit symbols and connections.

3.0 THE CANDIDATES' PERFORMANCE IN EACH TOPIC

The analysis of the candidate's performance on the topics which were assessed in the Electrical Draughting subject for the year 2023 indicates that the candidates performed well on *Domestic Wiring System* (78.95%), tested in Question 3, *Lighting Scheme* (68.02%) tested in Question 4 and 8. Other topics were; *Introduction to Electrical Draughting*, *International Organization for Standardization (ISO) Sheet Layout and Sketching*, *Domestic Wiring System*, and *Electrical Diagrams* (95.55%) tested in Question 1 which comprised of 10 multiple choice items. The good performance on these topics signifies that the candidates had enough knowledge, skills and competence in the concepts tested. It also shows that they had ability to follow the required examination instructions and identify the demands of the questions.

The topic on which the candidates had average performance were Ele*ctrical Diagrams* (44.44%) tested in questions 2, 5, 6 and 7. The average performance of the candidates on these topics was due to the fact that, they either provided correct responses to only few parts of the question, failed to label diagrams, or used incorrect symbols to represent the components in the diagrams. However, there was no topic with a weak performance among all the examined topics.

The appendix summarizes the candidates' performance on each topic. The green, yellow and red colours are used to represent good, average and weak performances respectively.

4.0 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

The general performance of the candidates in Electrical Draughting on Form Four National Examinations in the year 2023 was good. Out of the 247 candidates who sat for the paper, 215 (87.04%) passed, while 32 (12.96%) failed. The good performance of the candidates was the result of their ability to understand requirements of the questions, apply technical drawing skills and worthy mastery of the subject matter.

However, few shortcomings have been revealed. These include the candidates' insufficient knowledge in responding to some of the questions, failure to understand the questions requirements, insufficient technical drawing skills, and lack of proficiency in using symbols to construct circuit diagrams as it was highly observed in the topic of *Electrical Diagrams* which was averagely performed. Likewise, candidates exhibited difficult in interpreting the information/instructions given in the question to be represented in a diagram or converting one type of diagram into another.

4.2 Recommendations

Based on the observations made in the Candidates' Item Response Analysis (CIRA), the following recommendations are put forward in order to improve the future candidates' performance in this subject.

(a) Teachers should implement interactive teaching methods such as demonstrations, hands-on activities, and group projects to engage students actively in learning electrical drawing concepts. This will facilitate their ability to translate theoretical knowledge into practical applications.

(b) Teachers should provide individualized support to future candidates who might struggle with specific aspects of electrical drawing by offering extra assistance and resources as needed.

(c) Prospective candidates should be encouraged on collaborative learning by fostering a supportive classroom environment where they can work together, share ideas, and learn from one another's experiences.

(d) The prospective candidates should take initiative in self-learning by actively seeking out additional resources and practice exercises to supplement classroom instruction and deepen understanding.

(e) The future candidates should be guided to stay updated on advancements in electrical engineering and emerging technologies related to electrical drawing, as this can enrich understanding and broaden their skills.

(f) Regarding candidates' average performance in the topic of *Electrical Diagram*, prospective candidates should be guided to engage in extensive practice in constructing various types of circuits, including understanding the functions of different components used in creating circuits such as switches, lamps, motors etc, and how they interact within the circuit.

Appendix

A Summary of Candidates' Performance per Topic in Electrical Draughting Subject in the year 2023

S/n	Topic	Question Number	Percentage of Candidates who Scored 30 Per cent and Above	Remarks
1	Introduction to Electrical Draughting, International Organization for Standardization (ISO) Sheet Layout and Sketching, Domestic Wiring System, and Electrical Diagrams.	1	95.55	Good
2	Domestic Wiring System	3	78.95	Good
3	Lighting Scheme	4 & 8	68.02	Good
4	Electrical Diagrams	2,5,6 & 7	44.44	Average