THE NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

CANDIDATES' ITEM RESPONSE ANALYSIS REPORT FOR THE CERTIFICATE OF SECONDARY EDUCATION EXAMINATION (CSEE) 2015

082-ELECTRICAL ENGINEERING SCIENCE
(For School Candidates)

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FOREWORD

The Candidates' Items Response Analysis Report for Electrical Engineering Science subject for the Certificate of Secondary Education Examination (CSEE) 2015 is presented in order to provide feedback to secondary school students and teachers, educational policy makers and other educational stakeholders on the candidates' performance in this examination.

The Certificate of Secondary Education Examination (CSEE) is done at the end of fourth year of ordinary secondary education. It is a comprehensive evaluation which among other things exposes the effectiveness of general system of education and the mode of education delivery in Tanzania ordinary secondary schools.

The analysis of questions from various topics within the syllabus provides a deeper understanding of candidate's performance at individual candidate, school and national level as the report highlights some factors that made the candidates perform either poorly, averagely or well. This report will help secondary school teachers, candidates, parents and other educational stakeholders to improve the candidates' performance by learning from the highlighted factors. Therefore, National Examinations Council of Tanzania (NECTA) call upon readers of this report to come up with constructive suggestions on how to improve examination processes and reports arising therein.

Moreover, this report provides some recommendations to secondary school students, teachers, and the Ministry of Education, Science, Technology and Vocational Training.

The council would like to thank all examiners and other stakeholders who participated in one way or another to process and analyze the data used in this report.

Dr. Charles E. Msonde
EXECUTIVE SECRETARY

1.0 INTRODUCTION

The Certificate of Secondary Education Examination (CSEE) 2015 for Electrical Engineering Science subject (082) comprised sections A, B and C. Section A consisted of **one (1)** multiple choice question with ten items drawn from various topics in accordance with the 1994 syllabus and the 2008 examination format. Section B consisted of **ten (10)** short answer questions while section C consisted of **five (5)** structured questions. Candidates were required to answer **all** questions in sections A and B, and **three (3)** questions from section C. Marks allotted for each section were 10, 30 and 60 for sections A, B and C respectively.

A total of 332 candidates sat for Electrical Engineering Science examination and 168 (50.6%) candidates passed. In 2014, a total of 299 candidates sat for Electrical Engineering Science examination and 159 (53.5%) candidates passed. Comparatively, the candidates' performance in 2015 has decreased by 2.9 percent. The analysis of the candidates' performance is categorized into three grade ranges as follows: If the percent of candidates who scored 30 percent or above of the total marks allotted in a question is between 0-29, then the question is regarded as **poorly** performed. If the percentage is between 30-44 the performance is judged **average** and if the percentage of candidates is between 45-100, then the performance is **good**. In this report, data from candidates who did not attempt some compulsory questions have been ignored. (See Appendix)

The report presents a detailed analysis of the candidates' responses by indicating the task they were required to do on each question and how they performed it. Comments on the observed candidates' performance are given for each question. These are supported and illustrated by relevant extracts taken from candidates' scripts.

Therefore, the report is intended to reveal the subject overall general performance, specific areas of weaknesses and provide some recommendations for improvement. This report should be taken as an important guide to different education stakeholders including teachers, students and parents who should take appropriate measures to improve results in future examinations.

2.0 ANALYSIS OF THE CANDIDATES' PERFOMANCE IN EACH QUESTION

This part provides a detailed analysis of candidates' performance in each question. It also explains some reasons behind the candidates' performance and the challenges encountered by candidates when responding to a particular question.

2.1 SECTION A: Objective Questions

2.1.1 Question 1: Multiple-choice items (Various Topics)

In this question candidates were required to choose the correct answer from the given alternatives. The question consisted of ten (10) multiple choice items which were set from various topics.

Out of 332 candidates who were registered, 329 (99.1%) attempted this question. Statistical data show that, 90 (27.4%) of the candidates scored from 0 to 2 marks, 156 (47.4%) scored from 3 to 4 marks and 83 (25.2%) scored from 5 to 7 marks out of 10 marks allotted. The general performance of candidates in this question was good.

Nevertheless, a significant number of candidates were not successful in answering items (iv), (v) and (ix) correctly. In item (iv) candidates were required to identify the type of focusing used by a CRO from the given alternatives. The majority chose alternative A "Electromagnetic'' instead of alternative B "Electrostatic''. The Candidates confused between the two terms as both of them are used in the principles of operation of CRO. These results indicate that most of these candidates had inadequate knowledge of CRO concepts.

In item (v) the candidates were required to choose the correct statement regarding what is the basic requirement of D.C armature winding. Most candidates chose alternative D "it must be a wave winding'' instead of alternative A "it must be a closed one''. Those who opted for alternative "D" confused the types of D.C armature windings with its basic requirements. This shows that candidates lacked practical knowledge and skills on D.C armature winding.

In item (ix) the candidates were required to choose among the alternatives, the true statement about both series and parallel D.C circuits. Most candidates failed to understand that power is additive in series D.C current as well as parallel D.C circuit. Therefore, majority of them chose alternative E “voltage and current are additive’’ instead of alternative A “power are additive’’. Alternative “E” provided a very plausible distractor because current and voltage both represent Kirchhoff’s law which is applicable in D.C circuits. The low score of candidates in this question might be attributed to non-attainment of the fundamental concepts of practical knowledge and skills on power D.C circuits. Figure 1 summarizes the candidates’ performance of this question.

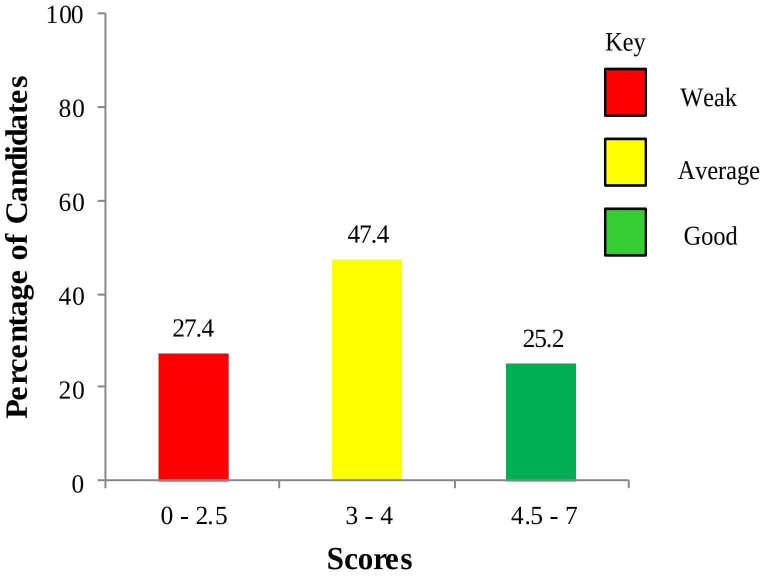


Figure 1: Performance of candidates in percentage

2.2 SECTION B: Short Answer Questions

2.2.1 Question 2: Transformer

This question was divided into two parts (a) and (b). The Candidates were required to:

(a) State the meaning of transformer; and

(b) Explain briefly the working principle of a transformer.

The question was attempted by 325 candidates whose scores were as follows: 155 (47.7%) candidates scored from 0 to 0.5 marks, 104 (31.3%) candidates scored 1 mark and the remaining 66 (21%) candidates scored from 1.5 to 3 marks out of 3 marks allotted in this question. The general performance of this question was good. Most of the candidates were able to state the meaning of a transformer and explain correctly its working principle. Extract 2.1 shows a sample of a good response.

Extract 2.1

2 a) Transformer. is an alternating machine that work under the process of electromagnetic induction and it used to transfer voltage from one circuit to another by stepping it up or down.

b) The transformer is working under the principle of electromagnetic induction in which the windings of transformer are not electrically connected to each other. Therefore when voltage is applied at primary coil it induced in secondary coil by induction.

In Extract 2.1, the candidate was able to give the meaning of a transformer and its working principle.

On the other hand, the candidates who performed poorly failed to give a correct response on the working principle of a transformer. This was due to lack of knowledge and practical skills on working principle of a transformer. Extract 2:1 shows poor response from one of the candidate.

Extract 2:2

2(a) Is the machine which control the specifics voltage to supply for every ways.

(b) i/ Is the station
→ Because every place for electricity supply is needed it is must to transformer station.

ii/ Specific machine.
→ Transformer is specific machiney because it is supply to electricity for every ways doesn't any excident.

Extract 2.2 is a sample of a poor response from a candidate who gave wrong meaning of transformer and failed to explain its working principle.

2.2.2 Question 3: Electromagnetism

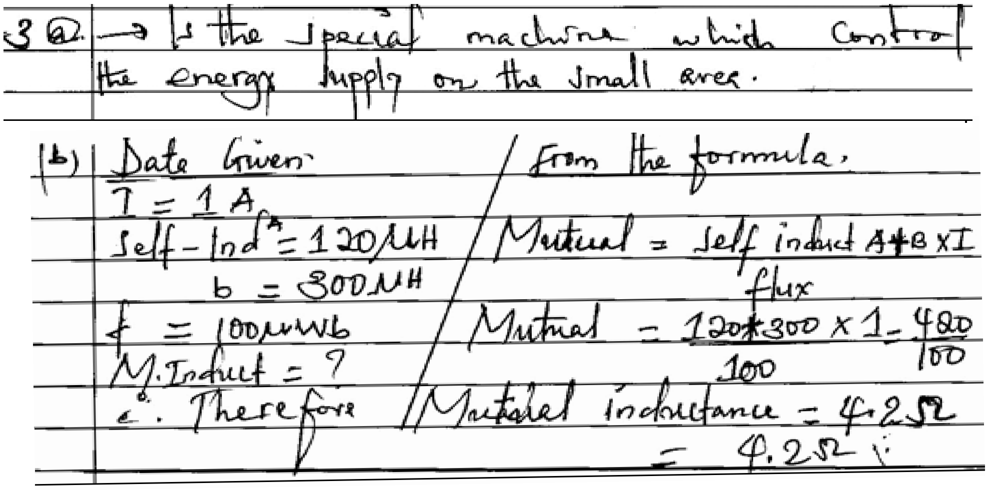
The question had two parts (a) and (b) which required the candidates to:

(a) Give the meaning of the term Mutual inductance as used in electrical technology; and

(b) Calculate mutual inductance between two coils, A and B having self-inductances of 120 μH and 300 μH respectively; if the current of 1A flows through coil produces flux linkage of 100 μWb turns in coil B.

The question was attempted by 283 candidates who scored as follows: 203 (71.7%) candidates scored from 0 to 0.5 marks, 75 (26.5%) scored 1 mark and 5 (1.8%) scored from 1.5 to 3 marks out of 3 marks allotted to this question. The general performance of this question was poor because majority of the candidates were not able to recall and apply the correct formula of calculating the mutual inductance of two given coils. The analysis indicated that, the candidate had poor knowledge of the concept of electromagnetism as seen in Extract 3.1 which shows a sample of a poor response.

Extract 3.1


3 (a) → Is the special machine which control the energy supply on the small area.

