

CARIBBEAN EXAMINATIONS COUNCIL

**REPORT ON CANDIDATES' WORK IN THE
ADVANCED PROFICIENCY EXAMINATION**

MAY/JUNE 2011

ELECTRICAL AND ELECTRONIC TECHNOLOGY

GENERAL COMMENTS

One hundred and thirty-one candidates registered for Unit 1 of which 111 wrote Paper 01 and 104 wrote Paper 02. Sixty-six candidates who registered for Unit 2 wrote both Papers 01 and 02 in this examination.

As in previous years, performance was somewhat poor; however there were signs of improvement over previous years. It appears as if this low level of performance could be a result of one or more of a number of factors including:

- Poor preparation of candidates for the examination in this subject
- The weak mathematics and science skills of the candidates
- The need for teacher orientation and training
- Unavailability of appropriate facilities to support this subject
- Inappropriate configuration of the units

There is need to conduct further investigation to determine the causes of poor performance in this subject area.

DETAILED COMMENTS

UNIT 1

Paper 01 – Short Answer Questions

Candidates were required to do all questions from this paper which accounted for 90 marks.

The marks scored by candidates ranged from 2 to 58. Five per cent of the candidates scored in the range 51–60, 9 per cent scored in the range 41–50, 17 per cent scored in the range 31–40 and 29 per cent scored in the range 21–30. The remaining 40 per cent scored 20 marks or below.

Module 1 – DC Circuit Theory

Candidates were required to use fundamental laws and simple theory to solve simple DC circuits. From a possible 30 marks, the highest score was 26 and the lowest score was 2. About 43 per cent of the candidates scored 50 per cent of the maximum score or above in this module; 19 per cent scored in the range 11–14, 20 per cent scored in the range 6–10 and the remaining 18 per cent scored in the range 1–5.

Question 1

This question tested candidates' knowledge of Ohm's Law and their ability to manipulate series parallel circuits. All candidates attempted the question of which 16 per cent were able to provide perfect responses (5–6 marks) whereas 31 per cent scored in the 3–4 mark range, 36 per cent scored between 1 and 2 marks; 17 per cent scored zero. In general, the response to this question was poor, even though this is considered a very simple question. Most candidates were able to calculate the total resistance in the series parallel circuit. Surprisingly, several candidates were unable to state Ohm's Law and were unable to determine the power dissipated in components. We recommend that teachers encourage students to review work done in CSEC Electrical Technology since this topic is covered in-depth at that level.

Question 2

This question focused on the capacitor and required candidates to calculate capacitances in series and the charge stored in this device. All except one candidate attempted the question and out of a possible 6 marks, 12 per cent provided perfect responses (5–6 marks) whereas 48 per cent scored in the 3–4 mark range; 34 per cent scored between 1 and 2 marks; 6 per cent scored zero. A number of candidates misinterpreted the question because of a missing punctuation mark; however, given the formula, most candidates were able to calculate the total value of capacitance in series.

Question 3

In this question, candidates were asked to identify the various types of capacitors and sketch a typical discharge curve of a capacitor. Fifteen candidates did not respond to this question. None of the candidates received marks in the 5–6 range, 33 per cent scored in the 3–4 mark range, 56 per cent scored between 1 and 2 marks; 11 per cent scored zero from a possible 6 marks. Most candidates were able to list the types of capacitors and were familiar with the characteristic curve. Many of them were unfamiliar with capacitance ranges and displayed ignorance of the prefixes (Milli, Kilo, etc.) Teachers should place emphasis on the labelling of graphs and working with prefixes.

Question 4

This question tested candidates' knowledge of inductors. All but 2 candidates responded to the question. About 34 per cent of the candidates were able to provide perfect responses (5–6 marks), whereas 32 per cent scored in the 3–4 mark range; 26 per cent scored between 1 and 2 marks; 8 per cent scored zero. This question represented a very good item for the candidates, however several experienced difficulty calculating flux.