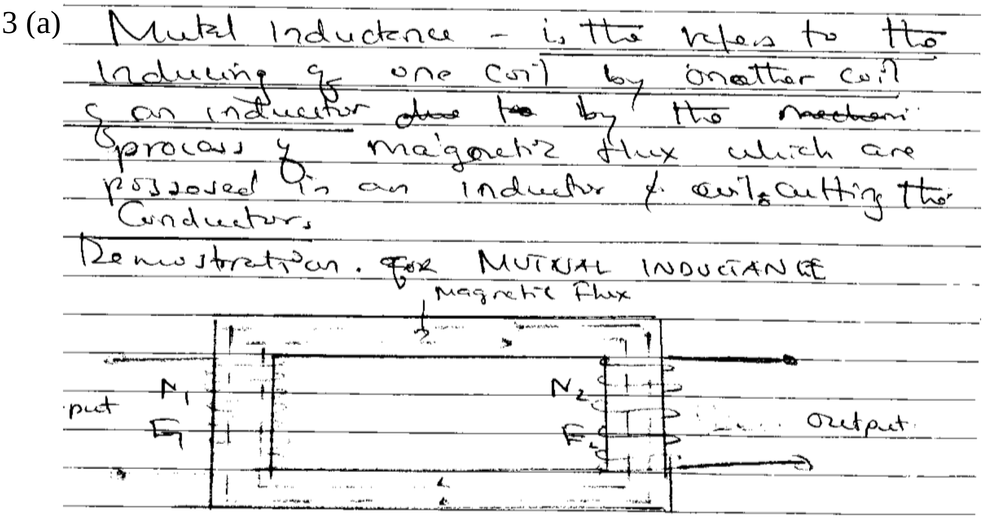
(b) Date Given
I = 1 A
Self-Ind A = 120 µH
b = 300 µH
f = 100 µWb
M.Induct = ?
∴ Therefore

From the formula.
Mutual = Self induct A + B x I / flux
Mutual = 120 + 300 x 1 / 100 = 420/100
Mutatal inductance = 4.2 Ω
= 4.2 Ω

Extract 3.1 illustrates responses from a candidate who failed to provide the correct meaning of mutual inductance and to perform its calculations.

Despite the overall poor candidates' performance in this question; there were few candidates (1.8%) who managed to give the correct answers as illustrated in Extract 3.2

Extract 3.2


3 (a) Mutal Inductance – is the refers to the inducing of one coil by another coil of an inductor by the process of magnetiz flux which are possesed in an inductor of coil cutting the conductors

Demonstration. For MUTUAL INDUCTANCE

3 (b) Data given

Self induction of coil A = 120 μH

Self induction of coil B = 300 μH

the current passing (I) = 1 A.

flux linkage in coil A ( ) = 100 μWb.

Required to calculate.

Mutual inductance btn two coils = ?

1 Recall from

x^t let mutual inductance be (M).

then M = $\frac{-\Delta\Phi}{\Delta I}$ ——— (i).

∴ the mutual = $\frac{100\mu Wb}{1A}$

= 100 μWb

∴ The mutual inducance between the two coils is 100 μWb/A.

Extract 3.2 is a sample of a good response from one of the candidate who managed to define and calculate mutual inductance.

2.2.3 Question 4: Conductor and Cables

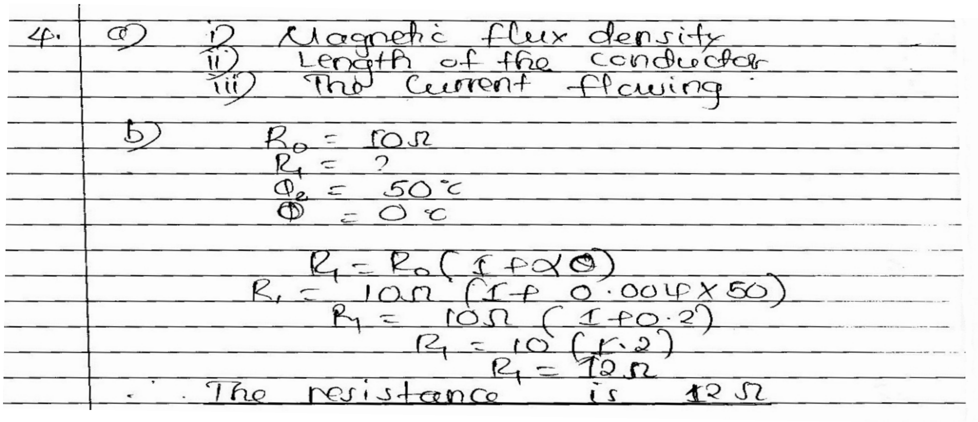
In this question the candidates were required to:

(a) State three factors which influences the force on current carrying conductor; and

(b) Determine the resistance of copper at 50°C if its resistance at 0°C is 10 Ω.

A total of 321 candidates attempted this question and their scores were as follows: 126 (13.7%) candidates scored from 0 and 0.5 marks, 21 (6.5%) scored 1 mark and 174 (54.2%) candidates scored from 1.5 to 3 marks out of 3 marks allotted to this question. The candidates' performance in this question was generally good. Extract 4.1 shows a sample of a good response.

Extract 4.1



4. a) i) Magnetic flux density
ii) Length of the conductor
iii) The current flowing

b) $R_o = 10\Omega$
$R_1 = ?$
$\theta_2 = 50°C$
$\theta = 0°C$

$R_1 = R_o(1 + \alpha\theta)$
$R_1 = 10\Omega\,(1 + 0.004 \times 50)$
$R_1 = 10\Omega\,(1 + 0.2)$
$R_1 = 10\,(1.2)$
$R_1 = 12\Omega$
∴ The resistance is 12Ω

Extract 4.1 shows a sample of response from a candidate who was able to state the factors which influence the force on current carrying conductor and managed to calculate the resistance at a given temperature.

The major weakness which has been noticed from candidates who failed this question was that; most of them were not conversant with the concepts related to *current carrying conductor* as used in Conductor and Cables. Consequently, they failed to recall the three factors which influence the force on current carrying conductor. They also failed to apply the correct formula of calculating resistance of material when a temperature rise factor is involved. Extract 4.2 illustrates this case.

Extract 4.2

4 a The factors which influences the force of Current Carying Conductor is Filter Circuit, power Circuit Converter and Coupling Circuit.

b Data given

Resistance of Copper 10 Ω

Temperature 0°C

what will resistance at 50°C ?

Solution

R = V/I

R = 10 Ω / 50°C 5

R = 5 Ω °C

The SI unit of Resistance is Ω

Now the resistance which will be its ~~of~~ of the 50°C is 5 Ω

In Extract 4.2, the candidate could not state factors which influence the force on current carrying conductor and applied a wrong formula to calculate the resistance of material at a given temperature rise.

2.2.4 Question 5: Measuring Instruments

The candidates were required to calculate the value of a shunt resistor to be connected in parallel with a meter to enable it to be used as an ammeter for measuring current up to 50 A; provided that a moving coil instrument gives a full scale deflection when the current is 40 mA and its resistance is 25 Ω.

The question was attempted by 309 candidates of whom, 95 (30.7%) scored from 0 to 0.5 marks, 45 (14.6%) scored 1 mark and 169 (54.7%) scored from 1.5 to 3 marks of which 34.6 percent of the candidates scored all the 3 marks allotted in this question. The general performance of this question was good. Most of them were able to calculate the value of a shunt resistor to be connected in parallel with a meter. Good performance in this question suggests that the candidates had adequate knowledge and skills on measuring instruments, particularly on the extension of meter ranges. Extract 5.1 illustrates a candidate's good response.

Extract 5.1

5 Data

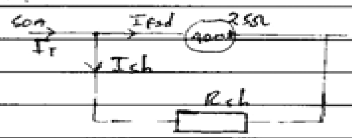
Current of instrument (I_{fsd}) = 40×10^{-3}A.

Resistance of instrument (R_{fsd}) = 25Ω.

Resistance shunt (R_{sh}) = ?

Current total (I_T) = 50A.

from:-



$V_{sh} = V_{fsd}$

$V_{fsd} = I_{fsd} \times R_{fsd}$

$= 40 \times 10^{-3} \times 25$

$V_{fsd} =$ ~~0.25V~~ 1V.

$I_T = I_{fsd} + I_{sh}$

$I_{sh} = I_T - I_{fsd}$

$I_{sh} = 50 - 0.04$

$I_{sh} = 49.96$A.

$V_{sh} = I_{sh} \times R_{sh}$ but $V_{sh} = V_{fsd}$

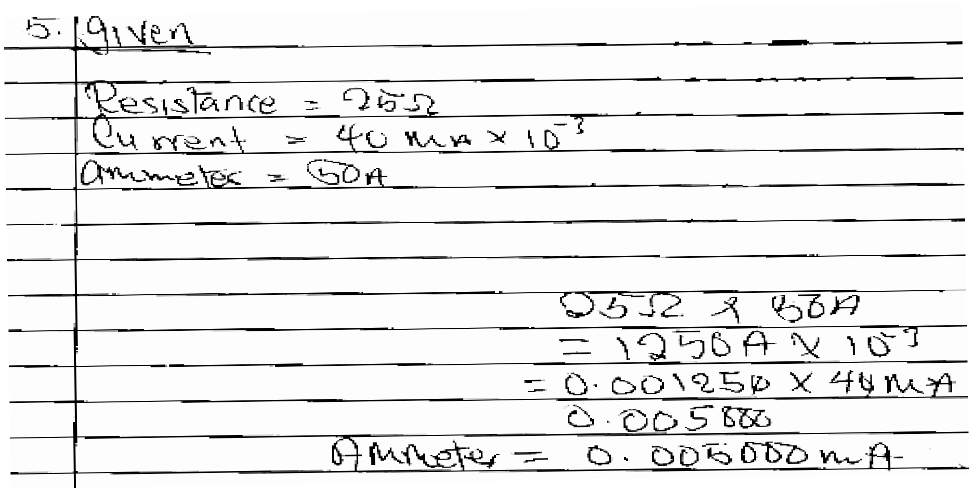
$R_{sh} = \frac{V_{sh}}{I_{sh}} = \frac{1\text{V}}{49.96}$

$R_{sh} = 0.02\Omega$

Extract 5.1 is a sample of a good response taken from a candidate's script. The candidate was able to calculate the value of a shunt resistor

On the other hand, candidates with low scores failed to recall the correct formula for calculating the value of a shunt resistor to be connected in parallel with a meter which is given by: $Rsh = \frac{Vsh}{Ish}$. Extract 5.2 shows a sample of poor response from a candidate.