Question 5

Candidates were asked to define mutual inductance and state one function of the iron core in an inductor. All except two candidates responded to the question. About 26 per cent of the candidates were able to provide perfect responses (5–6 marks) whereas 19 per cent scored in the 3–4 mark range; 30 per cent scored between 1 and 2 marks; 25 per cent scored zero. Most candidates were able to identify one function of the iron core on which coils are wound but were unable to sketch and label the diagram for demonstrating mutual inductance.

Module 2 – Analogue Electronics and Communications

Basic analogue and electronics and communications concepts were covered in this module. This module proved to be somewhat challenging as most candidates scored low marks. The highest score was 20 and 7 per cent of the candidates scored zero from a possible 30 points; 7 per cent scored in the range 16–20, 12 per cent scored in the range 11–15, 33 per cent scored in the range 6–10 and the remaining 41 per cent scored in the range 1–5.

Question 6

This question tested candidates' knowledge of the transistor. It proved relatively challenging. It is evident that many candidates were unfamiliar with the NPN transistor and what is meant by *dc Beta* of the transistor. Several candidates misinterpreted the formula for the common emitter transistor. Almost 41 per cent of them either scored zero or did not respond to the question. About 12 per cent were able to provide perfect responses (5–6 marks) whereas 21 per cent scored in the 3–4 mark range; 26 per cent scored between 1 and 2 marks.

Question 7

This question tested candidates' knowledge of oscillators. It proved difficult for most candidates since they were unfamiliar with Barkhausen criterion. A few candidates were able to identify the phase shift oscillator from the diagram given but were unable to explain its operation. About 73 per cent of the candidates either scored zero or did not respond to the question. Only 2 per cent scored in the 3–4 mark range. The remaining 25 per cent scored in the 1–2 mark range.

Question 8

Several candidates understood magnetic radiation and the concept of ground wave. About 10 per cent of them provided good responses (5–6 marks) whereas 34 per cent scored in the 3–4 mark range and 37 per cent scored in the range 1–2. The remaining 19 per cent scored zero or did not respond to the question. Most candidates who attempted this question were able to define ground wave. Candidates need to be more familiar with the frequencies for various electromagnetic waves.

Question 9

This question tested candidates' knowledge of the half wave rectifier. Approximately 10 per cent of the candidates provided solid responses (5–6 marks) whereas 30 per cent of the candidates scored in the 3–4 mark range; 48 per cent scored in the 1–2 range. The remaining 12 per cent scored zero or did not respond to the question. Most of the candidates who attempted this question were able to calculate the output voltage of the rectifier but experienced difficulty calculating the power dissipated by the diode.

Question 10

This question tested candidates' understanding of FM carrier waves and how to calculate the frequencies associated with this wave. Only 4 per cent of the candidates provided good responses (5–6 marks) whereas 21 per cent of the candidates scored in the 3–4 mark range and 17 per cent scored in the 1–2 range. The remaining 58 per cent scored zero or did not respond to the question.

Most of the candidates who attempted this question were able to calculate the highest and lowest carrier frequency but were unable to calculate the carrier swing of the FM signal.

Module 3 – Introduction to Power Systems

This module basically introduces candidates to electrical power systems and continues to be the most challenging of the three. The highest score was 16, and 15 per cent of the candidates scored zero from a possible 30 points. Of the 111 candidates, 2 per cent scored in the range 16–20, 2 per cent scored in the range 11–15, 34 per cent scored in the range 6–10 and 47 per cent scored in the range 1–5. These statistics suggest that candidates were ill prepared for this module.

Question 11

This question tested candidates' knowledge of magnetic flux and Fleming's left-hand rule. Surprisingly, it proved difficult for many candidates. Most candidates knew the properties of magnetic flux but were unable to illustrate Fleming's left-hand rule. Only 6 per cent of candidates provided good responses (5–6 marks) whereas 21 per cent scored in the 3–4 mark range and 40 per cent scored in the 1–2 range. About 33 per cent of the candidates either scored zero or did not respond to this question. Using a model to illustrate the rule is a good teaching tactic and should improve results in this area.