Extract 5.2


5. Given
Resistance = 25Ω
Current = 40 mA × 10^-3
Ammeter = 50A
25Ω × 50A
= 1250A × 10^-3
= 0.00125A × 44 mA
0.005000
Ammeter = 0.005000 mA

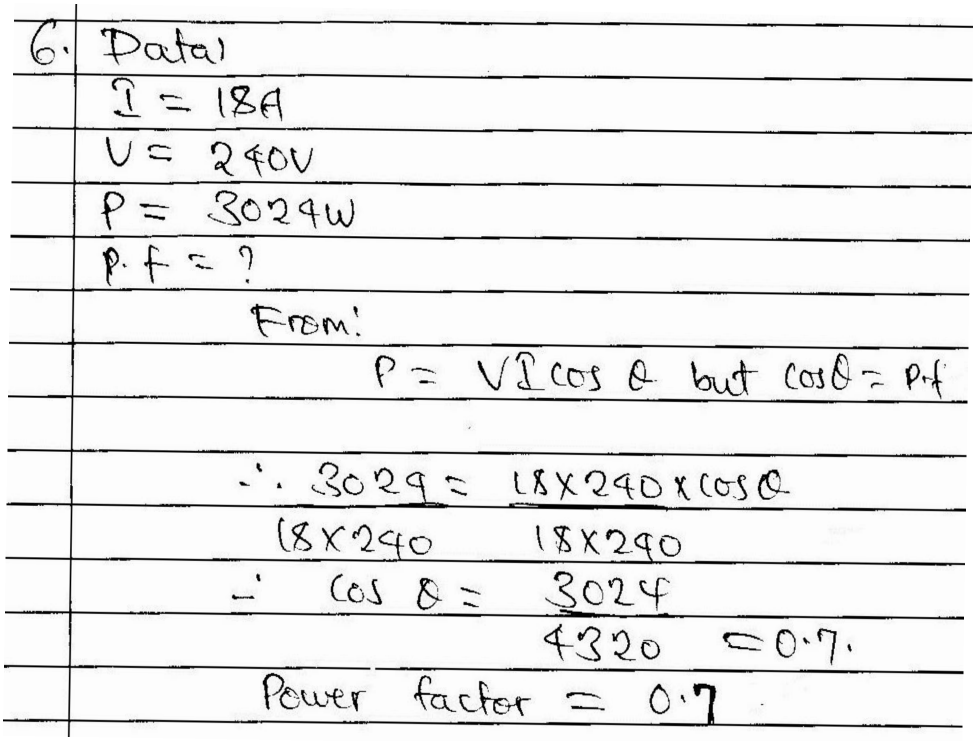
Extract 5.2 is a sample of a poor response of one of the candidates who used a wrong formula to calculate the value of a shunt resistor by multiplying a total current and meter resistance.

2.2.5 Question 6: A.C Circuits

The candidates were required to determine the power factor of an electric motor which draws a current of 18 A from a 240 volts source when a wattmeter is connected to the circuit indicates 3024 W.

A total of 320 candidates attempted this question and their scores were as follows: 133 (41.6%) candidates scored 0 to 0.5 marks, 26 (8.1%) scored 1 mark and 161 (50.3%) scored 1.5 to 3 marks out of 3 marks allotted. The candidate's performance in this question was generally good. Many candidates were able to recall and apply the correct formula for determining the power factor of an electric motor. Extract 6.1 shows a sample of a good response.

Extract 6.1



6. Data)

I = 18A

V = 240V

P = 3024W

p.f = ?

From:

$P = VI\cos\theta$ but $\cos\theta = p.f$

$\therefore \frac{3029}{18 \times 240} = \frac{18 \times 240 \times \cos\theta}{18 \times 240}$

$\therefore \cos\theta = \frac{3024}{4320} = 0.7.$

Power factor = 0.7

In Extract 6.1, a candidate managed to calculate the power factor of a circuit.

On the other hand, some candidates exhibited weakness in the technical aspect of computing power factor. They failed to apply the correct formula in calculating the power factor of an A.C motor. Extract 6.2 shows an example of a response from a candidate who confused the formula by dividing the voltage (240 V) by current (18 A) instead of multiplying them to obtain the apparent power which could be used to compute the power factor.

Extract 6.2

6. An electric motor draws 18A of current from a 240V Source. A wattmeter Connected to the Circuit indicates 3024W. What is the power factor of the circuit.

Solution

Data given.

A = 18

V = 240

W = 3024

where.

A = Ampere

V = Voltage

W = Power.

calculation

W = 3024 x 1000 = 3024000

= 240 ÷ 18

= 13.3

13.3

3024000

= 4.41.

∴ The power factor of the Circuit is 4.41

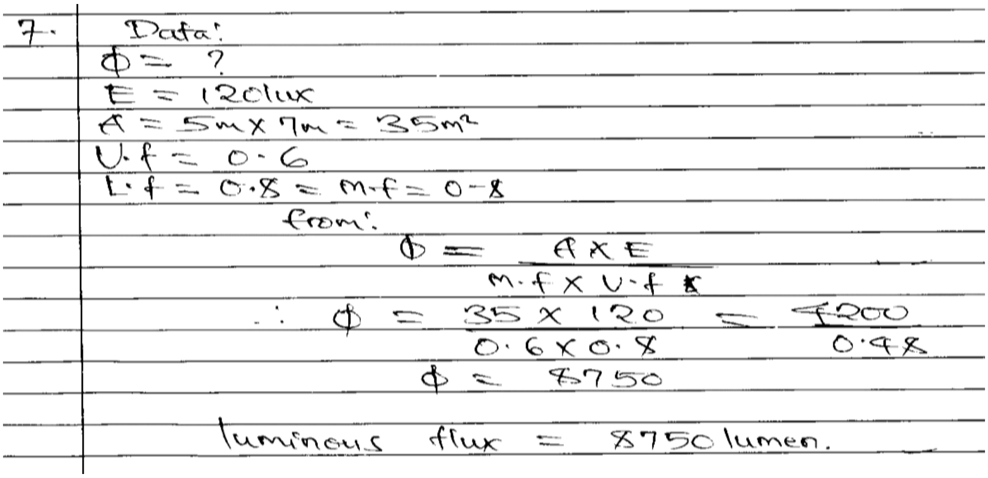
Extract 6.2 is a sample of a poor response extracted from a candidate's script. The candidate failed to apply the correct formula in calculating the power factor of the circuit.

2.2.6 Question 7: Illumination

The candidates were required to estimate the total luminous flux required to provide a service value of 120 lux in a room of 5 m by 7 m when utilization factor and light loss factors are 0.6 and 0.8 respectively.

This question was attempted by 296 candidates who scored as follows: 71 (24.0%) scored from 0 to 0.5 marks, 39 (13.2%) scored 1 mark and 186 (62.8%) scored from 1.5 to 3 marks out of 3 marks allotted. The candidate' performance in this question was generally good. Most of the candidates were able to apply the correct formulas on estimating the total illumination required as shown in Extract 7.1.

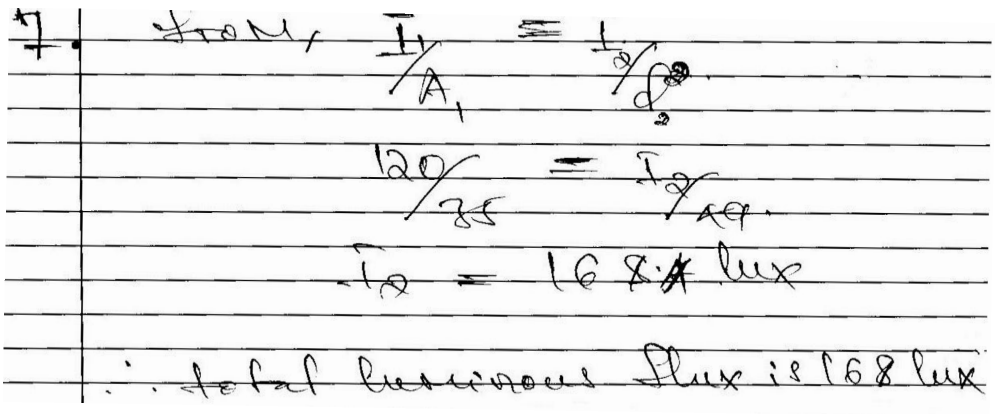
Extract 7.1


7. Data:
$\Phi = ?$
$E = 120lux$
$A = 5m \times 7m = 35m^2$
$U \cdot f = 0 \cdot 6$
$L \cdot f = 0 \cdot 8 = m \cdot f = 0 \cdot 8$
from:
$\Phi = \frac{A \times E}{m \cdot f \times U \cdot f}$
$\therefore \Phi = \frac{35 \times 120}{0 \cdot 6 \times 0 \cdot 8} = \frac{4200}{0 \cdot 48}$
$\Phi = 8750$
luminous flux = 8750 lumen.

Extract 7.1 is a sample of response from one of the candidates who managed to calculate the total luminous flux as per question demand.

Few candidates demonstrated incompetence in the applications of formulae and procedures used for calculations of total luminous flux in a given room. These candidates had insufficient knowledge on illumination and particularly on the terms and their relationship that could help them to meet the question's demand. Extract 7.2 illustrates this case.

Extract 7.2


7. From, $I_1/A_1 = I_2/A_2$
$120/35 = I_2/49$
$I_2 = 168 \cdot 4$ lux
$\therefore$ total luminous flux is 168 lux

Extract 7.2 shows a poor response from a candidate who failed to compute the total luminous flux.

2.2.7 Question 8: Battery and Cells

The question had two parts (a) and (b) which required the candidates to:

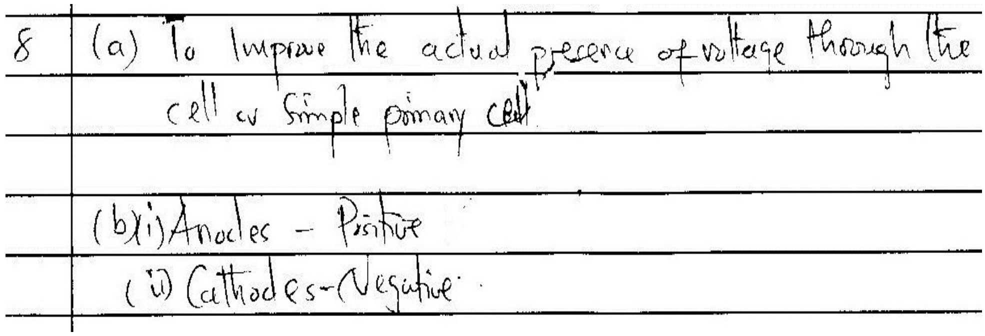
(a) State why modification of a simple primary cell is done; and

(b) List two materials used as positive and negative electrodes of a Leclanch’e cell (battery) and name the instrument used to measure specific gravity of the battery.

Statistics show that, out of 257 candidates who attempted this question, 163 (63.4%) scored 0 to 0.5 marks, 44 (17.1%) scored 1 mark and 50 (19.5%) scored from 1.5 to 3 marks out of 3 marks. Only 3.1 percent scored all 3 allotted marks.

This question was averagely performed. Some candidates were not able to provide correct answers to both parts (a) and (b). They could not explain why modification of a simple cell is done, and they failed to list down the materials used as positive and negative electrodes of Le’clanche cell. Nevertheless, they failed to name the instrument used to measure specific gravity of a battery. Probably, the candidates were not adequately prepared in this topic. Extract 8.1 shows a poor response from one of the candidate’s script.

Extract 8.1


8 (a) To Improve the actual presence of voltage through the cell or Simple primary cell

(b)(i) Anodes – Positive

(ii) Cathodes – Negative

In Extract 8.1, the candidate failed to provide the correct answer to this question.

Few candidates who performed well adhered to the demands of the question. They presented correct answers, showing that they had enough knowledge on battery and cells. Extract 8.2 shows the response from a candidate who performed well in this question.

Extract 8.2

8\. (a) Modification of a simple primary cell is done inorder to reduce the effects of Local action and polarization which mainly occur in a simple primary cell.

(b) i/ Positive electrode - Carbon

ii/ Negative electrode - Zinc.

- The instrument used to measure specific gravity is Hydrometer.

Extract 8.2 is a sample of a good response from a candidate who adhered to the question demands.

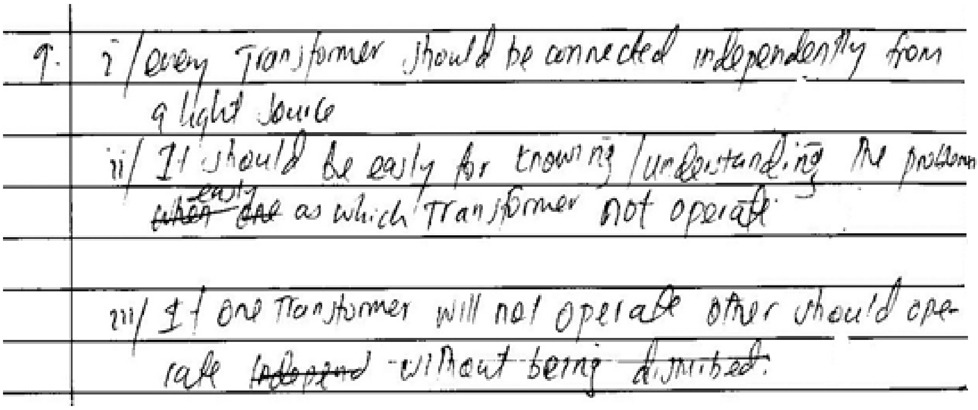
2.2.8 Question 9: Transformer

This question required the candidates to mention three conditions to be fulfilled when connecting the transformers in parallel.

Out of 221 candidates who attempted this question 180 (81.4%) candidates scored from 0 to 0.5 marks, 15 (6.8%) candidates scored 1 mark and the remaining 26 (11.8%) candidates scored from 1.5 to 3 marks out of 3 marks. Further analysis show that, a total of 111 (33.4%) of the registered candidates did not attempt this question.

Generally, the performance of this question was poor as most of the candidates scored below average. The candidates failed to recall that in order to connect transformers in parallel, frequency, percentage impedance, phase sequence and voltage supplies must be the same. This poor performance suggests that, most of the candidates lack basic skills on parallel connection of transformer. Extract 9.1 illustrates this case.

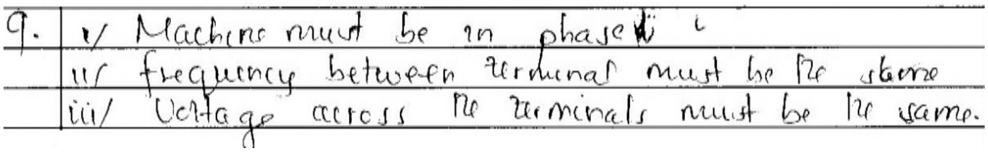
Extract 9.1


9. i/ every Transformer should be connected independently from a light source
ii/ It should be easly for knowing/understanding the problem ~~when the~~ easly as which Transformer not operate
iii/ If one Transformer will not operate other should operate ~~independ~~ ~~without being disturbed.~~

Extract 9.1 shows a poor response from a candidate who failed to give the conditions for parallel connection of transformer.

However, there were few candidates who managed to answer the question well as seen in extract 9.2.

Extract 9.2


9. i/ Machine must be in phase
ii/ frequency between terminal must be the same
iii/ Voltage across the terminals must be the same.

In Extract 9.2, a candidate was able to provide conditions to be fulfilled in order to connect transformer in parallel.

2.2.9 Question 10: A.C Motors

In this question, candidates were asked to:

(a) List two losses that occur in induction motors; and

(b) Calculate the power dissipated in the rotor of a 3-phase induction motor running at slip of 0.05 per unit, with an input power to its rotor of 10 kW.

Out of 316 candidates who attempted this question 52 (16.5%) candidates scored from 0 to 0.5 marks, 150 (47.4%) scored 1 mark and the remaining 114 (36.1%) scored from 1.5 to 3 marks out of 3 marks allotted.

The general performance of this question was good. Most candidates answered part (a) correctly. They managed to list losses that occur in an induction motor and applied the correct formula of power dissipated in the rotor. Candidates who scored low marks were poor in technical aspect of computing power dissipated in the motor .This shows that the candidates lacked knowledge on the area of motor losses. Extract 10.1 shows a sample of poor response from one of the candidates who just multiplied the number of phases, slip per unit and rotor input power in order to obtain the power dissipated.

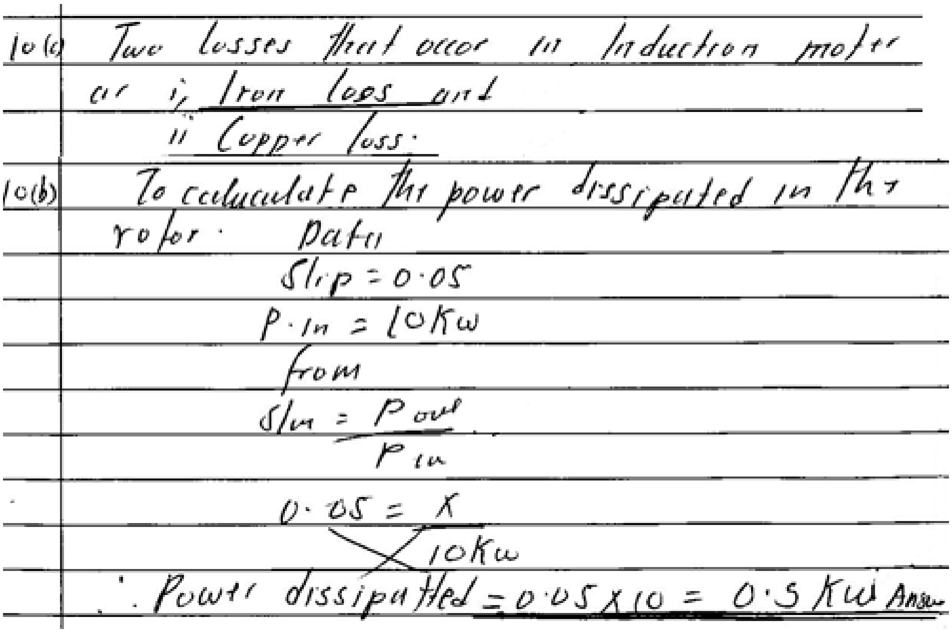
Extract 10.1

10	b) Data given
	ph = 3
	Δ = 0.05
	P = 10 kW
	P = 10 x 0.05 x 3
	p = 1.5
	P = 1.5 x 40 power is 1.5

Extract 10.1 shows a poor response from a candidate who failed to compute the power dissipated in the rotor.

On the other hand, majority of the candidates were able to provide correct responses about losses found in induction motors and to calculate the power dissipated in the motor using slip per unit and rotor input power. Extract 10.2 illustrates a good response from one of the candidate.

Extract 10.2



10 (a) Two losses that occur in Induction motor are i, Iron loss and ii Copper loss.

10(b) To calculate the power dissipated in the rotor. Data

Slip = 0·05

P·in = 10Kw

from

Slip = P out / P in

0·05 = X / 10Kw

∴ Power dissipated = 0·05 x 10 = 0·5 Kw Answ

Extract 10.2 shows good responses from one of the candidates who correctly applied the concept of slip per unit and rotor input power to calculate the power dissipated in the rotor.

2.2.10 Question 11: Capacitors and Capacitance

The question consisted of two parts, (a) and (b) which required the candidates to:

(a) Define the term “breakdown voltage of a material’’; and

(b) Calculate energy dissipated if a cloud is at the potential of 8 x 10^6 V relative to ground and a charge of 40 C is transferred in lighting stroke between the cloud and the ground.

Out of 268 candidates who attempted this question, 188 (70.1%) scored from 0 to 0.5 marks, 30 (11.2%) scored 1 mark and 50 (18.7%) scored from 1.5 to 3 marks out of 3 marks allotted in this question. Statistical data show that, 64 (19.3%) of the registered candidates did not attempt this question.

The general performance of this question was poor because majority of the candidates failed to define the term ‘breakdown voltage of a material’. They also failed to correlate the information given in the question to calculate the energy dissipated. This is an indication that, most of the candidates had inadequate knowledge and skills on capacitors and capacitance. Extract 11.1 is a sample of a candidate's poor response.

Extract 11.1

11. break down voltage of a matrigL materia is the voltage which are being b Reduced to a a voltage in a circuit.

b) Data given

Pd = 8 x 10^6

Q = 40 c

= 20MW The Energy dissipated

In Extract 11.1, the candidate failed to define "breakdown voltage of a material" and failed to calculate the energy dissipated.

However, few candidates managed to define the term "breakdown voltage of a material'' and applied the correct formula to calculate energy dissipated. Extract 11.2 is an example of a good response provided by one of the candidates.

Extract 11.2

11 (a) Breakdow Voltage of a material is the maximum voltage that Can be Connected to a certain device.

(b) DATA GIVEN

$V = 8 \times 10^6 V$

$Q = 40C$

$E = ?$

from formula $E = QV$

$E = 40 \times (8 \times 10^6)$.

$E = 320MJ$.

∴ The Energy dispatted is 320MJ.

In Extract 11.2, the candidate was able to give correct definition of breakdown voltage and used the correct formula to calculate the energy dissipated.

2.3 SECTION C: Structured Questions

2.3.1 Question 12: D.C Machines

This question comprised parts (a) and (b). In part (a), candidates were required to describe four conditions under which a self-excited D.C generator can fail to build up voltage. In part (b), they were required to calculate the generated voltage and the armature current for a long shunt compound generator which delivers a load current of 60A at 45 V and has armature series field and shunt field resistances of 0.06 Ω and 240 Ω respectively; given that, 0.5 V per brush is allowable for contact drop.

Out of 212 candidates attempted this question and their scores were as follows: 66 percent performed poorly as they scored from 0 to 5.5 marks, other 26.5 percent performed averagely by scoring from 6 to 9 marks and the remaining 7.5 percent scored from 10 to 13 marks out of 20 marks allotted in this question. The analysis revealed that, generally the candidate's performance in this question was average because 34 percent of the candidates scored 6 marks and above.

Most of the candidates who performed poorly failed to describe the four conditions under which a self-excited D.C motor can fail to build up voltage. They also failed to calculate the generated voltage and the armature current of a long shunt compound generator. This indicates that, most candidates had little knowledge about D.C generator. Extract 12.1 is an example of a poor response extracted from one of the candidate's script.

Extract 12.1

12. (i) Self - excited d.c generator can fail through looses e.g mechanical looses, copper looses etc.

(ii) D.c generator can also fail through friction.

(iii) D.c generator can fail to produce voltage because of the hystalisis loss and eddy current loss.

(iv) D.c generator fail to produce the voltage because of the ~~load~~, load, shunt, and Armature when they Operate under ~~opt~~ development.