Question 12

This question proved relatively difficult for most candidates. The majority of candidates were unfamiliar with wave windings however several of them understood the concept of *separately excited* in relation to dc machines. Only 1 per cent of the candidates provided a perfect response (5–6 points); 4 per cent scored in the 3–4 mark range; 22 per cent scored in the 1–2 mark range and the remaining 73 per cent either scored zero or did not respond to the question.

Question 13

Most candidates were unable to respond to this question. Candidates were unable to differentiate between earth fault and short circuit fault. A large number, 70 per cent of the candidates, either scored zero or did not provide a response. No candidate scored in the 5–6 mark range and one scored in the 3–4 mark range. The remaining 29 per cent scored in the 1–2 mark range.

Question 14

This question tested candidates' knowledge of the SCADA system. Most candidates displayed a good working knowledge of the system; however several of them were unable to state what the RTV is. About 26 per cent of the candidates provided good responses (5–6 marks) whereas 36 per cent scored in the 3–4 mark range; 24 per cent scored in the 1–2 mark range. The remaining 14 per cent either scored zero or did not respond to the question.

Question 15

This question tested candidates' knowledge of the separately excited generator. Some candidates were able to sketch the characteristic curve and determine what accounts for the remaining output voltage when the field current is removed. Fifty-six per cent of the candidates either scored zero or

did not provide a response. Four 4 per cent scored in the 3–4 mark range whereas the remaining 40 per cent scored in the 1–2 mark range.

Paper 02 – Essay Questions

One hundred and six candidates wrote this paper. They were required to respond to six questions worth 150 marks. Questions 1, 4 and 7, each worth 30 marks, were compulsory. Candidates were required to select one of the remaining two questions from each module; these questions were each worth 20 marks. Most candidates attempted the required two questions from each module.

The range of marks obtained was from a low of 4 to a high of 95. An unprecedented 8 per cent of the candidates scored above 80 marks. Almost 21 per cent of candidates scored in the range 50–79; 26 per cent scored in the range 30–49; 33 per cent scored in the range 10–29 and the remaining 12 per cent scored in the range 0–9.

Module 1 – DC Circuit Theory

Candidates were required to respond to Question 1 and one other from this section. From a possible score of 50 from this module, the highest score was 35. Roughly 5 per cent of the candidates scored in the range 31–40 whereas 21 per cent scored in the range 21–30; 33 per cent scored in the range 11–20; 40 per cent scored in the range 1–10 range and one candidate scored zero.

Question 1

This question focused on the inductor and mutual inductance. For the most part, candidates displayed knowledge of the inductor and were able to define the coefficient of coupling. Candidates experienced difficulty calculating the energy stored and the coefficient of coupling for two coils. The maximum score obtained was 19 from a possible 30 marks. About 29 per cent of those who attempted the question scored in the 11–20 mark range; 30 per cent scored in the 6–10 mark range, 36 per cent scored in the 1–5 mark range and 5 per cent either scored zero or did not attempt the question.

Question 2

This question was designed to test candidates' knowledge and understanding of the capacitor and time constant. Candidates were expected to calculate various parameters for a capacitor when given certain values. This question was selected by 37 per cent of the candidates. Although the question proved quite challenging for some candidates, many were able to sketch graphs, calculate energy stored, initial charging current and the time constant. From a possible 20 marks, the highest score was 19. Fifteen candidates scored in the 11–20 mark range; 15 scored in the 6–10 mark range; 10 candidates scored in the 1–5 mark range and one scored zero for this question.