(b) Data given

I = 60 A

V = 450 V

R_a = 0.06 Ω

R_s = 0.04 Ω

R_L = 240 Ω

(a) Calculate generated voltage ~~and~~ armature ~~curr~~

V = $E_b - I_a R_a$

V = 450 ~~$- I_a R_a$~~

~~V =~~ $I_a = V/R_a = \frac{450}{0.06}$

I_a = ~~1250~~ 7500

V = $E_b - I_a R_a$

V = 450 + 7500

V = 7950

∴ The generated e.m.f = 7940 V

(b) Armature current

~~V_a~~ = Eb − $I_a R_a$

~~I_a~~ =

~~V = IR = 60 × 240 = 1440V.~~

I_a = ~~Eb~~ $V/R_a = \frac{450}{0.06}$

I_a = 7500A

Extract 12.1 is a sample of a poor response from one of the candidates who failed to describe four conditions under which a self-excited D.C generator can fail to build up voltage. The candidate also failed to calculate the generated voltage and the armature current of a long shunt compound generator.

The candidates who performed averagely were able to describe either two or three of the four conditions under which a self-excited D.C generator can fail to build up voltage as required in part (a) but failed to perform calculations required in part (b). There were also a few candidates who performed well in this question as they managed to provide correct answers by applying appropriate formulae in calculating the generated voltage and armature current of a long shunt compound generator. Extract 12.2 is attached as a sample of good responses.

Extract 12.2

12.(b) Emf generated (E_g) = (

$E_g = V_L + I_a R_a + I_a R_{se}$ + V. drop brush

$V_L = 450V$

Voltage drop in armature $= I_a R_a$

$= 61.875 \times 0.06$

$= 3.7125V$

Voltage drop in series resistance $= I_a R_{se}$

$= 61.875 \times 0.04$

$= 2.475A$

Voltage drop in both brushes = 0.5V + 0.5V

= 1.0V

$E_g = 450 + 3.7125 + 2.475 + 1.0V$

$E_g = 457.1875V$

∴ The voltage generated = 457.1875V

Extract 12.2 is a sample of a good response from the candidate who provided the correct calculation of the generated voltage of a long shunt compound generator.

2.3.2 Question 13: Electric Heating

This question weighed 20 marks and it consisted of three parts (a), (b) and (c). The candidates were required to:

(a) Give six properties of a good heating element.

(b) Determine the power required in this heating process given that, a ply-wood board of 0.5 x 0.25 x 0.02 meter is to be heated from $25°C$ to $125°C$ in 10 minutes by dielectric heating employing a frequency of 30 MHz. Assume specific heat of wood is 1500J/kg/ $°C$, weight of wood 600 kg/m^3 and efficiency of process is 50%.

(c) Find how much did the temperature of water rise during a 30 minutes running period? Given that, the output of diesel engine was found to be 4.9 kW and a dynamometer used to check the output contained 30 kg of water. Neglect losses.

Out of 203 candidates who opted for this question 35 percent scored from 0 to 5.5 marks, 20 percent scored from 6 to 9 marks and the remaining 45 percent scored from 10 to 19 marks. The general performance for this question was good because 65 percent of the candidates scored above average. Most of the candidates were able to provide correct responses as requested in various parts of the question.

The candidates who performed well in this question managed to give the correct properties of a good heating element, determine the power required in the heating process of a ply-wood and calculating correctly the temperature of water rise. This indicates that, the candidates acquired sufficient knowledge and skills on the concept of electric heating. Extract 13.1 illustrates this case.

Extract 13.1

13 a
i. very High melting and boiling point
ii. Good conductor of heat and electricity
iii. High internal resistance
iv. Must be ductile
v. Should have high strength.
vi. Must be flexible

b. Data:

$V = 0.5 \times 0.25 \times 0.02 = 2.5 \times 10^{-3} m^3$

$\theta_1 = 25°C$

$\theta_2 = 1275°C$

$t = 10 min$

$f = 30MHZ$

$c = 1500 J/Kg/°C$

$\rho = 600 Kg/m^3$

$\eta = 50\%$

$P = ?$

From

$\rho = \frac{m}{V}$

$m = \rho V$

$= 600 \times 2.5 \times 10^{-3}$

$m = 1.5 Kg.$

$Q = mc\Delta\theta$

$= 1.5 \times 1500 \times (1275 - 25)$

$Q = 225,000 J$

$P = \frac{Q}{t} = \frac{Energy}{time}$

13 b

$P = \frac{Q}{t}$

$= \frac{225,000}{600}$

$P_{out} = 375 W$

$Efficiency, \eta = \frac{P_{out}}{P_{in}}$

$P_{in} = \frac{P_{out}}{\eta}$

$= \frac{375}{0.5}$

$P_{in} = 750W$

The power required is, $P_{in} = 750W$

c. Data.

$P = 4900W$

$m = 30 kg$

$t = 30 min \times 60 sec$

$\Delta\theta = ?$

From

$Power = \frac{Energy}{time}$

$Energy, Q = Power \times time$

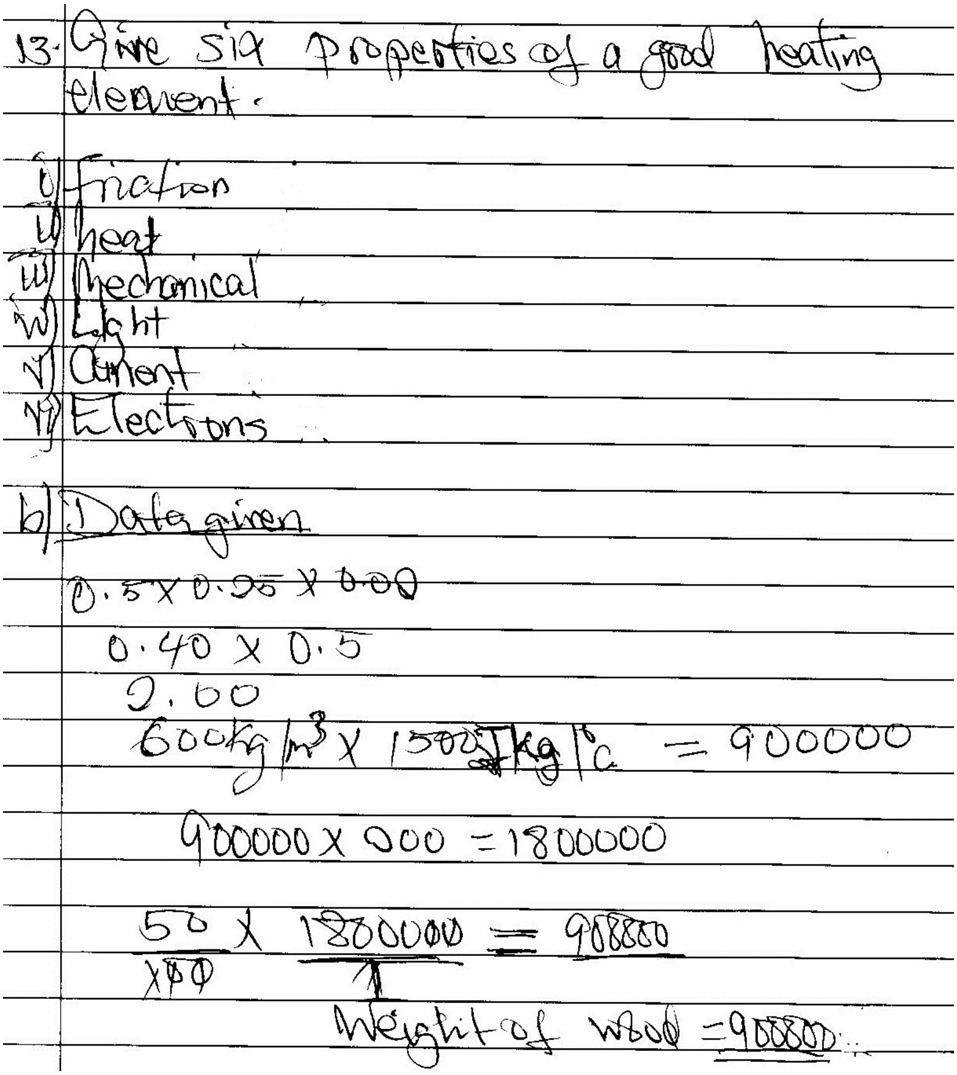
$= 4900 \times 1800$

$Q. = 8,820,000 J.$

Extract 13.1 shows a sample of a good response from a candidate who was able to give correct properties of a good heating element, determine the power required in the heating process of a ply-wood and determine the temperature rise of water.

On the other hand, candidates with low scores (35%) had inadequate skills and knowledge particularly on the aspect of properties of heating element and determination of power and temperature required in the heating process. They failed to recall that they were supposed to find first the volume of the wood to be heated and the weight of the wood and then use the formula MC∆t to determine energy. Extract 13.2 is a sample of a poor response from one of the candidates.

Extract 13.2



13. Give six properties of a good heating element.

i) Friction
ii) heat
iii) Mechanical
iv) Light
v) Current
vi) Electrons

b) Data given

~~0.5 X 0.05 X 0.00~~

0.40 X 0.5

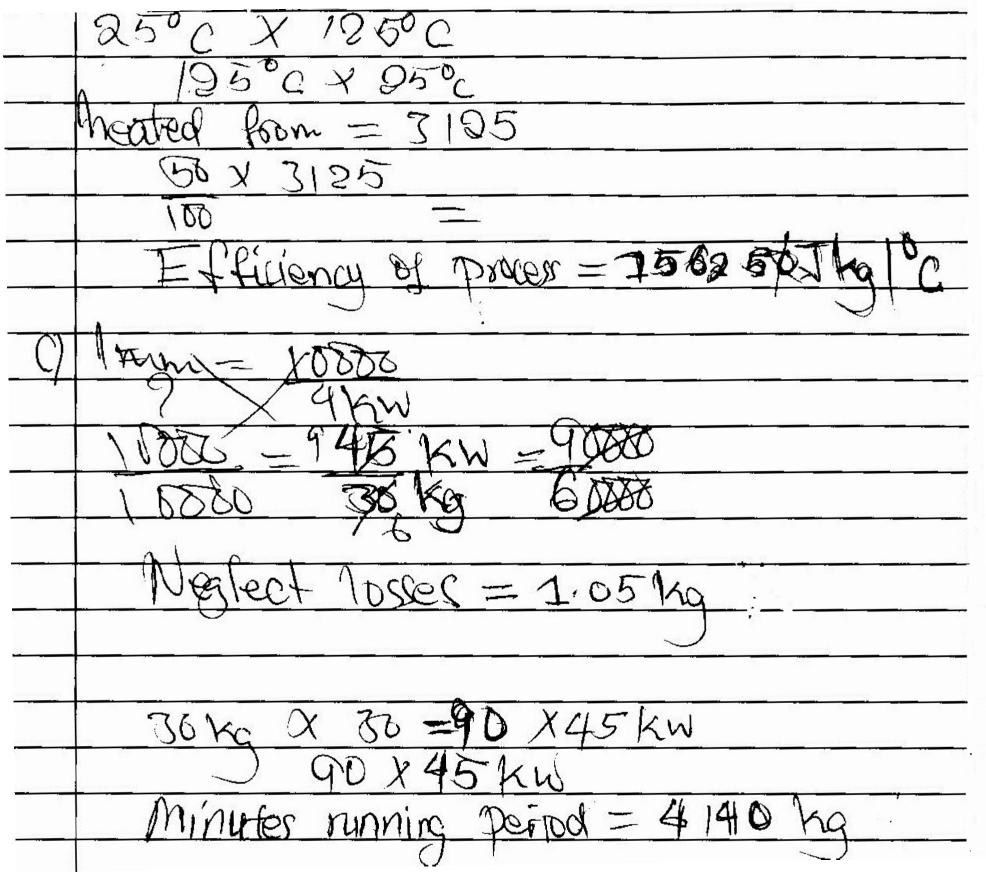
2.00

600kg/m³ X 1500J/kg/°C = 900000

900000 X 200 = 1800000

50/100 X 1800000 = 908880

Weight of wood = 908800



25°C X 125°C
195°C X 95°C
heated from = 3195
50 X 3125
100 =
Efficiency of process = 1562 5kJ kg/°C
C) 1 ... = 10800
? 4kW
10800 = 9 4.5 kW = 90000
10800 30 kg 60000
Neglect losses = 1.05 kg
36 kg α 30 = 90 X45 kW
90 X 45 kW
Minutes running period = 4140 kg

In Extract 13.2, a candidate failed to give properties of good heating element. The candidate used wrong formula in calculating the power required in the heating process of a ply-wood and the temperature rise of water.

2.3.3 Question 14: Illumination

The question consisted of three parts (a), (b) and (c) and it weighed 20 marks. The candidates were required to:

(a) Define the following terms as used in illumination:

- (i) Coefficient of utilization
- (ii) Maintenance factor
- (iii) Coefficient of reflection and
- (iv) Depreciation factor.

(b) Calculate total lumen, total power and number of lamps of a room, if power rate of one lamp is 30 W. Given that a room of 25 m long by 6 m wide had to be lighted to a level of 20 lux, while the average lumen of a lamp is 25lm/W.

(c) Suggest the number of lamps and their rating required to provide an illumination on 100 lux in a factory hall of 30 m by 15 m. Assuming that; the depreciation factor is 0.8, coefficient of utilization is 0.4 and efficiency is 141 lm/W. Given the size of lamps available is 100 W, 250 W, 400 W and 500 W.

This question was attempted by 203 candidates and their scores were as follows: 36.9 percent scored from 0 to 5.5 marks, 27.1 percent scored from 6 to 9 marks and 36 percent scored from 9.5 to 20 marks. The general performance of this question was good because 63.1 percent of the candidates passed by scoring from 6 to 20 marks. This indicates that, most candidates had acquired sufficient knowledge on the topic of Illumination.

Most of the candidates who performed well in this question were able to define the given terms and calculate the total lumen, total power as well as number of lamps for a room. Also, they were able to suggest the number of lamps and their rates for a factory hall. This is illustrated in Extract 14.1.

Extract 14.1

14. (b) (ii) Total Power.

From:- $P = \Phi / \eta$.

$$P = \frac{7500}{25} = 300\,W$$

∴ Total Power = 300W.

(iii) Number of lamps.

If :- 1 lamp = 30W

? x = 300W

$$x = \frac{300W \times 1\,lamp}{30W} = 10\,lamps$$

∴ Number of lamps = 10 lamps.

(c) Given:- E = 100 lux, sizes available:-

A = 30m × 15m · - 100W.

DF = 0.8 - 250W

CU = 0.4 - 400W and

η = 141 lm/W - 500W

N = ?

From:- $\Phi = \frac{E \times A}{D.F \times C.U} = \frac{100 \times 30 \times 15}{0.8 \times 0.4}$

$$\Phi = \frac{45000}{0.32} = 140625\,lm.$$

From:- $P = \Phi / \eta$

$$P = \frac{140625}{141} = 997.34\,W$$

Hence, Total power = 997.34W.

$\Phi = \frac{20 \times 25 \times 6}{0.8 \times 0.5} = \frac{3000}{0.4} = 7500\,lm$

∴ Total lumens is 7,500 lm.

14.(c) Now, number of lamps for the sizes is as follows:-

For 100W :-

From:- 1 lamp = 100W

?x = 997.34W

$x = \frac{997.34}{100} = 9.97 \approx 10$ lamps.

∴ 10 Lamps of 100W are needed.

For 250W :-

From:- 1 lamp = 250W

x? = 997.34W

$x = \frac{997.34}{250} = 3.98 \approx 4$ lamps

∴ 4 lamps of 250W are needed.

For 400W :-

From:- 1 lamp = ~~25~~ 400W

?x = 997.34W

$x = \frac{997.34}{400} = 2.49 \approx 3$ lamps

∴ 3 lamps of 400W are needed.

For 500W :-

From:- 1 lamp = 500W

?x = 997.34W

$x = \frac{997.34}{500} = 1.99 \approx 2$ lamps

∴ 2 lamps of 500W are needed.

Extract 14.1 shows a sample of a candidate's good response. The candidate managed to define the given illumination terms, calculate total lumen, total power and number of lamps for a room and suggest the number of lamps and their ratings in a factory hall.

The percentage of the candidates who performed poorly in this question is 36.9. They failed to calculate total lumen, total power and number of lamps for a room and suggest the number of lamps and their ratings in a factory hall. Other candidates knew the formula but failed to identify parameters which comply with the formula. Extract 14.2 shows a sample of a poor response from one of the candidate.

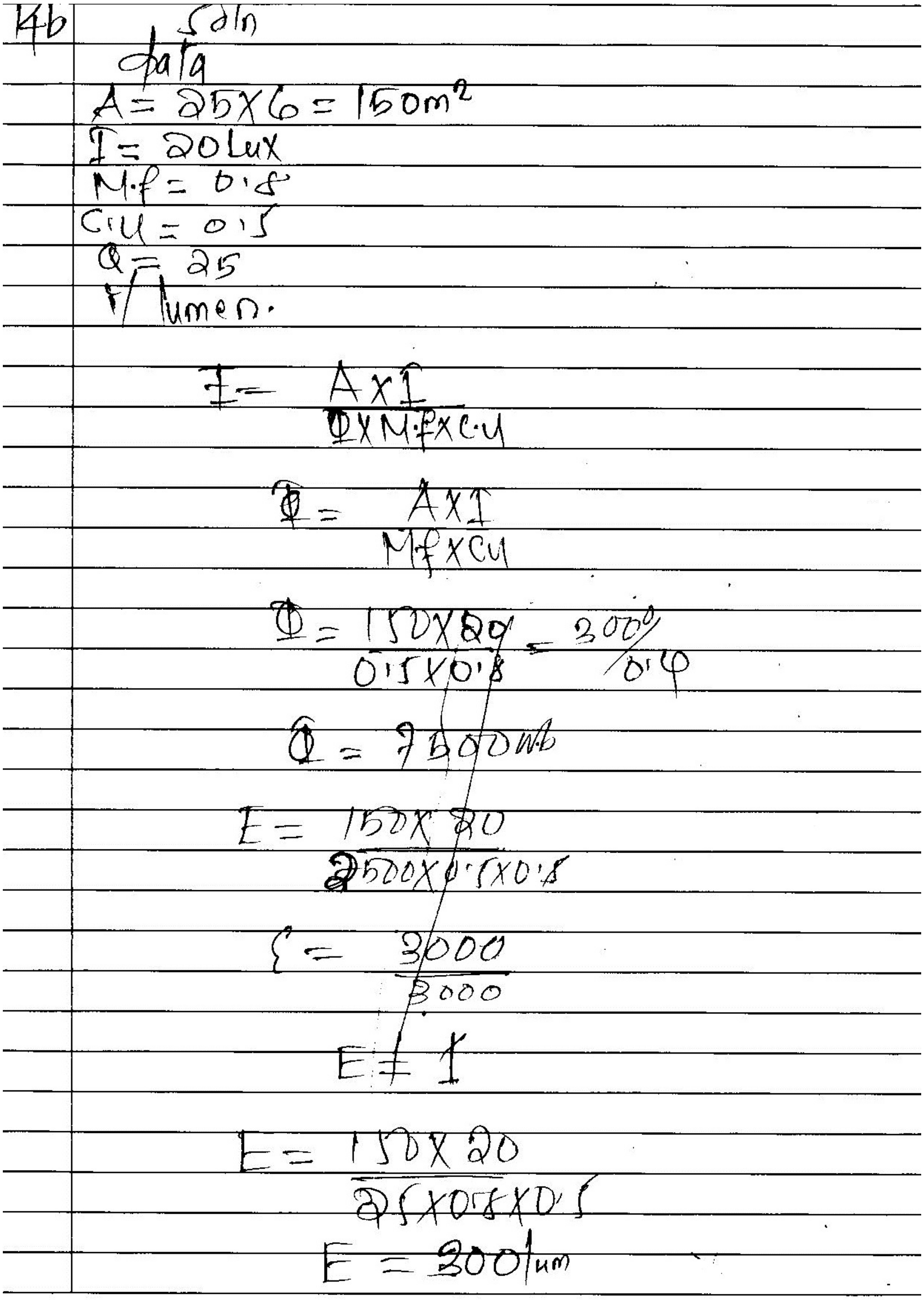
Extract 14.2

14a. i/ Coefficient of utilization → Is the Material which is used in the transformer to the Illuminate the number of lamps.

ii/ Maintanance factor – Is the factor that is used to in the Illumination to find the flux.

iii/ Coefficient of reflection → Is the Reflection of the light of the lamp in the Illumination.

iv/ Depreciation factor → Is the factor that is used in the Illumination from the Lambert law and Square law.



Extract 14.2 shows a sample of a candidate's poor response. The candidate failed to define the given illumination terms, calculate total lumen, total power and number of lamps for a room.

2.3.4 Question 15: Rectification

The question consisted of two parts, (a) and (b) and it weighed 20 marks. In part (a), candidates were required to:

(i) Define the term ‘rectification’ as applied in electric circuits,

(ii) Draw the circuit diagram of a full wave rectifier using a center tape transformer; and

(iii) Draw the input and output waveform of the full wave rectifier for one period.