Question 3

This question tested candidates' knowledge of Kirchoff's Laws and how to use this law to solve network problems. About 56 per cent of the candidates chose this question. It was evident that several candidates experienced difficulty calculating the values for the circuit. From a possible 20 marks, the highest score was 15 marks. Of the 60 candidates who attempted the question, 11 scored

in the 11–20 mark range, 17 scored in the 6–10 mark range and 31 scored in the 1–5 range. One candidate scored zero.

Module 2 – Analogue Electronics and Communications

Candidates were required to respond to Question 4 and one other from this section. From a possible score of 50 marks from this module, the highest score was 27 marks. Ten per cent of those who attempted this question scored in the range 21–30; 31 per cent of the candidates scored in the range 11–20; 56 per cent scored in the range 0–1 and 3 per cent scored zero.

Question 4

All candidates were required to answer this question which tested their knowledge of semiconductors. This question further aimed at determining candidates' knowledge of rectification in power supplies. Many candidates were unable to state the type of impurities used to dope silicon crystal. They were also unable to calculate the current rating of a Zener diode. The highest score was 17 from a possible 30 marks. Almost 17 per cent of those who attempted the question scored in the 11–20 mark range; 36 per cent scored in the range 6–10 and 44 per cent scored between 1 and 5 marks. About 3 per cent of the candidates either did not attempt the question or scored zero.

Question 5

This question focused on operational amplifiers. Sixty-five per cent of the candidates opted for this question. The highest score was 17 from a possible 20 marks. Approximately 12 per cent of the candidates who wrote the question scored in the 11–20 mark range, 13 per cent scored in the range 6–10, 55 per cent scored in the 1–5 range, and 20 per cent either scored zero or did not attempt the question.

Question 6

This question focused on the NPN transistor. It required candidates to outline the structure and operations of a NPN transistor and to carry out calculations for transistor biasing circuits. Twenty-five per cent of those who attempted this question scored a high of 8 marks from a possible 20. Eleven per cent of the candidates scored in the 6–10 range, 63 per cent scored in the 1–5 range, and 26 per cent candidates scored zero or did not respond to the question.

Module 3 – Introduction to Electrical Power Systems

Candidates were required to respond to Question 7 and one other from this section. From a possible score of 50 for this module, the highest score was 38. Approximately eight per cent of those who attempted this question scored in the range 31–40, 17 per cent scored in the range 21–30, 27 per cent scored in the range 11–20, 37 per cent scored in the range 1–10 and 11 per cent scored zero.

Question 7

This question tested candidates' knowledge of dc dynamos. Candidates were required to sketch and label the cross-section of the dynamo, draw and label connection diagrams and characteristic curves and calculate dynamo parameters. The maximum score obtained was 23 from a possible 30 marks. About 6 per cent of those who attempted the question scored in the 21–30 mark range; 19 per cent of

the candidates scored in the 11–20 mark range; 27 per cent scored in the 6–10 mark range; 31 per cent scored in the 1–5 mark range and 17 per cent either scored zero or did not attempt the question.

Question 8

This question tested candidates' knowledge of Lenz's Law, magnetomotive force and magnetic field strength. Fifty-four per cent of the candidates attempted this question and scored a high of 18 from a possible 20 marks. Thirty-three per cent of those who attempted it scored in the 11–20 mark range, 25 per cent scored in the 6–10 mark range, 32 per cent scored in the 1–5 mark range and 10 per cent either scored zero or did not attempt the question. It was evident that several candidates experienced difficulty responding to this question.

Question 9

This question tested candidates' knowledge of the Supervisory Control and Data Acquisition (SCADA) system. The question was attempted by 45.28 per cent of the candidates. The highest score was 20 from a possible 20 marks. Of those who attempted the question, 45 per cent were able to score in the 11–20 mark range, 20 per cent in the 6–10 mark range, 30 per cent in the 1–5 range, while 5 per cent either did not attempt the question or scored zero. Most candidates had a fair understanding of SCADA and were able to answer at least one segment of this question.