In part (b) candidates were required to:

(i) Give two advantages of half wave rectifier; and

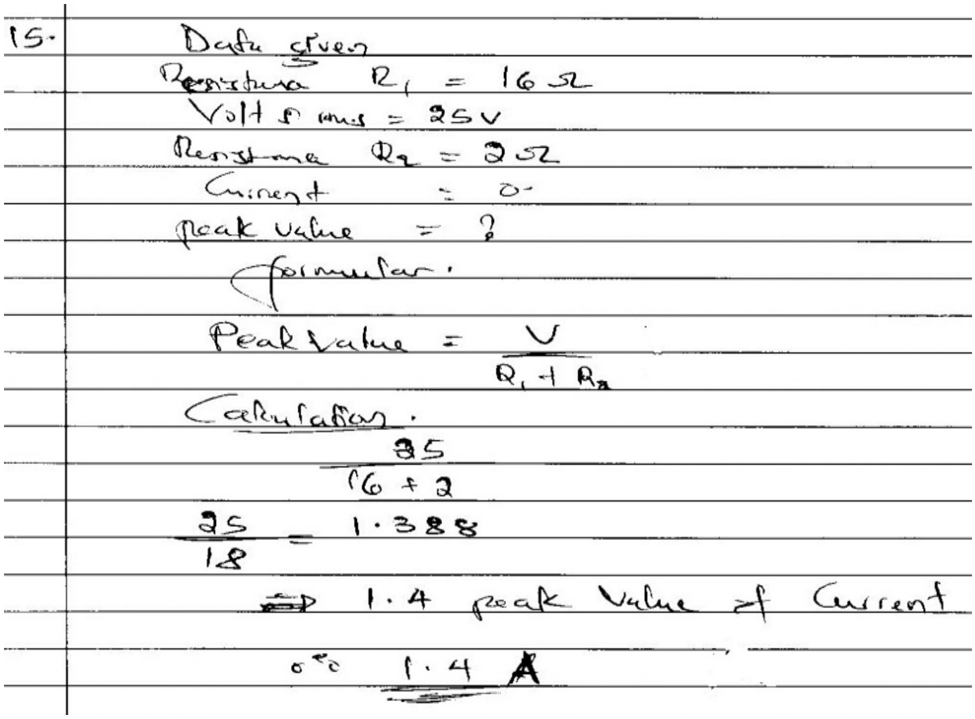
(ii) Calculate the average and peak values of current in the load for a half wave rectifier which is connected in series with a load of 16 Ω to a.c supply of 25 volts r.m.s value. The rectifier has a constant resistance of 2 Ω in the forward direction while the reverse current is zero.

This was the least opted question as it was attempted by only 108 candidates. Of those who attempted 74 percent scored from 0 to 5.5 marks, 12 percent scored from 6 to 9 marks and the remaining 13.1 percent scored from 10 to 14 marks out of 20 marks allotted. Therefore the general performance of this question was poor.

The majority of the candidates who managed to score high marks were able to define the term “rectification” in part (a) (i) and managed to draw input and output waveforms as required in part (a) (iii) but failed to draw the circuit diagram of the full wave rectifier using a center tape transformer as asked in part (a) (ii), instead they drew either half wave or bridge rectifier diagrams which were contrary to the question’s demand.

Moreover, a large number of candidates failed to give advantages of a half wave rectifier and calculate the average and peak values of the current in the load for a half-wave rectifier as required in part (b) (i) and (ii). This implies that, most of the candidates lacked sufficient knowledge and practical skills on the topic of rectification especially in calculating various electrical parameters in rectifier circuits and draw various rectifier circuits’ wave forms. Extract 15.1 is an example of a poor response from one of the candidate.

Extract 15.1



15. Data given

Resistance $R_1 = 16\,\Omega$

Volt r.m.s = 25V

Resistance $R_2 = 2\,\Omega$

Current = 0.

Peak value = ?

Formular.

Peak Value $= \frac{V}{R_1 + R_2}$

Calculation.

$\frac{25}{16+2}$

$\frac{25}{18} = 1.388$

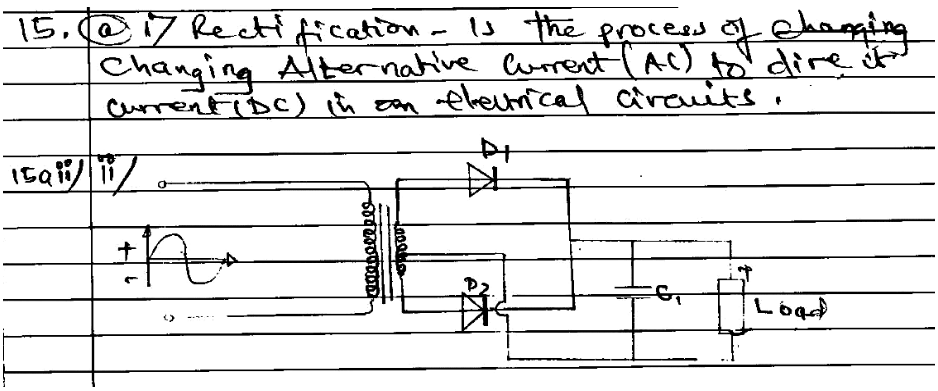
⇒ 1.4 peak value of current

∴ 1.4 A

Extract 15.1 shows a sample of a poor response from a candidate who failed to define rectification, draw a full wave rectifier and the input and output waveforms. The candidate also failed to give advantages of a half wave rectifier and to calculate the average and peak values of currents.

Extract 15.2 shows a sample of a good response from one of the few candidates who performed well in this question.

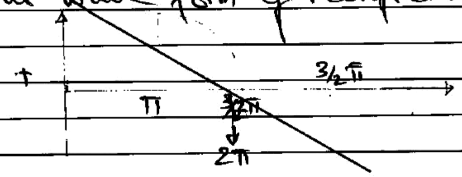
Extract 15.2



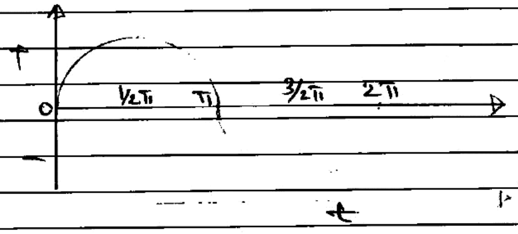
15. (a) i) Rectification - is the process of changing Changing Alternative current (AC) to direct current (DC) in an electrical circuits.

15a ii) ii)

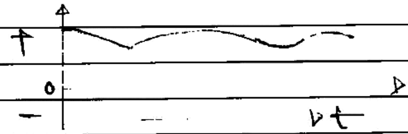
iii/ Input wave form of Rectifier.



ii/ - Input wave form of Rectifier.



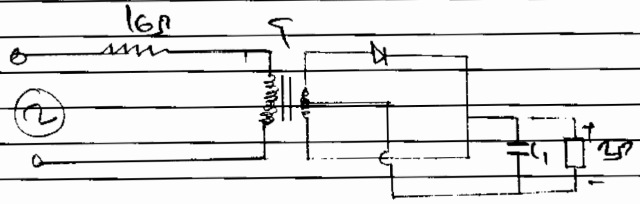
- out put wave form of Rectifier



15(b) i/ Advantages of Half wave rectifier
- It can low ~~expensive~~ cost and not consumes time (Low cost).
- It can produce full wave and steady dc current for uses.

ii/ Data:
R = 10Ω
Vrms = 25Volts V = Vrms × √2
= 25 × √2
= 35.36V.
R = 2Ω
Imax = ?
i = ?

Soln:
i = Imax sin θ
i = Imax sinωt
i = Imax sin2πft
But Imax = V/R



RT = 16Ω + 2Ω
RT = 18Ω
∴ RT = 18Ω.
Imax = 35.36/18
∴ Imax = 1.96A.

Extract 15.2 shows a sample of a good response from a candidate who correctly defined rectification, drew the circuit diagram of a full wave rectifier using a center tape transformer and its input and output wave forms and calculated the peak current of the load.

The overall performance of candidates in this question is summarized in Figure 2.

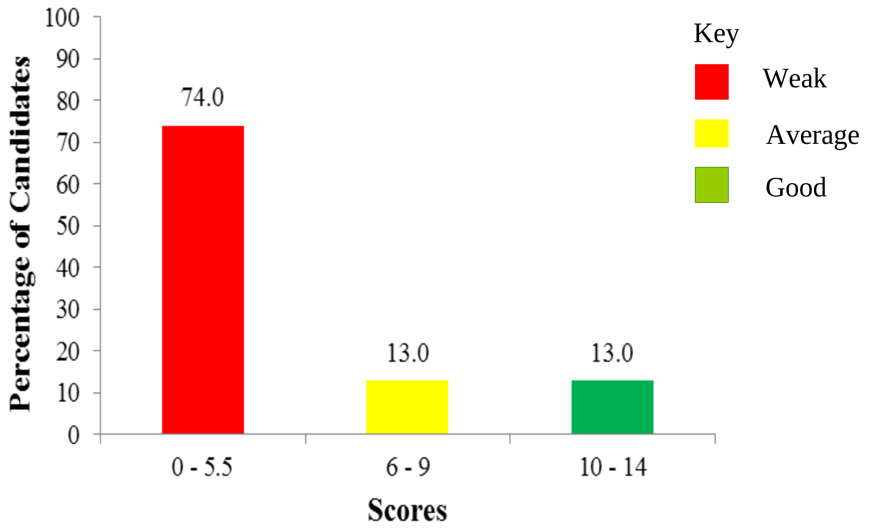


Figure 2: Performance of Candidates in Question 15

2.3.5 Question 16: A.C Circuits

This question consisted of parts (a) and (b) and it weighed 20 marks. In part (a) candidates were required to mention three disadvantages of the electric system to be operated at a low power factor and hence enumerate three methods in which this case can be improved or minimized.

In part (b) the candidates were given the following information: Three equal star-connected inductors take 8 kW at a power factor of 0.8 when connected across a 460 V, 3 phase wire supply. Candidates were required to calculate:

(i) line current

(ii) phase current

(iii) impedance per phase

(iv) resistance per phase

(v) inductive reactance per phase.

The candidates who attempted this question were 209 and they scored as follows: 45.5 percent scored from 0 to 5.5 marks, 21.5 percent scored from 6 to 9 marks and the remaining 33 percent scored from 10 to 20 marks. The candidates' performance in this question was therefore good as 54.5 percent scored from 6 to 20 marks.

These candidates were able to mention disadvantages of a low power factor and enumerate methods of improving low power factor. They also applied well the tested knowledge and skills on the formulae involved in calculating line current, phase voltage, impedance per phase, resistance per phase and inductive reactance per phase. Extract 16.1 illustrates this case.

Extract 16.1

16a dis advantage

i) Rating of the transformer and alternator is Inversely proportional to the power factor, hence KVA or KVA ratio will Increase

ii) Power loss is proportional to the square of the Current, hence Inversely proportional to the square of the power factor. Therefore at low power factor, more power loss and poor efficiency

iii) how lagging power factor, result In large Voltage drop which result In poor Voltage regulation. Hence addition regulation equipment is required to Keep the Voltage drop with permissible limit.

Power factor Improvement

i) Phasor advansor

ii) By Capacitor

iii) By Sychronous Motor.