UNIT 2

Paper 01 – Short Answer Questions

Candidates were required to do all questions from this paper which accounts for 90 marks. The range of marks scored by candidates was from a low of 3 to a high of 74. Of the 66 candidates, 8 per cent scored in the 51–75 range, 9 per cent scored in the 41–50 range, 12 per cent scored in the 31–40 range, 45 per cent scored in the 21–30 range, 17 per cent scored in the 11–20 range and 9 per cent scored in the 1–10 mark range. This data suggest that less than 20 per cent of the candidates scored above 50 per cent of the available marks.

Module 1 – AC Circuit Theory

Candidates were required to use fundamental laws and simple theory to solve simple AC circuits. From a possible 30 marks, the highest score was 24 and two candidates scored zero; 6 per cent of the candidates scored in the 21–30 range, 12 per cent scored in the 16–20 range, 23 per cent scored in the 11–15 range, 32 per cent scored in the 6–10 range and 26 per cent scored in the 1–5 mark range.

Question 1

This question tested candidates' knowledge of filters. They were asked to label the characteristic curve of a band pass filter, to draw the circuit of a simple low pass filter and explain how it works. Most candidates had basic knowledge of a typical response curve for a band pass filter but the majority of them were unable to label the response curve. Only 6 per cent of those who attempted the question provided excellent responses, scoring in the range 5–6 from a possible 6 marks; 10 per cent scored in the range 3–4, 58 per cent scored in the range 1–2 and 26 per cent either scored zero or did not attempt the question.

Question 2

This question tested candidates' knowledge of reactance. Many candidates understood *phase relationship* and knew the meaning of reactance. Most of them could state the formula for calculating inductive reactance but experienced difficulty transposing in the formula. They also experienced difficulty working with powers. About 26 per cent of those who attempted the question provided excellent responses, scoring in the 5–6 mark range; 34 per cent scored in the range 3–4, 28 per cent scored in the 1–2 mark range and 12 per cent either scored zero or did not respond to the question.

Question 3

Candidates were asked to express values of impedances in regular and polar form. This question was avoided by the majority of candidates. The percentage of candidates who provided perfect responses for this question (scoring in the 5–6 range from a possible 6 marks) was 15. Ten per cent scored in the range 3–4; 40 per cent scored in the range 1–2 and 35 per cent either scored zero or did not respond to the question.

Question 4

This question tested candidates' knowledge of the sine waveform and power factor. Most candidates were able to sketch and label the sine wave and indicate the values requested, however many of them did not understand the concept of power factor. About 23 per cent of those who attempted the question scored in the range 5–6 (from a possible 6 marks); 36 per cent scored in the range 3–4, 35 per cent scored in the range 1–2 and 6 per cent either scored zero or did not respond to the question.

Question 5

Given a series RLC circuit, candidates were asked to explain how the circuit reached resonance and sketch the variation of current and reactance with frequency. This question posed difficulties for more than 50 per cent of the candidates. They were able to draw and label the curves but could not illustrate reactance at resonance. No candidate provided a perfect response for this question; 24 per cent scored in the range 3–4, 41 per cent scored in the range 1–2 and 35 per cent either scored zero or did not respond to the question.

Module 2 – Digital Electronics and Data Communications

Basic analogue and electronics and communication concepts were covered in this module. The module was understood by only a few candidates — 14 per cent of the candidates scored 50 per cent or more of the 30 marks available. The highest score was 22 and the lowest score was 3; only 2 per cent of the candidates scored in the range 21–30; 12 per cent scored in the range 16–20; 35 per cent scored in the 11–15 range; 38 per cent scored in the range 6–10 and 13 per cent scored in the 1–5 mark range.

Question 6

Candidates were asked to define *UART* and terms such as *parity* and *framing error* as they related to the UART. They were also asked to explain how the UART is used. Most candidates were unaware of the content of this question. Only 12 per cent of the candidates scored in the 3–4 mark range; 55 per cent scored in the 1–2 mark range and 33 per cent either scored zero or did not respond to the question.

Question 7

Candidates were asked to state what a *shift register* is and give its uses. They were also asked to describe the function of the counter in a sequential logic circuit. In general, this question appeared difficult for the large majority of candidates as none was able to provide a perfect response. About 17 per cent of the candidates scored in the 3–4 mark range; 48 per cent scored in the 1–2 mark range and 35 per cent either scored zero or did not attempt the question.

Question 8

This question required candidates to define *ROM* and *PROM* and explain the basic difference between them. They were also asked to explain what a *demultiplexer* is. Most candidates were able to provide reasonable responses and no candidate scored zero; 14 per cent of the candidates scored in the range 5–6 (from a possible 6 marks); 67 per cent scored in the 3–4 range and 19 per cent scored in the range 1–2. No candidate scored zero.

Question 9

Candidates were asked to draw symbols and construct truth tables for the NOR and EX-OR gates. The question was relatively well understood by most candidates. Roughly 27 per cent of the candidates scored in the 5–6 mark range of the 6 point range scale; 42 per cent scored in the range 3–4; 18 per cent scored in the 1–2 mark range and 13 per cent either scored zero or did not attempt the question.

Question 10

This question tested candidates' knowledge of ideal switches and transistors. The question was well understood by most candidates; however many of them were unable to explain the construction of transistors and draw their symbols. About 14 per cent of the candidates provided good responses (scoring in the range 5–6 from a possible 6 marks); 29 per cent scored in the 3–4 mark range; 31 per cent scored in the 1–2 mark range and 26 per cent either scored zero or did not respond to the question.

Module 3 – Introduction to AC Machines

In previous years, this module posed significant challenges to candidates in general but there are signs that candidates are beginning to understand and meet the requirements. From a possible 30 marks, the highest score was 28; 6 percent of the candidates scored zero. Almost 5 per cent of the candidates scored in the range 21–30, another 5 per cent scored in range the 16–20; 16 per cent scored in the range 11–15; 30 per cent scored in the range 6–10, and 38 per cent scored in the 1–5 mark range.

Question 11

This question tested candidates' knowledge of transformers. Surprisingly, candidates did not perform as well as expected. Only 6 per cent of the candidates provided excellent responses (scoring in the 5–6 range from a possible 6 marks); 29 per cent scored in the range 3–4; 60 per cent scored in the range 1–2, whereas 5 per cent either scored zero or did not attempt the question. Most candidates were able to give another name for laminated core transformers.

Question 12

Candidates were asked to draw sketches and explain the operation of the single phase capacitor run and the split phase induction motors. This question proved difficult for most candidates since only 11 were capable of providing a response. Only 7 per cent of the candidates provided excellent responses (scoring in the 5–6 range from a possible 6 marks); 14 per cent scored in the range 3–4; 17 per cent scored in the 1–2 mark range, whereas 62 per cent either scored zero or did not respond to the question.

Question 13

Candidates were asked to explain the term *synchronous impedance* in relation to an AC motor. Additionally, candidates were given the armature resistance and reactance and asked to determine the synchronous impedance of the motor. The question proved to be quite challenging for most candidates as only 50 per cent of them responded. Approximately 25 per cent scored in the 5–6 mark range; 29 per cent scored in the 3–4 range; 14 per cent scored in the 1–2 mark range and 32 per cent either scored zero or did not attempt the question. It appears that candidates were not exposed to the concept of synchronous impedance during their studies.

Question 14

Given the equivalent circuit for a transformer, candidates were required to name the circuit elements and four parameters. Many candidates did not know the difference between circuit elements and circuit parameters. Only 7 per cent of the candidates provided excellent responses, scoring in the 5–6 mark range; 38 per cent scored in the range 3–4, 50 per cent scored in the 1–2 mark range and 5 per cent either scored zero or did not attempt the question.