16b. data given

$P = 8kW = 8000W$

P.factor = 0.8

Voltage line (VL) = 460V

Solution

In Star Connected

$I_L = I_{ph}$

$P = \sqrt{3}\, V_L I_L \cos\theta$

$$I_L = \frac{P}{\sqrt{3}\, V_L \cos\theta}$$

$$I_L = \frac{8000}{\sqrt{3} \times 460 \times 0.8}$$

$I_L = 12.55A$

i) Hence Line Current = 12.55A

ii) $$\frac{V_L}{\sqrt{3}} = \frac{\sqrt{3}\, V_{ph}}{\sqrt{3}}$$

$$V_{ph} = \frac{V_L}{\sqrt{3}}$$

$$V_{ph} = \frac{460}{\sqrt{3}}$$

$V_{ph} = 265.58V$

Hence Phase Voltage = 265.58V

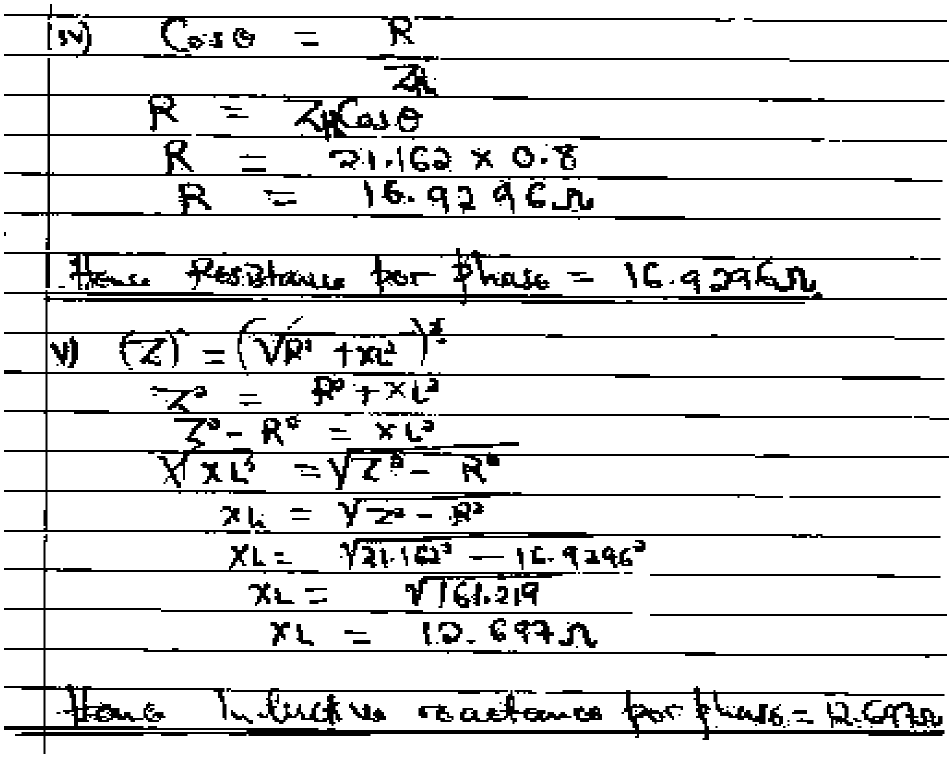
iii) Impedance per phase $(Z_{ph}) = \frac{V_{ph}}{I_{ph}}$

when $I_{ph} = I_L$ because star connected

$$Z_{ph} = \frac{265.58}{12.55}$$

$Z_{ph} = 21.162\Omega$

∴ Impedance per phase = 21.162Ω



(iv) $\cos\theta = \frac{R}{Z}$

$R = Z\cos\theta$

$R = 21.162 \times 0.8$

$R = 16.9296\,\Omega$

Hence Resistance per phase = $16.9296\,\Omega$

v) $(Z)^2 = \left(\sqrt{R^2 + XL^2}\right)^2$

$Z^2 = R^2 + XL^2$

$Z^2 - R^2 = XL^2$

$\sqrt{XL^2} = \sqrt{Z^2 - R^2}$

$XL = \sqrt{Z^2 - R^2}$

$XL = \sqrt{21.162^2 - 16.9296^2}$

$XL = \sqrt{161.219}$

$XL = 12.697\,\Omega$

Hence Inductive reactance per phase = $12.697\,\Omega$

Extract 16.1 shows the responses from one of the candidates who met the demands of the question.

However, candidates who performed poorly in this question did no attempt part (a) of the question which required them to mention disadvantages of a low power factor in the electric systems and enumerate methods of improving power factor. Most of them tried to do part (b) and majority failed to apply the correct formulae of calculating line current, phase voltage, impedance per phase and inductive reactance per phase. Extract 16.2 shows the responses of one of the candidates who performed poorly part (b) of this question.

Extract 16.2

16 (b) Soln

(i) star-connected inductor x power factor

8 kw x 0.8

= 6.4 kw

∴ line current = 6.4 kw

(ii) phase voltage

460 x 3 = 1,3~~7~~0 V

~~8 kw~~ ~~= 215.625~~

1380 V / 8 kw = 172.5 v/kw

∴ Phase voltage = 172.5 v/kw

iii impedance per phase

8 kw + 0.8 x 460 / 3   4,048 / 3 = 1349.3

∴ Impedance per phase = 1349.3 kw

(iv) Resistance per phase

172.5 kw − 0.8 = 171.7

∴ resistance per phase is 171.7 kw

(v) inductance reactance per phase

impedance per phase + resistance per phase / 6.4 kw

1349.3 + 171.7 / 6.4 kw = 1521 / 6.4 kw = 237.65625

∴ inductance reactance per phase = 237.66 kw

Extract 16.2 shows a sample of a poor response from a candidate who failed to calculate the line current, phase voltage, impedance per phase, resistance per phase and inductance reactance per phase in three equal star-connected inductors.

3.0 PERFORMANCE OF CANDIDATES IN DIFFERENT TOPICS

An analysis of topics which were examined in Electrical Engineering Science subject 2015 revealed that, most candidates were able to perform well in various topics included in the paper. However, in some topics the performance was either average or poor.

The analysis of individual questions indicates that there were seven topics with good performance. These include A.C Motors, Illumination, Measuring Instruments, Electric Heating, Conductors and Cables and A.C Circuits. Five topics namely Battery and Cells, Transformer, Rectification, D.C Machines and Capacitor and Capacitance were averagely performed. The analysis also reveals that most candidates performed poorly in the topic of Electromagnetism.

These results imply that, either some of the topics were not well covered by subject teachers or candidates lacked enough exercises and revision on the topics from which the questions were set.

A summary of the candidate's performance in each topic is presented in Figure 3. Green, yellow and red colors represent good, average and weak performance respectively.

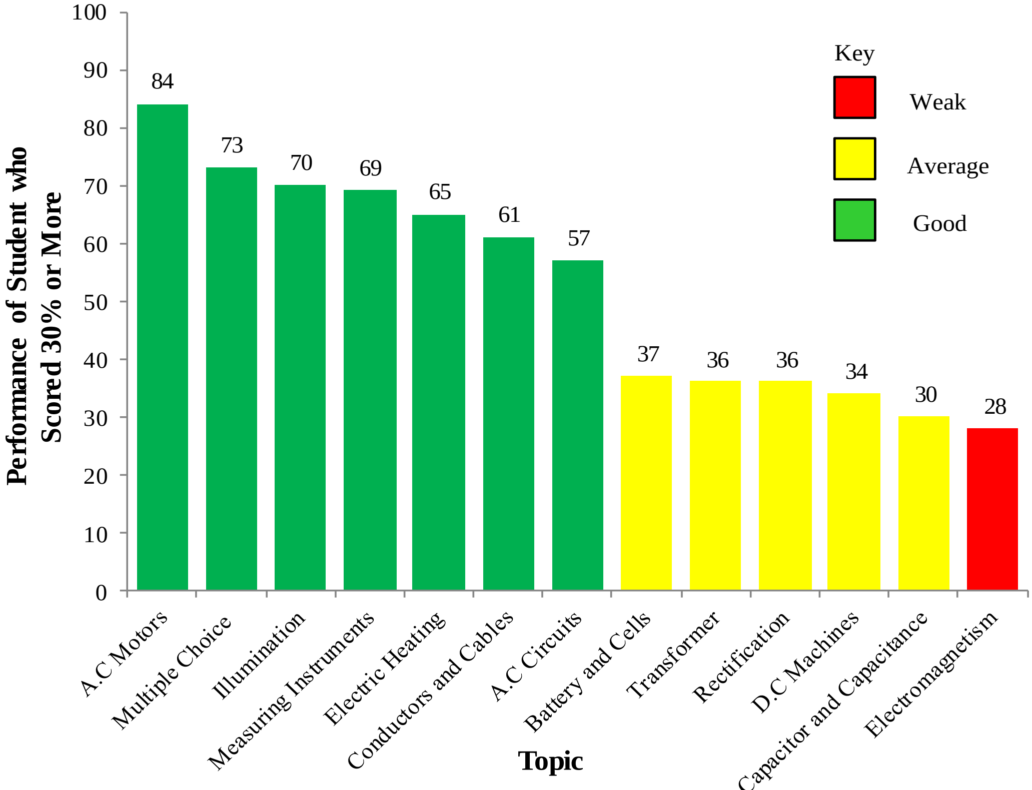


Figure 3: Analysis of Students' Performance Topic-wise in Electrical Engineering Science Subject

4.0 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

The general performance of Electrical Engineering Science for the year 2015 was good because 50.6 percent of the candidates passed the examination. However, this performance has decreased by 2.9 percent when compared to 2014.

The findings from the analysis show that the general level of performance and the quality of answers to the questions examined was satisfactory although there were few weaknesses noted. The major weaknesses noted include: candidate's inadequate knowledge and skills on the topics of Battery and Cells, Transformer, Rectification, D.C Machines, Capacitor and Capacitance and Electromagnetism. This could be due to either shortage of electrical engineering professional personnel and facilities or negligence of some candidates in putting seriously initiatives and efforts in their learning process. Another weakness observed was candidates' inability to tackle questions which involve mathematical computations and failure to identify the demands of the questions.

It is expected that the weaknesses noted and feedback provided in this report will be used as a guide by teachers and other educational stakeholders during teaching and learning process in order to raise the standard of performance in this subject.

4.2 Recommendations

On the basis of the shortcomings observed in the course of analysis of candidates' items response, this report recommends the following in order to improve performance in this subject.

(a) Candidates should make sure that they respond to the requirements of the question asked rather than answering out of the question's demand.

(b) Candidates should take serious initiatives and efforts to cover the whole syllabus through reading various materials from different recommended sources.

(c) Candidates should orient themselves with theoretical and computational type of questions by doing thorough practice in order to be able to tackle such questions accordingly.

(d) Teachers should practice a competence-based mode of material delivery to the students and they should ensure that the subject matter is well understood by students.

(e) Teachers should identify the weaknesses of their students and should equip them with sufficient knowledge and skills on the subject matter.

(f) The ministry should make an effort to provide technical text books to secondary schools which covers the whole syllabus for the required study materials.

Appendix

Comparison Analysis of Candidates' Performance in Electrical Engineering Science Subject per Question in 2014 and 2015

S/N	Topic	2014			2015		
		Number of Questions	Performance (%)	Remarks	Number of Questions	Performance (%)	Remarks
1	A.C Motors	-	-	-	1	84	Good
2	Multiple Choice from Various Topics	1	91	Good	1	73	Good
3	Illumination	1	76	Good	2	70	Good
4	Measuring Instruments	-	-	-	1	69	Good
5	Electric Heating	1	64	Good	1	65	Good
6	Conductors and Cables	-	-	-	1	61	Good
7	A.C Circuits	1	41	Average	2	57	Good
8	Battery and Cells	1	58	Average	1	37	Average
9	Transformer	1	47	Average	2	26	Average
10	Rectification	1	2	Weak	1	36	Average
11	D.C Machines	2	59	Average	1	34	Average
12	Capacitor and Capacitance	1	44	Average	1	30	Average
13	Electromagnetism	1	55	Average	1	28	Weak
14	Three Phase Systems	2	27	Weak	-	-	-
15	D.C Circuits	3	24	Weak	-	-	-

Key

Red	Weak
Yellow	Average
Green	Good