Question 15

Candidates were asked to draw and label an auto transformer that could be used to boost the voltage at the end of a power line. Additionally, they were given the turns ratio of a transformer and an input voltage and asked to determine the output. Only 5 per cent of the candidates provided excellent responses, scoring in the 5–6 mark range; 33 per cent scored in the range 3–4; 21 per cent scored in the 1–2 mark range and 41 per cent either scored zero or did not attempt the question.

Paper 02 – Essay Questions

Sixty-six candidates wrote this paper. They were required to respond to six questions which were worth 150 marks. Questions 1, 4 and 7, each worth 30 marks, were compulsory. Candidates were required to select one of the remaining two questions, worth 20 marks, in each module. Most candidates attempted the required two questions from each module.

The range of the marks obtained was from a low of 2 to a high of 106. Only 1 candidate scored in the 100 and above range; 5 per cent scored in the range 81–99; 9 per cent scored in the range 61–80; 45 per cent scored in the range 41–60; 8 per cent scored in the range 31–40; 15 per cent scored in the range 21–30; 14 per cent scored in the range 11–20 and 3 per cent scored in the range 1–10.

Module 1 – AC Circuit Theory

Candidates were required to respond to Question 1 and one other from this section. From a possible score of 50 marks from this module, the highest score was 30 and the lowest was 2. Approximately 30 per cent of the candidates scored in the range 21–30; 38 per cent scored in the range 11–20; 29 per cent scored in the range 6–10 and 3 per cent scored in the range 1–5.

Question 1

This question tested candidates' knowledge of resonance and magnification factor (Q). Many candidates experienced challenges with this question. Candidates were quite conversant with definitions but were unable to solve basic problems related to resonance circuits. The maximum score obtained was 14 from a possible 30 marks with 16 per cent of the candidates scoring in the 11–15 mark range; 32 per cent scoring in the 6–10 mark range; approximately 52 per cent scoring in the 1–5 mark range and no candidate failed to respond to the question, or obtained zero.

Question 2

This question tested candidates' knowledge of filters, specifically the low pass and notch filters. Although this question tested basic concepts on filters, the majority of candidates did not select it. It appears as if one or a combination of the following occurred:

- this topic was not taught,
- the question was too difficult, or
- the alternative question was more attractive to most candidates.

Only 8 per cent of candidates attempted the question and two scored 14 marks. Two candidates scored in the 6–10 mark range and one scored in the 1–5 range.

Question 3

This question tested candidates' knowledge of sinusoidal wave forms, and active and reactive power. Approximately 94 per cent of the candidates attempted the question and scored a maximum of 19 marks and a minimum of 2 marks from a possible 20 marks. Eighteen per cent of the candidates scored in the 16–20 mark range, 15 scored in the 11–15 mark range, 17 scored in the 6–10 mark range

and the remaining 18 candidates scored in the 1–5 mark range. No candidate scored zero. It is evident that most candidates were comfortable with this question.

Module 2 – Digital Electronics and Data Communications

Candidates were required to respond to Question 4 and one other from this section. From a possible score of 50 marks from this module, the marks obtained by candidates ranged from 0 to 40. Approximately 5 per cent of the candidates scored in the range 31–40; 39 per cent scored in the range 21–30, 24 per cent scored in the range 11–20; 12 per cent scored in the range 6–10; 17 per cent scored in the range 1–5 and 3 per cent of the candidates scored zero. These scores represent a significant improvement in the performance on this module when compared to previous years.

Question 4

This question tested candidates' knowledge of flip-flops. Most candidates were able to draw and explain the SR and JK flip-flops but were unable to explain their operation. The marks for this question ranged from 0 to 22 from a possible 30 marks. Approximately 6 per cent of the candidates scored in the range 21–30, whereas 12 per cent scored in the 16–20 mark range; 39 per cent scored in the 11–15 mark range; 25 per cent scored in the 6–10 mark range; 12 per cent scored in the 1–5 mark range and the remaining 6 per cent either scored zero or did not respond to the question.

Question 5

This question focused on MOSFETS and thyristors. Candidates were required to draw and describe the operation of these devices. Only 15 per cent of the candidates attempted this question. It appears that the question was either too difficult or the alternative question was more attractive to most candidates. Marks ranged from 0 to 8. Forty per cent of the candidates scored in the 6–10 mark range, 40 per cent scored in the 1–5 mark range and the remaining 20 per cent scored zero or did not attempt the question. It is evident that candidates were not prepared to answer this question. They were familiar with the symbol of the thyristor but had little knowledge about its operation.

Question 6

Candidates were required to define *noise* and to identify four categories. They were also asked to explain DPSK and FSK techniques as well as half and full duplex modes of communication. Eighty per cent of the candidates attempted this question and scored marks ranging from 0 to 18. Seven per cent of those who attempted the question scored in the range 16–20; 33 per cent scored in the 11–15 mark range; 30 per cent scored in the range 6–10; 24 per cent scored in the 1–5 mark range and the remaining 6 per cent either scored zero or did not respond to the question. Most candidates were able to explain the terms *half* and *full duplex*.

Module 3 – Introduction to AC Machines

Candidates were required to respond to Question 7 and one other from this section. From a possible score of 50 marks from this module, the marks obtained by candidates ranged from 0 to 39. Three per cent of the candidates scored in the range 31–40; 8 per cent of the candidates scored in the range 21–30; 23 per cent scored in the range 11–20; 32 per cent scored in the range 6–10; 21 per cent scored in the range 1–5 and 13 per cent candidates scored zero. Candidates' performance suggests that they were quite conversant with this module.

Question 7

This question tested candidates' knowledge of the synchronous generators. The marks obtained by candidates ranged from 0 to 22 from a possible 30 marks. Of those candidates who attempted the question, only one candidate (about 2 per cent) scored in the 21–30 mark range, 7 per cent scored in the 11–20 mark range; 26 per cent scored in the 6–10 mark range; 45 per cent scored in the 1–5 mark range and the remaining 20 per cent either scored zero or did not respond to the question. It appears that many candidates were not familiar with the universal voltage equation for the synchronous dynamo.

Question 8

This question focused on the transformer and required candidates to state the principle on which the transformer operates. They were required to display knowledge of concepts such as coefficient of coupling, mutual inductance and transformation ratio. Sixty-two per cent of the candidates attempted the question and marks ranged from 0 to 19. Approximately 33 per cent of the candidates who attempted it scored in the 11–20 mark range; 40 per cent scored in the 6–10 mark range; 23 per cent scored in the 1–5 mark range and the remainder 4 per cent either scored zero or did not respond to the question. It is evident that most candidates were familiar with the transformer and its operation. Most, however, were unable to calculate the transformation ratio.

Question 9

This question tested candidates' knowledge of the induction motor. The question focused on slip. Of the candidates who attempted this question, 32 per cent scored marks ranging from 0 to 5. Fifteen candidates scored in the 1–5 mark range and the remaining 16 either scored zero or did not respond to the question. The question was clearly quite challenging for candidates.

Paper 03 – School-Based Assessment (SBA)

An adequate number of SBA samples was submitted for inspection and moderation. The following were observed:

- The grades submitted from some of the schools appeared inflated.
- No project activity booklets were submitted.
- Students did not adhere to the specific guidelines/requirements for completing SBAs.
- Students did not generally follow the format established for writing reports.
- There is need to address sentence construction and spelling in the project documentation.
- Students need more guidance in documenting their methodology. Most samples observed were unacceptable. Students would benefit from closer supervision.
- In many instances, students failed to discuss the findings of the experiment or outcome of the project.
- Projects submitted from two schools were basically replicas of each other. Students need to submit their own projects.
- Some projects submitted were too simple for the CAPE level.